



Toward Improving Quality Adjustment in Price Statistics: Empirical Evidence Supporting So-called 50 Percent Rule

Speed Session 2
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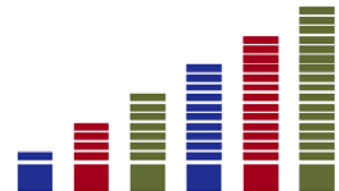
This paper is a short and preliminary version of Abe, Ito, Munakata, Ohyama, and Shinozaki (2016), which will be released as a Bank of Japan Working Paper soon.

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Madrid, May 31 - June 3

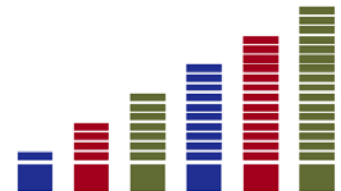
Introduction

- The price index is constructed by indexing the price of goods and services with the price at the base point in time as 100.
- If a representative product shifts from the old product to the new one, the target product for the price survey is changed.
- If there is a difference in quality between new and old products, the index reflects the residue after subtracting the price difference due to the difference in quality from the whole price difference (**quality adjustment**).
- However, it is not always easy to quantify the degree of quality growth of new products accurately.



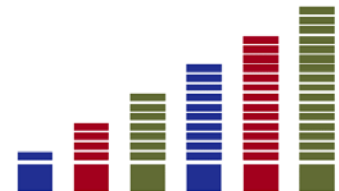
Introduction

- Some price statistics agencies have used a simple method to regard 50% of the price as the quality improvement part if its magnitude is not known (so-called **50% rule**).
 - In Netherlands (Hoven (1999))
 - In Sweden (Dalen and Tarassiouk (2013))
 - In Germany, prior to 1997 (Hoffmann (1999))
- The 50% rule has not been sufficiently supported either theoretically or in practice.
- In this paper, **we examine the appropriateness of the 50% rule empirically** by targeting at individual products of durable consumer goods sold in Japan.



Data Sets

- Develop the panel data sets by integrating the following:
 - Product specifications: registered at the **Kakaku.com**, a well-known internet price comparison site in Japan, between December 2012 and December 2015.
 - Weekly average prices: registered at the paid **Kakaku.com Trend Search** between December 2013 and December 2015.
- Home electrical appliances: 8 commodities
Digital consumer electronics: 12 commodities
- Number of products: 4,500
Size of panel data: 150,000
Total data volume: 5.6 million



Estimation of Hedonic Functions

- We estimate the following **semi-logarithmic hedonic functions** with a dummy variable to control the elapse of time from the launch of products to capture the price.

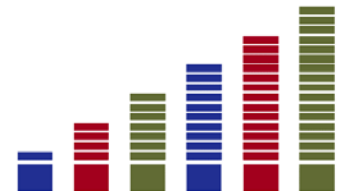
$$\ln(p_{i,t}) = \alpha + \sum_k \beta_k X_{i,k} + \sum_\tau \gamma_\tau D_t(\tau_i + \tau) + \sum_\tau \delta_\tau D_t(\tau) + \varepsilon_{i,t}$$

$$D_t(T) = \begin{cases} 1 & (\text{if } t = T) \\ 0 & (\text{if } t \neq T) \end{cases}$$

$p_{i,t}$: price of product i at time t , $X_{i,k}$: k th specification of product i

$D_t(\tau_i + \tau)$: dummy variable to control the elapsed weeks from the launch of product

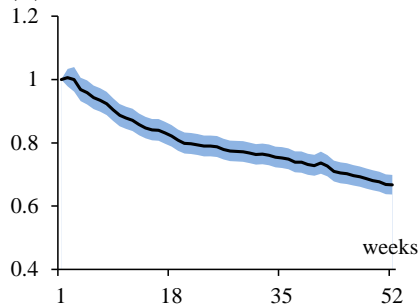
$D_t(\tau)$: dummy variable to control macroeconomic shocks in each quarter



