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Relative Prices as an Instrument of Forecasting of Prices.

The aim of the paper is the presentation of the theory of relative price as a novel tool that allows to estimate goods prices for the future. Relative price are essentially a projection of economy development scenario onto goods price. The proposed tool does not substitute cost-based methods to ground price. It is just another viewpoint on the state of affairs that makes its representation more relief. One of the peculiarities of such a point of view is analysis of price level country-wise and detachment of it into increased, normal and decreased levels.

Keywords: price level, international component, national features, conspicuous features

1. The problem appears.

Since July 1, 2008 the first-rate energetic company of the world -- RAO UES of Russia, which possessed capacity about 200 MW, ceased to exist.

One of aspects of preparation of the necessary argumentation for carrying out the reform was investigation of possibilities for RAO to gain funds for the further development under conditions of government rate regulation. This author was charged with the investigation. Its implementation was divided into two stages. Firstly, based on data of years 1998-2000 a valuation of development of the Holding for years 2001-2003 was conducted. The estimate obtained was called “3+3”. The fundament of the estimate is the idea of guaranteed maintenance of solvent demand of electricity and heat, which coincides essentially with the notion of capacity adequacy [Finon].

The first results according to “3+3” method were published in business journal a affiliated with the government. The main conclusion consisted of the grounds for 2-3 times increase of the nominal electricity rates within 3 years. The subsequent course of affairs has shown that the regulator fixed the tariffs close to 90% level of the values published in the article [Urinson et all].

An elaborated version of the model had years 1998-2002 as its basis and it was computed for the period of years 2003-2008. The new model was called “5+5” that emphasized the extrapolation of methods and style of management, existing in the Holding during the last 5 years, to the next five years.

The new model as well as the previous one represented the process of forming of plan of the Holding for 5 years in each of the three types of activity: operational, investment and financial. The table of cash flows played the role of a test that allowed to judge whether a plan variant was provided with finances or not.

Each element of the cash flows table appeared as a function of key activities of the Holding and nonnegative balance of the cash flow in every year was adopted as a necessary condition for development of the Holding. If this condition did not hold during the calculations the minimal rate increase was evaluated in order to reach equilibrium.

Let us note that given such a formulation of the problem the obtaining of balanced development of the company is a computational procedure: one should find tariff values that make net cash flow nonnegative. This formulation of the problem assumes the Regulator approves automatically the computed solution.

Such systems are usually called man-machine systems. The main factor in these computations is the qualification of experts; the calculations are used to control coordination of opinions and to reveal contradictions among them. This work was able to be fulfilled only due to repeated discussions of the initial assumptions and preliminary computational results with experts of RAO UES. It is important to stress that variants of computations were discussed at meetings of the chairman of the management board A. Chubais with his deputies, department directors and invited academic representatives. The vice-president of RAO UES of Russia Ya. Urinson was in charge of the operational management of the work.

As it was mentioned above an important assumption of the investigation was the automatic approval of the Regulator for the computed solution. It seems to be unreal because for reasons of bureaucratic tactics and proof of dignity the Regulator can not immediately agree with the project of tariff proposed for approval. Understanding of this leads to two consequences.

First, the Applicant presents to the Regulator a deliberately increased project tariff with the expectation the Regulator will certainly decrease it. In the soviet time there was a joke that request for resources looks like a camel with three humps: even if they cut off two humps there still remains one.

Second, the Regulator necessarily decreases the tariff at least in order to demonstrate his authority. But the regulator inevitably faces the question what is the limit he can decrease the rate to, because violation of limits can lead to social protest that adversely affects the career of the person committed the blunder. Since the Applicant has much more possibilities to ground the rate as compared with the Regulator the latter is interested in such methods of price evaluation that equalize him with the Applicant.

The liberalization of the electricity market does not eliminate the problem but restricts the object of regulation; instead of electricity price the object of regulation turns out to be the electricity transmission rate. The Regulator is not the only agency that affects the rate forming. Many things depend on action (or inaction) of the antimonopoly department.

The aforesaid means there is an uncertainty in the rate forming process. Since the ground of the project of rate is based on costs, an alternative viewpoint on the rate is reasonable to build on another basis. Such an alternative viewpoint relies on possibility of a customer to purchase.

Interest of the parties in an independent estimate of the rate is determined by the following. The Regulator is interested in it because it saves him from accusation of subjectivity and thus from necessity to prove his decisions.

