(Very) Technical Brief

Notes on CPI, smartphones and the 'obsolescence bias'

Imagine for a moment that you are working for a statistical agency. It is 2015. Your task is to start tracking concert ticket prices. After some thought, you decide that the price to see this summer's favourite band, Major Lazer (which was topping the charts in Russia at the time) would be representative. After all, they sell the most tickets, and thus reflect the mode for ticket price distribution.

Five years pass and questions arise as to why reported prices for concert tickets are declining year after year. Perhaps this reflects low demand? Perhaps this is the first sign of deflation? Alas, no. Looking under the hood of the statistical agency's calculations, we discover that **it is still tracking the prices for the concerts of the same band it chose five years ago**, and the **decline in ticket prices mainly reflects the band's struggle to come up with a new summer hit, rather than a general macroeconomic phenomena**.

Now, substitute 'ticket price' for 'smartphone' and 'statistical agency' for 'Rosstat' and you have a rough idea of what might be an important ingredient in the recent change in the mechanics of Russian inflation: i) its persistently low level and ii) the decline in the estimate of inflation's sensitivity to the exchange rate.

In this report, we provide tentative evidence that the excessive lag between the revisions in the specifications of smartphones that Rosstat chooses when monitoring prices, and changes in both technology and tastes, introduces what we call an 'obsolescence bias' into the CPI estimates. Indeed, this might both depress the level of estimated CPI growth and diminish its volatility in general (and in FX-sensitivity in particular).

We focus on smartphones in this note, but these issues might affect broader segments of consumer digital electronics as well as other categories.

1. So, what it is this all about?

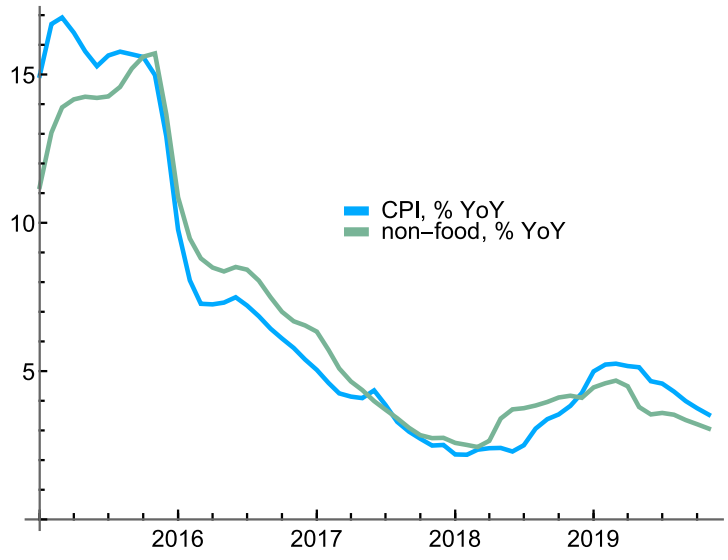
Short answer: The growth in the prices of communication devices in general, and smartphones in particular, has recently decoupled from both the inflation in broader non-food goods and FX to such an extent that we believe it is worth a closer look.

Full answer: Food is such an important component of Russian inflation that reviews often feel like recipes: this month it is a meat story and before that it was sugar, while fruits and vegetables remain a staple item pretty much all the time.

However, in the shadow of the conspicuous food price volatility there is an equally conspicuous stability: the decline in the prices of communication devices. The drop in phones price has averaged -3.9% YoY since 2H17, while the broader non-food goods category has added on average +3.5% YoY during the period.

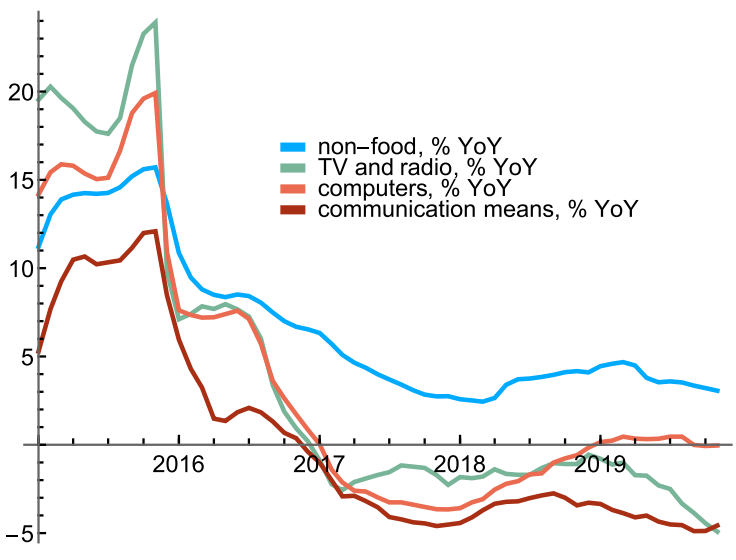
In this note, we look closely at this puzzling stability.

