Real-Time Consumer Price Indexes

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7. one does not fully understand CPI until one builds it himself!

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4. central banks do it, i.e. (Lünnemann & Wintr, 2006) at ECB, (Lazyan et. al, 2017) at CBA, (Hull et al., 2017) at Riksbank, (Macias & Stelmasiak, 2019) at NBP, (Ellul, 2019) at CBM

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3. (Aparicio & Berolotto, 2017): "online price indices anticipate changes in official inflation trends more than one month in advance. [...] baseline one-month forecast outperforms Bloomberg surveys of forecasters and statistical benchmarks for Australia, Canada, France, Germany, Greece, Ireland, Italy, the Netherlands, UK, and the United States, also Survey of Professional Forecasters for US"

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... better forecasting = closer match to the NSI's methodology, (Macias & Stelmasiak, 2019):

Fig. 8 Sugar price index - one kilogram white, regular sugar, m-o-m.

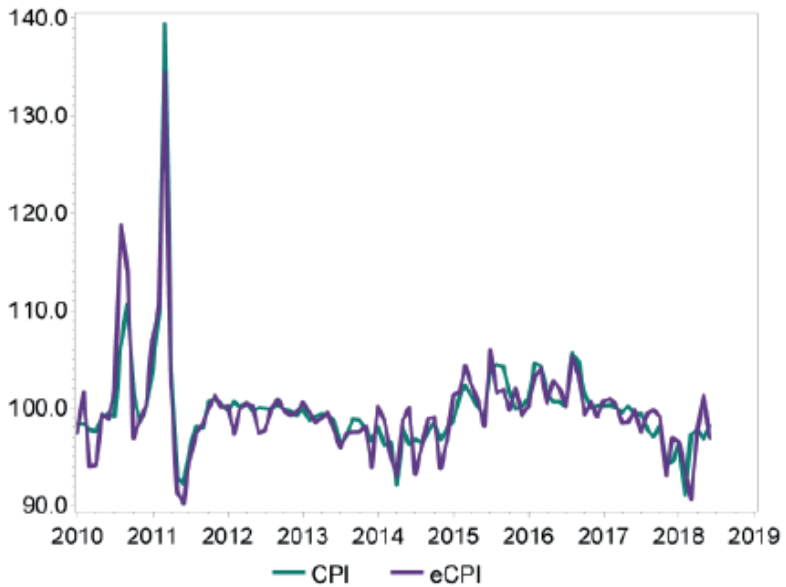
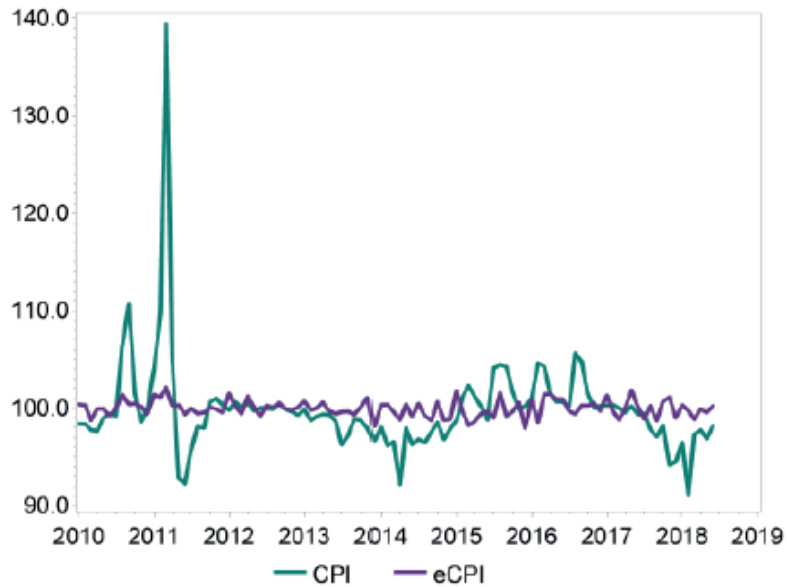


Fig. 9 Sugar price index - all kinds of sugar, m-o-m.



