# Model of Formation of Destructive Horizontal Processes and Counteraction to Them

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**Abstract**

A mathematical model of the formation of avalanche-like agitation processes in socio-economic systems has been verified. The model is based on the viral dissemination and impact of information on agents of social and economic processes, as well as the influence of absolute volumes of information flows on the dynamics of their growth. It has been shown that the classic Gartner hype cycle is a superposition of simultaneously acting factors of a destructive and constructive nature. On the basis of the verified model, the field of scenarios for counteracting destructive hype is generated. The grope of scenario dynamic time series allows decision makers to evaluate the effectiveness of management of counteracting the hazards of destructive hype processes, as well as the formation of control actions to achieve management goals in social and economic systems. The model developed and the results of its use make it possible to move from qualitative to quantitative methods of monitoring and managing hype processes.

**Keywords**

Model, information hypes, destructive effects of danger, counteraction, management

## 1. Introduction

Modern digital systems and technologies have become widespread and are developing more dynamically than other infrastructural solutions of socio-economic systems, not only due to the simplicity and availability of information, but also due to the impact on economic systems and their agents [1]. The critical impact of information flows on the formation of the behavior of groups of citizens in socio-economic systems was manifested in 2016, when the US Senate Intelligence Committee presented reports on the activity of Russian social media users during the presidential elections in the United States. The report claimed that accounts from Russia allegedly influenced Trump's victory. Since then, much attention has been paid to monitoring and countering information ceilings and even positive and negative assessments of accounts that affect the state of socio-economic systems. In 2020, during the new presidential elections, on the contrary, the influence of the incumbent on social networks was blocked, which undoubtedly influenced the election results. In this regard, methods and models of quantitative assessment of trends formed by information flows with the aim of supporting them in cases of interest of subjects of management of socio-economic systems, or, conversely, confronting them, if they are destructive, become relevant [2].

In the scientific literature, destructive actions (cyber-attacks aimed at communication systems, target servers; unauthorized access, spread of viruses) [3-6] are distinguished, which can be classified as cybercrimes [7, 8]. At the same time, the precedents of the influence of legitimate information flows, especially those of an agiotage nature [9], have not been sufficiently studied. In this regard, the present study aims to develop mathematical methods and models of these processes, both of a constructive and destructive nature.

BIT-2021: XI International Scientific and Technical Conference on Secure Information Technologies, April 6-7, 2021, Moscow, Russia
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It can be considered a textbook precedent for an abnormal growth in the share price of GameStop Corp in 2021. The company has been losing profits for several years. And in the stock market, its shares have traditionally been used by investment and hedge funds to make a profit through "short positions", that is, by selling shares at the current price, after which quotes are reduced due to an excess of stocks supply, and players buy the same shares but at a lower price. However, another hedge fund shorting in late 2020 sparked a fierce backlash on the Reddit platform, which is used by nearly three million people. The post by Elon Musk in support of the Reddit community was of great importance, after which quotes rose to $ 347.51 per share with an average price for the year of $ 7.138 (the price increased by 4868% from the annual average). The data visualization (https://ru.investing.com/equities/gamestop-corp-historical-data) underlying the presented conclusions about the abnormal increase in the GameStop share price is shown in Fig. 1.

