Секция «Методологические проблемы современной экономики»

The currency rates time series analyses

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This work is about (USD/RUB, USD/EUR, USD/CAD, USD/GBP, USD/CNY, USD/JPY) world currency pairs quotes nonstationary time series regularities and interrelations analysis with nontraditional correlation mining usage. Multiple generalizations of modified and adapted correlation indexes are used with assistance of information entropic approach. Data analysis is achieved and it is much more detailed than in classic theory. The subject for study is global foreign-exchange market represented by certain time series - currency quotations. The work main goal is to find out and detect development and structural economic changes tendencies. The actuality of the topic is conditioned by the fact that nowadays most economists use classic correlational analysis for admittedly nonsteady processes and it leads to false results. In the work six currency rates data in relation to the American dollar (USD) are taken in the capacity of statistics base: Russian rubble (RUB), euro (EUR), Canadian dollar (CAD), British pound (GBP), Chinese yuan (CNY) and Japanese yen (JPY). Pic 1. statistics base For the time series couples correlational relationships analysis we are to calculate three indexes: The first one is normalized autocovariance function of relation – correlation index calculated by the recurrence way.

$$r = \frac{\sum_{i=1}^{n}(x - \overline{x})(y - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x - \overline{x})^2 (y - \overline{y})^2}}$$

The next one is modified index of correlation.

$$r_{mod} = \frac{\sum_{t=2}^{n} \triangle x_{1t} \triangle x_{2t}}{\sum_{t=2}^{n} |\triangle x_{1t} \triangle x_{2t}|},$$
$$\triangle x_{it} = x_{it} - x_{it-1}, \ i = 1, 2.$$
$$-1 \le r_{mod} \le 1.$$

With the sample period broads changes range deviations varying not only in degree but in sign will be equal to the same periods of time and with the same statistics observation. It appears that the r index shows the connection between two ranges deviations from the process middle levels but not between the ranges. Modified index of correlation allows to estimate direct and negative correlation existence at the moment t thanks to congruence and incongruence of targeted variates growth signs. The last one is adapted index of correlation showing the correlation index movement over time.

$$r_t(\alpha) = \frac{s_t}{d_t},$$
$$s_t = (1 - \alpha) s_{i-1} + \alpha(\triangle x_{1t} \triangle x_{2t}), \ t = 1, 2, \ldots, T.$$
$$d_t = (1 - \alpha) d_{i-1} + \alpha |\triangle x_{1t} \triangle x_{2t}|, \ 0 < \alpha < 1.$$

Multiple generalizations of modified and adapted correlation indexes are calculated for structural changes in the world economics. Because correlation index is the time function that can be used for correlation relations analysis of phenomenon considered over the time. Pic.2.

Comparative analysis of correlation indexes Comparative analysis of correlation indexes shows modified index special sensibility however adapted index is much more sensible. Traditional index dynamics is represented by essentially smoothed graph that prevents data qualitative analysis. Using nontraditional indexes for structural changes analysis in the world economics the indexes show their effectiveness (pic.3). The adapted index clearly demonstrated eight serious periods in the world economics. The index showed not only crisis events but reacted on modest rates of economics rebuilding during the postcrisis years. Modified index shows more general picture and showed four serious periods. Pic.3. Rmod Vs. Rt The observes approaches united by the common name 'nontraditional correlational analysis' give an opportunity to get much more detailed information about variates relations. The data is more detailed than in the classic theory. The approaches open new perspectives in the complicated dynamical systems analysis.

Источники и литература

1) The Most Powerful Datasets in the World Live on Quandl // Quandl URL: https://www.quandl.com/ (дата обращения: 13.01.2018).

2) Lukashin YU. P. Adaptivnye metody kratkosrochnogo prognozirovaniya vremennyh ryadov. M: Finansy i statistika, 2003. 413 s.

