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Modeling globalization processes taking into account structural changes, using Algeria as an example

Elena D. Kopnova 

E-mail: ekopnova@hse.ru

Lilia A. Rodionova 

E-mail: lrodionova@hse.ru

National Research University Higher School of Economics
Address: 20, Myasnitskaya Street, Moscow 101000, Russia

Abstract

This work is devoted to modeling globalization processes, taking into account the dynamic links between them and structural changes in the trend parameters. Its relevance is due to the fact that most of the work on this topic is devoted to studying the impact of globalization on individual indicators of socio-economic development, and not enough attention is paid to studying the formation of the General trend of globalization, the interaction of its components. The latter is particularly important for developing countries, which are characterized by a strong heterogeneity of these components in the structure of globalization, as well as a marked variability of parameters in their trends. We proposed an approach of cointegration analysis of globalization processes taking into account structural shifts in the trends of these processes. As an example of the implementation of this approach, we consider modeling the dynamics of the components of the KOF globalization index for Algeria during the period 1970–2015. The stationarity of the series was tested using unit root tests with structural breaks: Andrews–Zivot and Perron tests for a series with one structural break, and Clemente–Montanes–Reyes and Lee Strazicich tests for series with one or two structural breaks. The Johansen test for small samples taking into account exogenous variables was used for cointegration testing. The presence of dynamic relationships was confirmed by comparing forecasts for the vector error correction model and one-dimensional models of processes using the Dibold–Mariano test. Interpretation of models was based on estimates of the impulse response function and the Cholesky decomposition of prediction error. The results show that the formation of the KOF Globalisation Index for Algeria is largely due to the mutual influence of its components. The dynamics of political and economic globalization are formed as a result of mutual changes in the sphere of external economic and political relations. The

role of international cooperation in the social sphere for the other two components of globalization in Algeria is small. At the same time, the dynamics of social globalization is determined by its own components. The proposed modeling methodology can be applied to the study of globalization processes in other countries of the world in order to justify political decision-making.

Key words: KOF Globalisation Index; cointegration model; vector error correction model; structural reaks; impulse response functions; Cholesky decomposition.

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Introduction

Globalization has been developing rapidly since the second half of the 20th century. According to 2018 data, almost a third of the increase in world GDP per capita is due to an increase in the level of globalization [1]. The results of globalization are most noticeable in third world countries, especially in Africa [2], where they are reflected in the context of a new model of economic development that provides for an increased role of such countries in the world economy [3]. According to forecasts, Africa, which currently contributes only 2% to the gross world product growth, will provide more than 75% of the world's population growth in the coming two decades, which in the conditions of globalization will be able to supply the world labor market [4]. Globalization processes in African countries, defining new conditions for the interaction of socio-economic and demographic factors, not only open up opportunities, but also create barriers to the growth of people's well-being, exacerbating social and political risks [5–8]. Making informed decisions in a rapidly and radically changing socio-economic environment requires operational monitoring and objective system analysis.

Current research on this topic is mainly devoted to assessing the impact of globaliza-

tion on the socio-economic development of countries. Thus, according to data from Nigeria for the years 1980–2012, the presence of dynamic links between foreign investment, international trade and economic growth is shown [9]. According to Tunisian data for the years 1983–2009 [10], the ambiguous role of economic globalization in the formation of the labor market was shown. The significant role of globalization is demonstrated by the study of the determinants of income inequality according to data from 68 African countries for the years 1990–2010 [11]. The results of the analysis of data from 52 African countries for 1996–2010 [12] indicated a positive impact of international trade and a negative impact of financial integration on the level of human capital.

Despite the available constructive results of statistical data analysis, there are no papers devoted to the analysis of globalization in African countries that study the dynamic relationships between its individual components: economic, political, and social. Not enough attention is paid to forecasting globalization processes. Most of the works deal with economic globalization, while in these countries the role of the other two components, especially the political component, is great. In addition, the research does not pay enough attention to the problems of variability in the trend of globalization processes, which

can significantly affect the results of statistical analysis [13]. Thus, taking into account the above, it is important to develop a statistical methodology for analyzing globalization processes in African countries using tools that can correctly take into account the interaction of economic, political and social globalization processes and the features of processes in individual countries.