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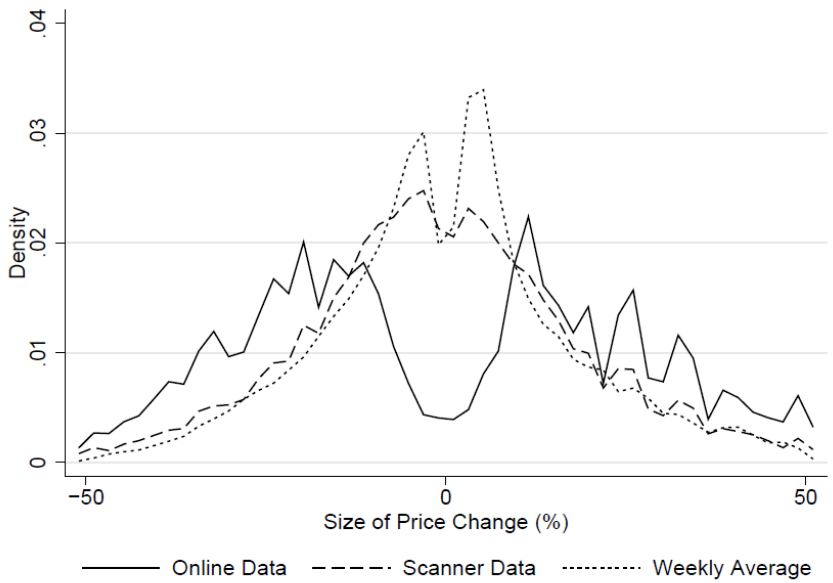

Figure 8: The Distribution of the Size of Price Changes in the US

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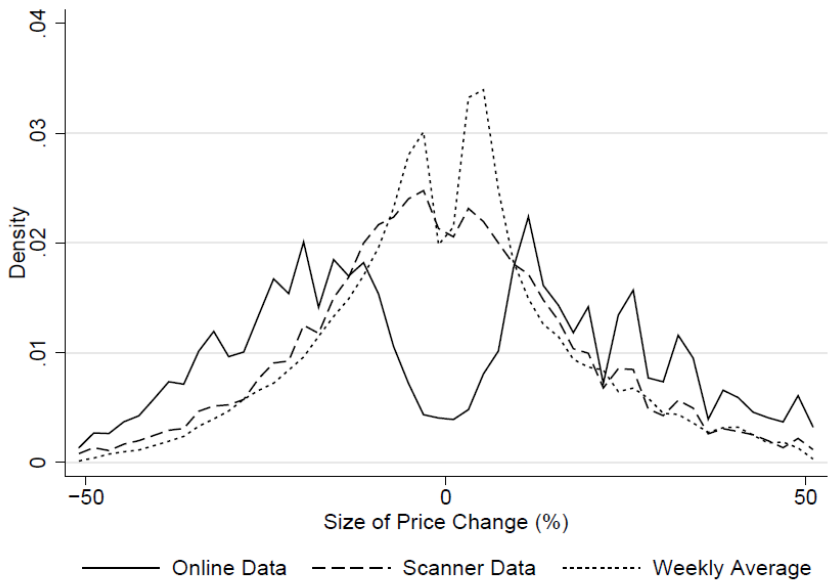

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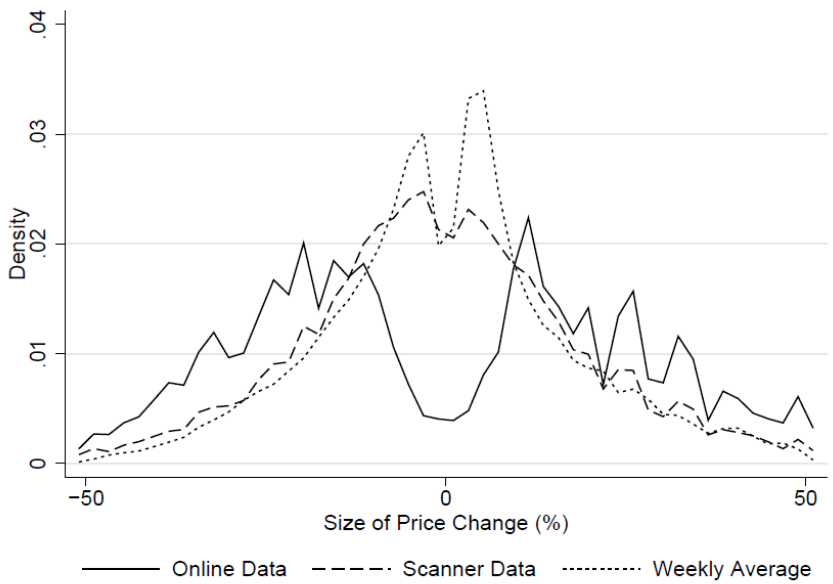

