Normalized Prices as a Forecasting Tool

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Abstract—In 2020, the retail price for a kilogram of butter in Russia was 638.69 rubles. The same price, but divided by GDP per capita, was 0.008757. Let’s call the resulting value the normalized price. The same normalized price for 1 kg of butter (0.008757) was in the United States and Sweden in 1949, and Australia in 1969. This allows data from more developed countries to be used to forecast prices in less developed countries for many years to come. To predict the normalized price, it is converted into a logarithm, which is decomposed into two components: international and national. The international component ln(Int) is determined by the laws of the market. The second, national, component ln(Nat) is determined by the peculiarities of the country’s policy. Arithmetically, it is the difference between the logarithms of the normalized price and the international component. The anomalousness of retail prices for butter in Russia, expressed in rubles during 1999–2020 is shown. In this period the prices were changing only in one direction—they were growing, which reflects the lack of competition on the market. The dynamics of normalized prices is described by the alternation of descending and ascending waves. On a descending wave, normalized prices go down—commodity availability increases, while an ascending wave corrects for a decline in rationed prices. According to the data of Australia, United Kingdom, New Zealand, USA, France and Sweden for 1801–2019, the average values of normalized prices were calculated for each year. It becomes clear that short series of the average values of normalized prices by country are lined up in a kind of parade of planets, which makes it easier to predict them. For ex-post forecast of normalized prices, the period 1801-2019 is divided into two parts: before and after 2010. Regression coefficients—weights for extrapolation of normalized prices for 2011–2019 are estimated according to the first part. Ex-post forecast is made according to the second part and compared with the actual values. The resulting differences are forecast errors. The independent variables of the model are the life expectancy of newborn males and the price of gold in US dollars. The mean square errors of such forecasts for each of the countries turned out to be LESS than the standard error of the equation used to estimate the regression parameters. In Russia, the actual prices for butter exceeded the ex-post forecast for 2016–2019. To characterize this excess, you can use the definition of "greed" proposed by the Prime Minister of the Russian Federation M. Mishustin.

Keywords: demand price, normalized price, price profile, international and national components, ex-post forecast

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In 2020, the retail price of 1 kg of butter in Russia was 638.69 rubles and GDP per capita (expenditure), 729,300 rubles. Let us call the price of butter expressed in units of GDP per capita normalized; in 2020, it was 0.008757. The same normalized price of 1 kg of butter was in the United States and Sweden in 1949 and in Australia in 1969. Over the years, normalized prices in these countries have decreased significantly due to the growth of GDP. Since the value of GDP per capita in Russia is noticeably lower compared to developed countries, today an average resident of our country has to spend significantly more of their income to buy 1 kg of butter than the residents of the above countries.

Forecast prices are necessary for solving problems, the main one being the evaluation of large investment projects (from $1 billion). Project benefits and damages should be expressed in prices that take into account the inevitable changes in the economy caused by the implementation of such a project. Guidelines on the evaluation of investment projects, e.g., of the European Union, recommend using shadow prices for this purpose [1, p. 56]. The main disadvantage of shadow prices is that they refer to the past, and normalized prices are algorithmically tied to the economic policy, in the implementation of which the evaluated project is supposed to contribute.

1 The editorial board believes that the normalized prices used by the author are a fairly analytical tool. However, many economists consider its use for long- and very-long-term demand forecasting to be not fully justified and hardly applicable.
The main points of the study are illustrated by the example of retail prices of butter. For this purpose, the array of prices by country is divided into two parts. The first part (up to 2010) is used to construct forecasts of normalized demand prices by country for 2011–2019, which are then compared to the actual prices for those years. For clarity, the article uses the simplest econometric model of the normalized price, and all calculations are done in Excel.

Anomalies in retail prices of butter in Russia. The anomaly of retail prices of butter in Russia over the past 30 years is shown in Fig. 1. Columns indicate retail prices of butter in Russia in rubles, and graphs indicate prices in Russia and in the United States in dollars; for Russia, recalculated at the current exchange rate. The curve shows the trend for the price equation in rubles and gives its parameters.

Figure 1 shows two anomalies in retail prices of butter in Russia.

1. In 29 years, there has not been a single decrease in retail prices in rubles. The trend-exponent with $R^2$ of almost 1 shows an average annual price growth rate of 12.1% in nominal terms. The dynamics of prices in a competitive market resembles the swings of a pendulum, and unidirectional changes in prices resemble a ladder leading upward.