1. Research information base

The statistical method of studying the processes of globalization in Africa was used on the example of Algeria according to the time series of sub-indices of the KOF-index of globalization [14] for the years 1970–2015¹. The dynamics of the selected indicators is shown in Figure 1.

Figure 1 shows that for Algeria, along with a very noticeable predominance of the political component in the structure of the COF-index of globalization, there is a high variability. This indicator was especially unstable in the period 1987–2008, known for the mass riots of 1986–1988, the civil war of 1991–2002 [15] and the subsequent activation of radical Islamists in 2006–2008. The figure shows that all components of the KOF-index of globalization are characterized by structural shifts in the parameters of their development trends, and it is noticeable that the variability of these trends has a similar character.

2. Research methods

The research methodology was based on the idea of cointegration analysis of time series using the vector error correction model (VECM) [16], taking into account the presence of structural shifts in the parameters of time series trends. To confirm the conclusions

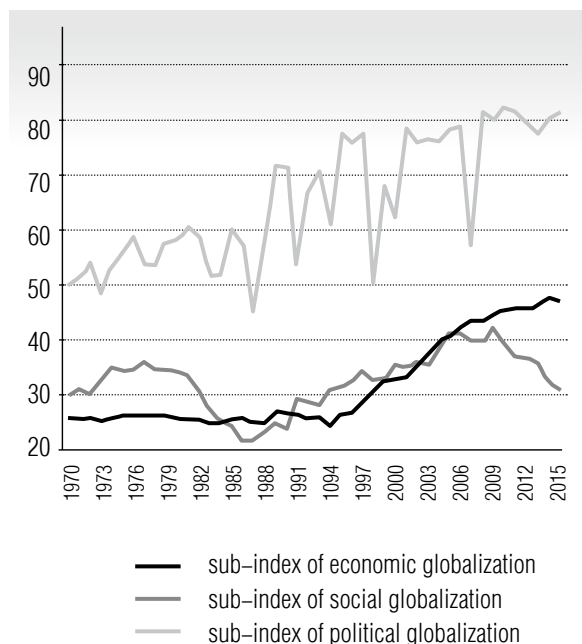


Fig 1. Dynamics of sub-indices of globalization in Algeria, 1970–2015

about the presence or absence of dynamic relationships and the choice of a model for forecasting, the method of comparing forecasts obtained from a multidimensional model and a set of three one-dimensional models was also used. One of these aggregates included integrated autoregressive – moving average (ARIMA) models [16]. Another set was made up of Holt–Winters short-term forecasting models (HWM) [17]. The use of HWM models was justified by the fact that they have a fairly high predictive capacity [18].

Let Y_t ($t = 1, 2, \dots, T$) – a random process that generates the time series of sub-indices of economic, political and social globalization on the time interval $[0, T]$: $Y_t = (pol_t, ec_t, soc_t)'$:

The process is considered in the form of a model:

$$Y_t = \mu_t \delta + X_t, \quad X_t = (X_{1t} \ X_{2t} \ X_{3t})'$$

¹ KOF (Konjunkturforschungsstelle) Globalisation Index: <https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html>

$$\mu_t = (1 \ t \ D_{B_1} \ D_{B_2} \ DT_{B_1} \ DT_{B_2} \ DU_{B_1} \ DU_{B_2}),$$

$$\delta = (\delta_1 \ \dots \ \delta_8)',$$

T_{B_j} – moment of structural shift

$$D_{B_j} = \begin{cases} 1, & t \geq T_{B_j} \\ 0, & t < T_{B_j} \end{cases}, \quad DT_{B_j} = \begin{cases} t - T_{B_j}, & t \geq T_{B_j} \\ 0, & t < T_{B_j} \end{cases},$$

$$DU_{B_j} = \begin{cases} 1, & t = T_{B_j} \\ 0, & t \neq T_{B_j} \end{cases}, \quad j = 1, 2.$$

