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RESEARCH PAPER

Dynamics of Forecasting the Development of Renewable Energy Technologies in Ukraine and Chile

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ABSTRACT
The processes of transformation of the energy space, namely the impact of alternative energy resources on it, are characterized by changes in the national economy in general and in the energy market in particular. The results of the analysis confirmed the significant dependence of electricity production indicators on renewable sources and such factors as GDP, CO_2 emissions, total electricity production, which requires improvement of organizational and economic bases for policy development of state support for renewable energy technologies in countries with exogenous factors. The interdependence between electricity production from renewable sources and economic indicators in Ukrainian-Chilean relations using macroeconomic multifactor analysis based on the correlation method allowed to identify the most influential factors.

KEYWORDS: *Alternative energy technologies; Multifactor analysis; Dynamics; Energy production; Correlation method.*

1. Introduction

In today's innovative economy, economic relations may have priority not commodity positions, and intellectual products and organizational and communicative systems of their implementation. This means the exchange of experience, licenses, “know-how”, rapid expansion of scientific, technical and technological cooperation. It is with this help that the issue of raising the technological level of certain industries and the national economy as a whole, the task of its accelerated technological re-equipment, expanding export opportunities and reducing imports, development of technical and economic ties between countries through specialization and cooperation in the production of various types of products [1, 10].

In our opinion, one of the potential areas is the exchange of experience, knowledge and technologies in the field of formation and implementation of a strategy for the development of non-traditional renewable energy. The prerequisites for this are the following circumstances:

– both in Ukraine and in Chile there are various natural and climatic conditions which provide development of non-conventional renewable energy (NCRE);

– both in Ukraine and in Chile there are sufficient potentials of NCRE sources;

– both Ukraine and Chile have comparable research and production potential that can be used to implement NCRE technologies;

– both Ukraine and Chile have embarked on the path of NCRE development at about the same time, since the 2000s [14].

An important role in the study of theoretical and methodological, scientific and applied problems of NCRE technologies, including the formation of the organizational and economic conditions for the development of this energy sector, belongs to such famous scientists as V. O. Babenko [15-21], G. M. Kaletnik, S. A. Kudrya, V. F. Reztsov, O. D. Vitvitskaya, S. V. Voytko, Yu. V. Makogon, V. V. Dzhedzhula, O. M. Sokhatska, E. V. Ryumin, Mark Z. Jacobson, Francisco Taveira-Pinto, Ted Trainer, Bruce N.Stram et al.

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Based on the analysis of literature sources, the authors concluded that awareness and perception of NCRE technologies in Chile is high, and in Ukraine is low, which is an important reason for the lack of energy management mechanism of the enterprise. It follows that the problem of these technologies is insufficiently studied.

NCRE technologies require special attention from the point of view of both theoretical development and the methodical approaches of its implementation. All this is necessary for the formation of a toolkit for the efficient operation of a modern energy-innovative enterprise [2].

The main goal of the research is to determine which components of the national economy affect the processes of transformation of the energy space, namely the development of alternative energy resources.

2. Results and Discussion

Factor analysis of the economies of Ukraine and Chile, their energy balance was conducted on the basis of data for the period 2007-2018 using the statistical package Statgraphics Centurion. Based on the performed factor analysis, we obtain analytical dependences of factors that have a prolonged impact on the development of NCRE technologies in Ukraine and Chile. Of the 16 factors selected by the author, a correlation analysis was conducted for Ukraine and Chile in order to trace the existing links between non-traditional and traditional energy, and other macroeconomic indicators of the countries [11]. First, we introduce the symbols of the selected factors, which are presented in table 1.

Tab. 1. Symbols of factors that characterize energy and economic relations between Ukraine and Chile

№	Indicator	Unit	Symbol
1	GDP	bln.USD	x_1
2	Export of goods	mln. USD	x_2
3	Import of goods	mln. USD	x_3
4	Import quota	%	x_4
5	Primary energy production	quad. Btu	x_5
6	Primary energy consumption	quad. Btu	x_6
7	Energy intensity	MJ / USD	x_7
8	Net energy imports	% of energy consumption	x_8
9	Energy consumption from fossil fuels	% of energy consumption	x_9
10	Export of fuel and energy products	% of exports of goods	x_{10}
11	Imports of fuel and energy products	% of imports of goods	x_{11}
12	CO_2 emissions	mln. tons	x_{12}
13	Total installed capacity of electricity	GW	x_{13}
14	Total production of electricity	TW/year	x_{14}
15	Installed capacity from NCRE	GW	x_{15}
16	Generation from NCRE	TW/year	x_{16}

Based on the correlation analysis, we will determine the extent to which alternative energy in Ukraine interacts with other factors. The results obtained are given in annex A (for Ukraine) and annex B (for Chile).

