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MODEL CALCULATIONS OF SHORT-TERM FORECASTS OF RUSSIAN ECONOMIC TIME SERIES

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INTRODUCTION TO ALL THE ISSUES

This Bulletin presents calculations of values of different economic indices of the Russian Federation in March–August of 2015 made on the basis on the time series models developed as a result of research carried out by the IEP in the past few years[1]. The used method of forecasting belongs to the group of *formal* or *statistical* methods. In other words, the obtained values are not the expression of the *opinion* or *expert evaluation* of the researcher, but calculations of future values of the specific economic index made on the basis of formal models of ARIMA (*p*, *d*, *q*) time series with taking into account the existing trend and, in some cases, its significant changes. The presented forecasts are of inertial nature because the respective models take into account the dynamics of the data till the date of making of the forecast and, particularly, depend to a great extent on the trends which are typical of the time series in the period which is just before the time interval for which the forecast is made. The evaluations of the future values of the economic indices of the Russian Federation can be used for approval of decisions related to the economic policy provided that the general trends observed till the date on which the forecast is made in respect of each particular index do not change, that is, there will be no serious shocks or changes in the existing long-term trends.

Despite the fact that a large volume of the data related to the period prior to the 1998 crisis is available, the analysis and model building for forecasting were carried out in the period after August 1998. It was justified by outputs of the previous research[2] whose main conclusion was the fact that with the pre-crisis period taken into account the quality of forecasts in most cases declines. On the other hand, now it seems incorrect to use ever shorter series (after the 2008 crisis), as statistical qualities of the models built on the basis of such a short period happen to be rather low.

The evaluation of the models of the economic indices was carried out on the basis of the standard methods of analysis of time series. At the first stage, correlograms of the researched series and their first differences were analyzed in order to determine the maximum number of the delayed values which need to be included into the specifications of the model. Then, on the basis if the outputs of the analysis of the correlograms all the series were tested for weak stationarity (or stationarity around the trend) by means of the Dickey–Fuller test. In some cases, testing of series for stationarity around the segmented trend by means of the Perron and Zivot–Andrews tests for endogenous structural changes[3] was carried out.

Upon division of the series into those with weak stationary, trend stationary, segmented trend stationary or difference stationary, models corresponding to each of the above types were evaluated (as regards the levels and if necessary with inclusion of the trend, segmented trend or the differences). On the basis the Akaike and Schwartz information criteria and the parameters of the rest of the models (lack of autocorrelation, homoscedasticity and normality) and the quality of in-sample-forecasts obtained by means of those models, the best one was selected. Calculations of the forecast values were carried out on the basis of the best model which was built for each economic index.

In addition to the above, on the basis of the models developed by the IEP *the Bulletin* presents the calculations of future values of monthly indices of the CPI, the volume of the import from all the countries and the export to all the countries on the basis of structural models (SM). The forecast values obtained on the basis of structural models can in a number of cases produce better results as

1 See, for example, R.M. Entov, S.M. Drobyshevsky, V.P. Nosko, A.D. Yudin. *The Econometric Analysis of the Time Series of the Main Macroeconomic Indices.* M., IET, 2001; R.M. Entov, V.P. Nosko, A.D. Yudin, P.A. Kadochnikov, S.S. Ponomarenko. *Problems of Forecasting of Some Macroeconomic Indices.* M., IET, 2002; V. Nosko, A. Buzaev, P. Kadochnikov, S. Ponomarenko. *Analysis of the Forecasting Parameters of Structural Models and Models with the Outputs of the Polls of Industries.* M., IET, 2003; M.Yu. Turuntseva and T.R. Kiblitskaya, *Qualitative Properties of Different Approaches to Forecasting of Social and Economic Indices of the Russian Federation.* M.: IET, 2010.

2 Ibid.

3 See.: Perron, P. Further Evidence on Breaking Trend Functions in Macroeconomic Variables, *Journal of Econometrics,* 1997, 80, pp. 355–385; Zivot, E. and D.W.K. Andrews. Further Evidence on the Great Crash, the Oil-Price Shock, and Unit-Root Hypothesis. *Journal of Business and Economic Statistics,* 1992, 10, pp. 25–270.

compared to ARIMA-models because in building of such models the additional information on the dynamics of exogenous variables is used. In addition to the above, inclusion of structural forecasts in building of aggregated forecasts (that is, forecasts obtained as an average value by a few models) may contribute to adjustment of forecast values.

In modeling the dynamics of the consumer price index, theoretical hypotheses resulting from the monetary theory were used. Utilized as explanatory variables were: the money supply, output volume and the dynamics of the nominal RUR/USD exchange rate which defines the dynamics of the alternative cost of money safe-keeping. Also, the model for the consumer price index included the index of prices on power because that index determined to a great extent the dynamics of manufacturers' costs.

It is to be noted that the main index which may have an effect on the value of the export and the import is the real exchange rate which fluctuations result in the change in the relative value of domestic and import goods. However, in the econometric models that effect is insignificant. The most important factors which   determine the dynamics of the export are the global prices on the exported resources, particularly, oil prices: price rises result in growth in export of goods. Used as a parameter of relative competitiveness of Russian goods was the level of households' income in the economy (the cost of the work force). In order to take into account seasonal fluctuations of the export, fictitious variables D12 and D01 equal to one in December and January, respectively, and zero in the other periods were introduced. The dynamics of the import is influenced by the income of households and industries; growth in income results in growth in demand in all the goods, including imported ones. The parameter of the households' income is the real disposable cash income, while that of the income of industries is the index of industrial production.

The forecast values of currency exchange rates are also based on structural models of their dependence on international oil prices.

Forecast values of explanatory variables required for making of forecasts on the basis of structural models were calculated on the basis of ARIMA (p, d, q) models.

Also, the paper presents calculations of the values of the indices of industrial production, producer price index and the index of the total number of the unemployed calculated with use of the results of the business surveys (BS) carried out by the IEP. The empirical studies show[1] that utilization of the series of the business polls as explanatory variables[2] in prediction models improves on average the accuracy of the forecast. Calculations of future values of those indices were made on the basis of the ADL-model (with addition of seasonal autoregressive delays).

The consumer price index and producer price index are forecasted using the large dataset (factor models – FM) as well. The factor models are based on the estimate of the main components of a large dataset of social and economic indices (in our case – 112 indices). The lags of those main components and lags of the dependent variable are used as regressors in such models. On the basis of the analysis of the quality of forecasts received for various sets of factor models, as regards the consumer price index a model which included the 9th lag, 12th lag and 13th lag of the four main components, as well as the 1st lag and 12th lag of the variable proper was selected, while as regards the producer price index – the model which included the 8th lag, the 9th lag and the 12th lag of the four principal components, as well as the 1st, the 3rd lag and the 12th lag of the variable proper.

All the calculations were carried out with use of the Eviews econometric package.

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1 See, for example: V. Nosko, A. Buzaev, P. Kadochnikov, S. Ponomarenko. *The Analysis of Forecasting Parameters of Structural Models and Models with Business Surveys Results*. M., IEP, 2003.

2 Used as explanatory variables were the following series of the business polls: the current/expected change in production, the expected changes in the solvent demand, the current/expected price changes and the expected change in employment.

Table 1

THE OUTPUTS OF CALCULATIONS OF FORECAST VALUES OF INDICES OF INDUSTRIAL PRODUCTION[1], (%)

| | Index of industrial production | | | | IIP for mining | | IIP for manufacturing | | IIP for utilities (electricity, water, and gas) | | IIP for food products | | IIP for coke and petroleum | | IIP for primary metals and fabricated metal products | | IIP for machinery | |
| | Rosstat | | NRU HSE | | | | | | | | | | | | | | | |
	ARIMA	BS	ARIMA	BS	Rosstat	NRU HSE	Rosstat	NRU HSE	Rosstat	NRU HSE	Rosstat	NRU HSE	Rosstat	NRU HSE	Rosstat	NRU HSE	Rosstat	NRU HSE
	Expected growth on the respective month of the previous year																	
Mar 2015	0,2	2,1	0,7	1,5	3.8	1.7	3.7	0.4	3.5	3.2	0.2	1.3	0.3	0.4	-0.3	4.5	16.3	5.4
Apr 2015	0,9	1,2	-0,7	0,5	2.9	1.6	2.8	-0.7	2.0	-2.2	0.8	-0.1	0.1	2.1	-1.6	3.7	7.6	-6.2
May 2015	0,9	0,4	-0,4	-0,5	2.9	1.4	1.2	-0.9	6.7	0.7	1.1	0.9	-2.3	0.0	0.4	0.5	2.1	-0.2
Jun 2015	2,4	3,0	0,6	2,5	2.7	2.1	4.5	0.6	7.4	1.1	1.9	5.9	-0.7	2.3	2.6	-0.7	3.2	2.6
Jul 2015	1,1	1,3	0,2	0,4	2.6	2.8	2.0	-0.1	6.9	1.3	2.2	3.8	4.3	6.6	2.3	-1.7	8.0	0.7
Aug 2015	2,4	1,2	1,2	0,4	1.3	2.4	4.6	1.8	7.4	1.3	2.3	2.9	2.9	3.9	2.6	-0.9	3.0	12.0
	For reference: actual growth in 2014 on the respective month of 2013																	
Mar 2014		1.4	-0.3		0.6	1.1	3.5	1.1	-6.6	-7.8	1.8	0.5	8.6	6.2	1.4	-0.1	-15.4	-12.6
Apr 2014		2.4	0.8		1.1	1.0	3.9	1.3	-1.9	-1.7	1.8	1.0	11.2	6.1	4.1	1.2	-10.9	-6.0
May 2014		2.8	1.3		0.9	1.5	4.4	1.5	-0.5	-0.8	7.2	2.8	8.2	2.7	5.9	3.9	-5.3	-1.3
Jun 2014		0.4	-0.1		0.8	1.0	0.3	-0.8	-0.8	-0.3	5.5	-0.2	6.7	1.9	-0.4	2.2	-0.6	-7.1
Jul 2014		1.5	-0.2		0.2	-0.1	2.4	-0.3	0.8	0.2	4.7	1.0	1.3	-2.2	1.9	4.1	-7.2	0.5
Aug 2014		0.0	-1.2		0.8	0.1	-0.6	-2.2	1.2	0.8	4.1	2.3	3.5	1.4	-0.6	3.5	-0.3	-10.3

Note: in the time spans under review, the series of the Rosstat and NRU HSE chain indices of IIP, as well as the NRU HSE chain IIP for manufacturing are identified as stationary processes around the trend with an endogenous structural change; the series of the Rosstat and NRU HSE chain IIPs for manufacturing, for primary metals and fabricated metal products, as well as the NRU HSE chain IIP for mining and Rosstat chain IIP for machinery are identified as stationary processes around the trend with two endogenous structural changes. The time series of other chain indices are stationary at levels.

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1 It is to be noted that for making of forecasts so-called "raw" indices (without seasonal and calendar adjustment) were used and for that reason in most models existence of the season factor is taken into account and, as a consequence, the obtained outputs reflect the seasonal dynamics of the series.

INDUSTRIAL PRODUCTION AND RETAIL SALES

Industrial production

For building of the forecast for March–August 2015, the series of monthly data of the indices of industrial production of the Federal State Statistics Service (Rosstat) from January 2002 till December2014, as well as the series of the base indices of industrial production of the Center for the Economic Situation under the National Research University Higher School of Economics (NRU HSE[1]) in the period from January 1999 till January 2015 were used (the value of January 2005 was equal to 100%). The forecast values of the series were calculated on the basis of ARIMA-class models. The forecast values of the Rosstat and NRU HSE indices of industrial production are calculated with use of business surveys (BS) as well. The obtained outputs are shown in Table 1.

As seen from *Table 1*, the average growth[2] in the NRU HSE industrial production index in March–August 2015 on the corresponding period of the previous year for industry in general amounts to 0.5%. As regards the Rosstat industrial production index, it amounts to 1.4%.

In March–August 2015, the monthly average values of the Rosstat and NRU HSE industrial production indices for mining amount to 2.7% and 2.0%, respectively. As for production of coke and petroleum, the average growth in the indices of Rosstat and NRU HSE is expected at the level of 0.8% and 2.6%, respectively.

In March–August 2015, average growth in the NRU HSE industrial production index for manufacturing amounts to 0.2% on the corresponding period of the previous year, while that in the Rosstat index, to 3.1%. The monthly average values of the Rosstat and NRU HSE industrial production indices for food products amount to 1.4% and 2.4%, respectively. In March–August 2015, the monthly average values of the Rosstat and NRU HSE industrial production indices for primary metals and fabricated metal products amount to 1.0% and 0.9%, respectively. As for machinery, the average growth in the indices of Rosstat and NRU HSE is expected at the level of 6.7% and 2.4%, respectively.

