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Investigation of the Demand for Domestic Tourism in Russia

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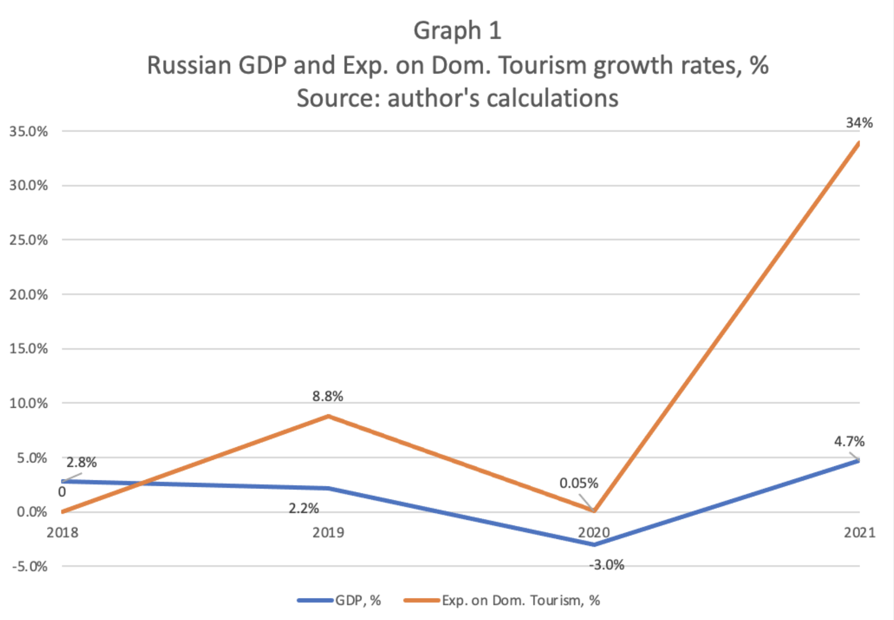
Abstract

Today tourism plays an integral role in the global economy. It affects all the main economic sectors and may influence the level of prosperity of a particular country. Domestic tourism is not an exception. However, the recent political and economic instabilities significantly changed the Russian tourists' prospects. This paper models the tourist demand for inner tourism in Russia and examines its main determinants.

1 Introduction

It is evident that tourism is one of the largest and most rapid growing sectors in the modern world. Its contribution to the economic growth and technological development cannot be underestimated. For instance, in Russia tourism sector accounted for almost 4% of GDP (RUB 3.7 trillion) in 2020 and influenced more than 50 industries according to Rosstat. It is important to note that tourism positively affects not only the rate of employment in a particular region, but also the related business sectors, such as transportation, entertainment, food, travel agencies, logistics and accommodation, foreign exchange income, living standards of the residents and local infrastructure. However, the recent covid-19 outbreak significantly changed the perspective. Due to worldwide pandemic the country borders have been closed. Being isolated from the rest of the world, the Russian population had to switch from the international to the domestic tourism. Interestingly, the Russians' expenditures on domestic tourism in the first half of May rose by approximately 13% more than in the previous prepandemic year. Even though 2020 was a year of severe economic decline with real disposable personal income falling by 2%[1], Russians' expenditures on air, train and buss tickets more than doubled comparing to January, while the demand for accommodation was 70% higher than the one in May, 2019[2]. In 2021 the expenditures rose by 34.3% [3] comparing to 2020 and taking into account the recent Russian Government's decisions the trend is here to stay in 2022. Nevertheless, a closer analysis of the dynamics of the aggregate expenditures on domestic tourism are similar to those of the Russian GDP (Graph 1).



Hence, the need for an econometric research on the Russian demand for domestic tourism arises. This paper is aimed at analyzing the main determinants of the demand for the

[1] Source: rosstat.gov.ru

[2] Source: statista.com

[3] Source: sberindex.ru

inner tourism, as well as its income and price elasticities. Moreover, the paper will test the hypothesis that the demand for domestic tourism in Russia is positively affected by the presence of the economic instability, such as an economic crisis of 2014 or covid crisis of 2020.