In connection with the following analyzes, it can be concluded that in Ukraine alternative energy does not have correlations with any of the selected factors, while in Chile there are such links. In the case of Ukraine, this analysis shows that NCRE in Ukraine is not a significant (influential) factor for both energy and the economy as a whole, despite the significant potential in this area.

The following is an identical analysis for Chile (annex B). Based on the results of correlation analysis, pairwise correlation coefficients were calculated to assess the tightness of the relationship. The correlation matrix contains such coefficients that reveal two-way relationships between the analyzed indicators [18]. From the data of correlations, we will define that alternative energy in Chile, namely the established installed capacity from NCRE and generation from NCRE (the main sources in Chile are solar, wind, geothermal, energy and small hydropower) connect to the following factors:

- there is a close direct connection between generation from NCRE and total production of electricity;
- a fairly close direct relationship is observed between generation from NCRE and CO_2 emissions;
- a moderate inverse relationship was found between generation from NCRE and Chilean GDP.

The established weak and practically absent, or negative connection between the above-stated factors allows to exclude these factors from the further analysis as insignificant.

The results obtained above suggest that in Chile, NCRE has an impact on the overall energy condition of the country and depends on some other economic factors [14].

The following analysis is due to the need to identify those factors that convincingly confirm the impact of energy resources from renewable sources on the economic development of Chile.

To establish pairwise relationships between the value of generation from NCRE and other factors (total production of electricity, CO_2 emissions, the country's GDP), paired regression equations were constructed as single cases of multiple relationships. Pairwise dependencies have allowed us to identify an isolated link between generation from NCRE and research factors. The initial equations are given in table 2.

Tab. 2. Regression equations describing the relationship between generation from NCRE and research factors

Factors of paired equations	Regression equation
Total production of electricity	$y = 4{,}02115\ln x - 15{,}01$
CO_2 emissions	$y = 7{,}7938 + 1{,}36785x - 0{,}590784x^2$
GDP	$y = 4{,}02115 + \frac{56{,}2665}{x}$

The regression equation was selected using the statistical package Statgraphics Centurion according to the following ratios of formal approximation criteria: minimum sum of deviations, maximum Fisher's criteria, minimum relative approximation error and no autocorrelation in the residuals [19, 20].

As confirmed by the calculations, the research pair dependences are described by the hyperbola equation in the case when the factor feature is Chilean GDP, the logarithmic function (total production of electricity) and the parabola equation (CO_2 emissions).

Summing up, we can draw the following conclusions: when changing the volume total production of electricity by the value of the logarithm per unit of generation from NCRE will increase by 2.6%. With the growth of primary energy consumption, generation from NCRE increases with acceleration, and with the change in CO_2 emissions, generation from NCRE increases. Under the influence of changes in the size of GDP in Chile, generation from NCRE changes by the inverse of the parameter a1, equal to 56.2665, so with GDP growth, generation from NCRE will increase by 0.15%.

Tab. 3. Statistical characteristics of regression equations

Function	Relative approximation error	Durbin-Watson test	Coefficient of determination	Fisher's criterion
NCRE – Total production	0,131	1,540	0,428	15,834
NCRE – CO_2 emissions	0,204	1,301	0,349	3,871
NCRE - GDP	0,288	2,823	0,213	4,265

According to the pairwise equation, it can be concluded that 42.8% of changes in generation from NCRE in Chile are caused by changes in total production of electricity, 34.9% - by changes in CO_2 emissions, 21.3% - by changes in the country's GDP. The remaining 57.2%, 65.1%, 78.7% of the variation in generation from NCRE in Chile are caused by changes in other factors that were not taken into account in each pair dependence.