Headline CPI vs non-food price growth, % YoY



Source: Rosstat, VTB Capital Research.

Non-food price growth vs digital electronics, % YoY



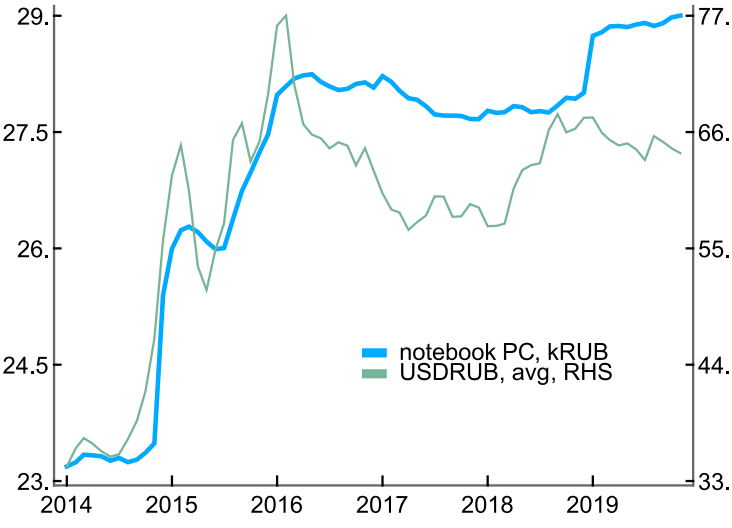
Source: Rosstat, VTB Capital Research.

2. Okay, but why is inflation in digital electronics puzzling?

Short answer: Smartphone prices have dramatically decoupled from USDRUB since 2H17 without apparent change in the supply structure and without comparable decoupling in other types of digital electronics.

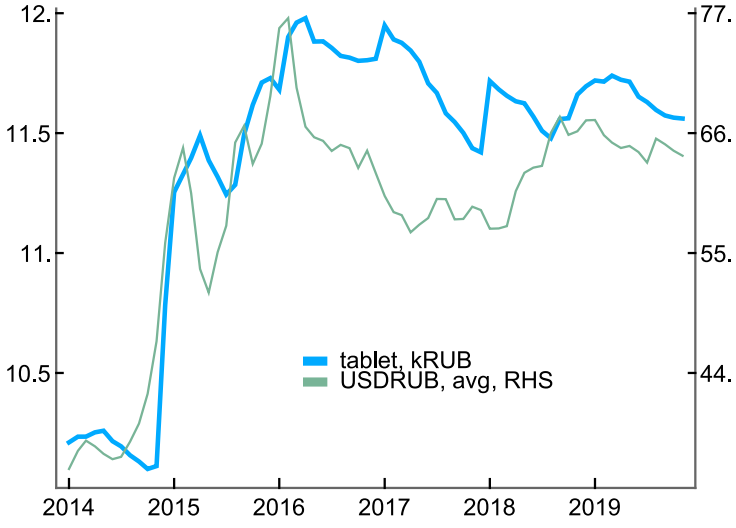
Full answer: Most consumer electronics are sensitive to exchange rates due to the structure of supply. This sensitivity is persistent and there is a tight link between RUB's movements against foreign currencies and the prices of notebook PCs, tablets etc. However, the prices for smartphones have demonstrably decoupled since 2H17.

Notebook PC prices are tightly linked to USDRUB...