2 Model

2.1 Literature Review

The modelling of touristic demand for travelling has always been an interesting issue for a great number of researchers. Li et al.(2005) states that tourism demand analysis has greatly improved in terms of the diversity of topics and research methodology used. For instance, before 1994 the prevailing econometric approach was OLS or GLS in modelling the international tourism demand (Loeb (1982), Rugg (1973) and Sheldon (1994)), whereas now more attention is payed to the implementation of more sophisticated time-series models, such as Error Correction Model (Kulendran and King (1997), Song and Wong (2003)). Interestingly, Lim (1997) claims that most of the tourism demand research papers use log-linear models, because they provide estimated elasticities which are easy to interpret. Nevertheless, the literature overview reveals that the determinants of the international tourism demand were abundantly examined, while there is a clear lack of the research on the determinants of the domestic demand for tourism. For instance, there exists a number of papers investigating the influence of global unfavourable events, such as economic crises or wars on international demand, while only Blunk et al.(2006) and Smorfitt et al.(2005) incorporate similar analysis for the inner tourism demand analysis. As for the case of Russia, the preliminary research shows that there are no modern relevant econometric papers on the domestic tourism demand modelling. Hence, the investigation of the demand of Russians for the inner tourism and the impact of economic situation on it are of great importance.

2.2 Description of the Data

As a proxy for the demand for domestic tourism the number of Russians who purchased tours from travel agencies will be employed. The data from Rosstat provides a trustworthy estimation of the number of citizens who chose to travel inside the country in years 2010-2020. So, dependent variable Q_t, in thousand people, represents the demand for local tourism in year t, t=1,...,11. As for the explanatory variables, it is reasonable to take the Disposal Personal Income per Capita (data also taken from Rosstat) as a measure of the Russians' income, which is a vital determinant of a demand. So, DPI_t, in RUB is expected to have a positive relation on the demand. Apparently, the average price of a tour, $price_t$, is another determinant of the demand. For its approximation the yearly average price (in RUB) of a tour sold by the domestic travel agencies, provided by Rosstat was taken. Since the data for both prices and DPI is in nominal terms, a transformation into real values is needed to get rid of the influence of inflation. To turn the variables into real values we multiply each value by 100 and divide by the GDP deflator taking 2010 as a base year. Apart from the DPI and prices, a RUB-USD exchange rate should be taken into consideration. When domestic currency depreciates, foreign goods become less competitive, as they are now relatively more expensive. So, the citizens have more incentives to opt for domestic tourism, rather than the international one. The data for the exchange rate, E_t, was taken from Yahoo.Finance. To account for the exchange rate deviation for each year the difference between the highest and the lowest close value is taken. In addition, the percentage of people who live below the poverty line, pov_t, might also have a positive relation with the demand for inner tourism. The data for this variable is taken from Rosstat. Finally, to test the main hypothesis of the paper on the influence of the state of economy on demand for local tourism, the intersection dummy variable, D, was introduced. D is equal to 1 if the year is a crisis one and 0 otherwise. In our model, crises years are 2014 (exchange rate crisis) and 2020 (covid crisis). A more detailed description of data is provided in the Appendix.

2.3 Model Specification

The relationship between the model variables would take the double-logarithmic form, so that the OLS method could be correctly employed and the slope coefficients would represent the elasticities of the respective explanatory variables of the demand function. As it was mentioned above, the number of Russian domestic tourists, Q_t, is regressed on real disposable personal income per capita, DPI_t, average real price of a tour, $Price_t$, a dummy variable D, denoting the presence of crisis in a particular year, the difference between the highest and the lowest close value of the exchange rate in each year, E_t and the percentage of population who live below the poverty line, Pov_t. Overall, the theoretic equation has the following form:

$$log(Q_t) = \beta_1 + \beta_2 log(DPI_t) + \beta_3 log(Price_t) + \beta_4 D + \beta_5 log(E_t) + \beta_5 log(Pov_t) + u_t$$

Before starting our analysis, the test for stationarity should be conducted, as according to Granger and Newbold (1974), the OLS estimation of a non-stationary time series can lead to a spurious regression, in which the model yields apparently significant regression coefficients although there is no relationship between the variables involved. To test for the stationarity the Augmented Dickey-Fuller test built in Eviews was implemented (level, intercept, no trend, number of lags determined by Akaike Criterion). For the demand, $log(Q_t)$ time series, $t_{st} = -0.26 > t_{cr}(5\%) = -3.21$, so the null hypothesis of non-stationarity of $log(Q_t)$ is not rejected at 5% significance level. Analogically, a unit root test reveals that all the time series are non-stationary even at 5% significance level[4]. However, the all the second-order differences are stationary at 5% significance level, so all the considered time series are integrated of order 2, I(2). Thus, we can perform cointegration analysis and test the residuals for the cointegration.

