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Forecast of Separate Indicators for Socio-Economic Development of the Russian Federation up to 2020

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Abstract: Our main goal is the forecast of macroeconomic indicators of Russia up to 2020. The forecast was built on the basis of the macroeconomic model, taken into account a variety of macroeconomic indicators, the complex interactions between them, the main aspects of policy and decision-makers. In the model used a technique of forecasting on the basis of the deflators of regions.

Key words: Forecasting of the Russian economy · Economics simulation · Agent-oriented modeling · The regression approach · Balance equations

INTRODUCTION

National economy forecasting for development in the conditions of uncertainty of a world environment is represented as a very complex challenge. In this article explained the expert assessment of development the economy of Russia till 2020. The offered schedules are resultant indicators of economy model created in Russian Plekhanov University of Economics. There was used the approach of imitating modeling which represents system of the nonlinear equations. Similar principles of modeling were offered by known scientists Ray J. Fair [1, 2], P.D. Adams, J.M. Horridge and Brian R. Parmenter [3], P. Berck, E. Golan and B. Smith [4], J.W. Forrester [5], Samuel H. Preston [6], Robert L. Brown [7], L.A. Golub [8]. And also the methods described by the Russian scientists in the works were applied: V.L. Makarova, V.L. Ayvazyana, Borisov Page of Century and Lakalina E.A. [9], Bakhtizina A.R. [10], N. Tikhomirov of the Item [11], A.V. Kashepova.

Description of Macroeconomic Indicators: Any concept of the country's socio-economic development is supposed to contain assumptions on the variants of the GDP's dynamics. Keeping this in mind, further we will be adhering to the borderline evaluation of the GDP rates (variant 2-optimistic, variant 5-pessimistic) elaborated by the Russian Ministry of Economic Development (MED).

Table 1: Variants of economic development (%)

GDP rate	2010	2011	2012	2013	2014
Variant 2 (optimistic)	104	104,1	103,7	104	104,6
Variant 5 (pessimistic)	104	104,1	100,25	103	102,7

Fig. 1: Observed and forecast GDP growth rates for optimistic and pessimistic variants of development.

With the account that MED's forecasting interval spans the period from 2011 to 2014, we had to come out with work hypothesis on the extension of these variants. Table 1 contains the data of MED's forecast.

Overall picture of GDP dynamics for both variants is reflected in Fig.1.

Decline in the rates of GDP's growth at the end of the forecasting period is explained by limited capacity of the domestic market, the growing share of import and slowing down export rates.

Let us consider the so called neutral forecast (not depending on the evaluations of Russia's MED), worked out with the help of the balance-regression model.

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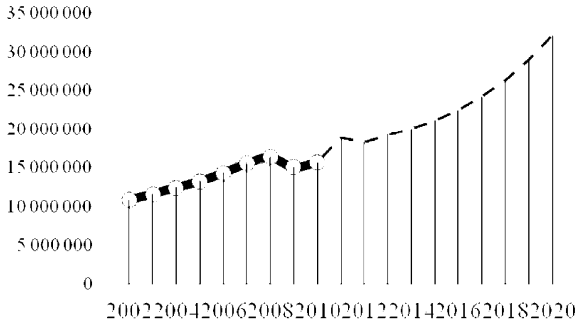


Fig. 2: Real GDP (in mln. rubles)

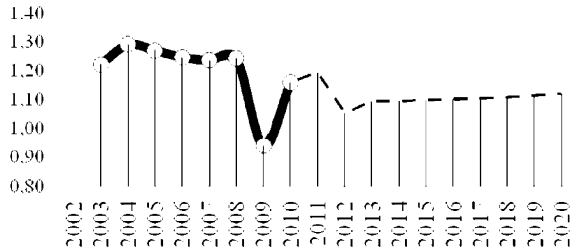


Fig. 3: Value of the index deflator

The main elements in the model are regression equations. The nominal GDP equation is modeled with the use of the following variables:

- Oil prices;
- Consumption;
- Gross accumulation of the main capital;
- Export;
- Import.

The real GDP growth rate demonstrates the speed of Russia's economic development (Fig.2). Here we observe a decline in 2012 with subsequent return to the former growth rates. It should be noted, that the forecast rates of the indicator are smaller than its pre-crisis level. Thus, according to the balance-regression model, the forecast value of GDP in 2020 shall be 32,500 billion rubles.

In compliance with our forecasting model the deflator index value after the decline in 2012 will further stabilize (Fig. 3).

Inflation (consumption prices index) both before the 2008 crisis, as well, as after that has a trend to decline, still, even by 2020 this indicator will be higher than in most developed countries (Fig.4).