The models under consideration differ in the representation of the X_t process:

$$\text{VECM: } \Delta X_t = \alpha \beta' X_{t-1} + \sum_{j=1}^p \Gamma_j \Delta X_{t-j} + U_t$$

$$\Delta X_t = X_t - X_{t-1}, \quad \alpha = \|\alpha_{ij}\|_{k \times r}, \quad \beta = \|\beta_{ij}\|_{k \times r},$$

$$\Gamma_j = \|\gamma_{is}\|_{k \times k}, \quad k = 3, \quad U_t = (U_{1t} \ U_{2t} \ U_{3t})',$$

r – rank of cointegration,

$$U \sim N(\mathbf{0}, I_T \otimes \Sigma_u), \quad U = (U_1 \ \dots \ U_T)'$$

$$\Sigma_u = \|\sigma_{ij}\|_{k \times k}, \quad \text{cov}[U_{it}, U_{js}] = \begin{cases} \sigma_{ij}, & t = s \\ 0, & t \neq s \end{cases}.$$

$$\text{ARIMA: } X_t = \sum_{j=1}^p \theta_j X_{t-j} + \sum_{j=1}^q \pi_j U_{t-j},$$

$$U_{it} \sim N(0, \sigma_i^2),$$

$$\text{cov}[U_{it}, U_{is}] = \begin{cases} \sigma_i^2, & t = s \\ 0, & t \neq s \end{cases}.$$

$$\text{HWM: } Y_t = X_t + U_t.$$

X_t contains a deterministic component in the form of a linear trend: $\mu_{t,\tau} = \alpha_{0t} + \alpha_{1t}\tau$:

$$U_{it} \sim N(0, \sigma_i^2),$$

$$\text{cov}[U_{it}, U_{is}] = \begin{cases} \sigma_i^2, & t = s \\ 0, & t \neq s \end{cases}.$$

$$E[Y_{t+\tau} | Y_t] = \mu_{t,\tau},$$

$$\alpha_{0t} = \lambda_0 Y_t + (1 - \lambda_0)(\alpha_{0t-1} + \alpha_{1t-1}),$$

$$\alpha_{1t} = \lambda_1 (\alpha_{0t} - \alpha_{0t-1}) + (1 - \lambda_1) \alpha_{1t-1},$$

λ_0, λ_1 – vectors containing adaptation parameters.

The stationarity of the processes generating the implementation of a series of sub-indices was pre-tested. Using the Dolado–Jenkinson–Sosvilla–Riviera procedure [19] for each time series, tests for the presence of a single root of the characteristic equation of the corresponding process, taking into account structural shifts, were applied. The tests are based on the augmented Dickey–Fuller test (ADF-test). To account for structural shifts, dummy variables were included. For a series with a single structural shift, Andrews–Zivot tests (AZ-test) [20] and Perron tests (P-test) [21] were used. For a series with one or two structural shifts, Clemente–Montanes–Reyes tests (CMR test) [22] or Strazicich (Lee, Strazicich) (LS-test) [23, 24] were used. The advantage of P- and LS-tests is that they overcome the disadvantage of AZ- and CMR-tests, which often, rejecting the null hypothesis, mistakenly lead to the conclusion of stationarity for a non-stationary process with structural shifts, and thus allow us to obtain an unambiguous result. The advantage of P- and CMR-tests is that they take into account both innovative and additive emissions in the dynamics series, while the LS-test takes into account only additive and A-Z – only innovative emissions. For comparison, classical tests for stationarity without taking into account structural shifts (ADF-, PP-, KPSS-tests [16]) were also used.

To evaluate the parameters of the cointegration equation and the error correction model Johansen’s approach [25] was used. By testing for cointegration, we used a modification of the Johansen test for short samples, which provides for the presence of deterministic variables in the model and determines the distribution of test statistics by the bootstrap method [26].

VECM and ARIMA models were evaluated using the maximum likelihood method and

tested with the inclusion of all dummy variables corresponding to structural shifts. Structural shifts were determined by the results of stationarity tests, as well as by visual analysis of graphs. The optimal model specification was selected based on the Schwartz criterion and the model's compliance with its prerequisites. The residues of models were tested for the absence of autocorrelation and compliance with the normal distribution law (the Breusch-Godfrey LM test, the Jarque-Bera test, and their multidimensional counterparts). Durnik-Hansen orthogonalization was used for the VEC model residues [27]. The short-term prediction algorithm of HWM was implemented using the minimum root mean square error (RMSE) criterion.