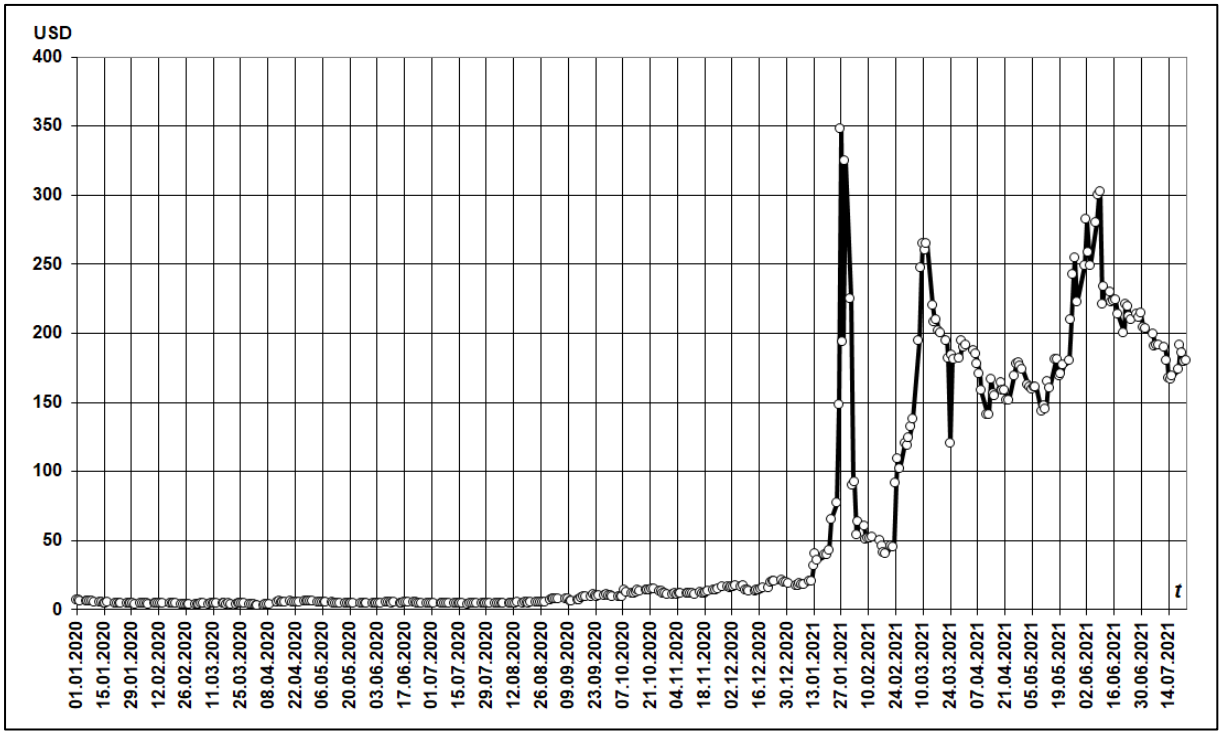


**Figure 1**: GameStop Corp's hectic stock price cycles

The presented result illustrates the formation of agiotage anomalies [10, 11] under the influence of information and information flows. The negative effect for short-term actors (investment and hedge funds) is obvious: their losses amounted to over USD 6 billion. It is important to note that the information calling for the acquisition of these shares was legitimate.

## 2. Model of the influence of digital resources on the consciousness and behavior of actors in socio-economic systems

The influence of information and information and communication technologies (ICT) on the behavior of citizens has been proven by scientific research [12, 13] and has been repeatedly confirmed by practice. There was even a whole generation Y (born 1980 - 1999, plus or minus 3 years for the left and right boundaries of the range), called the network. The expansion and strengthening of the influence of digital technologies on socio-economic systems and actors is manifested in the last two decades, when generation Z was formed (born in 2000 - 2019, plus or minus 3 years for the left and right boundaries of the range), called digital. These generations are characterized not only by the permanent use of world information resources [14], but also by such dependence on them that their social and economic activity is manifested to a greater extent in the network space [15], and in real time (online) than in real life and "live" social interaction "offline". The specified dependence on the information

resources of economic entities [1], mobile gadgets is a distinctive feature that characterizes and predetermines the features of social and economic behavior of generations Y and Z.

Although other generations of the world's population are not subject to such an irresistible dependence on digital resources, the influence of virtualization has grown so much [16, 17, 18] that the annual cash flows of marketers to bloggers, providers, and authoritative participants in social networks are 40 billion US dollars. It is important to note that this impact of information and information flows continues to grow rapidly [19]. This growth was especially pronounced during the coronavirus pandemic and the resulting restrictions on the physical interaction of people in the real world. The capitalization of telecommunications companies and companies that develop and provide video conferencing services grew faster than others.

The basis of the mathematical description of the processes of the formation and spread of excitement, we put the following empirical provisions. First, citizens are always characterized by heterogeneity (heterogeneity and opposition) of opinions (pluralism) on any aspect of social and economic processes [20, 21, 22]. Consequently, any new statement that appears in the ICT space, a priori, has its own audience of both approval and support, and potential opposition. Second: most of the actors decide to support one or another alternative based on comparative analysis, ratings and rankings for the most important indicator for the subject [17, 19]. This requires data generated by other entities to build a sequence of alternatives on their basis and give preference to one of them, or to the TOP lists of alternatives. Consequently, such groups of actors inevitably become followers. Some of them only need information about the opinion of authoritative actors. This practice is becoming widespread in the ICT space. Consequently, the growth rate of followers is proportional to the number of predecessors who substantiated and presented their judgment. Third: the limiting number of participants in the rush process (HYIP) is, of course, how finite is the resources, demand, or supply for which is subject to a rush cycle [22]. The above can be formalized mathematically [23] by the differential equation:

$$dQ/dt = v \cdot Q \cdot (1 - Q/Q_m) \quad (1)$$

where:

Q - is the current value of the investigated indicator of the social or economic process;

Qm - is the limiting value of the indicator under study (for example, the volume of demand), that is, the level of saturation;

v - is an indicator of the rate of propagation of a reaction, for example, to an information flow (the degree of influence of information on the acceptance of its content).

