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Impact of COVID-19 on household consumption in Russia

This paper investigates the impact of the COVID-19 pandemic on household consumption patterns in Russia. We use household budget survey data, modelling the impact of household socioeconomic characteristics on consumption patterns. Additionally, we account for the regional heterogeneity of the severity of the quarantine measures. The results indicate a quantitative change in household consumption structure, but consumers' behaviour patterns remain unchanged.

Keywords: micro-level analysis; COVID-19; consumption structure; rigidity of quarantine restrictions; income; education attainment.

JEL classification: D12; H12; C21; R29.

1. Introduction

Household consumption is a driver of economic growth (Rostow, 1959) and households are the most vulnerable economic agents to exogenous shocks and natural disasters. Empirical evidence shows that due to the global financial crisis (GFC) consumer activity in the US dropped by 8% (Lee et al., 2010). Figure 1 illustrates the share of household final consumption expenditure in the GDP of Russia.

The figure shows a considerable decline in the share of consumer spending in GDP in periods of increasing sanctions pressure (2015–2016) and at the start of the COVID-19 pandemic (2020: Q2). The household response to external shocks includes both a decrease in consumption and a reallocation of consumer expenditure (Gautier et al., 2020). Consequently, we expect a dramatic change in the structure of the consumer basket during the pandemic. Microeconomic theory, particularly Engel's law, argues that an increase in household income leads to a lower share of expenditure on food. Another characteristic of consumer expenditures is the income elasticity of demand, indicating the change in demand for goods or services with rising income. Given this background, we assess the impact of the COVID-19 pandemic on the structure of household expenditure determinants in Russian regions.

There are several motivations for the current study. *First*, in the face of heightened economic uncertainty caused by the COVID-19 pandemic, economic agents reshape their consumption patterns (Gautier et al., 2020; Grigoryev et al., 2021; Kansime et al., 2021). Furthermore, the impact of the pandemic is asymmetrical across income groups due to different consumption patterns and

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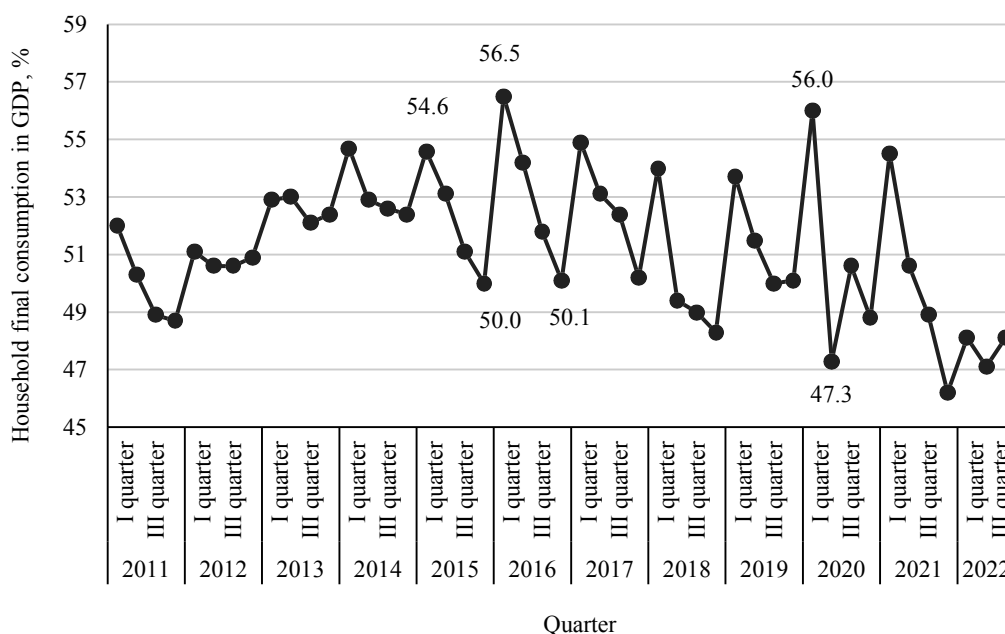


Fig. 1. Share of household final consumption expenditure in GDP

Source: Federal State Statistics Service (2023a).

financial resources. *Second*, the shares of consumer expenditure over the last 8 quarters are used in the calculation of the consumer price index (Federal State Statistics Service, 2015). Therefore, identifying the determinants of the structure of consumer spending provides more accurate estimates of inflation. The considerable discrepancy in the official estimates of prices and the inflation rate observed by households lead to social tensions and dissatisfaction among the population (Natalini et al., 2020). *Third*, Kolomak (2020) and Zubarevich, Safronov (2020) emphasise that the impact of the COVID-19 crisis on the Russian economy differs from the crises of 1998, 2008, and 2014. Due to the quarantine and inevitable decline in income, the crisis hit the market services sector hardest. *Fourth*, the impact of crises is asymmetrical for different regions (Zubarevich, 2020), which is justified by the high heterogeneity of Russian regions in terms of their income level and distribution. For instance, during the COVID-19 pandemic, the risk of unemployment increased in large cities and southern regions, while regions with a low share of services in gross regional product (GRP) were not affected by the crisis. The current study considers the regional aspect of the impact of the pandemic restrictions on household expenditures. Therefore, *the objective* of this study is to assess changes in the determinants of consumption patterns in Russian regions under the impact of the COVID-19 pandemic.

The study contributes to the literature in several ways.

First, we attempt to fill the literature gap by estimating the impact of COVID-19 on the household expenditure structure in Russian regions. Given the regional heterogeneity in terms of income and consumption patterns, we focus on this dimension.

Second, we use the Least Squares method based on household-level microdata, modelling the consumption structure depending on education and income levels, and quantifying the impact of the pandemic.

Third, the paper provides several interesting findings. We evidence that an increase in educational attainment enhances expenditure on food outside the home, alcohol, services, and non-food items, with a simultaneous decline in expenditures on food for consumption at home. We empirically confirm Engel's law in Russian regions, as shares of spending on food and services falls as household income rises, while shares of spending on alcohol, non-food, and food outside the home increase.

Fourth, we highlight differences in regional pandemic policies by identifying groups of regions with soft, medium, and hard quarantine measures. Empirical evidence on changes in consumption patterns provides a useful tool for regional policymakers to assess the effect of quarantine measures.

The rest of the paper is organised as follows. Section 2 reviews the existing theoretical and empirical studies on the consumption structure determinants and provides main research hypotheses. Section 3 discusses the peculiarities of Russian regions in the context of the COVID-19 pandemic. Section 4 describes statistical data and models for testing the hypotheses. Section 5 reflects the empirical results of the study, including statistical tests and econometric models. In Section 6, we slightly change the proxy variable for pandemic restrictions to check the robustness of our results. Section 7 contains the main conclusions concerning the impact of COVID-19 on the consumption structure in Russian regions.

2. Literature review

Examining the distribution of household expenditures, i.e. how the household budget is allocated to different categories of consumer goods, is one of the most traditional topics in theoretical microeconomics (Prais, Houthakker, 1971). Numerous studies have focused on the development of micro-based demand functions for different categories of goods and services (Anderson, Blundell, 1983; Attanasio, 1998; Banks et al., 1997; Barigozzi et al., 2012; Leser, 1963). Particular attention in the microeconomic literature is devoted to the impact of exogenous shocks on the consumption of a representative household. The works (Gali et al., 2007; Kydland, Prescott, 1982; Prescott, 1986) confirm that the natural response of households to external shocks is to reduce aggregate consumption. Nonetheless, Gautier et al. (2020) argue that households not only reduce aggregate consumption during crises, but also change the consumer spending structure. Interestingly, Dutt, Padmanabhan (2011) document the primary impact of the crisis on consumption patterns, whereas consumer decisions to reallocate expenditure are independent of changes in income and prices. Yang, Chen (2009) discuss the decisive importance of the nature of the crisis on the output structure at sectoral levels. For instance, the 2003 SARS-COV outbreak in China caused a decrease in spending on services, hotels, and recreation. Barro, Ursúa (2008) find evidence of increased substitution effects between durable and nondurable goods during major exogenous shocks. Given the theoretical and empirical evidence of the impact of exogenous shocks on consumption patterns, we develop our first hypothesis.

Hypothesis 1. The distribution of consumer expenditures (measured as the shares of expenditure types) is different in the pre-crisis, post-crisis, and pandemic crisis periods.

The substantial heterogeneity between households in observed commodity prices and socioeconomic characteristics has a significant impact on the consumer expenditure allocation (Pasinetti, 1983). We identify two strands of literature on the determinants of household expenditure. The first

group of studies focuses on the determinants of overall consumer spending. Bonsu, Muzindutsi (2017) empirically confirm the impact of exchange rate and economic growth on total household expenditure in the long run. Similarly, the macroeconomic drivers of household expenditures include public expenditures, inflation, and the Central Bank policy rate (Varlamova, Larionova, 2015). Sekhampu, Niyimbanira (2013) support the importance of individual household characteristics such as the number of people in the household, employment, age, and the number of family members in driving consumption expenditure. Cultural characteristics and traditions are also an important determinant of consumer spending (Verter, Osakwe, 2014).

The second group of studies focuses on the determinants of consumption structure. Venn et al. (2018) report that out-of-home food expenditure accounts for a significantly higher share of consumption as income rises. A similar conclusion is drawn by Ferdous et al. (2010), confirming the substitution effect between expenditure on services, food outside the home, and food at home. In contrast, Maniriho et al. (2021) provide empirical evidence of increased expenditure on food and non-food in more educated and urban households. Similarly, Soberon-Ferrer, Dardis (1991) argue that expenditure on food outside the home and on services is affected by the geographical location, family composition, and employment of the household head. Xiong et al. (2021) assert that expenditure on education and health is explained by changes in income, age, and the number of household members.

A vast literature exists assessing the cross-country effect of the COVID-19 pandemic on household consumption patterns. Grigoryev et al. (2021) find empirical evidence that the market services sector was hit the hardest by the pandemic, significantly lowering its share of GDP. Numerous cross-country studies indicate a shift in consumption patterns as a response to the pandemic crisis (Cavallo, 2020; Dumitras et al., 2021; Rehm et al., 2020). For instance, Xiong et al. (2021) document that during the pandemic spending on food, beverages, and housing remained unchanged, while reduced spending on education, recreation, and clothing is observed. Similarly, Gautier et al. (2020) confirmed the redistribution of shares in the consumption basket, expenses on accommodation and fuel dropped dramatically, while the share of food increased. In contrast, several studies on Chinese data show intra-group substitution (replacement of protein food by carbohydrate food) in the aftermath of the pandemic (Jia et al., 2021; Tian et al., 2022). In addition, the impact of the pandemic is asymmetrical not only across space (Zubarevich, 2020) but also across social groups (Abebe et al., 2022). Existing literature on the impact of the pandemic on household consumption patterns cross-nationally finds ample evidence of a reallocation between consumption expenditure categories. That said, several studies point to heterogeneity in quarantine measures during the COVID-19 pandemic (Migheli, 2022; Wang et al., 2021), indicating gaps in the existing literature. To address the existing gap, we test the second hypothesis.