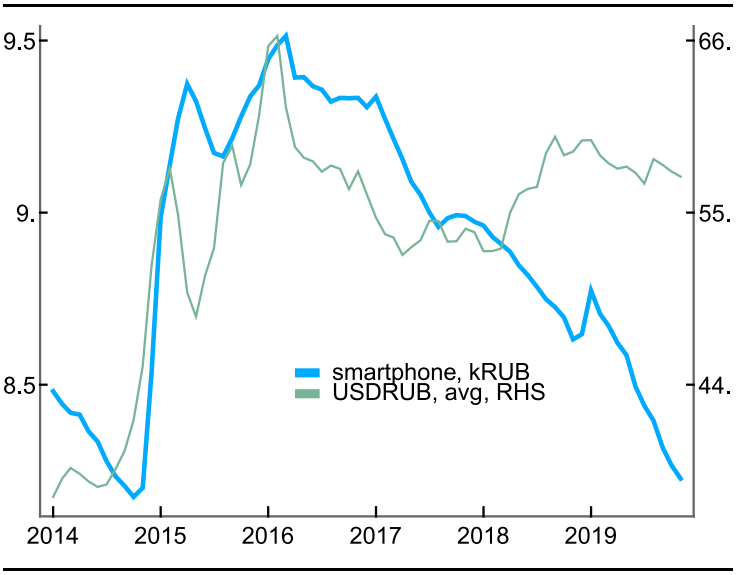
Source: Rosstat, VTB Capital Research.

...as are prices of tablets...



Source: Rosstat, VTB Capital Research.

...but smartphones decoupled at least 2 years ago



Source: Rosstat, VTB Capital Research.

3. Right, smartphone prices seem to have decoupled from FX, but perhaps this is due to there being newer and cheaper models on the market?

Short answer: This is unlikely, for two reasons. i) Euroset's data shows that the average price of phones went up +4 %YoY in 1H19 and this would typically be an estimate of the corresponding Rosstat value from below (because of the Gerschenkron effect). ii) Rosstat's technical specifications for the smartphones in its collection exclude most of the newer, popular models: only two of the top five smartphones by sales volumes qualify, and none of the top five smartphones by sales revenue qualify, according to the Euroset reports.

Full answer: We need to start with the basics of the CPI compilation. At the heart of Rosstat's approach to calculating CPI (and that used in most other countries) is the UN's Practical guide to producing consumer price indices.

Basically, the UN suggests that in order to track price level changes for a particular type of good (or service) the statistical agency has to select a representative specification:

"**5.10** The ultimate goal should be:

- An overall sample which is representative of the total population of goods and services being offered for sale and purchased. The sample chosen should be representative of price levels and, most particularly, price movements"

Preferably, representative, popular items need to be identified through market studies or price collectors' inquiries at the points of sale:

"**5.44** In each outlet collectors choose one variety representative of what people buy in the area or which people typically purchase in the outlet from all products matching the specification of each item to be priced in that outlet. To facilitate this they may ask the retailer what are the most popular brands and which are those stocked regularly."

So, how typical is Rosstat's choice of smartphone specifications compared with consumer preferences? Rosstat describes its specification for 2019 as follows:

"Smartphone in the medium price category with a display size from 3.5 to 6.0 inches, running Android or Windows, with 3.5 to 16Gb RAM, supporting one or two SIM cards, a memory card, Wi-Fi and Bluetooth."

So, how representative of smartphone purchases is this specification? We examine the report from Euroset, one of the key electronics retailers, for a cross-check.

Top-5 by number of sales	Top-5 by revenue
Samsung Galaxy A50	Samsung Galaxy A50
Samsung Galaxy J2 Core	Apple iPhone XR 64~Gb
Samsung Galaxy A10	Apple iPhone XR 128~Gb
Honor 7A	Samsung Galaxy A30
Honor 10 lite	Apple iPhone 8 64~Gb

Source: Euroset, VTB Capital Research.

How closely does this set of the most popular smartphones correspond to Rosstat's specifications? To answer this, we look at the data on specifications from GSMArena and the price ranges for phones from Yandex.Market.

Evidence 1: This simple check shows that out of the top five smartphone models by sales, only two qualify as representative under Rosstat's criteria, while the screen sizes of the other three exceed the 6 inch upper limit. Of the top five mobile phones by revenue, none qualifies because the iOS is excluded from the list of operating systems, it has a larger screen size or the internal memory exceeds the 16Gb limit.