[4] All the ADF tests' printouts are given in the appendix

First of all, we estimate the model using OLS and obtain the following results (Table 1):

Dependent Variable: LOG(Q)
Method: Least Squares
Date: 04/30/22 Time: 21:21
Sample: 1 11
Included observations: 11

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.918130	2.492599	-3.176656	0.0246
LOG(DPI)	2.457125	0.492431	4.989788	0.0041
LOG(PRICE)	-0.540418	0.613822	-0.880415	0.4189
D01	0.034549	0.138304	0.249803	0.8127
LOG(E)	-0.110195	0.060982	-1.807002	0.1306
LOG(POV)	1.395053	0.583094	2.392500	0.0622

R-squared	0.961558	Mean dependent var	14.76746
Adjusted R-squared	0.923116	S.D. dependent var	0.359820
S.E. of regression	0.099770	Akaike info criterion	-1.469439
Sum squared resid	0.049771	Schwarz criterion	-1.252405
Log likelihood	14.08191	Hannan-Quinn criter.	-1.606248
F-statistic	25.01334	Durbin-Watson stat	2.100278
Prob(F-statistic)	0.001510		

Table 1. Source: author's calculations

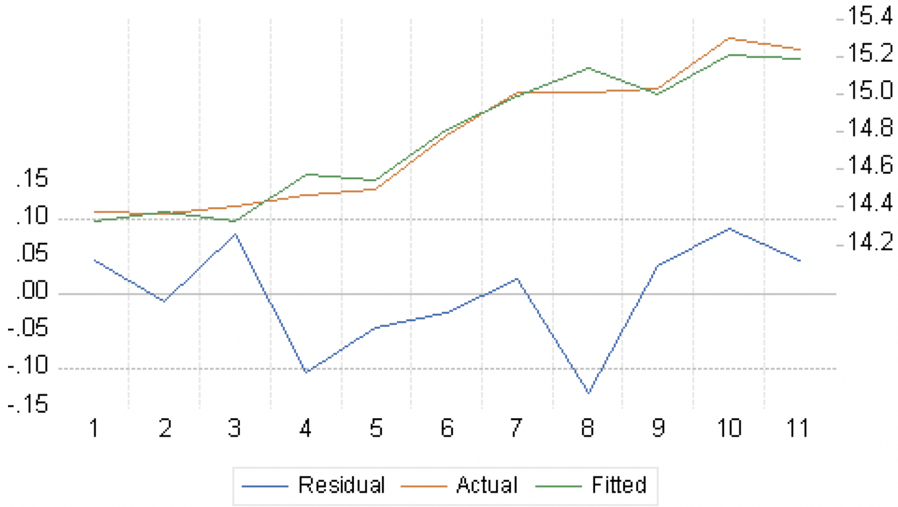
It can be seen that although $R^2 = 0.96$ is rather high, one can notice that some coefficients are insignificant (such as prices or variation in exchange rate). This can be explained by the issue of multicollinearity, which can be checked by the correlation matrix (Table 2):

	LOG_Q_	LOG_DPI_	LOG_PRICE__	D01	LOGE	LOG_POV_
LOG_Q_	1.000000	0.934854	0.790393	0.133125	0.335802	0.440922
LOG_D...	0.934854	1.000000	0.859987	0.258271	0.544997	0.332279
LOG_P...	0.790393	0.859987	1.000000	-0.037273	0.575578	0.605577
D01	0.133125	0.258271	-0.037273	1.000000	0.517451	-0.269388
LOGE	0.335802	0.544997	0.575578	0.517451	1.000000	0.312804
LOG_P...	0.440922	0.332279	0.605577	-0.269388	0.312804	1.000000

Table 2. Source: author's calculations

Indeed, the correlation between logarithms of DPI and prices is almost equal to 1 ($\rho = 0.86$), which is a direct evidence of the presence of multicollinearity. Nevertheless, all the considered variables are important in our analysis and dropping some independent variables can lead to the omitted variable bias, in this case coefficients will become biased, whereas standard errors and tests will be invalid.