Hypothesis 2. The rigidity of pandemic restrictions has an asymmetrical impact on the household consumption structure.

Russian research assessing the impact of the pandemic on household consumption patterns is limited and focused on the country level. Zubarevich, Safronov (2020) report a significant decrease in aggregate household consumption, leading to a reallocation of expenditure between categories. Similarly, Karpunina et al. (2022) find that the proportion of household expenditure on food rises, while spending on services declines during the pandemic. A similar conclusion is drawn from the survey in Ben Hassen et al. (2021), showing a change in consumer behaviour manifested in fewer outings from home, which inevitably leads to less being spent on food outside the home.

A significant limitation of these works is their methodological tools, as the statistical analysis does not capture the quantitative effects of the pandemic on household consumption patterns and the determinants of consumer spending. In addition, the country-level analysis does not take into account individual household effects, which our study captures at micro level. Given the lack of empirical evidence on the impact of determinants of consumer spending patterns during the COVID-19 pandemic, we derived our third hypothesis.

Hypothesis 3. The effect of financial and socioeconomic factors determining consumption patterns has changed due to COVID-19 pandemic.

The current study fills the gap in the literature by combining analysis of the impact of the determinants of the consumer expenditure structure and the impact of external shocks at the household level in Russian regions. We also consider several levels of quarantine restrictions, which is discussed in Section 3.

3. Peculiarities of Russian regions in the context of COVID-19

Zubarevich, Safronov (2020) emphasise that the impact of the COVID-19 crisis on the Russian economy differs from the crises of 1998, 2008, and 2014. The banking crisis of 1998 was accompanied by a depreciation of the ruble with a consequent increase in inflationary pressures. The geography of the crisis covered large urban agglomerations with a developed banking sector, while for the majority of the country the crisis remained relatively unnoticed (Zubarevich, 2020). The global financial crisis of 2008–2009 affected the machine-building and metallurgical industries in Russia, causing rising unemployment and falling tax revenues. During this crisis, the most affected regions were the metalworking and mechanical engineering regions, and the large industrial regions due to the high business involvement. In contrast, the largest urban agglomerations, along with resource extraction regions, experienced an easier recovery from the crisis, due to the large labour market and the short-term decline in global hydrocarbon prices, respectively. The crisis of 2014–2016 was concomitant with a considerable escalation of sanctions pressure, which caused a decline in the business climate in Russia, resulting in a sharp drop in investment, as well as a reduction in the product range due to the counter-sanctions on imported goods. The decline of incomes and the reshaping of the consumption patterns required a time lag, which led to a decline in consumption in all Russian regions. The crisis affected the largest industrial centres, which were heavily reliant on foreign investment. In contrast, we observed an upturn of investments in the largest and most profitable industries, such as oil and gas extraction (Zubarevich, 2020).

The pandemic crisis has a different nature due to significant quarantine restrictions, affecting the major cities of Moscow, Saint Petersburg, Ekaterinburg, Novosibirsk, and Kazan. Consequently, the market services sector, and hotels and catering establishments were hit hardest by this regional disparity. The market services sector is dominated by small and medium-sized businesses that are unable to incur the high costs of maintaining business (wages, rent) in the absence of revenues (Kolomak, 2020). The consequence is a considerable growth in unemployment in the largest cities, and a shift to shadow unemployment (part-time work, reduced working hours). Hence, the geography of the crisis covers large urban agglomerations as well as regions with a high share of services in GRP. Figure 2 reflects the increase (decrease) of the service sector's share in GRP in 2020 compared to 2019.

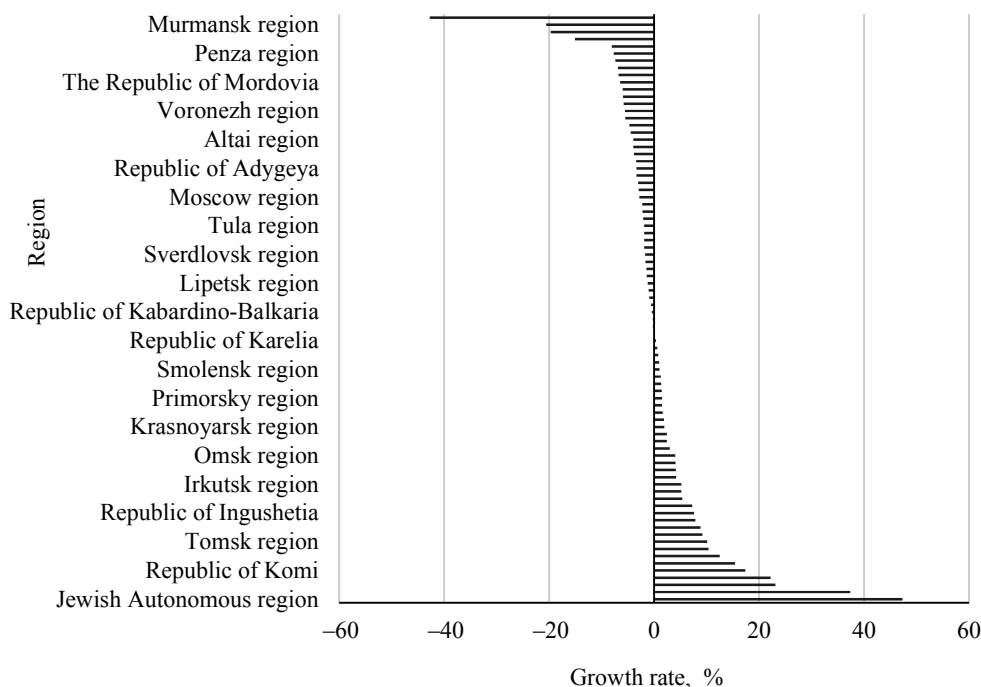


Fig. 2. Growth rate of the services' share in GRP

Source: Federal State Statistics Service (2023c).

We observe a significant drop (from 20 to 40%) in the share of services in GRP in Murmansk region, North Ossetia, Transbaikalian region, Dagestan Republic and Magadan region. In contrast, over half of regions demonstrate an increase in the share of services in GRP. The rationale for this is, *first*, the low base effect in the share of services in GRP in national republics (Tyva, Udmurtia, Sakha, Tatarstan, Bashkiria, Kalmykia) as well as in Siberian conurbation (Kemerovo, Tomsk, Irkutsk, Omsk regions). *Second*, the services sector includes various categories: public utilities, public transport, financial activities, education, health care, and catering. The tariffs for housing and communal services are indexed annually², compensating for the fall in other categories. Empirical studies on the impact of the pandemic on different economies show the most pronounced falls in the hotel industry and catering (Abebe et al., 2022; Grigoryev et al., 2021; Zubarevich, Safronov, 2020). We consider the dynamics of the share of hotel services and catering enterprises in the GRP of Russian regions (Fig. 3).

This sector suffered dramatic falls in more than 80% of Russia's regions. The largest drop is evident in Saint Petersburg with 53.8%, while in Moscow, hotels and catering declined by a quarter. In the rest of the regions, the decline is due to the attractiveness of the region for domestic tourism, and the development and prevalence of cafés and restaurants, with an average decline of 15 to 30%. However, the Komi Republic, Altai, and Ryazan regions experienced a substantial expansion of demand for hotels and catering establishments, suggesting a low-base effect and an increase in domestic tourism. Additionally, we examine the existence of statistical relationships.

² See <https://iz.ru/1030230/2020-07-01/s-1-iulija-v-rossii-proindeksiruiut-tarifny-na-uslugi-zhkhk>.

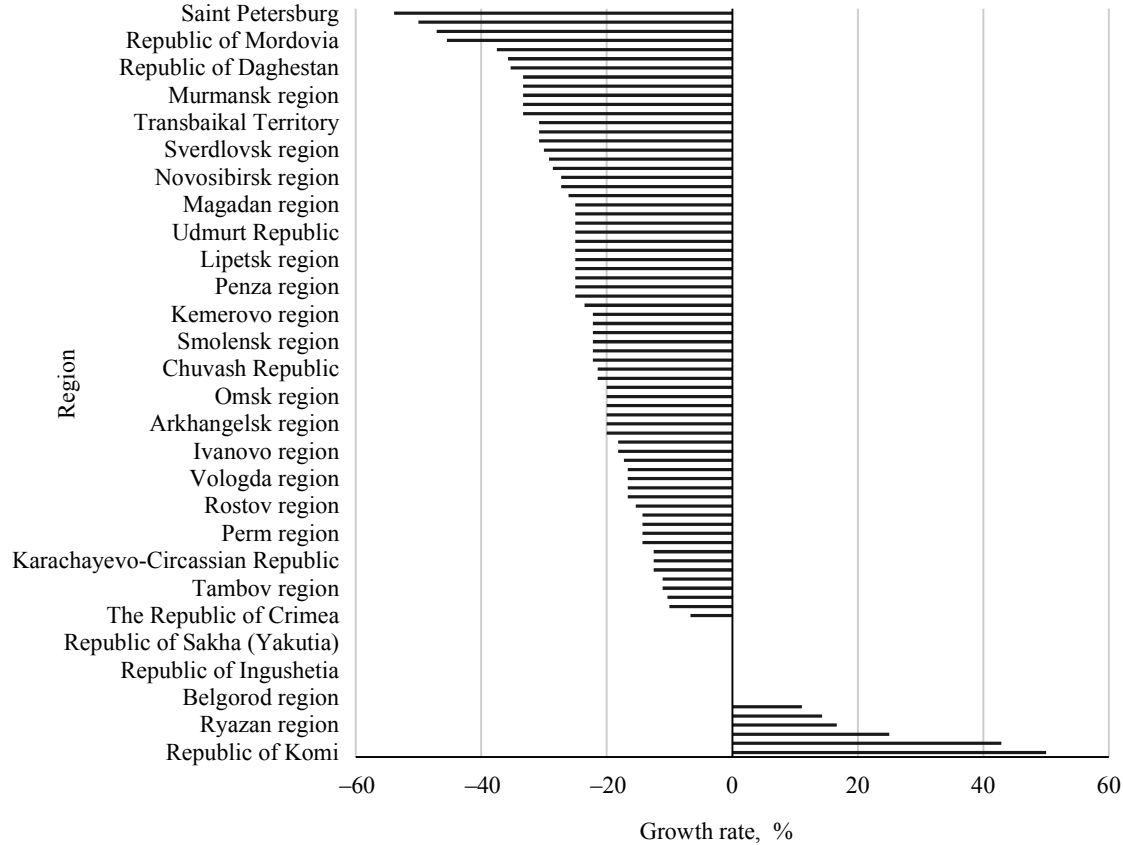


Fig. 3. Growth rate of the share of hotel and catering services in GRP

Source: Federal State Statistics Service (2023c).