Due to the fact, that the core of the 2020-Concept are the modernization measures in production, aimed at achieving a higher labor productivity, stronger competitiveness of the Russian produce in international markets, material-saving measures, we have paid attention

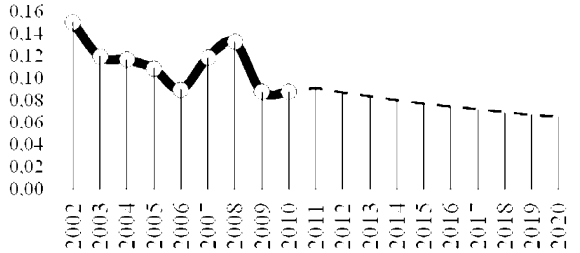


Fig. 4: Consumption prices index (in quotas)

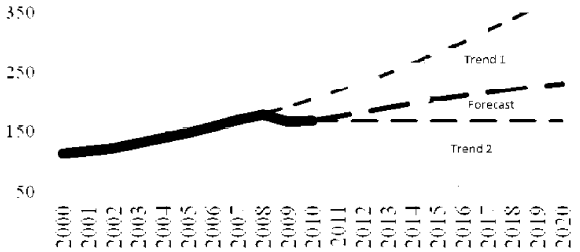


Fig. 5: Observed values and the forecast of labor productivity for GDP

to the public labor productivity dynamics, which we intend to measure as the relation of GDP in comparable 2000 year prices to the number of employed people. Labor productivity chart is given in Fig. 5.

At the interval of 2000-2008 years labor productivity was growing according to the quadruple trend 1:

$$PRS_t = 0{,}42_7 \cdot t^2 + 4{,}06_1 \cdot t + 10_8 \text{ (starting from } t = 1 \text{ for 2000)},$$

which is the evidence of positive features of the Russian economy on condition there are no external disturbances. The fall in labor productivity at the interval of 2009-2010 years can be explained by non-economic factors (reaction of the government), like keeping work places during the crisis, whose regressive continuation is demonstrated as trend 2:

$$PRS_t = \frac{WWPS_t}{L_t}, \quad (1)$$

where PRS_t-labor productivity for GDP in 2000 prices;
$WWPS_t$-GDP in 2000 year prices;
L_t-number of employed people.

Pessimistic evaluation of the GDP growth rates by variant 5 correspond to the hypothesis of a world economic crisis from 2012, rapid growth of the import share in the domestic market (Fig. 6). As a measure for the share of import was selected relation of the value of import in comparable prices to the sum of investments into the main capital and the final consumption in comparable prices:

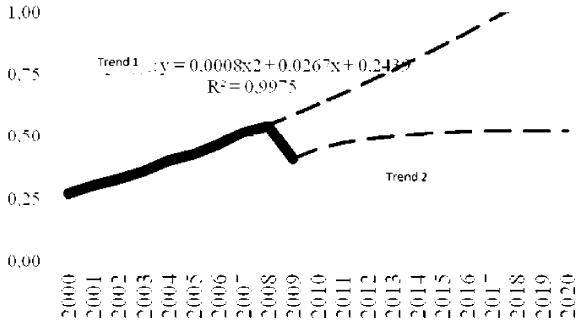


Fig. 6: Import share dynamics in the Russian domestic market

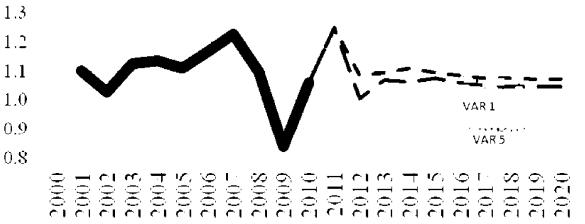


Fig. 7: Observed values and forecast of the growth of investment rates into the main capital

$$bS = \frac{IMS}{INS + YS}, \quad (2)$$

where *IMS*-import in comparable prices;
INS-investments into the main capital in comparable prices;
YS-final consumption in comparable prices.

Trend 1 corresponds to the tendency at the interval of the years 2000-2008. Should this tendency remain it will lead to the curtailment of home production and huge numbers of jobless people. Trend 2-admissible lower boundary, when domestic production is stagnating, while the number of unemployed remain the same.

Any major modernization requires the writing off of the outdated machinery and more investments for the acquisition of the new. In this respect, the assessment of the investment rates was carried out (Fig. 7) corresponding to the 2-d and 5-th variants of development.

Evaluation of the investment rates was performed on the basis of investment features in the Russian economy (non-linear trend), based on phase character of the investment process, where investments into the main capital in comparable prices are placed on the vertical axis and on the horizontal axis-GDP in comparable prices (Fig. 8). The investment character indicates the utmost volume of investments, which could be "swallowed" by the Russian economy at the given tempo of development.