In March–August 2015, the average growth in the Rosstat industrial production index for utilities (electricity, water and gas) amounts to 5.7% on the corresponding period of the previous year, while that in the NRU HSE index, to 0.9%.

Retail Sales

This section (Table 2) presents forecasts of monthly retail sales made on the basis of monthly Rosstat data in the January 1999 – December 2014 period.

As seen from *Table 2*, in March–August 2015 the average expected drop in monthly sales volumes amounts to about 12.6% on the corresponding period of 2014.

In March–August 2015, the average expected drop in monthly real sales amounts to 1.2% on the corresponding period of 2014.

Table 2

THE OUTPUTS OF CALCULATIONS OF FORECAST VALUES OF THE RETAIL SALES AND THE REAL RETAIL SALES

Forecast value according to ARIMA-model		
	Retail sales, billion Rb (in brackets – growth on the respective month of the previous year, %)	Real retail sales (as % of the respective period of the previous year)
Mar 2015	2259.4 (11.1)	98.9
Apr 2015	2262.3 (11.6)	98.0
May 2015	2333.9 (12.3)	98.5
Jun 2015	2373.1 (13.2)	98.9
Jul 2015	2459.2 (13.5)	98.9
Aug 2015	2543.6 (14)	99.4
For reference: actual values in the same months of 2014		
Mar 2014	2033.7	104.1
Apr 2014	2027.3	102.8
May 2014	2077.7	102.2
Jun 2014	2097.1	100.8
Jul 2014	2166.3	101.3
Aug 2014	2231.7	101.4

Note: series of retail sales and real retail sales in the January 1999 – December 2014 period.

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1 The indices in question are calculated by E.A. Baranov and V.A. Bessonov.
2 The average growth of industrial production indices is understood here as the average value of the said indices for six forecast months.

INVESTMENTS IN CAPITAL ASSETS

Table 3 presents the outputs of calculations of forecast values of investments in capital assets in March–August 2015. The forecasts were made on the basis of time-series models with utilization of the Rosstat data of the January 1999 – December 2014 period.

The outputs in *Table 3* show that in March–August 2015 the average expected drop in investments in capital assets amounts to about 0.6% on the corresponding period of 2014.

In March–August 2015, the average expected drop in real investments amounts to 5.1% on the corresponding period of 2014.

FOREIGN TRADE INDICES

Model calculations of forecast values of the export and export to countries outside the CIS and the import and import from countries outside the CIS were made on the basis of the models of time series and structural models evaluated on the basis of the monthly data in the period from September 1998 till December 2014 on the basis of the data of the Central Bank of Russia[1]. The outputs of the calculations are shown in Table 4.

Table 3

THE OUTPUTS OF CALCULATIONS OF FORECAST VALUES OF INVESTMENTS IN CAPITAL ASSETS AND REAL INVESTMENTS IN CAPITAL ASSETS

	Forecast values according to ARIMA-model	
	Investments in capital assets, billion Rb (in brackets – growth on the respective month of the previous year, %)	Real investments in capital assets (as % of the respective period of the previous year)
Mar 2015	673.1 (-3.9)	95.2
Apr 2015	732.5 (-3.4)	94.9
May 2015	1008.9 (0.2)	95.1
Jun 2015	1192.7 (1.7)	94.9
Jul 2015	1086.7 (0.7)	94.6
Aug 2015	1173.6 (1.2)	94.7
For reference: actual values in the same months of 2014		
Mar 2014	700.4	95.7
Apr 2014	758.2	97.3
May 2014	1007.1	97.4
Jun 2014	1172.3	100.5
Jul 2014	1078.8	98.0
Aug 2014	1160.0	97.3

Note: series of investments in capital assets in the January 1999 – December 2014 period are series of DS type.

In March–August 2015, the average expected growth in the export, import, export to countries outside the CIS and import from countries outside the CIS will amount to -24.5%, -29.7%, -21.0% and -33.8%, respectively, on the corresponding period of 2014. In March–August 2015, the average expected volume of the trade balance with all the countries will amount to $87.6bn which figure is equal to a 16.4% decrease as compared to the same period of 2014.

Table 4

THE OUTPUTS OF CALCULATIONS OF FORECAST VALUES OF VOLUMES OF FOREIGN TRADE TURNOVER WITH COUNTRIES OUTSIDE THE CIS

Month	Export to all countries				Import from all countries				Export to countries outside the CIS				Import from countries outside the CIS			
	Forecast values (billion USD a month)		Percentage of actual data in the respective month of the previous year		Forecast values (billion USD a month)		Percentage of actual data in the respective month of the previous year		Forecast values (billion USD a month)		Percentage of actual data in the respective month of the previous year		Forecast values (billion USD a month)		Percentage of actual data in the respective month of the previous year	
	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM
Mar 2015	34.7	31.6	74	67	18.7	17.3	69	63	31.6	30.3	78	74	16.0	15.3	67	64
Apr 2015	33.7	30.9	71	65	17.0	20.5	61	74	31.2	29.6	76	72	15.3	18.1	63	74
May 2015	37.0	29.6	84	67	18.7	19.7	72	76	29.6	31.5	80	85	17.8	14.8	77	64
Jun 2015	36.2	31.9	89	78	17.6	19.5	66	73	28.3	28.5	82	82	15.3	14.3	66	61
Jul 2015	37.8	30.1	82	65	19.6	20.3	67	70	32.0	29.8	78	73	16.5	15.1	64	59
Aug 2015	35.5	34.3	86	83	19.3	20.0	76	79	31.6	31.0	87	85	15.5	14.7	70	66

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1 The data on the foreign trade turnover is calculated by the CBR in accordance with the methods for making of the balance of payment in prices of the exporter-country (FOB) in billion USD.

Month	Export to all countries				Import from all countries				Export to countries outside the CIS				Import from countries outside the CIS			
	Forecast values (billion USD a month)		Percentage of actual data in the respective month of the previous year		Forecast values (billion USD a month)		Percentage of actual data in the respective month of the previous year		Forecast values (billion USD a month)		Percentage of actual data in the respective month of the previous year		Forecast values (billion USD a month)		Percentage of actual data in the respective month of the previous year	
	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM	ARIMA	SM
For reference: actual values in respective months of 2014 (billion USD)																
Mar 2014	47.0				27.3				40.7				23.9			
Apr 2014	47.7				27.7				40.9				24.3			
May 2014	44.1				26.1				37.2				23.1			
Jun 2014	40.6				26.7				34.7				23.3			
Jul 2014	46.2				29.2				41.1				25.8			
Aug 2014	41.5				25.3				36.5				22.2			

Note: in the period from January 1999 till December 2014, the series of the export, import, export to the countries outside the CIS and import from the countries outside the CIS were identified as stationary series in the first-order differences. In all the cases, seasonal components were included in the specification of the models.

DYNAMICS OF PRICES

The Consumer Price Index and Producer Price Indices

This section presents calculations of forecast values of the consumer price index and producer price indices (as regards both the industry in general and some types of its activities under the National Industry Classification Standard (NICS)) made on the basis of the time-series models evaluated on the basis of the Rosstat data in the period from January 1999 to December 2014[1]. Table 5 presents the outputs of model calculations of forecast values in March–August 2015 in accordance with ARIMA-models, structural models (SM) and models built with utilization of business surveys (BS).

Table 5

THE OUTPUTS OF CALCULATIONS OF FORECAST VALUES OF PRICE INDICES

Month	The consumer price index (ARIMA)	The consumer price index (SM)	The consumer price index (FM)	Producer price indices:														
				for industrial goods (ARIMA)	for industrial goods (BS)	for industrial goods (FM)	for mining	for manufacturing	for utilities (electricity, water, and gas)	for food products	for the textile and sewing industry	for wood products	for the pulp and paper industry	for coke and petroleum	for the chemical industry	for primary metals and fabricated metal	for machinery	for transport equipment manufacturing
Forecast values (% of the previous month)																		
Mar 2015	101,0	101,6	100,9	100,8	101,1	100,1	98.4	100.7	100.3	102.5	101.0	100.9	100.6	102.7	101.1	101.6	100.8	100.6
Apr 2015	101,2	101,2	100,9	100,3	100,8	100,8	99.0	100.9	100.0	102.3	100.9	100.9	100.5	102.6	100.4	101.3	100.9	100.3
May 2015	100,9	100,5	100,9	100,5	100,9	101,0	99.3	100.9	100.1	101.9	100.8	100.6	100.6	102.3	101.0	101.0	100.6	100.3
Jun 2015	100,8	100,5	100,7	100,9	100,8	101,8	99.7	101.0	99.8	101.4	100.7	100.9	100.4	103.5	100.7	100.7	100.5	100.8
Jul 2015	100,8	101,2	100,5	100,2	100,4	101,8	98.8	101.0	100.6	101.4	100.7	100.7	100.6	102.9	101.1	100.7	100.9	100.5
Aug 2015	100,3	101,0	100,5	100,2	100,3	102,8	98.8	100.8	101.4	100.9	100.7	100.4	100.4	102.2	101.4	100.7	100.9	100.4
Forecast values (% of December 2014)																		
Mar 2015	105.1	107.9	106,1	100.5	102,5	102,4	98.7	102.4	106.4	108.2	103.8	102.9	101.5	103.3	103.7	106.8	103.8	102.2
Apr 2015	106.4	109.2	107,0	100.9	103,4	103,2	97.7	103.4	106.4	110.7	104.8	103.8	102.0	106.0	104.1	108.1	104.8	102.5
May 2015	107.3	109.8	108,0	101.4	104,3	104,3	97.0	104.3	106.4	112.8	105.6	104.4	102.6	108.4	105.1	109.2	105.4	102.8
Jun 2015	108.2	110.3	108,8	102.3	105,2	106,1	96.7	105.4	106.2	114.3	106.3	105.4	103.0	112.2	105.9	110.0	105.9	103.6
Jul 2015	109.1	111.7	109,3	102.5	105,6	108,1	95.6	106.4	106.9	115.9	107.0	106.1	103.7	115.4	107.0	110.7	106.8	104.1
Aug 2015	109.4	112.8	109,9	102.7	105,9	111,1	94.4	107.3	108.4	116.9	107.7	106.5	104.0	118.0	108.5	111.6	107.7	104.6

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1 Structural models were evaluated in the period from October 1998.

Table 5, cont'd

Month	The consumer price index (ARIMA)	The consumer price index (SM)	The consumer price index (FM)	Producer price indices:														
				for industrial goods (ARIMA)	for industrial goods (BS)	for industrial goods (FM)	for mining	for manufacturing	for utilities (electricity, water, and gas)	for food products	for the textile and sewing industry	for wood products	for the pulp and paper industry	for coke and petroleum	for the chemical industry	for primary metals and fabricated metal	for machinery	for transport equipment manufacturing
For reference: actual values in the same periods of 2014 (% of December 2013)																		
Mar 2014	102.3			102.3			105.8	101.6	100.3	101.8	101.4	100.8	100.0	101.9	102.9	100.8	102.2	102.4
Apr 2014	103.2			103.0			106.0	102.6	100.4	103.4	102.1	100.2	100.3	103.3	104.8	102.2	102.9	102.9
May 2014	104.2			103.4			105.4	103.4	100.6	105.3	102.1	101.0	101.2	103.9	105.4	103.5	103.3	103.1
Jun 2014	104.8			104.3			106.9	104.3	100.3	106.6	102.0	102.1	101.2	105.9	106.2	105.4	104.1	101.8
Jul 2014	105.3			105.9			109.1	105.7	102.4	107.8	102.2	102.2	102.3	110.7	107.6	106.2	104.5	102.9
Aug 2014	105.5			105.9			106.9	106.4	102.8	109.0	102.6	102.5	101.9	111.7	107.5	106.6	105.9	102.7

Note: in the period from January 1999 till December 2014, the series of the chain producer price index for machinery are identified as a stationary process around the trend with two endogenous structural changes. The series of other chain price indices are stationary at levels.

In March–August 2015, the expected monthly average growth in the consumer price index will amount on average to 0.9% on the basis of three models. In the above period, the industrial producer price index is expected on average at the level of 0.9% a month, too. It is to be noted that the forecast of the producer price index on the basis of the ARIMA model is highly understated which factor is sooner related to small growth in that index in the previous year.