The assumption about the exogeneity of the i -th ($i = 1, 2, 3$) sub-index of globalization was tested by testing the significance of the coefficient estimation α_{ij} for the i -th correcting variable in VECM, as well as using The Granger causality test [16]. The Granger test, conducted under the VEC model, also took into account structural shifts and a corrective indicator $\beta' X_{t-1}$. We took into account the results of analysis of the structure of the Cholesky decomposition of the forecast error variance for each sub-index [28].

Forecast index values were defined as conditional mathematical expectations of model processes with a maximum forecast horizon of five years. By analyzing the predictive ability of models, a recursive calculation scheme was used [29, 30]. The choice of the optimal model for forecasting was determined using the calculation of intra-sample forecast error indicators [31]. The statistical significance of the difference in forecasts for different models was tested using the Diebold–Mariano method [32]. The results of comparing intra-sample forecasts were used to confirm the presence of dynamic links between sub-indices of globalization.

3. Results

3.1. Analysis of stationarity of the sub-indices of globalization, Algeria

Using ADF, PP, and KPSS tests without taking into account structural shifts for individual processes produced inconsistent results, as expected. For all sub-indexes, the hypothesis of non-stationarity was not rejected by the ADF and PP tests (except for the political one for PP), while the KPSS test did not reject the hypothesis of stationarity (at the significance level of 5%). Therefore, the results of testing processes for stationarity were taken into account, considering structural shifts. In *Table 1*, as an example, some results of this analysis are given, for the sub-index of political globalization, for the case of an additive structural shift only in a constant and inclusion of a trend and a constant in the test regression.

Table 1 shows that the P-, LS-, and CMR tests do not reject the null hypothesis of non-stationarity under the assumption of either one or two structural shifts at the 0.05 significance level, and almost uniquely determine the moments of the shift. In the P-test, the coefficient estimate for the variable that determines the structural shift is statistically insignificant (the t-statistic is 0.198), and this corresponds to some discrepancy in determining the moments of the shift. The results of testing the first differences for all sub-indexes showed that they were stationary. Therefore, it was concluded that these series are implementations of first-order integrated processes with structural shifts in the constant and / or trend.

3.2. Analysis of dynamic links between Algeria's globalization sub-indices

Some results of the cointegration analysis are shown in *Tables 2* and *3*. *Table 2* contains the results of cointegration testing for the case of a trend only in the long-term ratio, taking into

Table 1.

Results of testing for the stationarity of the sub-index of political globalization in Algeria taking into account structural changes

Number of structural shifts	Test indicators	P-test	LS-test	CMR-test
1	T-statistics	-2.434	-2.848	-1.004
	5% critical level	-4.860	-3.487	-3.560
	T-statistics for the shift variable	0.198	2.198	7.015
	Moment of shift	2001	1996	1990
2	T-statistics	-	-2.923	-3.093
	5% critical level	-	-3.563	-5.490
	T-statistics for the first shift variable	-	-2.524	3.351
	T-statistics for the second shift variable	-	-3.405	2.942
	Moments of shifts	-	1990, 1998	1990, 1998

Footnotes: 1. H_0 : the process is not stationary in the presence of structural shifts
 H_1 : the process is stationary in the presence of structural shifts
 2. The test equation included 8 lags.
 3. In the LS and CMR tests, the sample reduction rate was 10%.

account three lags of sub-indices and exogenous variables that characterize structural shifts in the trends of all series. In this example, two variables were included for the shift in the constant: (D_{1995} and D_{1991}) one variable for the shift in the slope of the trend (DT_{1987}) and three variables for the momentary jump (DU_{1989} , DU_{1998} , DU_{2007}). The table shows the asymptotic P-values for both Johansen test statistics (MacKin-

non-Haug-Michelis, 1999) (*asy LR(trace)* and *asy LR(max)*), as well as the bootstrapped (for 1000 observations) P-values for one of them (*boot LR(trace)*). The latter are more appropriate here, since they take into account structural shifts and the analyzed sample is small. The table shows that they indicate one cointegration ratio between sub-indices, while the asymptotic P-values of both statistics specify two ones (at

Table 2.