Equation (1) has a solution in the form of a sigmoid:

$$Q = \frac{Q_m}{1 + e^{u - v \cdot t}}. \quad (2)$$

where:

u - is a constant of integration, determined by the initial conditions (time reference);

e - is a constant (2.71828459).

The growth sigmoid is graphically shown in Fig. 2.

Obviously, information countermeasures are subject to the same distribution patterns that form the basis of equations (1) and (2). Consequently, the opposing processes are described by similar equations, but with the opposite sign:

$$dQ\_/dt = v\_ \cdot Q\_ \cdot (1 - Q\_/Q_{m\_}) \quad (3)$$

$$Q\_ = -\frac{Q_{m\_}}{1 + e^{u\_ - v\_ \cdot t}} \quad (4)$$

The decay sigmoid (4) is also shown in Fig. 2.

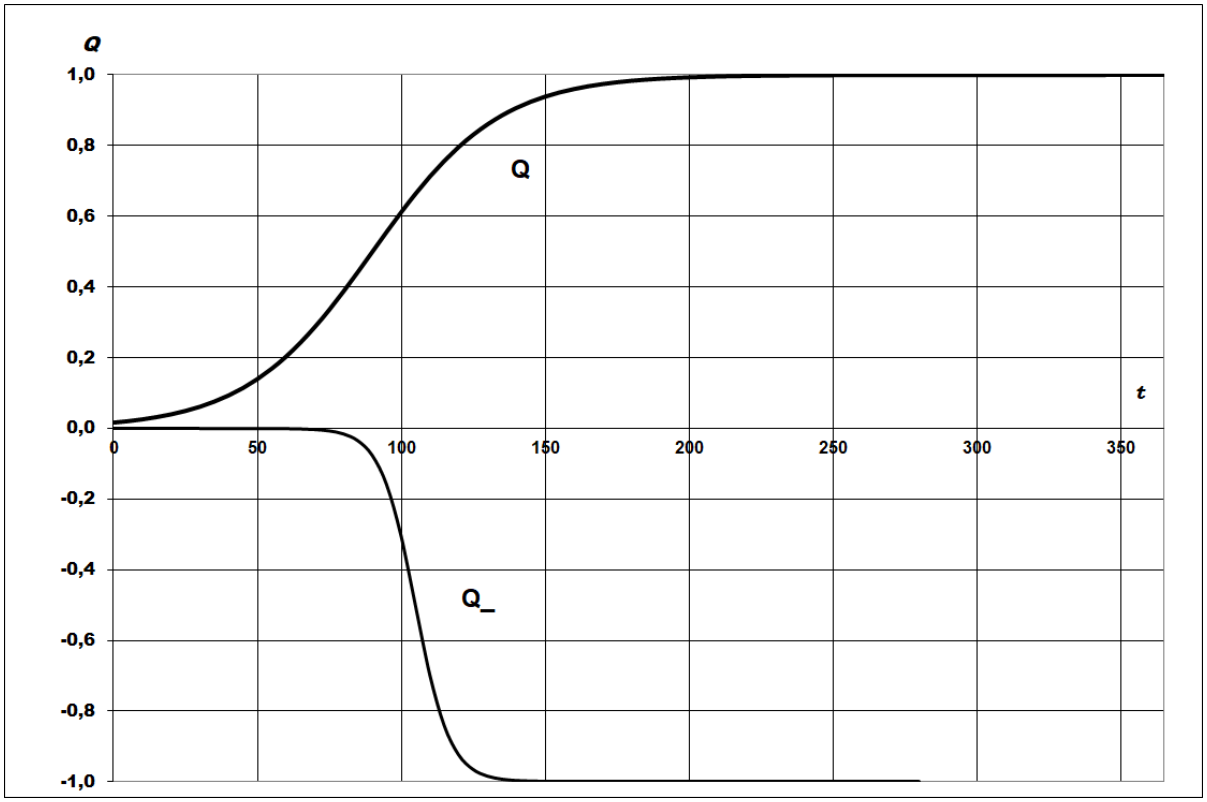


**Figure 2**: Sigmoids of growth and decline

Now the equation of the joint influence of information and information flows on the sigmoidal processes of growth and decline of agiotage processes can be represented by a superposition of (2) and (4):

$$Q_{sum} = \frac{Q_m}{1 + e^{u - v \cdot t}} - \frac{QA_{m\_}}{1 + e^{u\_ - v\_ \cdot t}} \quad (5)$$

The dynamics of changes in parameters in accordance with (5) is illustrated in Figure 3. Note that the solution obtained has a character of change consistent with the Gartner rush cycle, which is widely used not only by the company to analyze the state of the modern market, but also by enterprises to manage the market positions of their products.

