



JSPS Grants-in-Aid for Creative Scientific Research

Understanding Inflation Dynamics of the Japanese Economy

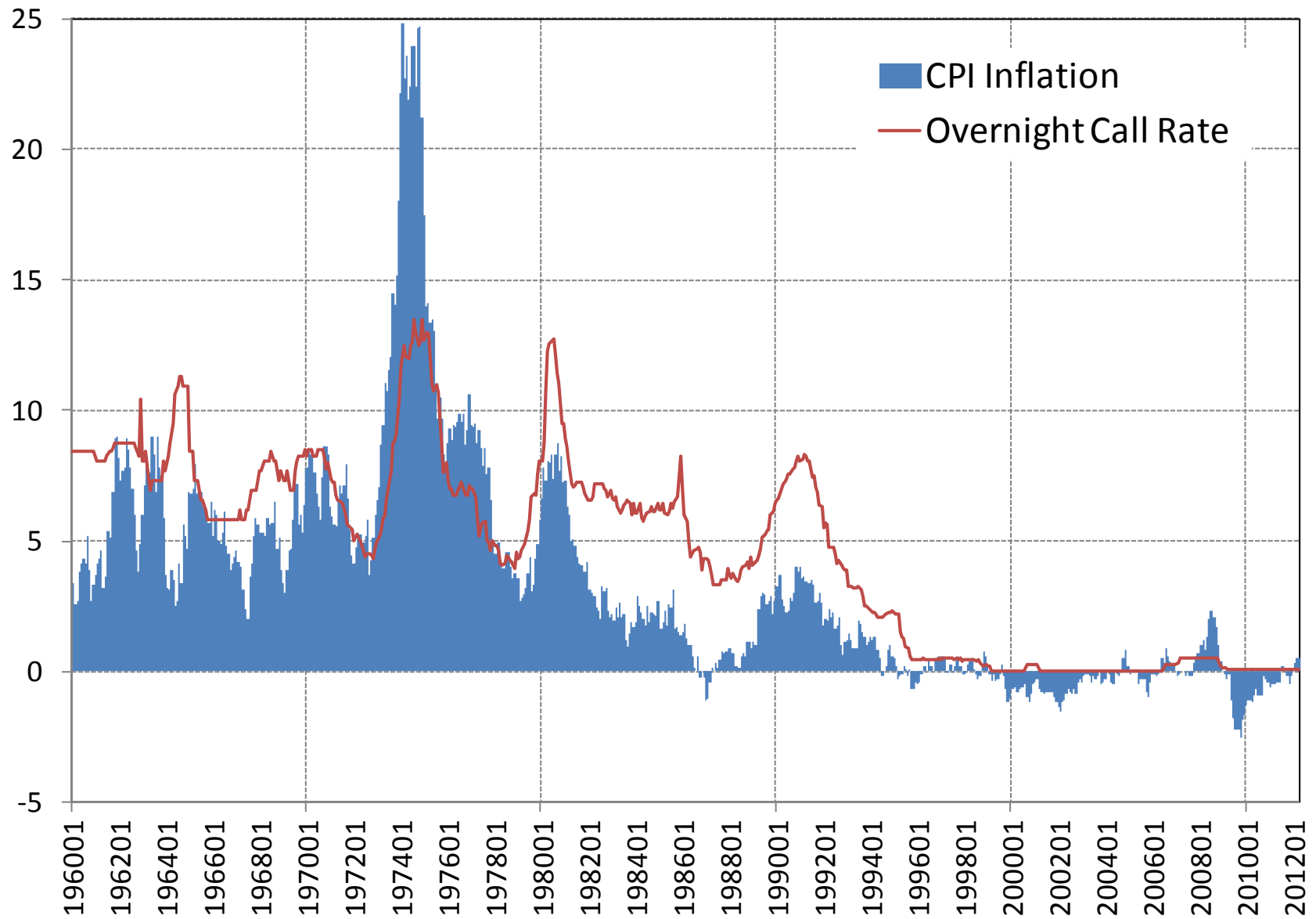
How Fast are Prices in Japan Falling?

Satoshi Imai
Chihiro Shimizu
Tsutomu Watanabe

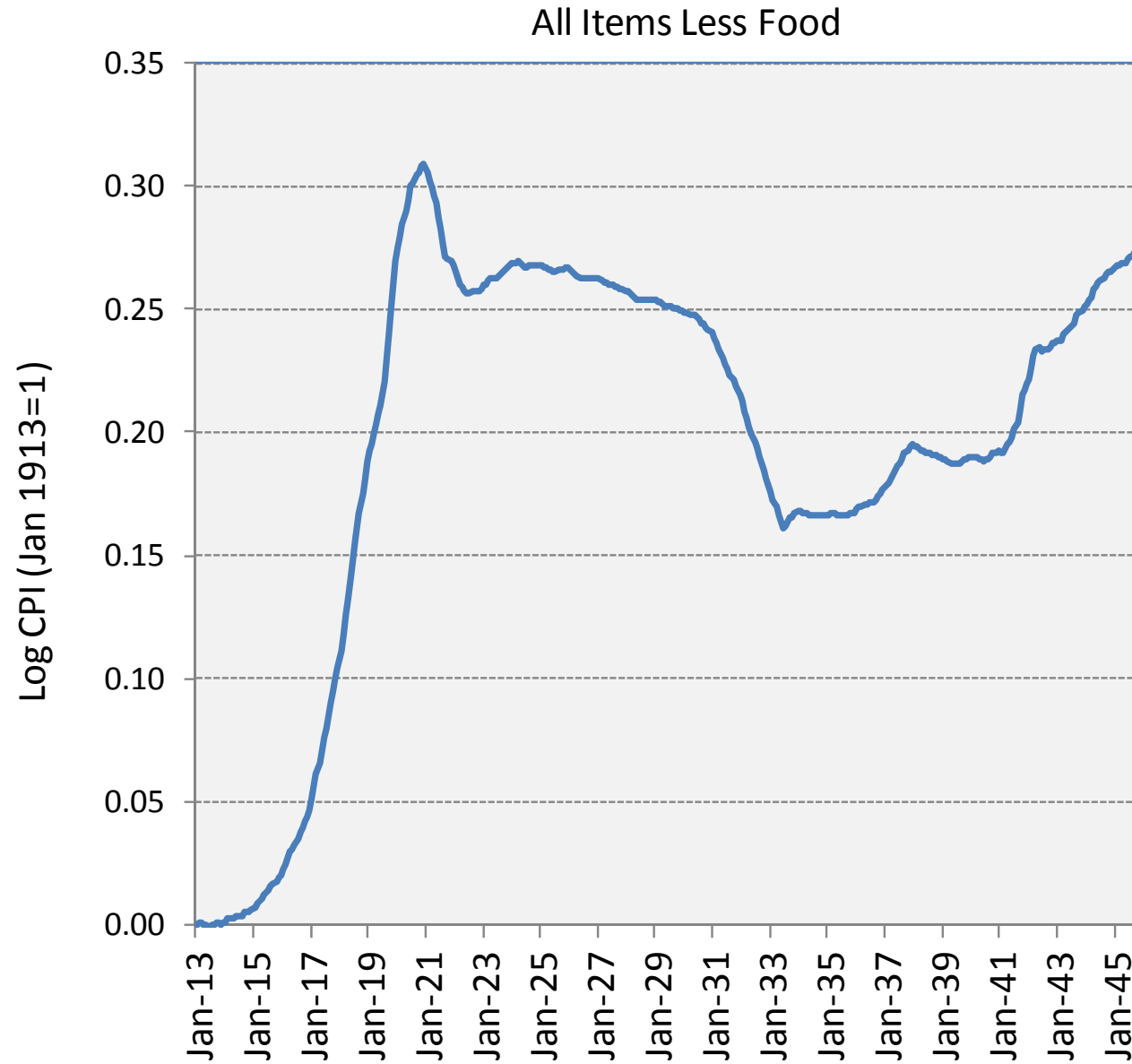
Statistics Bureau of Japan
Reitaku University & UBC
University of Tokyo & CIGS

June 15, 2012

Deflation in Japan



U. S. Consumer Price Index during the Great Depression

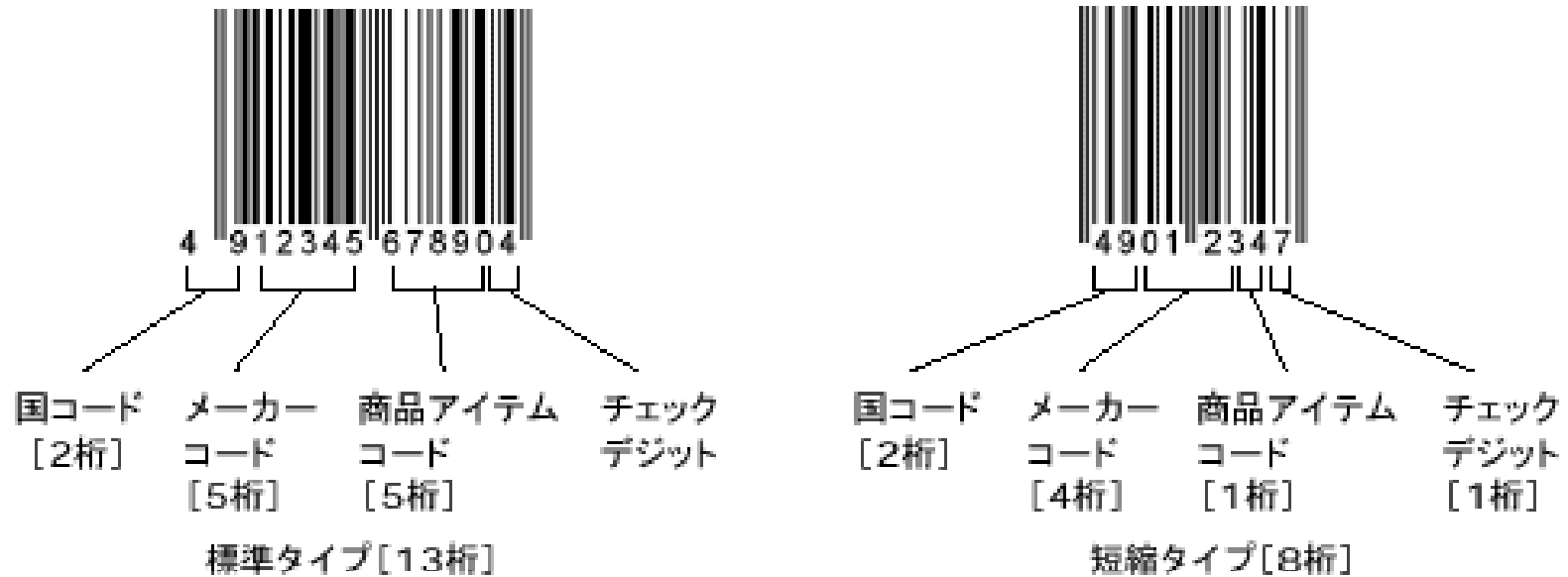


Methodology

Sampling and Aggregation

- Lower level
 - Outlet sampling
 - Product sampling
 - Price sampling
 - Lower level aggregation (Dutot vs. Jevons index)
- Upper level
 - Upper level aggregation