The test results of the sub-indices of globalization of Algeria for cointegration

Rank of cointegration / P-value	asy LR(trace)	asy LR(max)	boot LR(trace)
0	0.000	0.000	0.000
1	0.020	0.019	0.092

the level of 0.05). Therefore, further exactly one cointegration equation was evaluated.

The estimated VECM corresponded fairly well to the data, since assumptions about the correctness of its specification were not rejected. Thus, the *P*-value for Rao–Fischer statistics for checking the serial correlation of residuals amounted to 0.355, and the one for statistics for checking of normality was 0.989.

Table 3 shows parameter estimates and quality indicators for the error correction model presented. Table 4 gives the corresponding results

of the Granger causality test. Figure 2 demonstrates graphs of impulse responses of each sub-index to shocks in other sub-indices for 10 years. Figure 3 displays decompositions of the variance of the sub-index forecast error averaged over the first and second five years. The figures are presented in the assumption of the Cholesky superposition, in which the variable that changes after other variables is specified last in their sequence, for example, the following schemes were used for the response and decomposition of the variance of the pol forecast error: *soc – ec – pol*.

Table 3.

The results of the evaluation of the error correction model for sub-indices of globalization. Algeria

	Δpol_t	Δec_t	Δsoc_t
$\beta' X_{t-1}$	-0.458***	0.197***	
Δpol_{t-1}	-0.360***	-0.076**	-0.003
Δpol_{t-2}	-0.119	-0.081***	-0.005
Δec_{t-1}	1.653***	-0.061	0.063
Δec_{t-2}	1.602***	-0.449***	0.123**
Δsoc_{t-1}	-1.240	0.214	-0.025
Δsoc_{t-2}	-1.236	1.016***	0.089
D_{1991}	-7.359*	3.255***	-0.088
D_{1995}	5.603	-0.311	1.976***
DU_{1989}	10.888*	3.173*	2.734***
DU_{1998}	-27.860***	-4.151***	0.810
DU_{2007}	-25.184***	-1.242	-0.0564
DT_{1987}	-0.534**	0.201***	-0.047*
<i>Const</i>	15.022***	-6.020***	0.448
<i>BIC</i>	6.708	4.114	2.685
<i>R-sq</i>	0.850	0.721	0.706

Footnotes: 1. The significance level of parameter estimation is specified: * - 10%. ** - 5%. *** - 1%
 2. Coefficient estimates for $\beta' X_{t-1}$ presented for the case of normalization to *pol*

Table 4.

The Granger test results for sub-indices of globalization, Algeria

	χ^2 statistics, <i>P</i> -value		
	to Δpol	to Δec	to Δsoc
Δpol	–	0.005	0.928
Δec	0.000	–	0.049
Δsoc	0.166	0.000	–

Footnote: In the test equations, two lags of the first differences of the sub-indexes were used

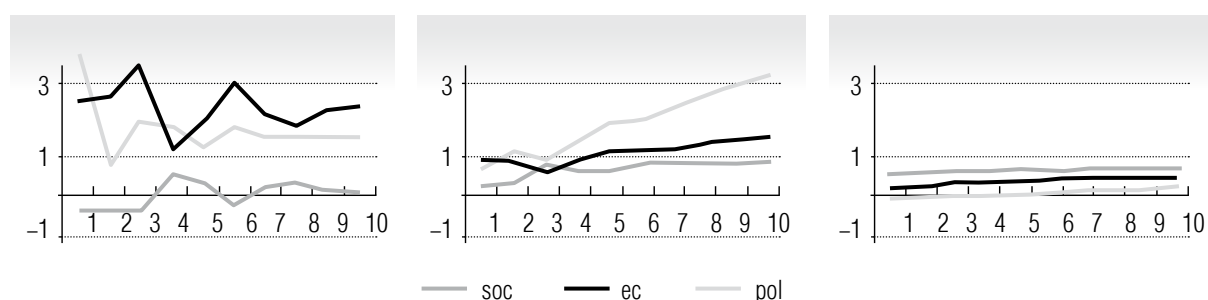


Fig 2. The value functions of impulse responses of the sub-indices of globalization of Algeria to shocks in them

