

# How Fast Are Prices in Japan Falling?

»» Satoshi Imai  
Chihiro Shimizu  
Tsutomu Watanabe


Japan



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# AGENDA

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- ▶ Background
  - ▶ Findings
  - ▶ Purposive vs Random
  - ▶ Methodology1 :Purposive Sampling
  - ▶ Methodology2:Random Sampling
  - ▶ Sampling error
  - ▶ Conclusion
  - ▶ Subsidiary finding
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# Background

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- ▶ Some argue that rate of deflation was too small in Japan

**Rate of deflation in each year (last 15 years)  
around 1 percent**

- Official CPI contains substantial upward bias?
  - Fuhrer et al.(2011)
  - Broda and Weinstein(2007)
  - Ariga and Matsui(2003)

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# Background

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## ▶ Purpose

- Investigate how much estimates of CPI inflation rate depend on the Methodology.
- Especially lower level Sampling Methodology

## ▶ Approach

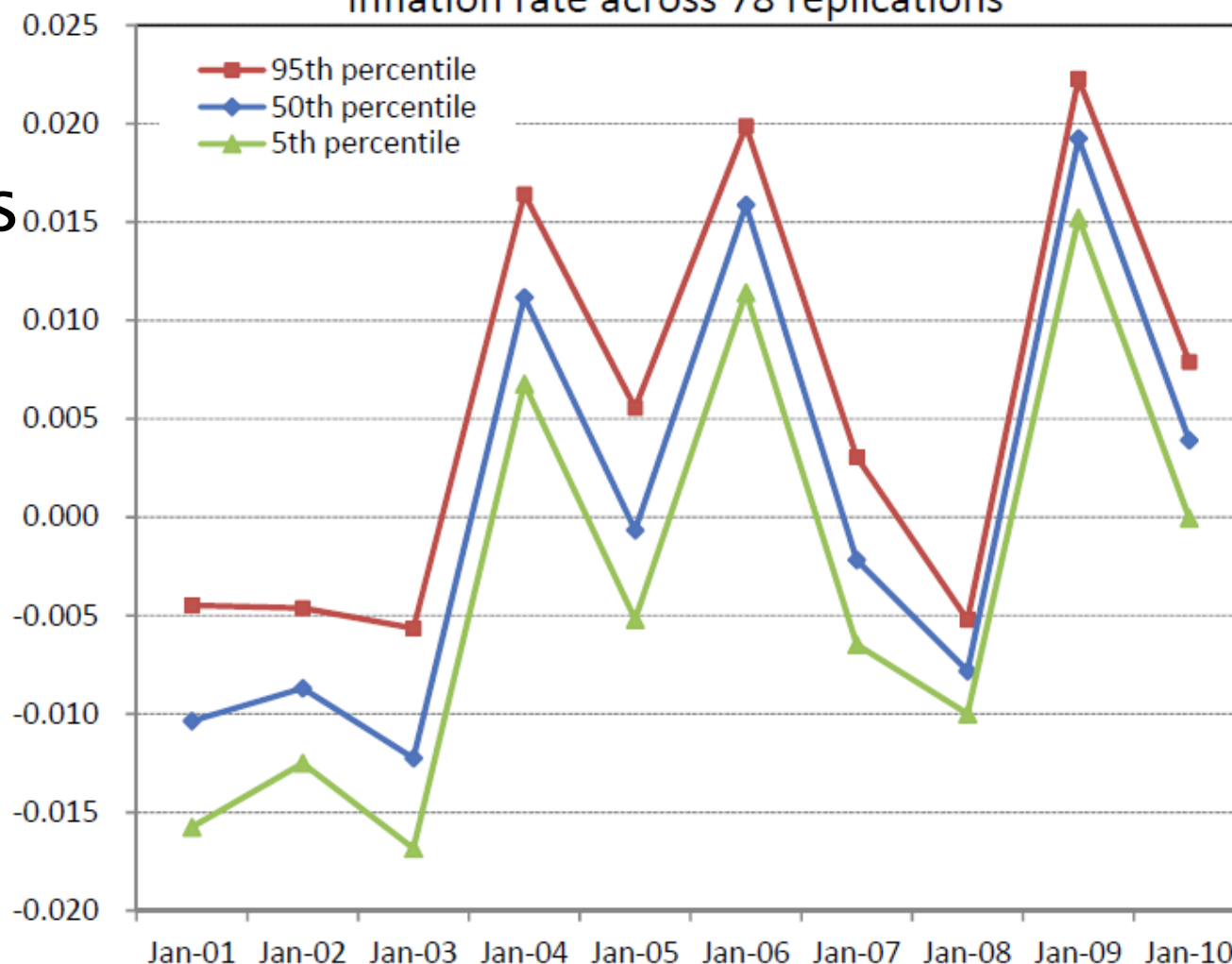
- 64 alternative sampling rules (Purposive Sampling)
    - Store sampling
    - Product sampling
    - Price sampling (Survey point, Sale regulation)
    - Region composition
  - Purposive Sampling – Random Sampling
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# Findings