To compare the mean values in 2019 and 2020 in the share of service and catering and hotels, we perform a *t*-test (Table 1).

The null hypothesis is the equality of mean values (average shares in GRP of the region). For services, we do not reject the null hypothesis, which indicates that there is no significant change in the region’s GRP in the pre-crisis and crisis periods. In contrast, the average shares of hotels and catering are quite different in 2019 and 2020, with an average drop of 22.9%. The consequence of this decline could be a significant redistribution of consumer spending in favour of food at home.

Table 1. *T*-test for shares of services and hotels and catering establishments in GRP

	Services	Hotels and catering establishments
<i>T</i> -test mean-comparison	-11.46 (35.65)	-22.93*** (2.98)
Interpretation	H_0 is accepted, no significant differences between 2019 and 2020	H_0 is rejected, there is a significant difference between 2019 and 2020

Note. Standard errors in parentheses. *** indicates 1% significance level.
 H_0 is the equality of mean values (average shares in GRP of the region).

Regional governors were empowered to manage the pandemic crisis, including the ability to suspend businesses, restrict the movement of citizens, decide on the regime of systemically important enterprises³. This results in even greater heterogeneity among Russian regions in terms of institutional arrangements. To capture this in our analysis, we distinguish between regions with hard, medium, and soft quarantine measures, following the methodology of the Saint Petersburg Policy Foundation as of June 2021⁴. The classification of regions according to the severity of official quarantine restrictions takes into account the existence of quarantine measures, prohibitions on mass events, the enforcement of vaccination for workers in certain sectors, and the proportion vaccinated with the first and second components of the coronavirus vaccine.

The regions with the most severe quarantine measures included Moscow, Moscow region, Yakutia, Buryatia, Khakassia, Karelia, Nizhny Novgorod, Irkutsk, Pskov, Ivanovo, Kaliningrad and Tula regions, and Krasnodar region. Strict movement restrictions were introduced, including visits to catering establishments with a QR code, as well as restrictions on visits to tourist attractions, for instance, the authorities of Buryatia restricted tourists' access to Baikal. In these regions entertainment facilities were forbidden to operate at night, and mass events were severely restricted. Mandatory vaccinations for certain categories of citizens were further imposed in these regions.

The largest group of regions with medium quarantine measures includes 43 regions. This group is notable for its stricter quarantine measures, without the introduction of compulsory vaccination. These regions restricted the operation of catering enterprises at night, identified population groups for whom self-isolation was mandatory (Khanty-Mansi Autonomous District, Ingushetia, Perm Region, Tambov, Tyumen, Amur, and Ryazan regions), and banned mass events (Mordovia, Bashkiria, Dagestan, Saint Petersburg, Orenburg, Penza, Kaluga, Vologda, and Novosibirsk regions).

A low degree of stringency of quarantine measures was implemented in Tyva, Lipetsk, Samara, Kirov, Volgograd, Saratov, Sverdlovsk, Chelyabinsk, Arkhangelsk, Tomsk, Orel regions, Kalmykia, Jewish Autonomous region, Krasnoyarsk region, Tatarstan, Chuvashia, Karachay-Cherkessia, Stavropol, Udmurtia, Adygeya, Kabardino-Balkaria. These regions had no compulsory vaccination, restrictions on movement or catering establishments.

4. Data and methodology

We consider five groups of consumer expenditures as dependent variables. Following the Rosstat methodology (Federal State Statistics Service, 2023b) the groups of expenditures on food at home, outside the home, and alcohol include the corresponding categories of consumption. The group of non-food goods includes a wide range of expenditures, such as: tobacco, clothing, building materials, fuel, furniture, household appliances, household chemicals, medicines, vehicles, leisure goods, printed matter, and hygiene products. The services category includes a wide range of services, for example housing, medical, transportation, information, recreational, veterinary, educational, hotel, and financial services. Figure 4 reflects the average consumer expenditures over 2019–2021.

³ Decree on measures to ensure the sanitary and epidemiological well-being of the population in connection with the spread of coronavirus infection. <http://kremlin.ru/acts/news/63134>.

⁴ See <https://www.fpp.spb.ru/fpp-rating-2021-06>.

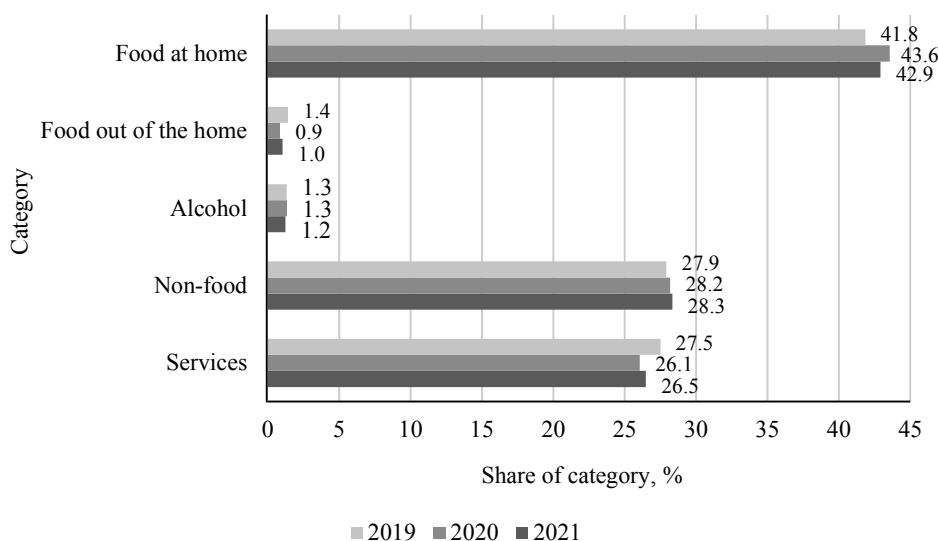


Fig. 4. Mean values of consumer expenditures from 2019 to 2021

Source: Federal State Statistics Service (2022).

We observe shifts during the crisis period in food at home and outside the home: expenditures on food at home increased by 1.8 percentage points, expenses on food outside the home declined by 0.5 percentage points, services dropped by 1.4 percentage points. Spending on alcohol was almost unchanged over the study period. An increase of 1.1 percentage points in expenditure on food at home is observed in 2021 compared to 2019, with a simultaneous decrease in services, alcohol, and food outside the home. We find a slight (in relative terms) redistribution of consumer spending categories, which is in line with the findings of Anderson, Blundell (1983). Anderson, Blundell argue that the effects of external change are long-lasting. Similarly, Barigozzi et al. (2012) find empirical evidence that the distribution of consumer spending is stable over time for each specific category but is heterogeneous across product categories. Figure 5 shows a comparison of the disaggregated structure of household expenditure in 2020, compared to 2019.

The results indicate significant changes in the structure of household consumption — expenditure on medicines and health care increased by 17%, while cultural, recreational, and transport services decreased by 57, 29 and 25% respectively. Disaggregation revealed significant within-group shifts in household consumption patterns, while confirming trends identified at the inter-group level (the substitution of expenditure on services by food at home).

We apply the Kolmogorov–Smirnov test and *t*-test to examine the equality of distributions and changes in mean values (Table 2). The mean share of alcohol consumption remains unchanged in 2020, compared to 2019, in contrast to other expenditure categories. The Kolmogorov–Smirnov test indicates unequal distribution of variables. Food at home expenditures increased in 2020 compared to 2019, which confirms previous results, while the expenditures for services and out-of-home food dropped significantly. In 2021, we observe restoring consumption patterns: outside food consumption slightly increased compared to 2020, as did the services and non-food spending, with a corresponding decrease in the expenditures on food at home.

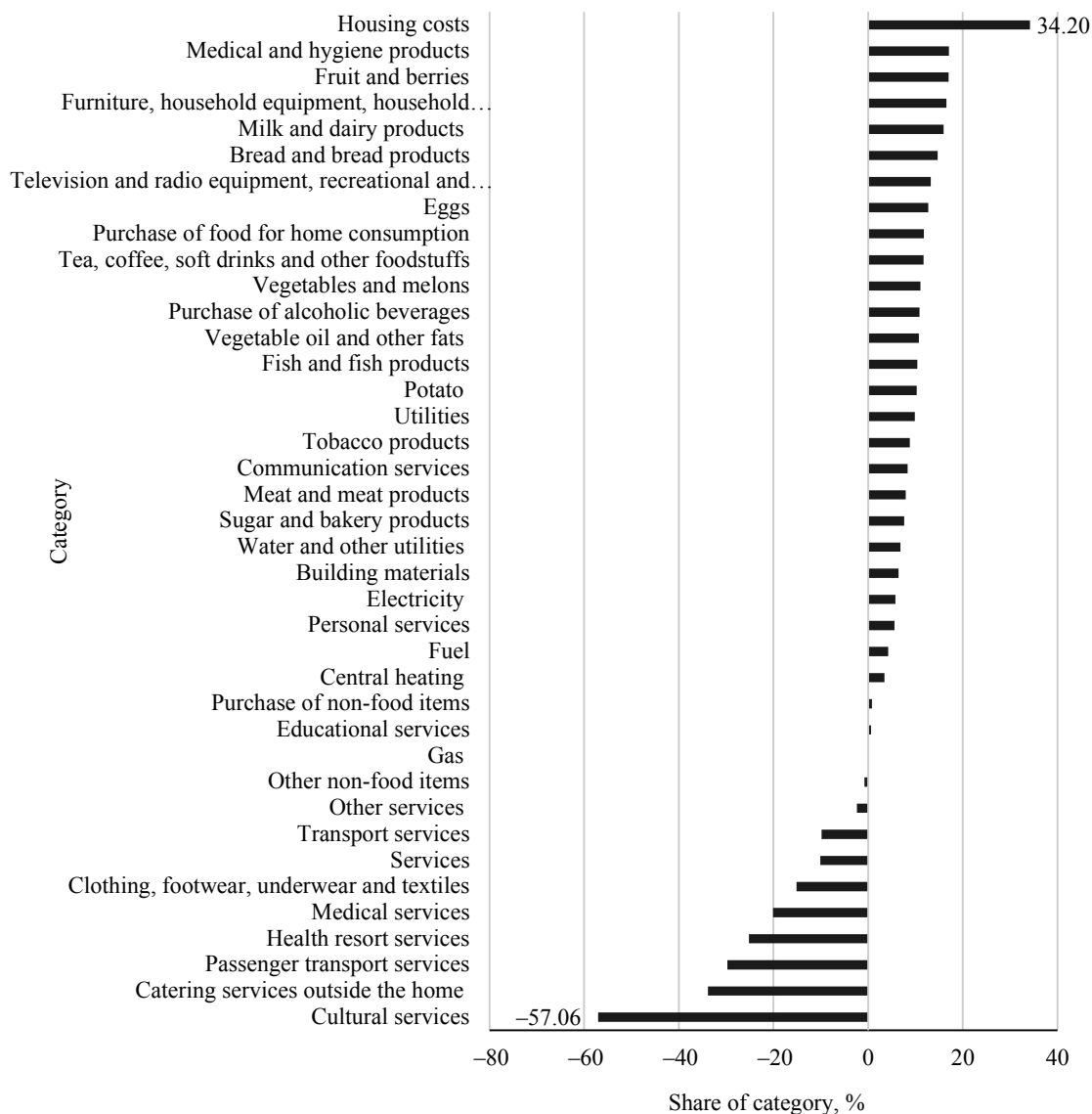


Fig. 5. Disaggregated consumption structure in 2020 compared to 2019

Source: Federal State Statistics Service (2023c).