JAN: Japanese Article Number



Product ID:
NISSIN CUP NOODLE
SOY SAUCE FLAVOR
4902105030080



小売物価統計の基本銘柄

1713	シュークリーム	カスタードクリーム入り
1714	プリン	チルドタイプ、カップ入り(140g入り)、「森永の焼プリン(森永乳業)」又は「焼プリン(オハヨー乳業)」
1721	ビスケット	箱入り(3枚パック×8袋入り)、「森永マリー」
1732	あめ	のど飴、袋入り(個包装紙込み 90g入り)
1741	せんべい	うるち米製せんべい、しょう油味、個装タイプ袋入り、普通品
1742	かわらせんべい	小麦粉製せんべい、並
1761	チョコレート	板チョコレート、58g、「明治ミルクチョコレート」又は「ロッテガーナミルクチョコレート」
1772	落花生	バターピーナッツ、普通品
1781	チューインガム	シュガーレスガム、粒ガム、14粒入り、「キシリトール ネオ」
1782	アイスクリーム	バニラアイスクリーム、カップ入り(120mL入り)、「ハーゲンダッツ バニラ」
1783	ポテトチップス	袋入り(60～95g入り)、成型ポテトチップスを除く

Number of Products that Meet the JSB Product Type Specifications

Item code	Description	No. of JAN codes (A)	No. of JAN codes that meet the product specifications (B)	(B/A)
1001	Rice-A (domestic)	11962	1649	0.138
1002	Rice-B (domestic)	11962	1905	0.159
1011	Glutinous rice	477	321	0.673
1031	Boiled noodles	4944	1213	0.245
1041	Dried noodles	2194	37	0.017
1042	Spaghetti	1410	237	0.168
1051	Instant noodles	6879	6	0.001
1052	Uncooked Chinese noodles	8042	2439	0.303
	⋮			

1321	Butter	369	30	0.081
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JSB Product Type Specifications for Butter

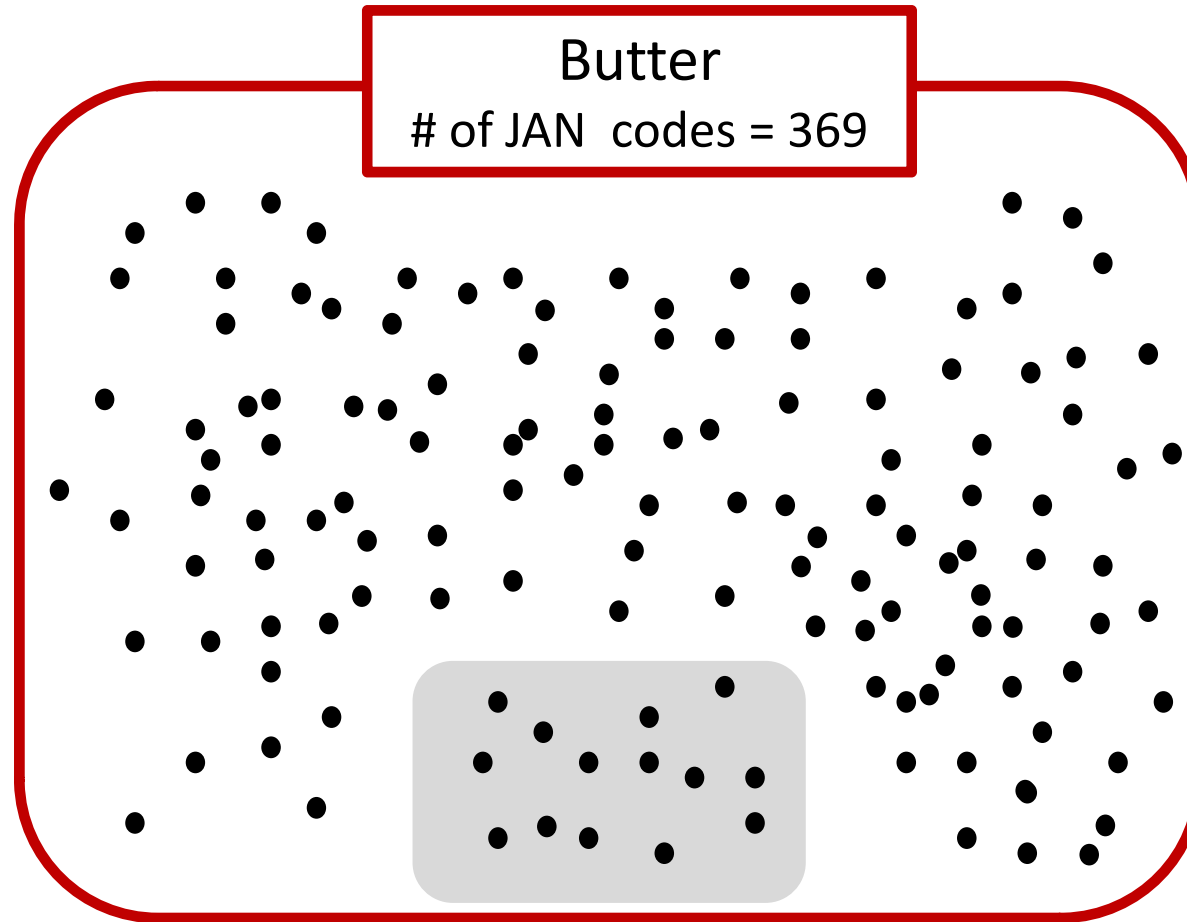
Jul 1996 - Jan 2001

“Snow Brand Hokkaido Butter”

Jan 2001 – present

200g. Packed in a paper container. Excluding unsalted butter.

Purposive vs. Random Sampling



- 200g
- Packed in a paper container
- Excluding unsalted butter

Data

Number of Outlets, Products, and Observations

	No. of outlets	Entries	Exits	No. of products	No. of observations
2000	185	21	5	174,928	242,357,320
2001	185	1	1	176,504	274,319,027
2002	186	14	13	180,355	283,433,216
2003	185	2	3	172,150	290,910,066
2004	168	14	31	182,661	282,074,675
2005	183	19	4	190,256	309,888,190
2006	186	7	4	206,287	329,139,639
2007	266	93	13	236,825	386,389,129
2008	257	4	13	234,660	419,941,109
2009	260	7	4	230,483	422,389,029
2010	256	0	4	223,810	410,358,552

Product Turnover

	No. of products in the 103 outlets	Entries	Exits	Entry rate	Exit rate
2000	203,563	-	-	-	-
2001	208,164	57,526	52,925	0.276	0.254
2002	217,139	66,035	57,060	0.304	0.263
2003	206,172	51,696	62,663	0.251	0.304
2004	222,486	74,655	58,341	0.336	0.262
2005	224,705	62,158	59,939	0.277	0.267
2006	242,669	80,361	62,397	0.331	0.257
2007	254,887	78,060	65,842	0.306	0.258
2008	268,541	89,557	75,903	0.333	0.283
2009	256,824	75,495	87,212	0.294	0.340

Purposive Sampling

64 sampling rules

■ Outlet sampling

- Two alternative definitions of commercial areas: the 200 outlets covered by our scanner data are located in a single region or in six different regions.
- Four alternative criteria for outlet selection: (1) the number of customer visits to the outlet over the last one month; (2) the number of customer visits to the outlet over the last three months; (3) the quantity sold at the outlet over the last month; (4) the quantity sold at the outlet over the last three months.

■ Product sampling

- Two alternative criteria for product selection: the quantity sold of the product over the last one month; and the quantity sold of the product over the last three months.
- Two alternative approaches to product type specifications: based on a full range of product characteristics and based on positive characteristics only.

■ Price sampling

- Two alternative definitions of a sale: the duration of a temporary price reduction is less than 8 days or less than 3 days.
- Two alternative definitions of the regular price: backward or forward imputation.