A director of an energy company has at least two reasons to be interested in an independent estimate. On the one hand, this estimate can be considered as the lowest limit of the rate that should be achieved. On the other hand, it is a long-term guiding line implemented in the rules of computing the rate, which is expedient in planning of long-term investments concerned with building of new objects and modernization of existing ones. The powerful aspect of this approach consists of the fact it binds the program of development of the company to scenario of economy development. By this reason it can be regarded as some specification of the program of medium-term development of the country and therefore gives a possibility to earn political dividends.

The aforesaid can be completely applied to determination of future prices that is extremely important for competent evaluation of effectiveness of investment projects.

2 The notion of "price level"

The title of the paper refers to the notion of "relative prices" in succession to the title of the original paper [Kossov] where the notion was introduced. Later we shall use the notion "price level" instead because it seems to be more precise.

“Price level” is considered as the quotient of the product price by GDP per capita. It corresponds to the part of GDP per capita that is equivalent to the price of product unit.

Thus,

Price level ≡ (Price)/(GDP per capita) (1)

or else in notation conventions

$$Z \equiv P/Y \qquad (1\text{-a})$$

Let us note that the equality (1) is a definition that the identity sign shows. In [Kossov] the fraction (1) is called “relative price”, GDP per capita is expressed in the current prices (Y) and presents the current state of national economics, usually during the year.

The price level can be expressed as a product of two numbers. One of them is regarded to be a function of GDP per capita in purchasing power parity prices (PPP) and the other one is defined as remainder term. The calculating of the first number by the same rules for all the countries allows to call the first multiplier the international component of the price level.

By definition

Price level = International component x National component (2)

The dependence of price level on GDP per capita (PPP) open up a possibility to use it when grounding future prices. The fundamental assumptions of this approach to evaluation of future prices are the following:

1) people in each country acts rationally so the part of family or organization budget assigned to purchasing of each product including electricity changes naturally in the curse of time;

2) volume of purchased products depends on the income of the customer. It is assumed that the mentioned dependences are properties of the product and do not depend on the country. There can be still several exceptional countries where consumption of the product differs sharply from one of the other countries. For example, this is the case for electricity consumption in Norway;

3) every country has its own features of pricing that should be taken into account when designing the future prices. For instance the gasoline price in the USA is traditionally lower compared with price in Italy.

2.1 Price design – extrapolation of the obtained dependence for estimation of future prices in an individual country.

Let us use the data from Russia to demonstrate the solution to the stated problem. In 2006 GDP per capita in Russia was $12100. Under assumption of 6% growth in 2020 GDP per capita will reach the level of $27400 (in prices of year 2006). The main idea of the method developed is to use electricity price of the countries with current GDP per capita close to $27400 as an estimate for Russia in 2020. In 2006 Korea, South; New Zealand, Spain, Taiwan Province of China, France, Italy, Sweden had GDP per capita (PPP) close to $27000 and can be considered as analogues for Russia in 2020.

The stated assumption allows to show in the Fig. 1 the path of Russia from the past into the future. The future estimate is taken to be the average price among the countries whose GDP per capita (PPP) in 2006 was close to $27000.