Next, a multifactor correlation-regression analysis was performed. Since the research factors are not independent, not closely related, they can be simultaneously included in a multifactor regression model, which has the following form:

NCRE = 5,71 + 0,17 *Total production – 0,035 * CO_2 em.+ 0,00002 GDP

That is, with a gradual decrease in the correlation-regression model, the following conclusions can be drawn:

- with an increase in total production of electricity, generation from NCRE will increase

by 0.17% at fixed average values of other factors of the model;
- the value of generation from NCRE will decrease by 0.035% with increasing CO_2 emissions per 1 ton at fixed average values of other factors of the model;
- the value of generation from NCRE in Chile will increase by 0.02% due to an increase in GDP per 1,000 dollars;
- parameter a0, which is equal to 5.71 is not considered economically, although it is assumed that it reflects the influence of factors not taken into account in the model;
- the link between generation from NCRE and CO_2 emissions is direct, and the inverse relationship between generation from NCRE and GDP and total production of electricity is inverse.

Statistical indicators calculated for the obtained model (relative approximation error is 5.3%; Durbin-Watson test - 1,572; Fisher test - 89,67) prove that the regression equation is statistically true, reliable and adequately reproduces the trends [9].

Tab. 4. Elasticity coefficients of regression equations

Factorial sign	Parameter in the model	Average value	Average effective signs	Coefficient of elasticity
Total production of electricity	0,17	1324,12	4,02	-0,87
CO_2 emissions	-0,025	6,37		-0,03
GDP	0,00002	27862,43		0.69

The coefficient of determination by the regression equation is 0.912 and shows that the variation of the import quota by 91.2% is due to the influence of factors included in the model, and the other 8.8% is the influence of those factors that were not taken into account in the model. To take into account the relative change in the performance characteristic of the selected factors, calculate the coefficient of elasticity (table 4).

The study of the influence of these factors on the import of fuel and energy products allows us to conclude that:
- there is almost no connection between the value of imports of fuel and energy products and CO2 emissions, energy intensity and the size of the import quota;
- weak feedback between imports of fuel and energy products, GDP and exports of goods;
- a moderate direct relationship was found between the import of fuel and energy products and the volume of generation from NCRE;
- a fairly close direct relationship is observed between the import of fuel and energy products and the volume of total electricity production (table 5).

Tab. 5. Regression equations describing the relationship between imports of fuel and energy products and the studied factors

У	X	Paired correlation coefficients	Connection level	Regression equation
Imports of fuel and energy products,% of imports	GDP, bln.USD	-0,28	Weak feedback	-
	Total production of electricity, TW/year	0,86	Tight straight	$y=0,009x^2+0,023x+0,19$
	CO_2 emissions, mln. tons	-0,06	Virtually absent	-
	Generation from NCRE, TW/year	0,55	Moderate, direct	$y=0,00004x^2+0,006x+ +0,105$
	Energy intensity, MJ / USD	-0,07	Virtually absent	-
	Export of goods, mln. USD.	-0,30	Weak feedback	-
	Import quota, %	0,06	Virtually absent	-

The established weak or practically absent connection between the effective sign and the above five signs allows to exclude these factors from the further analysis as insignificant. The pairwise connections we study between the import of fuel and energy products, total production of electricity and generation from NCRE are described by the equations of the parabola, based on which we can conclude that under the influence of changes in total production of electricity and generation from NCRE, imports of fuel and energy products in Chile are declining with a slight acceleration.

All even regression equations were evaluated according to the main statistical criteria, the values of which are given in table 6.

According to the even regression equation, it can be concluded that 73.9% of changes in imports of fuel and energy products are caused by changes in total production of electricity, 21.6% by changes in generation from NCRE. The remaining 26.1% and 78.4% of the variation in imports of fuel and energy products, respectively, are caused by changes in other factors not taken into account in each pair dependence.