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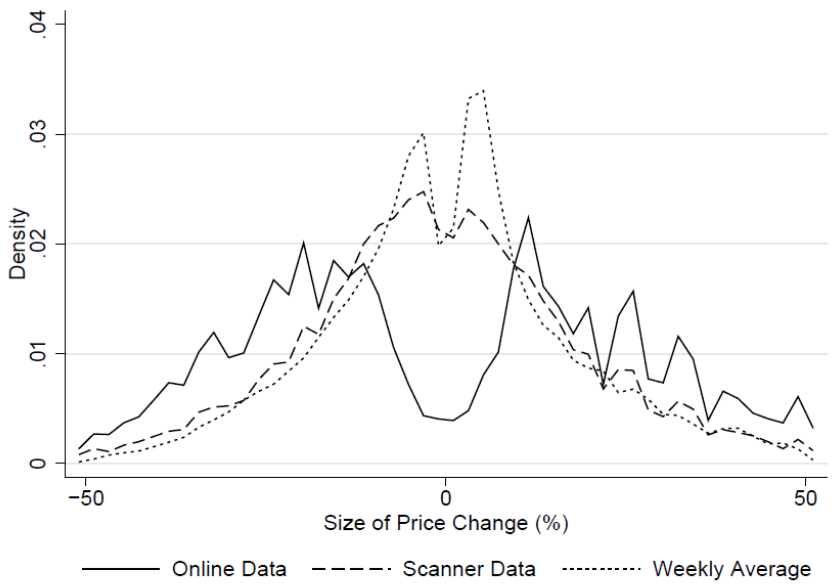
4. **why? imputation, price averaging, 'outlier' censoring**



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5. on average **approx. 72% of price levels were identical** in the online and offline samples

How are changes calculated?

The change in price at time t relative to base period b for good/service g is calculated as a geometric mean:

$$(I_b^t)^g = \left(\prod_{j=1}^{n(G_t)} \frac{p_j^t}{p_j^b} \right)^{\frac{1}{n(G_t)}} = \sqrt[n(G_t)]{\frac{p_1^t}{p_1^b} \frac{p_2^t}{p_2^b} \cdots \frac{p_{n(G_t)}^t}{p_{n(G_t)}^b}},$$

where G_t is a set of all goods corresponding to the specification g; $n(G_t)$ - quantity of goods in G_t); p_j^t - price of j good corresponding to specification g at time t; p_j^b - price of j good corresponding to specification g at base period b.

How are changes calculated?

Thus growth index for g - is geometric average of the elementary growth indexes $(i_b^t)^j = \frac{p_j^t}{p_j^b}$ for good j:

$$(I_b^t)^g = \left(\prod_{j=1}^{n(G_t)} (i_b^t)^j \right)^{\frac{1}{n(G_t)}}$$

... and the change in price at time t for good g relative to base period b is as follows:

$$(\pi_b^t)^g = 100 \times \left(\frac{(I_b^t)^g}{(I_b^b)^g} - 1 \right) = 100 \times \left((I_b^t)^g - 1 \right) \%$$

How does the elementary data look like?

"https://av.ru/i/317595/":
{"DateTimeObserved": 2020-07-04 07:49:21,
"URL": "https://av.ru/i/317595/",
"Status": InStock,
"CurrentPrice": 11870.0,
"CrossedPrice": null }