As regards Rosstat's producer price indices, in March–August 2015 the following monthly average growth rates are expected: mining (-1.0%), manufacturing (0.9%), utilities (electricity, water and gas) (0.4%), food products (1.7%), the textile and sewing industry (0.8%), wood products (0.7%), the pulp and paper industry (0.5%), coke and petroleum production (2.7%), the chemical industry (0.9%), primary metals and fabricated metal products (1.0%), machinery (0.7%) and transport equipment manufacturing (0.5%).

The cost of the Monthly per Capita Minimum Food Basket

This section presents the outputs of calculations of forecast values of the cost of the monthly per capita minimum food basket in March–August 2015. The forecasts were made on the basis of time series with use the Rosstat data in the period from January 2000 till December 2014. The outputs of calculations are shown in Table 6.

As seen from *Table 6*, growth in the cost of the monthly per capita minimum food basket as compared to the respective level of the previous year is expected. It is to be noted that the average expected cost of the monthly per capita minimum food basket amounts on average to about Rb 3,557. The expected growth in the cost of the monthly per capita minimum food basket amounts on average to about 12.8% as compared to the level of the same period of the previous year.

Table 6
THE FORECAST OF THE COST OF THE MONTHLY PER CAPITA MINIMUM FOOD BASKET

Forecast values according to ARIMA-model (Rb)	
March 2015	3534.4
April 2015	3567.1
May 2015	3598.5
June 2015	3594.6
July 2015	3541.2
August 2015	3504.8
For reference: actual values in the same months of 2014 (billion Rb)	
March 2014	3080.4
April 2014	3137.5
May 2014	3235.7
June 2014	3281.9
July 2014	3180.1
August 2014	3017.5
Expected growth on the respective month of the previous year (%)	
March 2015	14.7
April 2015	13.7
May 2015	11.2
June 2015	9.5
July 2015	11.4
August 2015	16.1

Note: the series of the cost of the monthly per capita minimum food basket in the period from January 2000 till December 2014 are stationary in the first-order differences.

Indices of Transportation Tariffs

This section presents calculations of forecast values of indices of transportation tariffs on cargo carriage[1], made on the basis of time-series models evaluated on the basis of the Rosstat data in the period from September 1998 till December 2014. Table 7 shows the outputs of model calculations of forecast values in March–August 2015. It is to be noted that some of the indices under review (for instance, the index of tariffs on pipeline transportation) are adjustable ones and for that reason their behavior is hard to describe by means of the time-series models. As a result, the future values may differ greatly from the real ones in case of the centralized increase of the tariffs in the period of forecasting or in case of absence of such an increase in the forecasting period, but with it taking place shortly before the beginning of that period.

Table 7

THE OUTPUTS OF CALCULATIONS OF FORECAST VALUES OF INDICES OF TRANSPORTATION TARIFFS

Period	The composite index of transportation tariffs	The index of motor freight tariffs	The index of pipeline tariffs
Forecast values according to ARIMA-models (% of the previous month)			
March 2015	100,1	100,4	102,8
April 2015	103,6	100,4	102,1
May 2015	100,1	100,4	99,7
June 2015	100,1	100,4	100,5
July 2015	103,4	100,4	102,7
August 2015	100,1	100,4	101,9
Forecast values according to ARIMA-models (% of December of the previous year)			
March 2015	100,3	103,6	100,3
April 2015	100,5	104,1	103,1
May 2015	104,1	104,5	105,3
June 2015	104,3	105,0	105,0
July 2015	104,4	105,4	105,5
August 2015	108,0	105,8	108,4
For reference: actual values in the same period of 2014 (% of the previous month)			
March 2014	100,1	100,5	100,0
April 2014	102,3	99,7	104,8
May 2014	100,1	99,9	100,0
June 2014	100,0	99,8	100,0
July 2014	104,6	100,0	109,1
August 2014	100,9	100,3	100,1

Note: in the period from September 1998 till December 2014, the series of the index freight tariffs were identified as stationary ones; the other series were identified as stationary ones in the period from September 1998 till October 2014, too; fictitious variables for taking into account particularly dramatic fluctuations were used in respect of all the series.

On the basis of the results of the forecast for March–August 2015, the composite index of transportation tariffs on cargo carriage will grow at the monthly average rate of 1.3%. Seasonal growth of 3.6 p.p. and 3.4 p.p. in the index is expected in April 2015 and July 2015, respectively.

The index of tariffs on motor cargo carriage will grow at the average monthly rate of 0.4% within those six months.

Within the next six months, the index of tariffs on pipeline transportation will grow at the monthly average rate of 1.6%. Seasonal growth of 2.1 p.p. and 2.7 p.p. in the index is expected in April 2015 and July 2015, respectively.

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1 The Bulletin presents a review of the composite index of transportation tariffs on cargo carriage and the index of transportation tariffs on motor cargo carriage, as well as the index of tariffs on pipeline transportation. The composite index of transportation tariffs on cargo carriage is calculated on the basis of the indices of tariffs on cargo carriage by individual types of transport: railway, pipeline, shipping, domestic water-borne, motor and air service (for more detailed information, pls. refer, for instance, to: Prices in Russia. The Official Publication of Goskomstat of RF, 1998).

World prices on natural resources

This section presents calculations of such average monthly values of the Brent oil prices ($ per barrel), the aluminum prices ($ per ton), the gold prices ($ per ounce), the copper prices ($ per ton) and the nickel prices ($ per ton) in March–August 2015 as were received on the basis of nonlinear models of time series evaluated on the basis of the IMF data in the period from January 1980 till January 2015.

THE OUTPUTS OF CALCULATIONS OF FORECAST VALUES OF WORLD PRICES ON NATURAL RESOURCES

Month	Brent oil ($ per barrel)	Aluminum ($ per ton)	Gold ($ per ounce)	Copper ($ per ton)	Nickel ($ per ton)
Forecast values					
March 2015	47,40	1731	1272	5350	14281
April 2015	46,05	1661	1269	5253	14280
May 2015	44,70	1666	1291	5217	14415
June 2015	43,35	1656	1318	5203	14538
July 2015	48,20	1629	1316	5188	14611
August 2015	51,26	1642	1320	5169	14666
Expected growth on the respective month of the previous year (%)					
March 2015	-55,9	1,5	-4,8	-19,5	-8,9
April 2015	-57,3	-8,3	-2,3	-21,3	-17,8
May 2015	-59,2	-4,9	0,3	-24,3	-25,7
June 2015	-61,2	-9,9	3,1	-23,7	-22,0
July 2015	-54,9	-16,4	0,4	-27,1	-23,6
August 2015	-49,7	-19,1	1,8	-26,2	-21,2
For reference: actual values in the same period of 2014					
March 2014	107,41	1705	1336	6650	15678
April 2014	107,88	1811	1299	6674	17374
May 2014	109,68	1751	1288	6891	19401
June 2014	111,87	1839	1279	6821	18629
July 2014	106,98	1948	1311	7113	19118
August 2014	101,92	2030	1296	7002	18600

Note: in the period from January 1980 till January 2015, the series of prices on oil, nickel, gold, copper and aluminum are series of DS type.

The average expected level of prices on oil amounts to about $46.8 per barrel which figure is on average 56.4% lower than the respective indices of the previous year. Prices on aluminum are expected at the level of about $1,664 per ton, while their average decrease is expected to amount to about 10% against the respective level of the previous year. Prices on gold are expected to amount to about $1,297 per ounce. Average prices on copper are expected to amount to about $5,230 per ton, while those on nickel, to about $14,464 per ton. The expected average depreciation of prices on gold, copper and nickel amounts to about 0.3%, 24% and 20%, respectively, on the respective period of the previous year.

MONETARY INDICES

The future values of the monetary base (in the narrow definition: cash funds and the Fund of Mandatory Reserves (FMR)) and M_2 monetary aggregate in March–August 2015 were received on the basis of models of time-series of respective indices calculated by the CBR[1] in the period from October 1998 till January 2015. Table 9 presents the outputs of calculations of forecast values and actual values of those indices in the same period of the previous year. It is to be noted that due to the fact

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1 The data on the specific month is given in accordance with the methods of the CBR as of the beginning of the following month.

that the monetary base is an instrument of the policy of the CBR the forecasts of the monetary base on the basis of time-series models are to a certain extent notional as the future value of that index is determined to a great extent by decisions of the CBR, rather than the inherent specifics of the series.

Table 9

THE FORECAST OF M$_2$ AND THE MONETARY BASE

Period	The Monetary base		M$_2$	
	Billion Rb	Growth on the previous month, %	Billion Rb	Growth on the previous month, %
March 2015	8497	5,6	31850	0,6
April 2015	8346	-1,8	32041	0,6
May 2015	8617	3,2	32233	0,6
June 2015	8502	-1,3	32424	0,6
July 2015	8779	3,3	32615	0,6
August 2015	8662	-1,3	32805	0,6
For reference: actual value in the respective months of 2014 (growth on the previous month, %)				
March 2014	0,4		-2,2	
April 2014	-1,0		1,2	
May 2014	3,2		0,3	
June 2014	-1,6		0,6	
July 2014	0,4		0,3	
August 2014	1,0		0,5	

Note: in the period from October 1998 to January 2015, all the time series of monetary indices were attributed to the class of series which are stationary in the first-order differences and have an explicit seasonal component.

In March–August 2015, the monetary base and the M$_2$ monetary index will grow at the monthly average rate of 1.3% and 0.6%, respectively.

INTERNATIONAL RESERVES

This section presents the outputs of the statistical evaluation of such future values of the international reserves of the Russian Federation[1] as were received on the basis of evaluation of the model of time series of the gold and foreign exchange reserves on the basis of the data of the CBR in the period from October 1998 till February 2015. That index is forecasted without taking into account a decrease in the amount of the reserves due to payment of the foreign debt and for that reason the values of the volumes of the international reserves in the months where foreign debt payments are made may happen to be overestimated (or, otherwise, underestimated) as compared to the actual ones.

On the basis of the outputs of the forecast, in March–August 2015 the international reserves will decrease at the monthly average rate of 4.1%.

Table 10

THE FORECAST OF THE INTERNATIONAL RESERVES OF THE RUSSIAN FEDERATION

Period	Forecast values according to ARIMA-models	
	Billion USD	Growth on the previous month, %
Mar 2015	360,7	-4,1
Apr 2015	346,7	-3,9
May 2015	338,9	-2,2
Jun 2015	326,7	-3,6
Jul 2015	308,7	-5,5
Aug 2015	291,8	-5,5
For reference: actual values in the same period of 2014		
Mar 2014	509,6	3,3
Apr 2014	486,1	-4,6
May 2014	472,3	-2,8
Jun 2014	467,2	-1,1
Jul 2014	478,3	2,4
Aug 2014	468,8	-2,0

Note: in the period from October 1998 till February 2015, the series of the gold and foreign exchange reserves of the Russian Federation were identified as stationary series in difference.

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1 The data on the volume of the gold and foreign exchange reserves is presented as of the first day of the following month.

FOREIGN EXCHANGE RATES

The model calculations of prospective values of the foreign exchange rates (RUR per USD and USD per euro) were made on the basis of assessment of the time series models (ARIMA) and structural models (SM) of the relevant indicators quoted by the RF Central Bank as of the last date of each month over the periods between October 1998 and February 2015 and between January 1999 and February 2015[1], respectively.

In March–August 2015, the value of the USD/RUR exchange rate is forecasted on the basis of the average of the two models equal to Rb 62.30 per $1.

A forecast of the EUR/USD exchange rate will amount on average to $1.13 per 1 euro.

Table 11

FORECASTS OF THE USD/RUR AND EUR/USD EXCHANGE RATES

Period	The USD/RUR exchange rate (RUR per USD)		The EUR/USD exchange rate (USD per EUR)	
	ARIMA	SM	ARIMA	SM
March 2015	61,13	62,94	1,13	1,12
April 2015	61,49	62,78	1,13	1,11
May 2015	61,90	62,90	1,13	1,11
June 2015	61,65	63,17	1,15	1,10
July 2015	61,63	63,51	1,17	1,10
August 2015	60,60	63,90	1,20	1,10
For reference: actual values in the similar period of 2014				
March 2014	35,69		1,37	
April 2014	35,70		1,41	
May 2014	34,74		1,35	
June 2014	33,63		1,37	
July 2014	35,72		1,33	
August 2014	36,93		1,32	

Note: in the respective periods, the series under review were identified as integrated series of the first order with a seasonal component.