From Table 3, the values of the determination coefficient show that the included variables sufficiently describe the short-term dynamics of all sub-indexes. Coefficient estimates for variables that correspond to structural shifts in sub-index trends are statistically significant², which indicates that they need to be taken into account in the analysis. An insignificant estimate for the correcting term in the error correction model for the social globalization sub-index indicates a weak exogeneity of this variable relative to the VECM parameters, which means that if the system of globalization sub-indexes deviates from the long-term equilibrium, it is not corrected. This variable is not strictly exogenous, since it reveals Granger causality on the part of the sub-index of economic globalization. This corresponds to the statistical significance of the coefficient estimate for in the specified equa-

tion. The responses of this sub-index to shocks in economic globalization are significant, although very weak (0.7 or less), and about 20% of the variance of the forecast error of this sub-index is due to the dynamics of economic globalization. Responses of the social globalization sub-index to shocks in the political globalization sub-index are statistically insignificant. At the same time, the impact of social globalization shocks on political globalization is statistically insignificant, while the impact on economic globalization, although significant, is small (up to 1.0). Therefore, we can talk about the relative independence of social globalization in a country that does not respond well to the variability of external economic and political relations and has little or no impact on their development.

The sub-indexes of political and economic globalization are endogenous variables. Accord-

² Here and then the significance level of 0.05 was taken into account

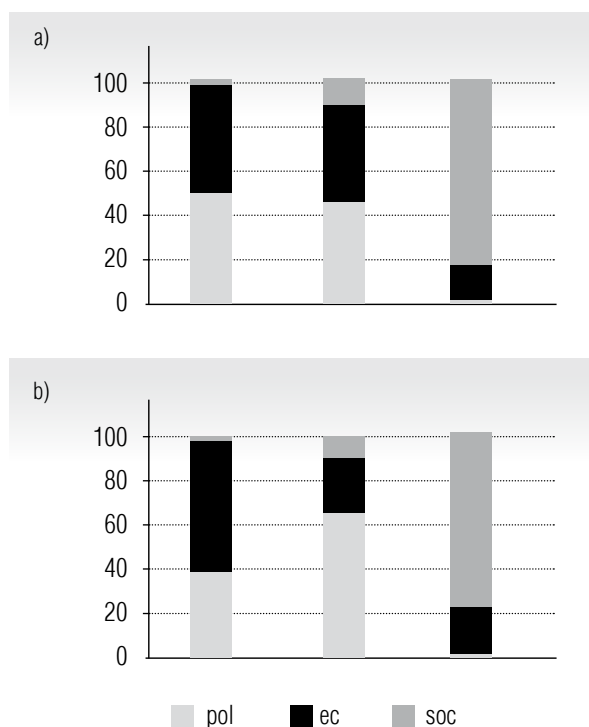


Fig 3. Decomposition of the average (for five years) variance of the forecast error of the globalization sub-indexes, Algeria
 a) the first five years, b) the last five years

ing to the results of Granger causality testing, they mutually condition each other in the short-term dynamics. Based on the impulse response charts, it is clear that for the political sub-index, the most significant responses occur in the first half of the ten-year period. The greatest effect is almost instantaneous response from your own shocks. The shocks of economic globalization have a delayed and unstable effect. After the 5-th lag, the indicator of political globalization remains at a new, higher level. This uneven response behavior is also evident in the typical roughness of the political sub-index graph (Figure 1). For the sub-index of economic globalization, the response to the shock in political globalization has been growing almost monotonously throughout the decade, reaching a fairly high level by the end of the decade. This corresponds to the decomposition of the variance of the forecast errors of sub-indexes both of politi-

cal and economic globalization and reveals the noticeable redistribution of the share of each component in the structure of the interdependence of political and economic globalization during the transition from the first five-years to the second one. Figure 3 shows that the role of foreign policy events in the formation of international economic relations in Algeria is more noticeable by the end of the decade, which indicates a certain inertia of their impact. This may explain the current downward trend in the level of economic globalization as a result of the sharp drop in the value of political globalization in 2007.