Tools

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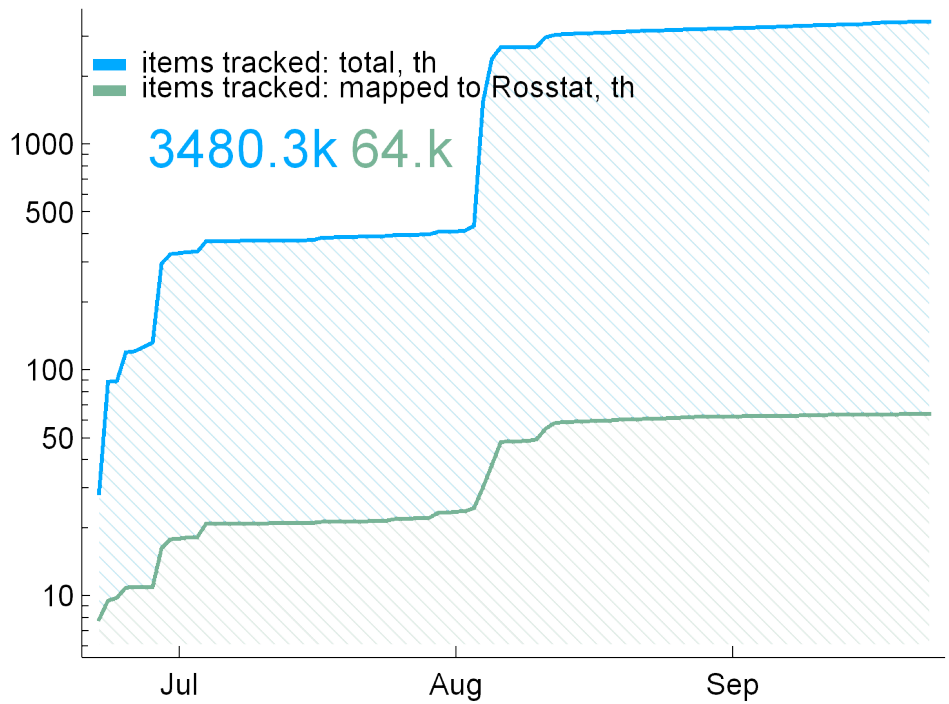
2. we use python + selenium + ms sql + captcha solvers

Scale

- 3.5M unique goods&services



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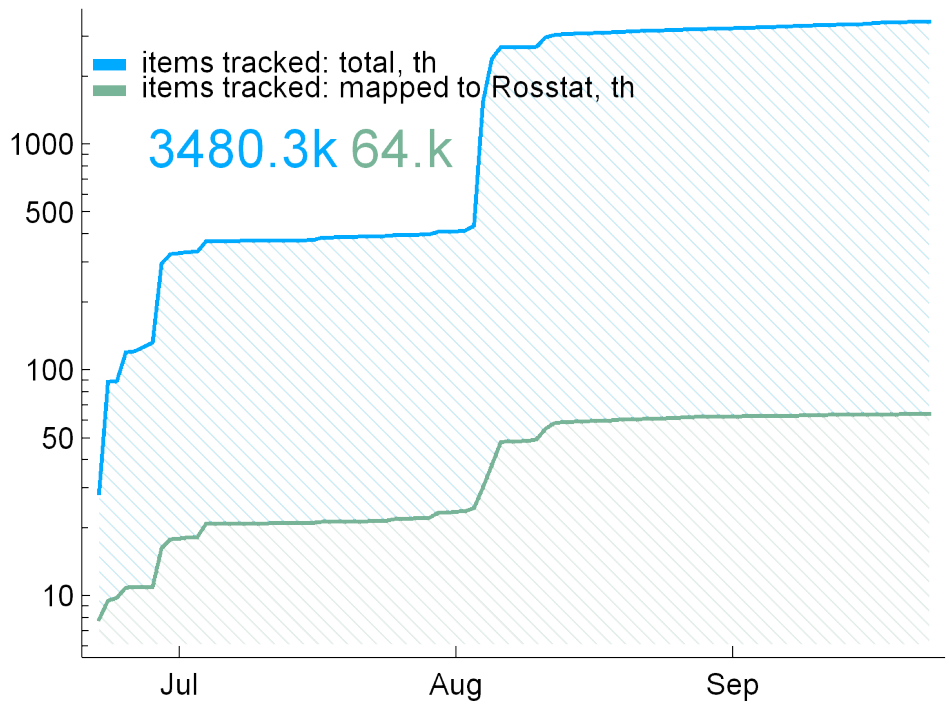