THE STANDARD OF LIVING INDICES

This section (Table 12) presents such outputs of calculations of forecast values of indices of real wages, real disposable income and real income[2] as were received on the basis of the model of time series of respective indices calculated by Rosstat and taken in the period from January 1999 till January 2015. The above indices depend to a certain extent on the centralized decisions on raising of wages and salaries to public sector workers, as well as those on raising of pensions, scholarships and allowances; such a situation introduces some changes in the dynamics of the indices under review. As a result, the future values of the indices of real wages and real disposable income calculated on the basis of the series which last observations are either considerably higher or lower than the previous ones due to such a raising may differ greatly from those which are implemented in reality.

The forecast values shown in *Table 12* point to a drop in all the indices of the standard of living. Average decrease of 0.2% and 0.1% in real disposable cash income and real cash income is expected, respectively, as compared to the same period of the previous year. A forecasted drop in

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1 The Bulletin applies the IMF's data for the period between January 1999 and December 2014. The data for January and February 2015 was obtained from the foreign exchange rate statistics website: www.oanda.com

2 *Real cash income* is a relative index which is calculated by means of division of the index of the nominal size (which was actually formed in the period under review) of households' cash income by the CPI. *Real disposable cash income* is cash income minus mandatory payments and contributions. (See: Rossiisky Statistichesky Ezhegodnik, Moscow, Rosstat, 2004, p. 212).

real wages is more substantial and amounts in 4.8% on an average monthly basis as compared to the same period of the previous year.

Table 12

THE FORECAST OF THE STANDARD OF LIVING INDICES

Period	Real disposable cash income	Real cash income	Real accrued wages
Forecast values according to ARIMA-models (% of the respective month of 2014)			
March 2015	101,7	101,6	94,4
April 2015	98,1	98,3	91,0
May 2015	98,2	98,3	94,0
June 2015	102,5	102,6	95,1
July 2015	100,0	100,1	96,5
August 2015	98,6	98,4	100,1
For reference: actual values in the respective period of 2014 (% of the same period of 2013)			
March 2014	92,7	93,9	103,8
April 2014	100,3	99,3	103,2
May 2014	106,0	105,9	102,1
June 2014	96,5	96,7	102,1
July 2014	102,4	101,3	101,4
August 2014	103,8	104,6	98,8

Note: for calculating purposes, the series of the real disposable cash income, real cash income and real accrued wages in the base form were used (March 1999 was adopted as a base period). In the period from January 1999 till January 2015, those series were attributed to the class of processes which are stationary in differences and have an explicit seasonal component.

EMPLOYMENT AND UNEMPLOYMENT

For the purpose of calculation of the future values of the employment (of the number the gainfully employed population) and the unemployment (the total number of the unemployed), models of time series evaluated in the period from October 1998 till December 2014 on the basis of the monthly data of Rosstat[1] were used. The unemployment was calculated on the basis of the models with results of the outputs of business polls[2], too.

It is to be noted that possible logical differences[3] in forecasts of the employment and the unemployment which totals should be equal to the index of the economically active population may arise due to the fact that each series is forecasted individually and not as the difference between the forecast values of the economically active population and another index.

According to forecasts based on the ARIMA models (*Table 13*), in March–August 2015 growth in the number of gainfully employed in the economy will amount on average to 0.5% a month as compared to the respective period of the previous year.

Average growth in the index of the total number of the unemployed is forecasted at the level of 4.2% a month as compared to the same period of the previous year. It is to be noted that there are substantial discrepancies between the forecasts of the level of unemployment received on the basis of different models.

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1   The index is calculated in accordance with the methods of the International Labor Organization (ILO) and is given as of the end of the month.

2   The model is evaluated in the period from January 1999 till December 2014.

3   For example, deemed as such a difference may be a simultaneous decrease both in the employment and the unemployment. However, it is to be noted that in principle such a situation is possible provided that there is a simultaneous decrease in the number of the economically active population.

Table 13

THE OUTPUTS OF CALCULATION OF FORECAST VALUES OF THE INDICES THE EMPLOYMENT
AND THE UNEMPLOYMENT

Month	Employment (ARIMA)		Unemployment (ARIMA)			Unemployment (BS)		
	Million people	Growth on the respective month of previous year (%)	Million people	Growth on the respective month of previous year (%)	% of the index of the number of the gainfully employed population	Million people	Growth on the respective month of previous year (%)	% of the index of the number of the gainfully employed population
March 2015	71,2	0,1	4,1	3,4	5,8	4,2	5,0	5,9
April 2015	71,5	0,7	4,0	-1,0	5,5	4,2	6,1	5,9
May 2015	72,2	0,9	3,7	0,6	5,2	4,2	10,8	5,7
June 2015	72,2	0,5	3,7	-0,6	5,1	4,1	10,8	5,7
July 2015	72,4	0,3	3,7	0,0	5,1	4,1	8,1	5,5
August 2015	72,6	0,3	3,7	-1,3	5,0	4,0	8,1	5,5
For reference: actual values in the same periods of 2014 (million people)								
March 2014	71.1				4.0			
April 2014	71.0				4.0			
May 2014	71.6				3.7			
June 2014	71.9				3.7			
July 2014	72.2				3.7			
August 2014	72.4				3.7			

Note: in the period from October 1998 till November 2014, the series of the employment is a stochastic process which is stationary around the trend. The series unemployment is a stochastic process with the first order integration. Both the indices include a seasonal component.