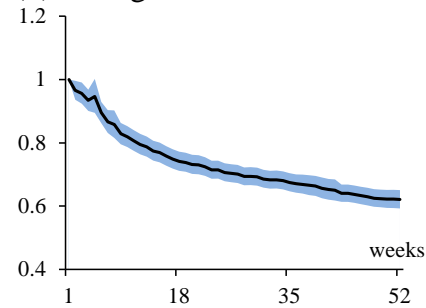
Pricing Patterns over Product Life-Cycle

Table 1-1: Home Electrical Appliances

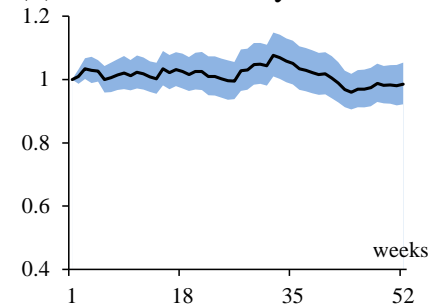
(1) Air conditioners



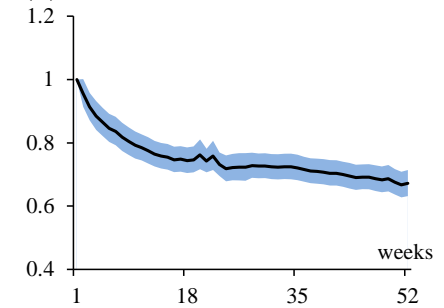
(2) Refrigerators and freezers



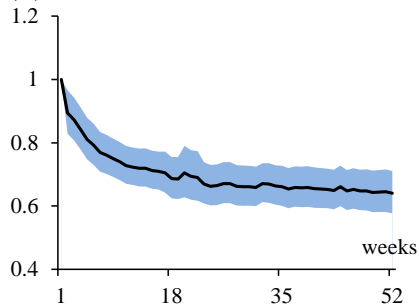
(3) Washers and dryers



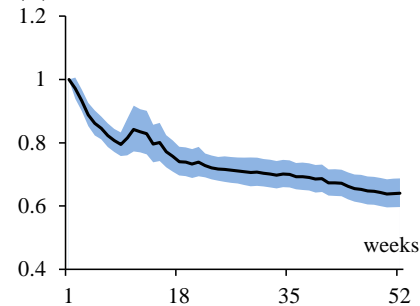
(4) Rice cookers



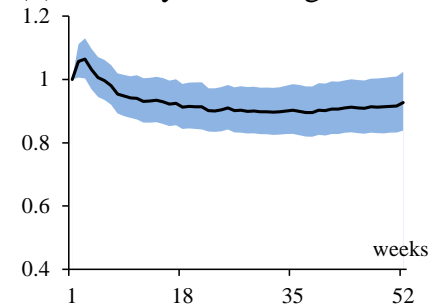
(5) Vacuum cleaners



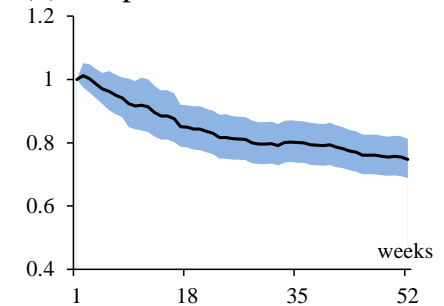
(6) Microwaves



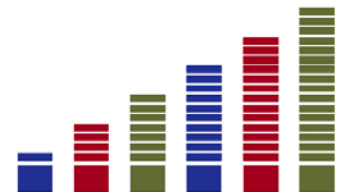
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(8) Air purifiers



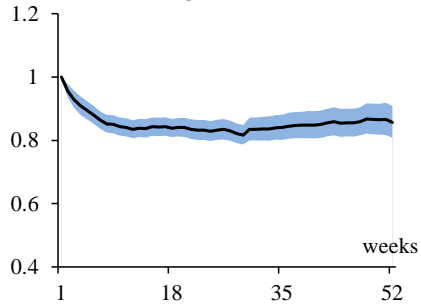
Note: The scale of longitudinal axis is adjusted by dividing a price by the price right after the launch of product. The shaded areas indicate double standard deviation $\pm 2\sigma$.