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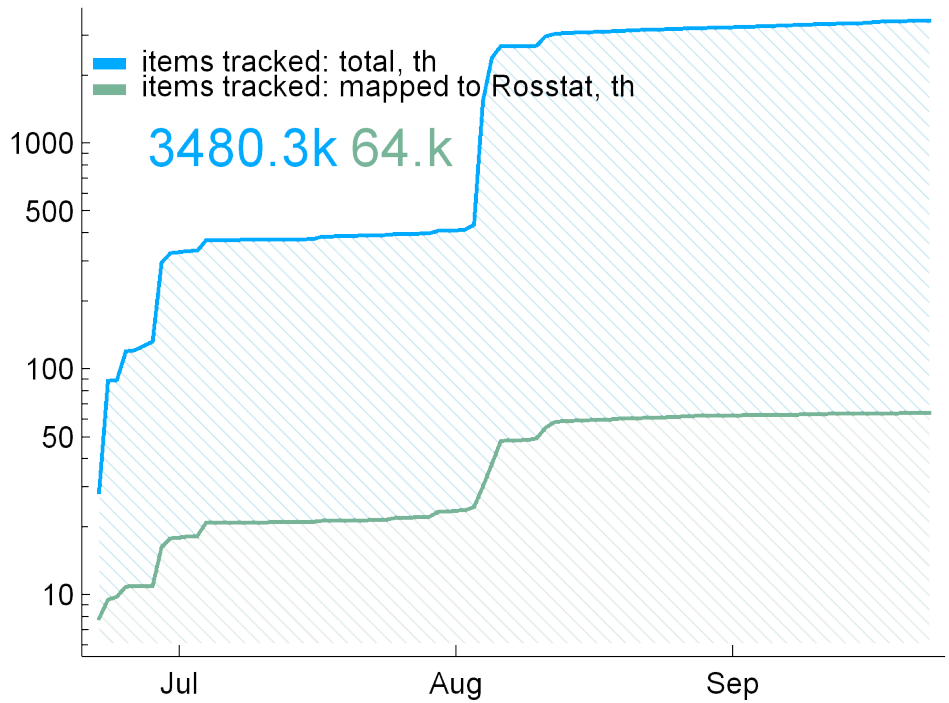