Now let us examine the residuals of the obtained regression. The Graph 2 depicts the residuals' behaviour, which looks more or less stationary. The fitted model nearly coincides with the actual data.



Graph 2. Source: author's calculations

To test the series for stationarity we will employ the Augumented Dickey Fuller Test built in Eviews. The ADF test (level, intercept, no trend, Akaike Criterion) yields test statistic -3.12, while the asymptotic critical value for five explanatory variables is -3.21 (Table 3). Hence, it is not significant even at the 5% significance level and H_0 of nonstationarity for the residuals is not rejected. This means that the considered variables are not cointegrated. The estimated coefficient of the lagged residual is -1.1, which corresponds to the AR(1) process with $\rho = -0.1$, so there is possibility that the residuals are in fact stationary, but autocorrelated, and the variables are cointegrated. The Durbin d-statistic in the initial regression is equal to 2.1, so the disturbance term might be subjected to negative autocorrelation.

Augmented Dickey-Fuller Unit Root Test on RES

Null Hypothesis: RES has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.124444	0.0571
Test critical values:	1% level	-4.297073	
	5% level	-3.212696	
	10% level	-2.747676	

Table 3. Source: author's calculations

Under autocorrelation the regression coefficients remain unbiased, but OLS is inefficient, while standard errors are estimated wrongly making t- and F-tests invalid. To test $H_0 : \rho = 0$ (no autocorrelation) against $H_A : \rho \neq 0$ (presence of autocorrelation) we will use Breusch-Godfrey AUTO(1) test. As indicated in Table 3, p-value of the test is 0.68, so there is strong evidence against first-order autocorrelation at any reasonable significance level.

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.063455	Prob. F(1,4)	0.8135
Obs*R-squared	0.171776	Prob. Chi-Square(1)	0.6785

Table 3. Source: author's calculations

Nevertheless, to avoid a spurious regression, we will need to transform our model in such a way that the series in it become stationary. We will firstly try Differencing. By applying the procedure we get the equation:

$$\Delta^2 Y_t = \beta_2 \Delta^2 X_{2t} + \beta_3 \Delta^2 X_{3t} + \beta_4 \Delta^2 X_{4t} + \beta_5 \Delta^2 X_{5t} + \Delta^2 u_t$$

In the obtained regression all the time series are stationary (integrated of order 2, I(2)), so the problem of spurious regressions is resolved. However, the main shortcoming of the differencing approach is that in equilibrium $\Delta^2 Y_t = \Delta^2 X_{2t} = \Delta^2 X_{3t} = \Delta^2 X_{4t} = \Delta^2 X_{5t} = 0$, which implies that only the short-run relationships can be examined. The estimates of coefficients for this second difference model are represented in Table 4.

Dependent Variable: D(LOG_Q_,2)
Method: Least Squares
Date: 04/29/22 Time: 15:07
Sample (adjusted): 3 11
Included observations: 9 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG_DPI_,2)	2.533752	2.172980	1.166026	0.3084
D(LOG_PRICE__,2)	-0.680987	0.322942	-2.108695	0.1026
D(D01,2)	-0.075293	0.042427	-1.774628	0.1506
D(LOGE,2)	0.020183	0.040891	0.493581	0.6475
D(LOG_POV_,2)	0.074012	0.486051	0.152272	0.8863

R-squared	0.751017	Mean dependent var	-0.002519
Adjusted R-squared	0.502034	S.D. dependent var	0.081004
S.E. of regression	0.057162	Akaike info criterion	-2.585672
Sum squared resid	0.013070	Schwarz criterion	-2.476103
Log likelihood	16.63553	Hannan-Quinn criter.	-2.822122
Durbin-Watson stat	2.287991		