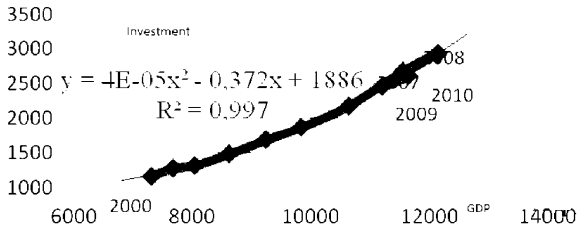


Fig. 8: Character of investments in the Russian economy

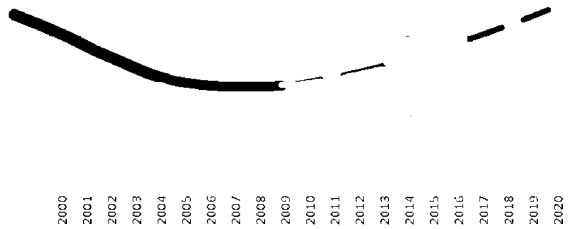


Fig. 9: Observed and forecast size of the population in Russia

It should be noted, that the determining coefficient for (R^2 = 0,99$_7$) non-linear trend has a fairly high value, which implies a small approximation error.

Annual investment rates into the main capital are calculated in the following manner: the GDP values in the prices of 2000 ($WWPS_t$) for the entire forecasting period where determined by the GDP rates. By the $WWPS_t$ values and the investment character were determined investment values into the main capital in comparable (INS_t) prices. By INS_t values were established annual rates:

$$pIN_t = \frac{INS_t}{INS_{t-1}} \quad (3)$$

The chart of annual investment rates into the main capital clearly illustrates, that in order to rapidly update the Russian economy with its currently rather outdated equipment, the proposed rates of investments into the main capital are insufficient.

Description of the Labor Market: To be sure, that the number of employed correlates with the demographic indicators, a forecast of the Russian population size (Fig. 9) was carried out, as well as for the quota of economically active population (Fig. 10) and delta adjustment to the number of economically active population (Fig.11).

delta-is an adjustment to the number of economically active population, calculated as:

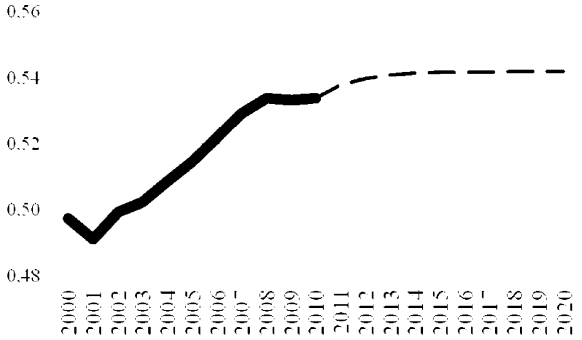


Fig. 10: Observed and forecast quota of economically active population in Russia

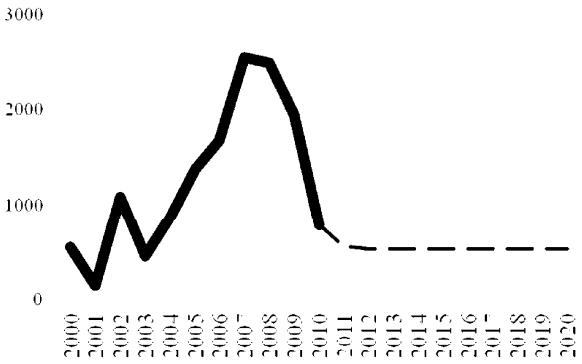


Fig. 11: Observed and forecast delta adjustments

$$\text{delta} = A\text{-}(L + BZ) \quad (4)$$

where A-the size of economically active population;
L-number of employed;
BZ-number of jobless.

Apart from the main forecast, Fig. 21 contains the forecast of the Federal Service for State Statistics (FSSS), displayed as a large area (shading) into which can fit all possible variants. We admit, that the forecast is slightly overstated because the drop in the birth-rate in the 1990s was not taken into account. The forecast was constructed with the employment of the multiplicative model:

$$N_t = N_{t-1} \bullet (1 + r_t\text{-}u_t + s_t), \quad (5)$$

where N_t-size of the population in Russia in the year t;
r_t-birth-rate coefficient;
u_t-death-rate coefficient;
s_t-migration balance;

Coefficients are computed in the following way:

$$r_t = \frac{R_t}{N_{t-1}}; u_t = \frac{U_t}{N_{t-1}}; s_t = \frac{S_t}{N_{t-1}}, \quad (6)$$