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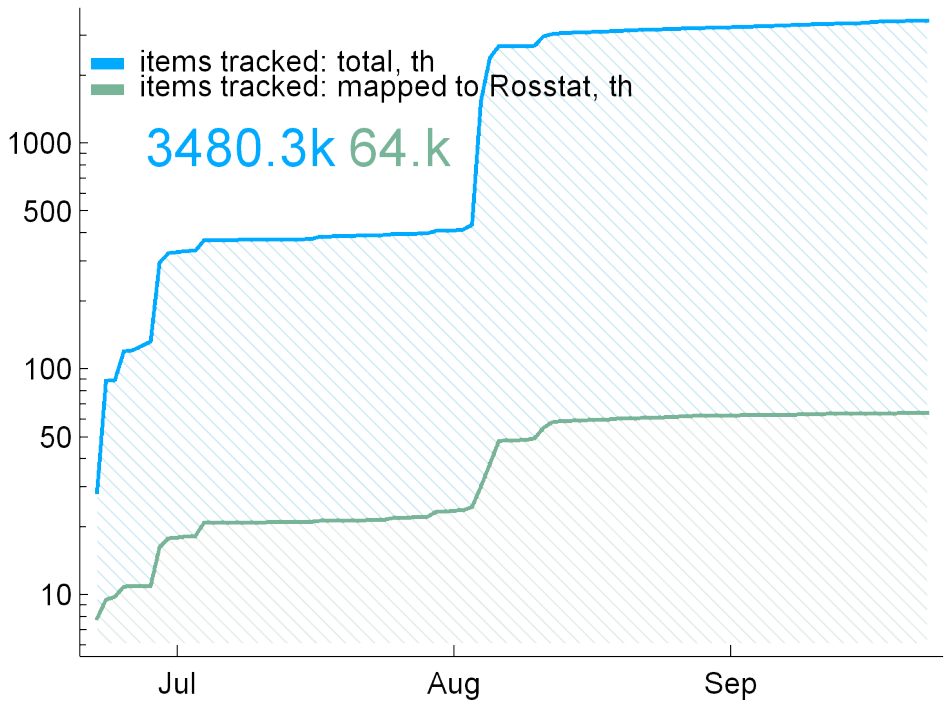
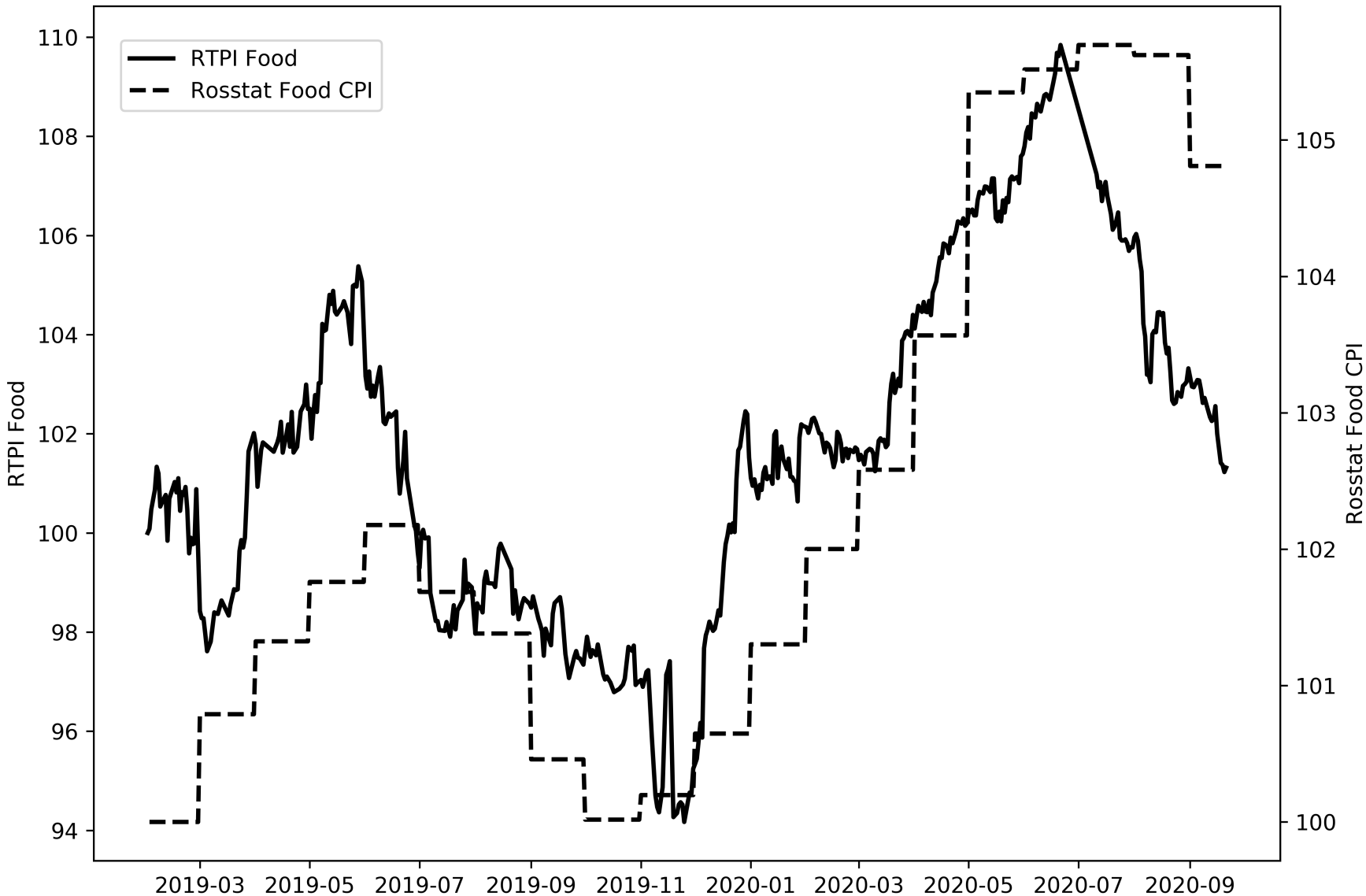
- fully cover Rosstat's goods product space