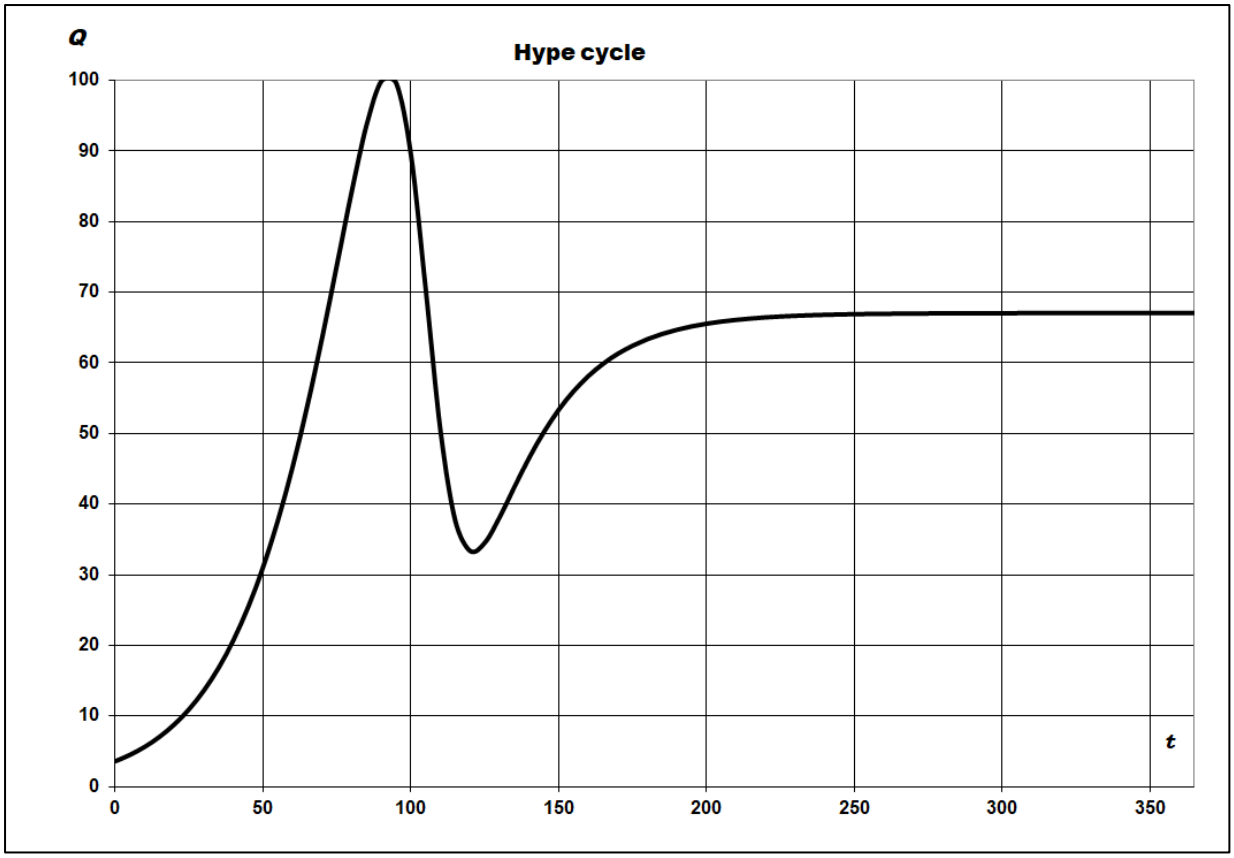


**Figure 3**: The nature of the rush cycle

The resulting solution makes it possible to assess and compare the nature of the rush dynamics, for example, depending on the weight or volume of information flows in socio-economic systems [18], which form the phase of rise ($k$ +) and decline ($k$_), and, accordingly, the risks of their destructive impact [24, 25, 26].

$$Q_{sum} = k_{+} \cdot \frac{Q_m}{1 + e^{u - v \cdot t}} - k_{-} \cdot \frac{Q_{m\_}}{1 + e^{u\_ - v\_ \cdot t}} \tag{6}$$

Depending on their ratio

$$k = k_{-}/k_{+} \tag{7}$$

we get the result of managing agiotage processes, visualized in Fig. 4.