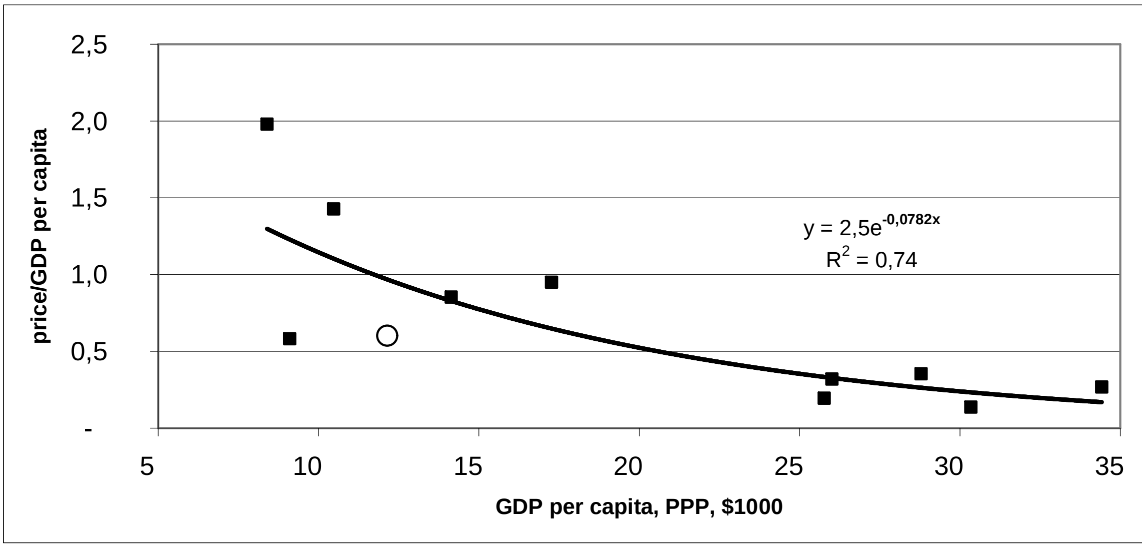

Fig. 1

The position of Russia in 2006 is designated with the circle in the figure. The left part of the graphics where the point of Russia-2006 is situated three countries have GDP per capita (PPP) in 2006 less than GDP of Russia (Turkey, Kazakhstan, Mexico, they lie on the left of Russia) and on the contrary two countries (Poland, Slovakia) have GDP grater than one of Russia (they lie on the right).

The trend line in the figure is interpreted as a path from the past into the future. The negative slope of the graphics is determined by the essence of the dependence: the richer country, the less part of GDP per capita must be spent to a product unit. The value of the trend slope is defined by elasticity (-0,0782x). The scheme of movement from the past into the future can be presented as a two-step consequence:

the first step: movement along the trend from the present (the circle in the figure) towards the five points in the right part of the figure. The last point on the path (on the trend) has GDP per capita equal to $27400. The trend expresses the international component of the price level, i.e. the first multiplier in the left term (2);

the second step: drive down from the highway to the “parking place” which is situated under the mark of $27400. The distance between the highway and the “parking place” is the national component of the price level, i.e. the second multiplier in (2). The main question is the location of the parking relatively the road. Location below the trend shows a decrease of the price level relative to the international component and on the contrary location above the trend shows an increase of the price level. We demonstrate further that Russia as a northern country has the “parking” below the trend. An important conclusion of the paper is ground for remoteness of the “parking” from the highway (trend).

One can measure elasticity using various methods each of them has its own errors. Therefore it is worthwhile to estimate the parameters of the trend with several, preferably essentially different methods in order to avoid blunders.

2.2 Price level models.[1]

In order to decompose the price level into components we need a model. Each model introduces its inherent noise into parameter values. By this reason, confidence in the unbiased estimation of parameters can be gained only if one uses at least two models that differ greatly in construction.

The dependence between price level and GDP per capita (PPP) is shown in Fig.1. One can see in the graphics that the dependence is not linear. Therefore the models, which have prices as dependent variables, use logarithms of the indices. An important specific of such models is interpretation of regression coefficients of independent variables as elasticity of the price by variables of the model.

As independent variables of the model due to preliminary observation results GDP per capita (PPP) (denoted by V) and the share of electricity generated by hydroelectric power plants in the whole electricity consumption capacity (denoted by Hyd) were selected.

In order to eliminate randomness in estimation of parameters data over several years and two models were used:

1) an ordinary linear regression which data belong to one year. The model has two groups of variables. The center of the first group is GDP per capita. The second group consists of dummy variables which are introduced in the procedure of parameter estimation in order to achieve the utmost adjustment of parameter values to original data. For the countries that have standardized residue with absolute value grater than 2, one introduces a dummy variable which has absolute value equal to 1 and the same sign as the standardized residue. Such dummy variables take upon themselves conspicuous features of electricity price level peculiar to some countries (further – conspicuous features). The fact the conspicuous features exist can be observed in a graphics like Fig.1 as a sufficient deviation of a point (price level of a country) from the trend. Regression parameters calculated for different years are independent one from another. Simple linear regression has no memory that make the estimation of parameters extremely flexible. The computation results for each year are similar to a freeze frame; every next frame has no connection with the previous one. Later on we shall refer to this model as model A;

2) a panel as a estimation of model parameters for the whole time interval under consideration rather then for one separate year as in the previous case. Such a model is called a panel. In the panel one should add the time variable to the variables of the first group of the model A. The second group is presented by dummy variables that absorb conspicuous features which are assumed to be constant for each country during the whole time interval. Such an assumption is too strict and excludes variation of conspicuous features within the period under