Tab. 6. Statistical characteristics of regression equations

Function	Relative approximation error	Durbin-Watson test	Coefficient of determination	Fisher's criterion
Import - Total production	0,145	1,677	0,739	15,79
Import - Generation from NCRE	0,233	2,241	0,216	2,86

Because the studied factors are independent, and not closely related, the multifactor regression model, which takes into account their simultaneous impact on the import of fuel and energy products, is as follows:

Import=0,046 – 4,5* Total production - 0,94* Gen. from NCRE

Thus, based on the above correlation-regression model, we can conclude that:

- with an increase in total production of electricity by 1 TWh at fixed average values of other factors of the model, imports of fuel and energy products will decrease by 4.5% of total imports of goods;
- with an increase in generation from NCRE for every 1 TWh at fixed average values of other factors of the model, imports of fuel and energy products will decrease by 0.94% of total imports of goods;
- parameter a0, equal to 0.046, is not considered economically, but reflects the influence of factors not taken into account in the model;
- the relationship between the import of fuel and energy products and the volume of total electricity production and the volume of generation from NCRE is inverse;
- statistical indicators calculated to obtain the model (relative approximation error is 12.7%; Durbin-Watson test - 2.46; Fisher's test - 16.93) prove that the regression equation is statistically significant, reliable and truthfully reflects the emerging trends;
- the coefficient of determination by the regression equation is equal to 0.726 and shows that the variation in imports of fuel and energy products by 72.6% is due to the influence of factors included in the model, and the remaining 27.4% are those that were not taken into account in the model.

To calculate the relative change in the performance characteristic due to the selected factors, the coefficients of elasticity were calculated (table 7).

Tab. 7. Elasticity coefficients of regression equations

Factorial sign	Parameter in the model	Average value	Average effective signs	Coefficient of elasticity
Total production of electricity	4,5	4,78	0,18	0,5
Generation from NCRE	0,94	5,96		0,09

That is, when total electricity production changes by 1%, import of fuel and energy products changes by 0.5%; with the growth of generation from NCRE, imports of fuel and energy products increase by 0.09%. This indicates that total production of fuel and energy products is more influenced by total production of electricity. We will study the influence of factors on the indicator of total electricity production (table 8).

Because the factors analyzed by us are still closely related, the multifactor regression model, which takes into account their simultaneous impact on the indicator of total electricity production, looks like this:
Total production=0,658 + 0,125* Gen. from NCRE + 27,727* Import.

Tab. 8. Regression equations describing the relationship between total production of electricity and the studied factors

У	X	Paired correlation coefficients	Connection level	Regression equation
Total production of electricity, TW/year	GDP, bln.USD	0,28	Weak straight	-
	s of fuel and energy products,% of imports	0,67	Moderate, direct	$y = 0{,}021x^2 + 0{,}263x + 8{,}319$
	CO_2 emissions, mln. tons	0,11	Virtually absent	-
	Generation from NCRE, TW/year	0,75	Tight straight	$y = 0{,}004x^2 + 0{,}036x + 0{,}71$
	Energy intensity, MJ / USD	0,39	Weak straight	-
	Export of goods, mln. USD.	0,07	Virtually absent	-
	Import quota, % GDP, bln.USD	-0,21	Weak feedback	-

Tab. 9. Statistical characteristics of regression equations

Function	Relative approximation error	Durbin-Watson test	Coefficient of determination	Fisher's criterion
Electricity production - Generation from NCRE	12,7	2,91	0,632	8,147
Electricity production - Import	14,3	3,06	0,845	17,12

The statistical characteristics calculated for the obtained model (relative approximation error is 15,7%; Durbin-Watson criterion - 2,159; Fisher's criterion - 16,932) convince that the regression equation is statistically significant, reliable and really reflects the trends. The coefficient of determination in the regression equation equal to 0.722 shows that the variation in total production of electricity by 72.2% is due to the influence of factors included in the model, and the other 27.8% is the influence of factors not taken into account in the model.

Tab. 10. Elasticity coefficients of regression equations

Factorial sign	Parameter in the model	Average value	Average effective signs	Coefficient of elasticity
Generation from NCRE	0,125	4,79	5,28	0,14
Import	27,727	0,12		0,65

With a change in the volume of generation from NCRE by 1%, total production of electricity changes by 0.14%, with an increase in imports of fuel and energy products by 1%, total production of electricity increases by 0.65%. Summarizing the results of calculations on the influence of factor characteristics on the effective ones in Chile, it should be noted that the indicator of generation from NCRE is most influenced by such factors as: total production of electricity, GDP and CO_2 emissions. Thus, when the volume of total production of electricity increases by 1 TWh at fixed average values of other factors of the model, the value of generation from NCRE increases by 0.17% (direct connection). The value of generation from NCRE in Chile will increase by 0.02% due to an increase in GDP per 1,000 dollars. (direct connection).

