

СЕКЦІЯ 3. МІЖРЕГІОНАЛЬНІ ТА ТРАНСКОРДОННІ СТАТИСТИЧНІ ДОСЛІДЖЕННЯ

CROSS-CORRELATION ANALYSIS OF FOREIGN STOCK MARKETS ON EXAMPLE OF UKRAINIAN STOCK INDEX UXI WITH S&P 500, DJIA, WIG20, NIKKEI, NASDAQ, FTSE 100, RTSI, MSCI EM

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In a context of modern globalization and the merger of capital markets, more and more practitioners and scientists are asking questions: are the smaller markets dependent on the biggest one? Transboundary and inter-market statistical research will be able to answer this question. Therefore, historical data of the stock index of the Ukrainian Stock Exchange (hereinafter UXI) from January 2008 to April 2017 [1] will be correlated with each known world stock index for the purpose of obtaining accurate results and the answer to the question: Is there a correlation with the change of world's stock markets and the Ukrainian's one?

To do this, we need to have a calculation of the correlation coefficient and the software program in which the operations will be performed. However, it is necessary to determine in advance, what are the data-sets, their distribution, the variance (deviation), which function will describe this dependence (linear or nonlinear). In our case, the totality of data-sets is nonlinear, the data are ungrouped, and the function is trend (nonlinear, convex), since there is no single local minimum or maximum.

We will not use absolute measurements, because we are interested only in the change of the highland (delta) between the close price of the current day and the close price of the previous one. This applies to all other indexes. That's why, the first need to find the pace of growth (deviation) every day from the absolute values of each index in points for each day from 2009 to 2017, and then to do correlating this data with similar indicators of the world stock exchanges. The complexity of calculations is that not all exchanges give the same types of data by days. Therefore, it is necessary to bring them to the common denominator (timeframe) and to do cleaning of data-sets and analyze them.

In analogy to the usual correlation (autocorrelation (AC), autoregression (AR)), the cross-correlation used by us between different time series of financial data, will be calculated according to the well-known formula:

$$\sum_{t=1}^I \ddot{E} (x_{t+k} - x_{f y_t} - y)$$

$$\sum_{t=1}^I \ddot{E} (x_{t+k} - x)^2 \sum_{t=1}^I \ddot{E} (y_t - y)^2$$

At the same time, we used nonparametric criteria (based on the absence of a priori guesses about the laws of the time series distribution) of modification correlations based on Pearson and Spearman, the options of which are programmed with the helps of the software package Statistica 10.0. With the help of it, we'll be:

- a) perform the cleaning and calculation of data obtained from official sites of exchanges [1] and rating agencies;
- b) import the data (relative deviation), which are compared by dates;
- c) using descriptive statistics, we determine the states of the data sets to obtain the correct results;
- d) perform by means of simple regression, correlation and extended models, namely, fixed nonlinear regression, calculation and data analysis (correlation of changes of selected world stock indices with the analyzed object - UXI).

That is, of the 2301 entries valid data (suitable for calculation, those that coincided without the absence) are 1049, which is 45.59%. Next, we calculate the cross-correlation of Pearson and display them using the cross-correlation matrix (Table 1; source of all tables: official data of stock exchanges, calculations by the author using the software package Statistica 10.0).

Table 1

Pearson correlation coefficient of stock indices of Ukraine, USA, Europe, Russia and Asia

Correlations (uxi+indx 1) Marked correlations are significant at $p < ,01000$

	RTSI, %	WIG, %	S&P500, %	DJIA, %	FTSE 100, %	NASDAQ, %	Nikkei 225, %	MSCI EM, %
UXI, %	,4831	,3996	,2480	,2433	,3878	,1690	,2172	,2098
	N=2251	N=2211	N=2216	N=2252	N=2227	N=1982	N=1896	N=1287
	p=0,00	p=0,00	p=0,00	p=0,00	p=0,00	p=,000	p=0,00	p=,000

Usually, the probability error rate p , remains at the level of 0.05, at the same time, that is, the accuracy of the data is 95%. We also use a nonparametric cross-correlation matrix based on Spearman (Table 2) to compare the results of the calculation.

Table 2

Correlation coefficient r Spearman's of stock indices of Ukraine, USA, Europe, Russia and Asia

Spearman Rank Order Correlations (uxi+indx 1) MD pairwise deleted Marked correlations are significant at $p < ,05000$

	RTSI, %	WIG, %	S&P500, %	DJIA, %	FTSE 100, %	NASDAQ, %	Nikkei 225, %	MSCI EM, %
UXI, %	0,426407	0,3296288	0,219095	3,217850	0,340476	0,143250	0,184176	0,208745

Herefrom, we can analyze the results of the calculations and formulate a certain opinion and develop a gradation or ranking of the coefficients of the correlation of world's stock indices with the Ukrainian UXI.