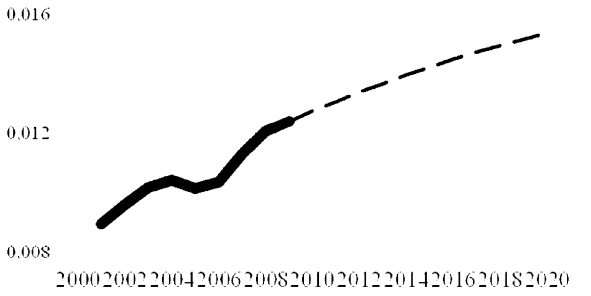


Fig. 12: Observed values and forecast of birth-rate coefficient

Fig. 13: Observed values and forecast of death-rate coefficient

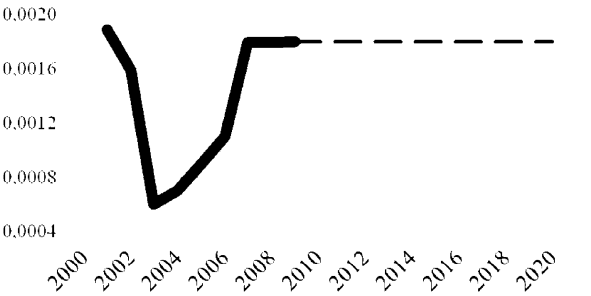


Fig. 14: Observed values and forecast of the migration coefficient

where R_t-the number of newborns in the year t;
N_{t-1}-size of the population in Russia in the year (t-1);
U_t-the number of deceased in the year t;
S_t-migration balance in the year t.

Charts of coefficients for birth-death-rates and migration balance in Fig. 12-14

It follows from the forecast of demographic indicators, that Russian economy has its own redundant labor resources and , therefore there's no need to increase labor migration (Fig.15).

As illustrated by Fig. 16 and 17 the forecast for the number of employed and jobless people remains fairly optimistic compared to the previous periods, e.g., unemployment by 2020 is noticeably reduced (Fig. 19).

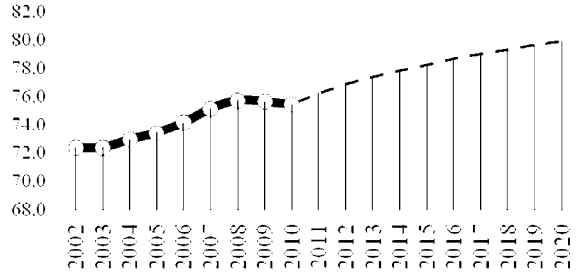


Fig. 15: The number of economically active population (mln people)

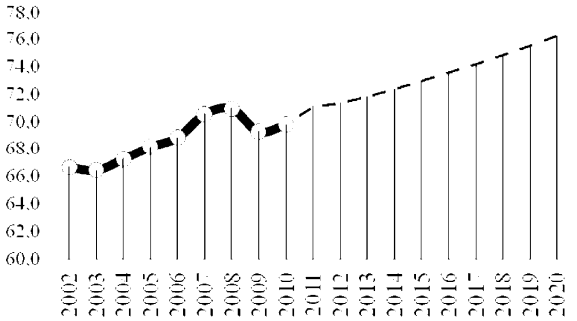


Fig. 16: Number of employed people (mln people)

Let us consider now the regional aspect of the Concept-2020. As is known, the forecast of socio-economic indicators for the development of Russian regions has a number of peculiarities resulting from openness of a region as the subject of observation. Regional gross accumulation, export and import are virtually unobservable, thus the counting of the production of goods and services for the forecast of the main indicators cannot be used. Hence, the researchers had to choose a different pathway: they began to assess gross regional product (GRP) as the share of the GRP of Russia, i.e. the sum total of the GRP for all regions. The same way is carried out assessment for the regional industries.

Such regional models have one peculiarity: the shaping of many expert assessments depends not only on the competence of regional experts, but also on the data from the federal center. Let us illustrate this point with an example. The forecast for the regional GRP is performed via expert evaluation of the (α_{it}) share of a region in the GRP

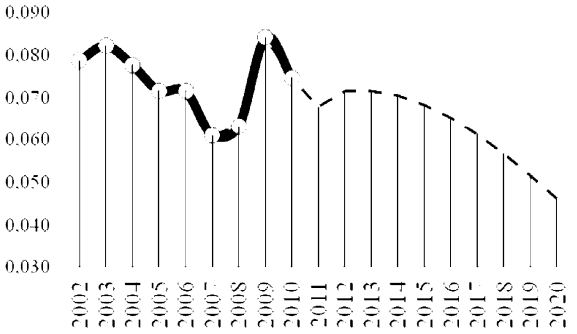


Fig. 17: Level of unemployment

structure of all regions of Russia (n), computed in comparable prices (in order to exclude the influence of the inflation background). This evaluation is reported to the federal center, but any expert assessment contains a portion of error, so the federal center calculates the correcting multiplier:

$$\lambda_t - \frac{1}{\sum_{i=1}^{n} \alpha_{it}}, \quad (7)$$

which is sent to each region. The adjusted value of each regional quota shall be equal to $\lambda_t \bullet \alpha_{it}$, $i = 1, n$.