[1] My colleague I.Nikonov has conducted at my request an investigation concerning the models used in long-term forecasting of electricity prices. One can divide these models into three main groups [Niimura, Li et al.]: equilibrium analysis model [Garces et al.], statistical models [Bunn] and simulation models [Angelus]. In equilibrium analysis models the price appears as the result of parity between electricity demand and supply. They exploit game theory methods to predict bidding behavior and market power. Statistical models are founded on statistical analysis of available data on the electricity price and related factors. They split into time series models (ARIMA, GARCH etc.), econometric models and nonlinear models that include neural networks and chaotic models. Simulation models construct a model of the power system, which represents all main elements and connections of the system, and imitate performance of the system. The models A and B described below in the section belong to statistical econometric ones. Borison [Borison et al] have presented system of calculations of the prices for the electric power in the future, using all accessible information.

review. In order to loosen this rigidity it is permitted to include dummy variables along the same principles as ones of the model A.

The panel with fixed effects looks like this

$$Z_{it} = [\alpha_1 V_{it} + \alpha_2 Hyd_{it} + \gamma_t T + b] + (\beta_i C_{it} + \varepsilon_{it}) \quad (3)$$

where the underline indices refer to countries (i) and years (t = 2000 -2006) This model gives a linear regression when $\gamma = \beta = 0$ that allows to conduct computations for each single year. The variables in the square brackets are common for all the countries and the variables in the round brackets are specific for individual countries.

In (3) **Z , V** and **Hyd** are correspondently logarithms of electricity price level, GDP per capita and the share of electricity generated by hydroelectric power plants in the whole electricity consumption amount in the country during the year;

T is a year variable, (t =1 in 2000 and t =6 in 2006;

C is a dummy variable which reflects conspicuous features of the countries, it is fixed before the calculations and its value is determined by stepwise regression. In a simple regression such a variable appears during calculations if a country has absolute value of the standardized residue greater then two. In the panel (model B) the variable is fixed. The choice of countries on which it has nonzero values is made by an algorithm of stepwise regression. Besides the variables C the model can also include dummy variables that absorb conspicuous features of particular countries in particular years;

α_1 is the elasticity of price level by GDP per capita (PPP). It shows how the changes in economy scale affect the price level. The value of the elasticity is negative: with the growth of economy scale the product becomes more disposable for customers;

$\boldsymbol{\alpha_2}$ is the impact of the share of electricity generated by hydroelectric power plants on the price level. It shows how many percentage points will be the price level change if the share of hydroelectric power plants changes by one percentage point in the opposite direction. By implication the parameter is negative because the electricity generated by hydroelectric plants is the cheapest,

$\boldsymbol{\gamma}$ is the autonomous growth rate of the price level in the course of time. We shall show later that it is determined by oil price dynamics in the world market;

$\boldsymbol{\beta}$ is a conspicuous feature which is a correction of the absolute term b. The correction reflects the peculiarity of the national policy in electricity price regulation. It is positive if the price level exceeds the average level defined by the trend value written in the square brackets in (3) and it is negative otherwise. Detection and insight in national features of countries in electricity pricing are important conditions for estimation of future prices;

ε_{it} is a random variable.

The expression in the squared brackets is a trend which is common for all the countries. It defines the international component of the price level. The expression in the round brackets is the national component. It consists of two parts: conspicuous features of the country ($\beta_i C_{it}$) and a random component (ε_{it}). For estimation of future prices it is important to assign dynamics of national features to indices which would allow to construct an external estimate of the national component for the future.

2.3 Parameters values

All the input data were taken from internet sources. Retail electricity prices in all the countries except Russia were taken from [EIA 2007]. Since this source contains electricity prices in Russia only over years 2001-2003, the data on electricity prices in Russia were obtained from [Ceni], the series embraces years 2000-2005. The price in 2006 was estimated according the data of its expected growth published by the director of economical policy department of RAO I. Kodzukhovski [Kodzukhovski 2006].

Примечание [NI1]: Желательно было бы пояснить значение индексов *i* и *t*.

Примечание [NI2]: С формальной точки зрения, нужно приравнивать нулю коэффициенты при данных переменных, а не сами переменные, потому что, например, равенство 2000г. = 0, соответствующее переменной T0, никогда не выполняется.

Немного неожиданно, что из линейной модели исключается переменная по выработке гидроэлектроэнергии.

Примечание [NI3]: Нельзя ли вместо семи фиктивных переменных использовать одну переменную – время?

Information on GDP per capita in three dimensions: in current prices in national currency, in USD with conversion from national currency according to the market exchange rate and to purchasing power parity,– was taken from [Econstat].