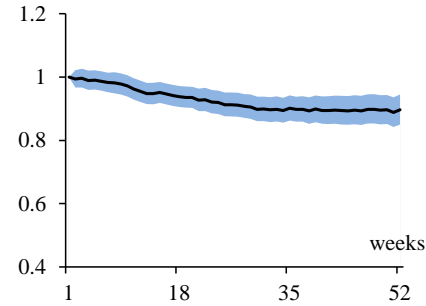
Pricing Patterns over Product Life-Cycle

Table 1-2: Digital Consumer Electronics

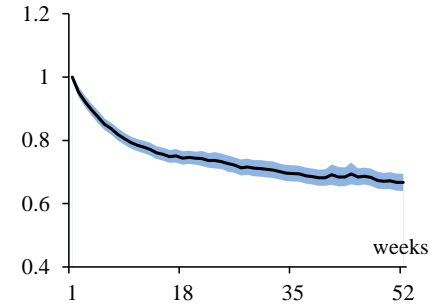
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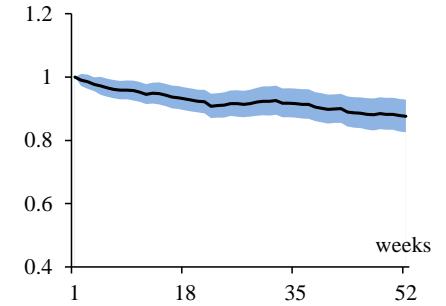
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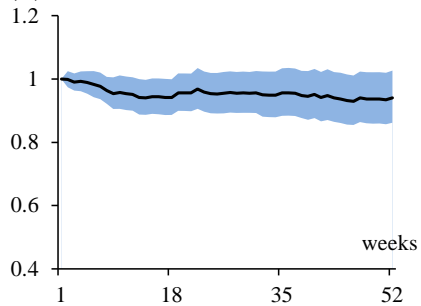
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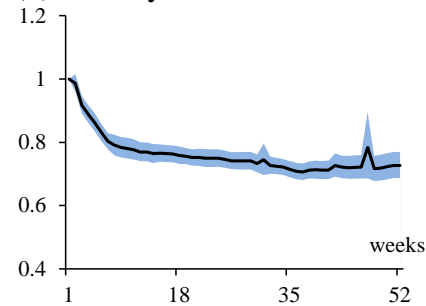
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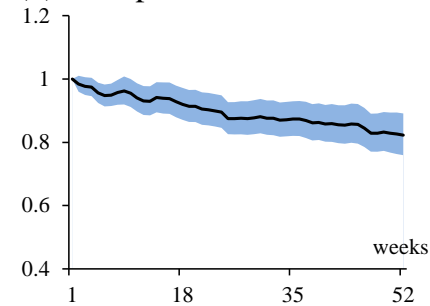
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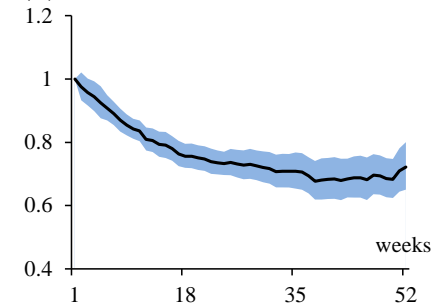
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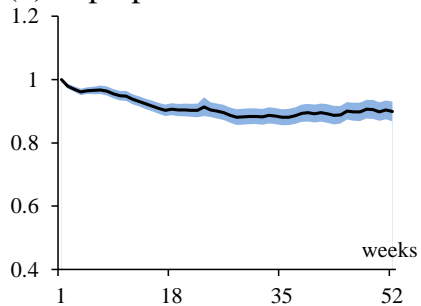
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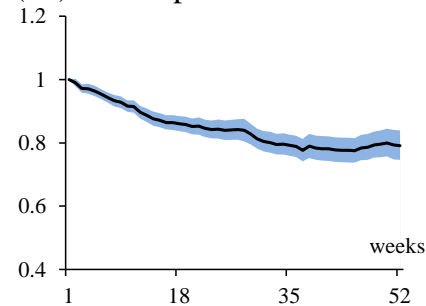
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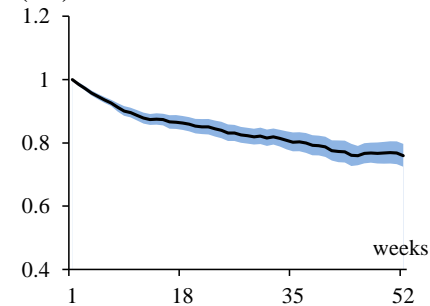
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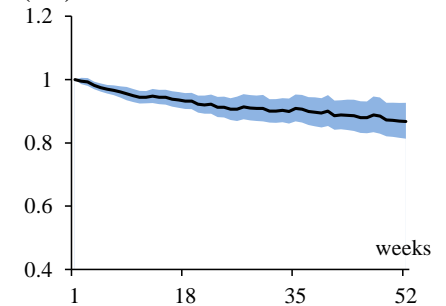
(10) Desktops