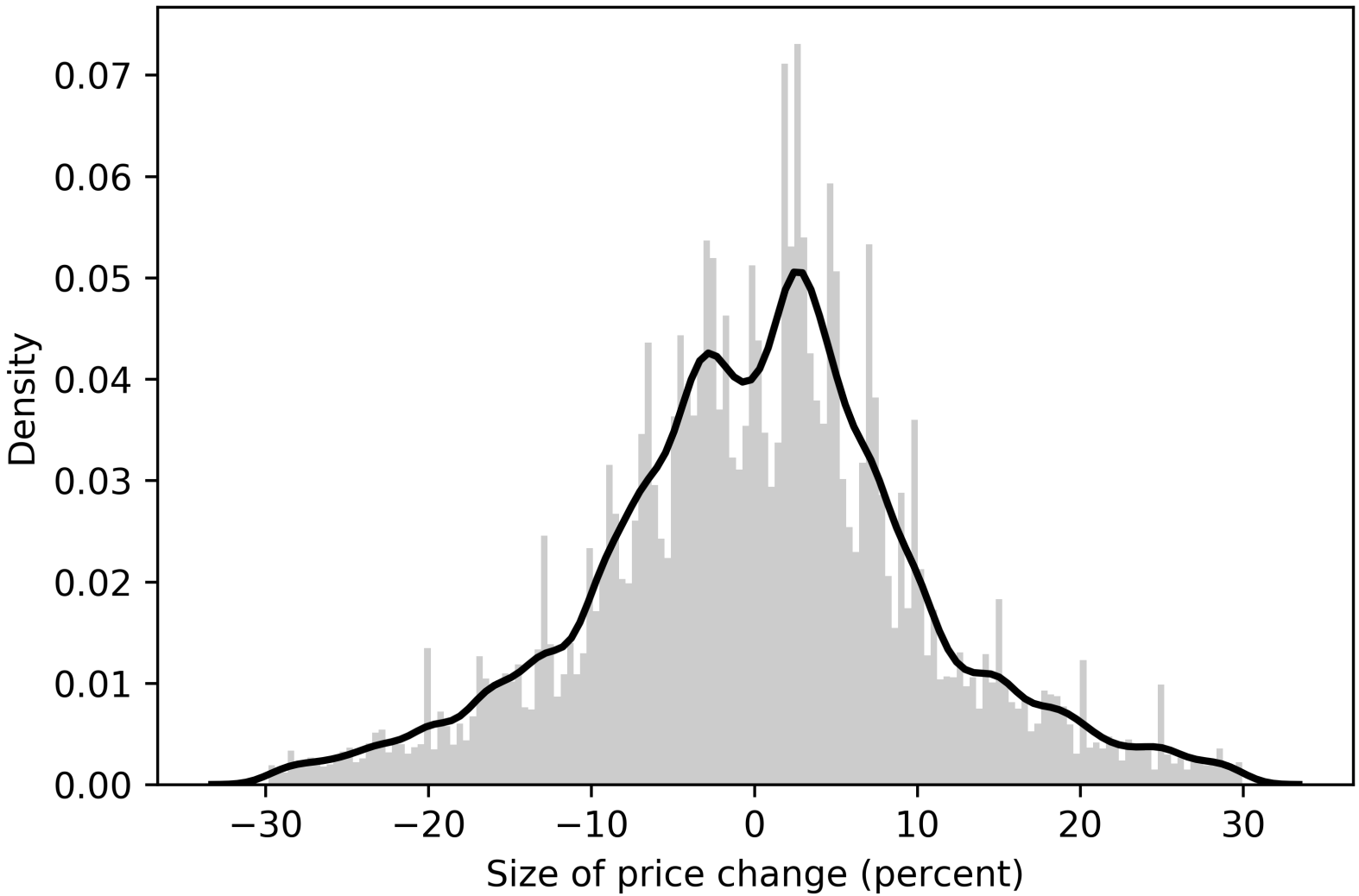


RTPI: ...but does it match?



RTPI: ...price change distribution - is it bimodal?

...a bit?



Access

- detailed disaggregated indexes generally matching Rosstat's classifier: https://research.vtbcapital.com/Content/Economics/rtpi.aspx

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- primary data is available through web API to fellow researchers

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- imputation and (temporary) unavailability

Challenges: Matching up with Rosstat

- note that CPI's methodology is not perfect (issues are not Russia-specific, but general), but is a result of the compromises/trade offs between cost of collection and width of coverage

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- but we want a cross-check and want to minimise methodology driven discrepancies and reveal genuine differences in trends (if any), so we try to match

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Limited territorial coverage.

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- For most non-food retailers geographic variation in price is variation in delivery, not item cost.

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3. also need to highlight that we collect price online, but these are not exclusively online prices: i.e. we collect data from menus, price lists etc.

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There are not weights attached to elementary price readings

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"at the second stage at the city level the individual growth index for a specific type of good/service is determined as a simple geometric mean of changes in comparable price readings:

$$I_{g_j,t/t-1} = \sqrt[n]{i_{c1,t/t-1} * i_{c2,t/t-1} * \cdots * i_{cn,t/t-1}}$$

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2. but it is what Rosstat methodology prescribes at the level of a city (Rosstat, 2014), p. 47:

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4. thus we expect the sampling universe to stabilise as coverage expands

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5. our raw data provides both the 'normal price' and the 'crossed price' which helps identify promos

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3. (a related issue with fiscal data: transaction price may not be generally available price)

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- more collaborators - to scale up store coverage, increase institutional robustness