Inflation rate has  $\pm 0.5\%$  sampling errors at 90% CI

(year-on-year based)

Distribution of sampling errors for the year-on-year inflation rate across 78 replications

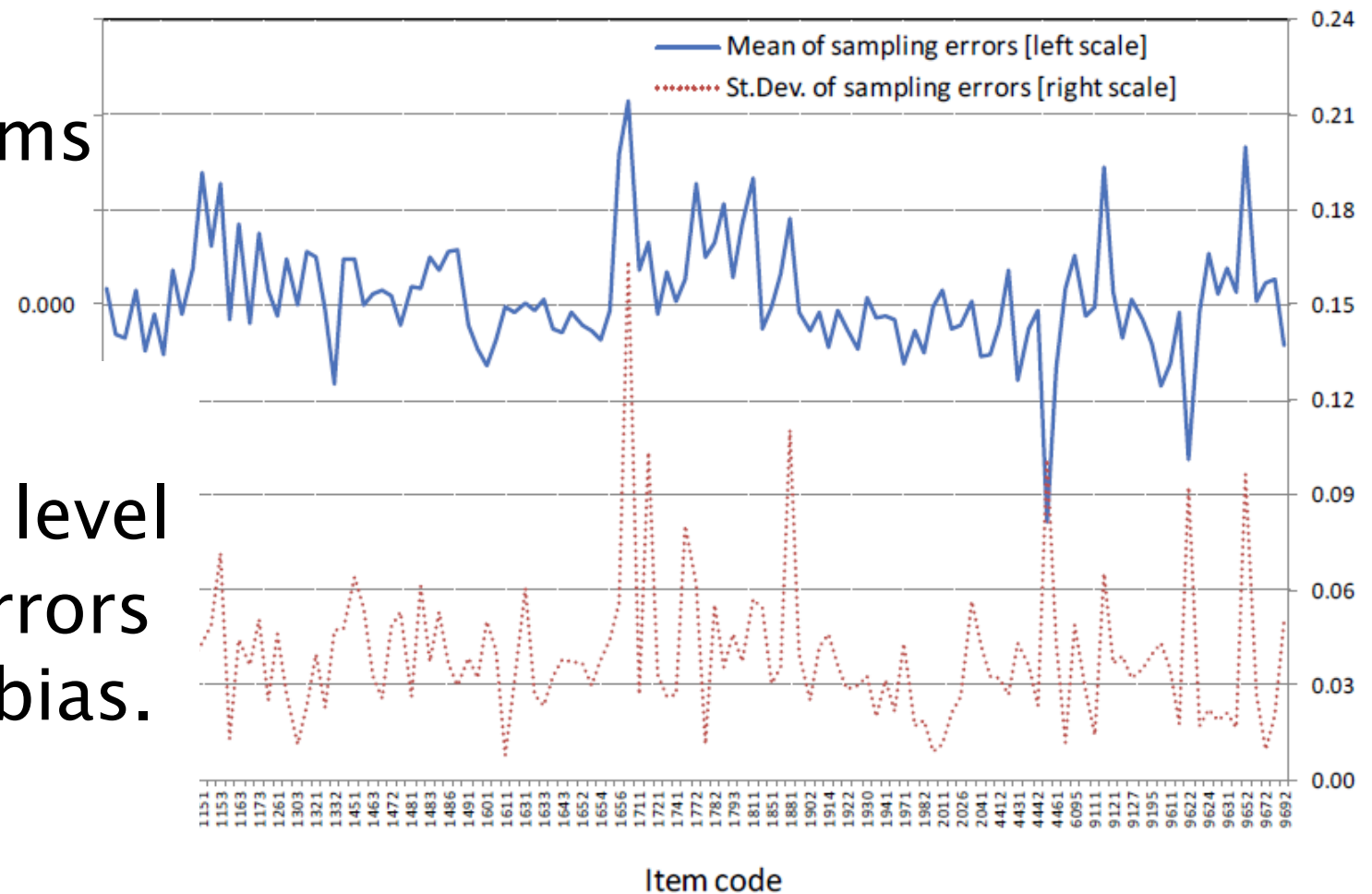


# Findings

Figure 7: Sampling Errors by Item

Sampling errors is various through items

It shows  
At the item level  
sampling errors  
may cause bias.