The share of hydroelectric power plants in electricity consumption was obtained as the quotient of the consumed hydroelectric power by the whole amount of the consumed electric power [EIA 2005]. For year 2006 the data of year 2005 were used.

The results of estimation are presented in Table 2. Bold type marks out the parameter of the international component of the retail electricity price level.

Both models have good fitting to the input data that is shown by determination values which are usually greater than 0,9. It means that the independent variables of the model explain at least 90% of differences of electricity price level among the countries. A high value of determination is important for selection of conspicuous features with the most completeness.

The greatest differences between the models A and B relate to presentation of conspicuous features of countries. In the model A the number of countries with conspicuous features appears to be less than in the model B.

In the table 1 the only countries that have conspicuous features in model B are shown. Empty cells for the model A indicate that in this model conspicuous features for the corresponding countries weren't detected.

Table.1 Regression coefficients of the models A and B

	Parameter estimates for different years, model A							Panel, model B
	2000	2001	2002	2003	2004	2005	2006	
Absolute term	**3,84**	**4,11**	**4,02**	**4,12**	**4,37**	**4,66**	**3,69**	**4,13**
Ln V	**-1,68**	**-1,78**	**-1,72**	**-1,73**	**-1,82**	**-1,86**	**-1,55**	**-1,80**
Ln Hyd	**-0,05**	**-0,06**	**-0,06**	**-0,06**	**- 0,06**	**-0,07**	**-0,10**	**-0,04**
T								0,07
Adjusted R^2	0,93	0,92	0,9	0,93	0,98	0,94	0,89	0,99
Chin Taiwan					0,46			0,31
Czech Rep								0,22
Finland								-0,20
France					-0,32	-0,47	-0,81	-0,45
Germany								-0,09
Greece								-0,24
Hungary								0,13
Ireland					0,46	-		0,39
Italy	0,80	1,13	1,04	1,09	1,13	0,81		0,85
Japan	0,56	0,66	-	-	0,58	0,47		0,49
Kazakhstan	-1,03	-1,13	-1,04	-1,09	-1,13	-1,41	-0,81	-1,37
Mexico								-0,37
New Zealand								-0,36
Norway	-1,03							-0,41
Poland								-0,24
Portugal					0,32			0,25
Russia	-0,78	-0,66		-0,52	-0,58	-0,81		-0,74
Slovak				0,52	0,58			0,33
South Africa	-0,80	-1,02	-1,04	-1,04				-1,03
Spain								-0,16
United Kingdom								-0,21
Dummy								0,20

In the table 1, as it was mentioned above, bold font marks out the parameters which are used in computation of the international component. The comparison of the mean values of the regression parameter for the model A and the corresponding values for the model B shows they are sufficiently close to each other. The most noticeable divergences in conspicuous features estimation belong to two countries – Germany and Norway.

The equations of the models A and B have a remarkable form: a positive absolute term and negative (elasticity) coefficients before Ln V (GDP per capita). It means there exists some virtual value of limiting price (when GDP is near to zero) which decreases if the economy growth. In power industry this process intensifies with the share of hydroelectric power plants in electricity generation whose elasticity is also negative and is of lower order compared to the elasticity by GDP. The gap between the elasticity's demonstrates the auxiliary role of hydroelectric power plants in explanation the differences of the retail electricity price levels among the countries. Decrease of price level lead to increase of demand on the product that reveals in growth of consumption per capita. The decrease of price becomes slower with the growth of economy scale which confirms by positive elasticity of the price level by the time. The reason for such a braking is the rise in price of the fuel that follows the growth of the oil price which has a strong correlation with the time variable in the period under consideration.

The general conclusion from the fulfilled analysis is the fact the both models leads to practically identical results regarding the extraction of the factors that determine differences in retail electricity price levels among countries.

2.5 National components.

Review of conspicuous features over the countries

The conspicuous features of countries fixed by dummy variables of the models form the basis for calculation of national components of the price levels. The distribution of conspicuous features of countries for the model B is presented in Table 2 which simultaneously serves as a histogram of the distribution and shows the place of each country in the whole data array of conspicuous features of all the countries.

The two upper rows denote respectively the upper and the lower limits of the interval of the group of countries. The arguments for this choice of limits will be given below. In the third row the size of the group is cited. For better visibility every country is not repeated seven times (for years 2000-2006) but is shown once. The number of years the country falls in the group is written after the name of the country and is separated from it by a space. If the number is not separated by space from the name of the country it denotes the last figure of the year. Five of the six such countries lie in the last group. Some names of countries are given in abbreviated form. Bold fonts mean northern countries.