- with an increase in CO_2 emissions by 1 million tons, the value of generation from NCRE will decrease by 0.35% at fixed average values of other factors of the model (feedback);

- by the value of the coefficient of determination it can be noted that 92.2% of the variation of generation from NCRE depends on the change of factors included in the model, and GDP and CO_2 emissions, and the remaining 8.8% is the influence of factors that were not taken into account in the model.

The import of fuel and energy products is influenced by such factors as total production of electricity and generation from NCRE; inverse relationship between the import of fuel and energy products and two factors (total production of electricity and generation from NCRE).

That is, with an increase in total production of electricity by 1 TWh at fixed average values of other factors of the model, imports of fuel and energy products will decrease by 4.5% of total imports of goods; with an increase in generation from NCRE for every 1 TWh at fixed average values of other factors of the model, imports of fuel and energy products will decrease by 0.94% of total imports of goods. Imports of fuel and energy products are also affected by factors such as import quotas, exports of goods, energy intensity (direct dependence), GDP and CO2 emissions (feedback).

That is, summarizing the data of the calculations, we can conclude that for the priority development and formation of strategies for the development of renewable energy technologies in Ukraine and Chile identified two main monitoring indicators that reflect the impact of renewable energy resources on energy development in total production of electricity and imports of fuel and energy products.

Thus, we obtained a model of the dependence of imports of fuel and energy products on indicators of the impact of alternative energy resources on the economic development of the country, which has the following standardized form:

$$ty = -0,28t_{x_1} + 0,86t_{x_2} - 0,06t_{x_3} + 0,55t_{x_4} - 0,07t_{x_5} - 0,3t_{x_6} + 0,06\,t_{x_7} \quad (1)$$

This standardized model of the dependence of total electricity production on indicators of the impact of alternative energy resources on the economic development of the country:

$$ty = 0,28t_{x_1} + 0,67t_{x_2} + 0,11t_{x_3} + 0,75t_{x_4} + 0,39t_{x_5} + 0,05t_{x_6} - 0,21\,t_{x_7} \quad (2)$$

Tab. 11. Comparison of ranks of model factors

Impact on imports of fuel and energy products		
	Standardized coefficients	Grade factor
GDP, bln.USD	-0,28	5
·oduction of electricity, TW/year	0,86	1
CO_2 emissions, mln. tons	-0,06	6
Generation from NCRE, TW/year	0,55	2
Energy intensity, MJ / USD	-0,07	7
Export of goods, mln. USD.	-0,3	4
Import quota, %	0,06	3
Impact on total production of electricity		
GDP, bln.USD	0,28	4
of fuel and energy products,% of imports	0,67	2

CO_2 emissions, mln. tons	0,11	5
Generation from NCRE, TW/year	0,75	1
Energy intensity, MJ / USD	0,39	3
Export of goods, mln. USD	0,05	6
Import quota, % GDP, bln.USD	-0,21	7

3. Conclusion

Based on the results of the calculations, it is concluded that for the Chilean country studied in the model, the state of development of alternative energy resources is significantly influenced by performance factors. Thus, in the first case, the change in such a factor as generation from NCRE in Chile is influenced by changes in total electricity production, CO_2 emissions and the country's GDP.

With regard to such an effective feature as the import of fuel and energy products, it was found that this factor is associated with changes in total electricity production and changes in electricity production from NCRE.

The findings of the study indicate that the effective feature is the total production of electricity, which changes under the influence of changes in imports of fuel and energy products and generation from NCRE.

This allows us to conclude that the processes of transformation of the energy space, namely the impact of alternative energy resources on it, are characterized by changes in the national economy in general and in the energy market in particular. The results of the analysis confirmed the significant dependence of generation from NCRE and such factors as GDP, CO_2 emissions, total electricity production, which requires improvement of organizational and economic bases for the formation of state support policies for NCRE technologies in countries with exogenous and endogenous factors.