2. Between 2010 and 2014, butter prices in Russia in terms of dollars exceeded those in the United States. However, GDP per capita (in terms of purchasing power parity) in Russia was at least half that of the United States, US dollars.

The normalized price of a commodity is defined as the fraction of the country’s GDP per capita per year ($Y$) equivalent to the price of the commodity being purchased ($p$), which characterizes it as a demand price:

$$z = \frac{p}{Y}.$$  

The universality of the indicator (cleared of inflation and national currency peculiarities) makes it much easier to compare normalized prices between countries and, in countries, between years. The value of the normalized price of a commodity is one of many characteristics of its time.

Fig. 1. Retail prices of butter in Russia and the United States, per 1 kg. ◦ Russia, rubles; — Russia, US dollars; and — United States, US dollars.
much more convenient for calculations to express their values in logarithms.

**Econometric model of the normalized price.** The input data for the model are dynamic series of indicators by country, which determines the 2D nature of observations: by country (i) and by year (t).

The dependent variable of the model is \( \ln(z) \), and we denote the forecast values by \( \ln(u) \). For the ex-post forecast, we will call the difference between them \( (\ln(u) - \ln(z)) \) the forecast error. It determines the forecast accuracy, which will be assessed by the root mean square error (RMSE), where \( T \) is the number of years for which the forecast is made; in our case, it is 9 years:

\[
RMSE = \left( \frac{\sum (\ln(u) - \ln(z))^2}{T} \right)^{0.5}
\]

\((t = 2011, \ldots, 2019)\). 

The main explanatory variable of the model \( \ln(z) \) should describe the state of the country. An obvious candidate for this role is GDP per capita in current prices. However, this is prevented by its use to calculate normalized price (1), where it is the denominator.

In the May Decree of the President of the Russian Federation (2018), the saving of the people is in the first place among the strategic goals. For this reason, it is advisable to take life expectancy at birth (LEB) as a characteristic of Russia’s development results. Extensive literature is devoted to this issue. A website Life expectancy was created on the Internet [10]. The position of Russia in the world in terms of LEB was studied in [11], and a close correlation of this indicator with other explanatory variables, LEBm and the price of gold.

Russia’s leading position in the world in terms of the excess of male mortality over female mortality makes this indicator strategically important for the country, which makes LEB for males (LEBm) the first independent variable of the model \( \ln(z) \).

The second explanatory variable in this model is the price of gold.

The need to include other explanatory variables in the model is determined in the process of solving the problem. The right part of model (3) is divided into components by brackets: international (square brackets, \( Int \)) and national (curly brackets, \( Nat \)):

\[
\ln(z_i) = [a_1 \times \ln(L_{i2011}) + a_2 \times \ln(A_{it}) + a_3 \times V_i] + \{a_4 \times W_i + \varepsilon_i\}
\]

where \( a_1-a_4 \) are regression coefficients, which are estimated from raw data; \( \varepsilon \) is the regression residual with mean (zero) and minimum variance; \( \ln(L_{i2011}) \) is the log price of LEBm by country in each year; \( \ln(A_{it}) \) is the gold price by year, the same for all countries in each year; \( V_i \) is the binary variable for years, its values for year \( t \) are 1 and for all other years, 0; \( W_i \) is the binary variable for countries, its values for country \( i \) are 1 and for all other countries, 0.

It follows from (3) that the values of \( \ln(\text{Int}) \) are determined by weighting factor values by countries using weights \( (a_1-a_3) \). The consistency of weights for all countries allows us to consider \( \ln(\text{Int}) \) values corresponding to a free (unregulated) market. It should be emphasized that \( \ln(\text{Int}) \) is an estimated value and, therefore, depends on the composition of the model’s independent variables.

For prices \( (P) \) in the usual sense of the word:

\[
P = [(\exp(\text{Int})) \times Y] \times \{\exp(\text{Nat})\} = \{\text{international component}\] \times \{\text{national component}\}. \tag{4}
\]

**Data sources.** The three main variables of the model determine the four indicators that constitute the database: for the dependent variable, these are prices and GDP per capita in the same, usually current, prices; for the independent variables, LEBm and the price of gold.

1. Prices are the only indicator for which there are only national data sources.

**Remark**

Russia
Rosstat. Consumer prices.

**Australia**
(1) 1850–1914. McLean, I.W. and Woodland, S.J., Consumer Prices in Australia 1850–1914, School of Economics Working Papers 1992-04: University of Adelaide, School of Economics 1992.