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# Purposive vs Random

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- ▶ SBJ employs Purposive approach

	Purposive	Random
Item	125 items	125 items
Product	Collect according to sale quantity ranking  Only products which matches to defined specification are allowed	Sale quantity waited random sampling  All products which belongs to item category are allowed

# Purposive vs Random

- ▶ Example from Table 1: Butter

Jul 1996 –Jan 2001	“Snow Brand Hokkaido Butter”
Jan 2001 – present	200g. Packed in a paper container. Excluding non-salt butters.

Item code	Description	# of JAN codes (A)	# of JAN codes that meet the product specifications (B)	(B / A)	Fraction of sales for products that meet the product specification
1321	Butter	369	30	0.081	0.458

- ▶ We conduct this kind of pre-treatment for 125 items



# Methodology1:

## Purposive Sampling

- ▶ 125 items over 200 outlets
- ▶ 64 different sampling simulations
  - Region : single region / six regions
  - Outlet : customer visits (1 or 3 month(s))  
quantity sold (1 or 3 month(s))
  - Products : quantity sold (1 or 3 month(s))  
(purposive specification pre-treated)
  - Specification :full list / positive only list
  - Sale duration :3 days / 8 days
  - Sale impute :backward / forward

# Methodology2: Random Sampling

- ▶ 125 items over 200 outlets
- ▶ sampling condition
  - Region : six regions
  - Outlet : random sampling waited with customer visits (1 month)
  - Products : random sampling waited with quantity sold (1 month)  
(all products belonging to the category)
  - Sale duration :8 days
  - Sale impute :forward

# Sampling error

- ▶ Sampling error of item  $i$

$$\delta_i(t) \equiv \sum_r \phi_r \left( n^{-1} \sum_{(o,j) \in A_{r,i}} \pi_{r,i,o,j}^{PS}(t) - n^{-1} \sum_{(o,j) \in B_{r,i}} \pi_{r,i,o,j}^{RS}(t) \right)$$