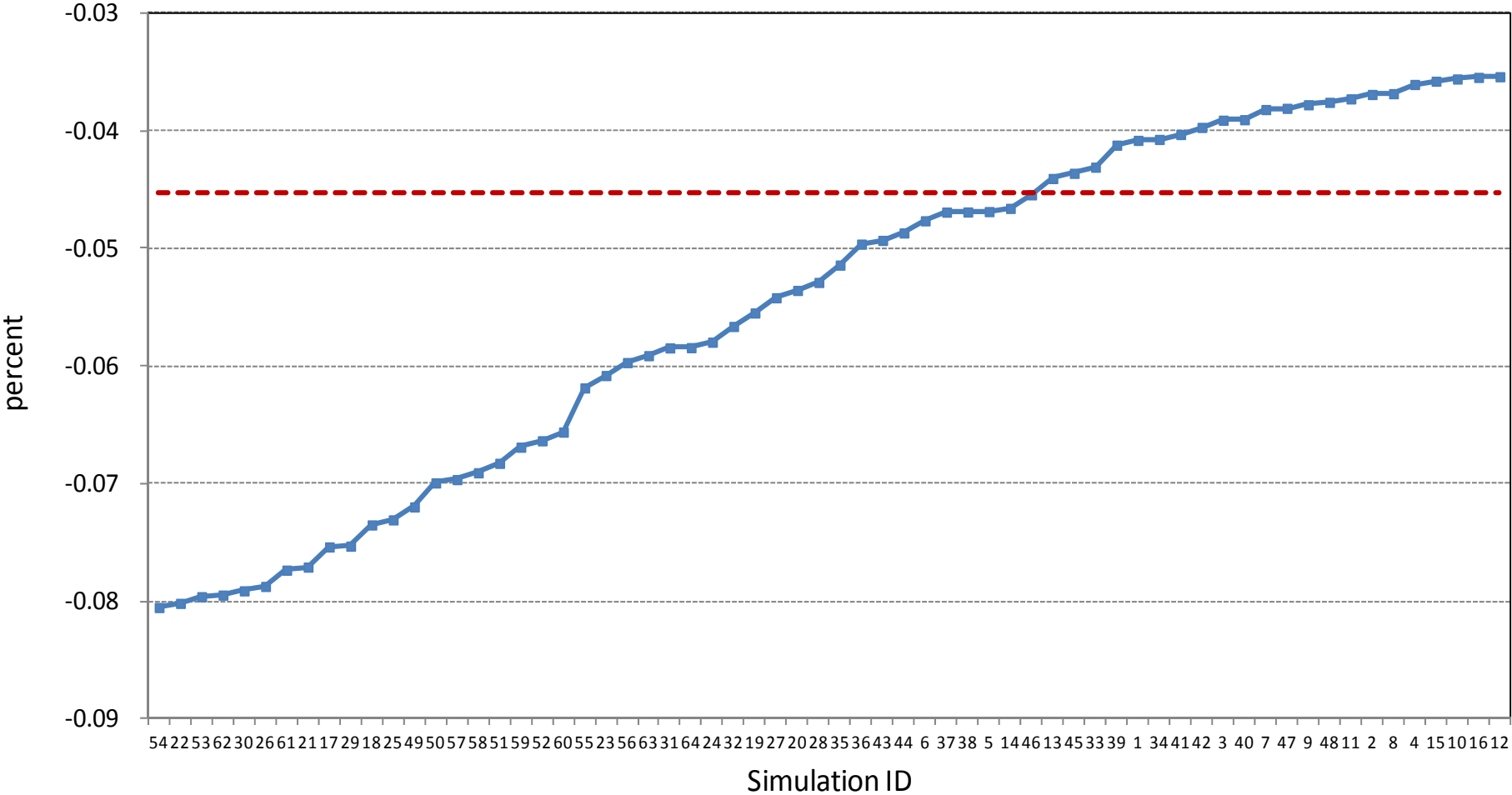
List of Purposive Simulations

	Regions	Outlet sampling	Product sampling	Range of product characteristics	Treatment of sale prices
#1	Single	One month customer visits	One month sales	Full range	8 days & forward imputation
#2	Single	One month customer visits	One month sales	Full range	3 days & forward imputation
#3	Six	One month customer visits	One month sales	Full range	8 days & forward imputation
#4	Six	One month customer visits	One month sales	Full range	3 days & forward imputation
#5	Single	One month sales	One month sales	Full range	8 days & forward imputation
#6	Single	One month sales	One month sales	Full range	3 days & forward imputation
#7	Six	One month sales	One month sales	Full range	8 days & forward imputation
#8	Six	One month sales	One month sales	Full range	3 days & forward imputation
#9	Single	One month customer visits	One month sales	Full range	8 days & backward imputation
#10	Single	One month customer visits	One month sales	Full range	3 days & backward imputation
#11	Six	One month customer visits	One month sales	Full range	8 days & backward imputation
#12	Six	One month customer visits	One month sales	Full range	3 days & backward imputation
#13	Single	One month sales	One month sales	Full range	8 days & backward imputation
#14	Single	One month sales	One month sales	Full range	3 days & backward imputation
#15	Six	One month sales	One month sales	Full range	8 days & backward imputation
#16	Six	One month sales	One month sales	Full range	3 days & backward imputation
#17	Single	One month customer visits	One month sales	Positive only	8 days & forward imputation
#18	Single	One month customer visits	One month sales	Positive only	3 days & forward imputation
#19	Six	One month customer visits	One month sales	Positive only	8 days & forward imputation
#20	Six	One month customer visits	One month sales	Positive only	3 days & forward imputation
#21	Single	One month sales	One month sales	Positive only	8 days & forward imputation
#22	Single	One month sales	One month sales	Positive only	3 days & forward imputation
#23	Six	One month sales	One month sales	Positive only	8 days & forward imputation
#24	Six	One month sales	One month sales	Positive only	3 days & forward imputation
#25	Single	One month customer visits	One month sales	Positive only	8 days & backward imputation
#26	Single	One month customer visits	One month sales	Positive only	3 days & backward imputation
#27	Six	One month customer visits	One month sales	Positive only	8 days & backward imputation
#28	Six	One month customer visits	One month sales	Positive only	3 days & backward imputation
#29	Single	One month sales	One month sales	Positive only	8 days & backward imputation
#30	Single	One month sales	One month sales	Positive only	3 days & backward imputation
#31	Six	One month sales	One month sales	Positive only	8 days & backward imputation
#32	Six	One month sales	One month sales	Positive only	3 days & backward imputation

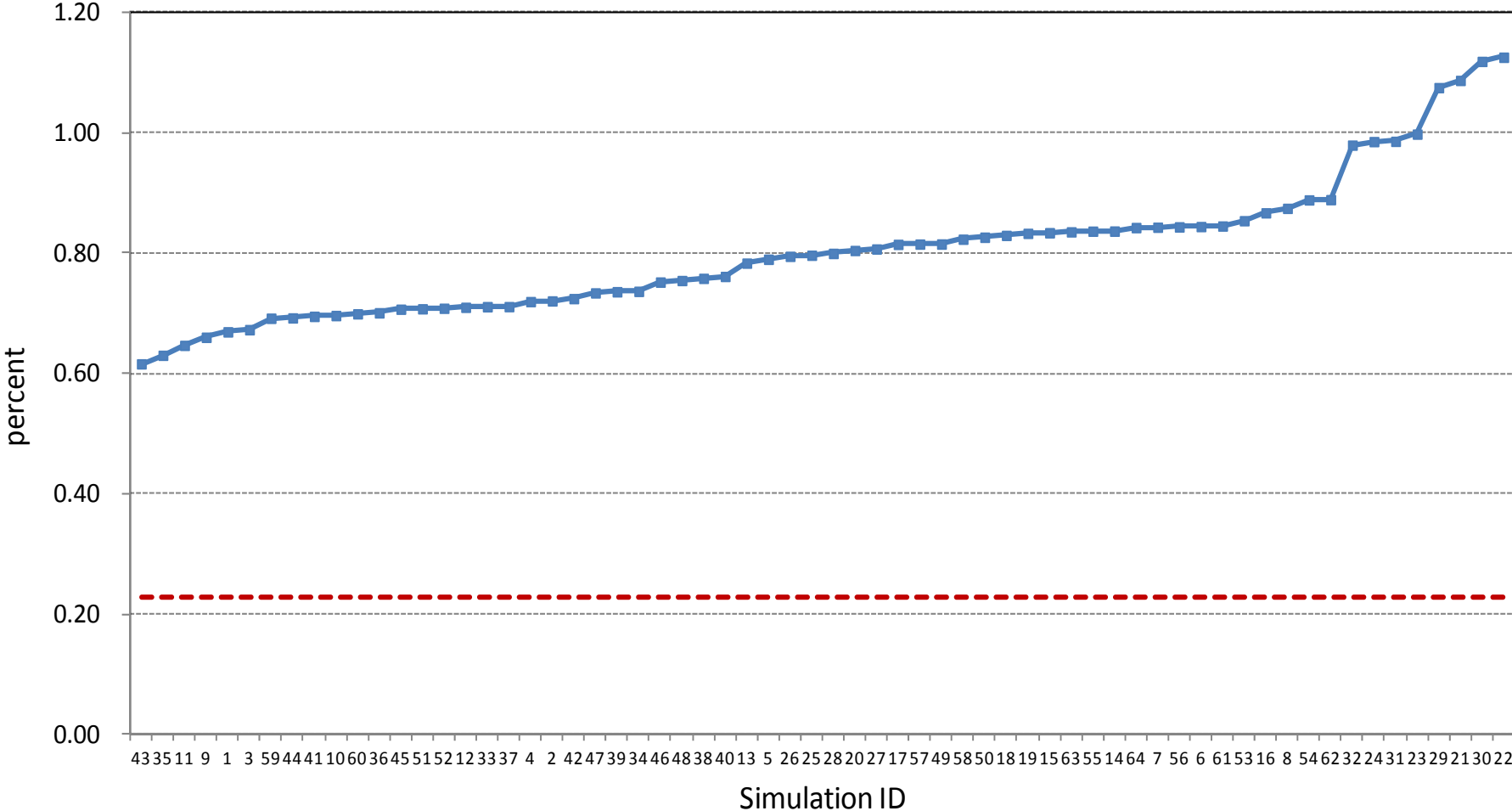
List of Purposive Simulations

	Regions	Outlet sampling	Product sampling	List of product types	Treatment of sale prices
#33	Single	Three month customer visits	Three month sales	Full range	8 days & forward imputation
#34	Single	Three month customer visits	Three month sales	Full range	3 days & forward imputation
#35	Six	Three month customer visits	Three month sales	Full range	8 days & forward imputation
#36	Six	Three month customer visits	Three month sales	Full range	3 days & forward imputation
#37	Single	Three month sales	Three month sales	Full range	8 days & forward imputation
#38	Single	Three month sales	Three month sales	Full range	3 days & forward imputation
#39	Six	Three month sales	Three month sales	Full range	8 days & forward imputation
#40	Six	Three month sales	Three month sales	Full range	3 days & forward imputation
#41	Single	Three month customer visits	Three month sales	Full range	8 days & backward imputation
#42	Single	Three month customer visits	Three month sales	Full range	3 days & backward imputation
#43	Six	Three month customer visits	Three month sales	Full range	8 days & backward imputation
#44	Six	Three month customer visits	Three month sales	Full range	3 days & backward imputation
#45	Single	Three month sales	Three month sales	Full range	8 days & backward imputation
#46	Single	Three month sales	Three month sales	Full range	3 days & backward imputation
#47	Six	Three month sales	Three month sales	Full range	8 days & backward imputation
#48	Six	Three month sales	Three month sales	Full range	3 days & backward imputation
#49	Single	Three month customer visits	Three month sales	Positive only	8 days & forward imputation
#50	Single	Three month customer visits	Three month sales	Positive only	3 days & forward imputation
#51	Six	Three month customer visits	Three month sales	Positive only	8 days & forward imputation
#52	Six	Three month customer visits	Three month sales	Positive only	3 days & forward imputation
#53	Single	Three month sales	Three month sales	Positive only	8 days & forward imputation
#54	Single	Three month sales	Three month sales	Positive only	3 days & forward imputation
#55	Six	Three month sales	Three month sales	Positive only	8 days & forward imputation
#56	Six	Three month sales	Three month sales	Positive only	3 days & forward imputation
#57	Single	Three month customer visits	Three month sales	Positive only	8 days & backward imputation
#58	Single	Three month customer visits	Three month sales	Positive only	3 days & backward imputation
#59	Six	Three month customer visits	Three month sales	Positive only	8 days & backward imputation
#60	Six	Three month customer visits	Three month sales	Positive only	3 days & backward imputation
#61	Single	Three month sales	Three month sales	Positive only	8 days & backward imputation
#62	Single	Three month sales	Three month sales	Positive only	3 days & backward imputation
#63	Six	Three month sales	Three month sales	Positive only	8 days & backward imputation
#64	Six	Three month sales	Three month sales	Positive only	3 days & backward imputation