(11) Point-and-shoot cameras



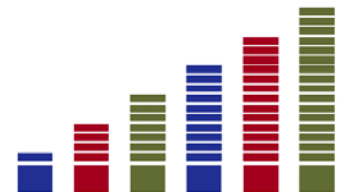
(12) DSLR/mirrorless cameras



Selection of Matched Pairs of Products

- Selection Criteria of Matched Pairs of Products are as follows:
 1. The launch date of a new product is later than that of the old one.
 2. New and old products are made by the same manufacturer.
 3. The price of a new product on the launch date is higher than that of the old product on the same day.
 4. The quality of the new product is better than that of the old one.
- Based on the matched pairs of products, we measure the **Quality Improvement Ratios** of individual pairs.

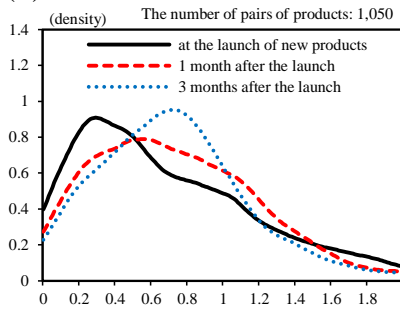
$$\mu_{\tau}^{i,j} \equiv \frac{\sum_k \beta_k (X_{j,k} - X_{i,k})}{\ln(p_{j,\tau_j+\tau}) - \ln(p_{i,\tau_j+\tau})}$$