ANNEX

Diagrams of the Time Series of the Economic Indices of the Russian

Fig. 1a. The Rosstat industrial production index (ARIMA-model)
(% of December 2001)
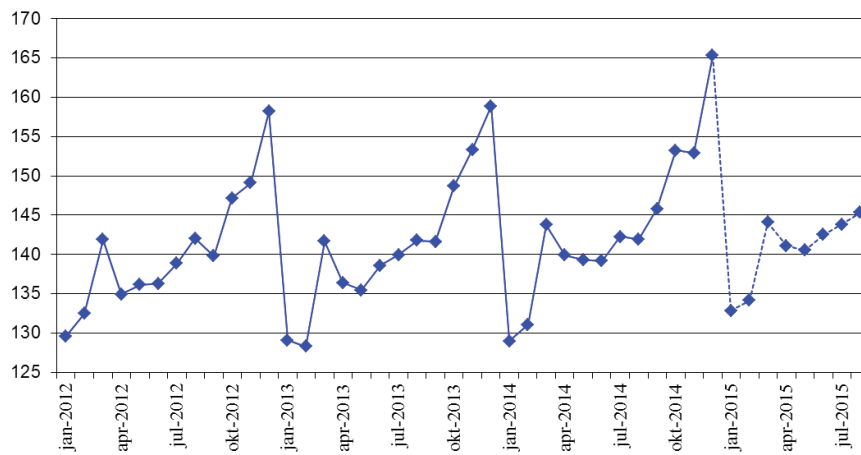
Fig. 1b. The NRU HSE industrial production index (ARIMA-model)
(% of January 2005)
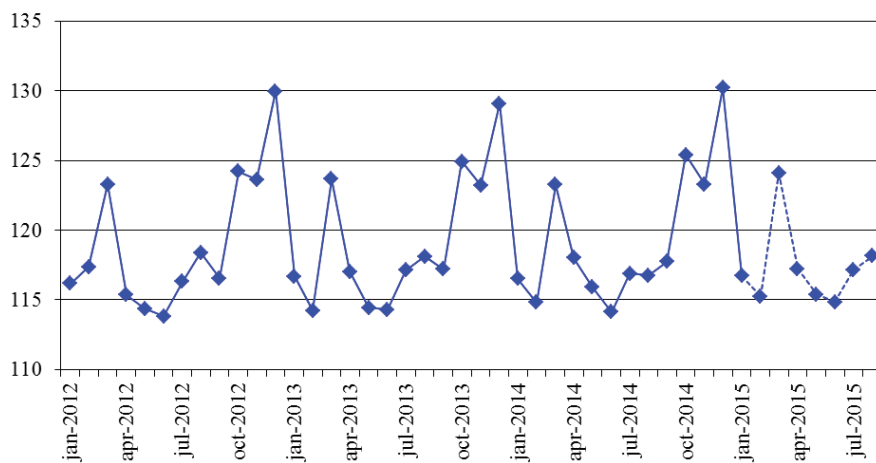
Fig. 2a. The Rosstat industrial production index for mining
(% of December 2001)
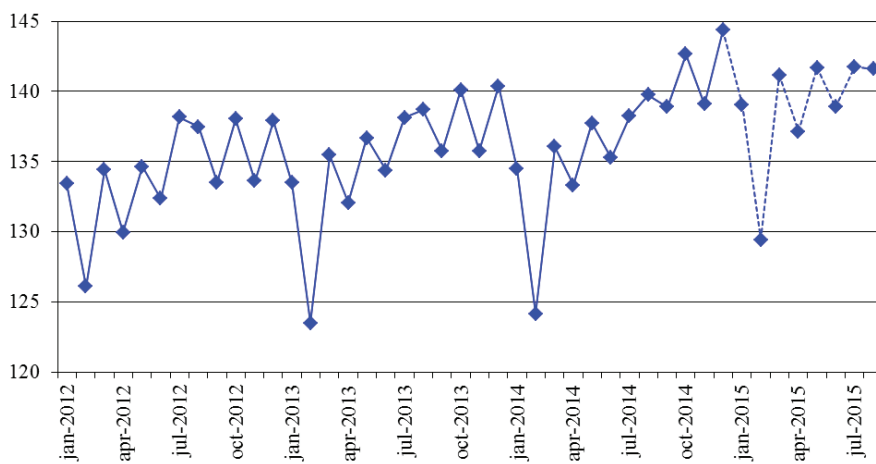
*Fig. 2b. The NRU HSE industrial production index for mining
(% of January 2005)*
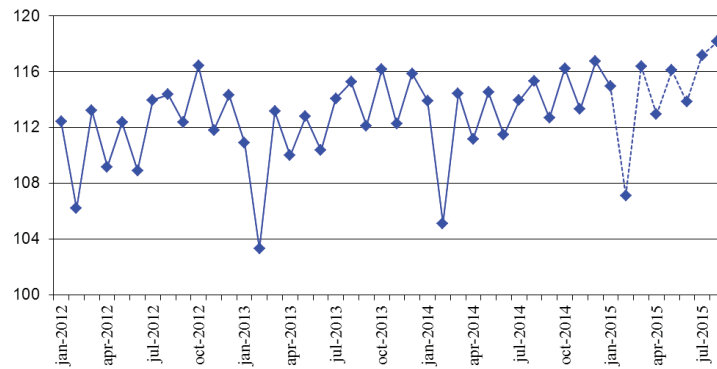
*Fig. 3a. The Rosstat industrial production index for manufacturing
(% of December 2001)*
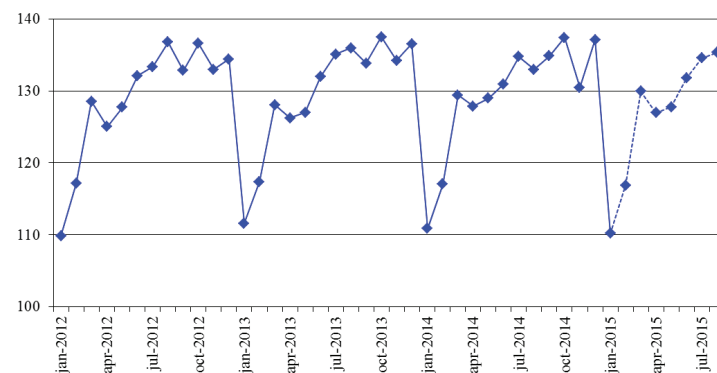
*Fig. 3b. The NRU HSE industrial production index for manufacturing
(% of January 2005)*
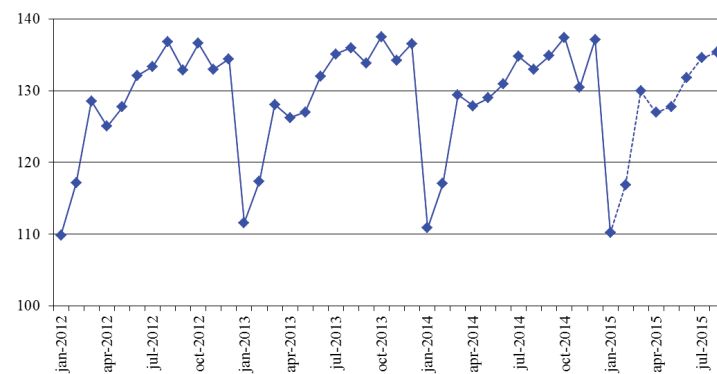
*Fig. 4a. The Rosstat industrial production index for utilities
(electricity, water, and gas) (as a percentage of that in December 2001)*
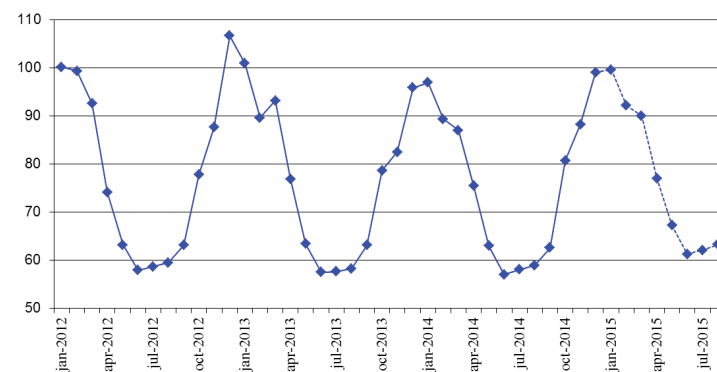
Fig. 4b. The NRU HSE industrial production index for utilities
(electricity, water, and gas) (as a percentage of that in January 2005)
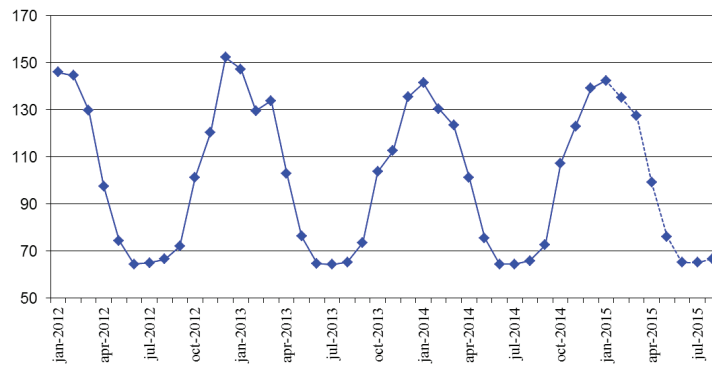
Fig. 5a. The Rosstat industrial production index for food products
(as a percentage of that in December 2001)
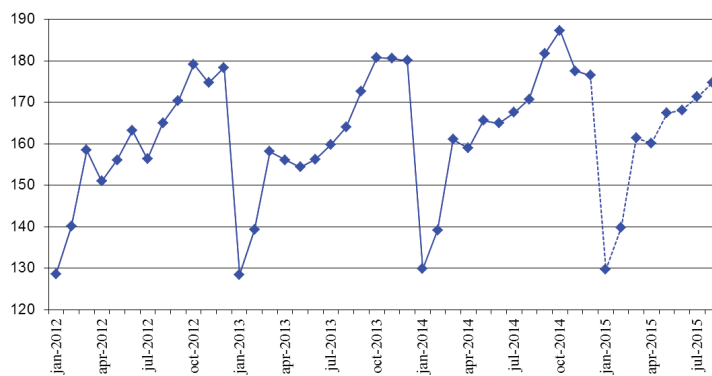
Fig. 5b. The NRU HSE industrial production index for food products
(as a percentage of that in January 2005)
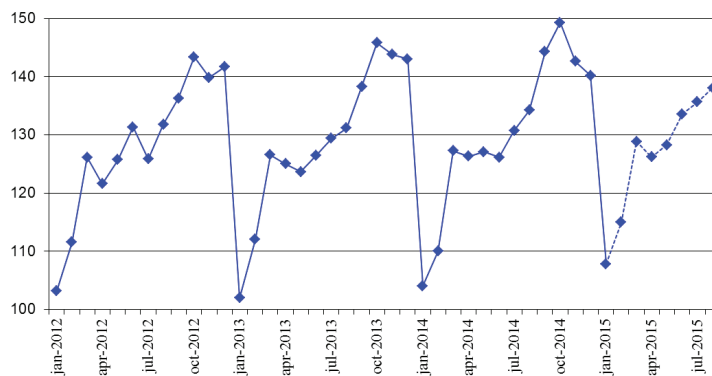
Fig. 6a. The Rosstat industrial production index for coke and petroleum
(as a percentage of that in December 2001)
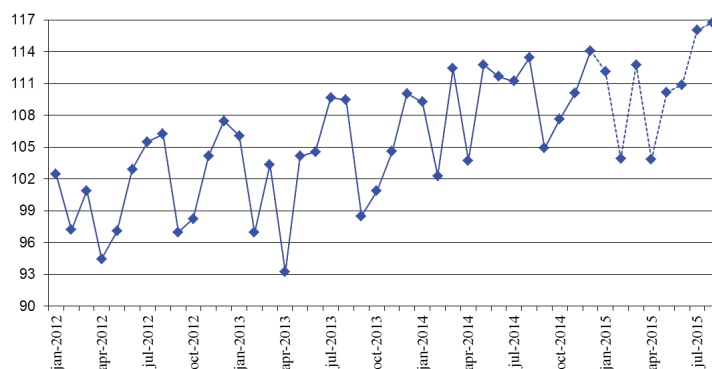
Fig. 6b. The NRU HSE industrial production index for petroleum and coke
(as a percentage of that in January 2005)
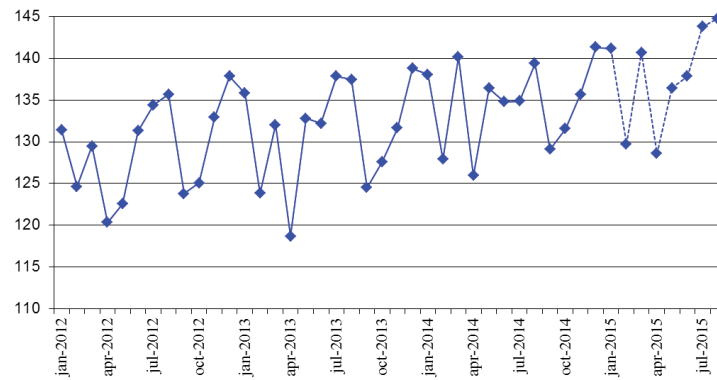
Fig.7a. The Rosstat industrial production index for primary metals and fabricated metal products
(as a percentage of that in December 2001)
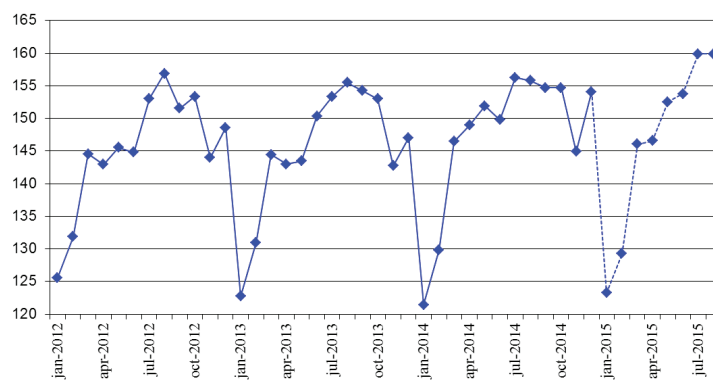
Fig. 7b. The NRU HSE industrial production index for primary metals and fabricated metal products
(as a percentage of that in January 2005)
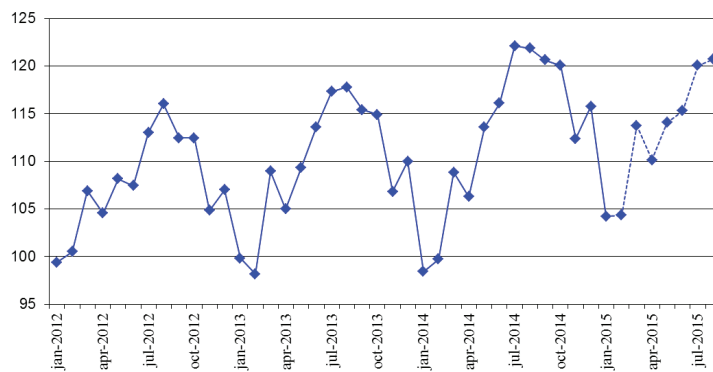
Fig. 8a. The Rosstat industrial production index for machinery
(as a percentage of that in December 2001)
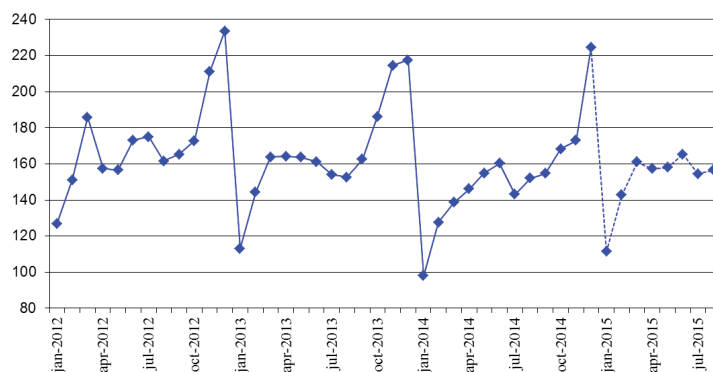