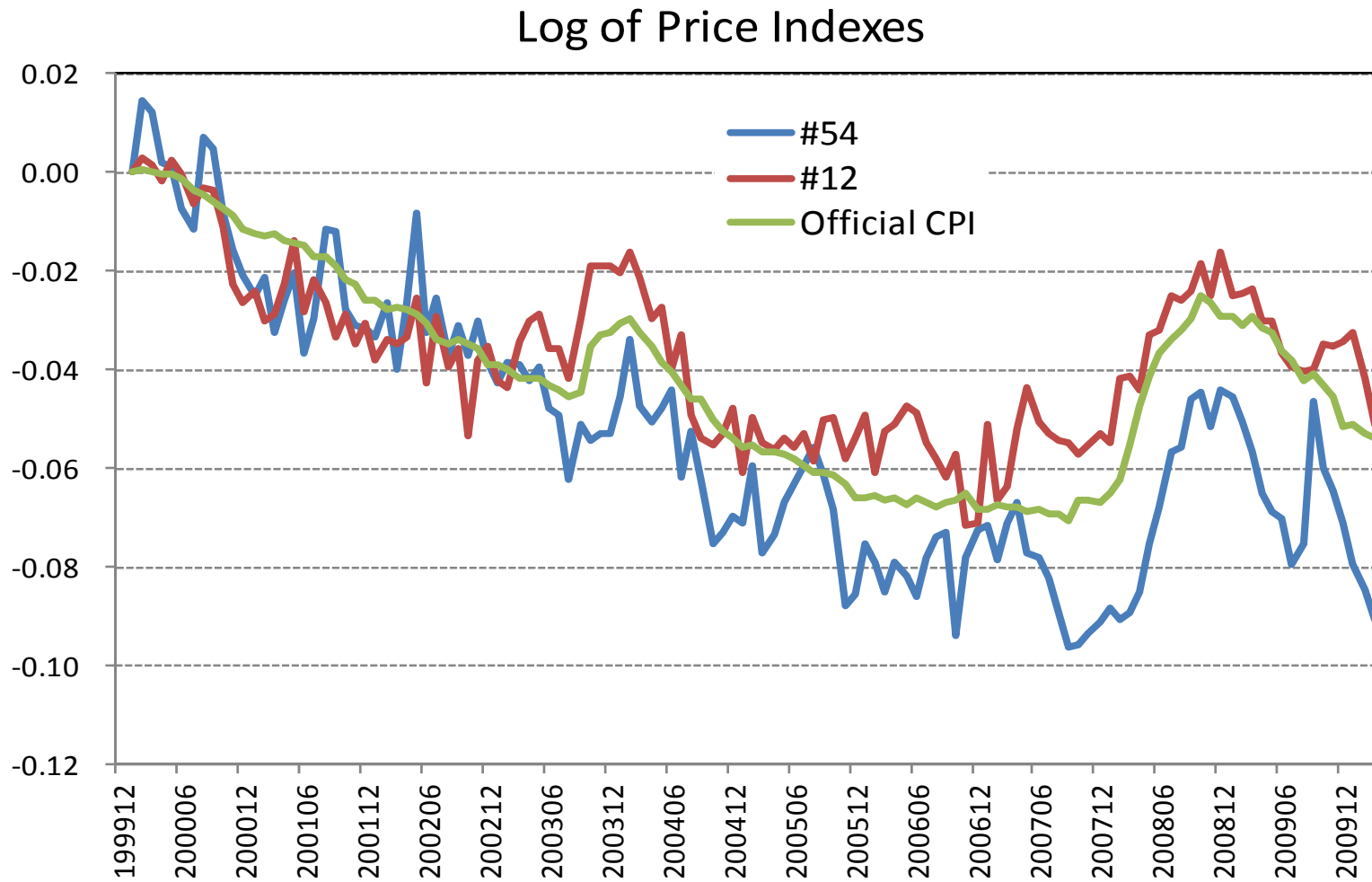
Results of 64 simulations: Mean of monthly inflation



Results of 64 simulations: Standard deviation of monthly inflation

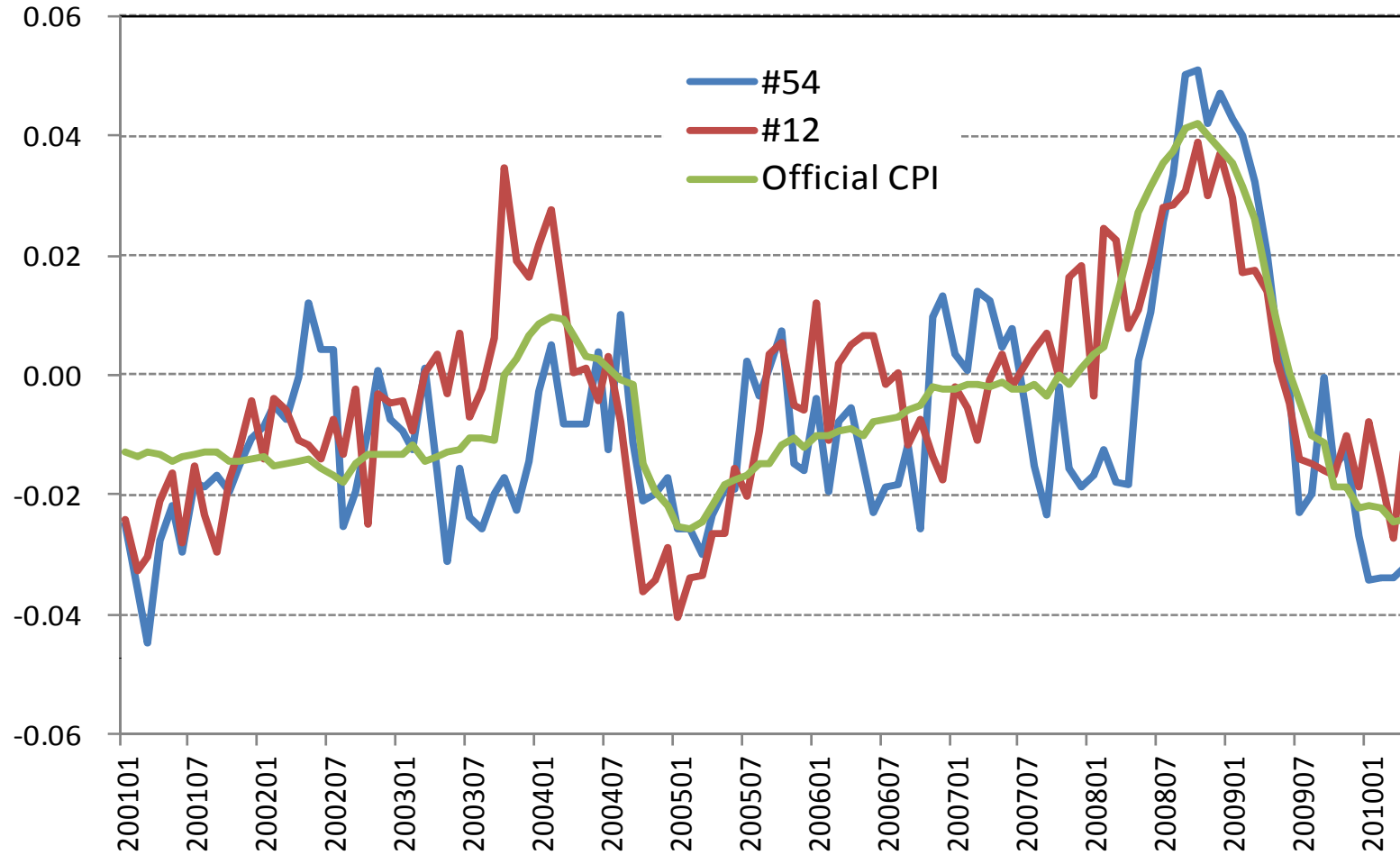


Price Indexes Based on Purposive Sampling



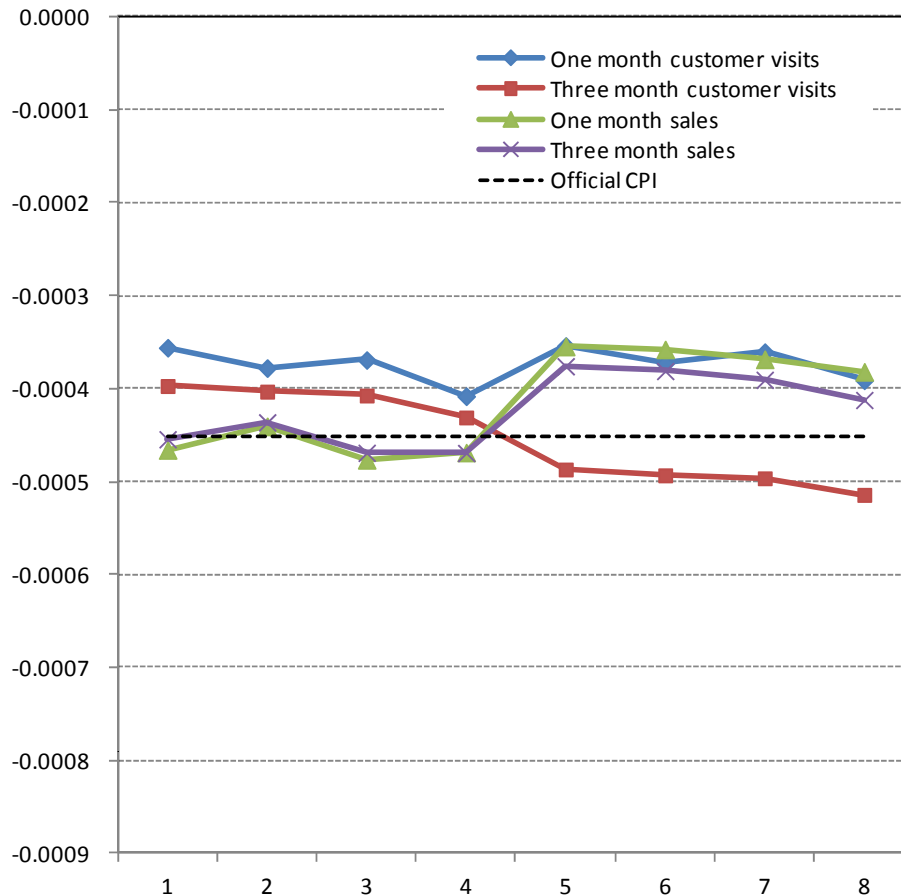
Price Indexes Based on Purposive Sampling