- ▶ Sampling error at the aggregate level

$$\delta(t) \equiv \sum_r \omega_i \delta_i(t)$$

- ▶ The central limit theorem

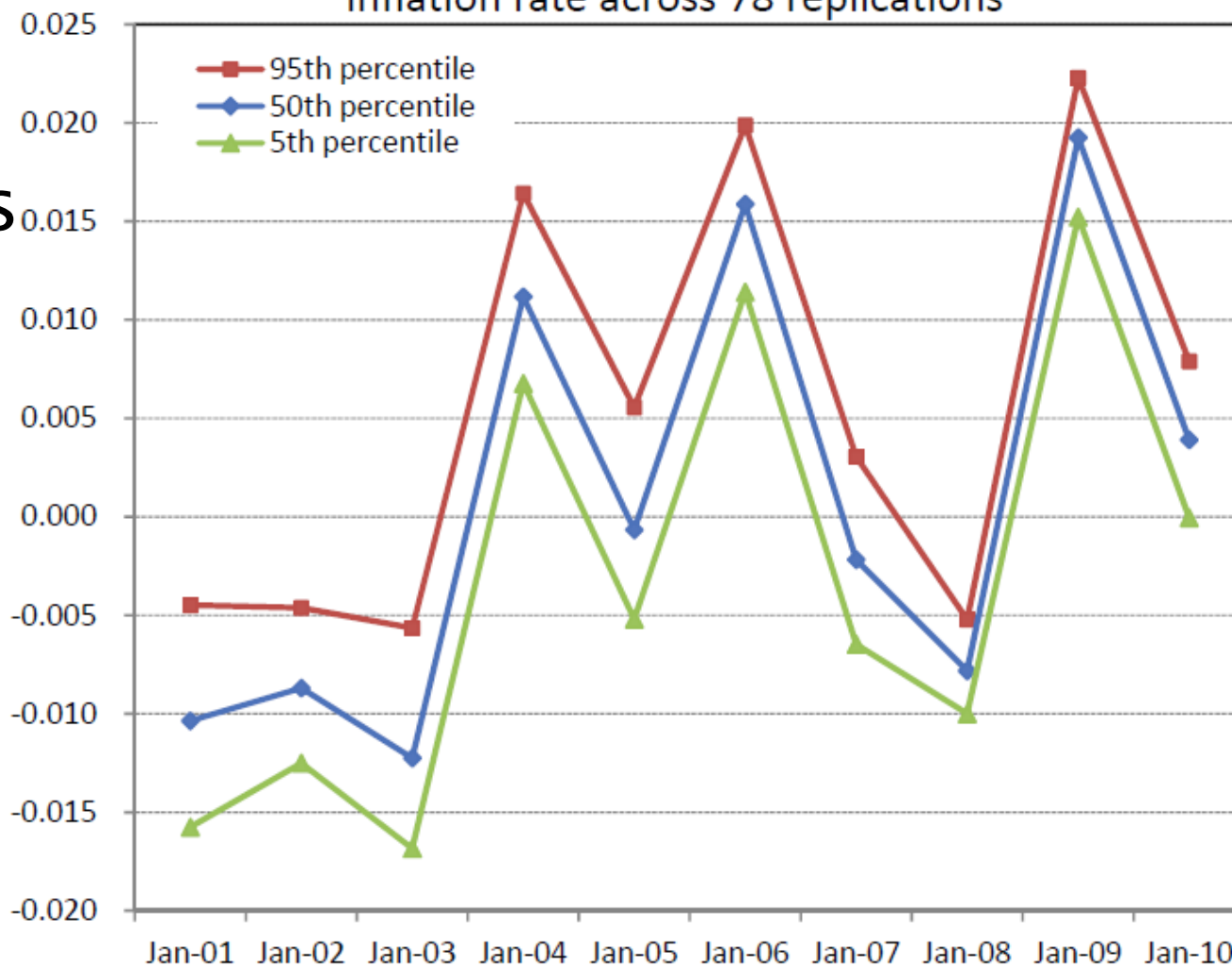
$$\sum_i \omega_i \hat{\delta}_i \xrightarrow{d} N \left( \sum_i \omega_i \mu_i, \sum_i \omega_i^2 \sigma_i^2 \right)$$

# Conclusion

Inflation rate  
has  $\pm 0.5\%$   
sampling errors  
at 90% CI

(year-on-year  
based)

Distribution of sampling errors for the year-on-year  
inflation rate across 78 replications