To appraise the dynamics of expert errors, a numerical experiment was done-a forecast was provided for the quotas of all 80 regions of the Russian Federation at the interval from 2010 to 2020.

The chart of the aggregate error:

$$\varepsilon_t = 1 - \sum_{i=1}^{n} \alpha_{it} \left(I = 1, n \right) \quad (8)$$

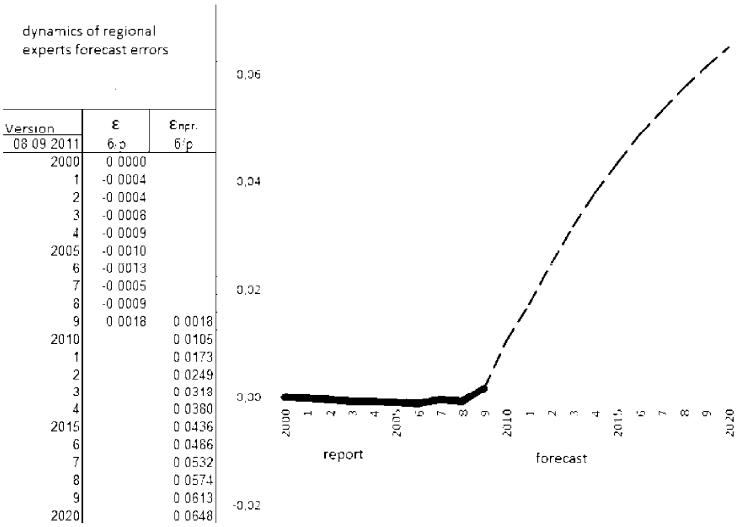
is given in Fig. 18.

The examples of the corrected quotas for the Belgorod and Ivanov regions are given in Fig. 19.

In order to obtain the forecasts for regional absolute values of GRP the following operations were performed. It is known, that the total sum of GPP of all regions differs from the GDP of Russia by the value of the federal surcharge (banking activities, taxes, expenditure on law enforcement bodies, etc). The share of the federal surcharge changes insignificantly, so the forecast for the value shall be:

Table 2: Some indicators describing labor market condition

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Unemploy-ment level, %	6,78	7,16	7,15	7,04	6,83	6,53	6,13	5,67	5,17	4,63
Employed mln people	71,10	71,37	71,85	72,37	72,93	73,54	74,18	74,85	75,54	76,22
Economic. active population in mln	76,27	76,87	77,39	77,85	78,28	78,67	79,03	79,36	79,65	79,92



Version 08 09 2011	ε б/р	εпрг. б/р
2000	0 0000	
1	-0 0004	
2	-0 0004	
3	-0 0008	
4	-0 0009	
2005	-0 0010	
6	-0 0013	
7	-0 0005	
8	-0 0009	
9	0 0018	0 0018
2010		0 0105
1		0 0173
2		0 0249
3		0 0318
4		0 0380
2015		0 0436
6		0 0486
7		0 0532
8		0 0574
9		0 0613
2020		0 0648