*Fig. 8b. The NRU HSE industrial production index for machinery
(as a percentage of that in January 2005)*
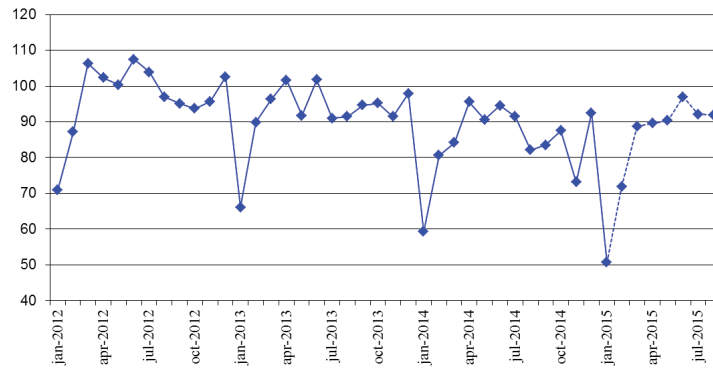
Fig. 9. The volume of retail sales (billion Rb)
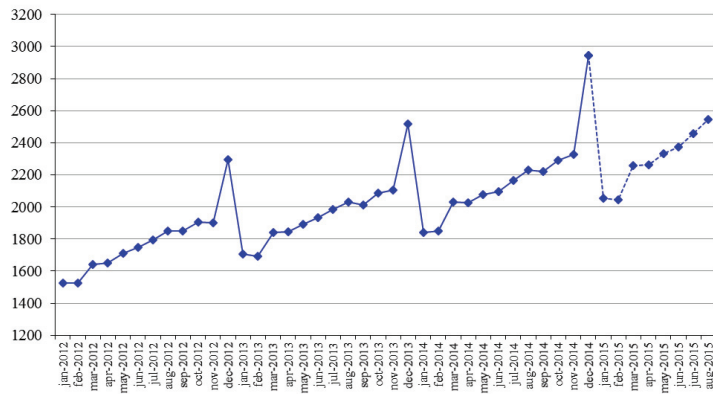
*Fig. 9a. The real volume of retail sales
(as a percentage of that in the same period of the previous year)*
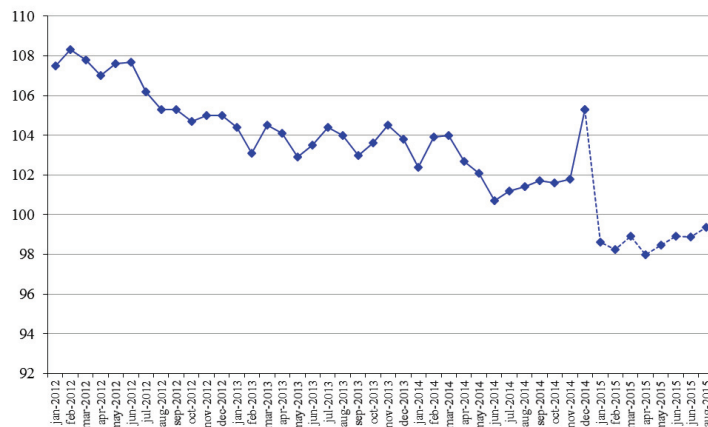
Fig. 10. Investments in capital assets (billion Rb)
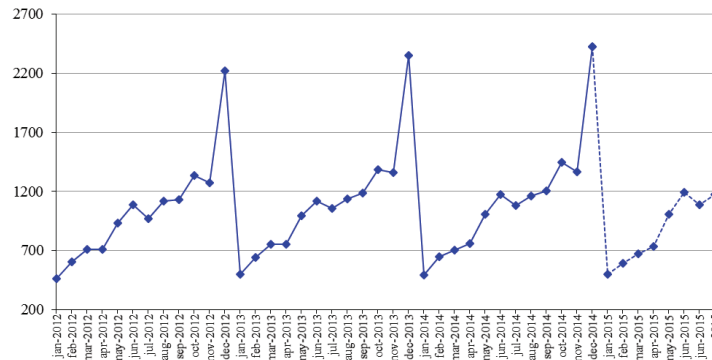
Fig. 10a. Real investments in capital assets
(as a percentage of those in the same period of the previous year)
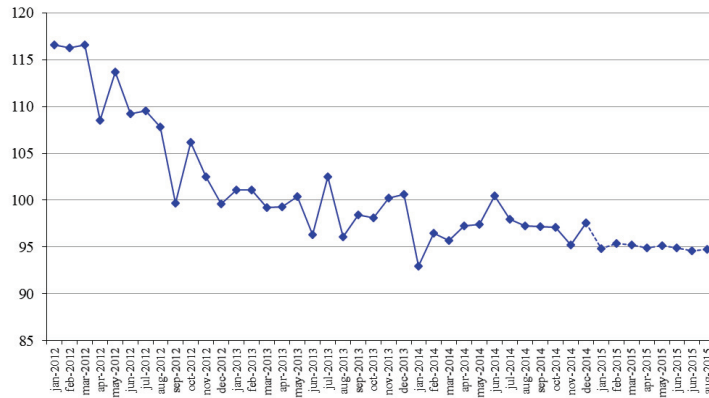
Fig.11. Export to all countries (billion USD)
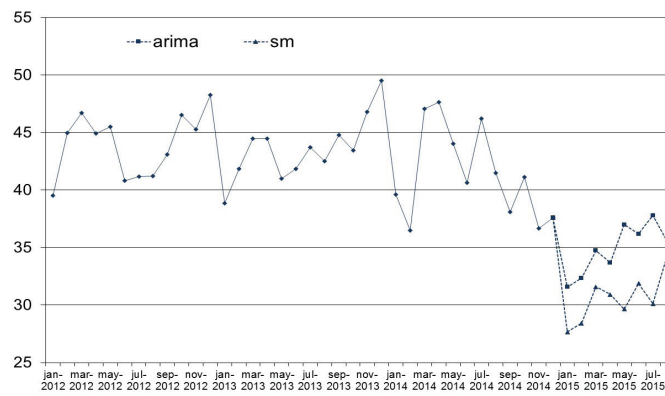
Fig. 12. Export to countries outside the CIS (billion USD)
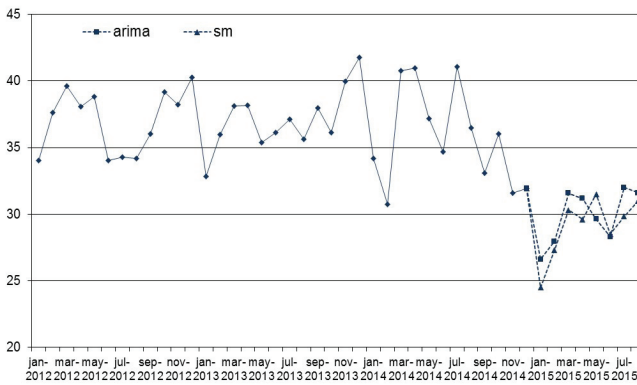
Fig. 13. Import from all countries (billion USD)
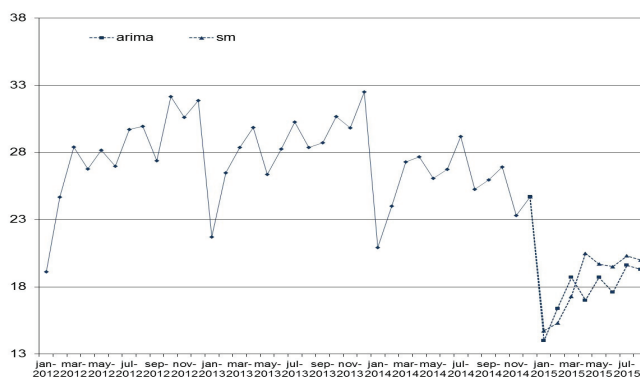
Fig. 14. Import from countries outside the CIS (billion USD)
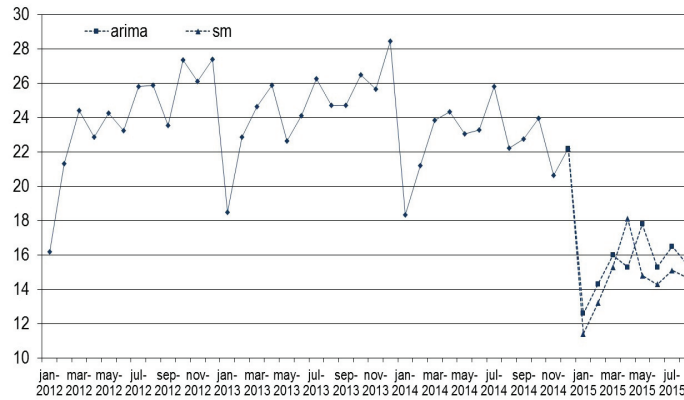
Fig. 15. The consumer price index
(as a percentage of that in December of the previous year)
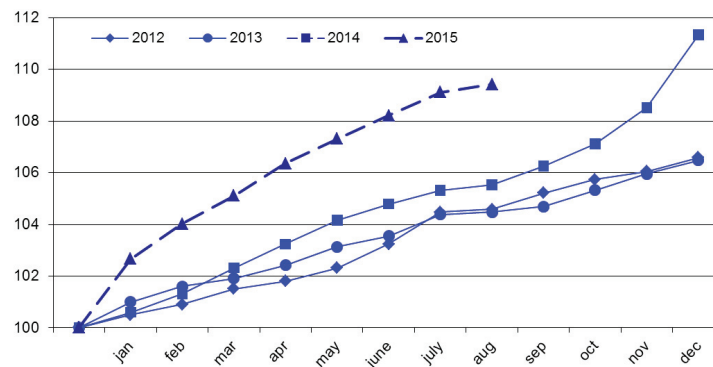
Fig. 15a. The consumer price index
(as a percentage of that in December of the previous year) (SM)
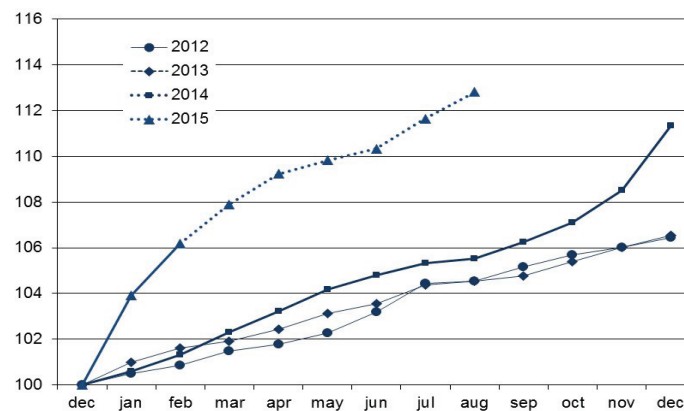
Fig.16. The producer price index for industrial goods
(as a percentage of that in December of the previous year)
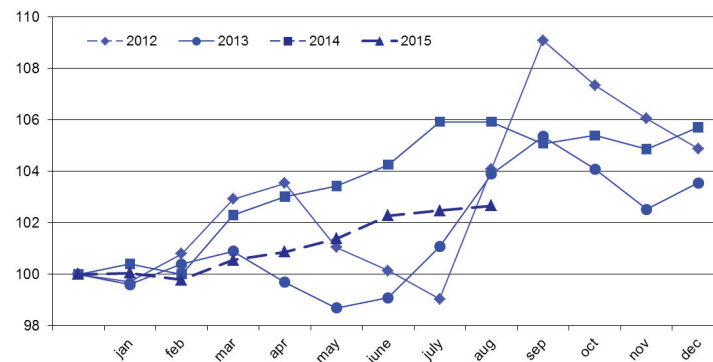
Fig. 17. The price index for mining
(as a percentage of that in December of the previous year)
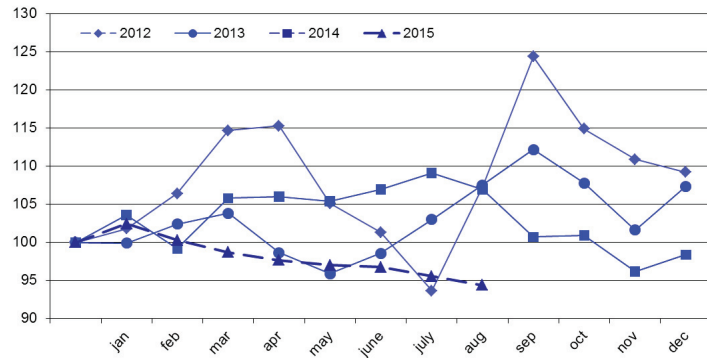
Fig. 18. The price index for manufacturing
(as a percentage of that in December of the previous year)
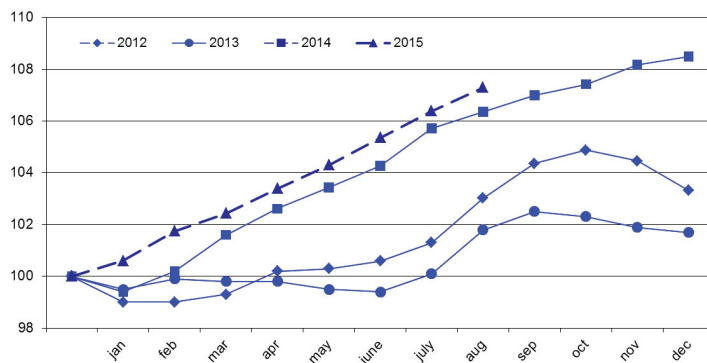
Fig. 19. The price index for utilities
(electricity, water, and gas) (as a percentage of that in December of the previous year)
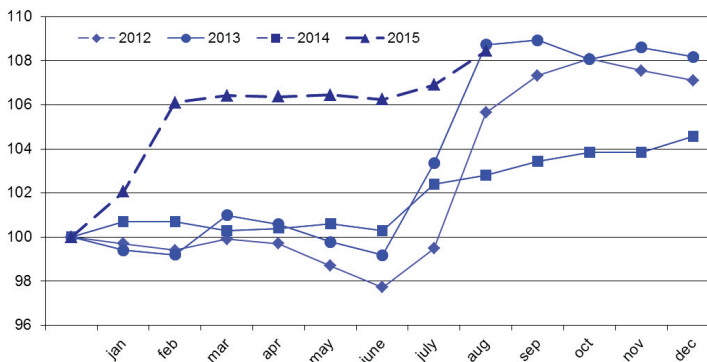
Fig. 20. The price index for food products
(as a percentage of that in December of the previous year)
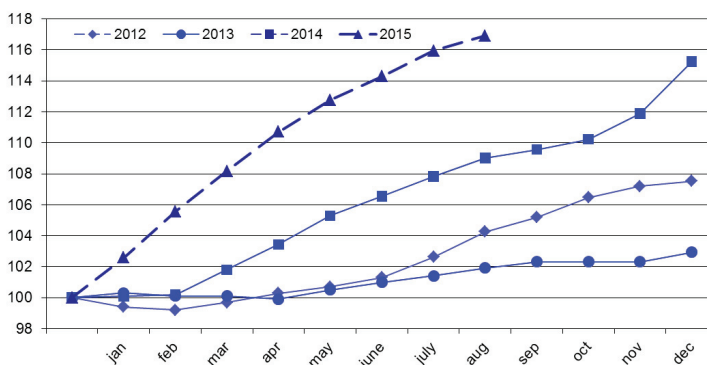
Fig. 21. The price index for the textile and sewing industry
(as a percentage of that in December of the previous year)
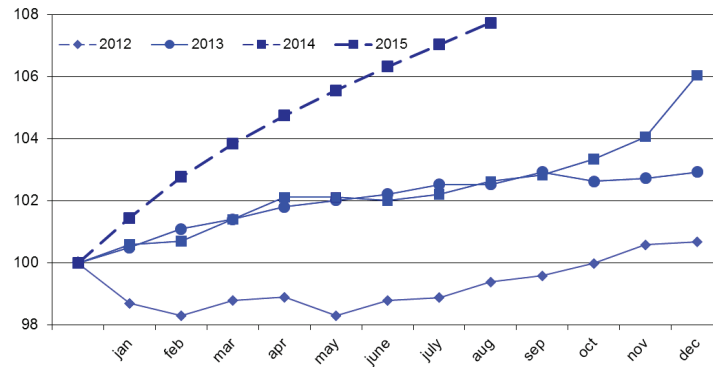
Fig. 22. The price index for wood products
(as a percentage of that in December of the previous year)