Since, it is known [2] that the value (modulo) of the correlation coefficient: up to 0.2 - a very weak correlation; to 0.5 - weak correlation; to 0,7 - average correlation; up to 0.9 - high correlation; over 0.9 - very high correlation; then in our case the most approximate index to the UXI index is the Russian RTSI index with a value of 0.48. After plotting these values, we obtain the following results, which are shown in Table 3:

Table 3

Ranking of indicators of correlation of world's stock indices with the index of the Ukrainian stock exchange for 2008-2017

№	Indices	UXI, %	N=	P=
1	RTSI, %	0,4831	2251	0
2	WIG, %	0,3996	2211	0
3	FTSE 100, %	0,3878	2227	0
4	S&P500, %	0,248	2216	0
5	DJIA, %	0,2433	2252	0
6	Nikkei 225, %	0,2172	1896	0
7	MSCI EM, %	0,2098	1287	0
8	NASDAQ, %	0,169	1982	0

This table indicates the effect of changes in world indexes to change the index of Ukrainian shares in descending order. That is, from 2008 to 2017 there is a weak correlation between RTSI, WIG20, FTSE100, SP500, DJIA, and the very weak composite dollar index of developing countries MSCI EM (there is only incomplete data from 2012, so we consider this correlation rejected) and the composite index of technology companies NASDAQ composite. These calculations can be called fairly

accurate, since the probability of error is less than 0.05 and even 0.01, as shown in Table 1. From here, we can conclude that there is a very weak influence on the change of the index of Ukrainian shares with world's stock indices.

At the same time, many practitioners claim [3] that there is a high correlation of the Ukrainian index with the MSCI Emerging Markets Index. But, as we see from the baseline correction calculations for 2012-2017 with the MSCI EM index and others, the confirmation of this hypothesis was not observed, but gave completely different results, since FTSE100 lost its position, and MSCI EM took its correlation position (Table 4) after ranking the results.

Table 4

Ranking of the Pearson's correlation indices of the world stock indices with the index of the Ukrainian stock exchange for 2008-2017

№	Indices	UXI, %	N=	P=
1	RTSI, %	0,2579	1270	0
2	WIG, %	0,2136	1244	0
3	MSCI EM, %	0,2098	1287	0
4	FTSE 100, %	0,1697	1244	0
5	S&P500, %	0,1265	1243	0
6	DJIA, %	0,0802	1246	0,005
7	NASDAQ, %	0,0657	1111	0,029
8	Nikkei 225, %	0,0596	1049	0,054

As we see, these additional calculations yielded results, since aggregates became more homogeneous (more data coincidence from the date). The TOP-3 coefficients of Pearson's correlation have become smaller, which suggests very weak links (0.2-0.3 points). Also, the results showed that the practice is somewhat cognitively (intuitively) determining this correlation, but the actual calculations show a different picture, since many stochastic, empirical and behavioral factors affecting these indices, in particular, that the given MSCI dollar index and shows the situation on Emerging Markets, and our market is Frontier - a market with limited (marginal) access to capital.

First of all, the Ukrainian market (Ukrainian Exchange) is changing under the influence of indicators: RTSI (Moscow Stock Exchange) - 48.31%, WSEI (Warsaw Stock Exchange) - 39.96%, followed by FTSE100 (London Stock Exchange) - 38.78% and MSCI EM (Euronext, Frankfurt Stock Exchange) - 20.98%. Also, calculations show that the correlation indicators are higher in the period from 2008 to 2017 than in 2012-2017, which leads us to the conclusion that the correlation was stronger in 2008-2012 than in subsequent years (Table 5).

Comparative table of stock indices correlations for 2008-2017 and 2012-2017

№	Indices	UXI, %, 2GG8-2G17	N=	Indices	UXI, %, 2G12-2G17	N=
1	RTSI, %	G,4831	2251	RTSI, %	G,2579	127G
2	WIG, %	G,3996	2211	WSEI, %	G,2136	1244
3	FTSE 100, %	G,3878	2227	MSCI EM, %	G,2G98	1287
4	S&P500, %	0,248	2216	FTSE 100, %	0,1697	1244
5	DJIA, %	0,2433	2252	S&P500, %	0,1265	1243
6	Nikkei 225, %	0,2172	1896	DJIA, %	0,0802	1246
7	MSCI EM, %	0,2098	1287	NASDAQ, %	0,0657	1111
8	NASDAQ, %	0,169	1982	Nikkei 225, %	0,0596	1049

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FINANCIAL SECURITY OF HOUSEHOLDS - THE ESSENCE AND SCALE OF THE PHENOMENON ON THE EXAMPLE OF POLAND

Introduction

Household financial security is significant in terms of meeting the individual and common needs of the household members. The level of satisfaction of these needs is directly related to the current financial situation of the household as well as to the prospect of a change of the current situation and the knowledge that enables efficient and effective management of household finances (Kozera 2016, pp. 319). According to M. Piotrowska (2017, pp. 463) the financial security of households could mean the ability to achieve the income, which is essential to meet the needs of households at an appropriate level and create financial reserves which could be used in case of