As a theoretical basis for our baseline empirical model, we use the basic model of consumer demand proposed by Leser (1963). The model excludes prices for goods and services, which become endogenous once integrated into the econometric analysis. We also follow a modification of the empirical model (Berendeewa, Ratnikova, 2018), which enables the modelling of the share of consumer expenditure, considering the role of the determinants of consumer demand.

Table 2. Kolmogorov–Smirnov and *t*-test for categories of household expenditures

Test	Food	Out-of-home food	Alcohol	Non-food goods	Services
<i>Comparison 2019 and 2020</i>					
<i>T</i> -test mean-comparison	1.719*** (0.046)	−0.557*** (0.012)	0.0119 (0.0080)	0.273*** (0.044)	−1.440*** (0.039)
Kolmogorov–Smirnov test	0.000	0.000	0.180	0.000	0.000
<i>Comparison 2020 and 2021</i>					
<i>T</i> -test mean-comparison	−0.653*** (0.046)	0.185*** (0.011)	−0.099*** (0.0078)	0.143*** (0.044)	0.426*** (0.038)
Kolmogorov–Smirnov test	0.0000	0.0000	0.0000	0.0000	0.0000
<i>Comparison 2019 and 2021</i>					
<i>T</i> -test mean-comparison	1.066*** (0.046)	−0.372*** (0.012)	−0.0870*** (0.0078)	0.416*** (0.044)	−1.015*** (0.039)
Kolmogorov–Smirnov test	0.0000	0.0000	0.0000	0.0000	0.0000

Note. Standard errors in parentheses. *** indicates 1% significance level. For Kolmogorov–Smirnov test *p*-values are represented.

We estimate a linear regression models with robust standard errors in White's form:

$$Y_{iyjr} = (\beta_{0j} + \delta_{0j}D) + (\beta_{1j} + \delta_{1j}D)X_1 + \dots + (\beta_{9j} + \delta_{9j}D)X_9 + \sum_{t=2}^4 \gamma_{ij}q_t + \varphi_{softj}dsoft_{ytr}D + \varphi_{hardj}dhard_{ytr}D + \theta_{rj}R_{ir} + \varepsilon_{iytj}, \quad (1)$$

using three samples (first sample for 2019 and 2020 years with N_1 observations, second sample for 2020 and 2021 years with N_2 observations, and third sample for 2019 and 2021 with N_3 observations);

where $i = 1, \dots, N_m$ ($m = 1, 2, 3$) is the number of the household in the corresponding sample, y — corresponding year (2019 or 2020 for the first sample, 2020 or 2021 for the second sample, 2019 or 2021 for the third sample);

$t = 1, 2, 3, 4$ is the number of the quarter; $r = 1, \dots, 83$ is the number of the region;

$j = 1, \dots, 5$ corresponds to the type of expenditure: 1 — share of food at home expenses, 2 — share out-of-home food expenses, 3 — share of alcohol expenses, 4 — share of non-food expenses, 5 — share of service expenses;

$X_1, \dots, X_9$ are explanatory variables, described in the Table 3 (*edulevel_max*, ..., *sq_pr*);

θ_{rj} represent fixed effects of the regions; R_{ir} is a dummy variable, equal 1, if household i is located in the r -th region.

We employ several dummy variables to consider seasonality and pandemic impact:

D — dummy for 2020 for the first sample (D_{2020}) and dummy for 2021 for the second and third samples (D_{2021}); q_t ($t = 2, 3, 4$) denotes the dummy for quarter;

$dsoft_{ytr}$ is dummy variable, that equals 1 if region r introduced soft quarantine measures in year y and quarter t ;

$dhard_{ytr}$ stands for the dummy, equals 1 if region r implemented hard quarantine restrictions in year y and quarter t ;

$\beta, \gamma, \delta, \varphi$ with different indices are sets of parameters; ε_{iytj} are errors.

To test the hypotheses, we use data from the quarterly survey of households conducted by Rosstat (Federal State Statistics Service, 2022). The database contains 576200 observations from 2019: Q1 to 2021: Q4 and includes personal and socioeconomic indicators of each household. The number of interviewed households varies from 48000 to 49200 households each year. The composition of the interviewed households can vary slightly from year to year, while within one year the number of households is constant. To increase the accuracy of the estimates, we excluded statistical outliers — households with aggregate monthly expenditures per household member less than 1000 rubles and more than 400000 rubles. Table 3 gives a detailed description of chosen variables.

Table 3. Variables description

Variable	Description
share_food	Share of food at home expenditure in total consumer spending (%)
share_food_out	Share of out-of-home food expenditure in total consumer spending (%)
share_alcohol	Share of expenditure on alcoholic beverages in total consumer spending (%)
share_non_food	Share of expenditure on non-food items in total consumer spending (%)
share_service	Share of expenditure on services in total consumer spending (%)
edulevel_max	Achieved level of education (maximum value in the household): 1 — no basic general education; 2 — basic general education; 3 — secondary general education; 4 — secondary vocational education; 5 — higher vocational education
child416	Number of children aged 4 to 16
child3	Number of children under 3 years of age
ln(income)	Average monetary income per capita in 2016 prices (Russian rouble), PPP, in logarithm
share_fakt	Share of growth in financial assets in income
share_ssber	Share of savings in income
city	Type of settlement: 0 — rural, 1 — urban
rich	Dummy variable denoting the financial self-assessment of the household: 1 — the household has enough money to buy everything it needs, or the household has enough money to cover its expenses but cannot buy a flat and a car; 0 — household does not have enough money even for food or not enough money to buy clothes and pay for housing and utilities or not enough money to buy durable goods
sq_pr	Total floor area per person in the household (sq. metres)
selfiso	Yandex self-isolation index: 0–2.4 — a lot of people are on the street; 2.5–2.9 — an average number of people are on the street; 2.9–3.5 — some people are on the street; 3.6–3.9 — the majority of people are at home; 3.9–5 — nobody is on the street

Source: Federal State Statistics Service (2022).

We divide the independent variables into three sub-groups, including social characteristics, financial characteristics, and the impact of the pandemic. The sub-group of social household characteristics includes the number of children aged up to 16 and educational attainment. This approach follows the papers of (Ferdous et al., 2010; Varlamova, Larionova, 2015; Venn et al., 2018),

who examine the impact of social factors on consumption patterns. Financial characteristics of a household include household income, the share of growth in financial assets and savings in income, financial self-assessment of the household, and housing area per household member. Edelstein, Kilian (2009) highlight income and savings as determinants of energy consumption. Similarly, Verter, Osakwe (2014) provide evidence of a significant impact of income and savings on household consumption structure. We use dummy variables for 2020 and 2021, dummy variables to estimate the impact of the rigidity of quarantine restrictions during the pandemic. Abebe et al. (2022), Dumitras et al. (2021), Tian et al. (2022) employ binary variables to estimate pandemic impacts, distinguishing pre-crisis, crisis, and post-crisis periods.

We estimate equation (1) on the subsamples that include analysis for different timeframes of COVID-19 crisis. We perform econometric analysis for comparison of pre-crisis and crisis periods (2019 and 2020), crisis and post-crisis periods (2020 and 2021), pre-crisis and post-crisis periods (2019 and 2021).

5. Empirical results

This section is devoted to the analysis of the impact of official quarantine measures on consumption structure, while the next section analyses the actual isolation of residents (compliance with restrictive measures) related to the COVID-19 pandemic. Table 4 reports the results of estimations for model (1) for each dependent variable, i.e. expenditures on food at home, out-of-home food, alcohol, non-food goods, and services based on the 2019 and 2020 subsamples. Given the heterogeneity of Russian regions, we employ standard errors in White's form to address potential heteroskedasticity. We also estimate the same model specifications employing standard errors in a clustered form. Estimated coefficients from the analogous model with clustered standard errors are exclusively of the same significance level, confirming the robustness of chosen form of the model. To increase the efficiency of our estimates, we test the hypothesis of the joint insignificance of coefficients for factors whose coefficients were individually insignificant. Once this hypothesis was not rejected, we incorporated the appropriate constraint into the equation (by excluding the corresponding variables from the model).

We explain the moderate values of R -squared by the highly heterogeneous Russian households in terms of individual characteristics (education, income levels, housing conditions, savings patterns). Given this fact, linear models are unable to explain the high share of variation. Increases in income stimulate spending on out-of-home food, alcohol, and non-food items, and services. In contrast, we observe a 3.2 p.p. decline in the share of spending on food with a 1% rise in income in 2019 (and 2.4 p.p. in 2020), which is consistent with Engel's law. Similarly, Kotelnikova, Radaev (2017) document the presence of Engel's law in Russia, with a higher impact of income during economic shocks. The estimates of intersection coefficients for education level, number of children, income, type of settlement, housing conditions, and savings change during the pandemic. The intersection coefficients for education level, number of children, income, type of settlement, housing conditions, and savings quantify change during the pandemic. This results in an increase of the expenditure shares on food at home, alcohol, and non-food items with a simultaneous decrease in the expenditures on out-of-home food and services as income rises in 2020 compared to 2019. Education level contributes to a rise in the share of spending on out-of-home food, alcohol, non-food goods, and services, while the share of spending on food declines. In contrast,