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Annex A

Correlation analysis for Ukraine

Factor	Obtained coefficients correlations															
x_1		0,96	0,97	x	0,61	0,58	x	x	x	0,68	x	0,73	x	0,87	x	x
x_2	0,96		0,99	x	0,59	x	x	x	x	0,67	x	0,67	x	0,84	x	x
x_3	0,97	0,99		x	x	x	x	x	x	0,62	x	0,63	x	0,80	x	x
x_4	x	x	x		x	-0,58	-0,70	-0,61	x	x	x	x	x	x	x	x
x_5	0,61	0,59	x	x		0,88	0,81	0,83	0,80	0,76	0,67	0,87	0,67	0,86	-0,80	-0,77
x_6	0,58	x	x	-0,58	0,88		0,88	0,86	0,86	0,68	x	0,85	x	0,75	-0,81	-0,83
x_7	x	x	x	-0,70	0,81	0,88		0,85	0,89	0,59	x	0,84	x	0,66	-0,81	-0,80
x_8	x	x	x	-0,61	0,83	0,86	0,85		0,93	0,73	x	0,83	x	0,69	-0,89	-0,84
x_9	x	x	x	x	0,80	0,86	0,89	0,93		0,68	x	0,83	0,59	0,63	-0,97	-0,92
x_{10}	0,68	0,67	0,62	x	0,76	0,68	0,59	0,73	0,68		0,79	0,85	x	0,85	-0,76	-0,84
x_{11}	x	x	x	x	0,67	x	x	x	x	0,79		x	x	0,60	-0,60	-0,63
x_{12}	0,73	0,67	0,63	x	0,87	0,85	0,84	0,83	0,83	0,85	x		0,65	0,93	-0,81	-0,86
x_{13}	x	x	x	x	0,67	x	x	x	0,59	x	x	0,65		x	-0,59	x
x_{14}	0,87	0,84	0,80	x	0,86	0,75	0,66	0,69	0,63	0,85	0,60	0,93	x		-0,63	-0,70
x_{15}	x	x	x	x	-0,80	-0,81	-0,81	-0,89	-0,97	-0,76	-0,60	-0,81	-0,59	-0,63		0,96
x_{16}	x	x	x	x	-0,77	-0,83	-0,80	-0,84	-0,92	-0,84	-0,63	-0,86	x	-0,70	0,96	
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}

Note: X - not significant at 5%

Annex B

Correlation analysis for Chile

Factor	Obtained coefficients correlations															
x_1		0,59	0,83	x	x	0,73	-0,87	x	x	-0,80	-0,62	0,88	0,79	0,80	0,65	0,69
x_2	0,59		x	x	x	-0,61	x	0,59	x	x	x	x	x	x	x	x
x_3	0,83	0,82		x	x	x	-0,75	x	x	x	x	0,61	x	x	x	x
x_4	x	x	x		-0,73	-0,63	x	x	x	0,63	0,80	x	-0,67	-0,59	-0,66	-0,67
x_5	x	x	x	-0,73		0,60	x	x	x	x	-0,68	x	x	x	0,74	0,71
x_6	0,73	x	x	-0,63	0,60		-0,70	x	x	x	-0,77	0,84	0,95	0,93	0,96	0,897
x_7	-0,87	-0,61	-0,75	x	x	-0,70		x	x	x	x	-0,79	-0,68	-0,63	-0,59	-0,62
x_8	x	x	x	x	x	x	x		0,89	x	0,67	x	-0,63	x	-0,62	-0,61
x_9	x	0,59	x	x	x	x	x	0,89		x	0,62	x	x	x	x	x
x_{10}	-0,80	x	x	0,63	x	x	x	x	x		0,79	-0,65	-0,72	-0,69	x	x
x_{11}	-0,62	x	x	0,80	-0,68	-0,77	x	0,67	x	0,79		-0,75	-0,89	-0,87	-0,81	-0,83
x_{12}	0,88	x	0,61	x	x	0,84	-0,79	x	x	-0,65	-0,75		0,90	0,90	0,85	0,86
x_{13}	0,79	x	x	-0,67	x	0,95	-0,68	-0,63	x	-0,72	-0,89	0,90		0,97	0,94	0,96
x_{14}	0,80	x	x	-0,59	x	0,93	-0,63	x	x	-0,69	-0,87	0,90	0,97		0,90	0,93
x_{15}	0,65	x	x	-0,66	0,74	0,96	-0,59	-0,62	x	x	-0,81	0,85	0,94	0,90		0,96
x_{16}	0,69	x	x	-0,67	0,71	0,97	-0,62	-0,61	x	x	-0,83	0,86	0,96	0,93	1	
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}

Note: X - not significant at 5%

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