Year-on-Year Inflation

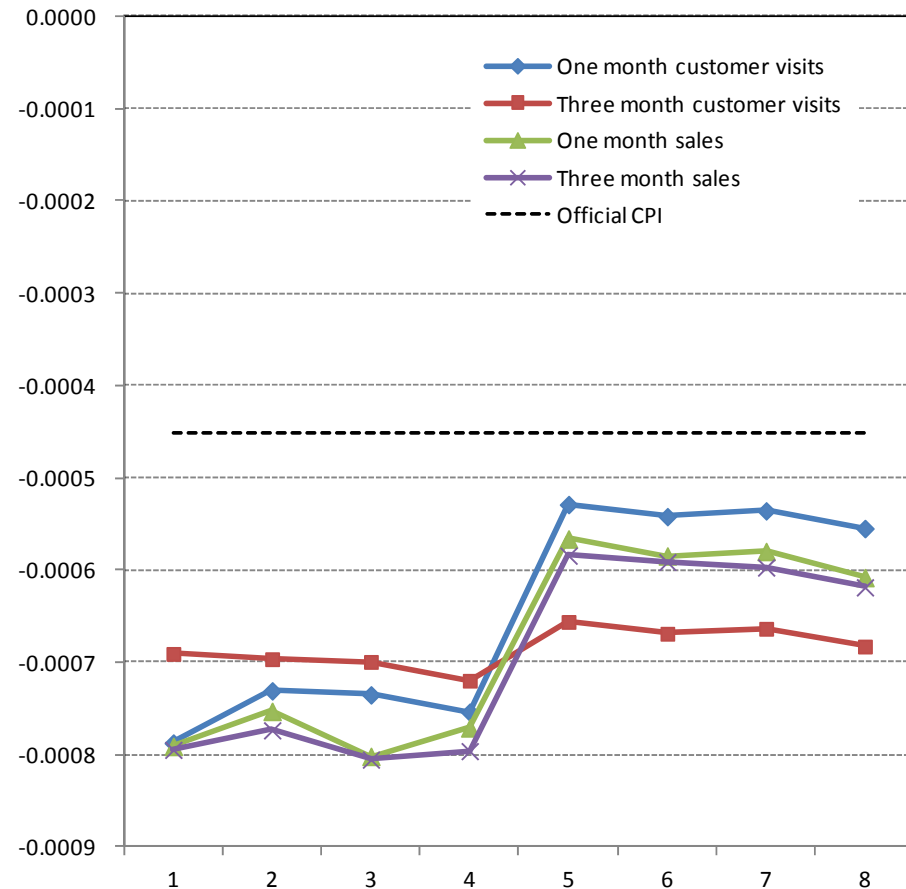


Outlet and Product Sampling

Sampling with full range of characteristics



Sampling with positive characteristics only

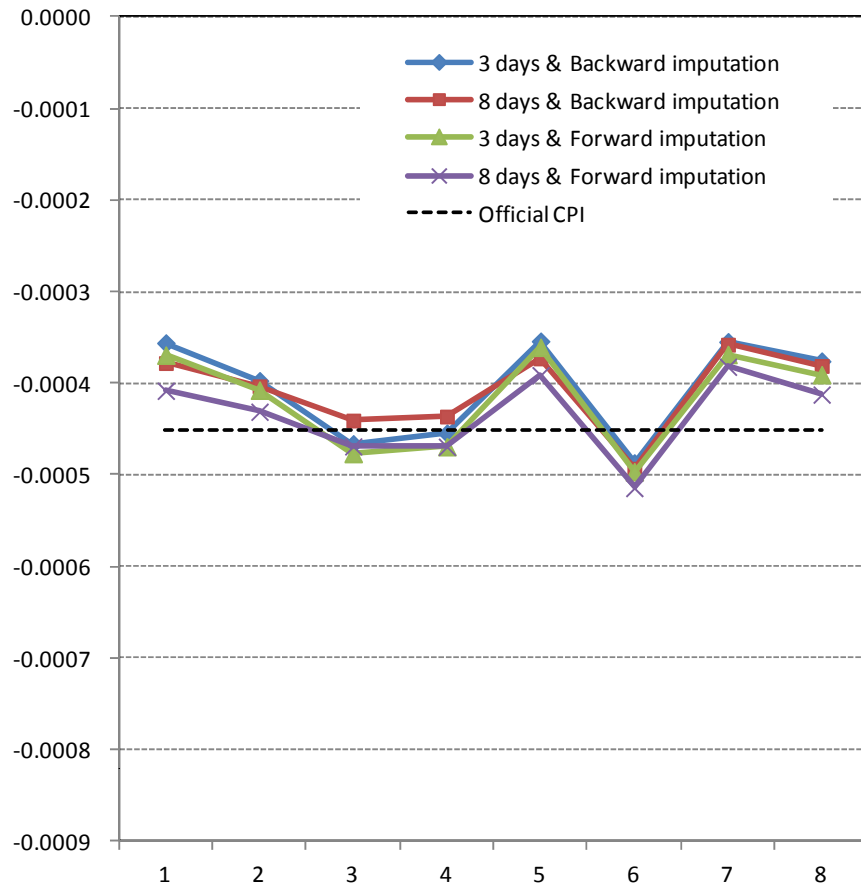


1. Single region & 3 days-backward
2. Single region & 8 days-backward
3. Single region & 3 days-forward
4. Single region & 8 days-forward

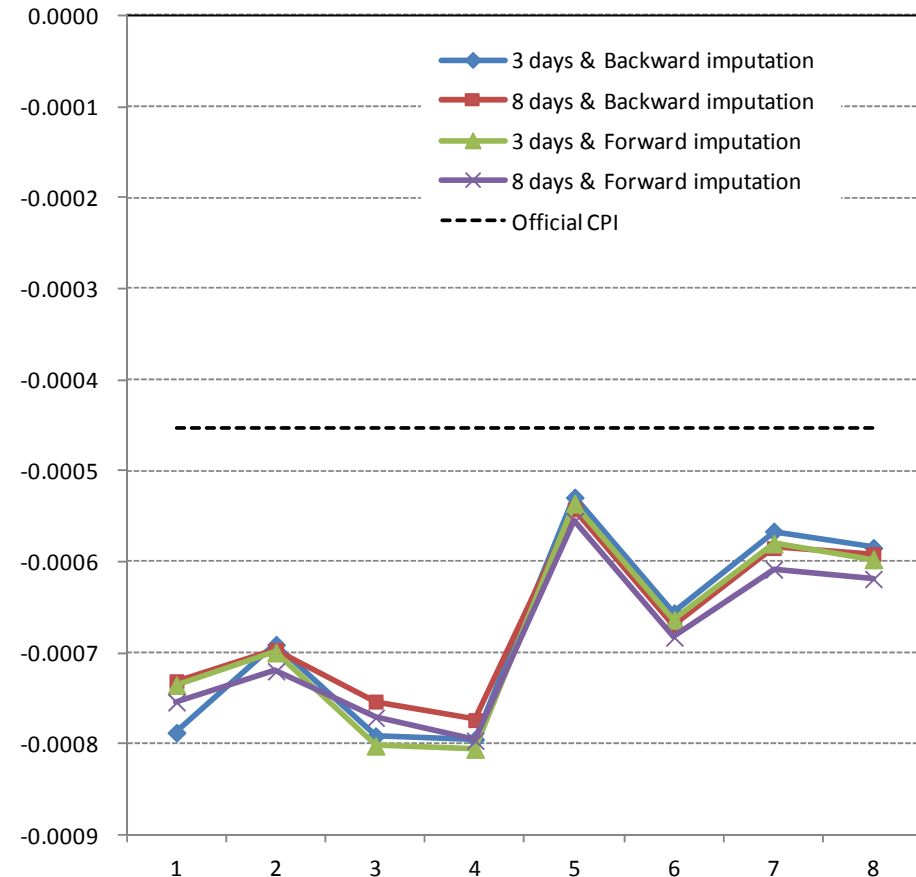
5. Six regions & 3 days-backward
6. Six regions & 8 days-backward
7. Six regions & 3 days-forward
8. Six regions & 8 days-forward

Treatment of Sale Prices

Sampling with full range of characteristics



Sampling with positive characteristics only

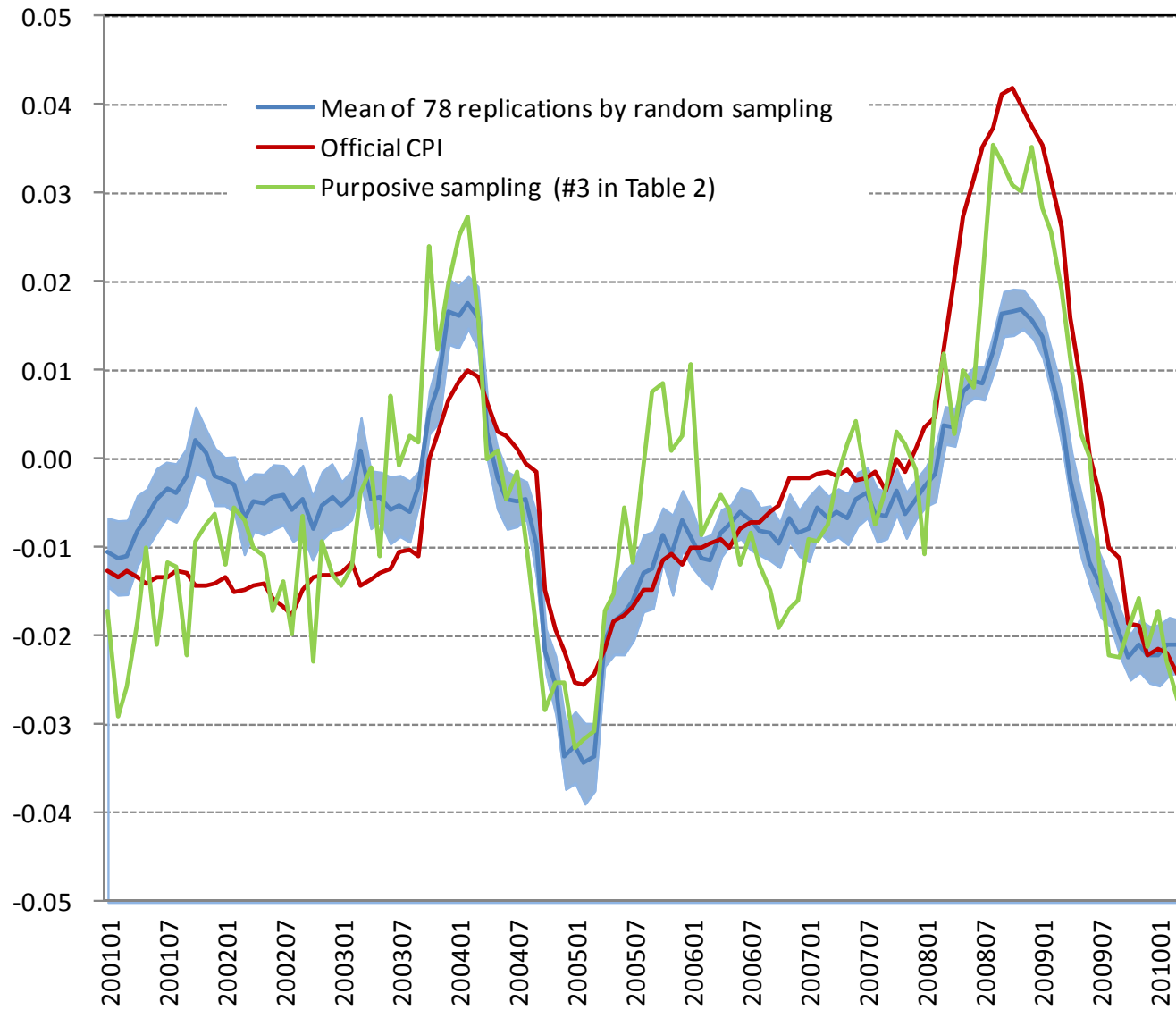


1. Single region & one-month customer
2. Single region & 2. three-month customer
3. Single region & one-month sales
4. Single region & three-month sales