Table 4. OLS estimates for structure of consumer expenditures for 2019 and 2020

	Food at home	Out-of-home food	Alcohol	Non-food goods	Services
edulevel_max	-2.851*** (0.0410)	0.389*** (0.0104)	0.0330*** (0.00535)	1.224*** (0.0277)	1.239*** (0.0355)
edulevel_max×D ₂₀₂₀	0.371*** (0.0573)	-0.167*** (0.0133)			-0.273*** (0.0483)
child416	-2.573*** (0.0511)	0.702*** (0.0163)	-0.0544*** (0.00616)	1.555*** (0.0512)	0.342*** (0.0447)
child416×D ₂₀₂₀	0.356*** (0.0706)	-0.265*** (0.0201)		0.921*** (0.0718)	-0.949*** (0.0604)
child3	-2.062*** (0.131)	-0.0734* (0.0362)	-0.0996*** (0.0162)	3.404*** (0.141)	-1.175*** (0.121)
child3×D ₂₀₂₀	-0.177 (0.194)	0.109* (0.0476)		0.979*** (0.208)	-0.891*** (0.172)
ln(income)	-3.150*** (0.0566)	0.718*** (0.0187)	0.225*** (0.00963)	1.704*** (0.0546)	0.486*** (0.0514)
ln(income) ×D ₂₀₂₀	0.757*** (0.0770)	-0.232*** (0.0232)	0.0278* (0.0123)	0.294*** (0.0727)	-0.811*** (0.0680)
share_fakt	3.854*** (0.0648)	0.0442*** (0.0109)	0.0810*** (0.00738)	-4.052*** (0.111)	0.0417 (0.0929)
share_fakt×D ₂₀₂₀				-0.427** (0.137)	0.505*** (0.128)
share_ssber	-4.307*** (0.0939)	-0.178*** (0.0165)	-0.125*** (0.0119)	3.643*** (0.105)	1.210*** (0.107)
share_ssber×D ₂₀₂₀					-0.487*** (0.146)
city	-1.103*** (0.0719)	0.398*** (0.0171)	-0.0719*** (0.0131)	-5.077*** (0.0510)	5.878*** (0.0613)
city×D ₂₀₂₀	0.330*** (0.0998)	-0.197*** (0.0212)	0.0828*** (0.0180)		-0.269** (0.0825)
rich	-3.608*** (0.0525)	0.386*** (0.0162)	0.259*** (0.0103)	4.024*** (0.0533)	-1.060*** (0.0463)
sq_pr	0.128*** (0.00270)	-0.0300*** (0.000661)	-0.0118*** (0.000434)	-0.126*** (0.00249)	0.0418*** (0.00223)
sq_pr×D ₂₀₂₀	-0.0190*** (0.00369)	0.0129*** (0.000818)	-0.00274*** (0.000596)	-0.00869* (0.00339)	0.0149*** (0.00300)
D ₂₀₂₀	-7.330*** (0.736)	2.423*** (0.222)	-0.244* (0.107)	-2.817*** (0.688)	8.074*** (0.657)
dhard	0.684*** (0.116)	-0.389*** (0.0307)	0.0244 (0.0218)	-0.0250 (0.0217)	-0.139 (0.0978)
dsoft	0.266** (0.0934)	-0.291*** (0.0243)	-0.0253 (0.0181)	0.564*** (0.0909)	-0.474*** (0.0811)
Constant	81.45*** (0.565)	-7.164*** (0.181)	-0.489*** (0.0968)	13.38*** (0.553)	12.78*** (0.518)
Time effects			Yes		
Regional effects			Yes		
Observations	383173	383170	383172	383172	383172
R-squared	0.217	0.085	0.046	0.171	0.154

Note. Robust standard errors in parentheses. ***, **, * indicates 1, 5 and 10% significance level.

we observe a diminished effect during the acute phase of the pandemic for spending on out-of-home food and services, which is in line with prior findings (Xiong et al., 2021). The rigidity of quarantine measures has a significant impact on dependent variables, contributing changes in the shares of food and non-food goods, substituting out-of-home food spending and services in the consumer basket. The similar effect of food substitution of other consumer spending categories during the pandemic is reported by Chen et al. (2021). Interestingly, the impact of hard and soft quarantine restrictions is unidirectional in some cases. For instance, in the regions with soft and hard quarantine measures, we observe the substitution of expenditure on food outside the home by spending on food at home. Households in regions with soft quarantine measures increased the share of expenditure on non-food goods and reduced the share of spendings on services. Table 5 indicates the results of similar model specification employing the 2020 and 2021 subsample.

The results of the regression equations in 2019, 2020 and 2020, 2021 subsamples report that the impact of the determinants (signs at slope coefficients) in the two subsamples in 2019, 2020 and 2020, 2021 remained unchanged, although the absolute values of the coefficients have shifted. Rising income drives expenditures on out-of-home food, alcohol, and non-food items. Interestingly, expenditures on out-of-home food and services augment as the level of education increases in 2021, as opposed to 2020. The presence of contradictory results in the two subsamples confirms the existence of a recovery pattern in terms of consumption structure after 2020, which is in line with the study of (Berendeeva, Ratnikova, 2018). Interestingly, in contrast to the 2019 and 2020 subsample, the impact of quarantine restrictions suggests a multidirectional effect, e. g., on services, implying that hard quarantine measures contribute to the share of services, while soft quarantine hinders it. Table 6 describes the results of OLS estimates for the 2019 and 2021 subsample.

The 2019 and 2021 subsample captures the impact before and after the acute phase of pandemic crisis. Essentially, the regression results demonstrate that the impact of independent variables is similar to that obtained in the previous models. Therefore, we report that consumer patterns remained unchanged after the pandemic. However, during the crisis we observe a statistically significant impact of the pandemic, implying the existence of a quantitative change of consumption expenditures. Given the limited number of hard and soft quarantine restrictions, we conclude the diminishing impact of pandemic restrictions, which is in line with the prior findings from (Tian et al., 2022). Based on the findings, we can draw the following conclusions.

- 1) In 2020, the impact of determinants changed, which is reflected in the absolute values of coefficient variations, with the sign remaining unchanged. In 2021, on the other hand, we find a return to the 2019 behaviour pattern.
- 2) The severity of quarantine measures appeared to have a unidirectional impact in 2020, and a multidirectional effect in 2021. The impact of quarantine restrictions decreased in 2021, as reflected by the low absolute values of the slope coefficients.
- 3) The higher the education level of household members, the lower their expenditures on food and the higher the share of expenditures on other categories (especially services). In 2020, this dependency persisted, but to a lesser extent for the share of expenditure on food and services. In the wake of the crisis, the overall consumption trends for more educated households slightly weakened.
- 4) As income rises, the share of food expenditure decreases (Engel's law). We observe a slow-down of this trend in 2020 for food at home, out-of-home food, and services. The crisis has slightly weakened the overall trends for richer households.

Table 5. OLS estimates for structure of consumer expenditures for 2020 and 2021

	Food at home	Out-of-home food	Alcohol	Non-food goods	Services
edulevel_max	-2.572*** (0.0297)	0.226*** (0.00849)	0.0329*** (0.00523)	1.268*** (0.0388)	0.981*** (0.0337)
edulevel_max×D ₂₀₂₁		0.106*** (0.0123)		-0.146** (0.0541)	0.170*** (0.0472)
child416	-2.195*** (0.0510)	0.423*** (0.0125)	-0.0507*** (0.00608)	2.459*** (0.0520)	-0.619*** (0.0413)
child416×D ₂₀₂₁	-0.168* (0.0704)	0.0455* (0.0182)		-0.606*** (0.0721)	0.691*** (0.0584)
child3	-2.229*** (0.145)	0.0214 (0.0247)	-0.0901*** (0.0171)	4.373*** (0.154)	-2.096*** (0.123)
child3×D ₂₀₂₁	1.015*** (0.208)			-1.332*** (0.220)	0.358* (0.177)
ln(income)	-2.557*** (0.0565)	0.565*** (0.0167)	0.246*** (0.00753)	1.503*** (0.0556)	0.211*** (0.0489)
ln(income)×D ₂₀₂₁	0.127 (0.0766)	-0.0807*** (0.0210)	0.0136*** (0.00176)	0.457*** (0.0758)	-0.453*** (0.0644)
share_fakt	3.891*** (0.0843)	0.0237* (0.0115)	0.0682*** (0.00790)	-4.501*** (0.134)	0.527*** (0.0878)
share_fakt×D ₂₀₂₁	-0.309** (0.102)			0.668*** (0.189)	-0.378** (0.127)
share_ssber	-4.137*** (0.0995)	-0.177*** (0.0168)	-0.107*** (0.0126)	3.696*** (0.155)	0.752*** (0.102)
share_ssber×D ₂₀₂₁				-0.514* (0.215)	0.455** (0.144)
city	-0.771*** (0.0711)	0.228*** (0.0103)	-0.00952 (0.00914)	-5.105*** (0.0709)	5.680*** (0.0415)
rich	-3.716*** (0.0516)	0.378*** (0.0148)	0.272*** (0.0141)	4.075*** (0.0519)	-1.196*** (0.0610)
rich×D ₂₀₂₁			-0.0508** (0.0185)		0.415*** (0.0851)
sq_pr	0.111*** (0.00269)	-0.0173*** (0.000521)	-0.0146*** (0.000406)	-0.133*** (0.00262)	0.0530*** (0.00208)
sq_pr×D ₂₀₂₁	0.00642 (0.00360)	-0.00455*** (0.000724)	0.00120* (0.000471)	0.00989** (0.00355)	-0.0109*** (0.00279)
dhard	-1.265 (1.178)	-0.483*** (0.0513)	0.0504 (0.0306)	-0.125 (0.152)	0.459*** (0.138)
dsoft	0.419*** (0.126)	-0.552*** (0.0388)	0.0125 (0.0253)	0.782*** (0.124)	-0.669*** (0.113)
D ₂₀₂₁	0.485 (0.711)	-0.921*** (0.205)		5.350*** (0.725)	-4.911*** (0.637)
Constant	74.41*** (0.566)	-4.970*** (0.146)	-0.857*** (0.0797)	10.50*** (0.570)	20.91*** (0.490)
Time effects			Yes		
Regional effects			Yes		
Observations	383001	383000	383000	382999	383001
R-squared	0.204	0.072	0.048	0.175	0.150

Note. Robust standard errors in parentheses. ***, **, * indicates 1, 5 and 10% significance level.

Table 6. OLS estimates for structure of consumer expenditures for 2019 and 2021

	Food at home	Out-of-home food	Alcohol	Non-food goods	Services
edulevel_max	-2.860*** (0.0407)	0.391*** (0.0104)		1.166*** (0.0278)	1.190*** (0.0252)
edulevel_max×D ₂₀₂₁	0.255*** (0.0567)	-0.0856*** (0.0138)	0.0307*** (0.0071)		
child416	-2.453*** (0.0367)	0.577*** (0.0109)	-0.0455*** (0.0060)	1.732*** (0.0365)	0.190*** (0.0309)
child416×D ₂₀₂₁	0.0232 (0.0211)	-0.232*** (0.0664)	0.003 (0.0289)	0.324*** (0.0416)	-0.225*** (0.0701)
child3	-2.043*** (0.132)	-0.0429 (0.0265)	-0.118*** (0.0157)	3.278*** (0.105)	-1.184*** (0.121)
child3×D ₂₀₂₁	0.824*** (0.200)				-0.593*** (0.175)
ln(income)	-3.064*** (0.0494)	0.656*** (0.0176)	0.235*** (0.00961)	1.654*** (0.0417)	0.389*** (0.0441)
ln(income)×D ₂₀₂₁	0.394*** (0.0535)	-0.0596** (0.0213)	0.0189 (0.0119)	0.0761*** (0.0146)	-0.159*** (0.0462)
share_fakt	3.823*** (0.0890)	0.0469*** (0.0121)	0.0808*** (0.00715)	-4.026*** (0.123)	0.0953 (0.0657)
share_ssber	-4.485*** (0.126)	-0.161*** (0.0187)	-0.121*** (0.0125)	3.512*** (0.138)	1.150*** (0.0759)
share_ssber×D ₂₀₂₁	0.400* (0.183)			-0.169 (0.202)	
city	-1.146*** (0.0709)	0.401*** (0.0171)	-0.0656*** (0.0130)	-5.072*** (0.0703)	5.923*** (0.0593)
city×D ₂₀₂₁	0.644*** (0.0966)	-0.187*** (0.0230)	0.0497** (0.0176)	-0.266** (0.0960)	-0.313*** (0.0776)
rich	-3.715*** (0.0518)	0.402*** (0.0166)	0.230*** (0.00985)	3.902*** (0.0525)	-0.820*** (0.0464)
sq_pr	0.122*** (0.00192)	-0.0299*** (0.000664)	-0.0123*** (0.000434)	-0.124*** (0.00237)	0.0432*** (0.00157)
sq_pr×D ₂₀₂₁		0.00941*** (0.000846)	-0.00145* (0.000570)	-0.00688* (0.00299)	
dhard		-0.1106*** (0.237)	0.0535** (0.0208)		
dsoft	-0.240** (0.0922)	-0.0812** (0.0263)			0.285*** (0.0818)
D ₂₀₂₁	-4.290*** (0.591)	0.428* (0.201)	-0.423*** (0.109)		0.684 (0.452)
Constant	81.12*** (0.522)	-6.835*** (0.168)	-0.560*** (0.0919)	13.93*** (0.433)	14.16*** (0.453)
Time effects			Yes		
Regional effects			Yes		
Observations	383952	383950	383952	383949	383951
R-squared	0.213	0.083	0.045	0.160	0.147