(2) Butter prices in Sydney in 1968–1984 are taken from New Zealand Statistical Yearbooks 1969–1985.

England
(1) 1800–1869. Clark, G., The price history of English agriculture, 1209–1914, University of California, Davis 2003, 109 p. Agprice.pdf (November 12, 2021).

(2) 1987–2019. Office for National Statistics. https://www.ons.gov.uk/economy/inflationandpricesindices/timeseries/doam/mm23.

The 2013–2019 retail prices of a 250 g pack of butter were taken as the basis and used to reconstruct prices for 1987–2012.

New Zealand
(1) 1963–1997. Usually, the 23rd chapter of the Statistical Yearbook of the previous year (Statistics New Zealand, database). Since 1998, butter has been excluded from the list of goods for which retail prices were published.

(2) 2008–2020. Food Price Index, which refers to the cheapest salted butter. https://figure.nz/ chart/WNZO-pEoBKryz4hBh-K8zPq11jO3mc5J7u.

United States
1890–1970. Historical statistics of the United States. Colonial times to 1970. US Census Bureau. 1975. Row E193 presents the retail prices of butter (in cents per pound). The 1970 supplement is from the Butter Inflation Calculator 1939–2020. https://www.officialdata.org/Butter/price-inflation. Retail Prices of Selected Foods in U. S. Cities
1890–2015 was used as control data. https://www.infoplease.com/business/economy/retail-prices-selected-foods-us-cities-1890-2015

**France**

(1) Prices by the end years of decades (1900–2010 and 2013): EVOLUTION DES PRIX MOYENS DEPUIS 1900/2013. https://france-inflation.com/index.php

(2) Butter Price Index (1990–2019), which was used to reconstruct prices for the intermediate years. https://www.insee.fr/en/statistiques/serie/001764453

**Sweden**

(1) 1800–1913. Edvinsson, R., and Söderberg, J., The evolution of Swedish consumer prices 1290–2008, in Exchange Rates, Prices, and Wages, 1277–2008, Stockholm: Sveriges Riksbank and Ekerlids Förlag, 2010. The Riksbank homepage.

(2) Butter prices in 1997–2013. Statistical Yearbook of Sweden 2005, p. 374; Jordbruksstatistisk sammanställning 2018. SCb.: Jordbruksverket Statistiska centralbyrån 2018; (Statistical Yearbook of Sweden 2010, p. 336), Statistiska centralbyrån. Agricultural statistics 2016 including food statistics, tables 2016, p. 256). The last year for which we were able to find retail prices of butter was 2012.

(3) A supplemental calculation of retail prices for 2013–2019 was made using butter retail price indices for 2010–2019 (Statista, 2020).

(4) The butter price of 83 kronor in 1997 is questionable, because it is twice the price of subsequent years. It is changed to 39.92 kronor according to the consumer price index.

2. GDP per capita. Before 1960, national data, since 1960, World Bank data.

**Remark**

Sources: GDP per capita in current prices in local currency:

1. 1960–2019. World Bank. https://databank.worldbank.org/source/world-development-indicators

2. Before 1960:

**Australia**

Australian economic growth in historical perspective, School of Economic Working Papers 2004-01, *University of Adelaide, School of Economics, Adelaide*, 2004.

**England.** Measuring Worth website. https://www.measuringworth.com/datasets/ukgdp/

**United States.** Historical statistics of the United States. Colonial times to 1970, Washington: U.S. Dept. of Commerce, Bureau of the Census, 1975. Row F2, Gross National Product per capita (in dollars);

**Sweden.** Edvinsson, R., The gross domestic product of Sweden within present borders, 1620–2012, in *Volume II: House Prices, Stock Returns, National Accounts, and the Riksbank Balance Sheet, 1620–2012* The Riksbank homepage.

3. Life expectancy at birth, males. Before 1960, national data, since 1960, World Bank data.

**Remark**

For all countries since 1960, World Bank data https://data.worldbank.org/indicator/SP.DYN.LE00.MM?locations=D

**Australia:** Life expectancy (from birth) in Australia, from 1870 to 2020. https://www.statista.com/statistics/1041176/life-expectancy-australia-all-time/.

**England:** Gallop, A., Mortality improvements and evolution of life expectancies. Actuary, Pensions policy, Demography and Statistics. UK Government Actuary’s Department. https://www.osfi-bsif.gc.ca/Eng/Docs/DEIP_Gallop.pdf.

**United States.** Changes in Life Expectancy in the United States, 1900–2000. https://www.seniорliving.com/history/1900-2000-changes-life-expectancy-united-states/.