It should be noted that the result of applying the Johansen approach without taking into account structural shifts to the analyzed series did not contradict the above conclusion about the presence of a single cointegration ratio for the same model specification, however, the quality of the estimated model was much worse. Thus, the value of the Schwartz information criterion for such a model was 10% higher, and the assumptions about uncorrelated residues and normality were not fulfilled.

3.3. Prediction of sub-indexes of globalization, Algeria

ARIMA and HWM models were built to confirm the dynamic relationships identified, as well as to predict each sub-index. Tables 5 and 6 show some of the results of their evaluation. Table 5 demonstrates that the moments of structural shifts in the ARIMA models mostly coincide with the moments figuring in the VECM. The results of testing the residues of each model indicate a fairly correct choice of specification.

Table 6 shows the values of optimal smoothing parameters for HWM. Their small values for pol indicate that current information is poorly taken into account in forecasting, which may lead to under-accounting of structural shifts in the trend, especially impulse ones.

Table 5.

Results of evaluation of ARIMA-models of sub-indexes of globalization. Algeria

Sub-indexes	<i>ec</i>	<i>pol</i>	<i>soc</i>
Exogenous variable	DT_{1987}, DT_{2007}	DU_{1998}	$D_{1995}, DT_{2007}, DU_{1989}$
<i>q</i>	1.3	1	0
<i>LM</i> -test. 2 lags. <i>P</i> -value	0.467	0.492	0.770
<i>JB</i> -test. <i>P</i> -value	0.942	0.067	0.374

Table 7 shows the results of an intra-sample forecast for one year for the entire sample for three models. It can be seen that for VECM, the root-mean-square error of the forecast for all series is the smallest. The MD test indicates that the difference between forecast errors for VECM and ARIMA is statistically significant for political globalization. Since the response to shocks in the sub-index of political globalization is delayed for economic globalization, it does not appear in the static forecast. At the same time HWM predicts all rows worse. This again suggests that structural shifts should be taken into account correctly, because this model does not explicitly provide for this.

In Table 8 similar results of an out-of-sample forecast calculated using a recursive scheme are presented. Again, as with the intra-election forecast, for political globalization, the forecast is better for the multidimensional model by at least 3 years. Although according to the *p*-values of the Mariano-Diebold test statistics, the difference between RMSE is statistically insignificant. For economic and social

globalization, sub-indexes are better predicted using the ARIMA model, and this difference is statistically significant for economic globalization. Perhaps, here again, the effect of political globalization is delayed and begins to be felt only in the second five-year period.

Figure 6 shows a fragment of the series from 2001 to 2015 with a forecast for the period up to 2020. A solid line indicates the forecast for VECM, points – for the ARIMA, and a dotted line-for the HWM algorithm. The forecast for the KOF-index of globalization was calculated as the arithmetic average of the forecasts of individual sub-indices in accordance with the official method of its calculation [14]. The 80% confidence interval for the forecast of political and economic globalization sub-indices for VECM is shown in gray. It can be seen that the forecasts for the sub-index of economic globalization for all three models are in this range. Perhaps this is due to the fact that the strong shocks of the sub-index of political globalization which significantly affect its behavior have remained in the past. For polit-

Table 6.

Results of evaluation of HWM

Smoothing parameters	<i>ec</i>	<i>pol</i>	<i>soc</i>
λ_0	0.660	0.050	0.950
λ_1	0.610	0.090	0.290

Table 7.

Results of the intra-sample forecast of globalization sub-indexes, Algeria (1971-2015), RMSE

Model / Sub-indexes	<i>pol</i>	<i>ec</i>	<i>soc</i>
VECM	3.755	1.026	0.502
ARIMA	5.662	1.180	0.542
HWM	6.928	1.891	0.828
MD (for VECM, ARIMA)			
<i>P</i> -value	0.009	0.219	0.117

Table 8.