Note. Robust standard errors in parentheses. ***, **, * indicates 1, 5 and 10% significance level.

6. Robustness check

To check the robustness of our estimates, we use a proxy variable to capture the severity of quarantine restrictions: the self-isolation index developed by Yandex (2021). Kolosnitsyna, Chubarov (2022) argue that the self-isolation index serves as a proxy for the stringency of restrictions, as it reflects how quarantine measures are actually implemented rather than the formal set of restrictions. The self-isolation index measures a different extent of quarantine restrictions, where a score from 3.6 to 5.0 indicates strict quarantine measures (most people are at home) and a score from 0 to 2.9 reflects soft quarantine measures. The model specification remains the same as in Section 5. Table 7 shows the results of the modelling with the self-isolation index for the 2019 and 2020 subsample.

The results reveal similar slope coefficients for the financial (income, housing, savings) and social (level of education, number of children) indicators, along with their significance, which supports our previous findings. The explanatory power of the models (R -squared) is slightly higher compared to the models from Section 5. A greater self-isolation index (increased stringency of quarantine measures) raises the share of expenditure on food and alcohol and cuts the share of expenditure on out-of-home food, services, and non-food items, which is consistent with the main results. Interestingly, dummy variables failed to capture the small increase in the share of alcohol expenditure in household budgets, although several researchers find evidence that the pandemic contributed to an increase of alcohol consumption (Ramalho, 2020; Rehm et al., 2020).

Table 8 provides estimates for the 2020 and 2021 subsample with the self-isolation index. In contrast to the main results, increasing the stringency of quarantine measures reduces the share of expenditure on food, indicating a decreasing effect of quarantine restrictions in 2021. Additionally, the self-isolation index contributes to an increase in the share of non-food items and discourages out-of-home food expenditures, confirming previous results. The severity of quarantine measures shows no significant effect on the share of expenditure on alcohol.

Table 9 summarizes the results of the OLS estimates for the 2019 and 2021 subsample. In contrast to previous results, we observe an increase in the share of spending on services as quarantine measures increase. Such a result may seem counter-intuitive, but it indicates a recovery in consumer habits and a simultaneous reduction in the impact of pandemic restrictions. There is a decline in the share of spending on food with substitution for out-of-home food and non-food items as the self-isolation index increases, confirming the relative unimportance of pandemic restrictions as the acute phase of the crisis receded.

The findings in this section indicate that the estimates of the coefficients of the independent variables are very similar (in significance and coefficient values), which confirms the robustness of the main results obtained in Section 5. However, there are differences in the impact of the quarantine measure severity depending on how they are recorded: as the official requirements of local authorities (Hard quarantine and Soft quarantine variables based on models (1)–(3)) or as the actual level of self-isolation (the self-isolation index variable). One may recall Saltykov-Shchedrin's famous phrase "The strictness of Russian laws is softened by the optionality of their enforcement". It is likely to be partly applicable to the period of restrictions during COVID-19.

Table 7. OLS estimates for structure of consumer expenditures for 2019 and 2020 with the self-isolation index

	Food at home	Out-of-home food	Alcohol	Non-food goods	Services
edulevel_max	-2.866*** (0.0409)	0.394*** (0.0104)	0.0330*** (0.00535)	1.224*** (0.0277)	1.245*** (0.0355)
edulevel_max×D ₂₀₂₀	0.401*** (0.0573)	-0.177*** (0.0133)			-0.284*** (0.0483)
child416	-2.566*** (0.0511)	0.702*** (0.0163)	-0.0543*** (0.00616)	1.546*** (0.0512)	0.348*** (0.0446)
child416×D ₂₀₂₀	0.355*** (0.0705)	-0.267*** (0.0201)		0.934*** (0.0718)	-0.967*** (0.0603)
child3	-2.041*** (0.131)	-0.0736* (0.0362)	-0.0992*** (0.0161)	3.384*** (0.141)	-1.172*** (0.121)
child3×D ₂₀₂₀	-0.199 (0.194)	0.107* (0.0476)		1.007*** (0.208)	-0.905*** (0.172)
ln(income)	-3.134*** (0.0566)	0.717*** (0.0187)	0.225*** (0.00963)	1.689*** (0.0546)	0.486*** (0.0514)
ln(income)×D ₂₀₂₀	0.748*** (0.0769)	-0.232*** (0.0232)	0.0271* (0.0123)	0.312*** (0.0726)	-0.822*** (0.0679)
share_fakt	3.846*** (0.0648)	0.0449*** (0.0109)	0.0807*** (0.00738)	-4.062*** (0.111)	0.0371 (0.0930)
share_fakt×D ₂₀₂₀				-0.395** (0.137)	0.520*** (0.128)
share_ssber	-4.331*** (0.0941)	-0.173*** (0.0164)	-0.126*** (0.0119)	3.651*** (0.105)	1.209*** (0.107)
share_ssber×D ₂₀₂₀					-0.468** (0.146)
city	-1.084*** (0.0719)	0.396*** (0.0170)	-0.0722*** (0.0131)	-5.075*** (0.0510)	5.861*** (0.0613)
city×D ₂₀₂₀	0.282** (0.0997)	-0.190*** (0.0212)	0.0831*** (0.0180)		-0.230** (0.0824)
rich	-3.604*** (0.0525)	0.385*** (0.0162)	0.260*** (0.0103)	4.023*** (0.0533)	-1.063*** (0.0463)
sq_pr	0.127*** (0.00270)	-0.0300*** (0.000661)	-0.0118*** (0.000434)	-0.126*** (0.00249)	0.0419*** (0.00223)
sq_pr×D ₂₀₂₀	-0.0188*** (0.00369)	0.0129*** (0.000818)	-0.00272*** (0.000596)	-0.00900** (0.00339)	0.0152*** (0.00300)
D ₂₀₂₀	-11.73*** (0.763)	3.337*** (0.227)	-0.334** (0.115)	-1.280 (0.717)	10.09*** (0.682)
selfiso	2.405*** (0.113)	-0.519*** (0.0271)	0.0494* (0.0205)	-0.851*** (0.110)	-1.061*** (0.0955)
Constant	81.28*** (0.565)	-7.079*** (0.181)	-0.491*** (0.0967)	13.38*** (0.553)	12.84*** (0.518)
Time effects			Yes		
Regional effects			Yes		
Observations	383173	383170	383172	383172	383172
R-squared	0.218	0.085	0.046	0.171	0.155

Note. Robust standard errors in parentheses. ***, **, * indicates 1, 5 and 10% significance level.

Table 8. OLS estimates for structure of consumer expenditures for 2020 and 2021 with the self-isolation index

	Food at home	Out-of-home food	Alcohol	Non-food goods	Services
edulevel_max	-2.572*** (0.0297)	0.227*** (0.00849)	0.0329*** (0.00523)	1.268*** (0.0388)	0.980*** (0.0337)
edulevel_max×D ₂₀₂₁		0.103*** (0.0123)		-0.147** (0.0541)	0.173*** (0.0472)
child416	-2.196*** (0.0510)	0.425*** (0.0125)	-0.0508*** (0.00608)	2.454*** (0.0520)	-0.615*** (0.0413)
child416×D ₂₀₂₁	-0.167* (0.0704)	0.0426* (0.0182)		-0.594*** (0.0721)	0.683*** (0.0584)
child3	-2.234*** (0.145)	0.0224 (0.0247)	-0.0902*** (0.0171)	4.367*** (0.154)	-2.089*** (0.123)
child3×D ₂₀₂₁	1.022*** (0.208)			-1.321*** (0.220)	0.346 (0.177)
ln(income)	-2.560*** (0.0565)	0.564*** (0.0167)	0.246*** (0.00754)	1.510*** (0.0556)	0.209*** (0.0489)
ln(income)×D ₂₀₂₁	0.131 (0.0767)	-0.0769*** (0.0211)	0.0137*** (0.00184)	0.443*** (0.0758)	-0.448*** (0.0644)
share_fakt	3.891*** (0.0843)	0.0232* (0.0115)	0.0682*** (0.00790)	-4.500*** (0.134)	0.525*** (0.0877)
share_fakt×D ₂₀₂₁	-0.307** (0.102)			0.666*** (0.189)	-0.376** (0.127)
share_ssber	-4.135*** (0.0995)	-0.174*** (0.0168)	-0.107*** (0.0126)	3.692*** (0.155)	0.758*** (0.102)
share_ssber×D ₂₀₂₁				-0.514* (0.215)	0.444** (0.144)
city	-0.770*** (0.0711)	0.228*** (0.0103)	-0.00949 (0.00914)	-5.102*** (0.0709)	5.680*** (0.0415)
city×D ₂₀₂₁	0.135 (0.0981)			-0.191 (0.0984)	
rich	-3.715*** (0.0516)	0.378*** (0.0148)	0.272*** (0.0141)	4.076*** (0.0519)	-1.201*** (0.0610)
rich×D ₂₀₂₁			-0.0507** (0.0185)		0.423*** (0.0851)
sq_pr	0.111*** (0.00269)	-0.0174*** (0.000522)	-0.0146*** (0.000406)	-0.133*** (0.00262)	0.0531*** (0.00209)
sq_pr×D ₂₀₂₁	0.00649 (0.00360)	-0.00443*** (0.000724)	0.00120* (0.000471)	0.00965** (0.00355)	-0.0109*** (0.00279)
selfiso	-0.132** (0.0487)	-0.171*** (0.0124)	-0.00594 (0.00928)	0.329*** (0.0480)	-0.0183 (0.0407)
D ₂₀₂₁	0.466 (0.711)	-1.038*** (0.205)		5.469*** (0.726)	-4.907*** (0.636)
Constant	74.64*** (0.574)	-4.503*** (0.146)	-0.848*** (0.0820)	9.731*** (0.578)	20.98*** (0.495)
Time effects	Yes				
Regional effects	Yes				
Observations	383001	383000	383000	382999	383001
R-squared	0.204	0.072	0.048	0.175	0.150

Note. Robust standard errors in parentheses. ***, **, * indicates 1, 5 and 10% significance level.