Fig. 18: Dynamics of the forecast errors committed by regional experts

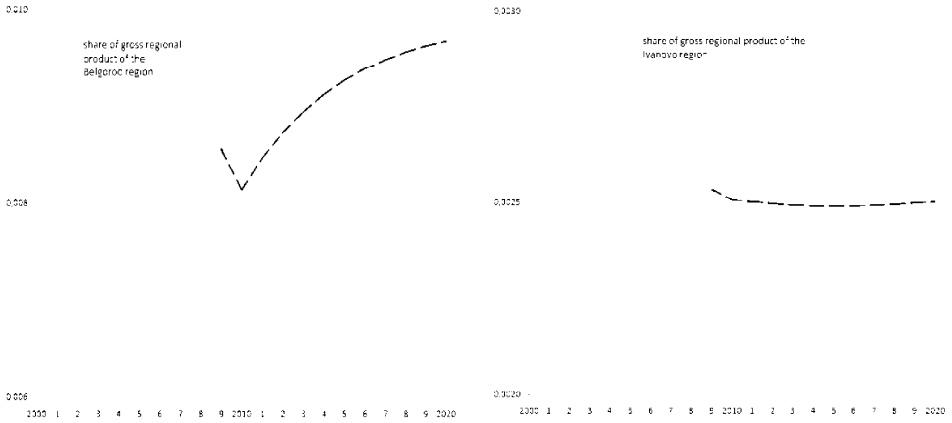
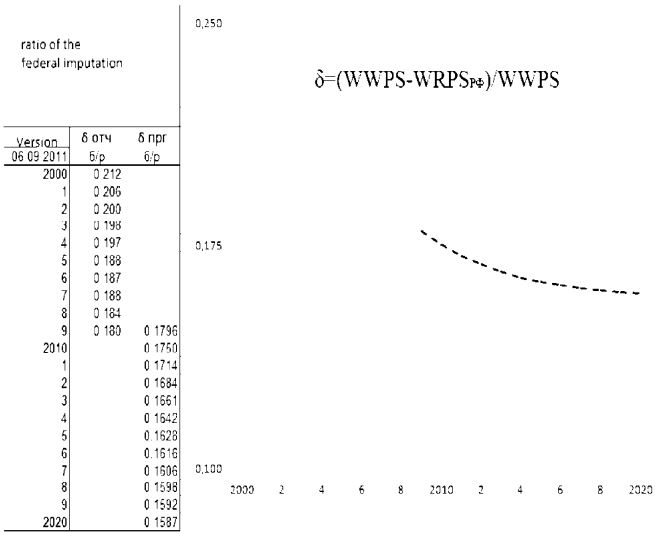


Fig. 19: Examples of the forecast for the regions' GRP quotas in the GRP structure of Russia



Version 06 09 2011	δ отч б/р	δ прг б/р
2000	0 212	
1	0 206	
2	0 200	
3	0 198	
4	0 197	
5	0 188	
6	0 187	
7	0 188	
8	0 184	
9	0 180	0 1796
2010		0 1750
1		0 1714
2		0 1684
3		0 1661
4		0 1642
5		0 1628
6		0 1616
7		0 1606
8		0 1598
9		0 1592
2020		0 1587

Fig. 20: Observation and forecast for the coefficient of the federal surcharge

Table 3: List of Russian regions which have coordinated statistical reporting

1	Belgorod region	41	Stavropol krai
2	Bryansk region	42	Bashkortostan Republic
3	Vladimir region	43	Mary El Republic
4	Voronezh region	44	Mordoviya Republic
5	Ivanov region	45	Tatarstan Republic
6	Kaluga region	46	Udmurtiya Republic
7	Kostroma region	47	Chuvashiya Republic
8	Kursk region	48	Perm krai
9	Lipetsk region	49	Kirov region
10	Moscow region	50	Nizhegorodsk region
11	Oryol region	51	Orenburg region
12	Ryazan region	52	Penza region
13	Smolensk region	53	Samara region
14	Tambov region	54	Saratov region
15	Tver region	55	Ulyanovsk region
16	Tula region	56	Kurgan region
17	Yaroslavl region	57	Sverdlovsk region
18	Moscow	58	Tyumen region
19	Kareliya Republic	59	Chelyabinsk region
20	Komi Republic	60	Altai Republic
21	Arkhangelsk region	61	Buryatiya Republic
22	Vologda region	62	Tyva Republic
23	Kaliningrad region	63	Khakasiya Republic
24	Leningrad region	64	Altai krai
25	Murmansk region	65	Zabaikalsk krai
26	Novgorod region	66	Krasnoyarsk krai
27	Pskov region	67	Irkutsk region
28	St.Petersburg	68	Kemerov region
29	Adygeya Republic	69	Novosibirsk region
30	Kalmykiya Republic	70	Omsk region
31	Krasnodar krai	71	Tomsk region
32	Astrakhan region	72	Sakha (Yakutiya) Repblic
33	Volgograd region	73	Kamchatka krai
34	Rostov region	74	Primorskiy krai
35	Dagestan Republic	75	Khabarovsk krai
36	Ingushetiya Republic	76	Amurskaya region
37	Kabardino-Balkariya Republic	77	Magadan region
38	Karachayevo-Cherkessiya Republic	78	Sakhalinskaya region
39	North Osetiya-Alaniya Republic	79	Jewish autonomous region
40	Chechnya Republic	80	Chukotka autonomous okrug

$$\delta_t = \frac{WWPS_t - WRPS_t}{WWPS_t} = 1 - \frac{WRPS_t}{WWPS_t}, \quad (9)$$

where $WWPS_t$-values of GDP for Russia in the prices of 2000;

$WRPS_t$-values of the total sum of GRP for Russia in the prices of 2000.

Chart δ_t, t = 2000-2020, is given in Fig. 20.

Knowing the forecast δ_t, it's possible to evaluate the total sum value of Russia's GRP $WRPS_t = (1-\delta_t) \bullet WWPS_t$ spanning the whole forecast period 2011-2020.