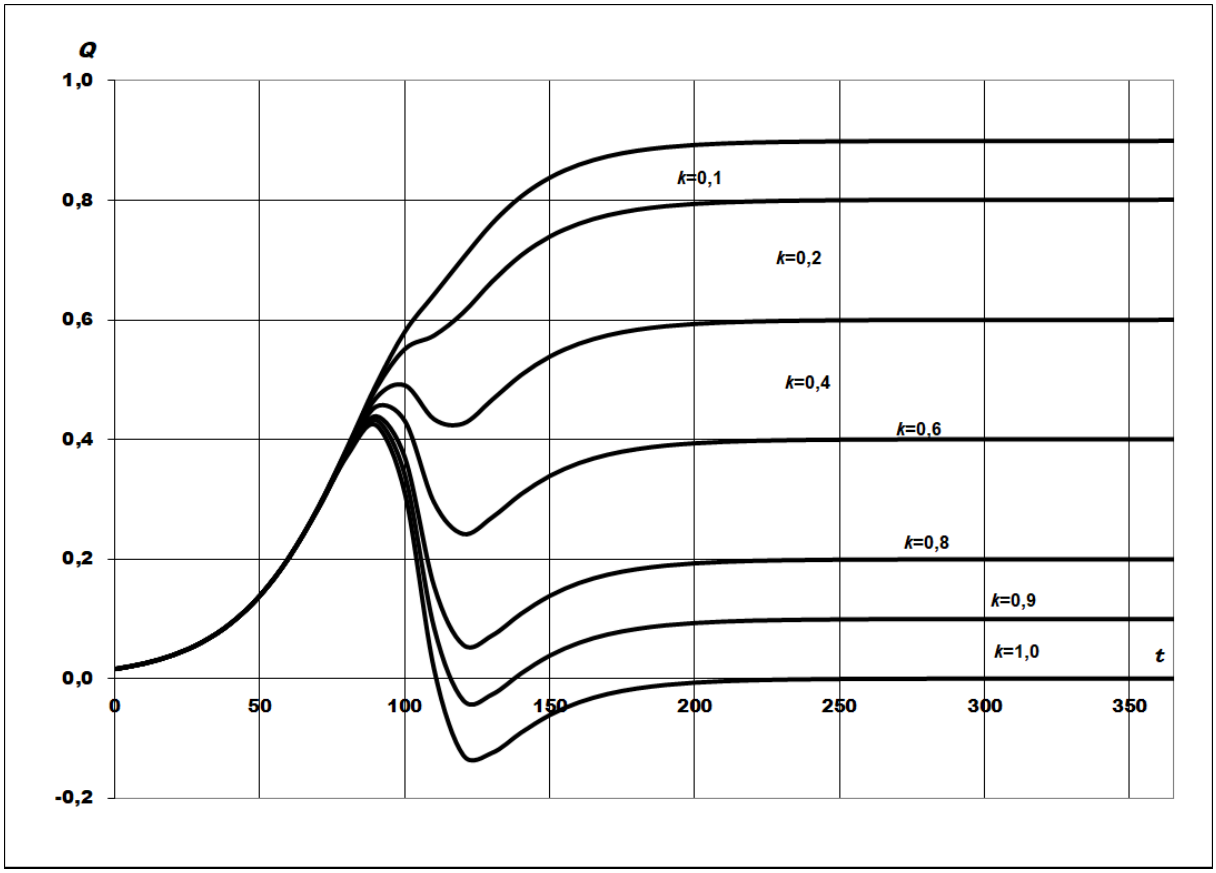


**Figure 4**: Scenarios to counteract rush processes

The obtained result of modeling rush cycles with varying degrees of resistance, for example, to anomalous processes, makes it possible to quantitatively estimate the resources necessary for such resistance based on the ratio of information flows of a destructive and constructive nature.

The mathematical model of agiotage socio-economic processes has been verified. The regularities of agiotage growth and decline are established, their unity, identity, but the opposite direction of temporal dynamics is shown. A parameter has been introduced that makes it possible to assess and compare the impact of both anomalous and countermeasures, for example, in the form of generated information flows [27].

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