Table 9. OLS estimates for structure of consumer expenditures for 2019 and 2021 with the self-isolation index

	Food at home	Out-of-home food	Alcohol	Non-food goods	Services
edulevel_max	-2.857*** (0.0407)	0.391*** (0.0104)		1.166*** (0.0278)	1.190*** (0.0252)
edulevel_max×D ₂₀₂₁	0.249*** (0.0567)	-0.0854*** (0.0138)	0.0312*** (0.00713)		
child416	-2.452*** (0.0367)	0.577*** (0.0109)	-0.0457*** (0.00602)	1.731*** (0.0365)	0.190*** (0.0309)
child416×D ₂₀₂₁	-0.201** (0.086)	0.0316 (0.0309)		-0.468*** (0.165)	0.622*** (0.129)
child3	-2.036*** (0.132)	-0.0423 (0.0265)	-0.118*** (0.0157)	3.280*** (0.105)	-1.193*** (0.121)
child3×D ₂₀₂₁	0.808*** (0.200)				-0.575** (0.175)
ln(income)	-3.055*** (0.0494)	0.655*** (0.0176)	0.235*** (0.00961)	1.670*** (0.0418)	0.385*** (0.0441)
ln(income)×D ₂₀₂₁	0.383*** (0.0535)	-0.0585** (0.0214)	0.0181 (0.0119)	0.0414* (0.0162)	-0.154*** (0.0463)
share_fakt	3.822*** (0.0890)	0.0469*** (0.0121)	0.0811*** (0.00715)	-4.026*** (0.123)	0.0946 (0.0657)
share_fakt×D ₂₀₂₁	-0.220 (0.131)			0.178 (0.182)	
share_ssber	-4.484*** (0.126)	-0.161*** (0.0187)	-0.121*** (0.0125)	3.520*** (0.138)	1.149*** (0.0759)
share_ssber×D ₂₀₂₁	0.403* (0.182)			-0.190 (0.202)	
city	-1.157*** (0.0709)	0.401*** (0.0171)	-0.0671*** (0.0130)	-5.073*** (0.0703)	5.929*** (0.0593)
city×D ₂₀₂₁	0.663*** (0.0966)	-0.187*** (0.0230)	0.0526** (0.0176)	-0.265** (0.0960)	-0.324*** (0.0776)
rich	-3.716*** (0.0518)	0.402*** (0.0166)	0.230*** (0.00985)	3.902*** (0.0525)	-0.819*** (0.0464)
sq_pr	0.122*** (0.00192)	-0.0299*** (0.000664)	-0.0123*** (0.000434)	-0.124*** (0.00237)	0.0432*** (0.00157)
sq_pr×D ₂₀₂₁		0.00942*** (0.000845)	-0.00143* (0.000570)	-0.00610* (0.00300)	
selfiso	-0.450*** (0.0524)	0.0597*** (0.0150)	-0.00562 (0.00741)	0.263*** (0.0515)	0.172*** (0.0450)
D ₂₀₂₁	-3.662*** (0.595)	0.319 (0.203)	-0.404*** (0.109)		0.499 (0.458)
Constant	81.24*** (0.522)	-6.841*** (0.168)	-0.565*** (0.0919)	13.68*** (0.436)	14.09*** (0.453)
Time effects			Yes		
Regional effects			Yes		
Observations	383952	383950	383952	383949	383951
R-squared	0.213	0.083	0.045	0.161	0.147

Note. Robust standard errors in parentheses. ***, **, * indicates 1, 5 and 10% significance level.

7. Conclusion

This paper investigates the impact of the COVID-19 pandemic on household consumption structure in Russia. To test our hypotheses, we utilize the data from the Household Budget Survey conducted by Rosstat and implement the t -test, Kolmogorov–Smirnov test, and Least Squares method. We address seasonality using dummy variables for quarters, as well as heteroscedasticity, applying standard errors in clustered and White's form. We account for the heterogeneity of the Russian regions in terms of the imposed quarantine restrictions. We apply the self-isolation index as a proxy for the stringency of pandemic restrictions.

The results reflect a quantitative change in the structure of household expenditures during the pandemic, as confirmed by the results of the statistical tests. Expenditures on food at home increased in 2020 compared to 2019 on average by 1.8 percentage points, with a simultaneous decrease in the share of services by 1.4 percentage points and expenditures on food outside the home by 0.5 percentage points. We observe a slight decrease in spendings on alcohol in 2021, compared to 2020. Interestingly, the crisis raised the shares of spending on food at home and non-food items and reduced the shares of spending on alcohol, services, and food outside the home, compared to the pre-crisis year.

We evidence that during the acute phase of the pandemic (based on the official quarantine measures), households in regions with strict quarantine measures reallocated expenditures on consumption towards food at home, replacing expenditures on food outside the home. For regions that imposed mild quarantine restrictions, we observe a decline in the share of expenditure on services and food outside the home, while there is an increase in the share of expenditure on food at home and non-food items. Interestingly, the effect of quarantine restrictions is asymmetrical between the categories of consumer spending.

We highlight that wealthy households have a different consumption structure implying that an increase in income decreases the share of expenditure on food at home, while the share on food outside the home, services, alcohol, and non-food goods rises. The share of services expenditures of better educated household members tends to be higher than that of poorer ones, as the education level increases, the share of expenditure on food at home and alcohol decreases, while the proportion on food outside the home, services and non-food items rises. In addition, we confirm Engel's law in the Russian regions, except during the acute phase of the crisis, when rising incomes stimulate an increase in the share of food expenditure. In times of crisis, households change their habits, which leads to a temporary change in the impact of the determinants of consumer spending. Nonetheless, consumer behaviour tends to recover. We find no empirical evidence of changed consumer behaviour patterns; households return to previous habits.

We highlight the following limitations of the current study. *First*, the estimating methodology reflecting the impact of quarantine restrictions is constrained. The rationale for this is that dummy variables fail to capture the effects associated with different durations of pandemic restrictions (quarantine restrictions were wave-like in nature). To address this concern, the recent Dynamic DID method developed by Sun, Abraham (2021) can be applied. This method evaluates the effect of treatment given different periods of time during which the treatment was given. *Second*, given the large number of zero values among the share of spending on alcohol and food outside the home, least squares estimates may be less accurate. To address this problem, further research will utilize the tobit model. *Third*, the empirical model imposes a restriction on the inclusion of prices of relevant goods and services, as the latter are endogenous. In addition, Russian statistical agencies do

not gather information on price levels and observed inflation at the individual level, which makes it difficult to extend the empirical model.

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References

- Abebe G. K., Charlebois S., Music J. (2022). Canadian consumers' dining behaviors during the COVID-19 pandemic: Implications for channel decisions in the foodservice industry. *Sustainability*, 14 (9), 1–21. DOI: 10.3390/su14094893.
- Anderson G., Blundell R. (1983). Testing restrictions in a flexible dynamic demand system: An application to consumers' expenditure in Canada. *The Review of Economic Studies*, 50 (3), 397–410. DOI: 10.2307/2297672.
- Attanasio O. (1998). Consumption demand. *Working Paper* 6466. National Bureau of Economic Research. Cambridge, USA. DOI: 10.3386/w6466.
- Banks J., Blundell R., Lewbel A. (1997). Quadratic Engel curves and consumer demand. *Review of Economics and Statistics*, 79 (4), 527–539. DOI: 10.1162/003465397557015.
- Barigozzi M., Alessi L., Capasso M., Fagiolo G. (2012). The distribution of household consumption-expenditure budget shares. *Structural Change and Economic Dynamics*, 23 (1), 69–91. DOI: 10.1016/j.strueco.2011.09.003.
- Barro R. J., Ursúa J. F. (2008). Macroeconomic crises since 1870. *Working Paper* 13940. National Bureau of Economic Research. Cambridge, USA. DOI: 10.3386/w13940.
- Ben Hassen T., El Bilali H., Allahyari M. S., Berjan S., Fotina O. (2021). Food purchase and eating behavior during the COVID-19 pandemic: A cross-sectional survey of Russian adults. *Appetite*, 165, 105309, 1–10. DOI: 10.1016/j.appet.2021.105309.
- Berendeeva E. V., Ratnikova T. A. (2018). Modeling the food embargo impact on the Russian households' consumption. *HSE Economic Journal*, 22 (1), 9–39 (in Russian). DOI: 10.17323/1813-8691-2018-22-1-9-39.
- Bonsu C. O., Muzindutsi P.-F. (2017). Macroeconomic determinants of household consumption expenditure in Ghana: A multivariate cointegration approach. *International Journal of Economics and Financial Issues*, 7 (4), 737–745.
- Cavallo A. (2020). Inflation with Covid consumption baskets. *Working Paper* 27352. National Bureau of Economic Research. Cambridge, USA. DOI: 10.3386/w27352.
- Chen H., Qian W., Wen Q. (2021). The impact of the COVID-19 pandemic on consumption: Learning from high-frequency transaction data. *AEA Papers and Proceedings*, 111, 307–311. DOI: 10.1257/pandp.20211003.
- Dumitras D. E., Harun R., Arion F. H., Chiciudean D. I., Kovacs E., Oroian C. F., Porutiu A., Muresan I. C. (2021). Food consumption patterns in Romania during the COVID-19 pandemic. *Foods*, 10 (11), 1–18. DOI: 10.3390/foods10112712.
- Dutt P., Padmanabhan V. (2011). Crisis and consumption smoothing. *Marketing Science*, 30 (3), 491–512. DOI: 10.1287/mksc.1100.0630.