**Sweden:** Life expectancy 1751–2019. https://www.scb.se/en/finding-statistics/statistics-by-subject-area/population/population-composition/ population-statistics/pong/tables-and-graphs/yearly-statistics-the-whole-country/life-expectancy/.

https://www.osfi-bsif.gc.ca/Eng/Docs/DEIP_Gallop.pdf.

4. Price of gold was taken from The Price of Gold, 1257–Present. https://www.measuringworth.com/gold/.

**Normalized retail prices of butter in historical perspective.** Figure 2 shows the dynamics of the logarithm of normalized retail prices for 1 kg of butter, arithmetic averages over the years for Australia, England, New Zealand, France, United States, and Sweden. The graph shows the years of local extrema to which the landmark events of those years can be linked. The countries were selected on the following grounds: France is the leader in per capita butter consumption, and French cuisine is notable for its extensive use of butter; New Zealand is a world exporter of butter; and historical prices and GDP data are available for Australia, England, the United States, and Sweden.

It is important to note that the change in the list of countries when calculating ln(z) averages by year did not affect the alignment of points in a kind of a parade of planets, which rules out the randomness of the result, the ln(z) profile.

The main advantage of the profile is the ability to analyze the dynamics of normalized prices in developed countries over a horizon of more than 200 years. The downward trend (parabola with $R^2 = 0.98$) means that one can work less every year to buy 1 kg of goods, while the negative acceleration ($-8 \times 10^{-5}$) indicates an annual decline in the normalized price as a trend. The logic of economic development suggests that such a process cannot continue indefinitely. There is bound to be a switch to an upward trajectory to correct the rate and from there, back to a downward trajectory.

The abovesaid defines the dynamics of the normalized price of goods as the alternation of two types of waves:

— Downward, i.e., decrease in the normalized price as a result of increased productivity, which makes
a good more affordable relative to other goods, thereby increasing demand for it.

— Upward, i.e., correcting too strong a decrease in the normalized price.

Upward waves are usually shorter than downward waves.

In order to illustrate the above, consider the logarithms of butter retail prices by developed countries for 1801–2019. To do this, we will isolate the downward waves from the entire array by defining them as the years \( t \) in which there was a decrease in \( \ln(z) \), i.e., \( z_t < z_{t-1} \).

From 1801 to 2019, \( \ln(z) \) decreased from –5.5 to –8.6. At the same time, the sum of downward waves was –7.9, and the sum of their corrections by upward waves was –4.8, which determined the total decrease in \( \ln(z) \) by \(-7.9 + 4.8 = -3.1\), which is the same as the difference between the \( \ln(z) \) values for the extreme years. The change in \( \ln(z) \) from 1801 to 2019 is similar to a sailing ship tacking against the wind, where the tacks are the downward and upward waves (Table 1).

The consistency of the data profile built from the short series of the profile is confirmed by the association of local extrema with historical events and the trend with \( R^2 \) close to 1. Note that the above is a property of normalized free market prices, and butter prices are just an example.

In the dynamics of \( \ln(z) \) by developed countries, we can distinguish the following stages, which differ markedly in the rate of change of \( \ln(z) \).

1. 1801–1844. The \( \ln(z) \) values fluctuated around an average of –5.34. The normalized prices began to go down only with the beginning of railroad construction in the mid-19th century, which caused an acceleration of GDP growth. The \( \ln(z) \) minimum in 1881 was followed by the crisis of 1882–1889. The era ended with the boom of joint-stock companies. The electivity of management in companies undermined the moral grounds for the inherited power.

2. 1890. The beginning of the era of the internal combustion engine and electricity. Fastest economic growth in history. Internationalization of business

### Table 1.

| Wave length, years | Number of waves for the period |
|-------------------|------------------------------|
|                   | downward | upward |
| 1                 | 21       | 34     |
| 2                 | 18       | 13     |
| 3                 | 6        | 5      |
| 4                 | 5        | 2      |
| 5                 | 2        | 1      |
| 6                 | 0        | 0      |
| 7                 | 0        | 0      |
| 8                 | 1        | 0      |
| 9                 | 2        | 0      |
| **Total**         | **55**   | **55** |
| **Number of observations, years** | **131** | **88** |
| **Average wavelength, years** | **2.4** | **1.6** |
(transnational corporations) prompted the formation of unions of states (European Union). The electivity of power has significantly strengthened, and countries with a parliamentary form of government have been the most successful in improving the quality of life. The crisis of 2009 marked its end.