Results of the out-of-sample recursive forecast of globalization sub-indexes, Algeria (2011–2015)

Horizon	<i>ec</i>			<i>pol</i>			<i>soc</i>		
	ARIMA	VEC	MD	ARIMA	VEC	MD	ARIMA	VEC	MD
1	1.208	1.934	0.138	9.766	5.807	0.313	0.730	0.822	0.413
2	1.605	4.205	0.012	10.435	7.855	0.328	0.862	0.909	0.441
3	1.787	6.508	0.000	12.508	11.349	0.386	1.328	1.444	0.112
4	2.746	9.855	0.000	12.411	13.412	0.962	1.925	2.062	0.298
5	4.030	13.938	0.000	11.440	16.393	0.489	2.634	2.903	0.211

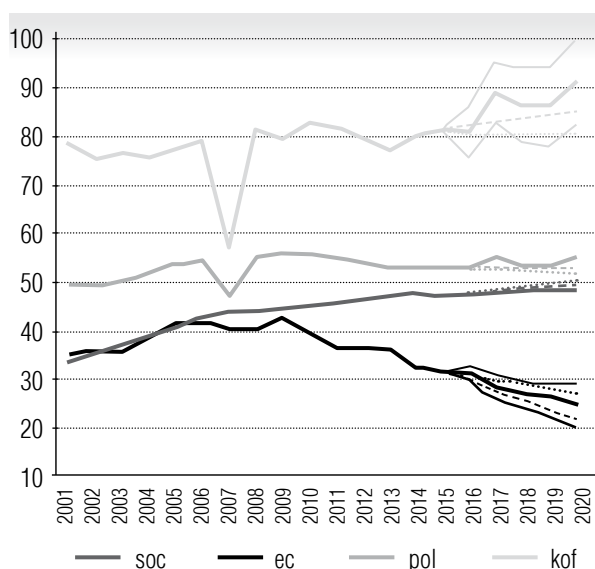


Fig 6. Forecast of globalization sub-indexes until 2020, Algeria

ical globalization, forecasts for models vary, and do not always fall within the specified confidence interval. Forecasts of the social globalization sub-index for different models are almost identical, which corresponds to its relative independence in the sub-index system. Forecasts for the KOF-index of globalization are also almost identical, however, the graph still indicates a slight overestimation of the forecast for the VECM.

Thus, the formation of the KOF-index of globalization for Algeria is largely due to the mutual influence of its components. The weak growth of the sub-index of political globalization is formed mainly as a result of changes in the sphere of economic and political external relations. Economic globalization has a nega-

tive trend. The direct impact of political globalization on it which is noticeable in the short-term dynamics is not able to reverse this trend, perhaps because of the strong variability of the process of political globalization. Stabilization of the overall level of globalization in this country is provided by the positive dynamics of social globalization, which is formed almost self-sufficient, thanks to the rapid development of social networks and mobile communications. However, its role for political and economic integration in Algeria is small.

Conclusion

Approbation of the research methodology using the tools of cointegration analysis of random processes taking into account structural shifts in the parameters of their trends, as well as comparison of the predictive ability of one-dimensional and multi-dimensional models indicated its effectiveness and the possibility of further use in such tasks. This study will contribute to the development of a methodology for predicting globalization indicators in countries where their dynamics are unstable. ■

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About the authors

Elena D. Kopnova

Cand. Sci. (Tech.);

Associate Professor, Department of Statistics and Data Analysis, Faculty of Economic Sciences, National Research University Higher School of Economics, 20, Myasnitskaya Street, Moscow 101000, Russia;

E-mail: ekopnova@hse.ru

ORCID: 0000-0002-8429-141X

Lilia A. Rodionova

Cand. Sci. (Econ.);

Associate Professor, Department of Statistics and Data Analysis, Faculty of Economic Sciences, National Research University Higher School of Economics, 20, Myasnitskaya Street, Moscow 101000, Russia;

E-mail: lrodionova@hse.ru

ORCID: 0000-0002-0310-6359