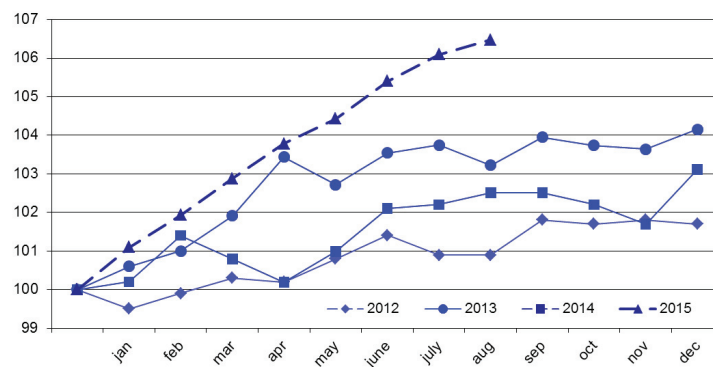
Fig. 23. The price index for the pulp and paper industry
(as a percentage of that in December of the previous year)
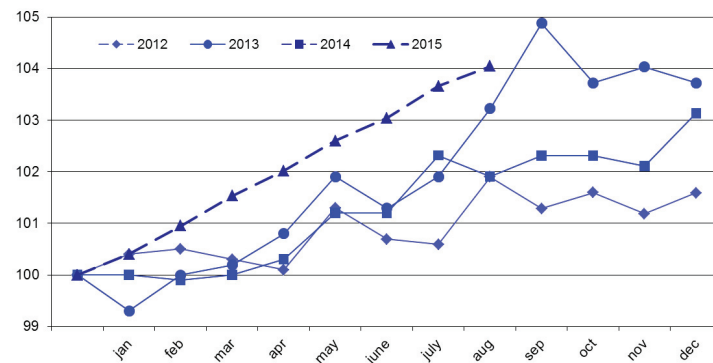
Fig. 24. The price index for coke and petroleum
(as a percentage of that in December of the previous year)
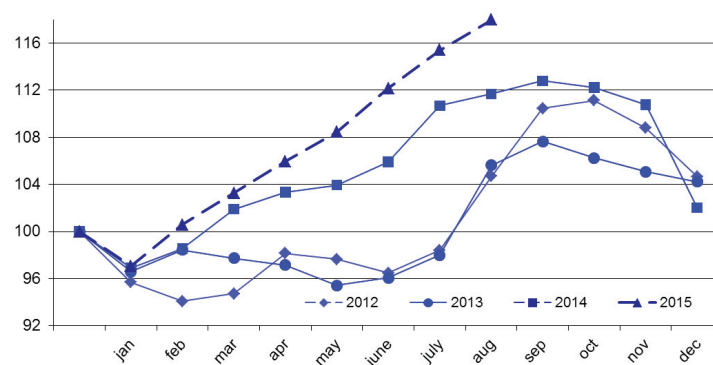
Fig. 25. The price index for the chemical industry
(as a percentage of that in December of the previous year)
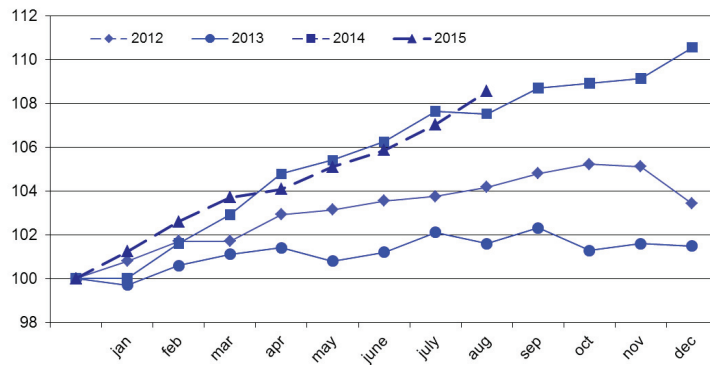
Fig.26. The price index for primary metals and fabricated metal products
(as a percentage of that in December of the previous year)
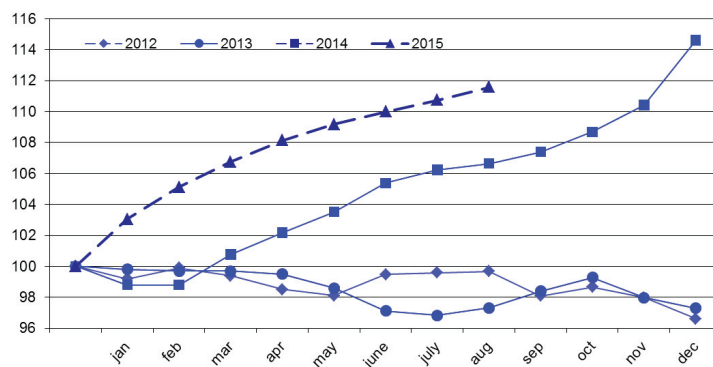
Fig.27. The price index for machinery
(as a percentage of that in December of the previous year)
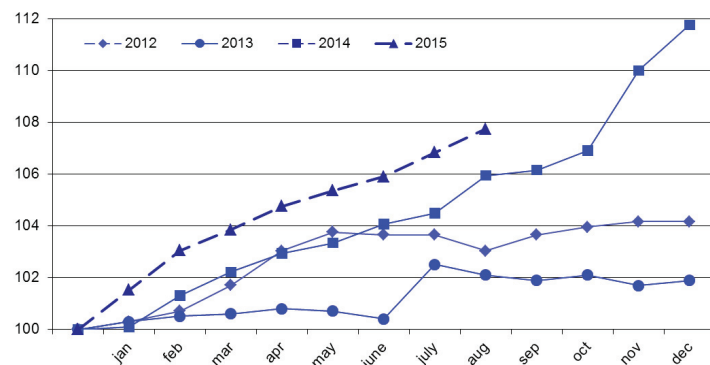
Fig.28. The price index for transport equipment manufacturing
(as a percentage of that in December of the previous year)
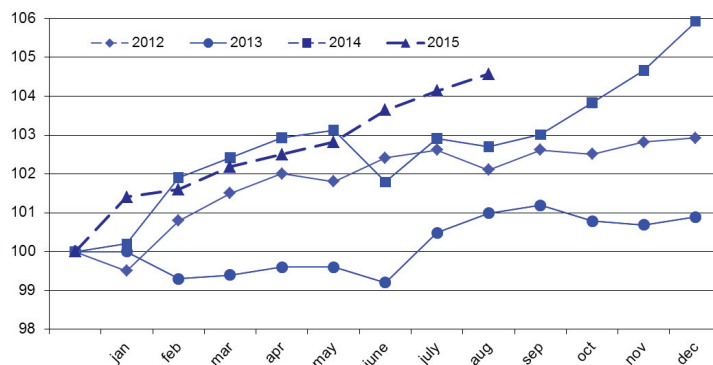
Fig. 29. The cost of the monthly
per capita minimum food basket (Rb)
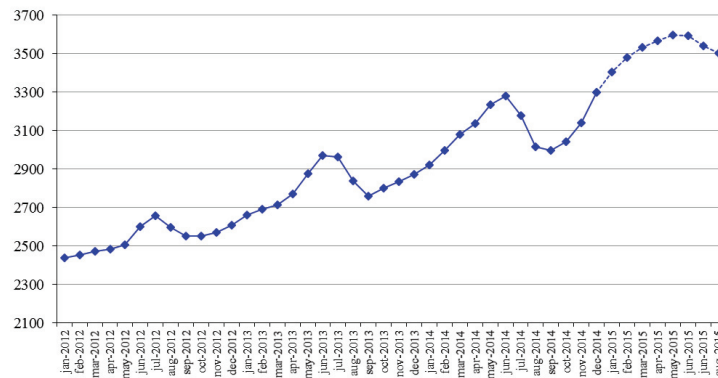
Fig. 30. The composite index of transportation tariffs
(for each year, as a percentage of that in the previous month)
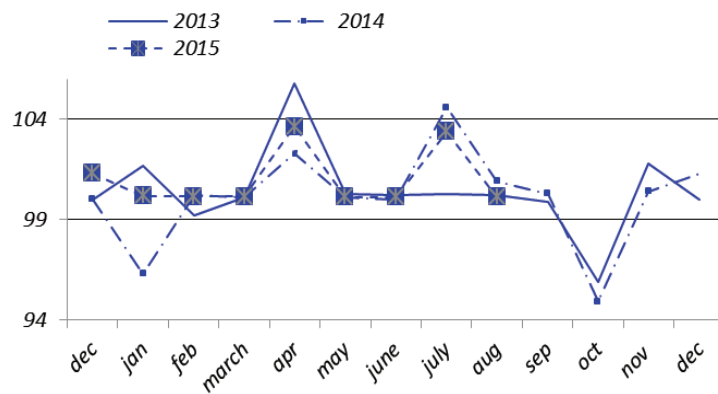
Fig. 31. The index of motor freight tariffs
(for each year, as a percentage of that in the previous month)
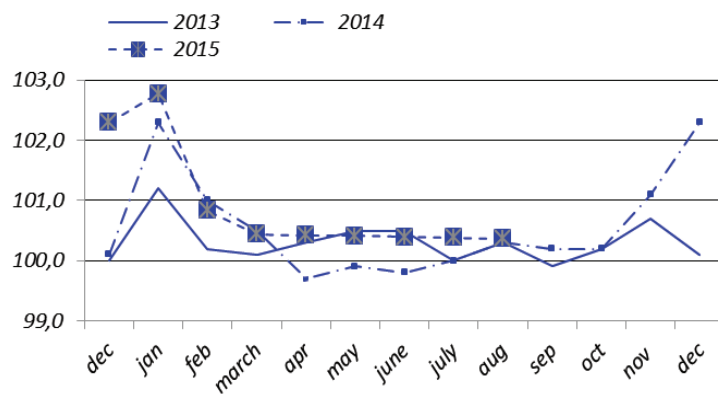
Fig. 32. The index of pipeline tariffs
(for each year, as a percentage of that in the previous month)
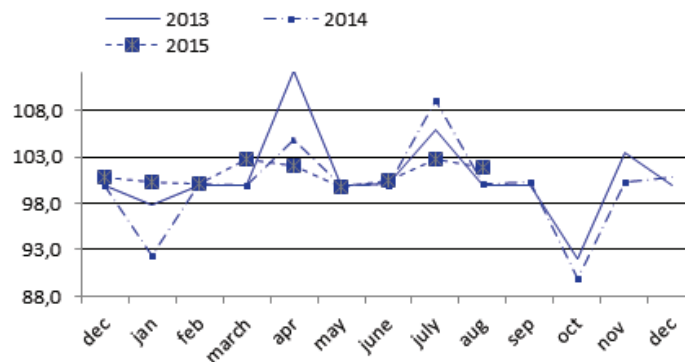
Fig. 33. The Brent oil price ($ per barrel)
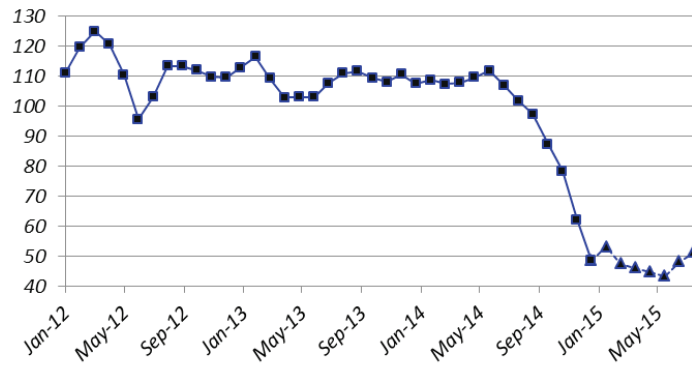
Fig. 34. The aluminum price ($ per ton)
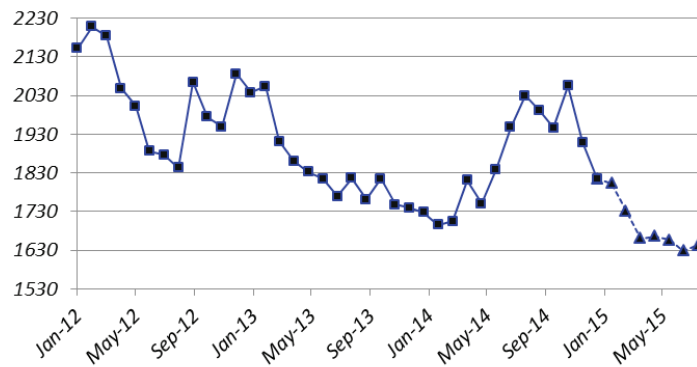
Fig. 35. The gold price ($ per ounce)
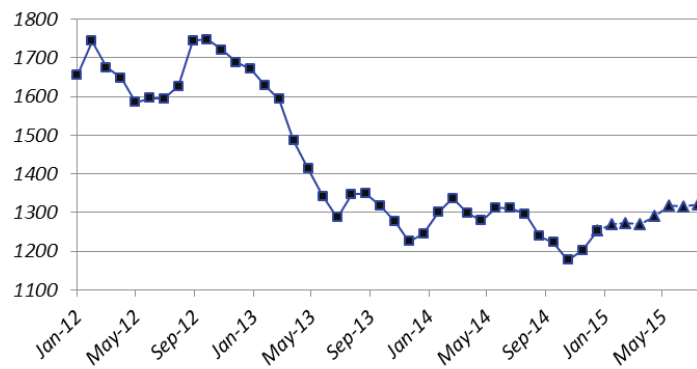
Fig. 36. The nickel price ($ per ton)
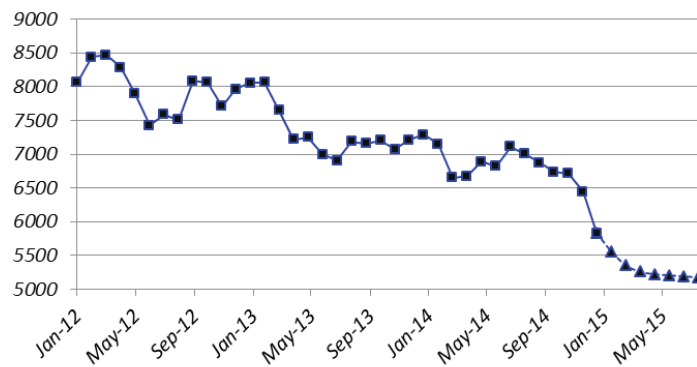
Fig. 37. The copper price ($ per ton)
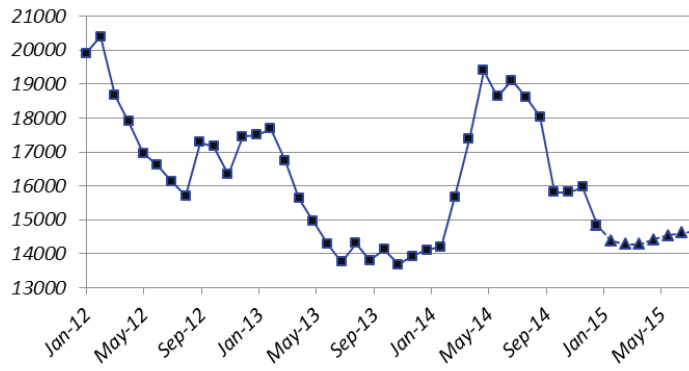
Fig. 38. The monetary base, billion Rb
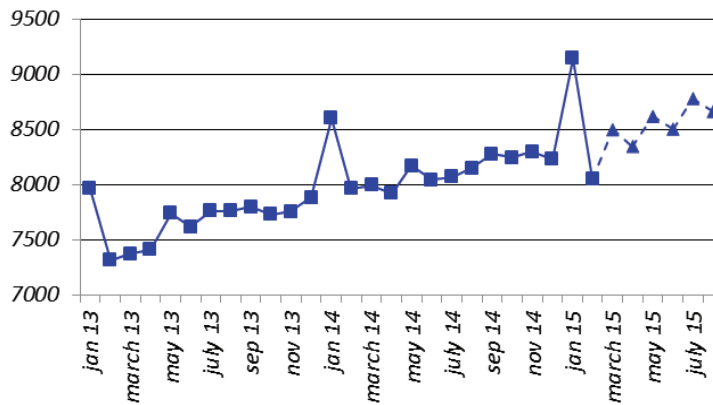
Fig. 39. M₂, billion Rb
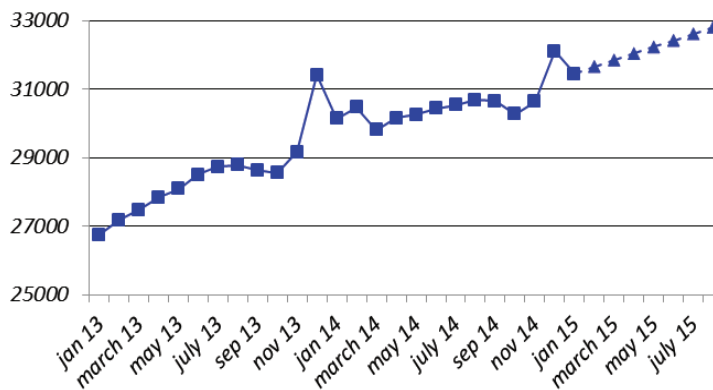
Fig. 40. The international reserves of the Russian Federation, million USD
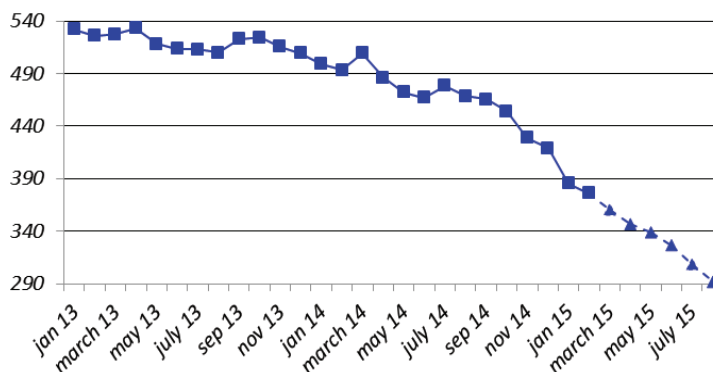
Fig. 41. The RUR/USD exchange rate
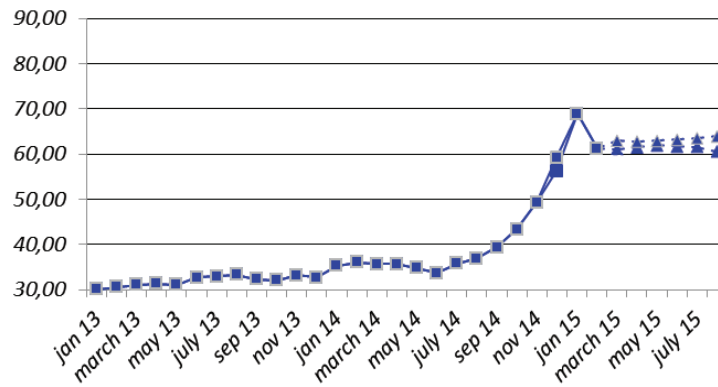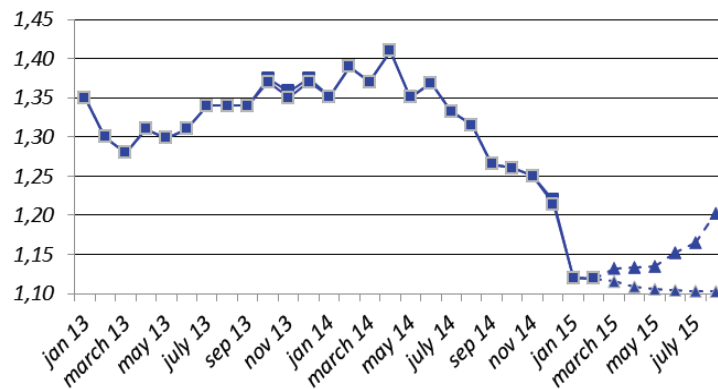