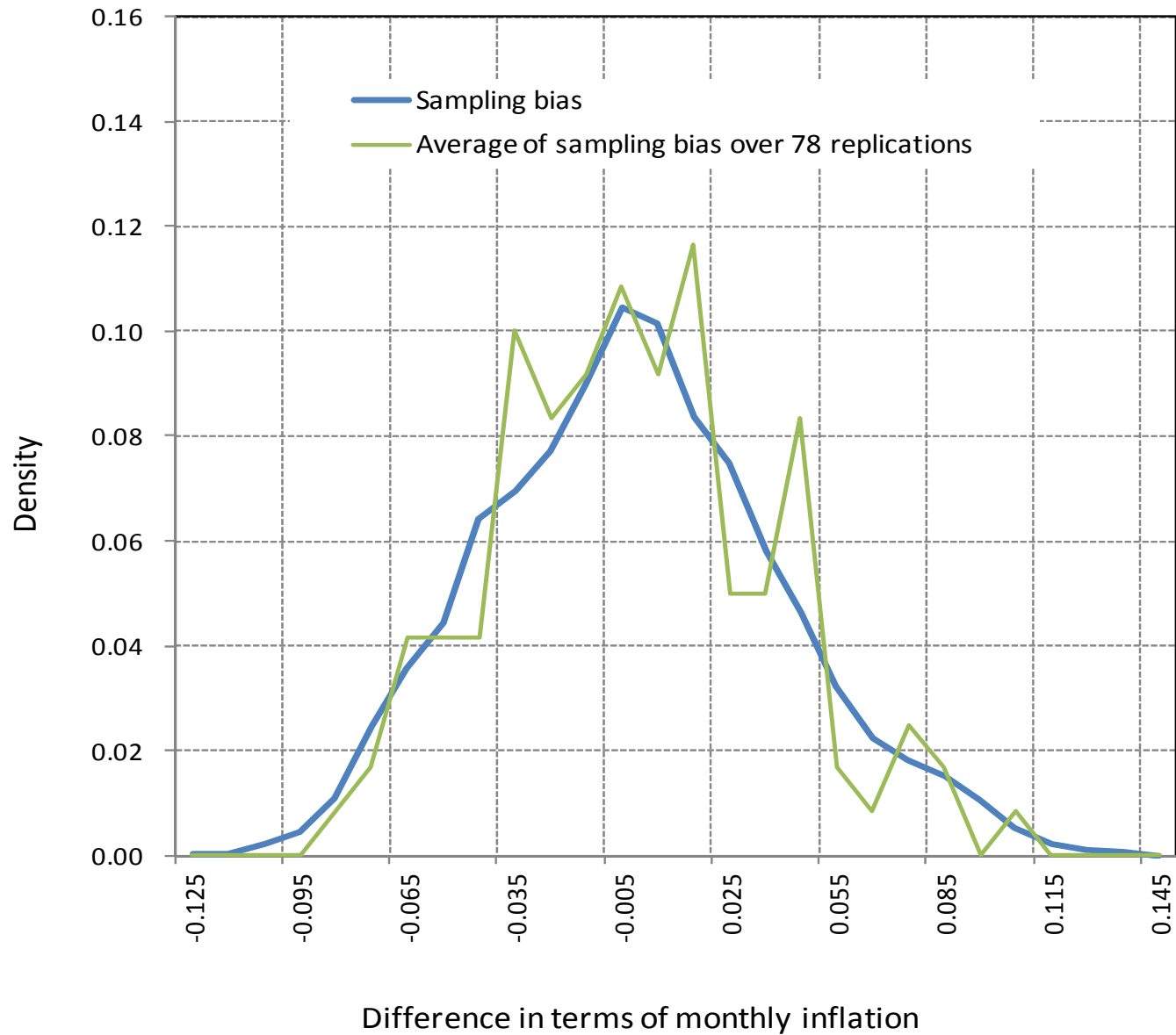
5. Six regions & one-month customer
6. Six regions & three-month customer
7. Six regions & one-month sales
8. Six regions & three-month sales

Random Sampling

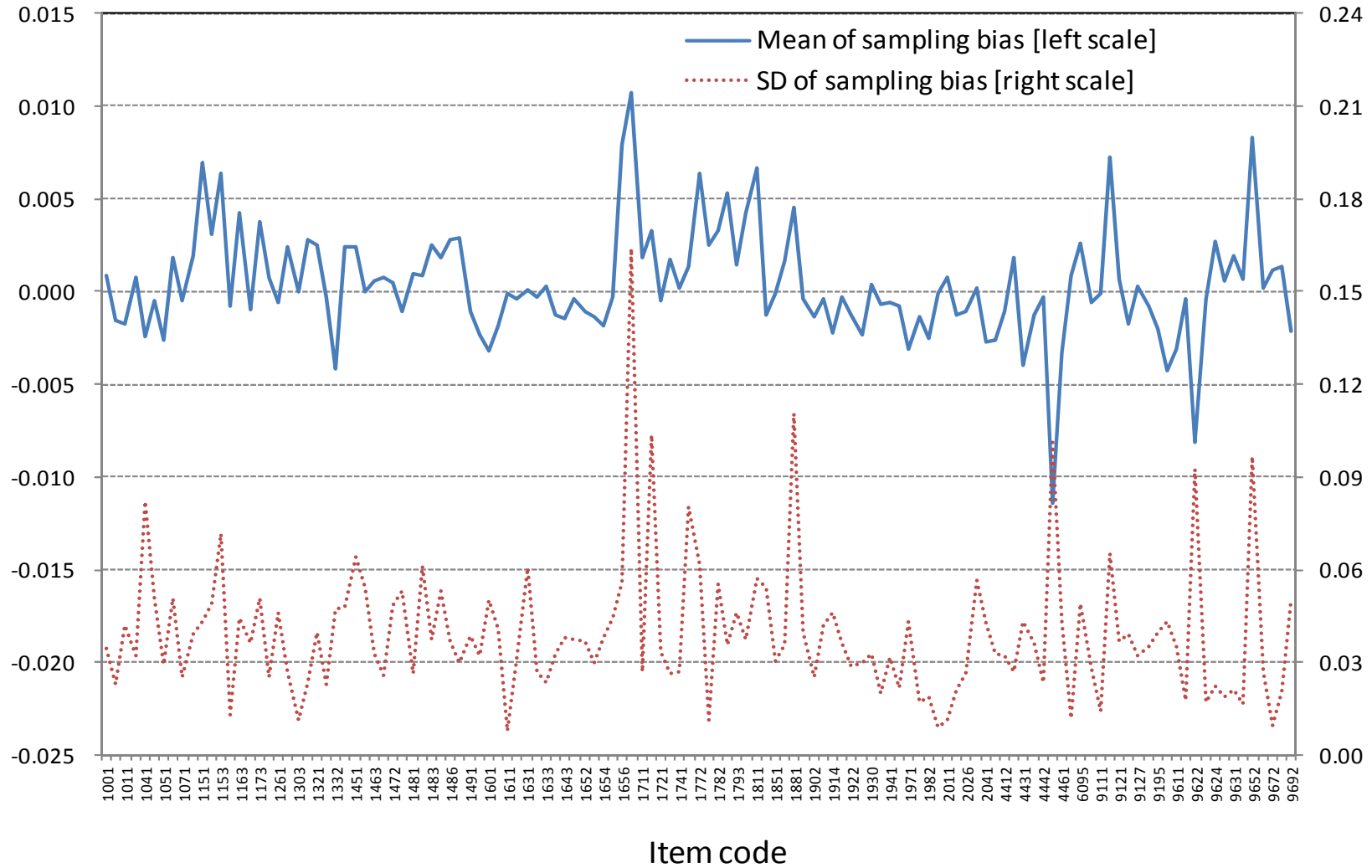
Year-on-Year Inflation Estimated Using Random Sampling