Table 2 Distribution of logarithms of conspicuous features

Up	-0,64	-0,36	-0,1	0	0			0,048	C		
Down		-0,64	-0,36	-0,1	0			0,334			
N	18	28	32	6	58		1	38			
1	Kazak-7	**Norway-7**	Poland 7	Germany-6	Australia-5	Romania-6	Spain6	Hungary-7			
2	S.Africa-4	Mexico 7	Greece 7		**Canada-5**	Switz-6		Ireland0			
3	**Russia-7**	France-7	UK-5		Denmark-5	Thailand-5		Switz0			
4		NZea- 7	Spain- 6		Korea, S - 6	Turkey-6		Turkey2			
5			**Finland-**		Denmark-	USA-7		Czech-7			

			6		5						
								Portug-7			
7								Taipei-7			
8								Slovak-7			

The center of the distribution was formed of the countries without conspicuous features. Such countries count about 25% of the total number of observations and they are situated in two columns. Germany and Spain join directly to the center because they have the lowest conspicuous features in 2006 so one can add them to the group without conspicuous features.

One of the main peculiarities of the distribution of conspicuous features is a drift in the negative direction: among 199 observations there are 83 negative values and 56 positive. It indicates that the conspicuous features are much more often used by the authorities in order to decrease the price level rather than to increase it. This fact is especially evident for the ends of the distribution: the extreme groups contain respectively 18 and 6 observations and the previous ones contain 28 and 0 observations.

Another peculiarity is for the northern countries (Russia, Norway, Finland). They all lie in the left side of the distribution.

National components (NC).

National components are the coefficients of the transformation of the international component into the price level.

For each country the logarithm values of the national components are sums of two summands:

- a random variable that is determined after using the least square method for estimation of the parameter of the model. By this reason it is of fundamental importance to obtain the maximal possible value of adjusted determination. The random variables have zero mean value and normal distribution;
- deterministic variable formed by dummy variables. Since the values of national components used in the analysis were received from a statistical data processing they inevitably depends on the model used and have some inaccuracy. Therefore the absence of conspicuous features takes place not only when the national component is equal to 1 but when it lies within 10% limit from 1, i.e. on the interval from 0,9 to 1,1. Keeping 20% step for the further analysis we get seven groups of the distribution of the national component of the price level.

Table 3 Groups of national components.

	Name of the group	Absolute value		Logarithms	
		below	upper	below	upper
A	Extremely low price	less than 0,5		less than -0,69	
B	Low price	0,5	0,7	-0,69	- 0,36
C	Reduced price	0,7	0,9	-0,36	- 0,11
D	Normal price	0,9	1,1	-0,11	0,10
E	Advanced price	1,1	1,3	0,10	0,26
F	High price	1,3	1,5	0,26	0,41
G	Extremely high price	more than 1,5		more than 0,41	

The classification constructed was used for analysis of results, obtained for retail electricity prices in the models A and B, which were summarized in table 4. The table contains data of year 2003 which is the last year we have data for all the countries included in the analysis.

Table 4 Group distribution of countries in 2003

Group	model A	model B
A	Kazakhstan, South Africa	Kazakhstan, South Africa
B	Mexico, Russia	Russia, Mexico, France, United Kingdom
C	France, Greece, New Zealand, Norway, Spain, United Kingdom, Poland	New Zealand , Greece, Norway, Spain, Poland, Korea, South
D	Cyprus, Australia, Denmark, Finland, Korea, South; Canada, Germany	Finland, Germany, Australia, Cyprus, United States, Canada, Switzerland, Romania, Denmark, Thailand, Turkey
E	Romania, Hungary, Switzerland, Thailand, Turkey, Czech Rep.	Czech Rep., Hungary, Portugal
F	Portugal, Taipei	Taipei , Slovak , Ireland , Japan
G	Ireland, Italy, Japan, Slovakia	Italy

The main conclusion from the presented lists is that the countries, which lie in the same row according the model A, are situated also in the same row or in the neighbor row in the model B. Such a location of countries is evidently not causal.

In both cases Russia belongs to group B as a country with low price level.

