

8

Mathematical Modeling of Socio-Political Destabilization of the States in the Context of Globalization

COMMEMORATIVE MEDAL FOR YOUNG RESEARCHERS

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Abstract

The article presents the main results of the study of the socio-political destabilization of the states using mathematical modeling and methods of descriptive statistics.

Keywords: *modeling, socio-political destabilization, mathematical models, statistics.*

Despite the large number of scientific literature concerning the theoretical and methodological study of socio-political destabilization, the problematic field remains open in terms of forecasting destabilization events in various countries of the world in the short, medium and long term. For example, the ‘Arab Spring’, the second revolution in Ukraine, the civil war in Syria, the change of political power in Yerevan, and an attempt to remove the leader of the Republic of Belarus from power by quasi force were not predicted by the prominent scholars.

In continuation of the theoretical and methodological part, it should be noted that at present there is no single unified terminology accepted by the scientific community in terms of socio-political destabilization (Ilyin and Bilyuga 2017). On the contrary, there is a very broad predominance of definitions of ‘socio-political destabilization’ (Feierabend I. and Feierabend R. 1966; Duff and McCamant 1968; Sanders 1981; Ersson and Lane 1983; Muller and Jukam 1983; Makarychev 1998; Kolstad 2008; Semchenkov 2012; *etc.*), various categorizations of the types of socio-political destabilization (Baigushkina and Zagladin 2011; Goldstone 2014; Goldstone and Ritter 2018, Grinin, Korotayev *Kondratieff Waves: Processes, Cycles, Triggers, and Technological Paradigms* 2022 161–168 DOI: 10.30884/978-5-7057-6191-3_09

and Malkov 2010), the fundamental and provoking reasons of socio-political destabilization (Beissinger 2007; Bunce and Wolchik 2006; Chenoweth and Ulfelder 2017; D'Anieri 2006; Hall 2017; Ketchley 2017; Kuzio 2006; McFaul 2005; Mitchell 2012; Radnitz 2010; Ritter 2015; Silitski 2009; Wang 2018; Way 2008; Belkovsky 2005; Zatulin 2005; Issaev 2006, 2014; Maksimov 2010; Manoilo 2015a, 2016, 2017; Naumova, Avdeyev, and Naumov 2013; Pugachev 2005; Sirota 2006; Sundiyev and Smirnov 2016; Svobodnaya Rus 2015).

Nevertheless, I consider socio-political destabilization as 'a destructive process initiated or supported from the outside, leading to a disruption of the stable functioning of the socio-political system of the state' (Bilyuga 2019).

The situation is similar with the existing research methods of socio-political destabilization. Analyzing the scientific literature on the research topic, the following main approaches to the analysis of the problem of modeling the socio-political destabilization of states in the context of globalization were identified – the Delphi method, qualitative and quantitative methods (*Ibid.*). Each of these methods has a very large development base and has its own advantages and disadvantages. However, given the fact that the most reliable and closest to objective reality method requires three main features: dynamism, quantitative forecasting and objectivity. It was found that only one of the methods of quantitative approaches is suitable, namely dynamic modeling, which is still in its infancy at present, precisely when considering the topics of this research.

When analyzing other approaches, one can notice the absence of either one feature or the sum of features, which undoubtedly affects the conduct of a full-fledged research into socio-political destabilization (see Table).

Table. Analysis of existing research methods of socio-political destabilization

№	Methods		Approach of analysis	Predictability	Subjectivity/objectivity
1	Qualitative methods		dynamic	qualitative	subjective
2	The Delphi method		static	qualitative	subjective
3	Quantitative methods	(indices)	static	—	objective
		(dynamic model)	dynamic	quantitative	objective

Thus, a dynamic mathematical model should be more or less close to reality, cover the dynamics of the process (to analyze the process in time), and have a quantitative component (to be able to measure the phenomenon, event or process under study in numbers) and, most importantly, it should be objective and predictive potential.

Nevertheless, one should note that the existing variety of different variants of socio-political destabilization indices with various combinations of factors based on statistical methods has a weak prognostic potential. At the same time, logical and mathematical models that would allow analyzing and modeling the

influence of foreign policy factors on socio-political destabilization in various countries with high reliability for the medium and long term do not currently exist. Thus, the most preferable option, on the basis of which it is possible to identify the level of influence of factors on the socio-political destabilization of states, is a combined approach which involves the use of statistical methods combined with logical-mathematical models.

The combined approach to the analysis of the influence of various factors on the socio-political destabilization of the states consists of three stages. At the first stage, the analysis of the key features and conditions of development in the states under study is carried out according to the criteria given here (*Ibid.*). The next stage is followed by the development of logical-mathematical model to assess the influence of factors on the socio-political destabilization of the states. At the third stage, a quantitative analysis of real data is used, as a result of which the most dangerous factors are highlighted that can destabilize the situation in the state, provided that the internal situation in the country leaves much to be desired.

This analysis seeks to develop a combined approach to the study of socio-political destabilization using mathematical modeling (*Ibid.*).

Some of the results presented below were obtained at the third stage of the combined approach. Their scientific novelty is that for the first time the well-known qualitative axioms were substantiated and proved with the help of mathematical tools.

For example, there was found significant relationship between the index of the intensity of socio-political destabilization and different types of regimes – destabilization is significantly higher in the countries with transitional democracies and in the countries with an authoritarian type of regime (see Fig. 1).