Then the evaluation of the GRP for each region in the prices of 2000 shall be:

$$WRPS_{it} = WRPS_t \bullet \lambda_t \ \alpha_{it}, \ i = 1, n \quad (10)$$

Assessment of regional GRP values in current prices was done by the formula:

$$WRP_{it} = Dw_{it} \bullet WRPS_{it}, \ i = 1, n. \quad (11)$$

The forecasting technique for base deflators of the regions is omitted here for the sake of briefness. Knowing the regional GRP values and other fundamental indicators of regional economies, its possible to provide a forecast for regional labor productivity, number of the population, unemployed, the volume of investments into the main capital, etc. These indicators have been computed for all 80 regions of the Russian Federation (Table 3). In Fig. 21-25 the charts of these indicators are presented only for the typical group of regions.

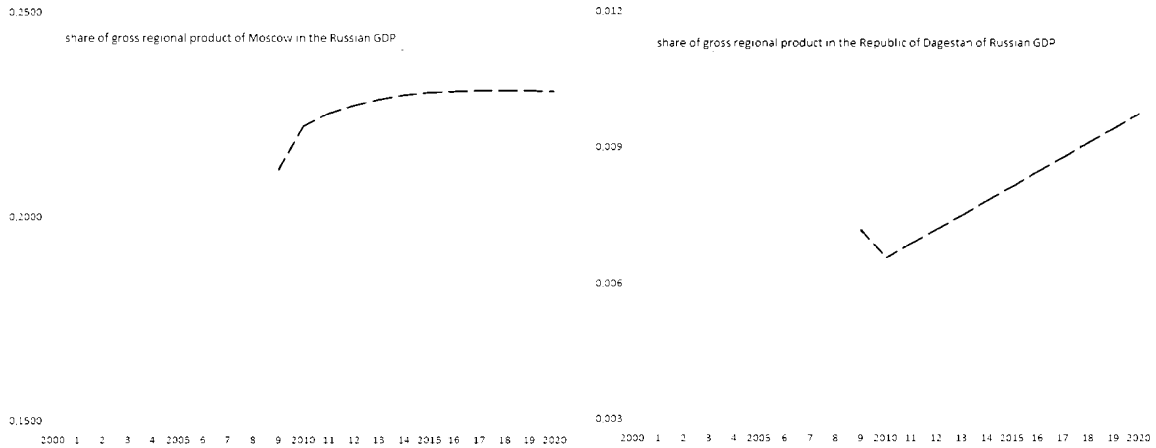


Fig. 21: Adjusted quotas of GRP in the GRP structure of Russia

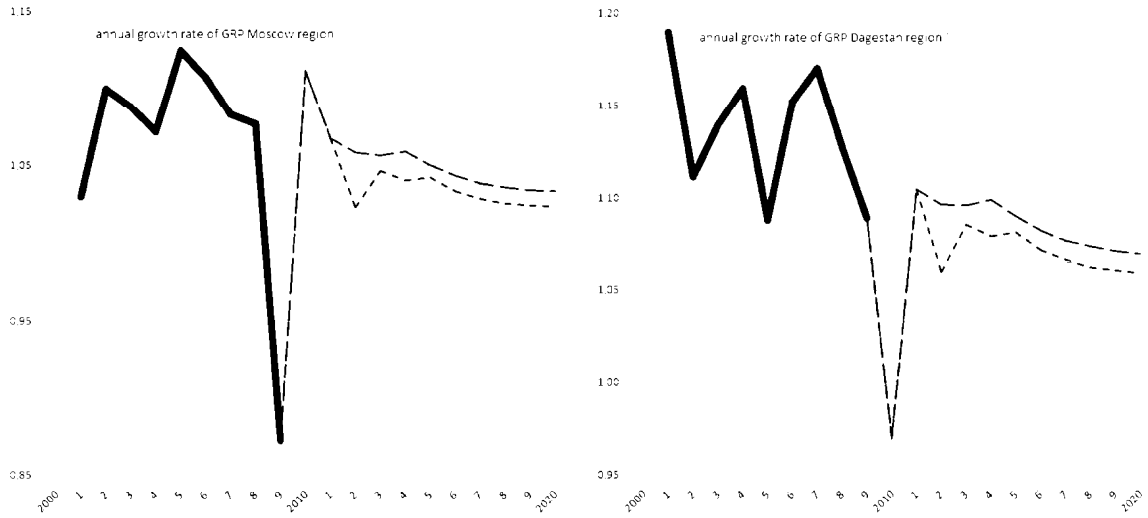


Fig. 22: Annual rates of GRP growth in the regions

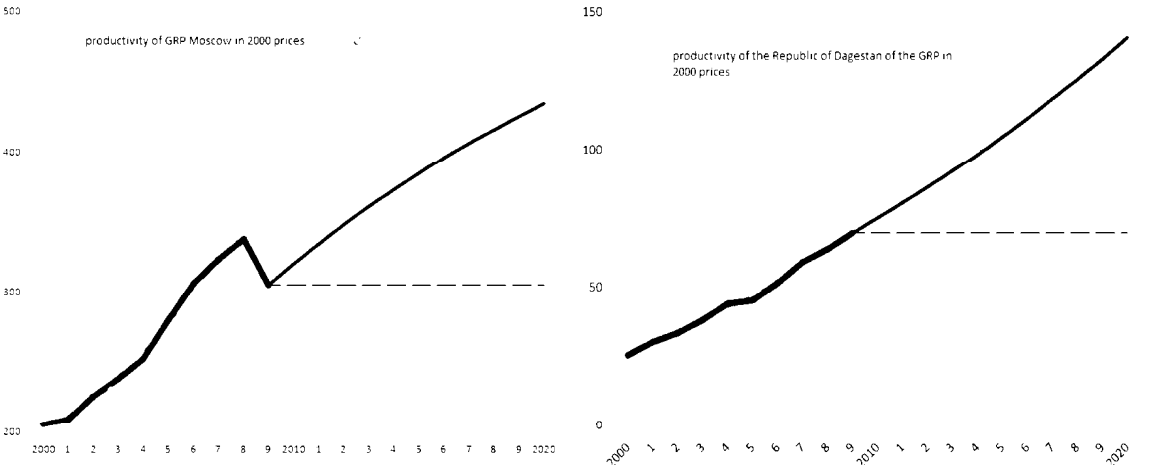


Fig. 23: Labor productivity in the regions by GRP

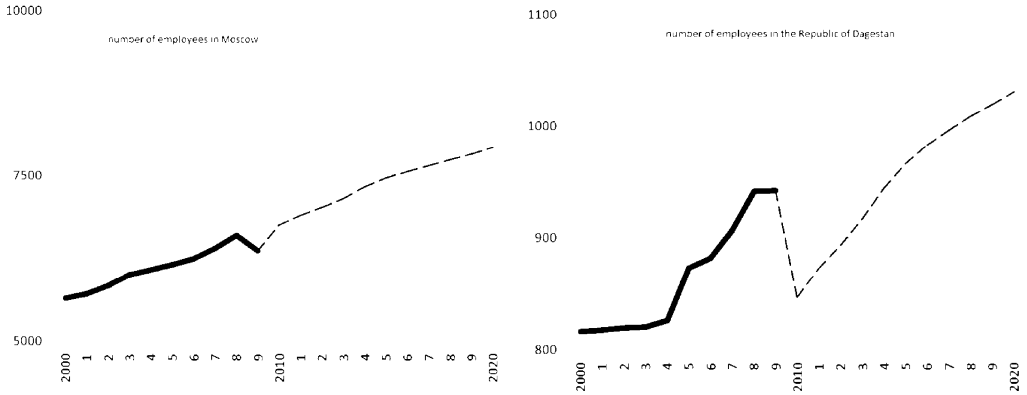


Fig. 24: Number of employed people in the regions

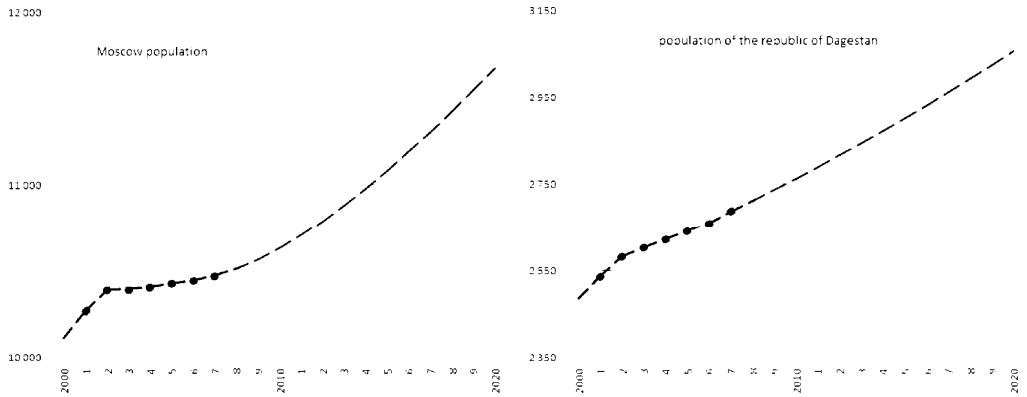


Fig. 25: Size of the population in the regions

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