It should be mentioned that none of the northern countries (Canada, Finland, Norway and Russia) sinks lower than group D. The reason for the discovered rule is the geographic position of the northern countries and therefore a higher consumption of energy including electric one. In order to compensate inevitable over expenditure of electricity the government has to keep reduced energy prices and first of all prices of everywhere used electrical energy. The ground of this policy is realization of rent through reduced electricity price. In western countries, except Finland, the source of the rent is a higher share of electricity generated by hydroelectric power plants. In Russia the rent is formed due to low natural gas price for the power plants. The price in Sweden is lower than prices in neighbor countries and two times less than prices in Germany. By these reasons the national component of the price in Sweden can be only noticeably negative [Swedish]. Thus, the Swedish data confirm the negativity of national components for northern countries. The cause of such a consensus is explained by the fact the reduced electricity prices allow to support competitiveness of the national economy compared to countries located in more comfortable climate.

The analysis conducted permits to conclude that concerning the values of national component of the retail electricity price level in Russia till year 2020 there is no argument to suppose that they can be positive.

3. Retail electricity price design in Russia for the future

We base the retail electricity price design on the forecast of Russian economy development till 2030 prepared by the Institute of national economic forecasting of Russian academy of science [Longterm]. The obtained result is used in comparison with the design of retail electricity price till 2011 published by the Ministry for economic development (MD) [Vedomosti]. We come to a conclusion that the latter estimates are overpriced.

The algorithm of computations of the future prices is implemented in Table 5. The bold font marks out the facts, the bold italic type marks out the coefficients for calculation the international component of the price, they were taken from Table 2. In order to make the table more compact only a part of the table is drawn: years 2006-2011, which are used for comparison the result with the forecast of MD, and year 2020.

The first column contains the retail electricity prices: the actual prices for years 2000-2006 (bold font) and the prices which follow from the published indices of price growth in years 2007-2011.

The column 2 contains the values of GDP per capita (PPP) according to [Longterm, tab.11].

The column 3 holds the values of GDP per capita in current prices taken from [Longterm, tab.11] .

The column 4 presents the share of hydroelectric power extrapolated according to the existing tendency.

The column 5 contains the logarithms of the international component. The component was calculated by the panel equation of Table 2 with the coefficients taken from the head of Table 5.

The column 6 contains the logarithms of the national component Ln(Col.1/Col.3)-Col.5. The values for years 2007-2020 are determined on the assumption by 2020 they should increase to the level -0,1 which accepted as the maximal value for a northern country. Approaching to the maximum is supposed to be proportional to the number of the years remained (Column 9). In order to calculate the values of the national component for years 2007-2020 the coefficient by Col. 9 is quoted in the last row of the column 6.

The column 7 holds the calculated values of logarithms of the retail electricity price level, Col.7 = Col.5+Col.6.

The column 8 presents the calculated retail electricity price level – virtual values of price level, Col.8 = Col.3*exp(Col.7) .

The column 9 shows the number of the years remained until 2020.

The column 10 contains the national component corresponding the Russian government's suppositions of electricity prices growth, Col.10=Ln(Col.1/Col.3) - Col.4.

Table 5. Algorithm of computation of the future prices.

Coefficients										
T	***Abs. term***	***Ln V***		***Ln H***		NC 2020=				
0,070	***4,130***	***-1,8***		***-0,042***		-0,10				
Year	Price	GDP (PPP) $ ths	GDP curr. ths rubles		Ln Inter	Ln NC	LN Z	Virtual prices	Years remains	Ln NC, MD
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
2006	**102**	**12,1**	**170**	22%	0,20	- 0,71	- 0,50	102		
2007	115	13,1	189	23%	0,13	- 0,62	- 0,49	115	13	
2008	134	14,2	221	24%	0,06	- 0,54	- 0,48	136	12	0,12
2009	169	15,3	255	21%	- 0,01	- 0,47	- 0,48	159	11	0,10
2010	206	16,5	291	23%	- 0,07	- 0,40	- 0,47	181	10	0,07
2011	243	17,9	331	21%	- 0,15	- 0,34	- 0,49	203	9	
2020		37,1	919	21%	- 0,82	- 0,10	- 0,92	365		
						0,006664				

The results of the design of the retail electricity price level of Russia compared with the actual data for the northern countries (Canada, Finland, Norway, Russia) denoted as Past, are given in Fig. 3. The top-down order of the countries is the following: Russia, Canada, Finland and Norway. The actual data pictured as empty squares lie practically on one line. This trend line corresponds to the passive forecast for Russia (Pas Rus) calculated for GDP values of years 2007-2020 taken from the column 2 of Table 3.