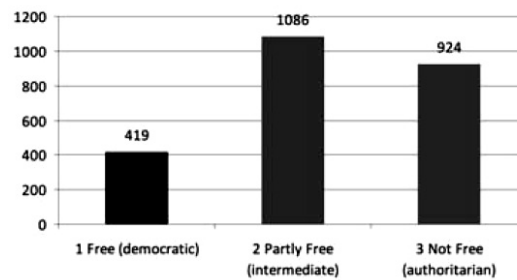


Fig. 1. Index of the intensity of socio-political destabilization for democratic, authoritarian and intermediate regimes from 1973 to 2012

Source: URL: <https://freedomhouse.org/report/freedom-world-2015/methodology#.VeVBePntmko>; Banks and Wilson n.d.; Bilyuga 2017.

At the next stage, an attempt was made to search for links between socio-political destabilization (in particular, the intensity of anti-government demonstrations) and the economy. As a result of statistical analysis, a direct positive relationship was found between GDP per capita in PPP and the intensity of anti-government demonstrations, which shows that for countries with GDP below US\$ 20,000 dollars per capita, a higher level of demonstrations should be expected (see Fig. 2).

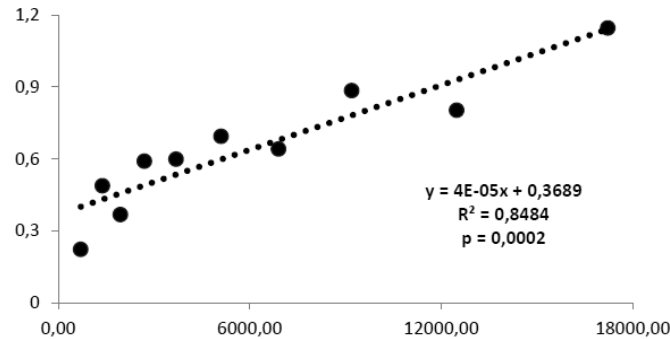


Fig. 2. Correlation between GDP per capita for the countries with incomes not exceeding US\$ 20,000 dollars (PPP – purchasing power parity; x-axis) and the intensity of anti-government demonstrations (y-axis) for the corresponding year, 1960–2014 (scatter plot with fitted regression line)¹

Source: URL: <http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD>; <http://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG>; Banks and Wilson 2016; Korotayev, Bilyuga, and Shishkina 2017.

The next important factor was the Brent crude oil price indicator which is especially important for export-oriented countries, which depend on the prices of certain energy-resource goods for export. A negative relationship was found between the three-year drop in Brent oil prices to the level of US\$ 30 dollars and an increase in the intensity of the socio-political destabilization index (see Fig. 3).

¹ Here, GDP per capita deciles are within the following boundaries: the first decile – from the minimum up to US\$ 1,160; the second decile – from US\$ 1,160 to US\$ 1,600; the third decile – from US\$ 1,600 to US\$ 2,290; the fourth decile – from US\$ 2,290 to US\$ 3,110; the fifth decile – from US\$ 3,110 to US\$ 4,280; the sixth decile – from US\$ 4,280 to US\$ 5,930; the seventh decile – from US\$ 5,930 to US\$ 7,870; the eighth decile – from US\$ 7,870 to US\$ 10,500; the ninth decile – from US\$ 10,500 to US\$ 14,400; and the tenth decile – from US\$ 14,400 to US\$ 20,000. PPP = purchasing power parity.

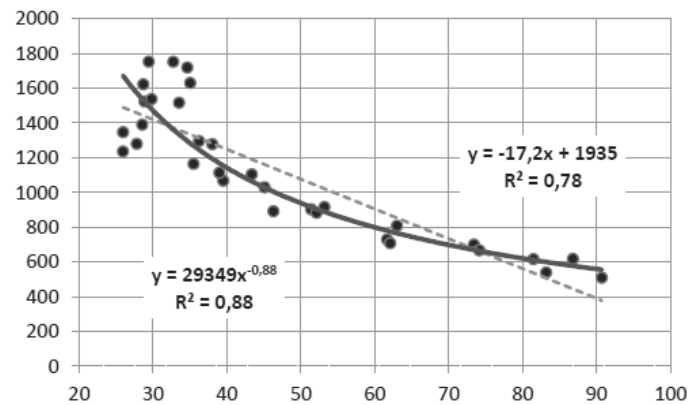


Fig. 3. Correlation between the average annual price of Brent crude oil (x-axis) and the average value of the CNTS socio-political destabilization index (y-axis) for oil-exporting countries in three years (using five-year smoothed averages), 1977–2008 (scatter plot with superimposed power and linear regression lines)

Source: Banks and Wilson 2016; URL: <http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RB RTE&f=A>; Korotayev, Bilyuga, and Zinkina 2016.

If the oil price falls to US\$ 30 dollars consecutively within three years, one should expect destabilization in the export-oriented countries of raw materials.

Summing up, one should note again that the research topic is of the most urgent interest, taking into account at least rather chaotic and unpredictable processes both within a state and outside it, for example, among its closest neighbors. There is a huge need for its development both in theoretical terms and in practice when making forecasts of the emergence of these destabilizing events or predicting the further course of their development.

As a near-term research perspective, it is planned to develop a universal dynamic multiplicative index, which will improve the quality of analysis and monitoring of socio-political destabilization, to timely identify the risks of socio-political destabilization, to explore possible ways to overcome such risks, to monitor the development of the situation, in particular, in a number of post-Soviet states.

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