Иллюстрации

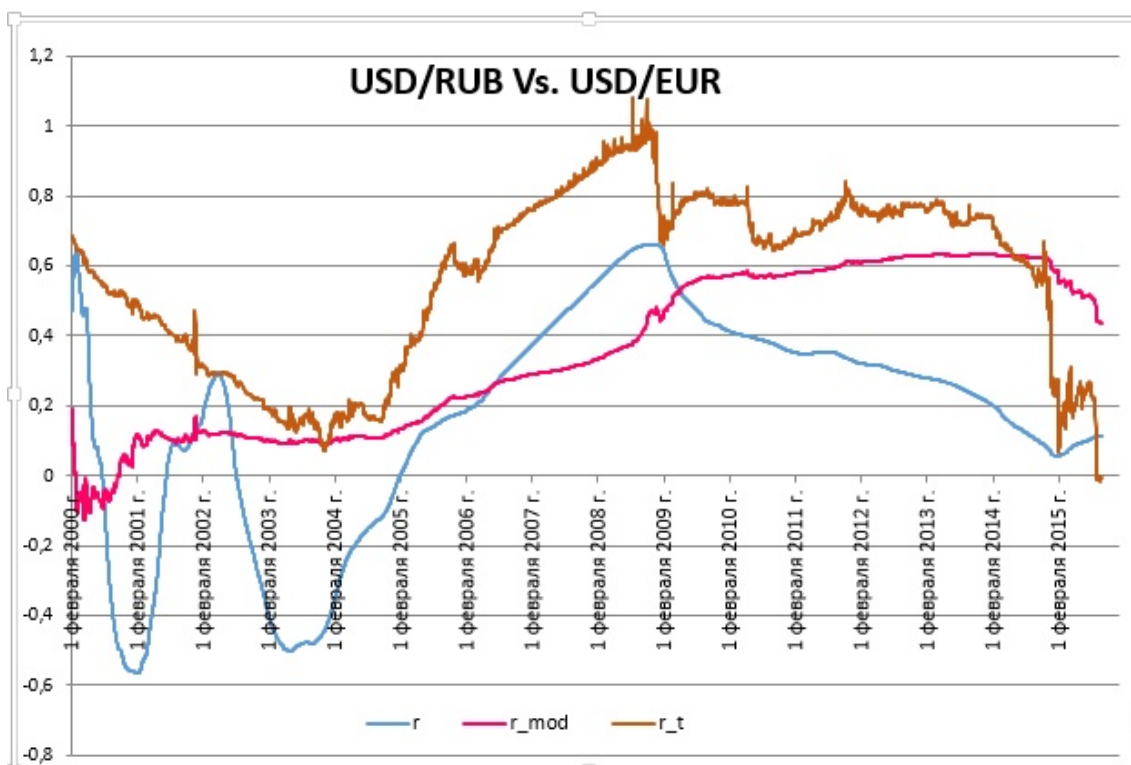| Дата	USD / RUB	USD / EUR	USD / CAD	USD / GBP	USD / CNY	USD / JPY
1 января 2000 г.	27,46	0,9921	1,4455	0,6178	8,2795	102,21
2 января 2000 г.	27,46	0,9942	1,445	0,6183	8,2795	102,16
3 января 2000 г.	27,46	0,9944	1,4452	0,6183	8,2795	102,1
⋮	⋮	⋮	⋮	⋮	⋮	⋮
1 февраля 2016 г.	76,1814	0,9206	1,4003	0,6993	6,5844	121,19

Рис. 1. Statistics base
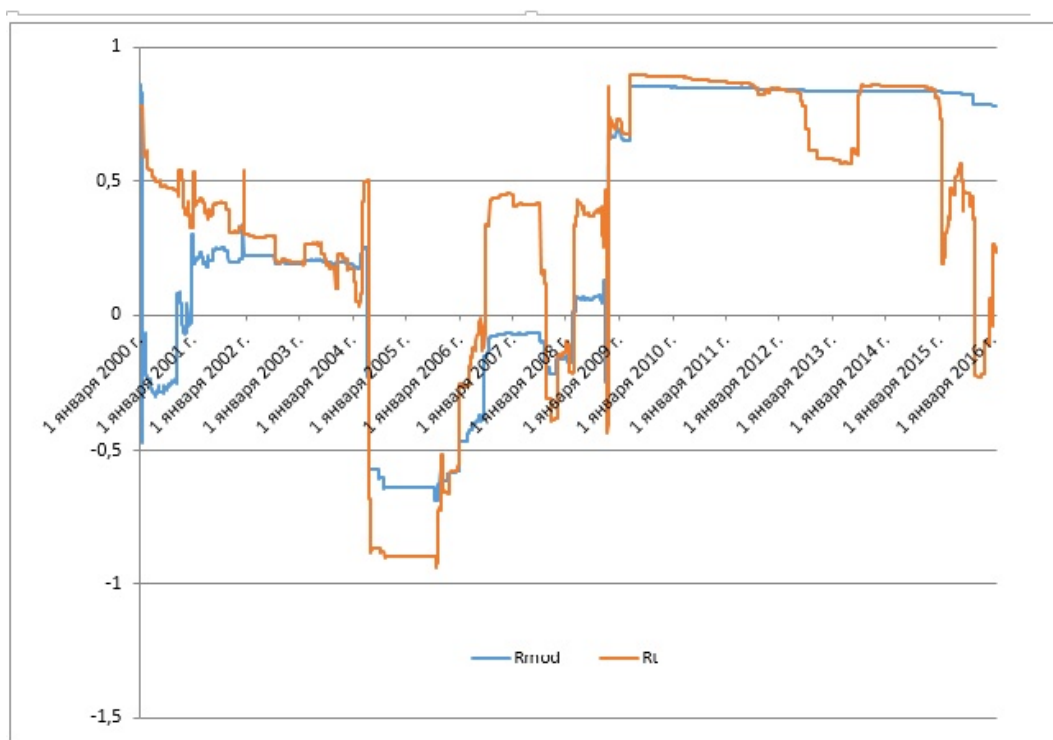
Рис. 2. Comparative analysis of correlation indexes

Рис. 3. Rmod Vs. Rt