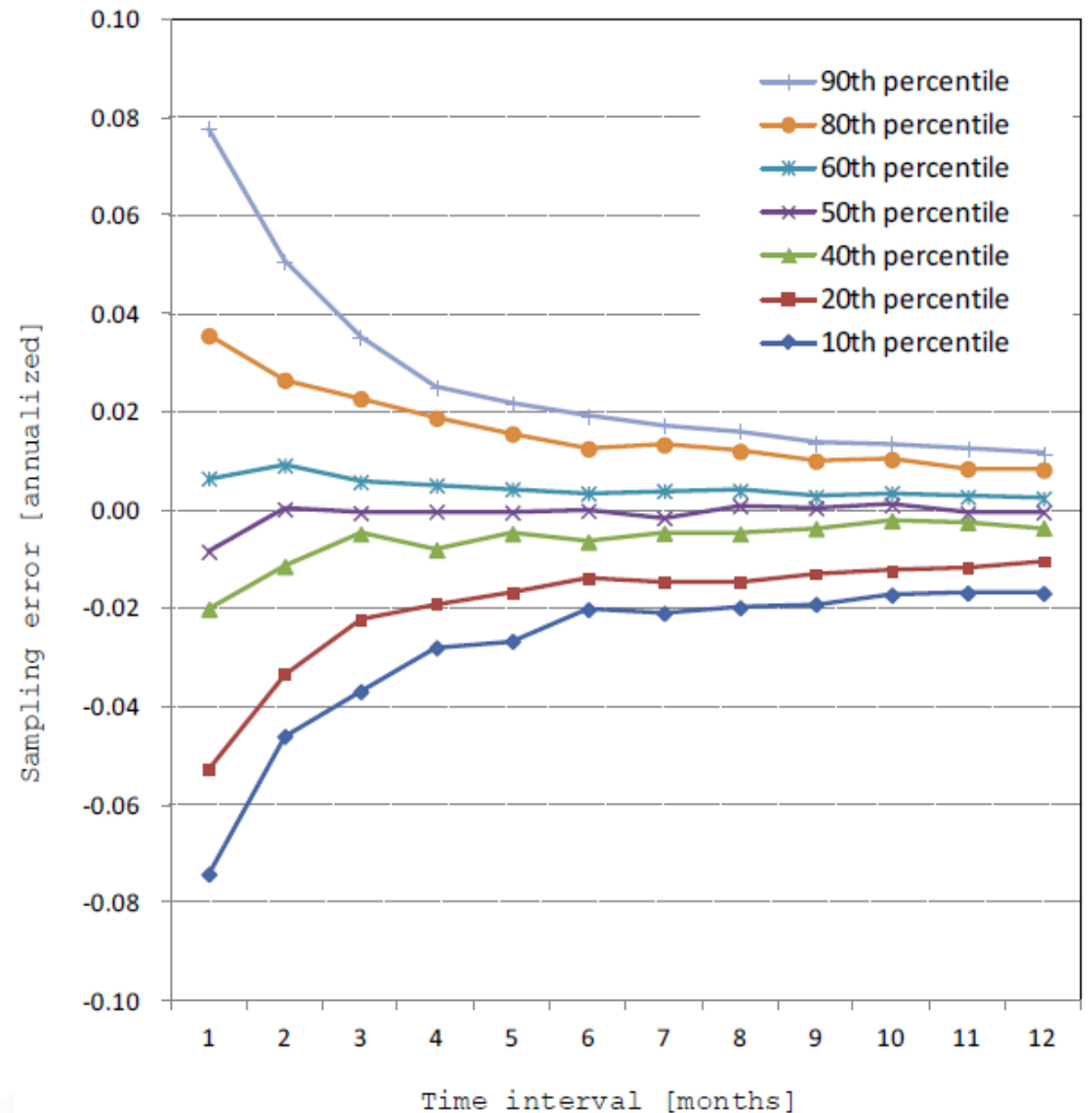


# Conclusion

Figure 12 shows Sampling error is wide even annual level (time interval 12)

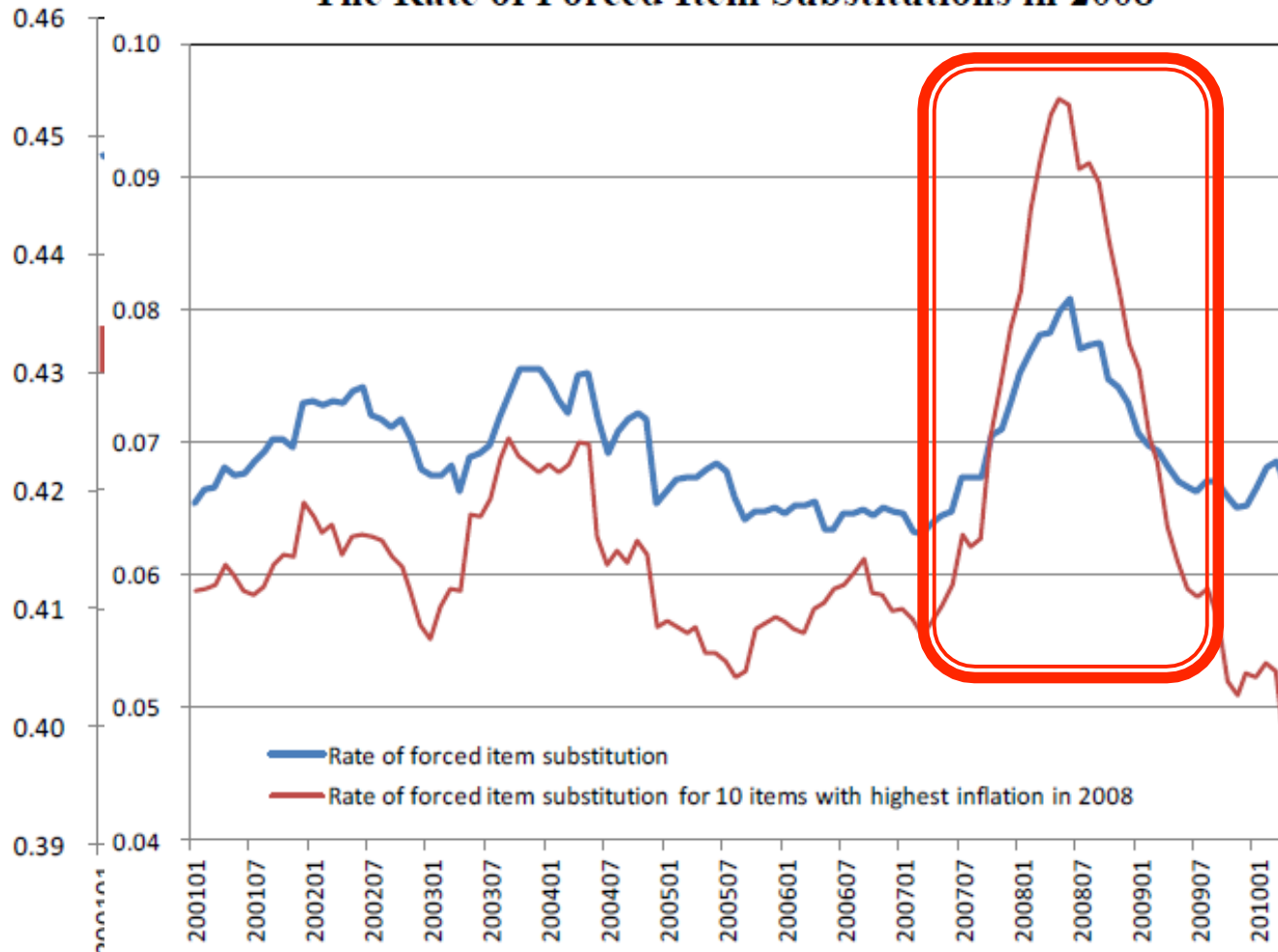
For the future plan, We estimate convergence effect extending up to 500 items.