Table 4. Source: author's calculations

In order to investigate the long-run relationships, we will need to transform the initial model to get the cointegarating relation between the demand for domestic tourism and the considered variables. To modify the initial regression with no autocorrelation we will nevertheless make an AR(1) transformation:
$log(Q_t) = \beta_1 + \beta_2 log(DPI_t) + \beta_3 log(Price_t) + \beta_4 D_t + \beta_5 log(E_t) + \beta_6 log(Pov_t) + u_t$ (1)
Lag and multiply by ρ the initial model:
$\rho log(Q_{t-1}) = \rho\beta_1 + \rho\beta_2 log(DPI_{t-1}) + \beta_3 log(Price_{t-1}) + \rho\beta_4 D_{t-1} + \rho\beta_5 log(E_{t-1}) +$
$+ \rho\beta_5 log(Pov_{t-1}) + \rho u_{t-1}$ (2)
Subtract (2) from (1):
$log(Q_t) = (1-\rho)\beta_1 + \rho log(Q_{t-1}) + \beta_2(log(DPI_t) - \rho log(DPI_{t-1})) + \beta_3(log(Price_t) -$
$-\rho log(Price_{t-1})) + \beta_4(log(D_t) - \rho log(D_{t-1})) + \beta_5(log(E_t) - \rho log(E_{t-1})) + \beta_6(log(Pov_t) -$

$-\ \rho log(Pov_{t-1}))$
It will yield the following results:

Dependent Variable: LOG(Q)
Method: ARMA Conditional Least Squares (Gauss-Newton / Marquardt steps)
Date: 04/29/22 Time: 16:37
Sample (adjusted): 2 11
Included observations: 10 after adjustments
Convergence achieved after 18 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.64136	12.21617	-1.034805	0.3769
LOG(DPI)	3.338145	1.433675	2.328383	0.1023
LOG(PRICE)	-0.738859	0.480938	-1.536288	0.2221
D01	-0.144061	0.133542	-1.078775	0.3597
LOG(E)	0.002730	0.068089	0.040096	0.9705
LOG(POV)	0.393084	0.698486	0.562766	0.6129
AR(1)	0.598939	0.379386	1.578703	0.2125

R-squared	0.972242	Mean dependent var	14.80721
Adjusted R-squared	0.916727	S.D. dependent var	0.352909
S.E. of regression	0.101839	Akaike info criterion	-1.534812
Sum squared resid	0.031114	Schwarz criterion	-1.323002
Log likelihood	14.67406	Hannan-Quinn criter.	-1.767166
F-statistic	17.51297	Durbin-Watson stat	1.899221
Prob(F-statistic)	0.019565		

Table 5. Source: author's calculations

And as it can be seen in Table 6 p-value of the ADF test on residuals of the transformed model for stationarity is equal to $p - value = 0.0002$, which reveals that the obtained relation shows cointegrated time series.

Augmented Dickey-Fuller Unit Root Test on RES_TESTIC

Null Hypothesis: RES_TESTIC has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.489355	0.0002
Test critical values:	1% level	-4.297073	
	5% level	-3.212696	
	10% level	-2.747676	

Table 6. Source: author's calculations

At the same time there is no problem of autocorrelation according to Breusch-Godfrey AUTO(1) test, as the p-value of the corresponding test is almost 0.9 (see Table 7).

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

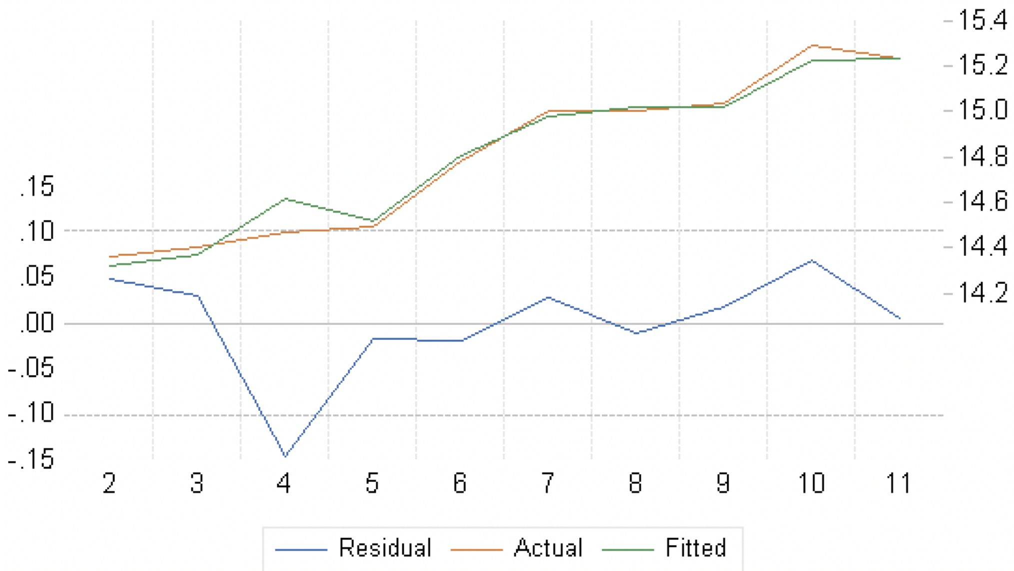
F-statistic	0.003706	Prob. F(1,2)	0.9570
Obs*R-squared	0.018494	Prob. Chi-Square(1)	0.8918