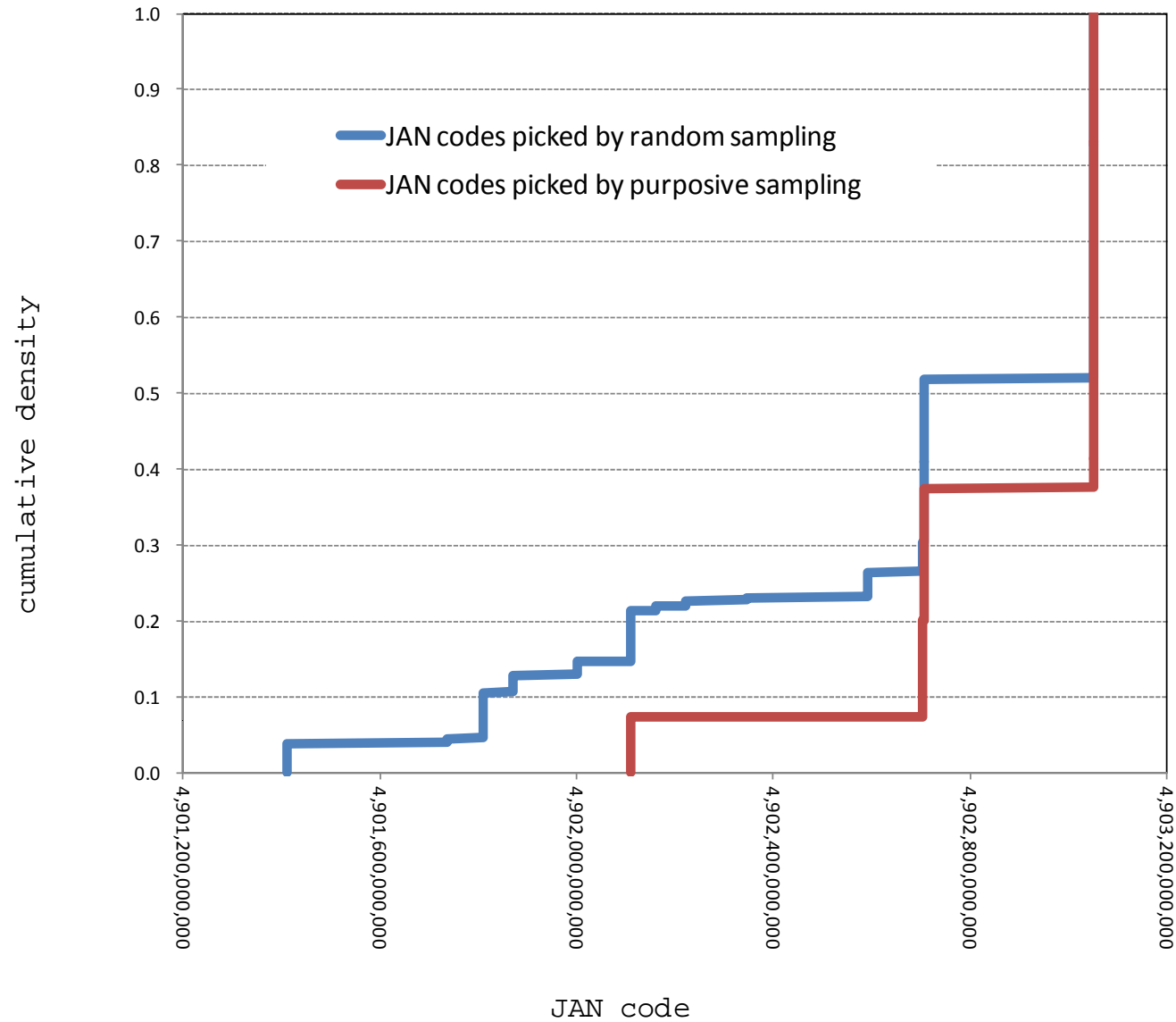
Sampling Bias for Margarine



Sampling Bias by Item

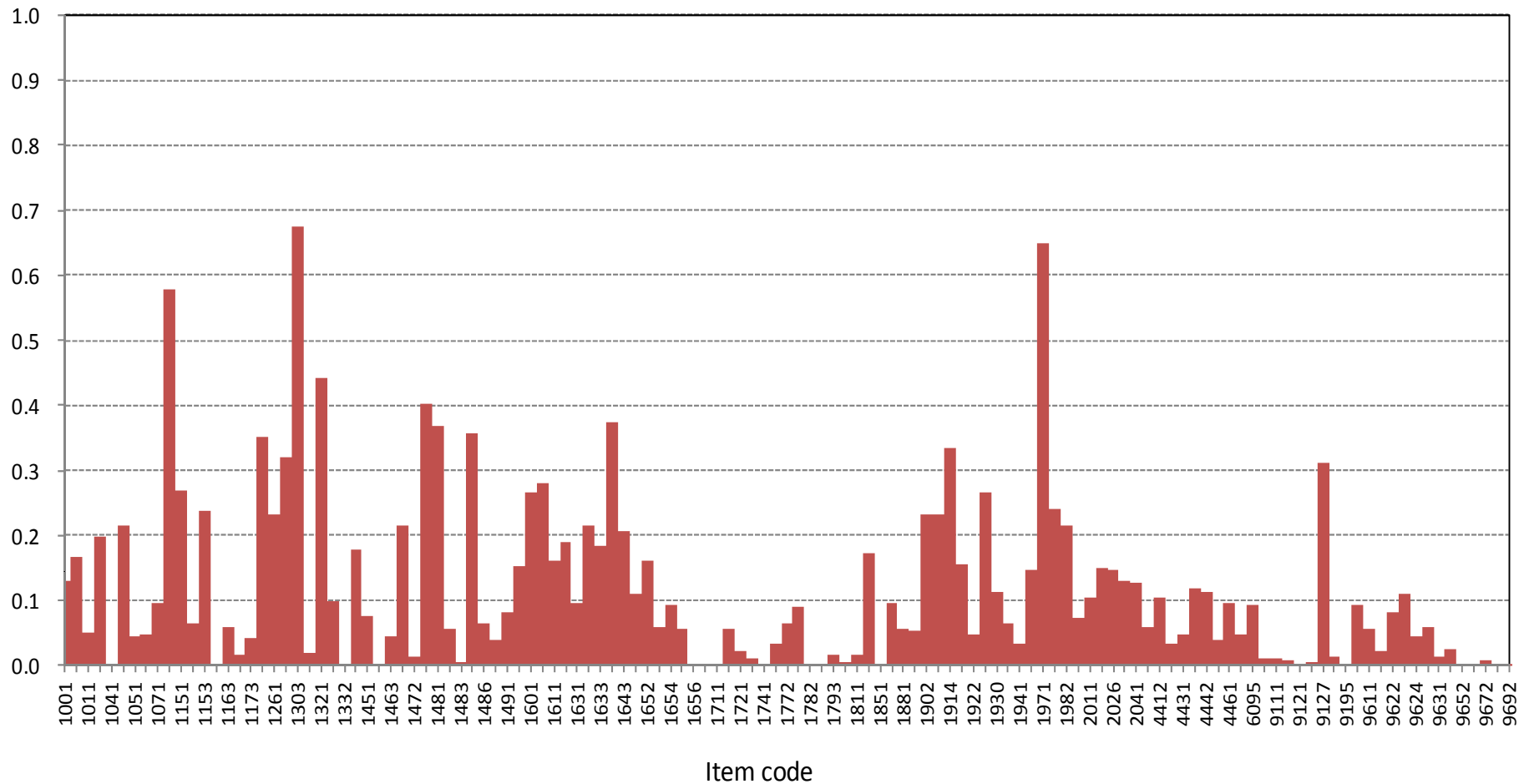


JAN codes picked by random and purposive sampling: Margarine

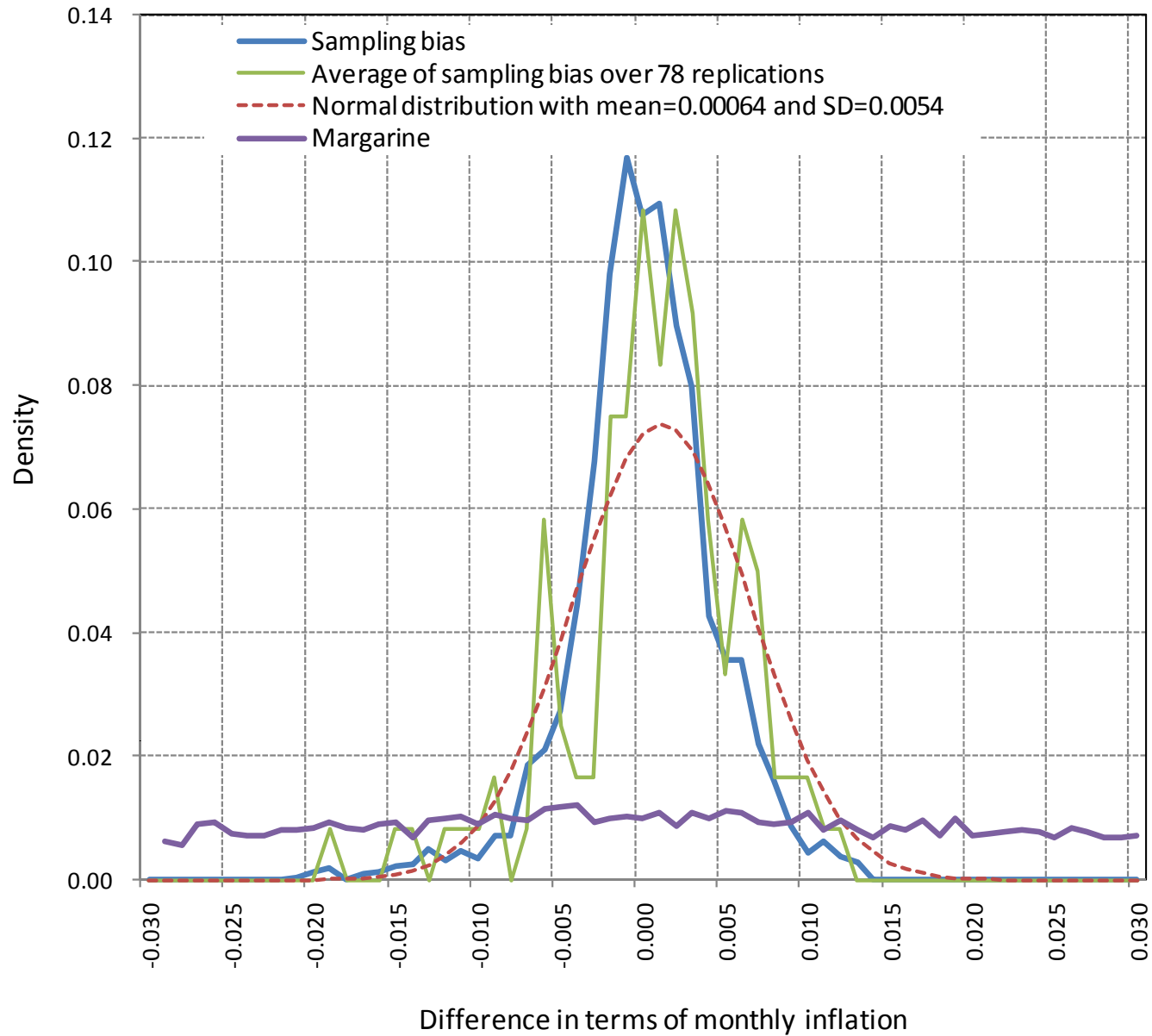


Overlap of Products that Meet the JSB Product Type Specifications among Those Picked by Random Sampling

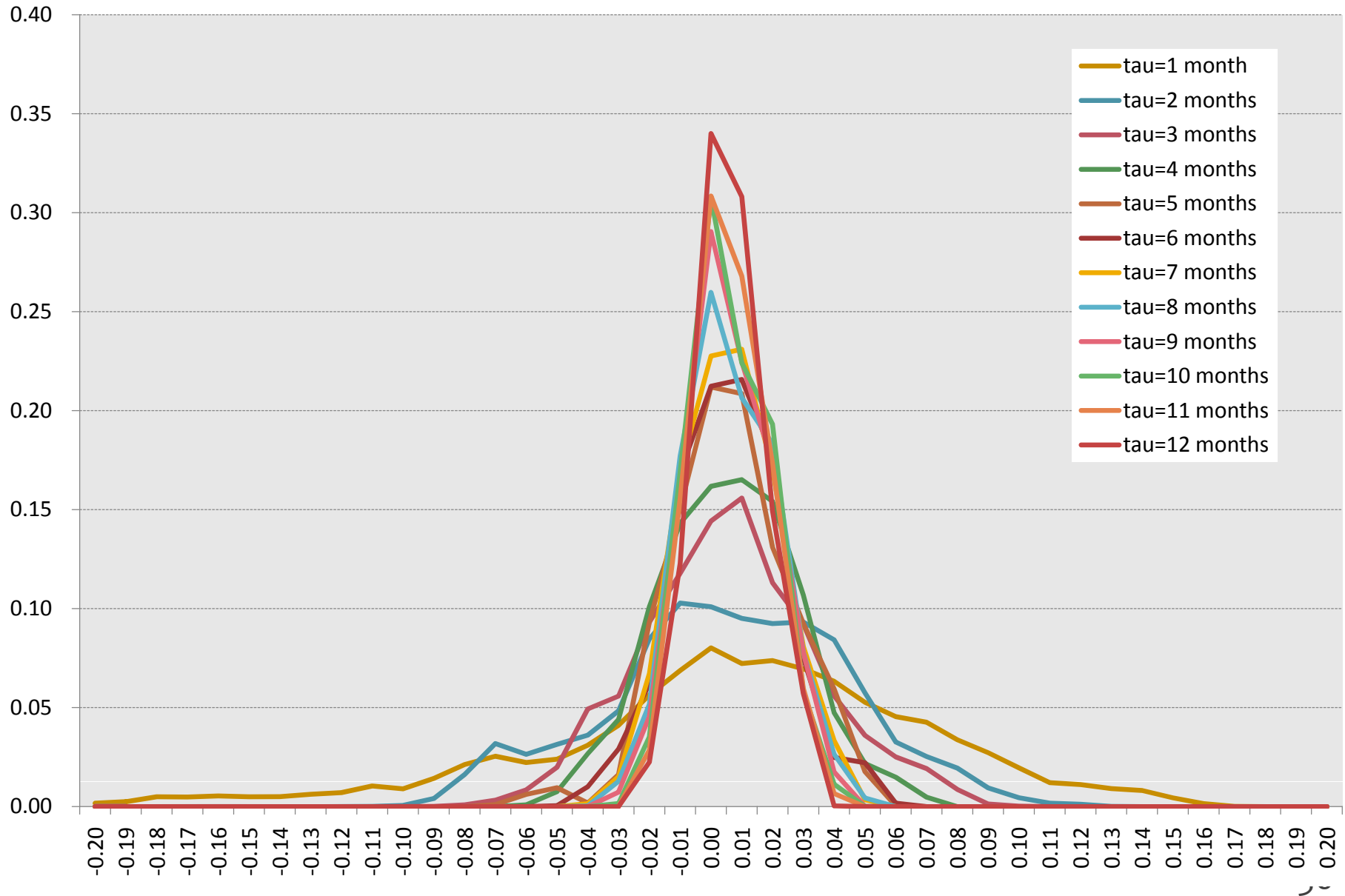
Fraction of matches at the level of JAN code