Ошибка! Ошибка связи.

Fig. 3

Int Rus is a projection of economy development onto retail electricity price under assumption the national component of Russia varies strongly. The projection (black triangles) differs essentially from the existing trend and implies the policy of considerable changes of electricity prices in Russia. Such a policy needs to be carefully argued with estimation of the possible consequences. The filled circles present the logarithms of the retail electricity price level according to suppositions of the ministry of economic development (MD). The graphics shows these points are practically perpendicular to the existing trend.

Turnings at right-angle in the policy of economic development lead inevitably to severe shocks. Therefore before the implementation of such changes one must evaluate the possible risks. The answers are needed at least to the following questions:

1) what is the reason for such an abrupt increase of the retail electricity prices. The reference to necessity of considerable investments in the energy industry seems not to be convincing because one can increase the gain by means of reduction in taxes instead of increasing in prices;

2) why one should obtain reducing of energy consumption through increase of the prices and thus speed up inflation if the same goal can be achieved with the aid of tax on greenhouse gas emission? In every case the noticeable effect will appear only after consumers replace the equipment, i.e. in a number of years.;

3) what is the compensation of the industries affected by this price increase? Without compensation the rise of social tension is inevitable;

4) among northern countries only Canada has the retail electricity price level similar but still less than the level predicted by MD. Why other northern countries are not in a hurry to reject the reduced retail electricity price level?

And finally the last question. Does the idea of drastic increase in energy prices and in particularly in electricity prices appear to be a trigger of a new revolution Russia’s got very tired with?

3.1 Estimation of future prices and project estimation.

The analysis fulfilled for the future electricity prices in Russia demonstrates the essence of the problem which prices are reasonable to use for calculating the cash flows when evaluating investment projects. One can propose three possible solutions:

1) rely on prices corresponding to plans of the government. As the calculations show these prices will be high which promise considerable revenue. The question is whether the prices can be actually achieved?
2) rely on the international component of the price (Col.3 x exp(Col.5)).;
3) produce an estimate of the future prices therefore it is important to determine the value of the national component, column 8.

For the reasons clear from the figure 3 it is meaningless to follow declarations of the government, the history of Russia (and the USSR) provides many confirmative examples for this rule. The significance of declarations of the government is that they allow to get some ideas about the directions of the economic policy and to check the investment project does not conflict with them.

The orientation toward the international component of the retail electricity price level assumes the invariability of the national policy concerning the electricity prices that is obviously not the case for Russia nowadays.

The most preferred solution uses a reasonable conjecture about changes of conspicuous features and calculates the electricity price taking into consideration this changing value of the national component.

Main results and problems.

The notion “price level” is a useful tool for estimation of future prices. These estimates are an important supplement to cost-based forecast of prices. The dependence of price level on economic development is a prerequisite for using this tool in computations related to future prices. The essence of this dependence becomes clear by processing of data of a group of countries that have considerably different GDP per capita.

The model of price level is a linear regression binding logarithms of the parameters. The main independent variable is GDP per capita (PPP). Inclusion of other variables such that the share of hydroelectric power allows to improve the exposure of information for such countries as Norway where almost all electric energy is produced by hydroelectric power plants. The regression coefficients of the variables are elasticity indices which show the reaction of the price level when the variables change. The calculations have shown that the price level is quite sensible to the economy growth, the value of the regression coefficient -1,8 indicates price reduction that surpass the rate of economy growth. The conspicuous features of countries in forming of the price level are absorbed by dummy variables. A panel with fixed effects allows to reach the level of determination about 0,9.

National component of the price level is defined as a quotient of the price level by the international component. The presence of conspicuous features in the national component makes the binding between them and the distinctive features of countries of great importance. Understanding of this connection is important for estimation of future values of the national component.

Estimation of parameters of the regression equation that connects the price level with GDP per capita (PPP) is just a necessary condition for forecasting the future prices. A sufficient condition is a scenario of economic development that considers the product price as its illustrations.

Inertial forecasts worked out by authoritative institutes allow to use the price projections constructed from them as some kind of test that examines another assumptions concerning prices. These assumptions can sufficiently differ from the test, in this they must be supported with a plan of actions that should be undertaken in order to dampen the risks appeared after a drastic structural shift caused by the anticipated radical changes of prices.

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GDP based on PPP per capita GDP	PPPPC	US dollars
GDP per capita, current prices	NGDPPC	National currency
GDP per capita, current prices	NGDPDPC	US dollars

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