Rosstat's smartphone vs. household preferences

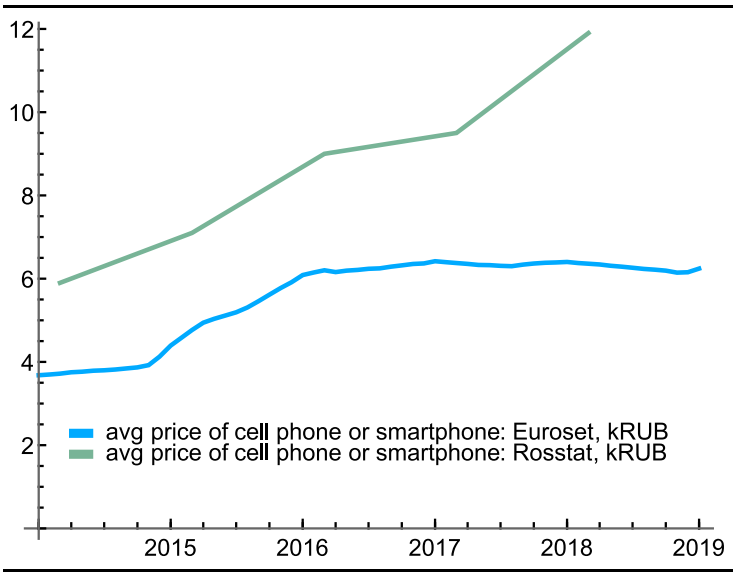
	Display size		Internal memory		Memory card support	OS	Price, RUB	
	from	to	from	to			from	to
Rosstat	3.50	6.00	3.50	16.00	Yes	Android or Windows	8,642	
Samsung Galaxy A50	6.40	6.40	64.00	128.00	Yes	Android	12,960	18,290
Samsung Galaxy J2 Core	**5.00**	**5.00**	**8.00**	**16.00**	**Yes**	**Android**	**5,470**	**7,490**
Samsung Galaxy A10	6.20	6.20	32.00	32.00	Yes	Android	7,357	10,740
Honor 7A	**5.70**	**5.70**	**16.00**	**32.00**	**Yes**	**Android**	**5,126**	**7,585**
Honor 10 lite	6.21	6.21	32.00	128.00	Yes	Android	10,790	16,880
Apple iPhone XR	6.10	6.10	64.00	256.00	No	iOS	36,490	76,800
Samsung Galaxy A30	6.40	6.40	32.00	64.00	Yes	Android	10,354	18,590
Apple iPhone 8	4.70	4.70	64.00	256.00	No	iOS	22,290	71,970

Source: Euroset, Yandex.Market, GSMArena, VTB Capital Research.

Evidence 2: Another report by Euroset provides average sale prices for its mix of cellphones and smartphones. We use Rosstat's data on the prices and weights of cellphones and smartphones to construct a comparable average price.

The key in this illustration is not the mismatch in the levels of prices (which might be due to different samples), but the decoupling of trends, which shows that the retailer's data does not deliver a visible decoupling with the exchange rate. Also, Euroset reports that the average sales price went up 4% YoY in 1H19 to RUB 15.7k vs. Rosstat's -2.8% YoY growth and a price of RUB 8.6k. Typically, the type of price index used by Euroset (Paasche) is lower than that which Rosstat uses (Laspeyres) and thus the discrepancy is even more interesting.

Retailer's and Rosstat's average prices, RUB '000



Source: Euroset, Rosstat, VTB Capital Research.

4. Might the reason be changes in the quality of smartphones used by the statistical service (more cameras, higher display quality, etc)?

Short answer: No, Rosstat does not correct for changes in quality.

Full answer: Sometimes statistical services account for changes in quality by running hedonic regressions. This allows them to produce an estimate of how changes in, for example, screen resolution or the number of cameras, offset average price increases.

However, Rosstat does not use such procedures (to the best of our knowledge).

As a bit of international experience, BLS notes that "smartphones are the only items [in the 'Telephone hardware, calculators, and other consumer information items' category] which are quality adjusted due to the rapid rate of technological advancements and improved quality to consumers." This is a recent practice: BLS only started to produce quality-adjusted inflation for smartphones in January 2018.

5. Why do you think the trends in Rosstat's smartphone prices differ from those in the retailer's data?

Short answer: The 'obsolescence bias'. For smartphones, Rosstat's excessively narrow specification excludes most of the modern and popular smartphones from its observation set.

Full answer: By lagging the shifts in consumer preferences, Rosstat's sample of products follows those that are no longer the ones most frequently chosen by consumers. This decline in demand means that Rosstat registers a persistent decline in prices, which might actually be quite different from market prices (i.e. those of representative transactions).