3. The year 2009 can be considered the beginning of the Internet era. Changes in the organization of business: networks, the concept of sustainable development as the need to supplement the assessment of companies’ activities by social and environmental indicators. Figure 2 shows the change in the \( \ln(z) \) trend from decline to growth. This process was greatly accelerated by “dropping money from a helicopter,” primarily in developed countries, because of COVID-19. The 2009 crisis clearly broke the trend: instead of the traditional decline, the \( \ln(z) \) profile shows clear growth.

4. Russia’s position above the \( \ln(z) \) profile for developed countries means higher normalized prices compared to developed countries. In order to buy 1 kg of butter, a Russian resident needs to spend a larger portion of their income than residents of developed countries. The difference in abscissa values answers this question numerically. For 2019, its values for developed countries were \(-8.59\) and for Russia \(-7.10\). The difference \( \exp[-7.10-(-8.59)] = 4.4 \) means that in Russia you have to pay 4.4 times the per capita share of GDP to buy 1 kg of butter than in developed countries.

**Forecast of \( \ln(u) \) for years ahead.** The \( \ln(u) \) forecast is made in four steps:

1. Data preparation.
2. Estimation of model parameters.
3. Calculation of the \( \ln(u) \) forecast for 2011–2019.
4. Refinement of the forecast caused by the identified nonrandomness of regression residuals for individual countries.

The purpose of the first stage is to eliminate the impact of short-term anomalies on the long-term trend of the normalized price by excluding such observations from the calculation. This has had the strongest effect on Russia: years with decreasing values of LEBm (1999–2006) by year due to force majeure, the collapse of the Soviet Union, have been excluded. The decrease in GDP by years contradicts the logic of the \( \ln(z) \) model.

At the second stage, the model is augmented with two types of binary variables characterizing the features of individual years and countries. The specifics of the years are included in the international component, and the countries are included in the national component (Table 2).

At the third stage, the ex-post forecast of \( \ln(u) \) by country for 2011–2019 is constructed based on the actual values of explanatory variables (LEBm is \( L \), and gold price is \( Au \)).

Table 3 presents data on the errors in the forecasts made by country (\( \ln(z) - \ln(u) \)), arithmetic average and root-mean-square deviations (RMSD). For all countries except Sweden, data refer to 2011–2019; for Sweden, to 2011–2018. Australia is excluded from the calculations, because the last observation available to the author is from 1984, and the calculations require data from 2010.

Comparison of averages with the RMSD by country shows that they differ only for Russia, and for developed countries they almost coincide. This indicates a strong forecast bias as compared to the actual data. The prerequisites for such a bias were discussed in the analysis of Fig. 2.

The task of the fourth stage is to eliminate the biases in the forecasts by country caused by the break in the trend of \( \ln(z) \) since 2009 (Fig. 2). To do this, the values of the initial forecast are reduced by the value of the forecast error in 2010 (\( \ln(z) - \ln(u) \)), if it turns out to be negative.

Table 2. Model parameter values \( \ln(z) \)

| Indicator             | Values | Notes                                                                 |
|-----------------------|--------|----------------------------------------------------------------------|
| Normalized \( R \)-square | 0.94   | The equation explains 94% of differences between \( \ln(z) \)          |
| Root-mean-square error | 0.33   | Variance in source data is a criterion for assessing forecast accuracy |
| Number of observations | 412    | Over one hundred observations per independent variable               |
| Importance \( F \)     | 0.00   | Importance of all variables and each individually is estimated with \( p < 1\% \) |
| \( \ln(L) \)           | -2.15  | The normalized price decreases as the values of independent variables increase |
| \( \ln(Au) \)          | -0.55  |                                                                     |
| Russia                | 1.48   | Corresponds to the position of Russia in Fig. 1                      |
| Free term             | 4.12   |                                                                     |

Source. Author’s calculations.
an outlier. A comparison of the data in Table 4 with those in Table 3 shows that they have decreased in absolute values. The large differences between the averages and the RMSD in Table 4 indicate that the forecast bias was at least significantly reduced.

The good sensitivity of the algorithm is evidenced by the data for New Zealand, in which some of the prices relate to cheaper salted butter, which is what the forecast showed.

All of the RMSD values by country are markedly lower than the standard error of the equation (0.33 in Table 2), which allows us to consider the accuracy of the forecast satisfactory.

**Arithmetic and substantive results of the ex-post forecast.** The arithmetic results of the forecast are reduced to the calculation of the RMSD, and the substantive results are reduced to the understanding of the result.