- Edelstein P., Kilian L. (2009). How sensitive are consumer expenditures to retail energy prices? *Journal of Monetary Economics*, 56 (6), 766–779. DOI: 10.1016/j.jmoneco.2009.06.001.
- Federal State Statistics Service. (2015). Official statistical methodology for determining the weekly consumer price index estimate (in Russian). <https://docs.cntd.ru/document/727631312>.
- Federal State Statistics Service. (2022). Sample household budget survey (in Russian). <https://obdx.gks.ru>.
- Federal State Statistics Service. (2023a). Share of household final consumption expenditure in GDP according to SNA methodology 2008 (in Russian). <https://fedstat.ru/indicator/57423>.
- Federal State Statistics Service. (2023b). Household income, expenditure, and consumption (in Russian). <https://rosstat.gov.ru/compendium/document/13271>.
- Federal State Statistics Service. (2023c). Russian regions. Socio-economic indicators (in Russian). <https://rosstat.gov.ru/folder/210/document/13204>.
- Ferdous N., Pinjari A. R., Bhat C. R., Pendyala R. M. (2010). A comprehensive analysis of household transportation expenditures relative to other goods and services: An application to United States consumer expenditure data. *Transportation*, 37 (3), 363–390. DOI: 10.1007/s11116-010-9264-2.
- Gali J., Gertler M., Lopez-Salido J. D. (2007). Markups, gaps, and the welfare costs of business fluctuations. *The Review of Economics and Statistics*, 89 (1), 44–59. DOI: 10.1162/rest.89.1.44.
- Gautier E., Ulgazi Y., Vertier P. (2020). Inflation and households' inflation expectations during the Covid-19 pandemic. *Banque De France, Eco Notepad*, 171.
- Grigoryev L. M., Elkina Z. S., Mednikova P. A., Serova D. A., Starodubtseva M. F., Filippova E. S. (2021). The perfect storm of personal consumption. *Voprosy Ekonomiki*, 10, 27–50 (in Russian). DOI: 10.32609/0042-8736-2021-10-27-50.
- Jia P., Liu L., Xie X., Yuan C., Chen H., Guo B., Zhou J., Yang S. (2021). Changes in dietary patterns among youths in China during COVID-19 epidemic: The COVID-19 impact on lifestyle change survey (COINLICS). *Appetite*, 158, 105015, 1–9. DOI: 10.1016/j.appet.2020.105015.
- Kansiime M. K., Tambo J. A., Mugambi I., Bundi M., Kara A., Owuor C. (2021). COVID-19 implications on household income and food security in Kenya and Uganda: Findings from a rapid assessment. *World Development*, 137, 105199, 1–10. DOI: 10.1016/j.worlddev.2020.105199.
- Karpunina E. K., Ruzhanskaya N. V., Podorova-Anikina O. N., Zubareva N. N., Luchaninov R. S. (2022). Transformation of consumer behavior during the COVID-19 pandemic. *Geo-Economy of the Future: Sustainable Agriculture and Alternative Energy*, 85–96. DOI: 10.1007/978-3-030-92303-7_10.
- Kolomak E. A. (2020). Economic effects of pandemic-related restrictions in Russia and their spatial heterogeneity. *R-Economy*, 6 (3), 154–161. DOI: 10.15826/recon.2020.6.3.013.
- Kolosnitsyna M. G., Chubarov M. Y. (2022). Spread of COVID-19 in the Russian regions in 2020: Factors of excess mortality. *Population and Economics*, 6 (4), 1–20. DOI: 10.3897/popecon.6.e87739.
- Kotelnikova Z., Radaev V. (2017). Recomposition and levelling of consumption expenditures across four economic shocks in Russia, 1994–2014. *International Journal of Consumer Studies*, 41 (4), 439–448. DOI: 10.1111/ijcs.12372.
- Kydland F. E., Prescott E. C. (1982). Time to build and aggregate fluctuations. *Econometrica*, 50 (6), 1345–1370. DOI: 10.2307/1913386.
- Lee J., Rabanal P., Sandri D. (2010). US consumption after the 2008 crisis. *IMF Staff Position Notes*, 10 (1), 1–23. DOI: 10.5089/9781455222964.004.

- Leser C. E. V. (1963). Forms of Engel functions. *Econometrica*, 31 (4), 694–703. DOI: 10.2307/1909167.
- Maniriho A., Musabanganji E., Nkikabahizi F., Ruranga C., Lebailly P. (2021). Analysis of the determinants of households' expenditures in Rwanda. *UKH Journal of Social Sciences*, 5 (1), 8–17. DOI: 10.25079/ukhjss.v5n1y2021.pp8-17.
- Migheli M. (2022). Covid-19 and heterogeneous restrictions: Possible consequences for EU cities. *Cambridge Journal of Regions, Economy and Society*, 15 (3), 703–723. DOI: 10.1093/cjres/rsac020.
- Natalini D., Bravo G., Newman E. (2020). Fuel riots: Definition, evidence and policy implications for a new type of energy-related conflict. *Energy Policy*, 147, 111885, 1–10. DOI: 10.1016/j.enpol.2020.111885.
- Pasinetti L. L. (1983). *Structural change and economic growth: A theoretical essay on the dynamics of the wealth of nations*. Cambridge University Press.
- Prais S. J., Houthakker H. S. (1971). *The analysis of family budgets*. Cambridge University Press.
- Prescott E. C. (1986). Theory ahead of business-cycle measurement. *Carnegie-Rochester Conference Series on Public Policy*, 25, 11–44. DOI: 10.1016/0167-2231(86)90035-7.
- Ramalho R. (2020). Alcohol consumption and alcohol-related problems during the COVID-19 pandemic: A narrative review. *Australasian Psychiatry*, 28 (5), 524–526. DOI: 10.1177/1039856220943024.
- Rehm J., Kilian C., Ferreira-Borges C., Jernigan D., Monteiro M., Parry C. D. H., Sanchez Z. M., Manthey J. (2020). Alcohol use in times of the COVID 19: Implications for monitoring and policy. *Drug and Alcohol Review*, 39 (4), 301–304. DOI: 10.1111/dar.13074.
- Rostow W. W. (1959). The stages of economic growth. *The Economic History Review*, 12 (1), 1–16. DOI: 10.2307/2591077.
- Sekhampu T. J., Niyimbanira F. (2013). Analysis of the factors influencing household expenditure in a South African township. *International Business & Economics Research Journal (IBER)*, 12 (3), 279–284. DOI: 10.19030/iber.v12i3.7671.
- Soberon-Ferrer H., Dardis R. (1991). Determinants of household expenditures for services. *Journal of Consumer Research*, 17 (4), 385–397. DOI: 10.1086/208565.
- Sun L., Abraham S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225 (2), 175–199. DOI: 10.1016/j.jeconom.2020.09.006.
- Tian X., Zhou Y., Wang H. (2022). The impact of COVID-19 on food consumption and dietary quality of rural households in China. *Foods*, 11 (4), 510, 1–14. DOI: 10.3390/foods11040510.
- Varlamova J., Larionova N. (2015). Macroeconomic and demographic determinants of household expenditures in OECD countries. *Procedia Economics and Finance*, 24, 727–733. DOI: 10.1016/S2212-5671(15)00686-3.
- Venn D., Dixon J., Banwell C., Strazdins L. (2018). Social determinants of household food expenditure in Australia: the role of education, income, geography and time. *Public Health Nutrition*, 21 (5), 902–911. DOI: 10.1017/S1368980017003342.
- Verter N., Osakwe C. N. (2014). A time series analysis of macroeconomic determinants of household spending in the era of cross-cultural dynamics: Czech Republic as a case study. *Procedia Economics and Finance*, 12, 733–742. DOI: 10.1016/S2212-5671(14)00400-6.
- Wang J., Xu X., Wang S., He S., He P. (2021). Heterogeneous effects of COVID-19 lockdown measures on air quality in Northern China. *Applied Energy*, 282, 116179, 1–10. DOI: 10.1016/j.apenergy.2020.116179.

- Xiong J., Tang Z., Zhu Y., Xu K., Yin Y., Xi Y. (2021). Change of consumption behaviours in the pandemic of COVID-19: Examining residents' consumption expenditure and driving determinants. *International Journal of Environmental Research and Public Health*, 18 (17), 9209, 1–15. DOI: 10.3390/ijerph18179209.
- Yandex. (2021). *Yandex research — self-isolation index* (in Russian). <https://yandex.ru/company/researches/2020/podomam>.
- Yang H., Chen K. (2009). A general equilibrium analysis of the economic impact of a tourism crisis: A case study of the SARS epidemic in Taiwan. *Journal of Policy Research in Tourism, Leisure and Events*, 1 (1), 37–60. DOI: 10.1080/19407960902738313.
- Zubarevich N. V., Safronov S. G. (2020). Russian regions in the acute phase of the coronavirus crisis: differences from previous economic crises of the 2000s. *Regional Research of Russia*, 10 (4), 443–453. DOI: 10.1134/S2079970520040115.
- Zubarevich N. V. (2020). Regional'nye riski novogo krizisa dlya zanyatosti i byudzhetrov regionov. *Monitoring Ekonomicheskoy Situatsii v Rossii: Tendentsii i Vyzovy Social'no-Ekonomicheskogo Razvitiya*, 7 (109), 3, 1–13 (in Russian).

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Appendix 1. Descriptive statistics of regressors

Variable	Year	Mean	Standard deviation	Min	Max
share_food	2019	41.8	14.5	0	100
	2020	43.6	14.3	0	97.8
	2021	42.9	14.2	0	96.5
share_food_out	2019	1.4	4	0	83.5
	2020	0.9	3.1	0	85.1
	2021	1	3.5	0	88.8
share_alk	2019	1.3	2.5	0	57.3
	2020	1.3	2.5	0	52.1
	2021	1.2	2.4	0	61.7
share_non_food	2019	27.9	13.7	0	95.9
	2020	28.2	13.8	0	96
	2021	28.3	13.6	0	95.2
share_service	2019	27.5	12.4	0	98.8
	2020	26.1	11.6	0	96.3
	2021	26.5	11.8	0	95.5
child416	2019	0.407	0.730	0	8
	2020	0.404	0.735	0	7
	2021	0.397	0.734	0	7
child3	2019	0.047	0.220	0	3
	2020	0.040	0.204	0	3
	2021	0.036	0.194	0	3

End of Appendix 1

Variable	Year	Mean	Standard deviation	Min	Max
income	2019	29851.0	27856.6	358.1	376611
	2020	30170.7	27882.4	490.8	345120
	2021	31343.7	28464.8	563.4	351438
edulevel_max	2019	4.270	0.784	1	5
	2020	4.277	0.776	1	5
	2021	4.286	0.767	1	5
share_fakt	2019	0.155	0.512	-9.99	4.991
	2020	0.181	0.503	-9.926	5.665
	2021	0.167	0.482	-9.862	5.632
share_ssber	2019	0.232	0.374	0	9.862
	2020	0.245	0.389	0	9.941
	2021	0.229	0.367	0	9.886
rich	2019	0.218	0.413	0	1
	2020	0.235	0.424	0	1
	2021	0.251	0.434	0	1
city	2019	0.697	0.460	0	1
	2020	0.697	0.460	0	1
	2021	0.697	0.460	0	1
sq_pr	2019	29.520	17.372	0	250
	2020	29.842	17.295	0	250
	2021	30.300	17.548	0	250
dhard	2019	0.000	0.000	0	0
	2020	0.129	0.335	0	1
	2021	0.172	0.378	0	1
dsoft	2019	0.000	0.000	0	0
	2020	0.201	0.400	0	1
	2021	0.267	0.443	0	1