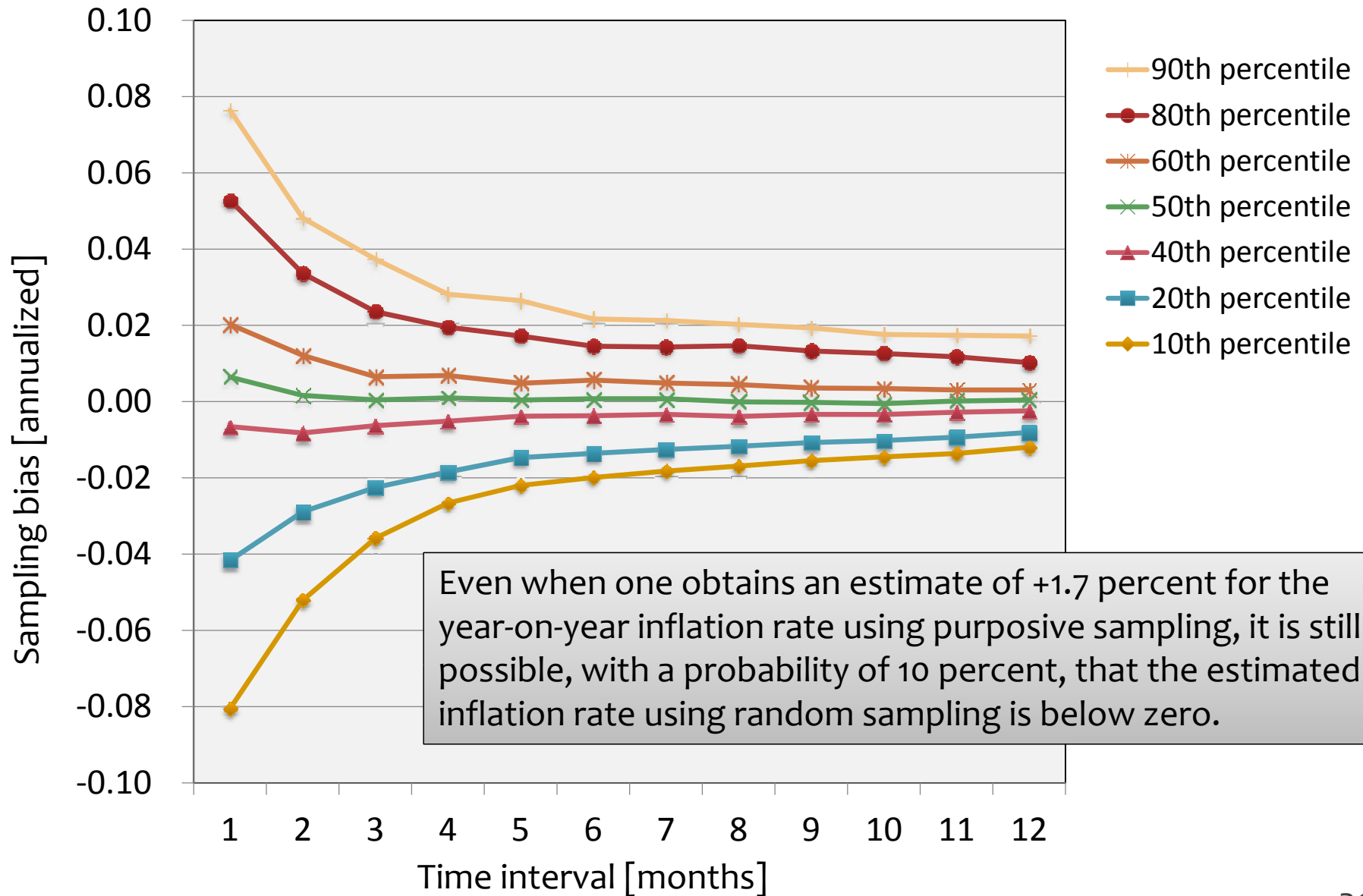
Sampling Bias at the Aggregate Level



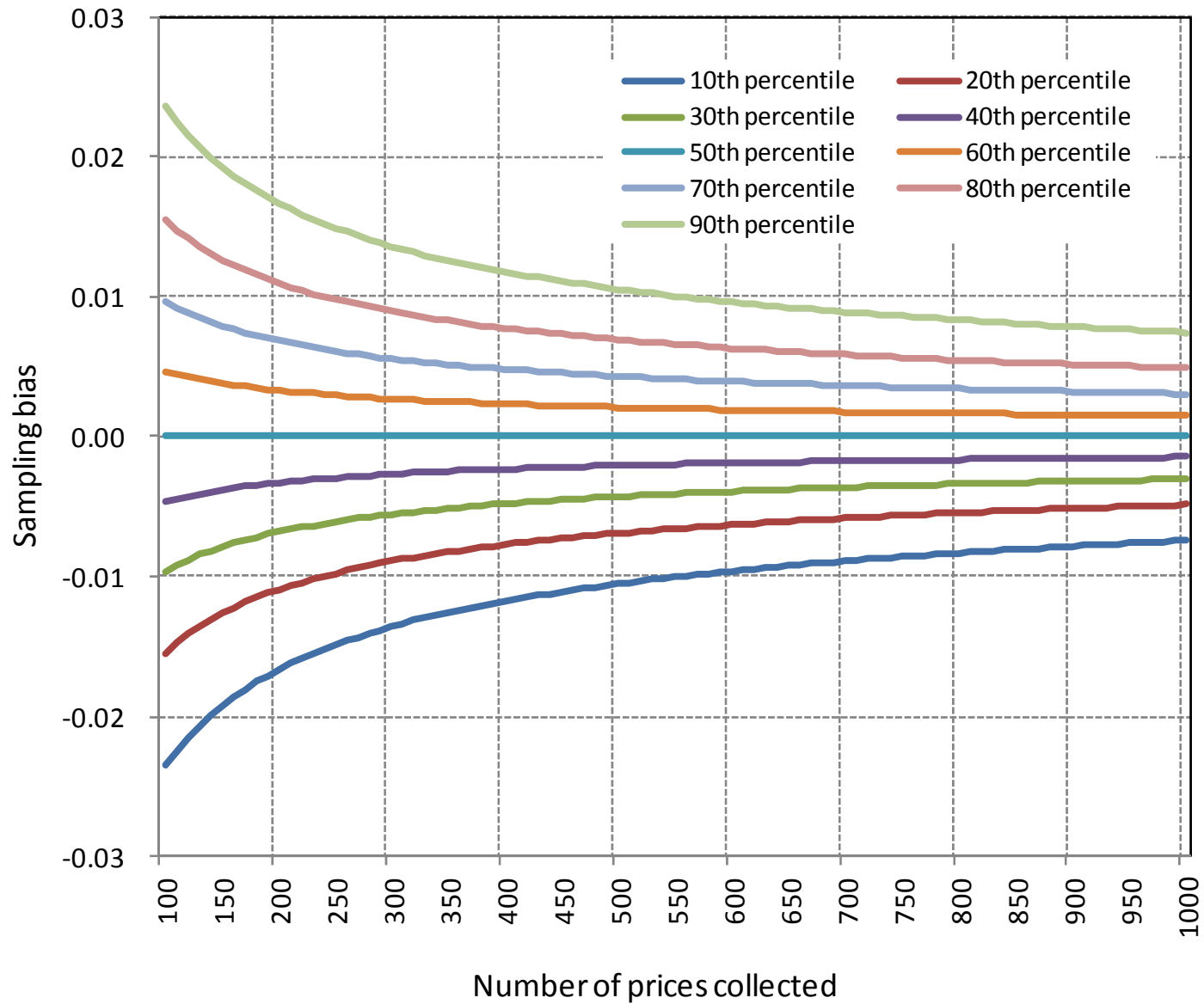
Sampling Bias for Different Time Intervals



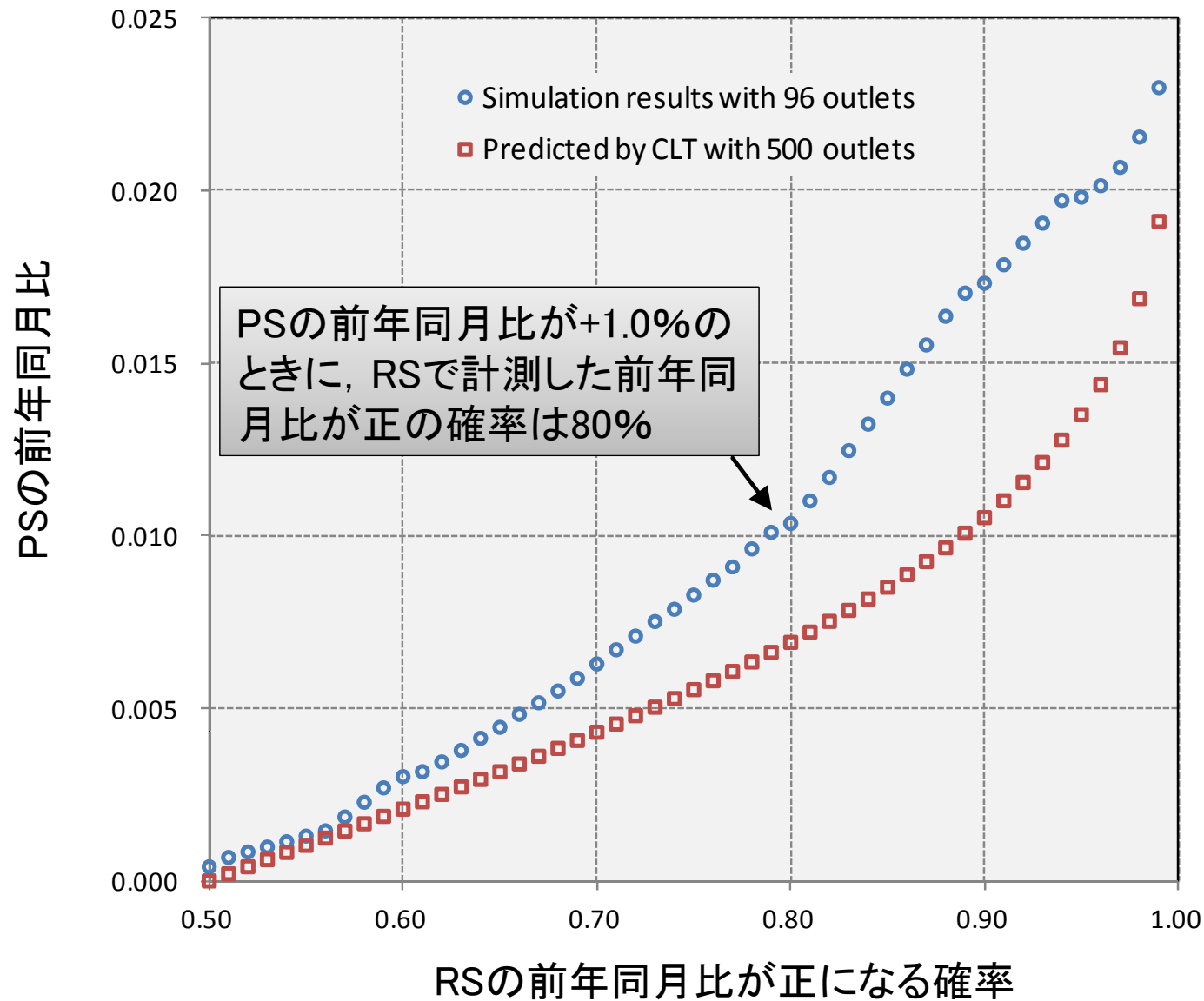
Sampling Bias for Different Time Intervals



前年同月比のsampling bias: 理論値



Random samplingの前年同月比が正であるための条件



(暫定的な)結論

- Purposive samplingのルールとして総務省統計局のルールと類似のものを使用すると、公表値とほぼ同じインフレ率を再現できる。
 - ただし、インフレ率のボラティリティは公表値を大きく上回る。
- Purposive samplingのルールを変化させると、デフレ率は最大でCPI公表値の約2倍となる。
 - しかしそれでも、米国の大恐慌期の激しいデフレ(年率7%)には遠く及ばない。日本のデフレはmoderateである。
- Random samplingとpurposive samplingの差(サンプルバイアス)は個別品目では極めて大きい。しかし125品目を集計すると、バイアスは劇的に縮まる。
 - 仮にpurposive samplingによる推計値が+1%だったとしても、random samplingによる推計値は、20%の確率でマイナス。この意味で、purposive samplingの推計値からデフレ脱却を判断するには「のりしろ」が必要。