In the middle of the forecast period in 2014, Russia experienced a force majeure: in response to sanctions, antisanctions were imposed, which led to a reduction in butter imports (by weight) in 2015–2019 against 2005–2013 by 24%. Given that the share of butter commodity imports in 2005–2013 was 35%, this inevitably worsened competition in the market, which could not but cause an increase in prices [12].

Excessive (compared to international levels) retail prices of butter in Russia are associated with the organization of the dairy business in the country, in which the leading role is played by large companies that create large livestock complexes. Distinctive features of such complexes are significant capital intensity, extensive use of “chemistry” for epizootic prevention due to high density of animals in the premises, stall barns. Such complexes have a negative impact on the environment [13], which contradicts the principles of a green economy.

| Country   | Average | RMSD |
|-----------|---------|------|
| Russia    | 0.07    | 0.18 |
| England   | 0.75    | 0.76 |
| New Zealand | 0.37   | 0.42 |
| United States | 0.34  | 0.35 |
| France    | 0.75    | 0.76 |
| Sweden    | 0.35    | 0.21 |

Source: Author’s calculations.

| Country   | Average | RMSD |
|-----------|---------|------|
| Russia    | –0.01   | 0.16 |
| England   | –0.05   | 0.11 |
| New Zealand | 0.07   | 0.20 |
| United States | –0.11 | 0.13 |
| France    | –0.02   | 0.10 |
| Sweden    | –0.02   | 0.11 |

Source: Author’s calculations.

An alternative to the Russian way of dairy development is the cooperation of farmers, practiced, e.g., in Finland and India. Farms fit into the environment, which allows them to meet environmental requirements without significant costs. In Russia, the share of farmers in milk production in 2020 was only 7.5%, which is an order of magnitude lower than in Finland [14].

In Fig. 3, the ex-post forecast of retail prices of butter (solid line) is compared to the actual prices for Russia (bars) and retail prices of butter in Finland (dotted line).

![Fig. 3. Butter retail prices: actual for Russia and Finland and their ex-post forecast for Russia: □ Russia; — forecast; and --- Finland. Source: Author’s calculations.](image-url)
The comparison shows that the ex-post forecast exceeded the actual prices in 2011–2015 and was lower in 2017–2019.

The lag between the forecast and the actual data in 2017–2019, as already mentioned, was due to the anti-sanctions, to which we should add the lobbying power of large companies. The close correlation between the physical volume of butter imports into Russia and its retail prices ($R^2 = 0.69$) suggests that the antisanctions led to higher prices through a chain of connections. Another factor is the desire of producers and traders to retain income in rubles and compensate for the drop in the ruble–dollar exchange rate by charging higher prices. This follows from the correlation of the ruble–dollar exchange rate with the prices exceeding the ex-post forecast ($R^2 = 0.55$).

In 2019, Finland’s GDP per capita at purchasing power parity was almost twice that of Russia. For this reason, butter prices in Finland, if the market in Russia was normal, should have exceeded Russian prices, but the situation was different in 2011–2019. In 2011–2014, the retail prices of butter in the two countries were almost the same, while in 2015–2018, the prices in Finland were lower than in Russia.

Interestingly, butter retail prices in ruble terms in Finland and India almost coincided, which, due to similar approaches to the organization of dairy business in these countries, is difficult to consider accidental. The price of the problem for Russia is the increase in retail price for 1 kg of butter by about 100–150 rubles, which are paid by consumers for the “special way” of dairy business in the country. According to [15], in Russia under comparable conditions business pays at least 40% more taxes and fees than in developed countries.

The discrepancy between the ex-post forecast and the actual data points to the need to rethink the development strategy of the dairy business in Russia in order to fit it into the green economy. For this reason, it is advisable to focus on the forecast based on normalized prices to evaluate investment projects.

**Conclusions.** In terms of arithmetic, the results of the ex-post forecast should be considered overestimated for 2011–2015 and underestimated for 2017–2019. Substantively, the excess of actual prices over the ex-post forecast in 2017–2019 should be considered as greed, as defined by Russian Prime Minister M. Mishustin.

For evaluation of butter projects, we should focus on the retail price close to the ex-post forecast. In the long-term, the removal of sanctions and competition in the market will lower the normalized prices.

The anomaly in retail prices of butter in Russia in rubles was found: they have only been increasing over the last 30 years.

**Conflict of interest.** The author declares that he has no conflicts of interest.

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