Fig. 42. The USD/EUR exchange rate

Fig. 43. Real disposable cash income
(as a percentage of that in the same period of the previous year)
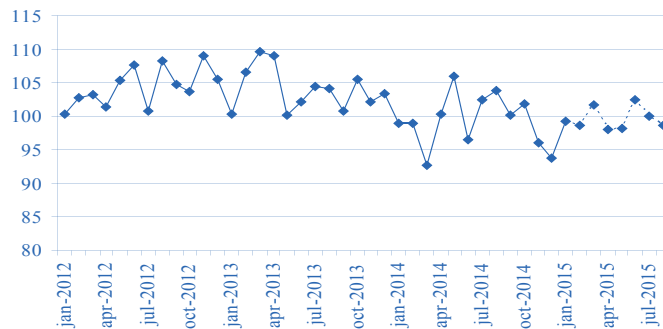
Fig. 44. Real cash income
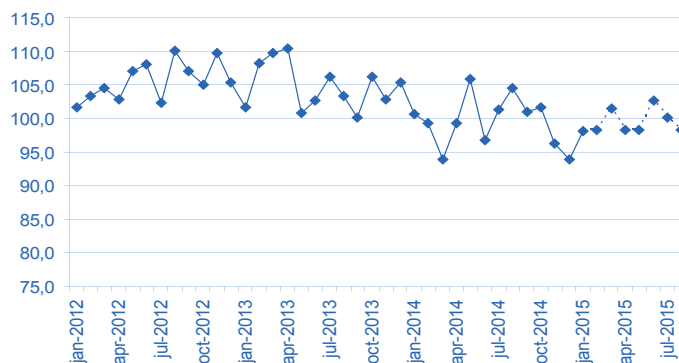*(as a percentage of that in the same period of the previous year)*

Fig. 45. Real accrued wages
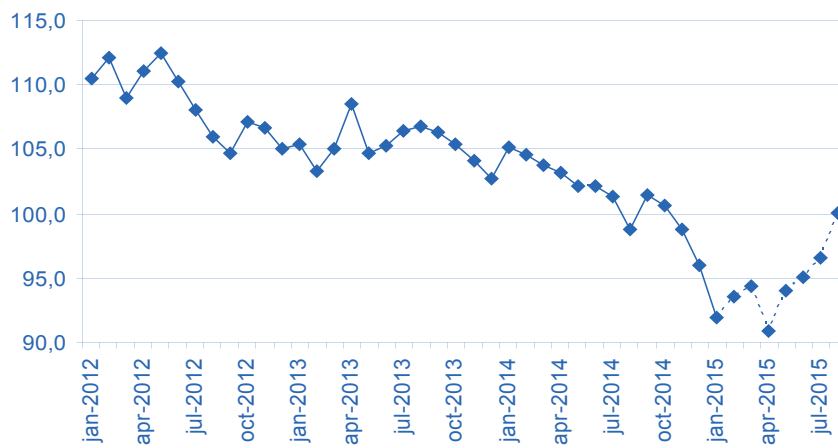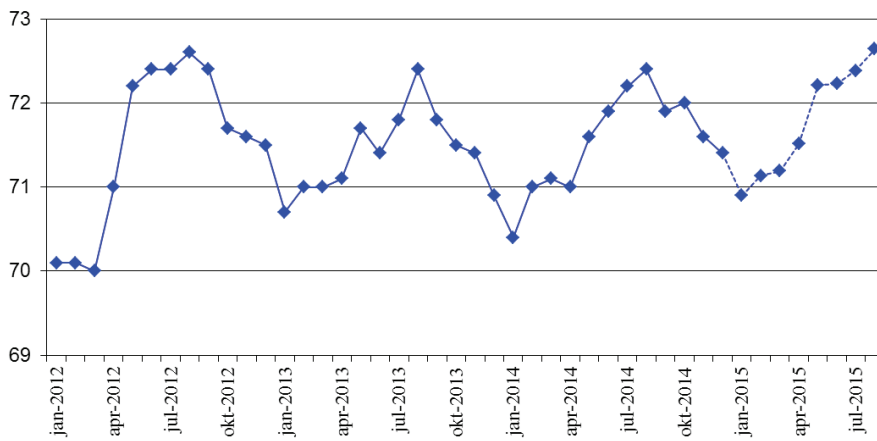*(as a percentage of those in the same period of the previous year)*

Fig. 46. Employment (million people)

Fig. 47. Unemployment (million people)