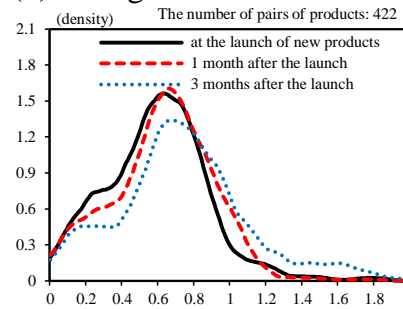
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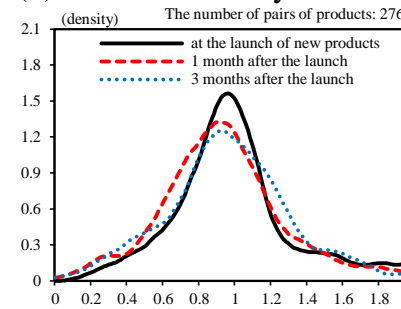
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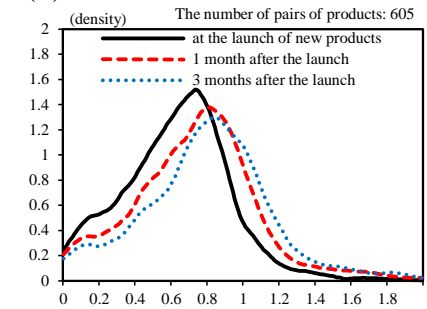
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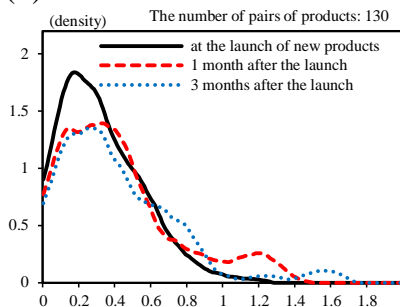
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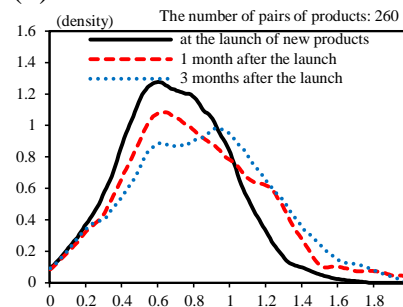
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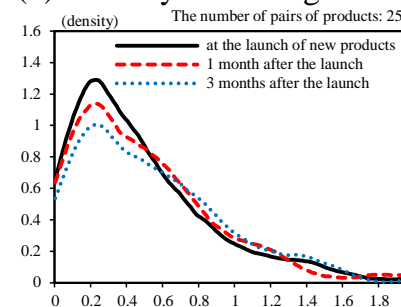
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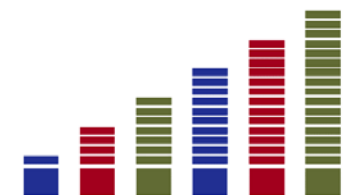
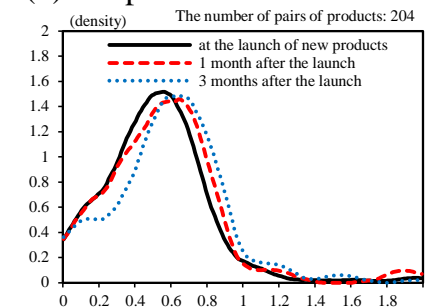
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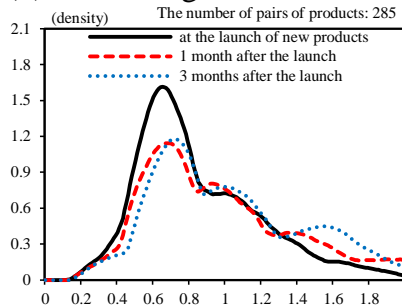
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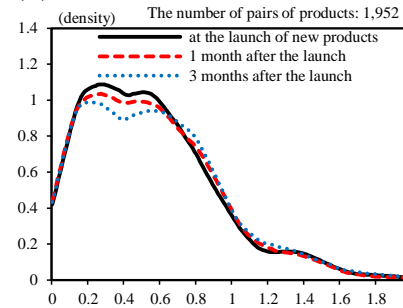
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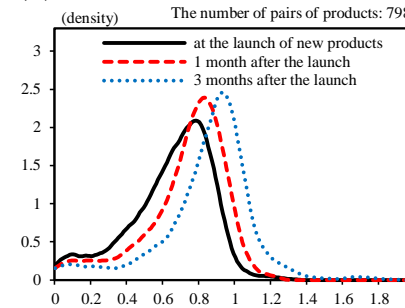
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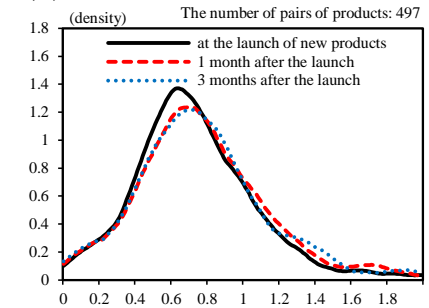
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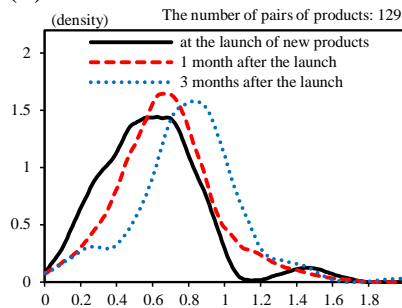