Table 7. Source: author's calculations

Hence, the received cointegrated relation indeed represents the long-run link between the variables. Furthermore, its coefficients can be interpreted as the long-run elasticities, that were initially our main object of analysis. The equation looks as follows:
$log(Q_t) = -12.6 + 0.6log(Q_{t-1}) + 3.3log(DPI_t) - 0.73log(Price_t) - 0.14D + 0.003log(E_t) + 0.39log(Pov_t)$

3 Conclusion

Overall, we have constructed a good model that represents the long-run, stable relation between the variables of interest. Indeed, its coefficient of determination is rather high $R^2 = 0.97$, while the p-value of the test on the significance of the obtained regression is 0.019, so the regression is significant at 5% significance level. Moreover, if we take a look at the Graph , we well notice that the fitted model nearly coincides with the actual data, while the residuals are stationary.



Graph 3. Source: author's calculations

However, most regressors turned out to be insignificant as a price for making the relation cointegrated. The regressors' insignificance can also be explained by the by presence of multicollinearity and a lagged dependent variable.

The analysis of the dummy variable that stands for the state of the economy reveals that the state of crisis does not affect the tourist's demand for inner travels. The regular t-test for the significance of a dummy shows $p-value = 0.36 > 0.05$, so dummy variable is insignificant at 5% significance level. Moreover, all other important variables, such as the DPI, prices for tours, yearly difference in exchange rates and the level of poverty of the population appeared to be statistically insignificant at any reasonable significance level. This implies that all the initial hypothesis are not confirmed. The model states that the demand for domestic tourism does not increase when the economy is in a recession, that is an increase in the percentage of people below the poverty line and the variance of exchange rate do not induce higher demand as it was predicted. In addition, it reveals counter logical results that the prices for tours, as well as the people's disposable income do not affect the quantity of tours demanded.

As for the elasticities analysis, the short-run change in delta income elasticity constitutes 2.5, while the similar change in price elasticity is -0.68. The short term change in delta income elasticity is rather high and indicates that domestic travelling is likely to be a normal good, since it is positive. Negative short term change in delta price elasticity shows that Russians treat inner travelling as an ordinary good, rather than a Giffen one. The interpretation is complicated due to the second order differences. However, the long-run elasticities are of a much greater interest. According to Table 5, a rise in DPI per Capita by 1% leads to an increase in demand by approximately 3.3%, which is even larger than the short run effect. For the price elasticity, an increase in the price for touristic tours by 1% induces a fall in the demand by 0.74%. Thus, the domestic travelling tours is a normal, ordinary good. It is also important to note that the in the long run if the percentage of people living in extreme poverty increases by 1%, demand will rise by 0.39% (positive relation), while in presence of a crisis, the average demand for domestic tourism slightly reduces (negative relation), which also contradicts the initial hypothesis.

Nevertheless, there are several main shortcomings of this paper, that gave a room for further investigation. Firstly, the sample size is extremely low (only 11 observations are included) due to the limited data available at Rosstat data base. Hence, the results might be severely biased. Moreover, the model specification might be improved so that the regressors' coefficients estimates become significant and the issue of multicollinearity is got rid of. In our model, however, dropping of insignificant independent variables might lead to omitted variable bias, while the inclusion of irrelevant variables can potentially cause reduction in efficiency of estimates. That is why transforming the variables by aggregation and imposing restrictions are the best ways to improve the model specification. Furthermore, in order to take into account the dynamic changes in demand elasticities, it would be really useful to implement and examine the Error Correction Model. One can also argue that the panel data framework could be implemented instead of a regular time series analysis. However, the data base from the Rosstat does not include the number of tourists who purchased domestic tours by Russian regions and so do other variables. Hence, due to the lack of official data panel data model could not be implemented. Finally, the proxies chosen for the variables of interest might not be the best estimates. In particular, the quantity of tours demanded are are estimated by the number of tourists who purchased the tours from travel agencies, while the majority of Russian tourists opt for planning their vacations themselves. So in fact the demand for domestic tourism is much larger and more volatile. Thus, the model might be significantly improved taking into account these remarks.