Figure 12: Sampling Errors for Different Time Intervals

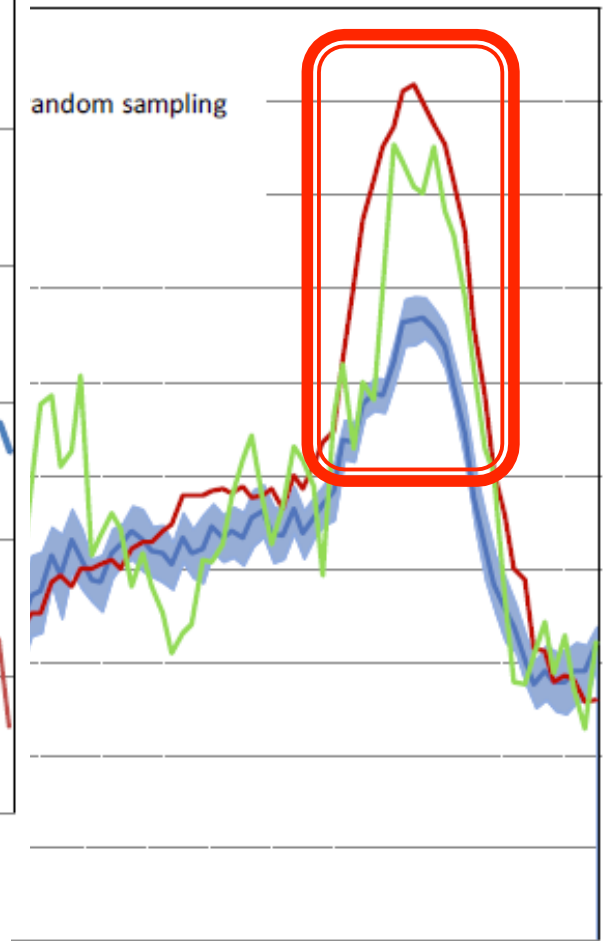


# Subsidiary finding

The Rate of Forced Item Substitutions in 2008



Estimated by Random Sampling



property

200101 200107 200201 200207 200301 200307 200401 200407 200501 200507 200601 200607 200701 200707 200801 200807 200901 200907 201001

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**Thank you for all your  
attention.**

**Contact to:**

**s2.imai@soumu.go.jp**

**Satoshi Imai**

**cshimizu@reitaku-u.ac.jp**

**Chihiro Shimizu**

**watanabe@e.u-tokyo.ac.jp**

**Tsutomu Watanabe**