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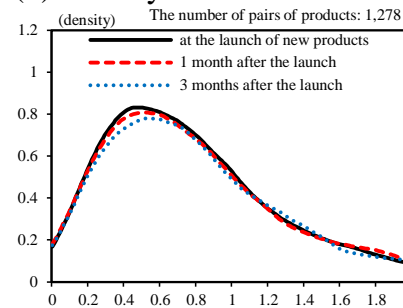
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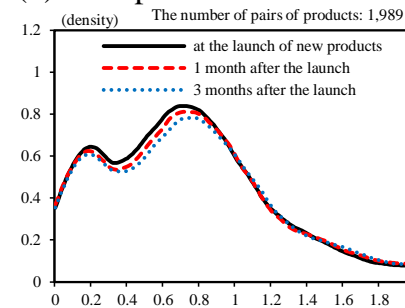
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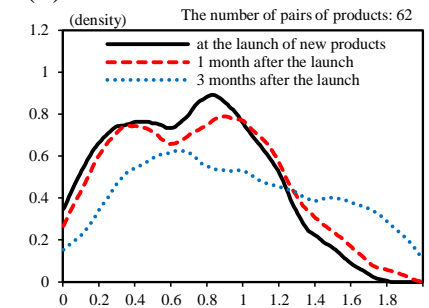
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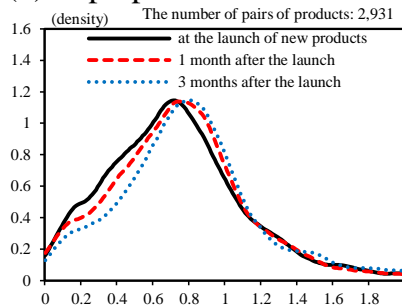
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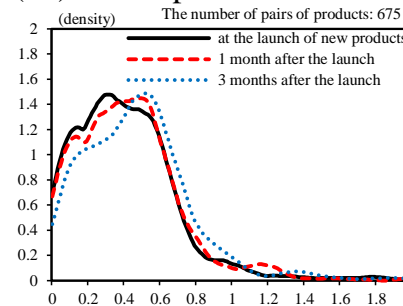
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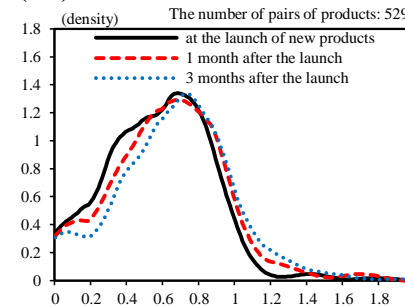
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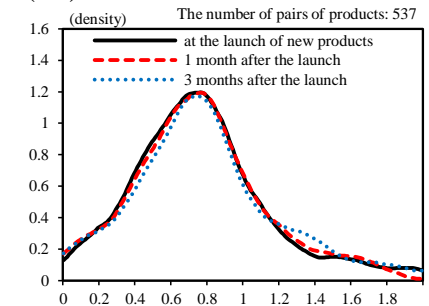
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Conclusion

- **The results of the paper generally support the appropriateness of the 50% rule** which is easy to adopt even under severe resource constraints and improves quality of price indexes.
- The Bank of Japan has announced the rebasing of the PPI by updating the base year from 2010 to 2015. Taking that opportunity, **the Bank plans to introduce a new quality adjustment method for some durable consumer goods based on the thinking of the 50% rule as a second-best measure.**