We hope the example at the beginning of this note provides an intuitive scenario.

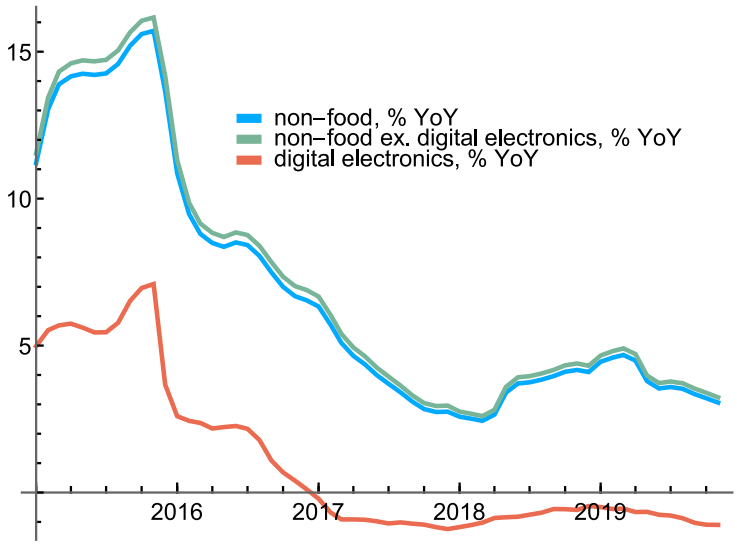
6. How significant is this obsolescence bias?

Short answer: While the scale is uncertain, we believe that this bias both decreases the level and general volatility of inflation, and its sensitivity to FX. Our conservative estimate suggests that the headline inflation might have been 0.1-0.2pp per year higher under broader specifications for all digital electronics.

Full answer: It is hard to say, because this would require a deep and detailed historical data set on the sales of mobile phones and their prices.

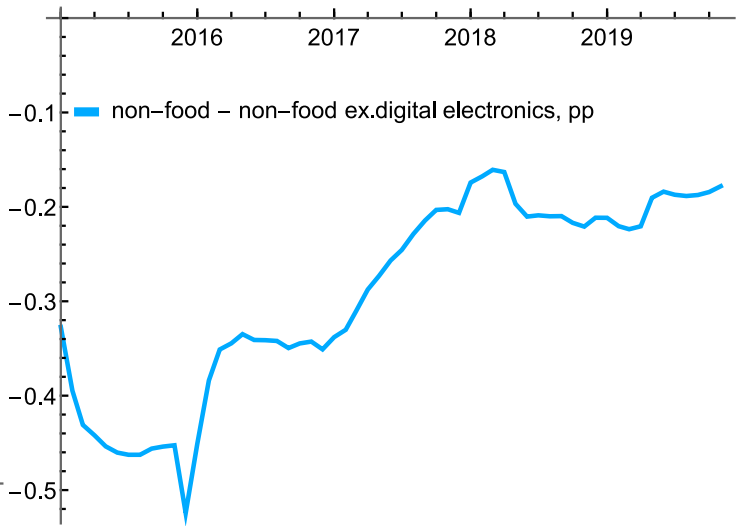
However, we believe it makes sense to assume that the prices of popular phones broadly trace the prices of other non-food goods. In this case, the inflation in non-food (ex-digital electronics) is -(0.2-0.4)pp lower than the broad non-food goods inflation. Scaled by the share of non-food goods in the headline inflation, we arrive at a rough estimate of a 0.1-0.2pp effect.

Non-food vs. non-food ex. digital electronics price growth, % YoY



Source: Rosstat, VTB Capital Research.

Difference between broad and ex-electronics non-food inflation, pp



Source: Rosstat, VTB Capital Research.

7. What can be done?

In our view, the best that can be done is precisely what the UN manual suggests: representative goods must be selected based on extensive market research, which reveals shifts in consumer preferences and habits. This potentially means that the specifications are updated more frequently (possibly even intra-year updates, which is BLS's practice).

The second best is just to broaden the specifications for smartphones (larger screen sizes, larger internal memory ceilings, the inclusion of iOS devices, etc.).

We would also welcome the use of methods to correct quality adjustments. According to recent research (Byrne et. al, 2019), this could more than offset any upward pressure from corrections for the obsolescence bias.

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Not Rated	0	0%	Not Rated	0	0%
Under Review	12	10%	Under Review	2	9%
	126	100%		22	100%

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