Appendix

*All the calculations and estimations were maid in students' version of Eviews12

The demand for domestic tourism was measured by the number of Russians who purchased tours from travel agencies from 2010 till 2020.

ЧИСЛЕННОСТЬ РОССИЙСКИХ ТУРИСТОВ, ОТПРАВЛЕННЫХ ТУРИСТСКИМИ ФИРМАМИ В ТУРЫ

тысяч человек

	2010	2011	2012	2013	2014	2015	2016	2017[1)]	2018[1)]	2019	2020
Отправлено российских туристов – всего	**8203.9**	**8023.7**	**8942.2**	**9883.0**	**8487.1**	**7889.2**	**6706.3**	**8915.4**	**8860.9**	**11825.8**	**6462.6**
из них по странам:											
Россия	1741.0	1731.0	1792.3	1916.4	1974.2	2628.2	3284.2	3285.4	3374.6	4373.1	4126.8
страны СНГ	113.7	102.1	129.1	130.5	49.3	39.1	28.5	44.0	67.6	57.6	8.3

The average price of a tour for a given year is calculated as total proceeds of travel agencies from tours sale divided by total number of inner touristic tours sold.

The maximum change in the exchange rate is calculated as the delta of maximum close rate and the mininmum one:

	min close	max close	Delta
2010	29.0	31.6	2.6
2011	27.2	32.1	5.0
2012	29.2	32.9	3.8
2013	30.0	33.4	3.4
2014	33.6	65.3	31.6
2015	49.3	81.8	32.5
2016	59.5	78.4	18.8
2017	56.2	60.5	4.3
2018	56.3	69.0	12.7
2019	61.3	66.7	5.5
2020	65.5	80.9	15.5

All the time series are integrated of order 2:

Augmented Dickey-Fuller Unit Root Test on D(LOG_Q_,2)

Null Hypothesis: D(LOG_Q_,2) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.594655	0.0398
Test critical values:	1% level	-4.803492	
	5% level	-3.403313	
	10% level	-2.841819	

Augmented Dickey-Fuller Unit Root Test on D(LOG_DPI_,2)

Null Hypothesis: D(LOG_DPI_,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.123788	0.0177
Test critical values:	1% level	-4.582648	
	5% level	-3.320969	
	10% level	-2.801384	

Augmented Dickey-Fuller Unit Root Test on D(LOG_PRICE__,2)

Null Hypothesis: D(LOG_PRICE__,2) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.888977	0.0281
Test critical values:	1% level	-4.803492	
	5% level	-3.403313	
	10% level	-2.841819	

Augmented Dickey-Fuller Unit Root Test on D(D01,2)

Null Hypothesis: D(D01,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.874667	0.0071
Test critical values:	1% level	-4.582648	
	5% level	-3.320969	
	10% level	-2.801384	

Augmented Dickey-Fuller Unit Root Test on D(LOGE,2)

Null Hypothesis: D(LOGE,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.591656	0.0099
Test critical values:	1% level	-4.582648	
	5% level	-3.320969	
	10% level	-2.801384	

Augmented Dickey-Fuller Unit Root Test on D(LOG_POV_,2)

Null Hypothesis: D(LOG_POV_,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.533598	0.0106
Test critical values:	1% level	-4.582648	
	5% level	-3.320969	
	10% level	-2.801384	

The Eviews code is as follows:

```
LS(ARMA=CLS, OPTMETHOD=OPG) log(q) C log(dpi) log(price) d01 log(e) log(pov)
ls log(q) c log(dpi) log(price) d01 log(e) log(pov)
ls d(LOG_Q_ ,2) d(LOG_DPI_ ,2) d(LOG_PRICE__ ,2) d(d01,2) d(LOGE ,2) d( LOG_POV_ ,2)
genr res_dif = resid
ls log(q) c log(dpi) log(price) d01 log(e) log(pov)
```