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Algorithm to Determine the Target State of a System and the Best Path to It

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Abstract

In the planning and management they usually decide how to move some object from the state in which it is in a fixed time interval (given, start, or initial state) to another state in a future time interval (desired, target, or planned state). The initial state of the object is known, definite unequivocally and exists. Future states can be many, and they exist only in the form of images, visions and ideas of the plan developers or persons who order the plan. It is assumed that the transition from the initial state to the desired one is possible. There are many possible ways of transition. The task is to choose the best, according to some criterion, a sequence of transition. The algorithm for determining the sequence of transfers of some object from a given state to the desired one I presented in this paper. The algorithm takes into account the presence of different possible transitions from one state to another one and shows a point-multiple mapping of the initial state of an object in the set of its desired states. The sequence of transfers, in which the total expected gain from changing the state of the object in a given period reaches its extreme — maximum or minimum, is found in the process of comparing different variants of transferring this object from one state to another. An example of finding the trajectory of transferring the object from a given state to one of its possible desired states, on which the maximum total expected result is achieved, I gave in this article.

Keywords: algorithm, goal, estimation, system, a sequence of transitions, tabulation
JEL Classification: C51, E17, E61

The most essential components of planning the development of economic entities (whole country's economy, of its administrative-territorial formations, complexes, industries and private spheres of the socio-economic activities, legal and natural persons etc.) is knowledge of the patterns of transition of object from one state to another, and the ability and opportunity to influence the behaviour of the object. The planned state of the object is fixed in the planning tasks and in the indicators of its state in the established time intervals. In a formalised form, knowledge of the regularities of the object's transition from one state to another appears as a transition algorithm[1].

Monitoring of the progress of any decision, including established targets, includes checking the level of implementation and evaluation of performance at different time stages of realisation of decisions. For control the implementation of the decision (plans) and for assessment of the achieved results, it is also useful to have a strict algorithm for transferring the object to the desired state.

According to the methodology of the system approach, objects with which some actions are performed should be considered as systems[2]. In the case of planning, such systems can be

[1] "Algorithm: a finite ordered set of precisely defined rules for solving a particular problem" (National standard, article 7.1.2).

[2] Defining a variety of objects as systems, researchers have always recognized that they have the properties of complexity and integrity: "The system is a complete set of interrelated elements" (Sadovsky & Yudin, 1969, p. 12); "A system is an organized complex whole, a set or a combination of objects or parts that form a complex whole" (Johnson, Kast, & Rosenzweig, 1971, p. 26).

economic objects and economic entities. By its nature, composition and interrelationships of the constituent elements of the country's economy, its administrative-territorial formations, complexes, industries and spheres of the socio-economic activities, large companies and corporations is consistent with the notion of system: "an organized, purposeful structure that consists of interrelated and interdependent elements (components, entities, factors, members, parts etc.). These elements continually influence one another (directly or indirectly) to maintain their activity and the existence of the system, in order to achieve the goal of the system"[3].

An algorithm for determining the policy of transferring the system from the specified (given, starting, or initial) state to the best, according to some criterion, future (desired, target, or planned) state is given below. The final state of the system[4] depends both on its initial state and on the means and methods of transferring the system from the initial state to the desired one. Philosophically, the target and initial states of the system differ as ideal and actual. Valid determines the desired, implemented the desired becomes valid. The initial state of the system allows not only to define and formulate the goal but also to work on its achievement: it gives the tools (means) to achieve the goal[5]. "The notions of end and means necessarily presuppose each other. They are the contradictory unity of the desired and the real, the ideal and the material. The development of means leads to the improvement and realisation of the goal, the realisation of the goal requires further improvement and development of means that play a real role in the disclosure and realisation of goals" (Kazantsev, 1972, p. 99). At the same time, the higher the level of development and quality of the system in its initial state, the higher the requirements for the target state of the system can be.

From the above, it follows that the initial and target state of the system must be considered in their mutual relationships. Such systematic consideration, in particular, allows to identify false (in terms of compliance with reality and the laws of its changes) and unattainable in this state of the system goals. You should also not specify the target state of the system only as generated from the outside, the parent system[6].

Setting the target state of a system begins with an analysis of capabilities of the existing (specified) system and writing probable scenarios of its development[7].

When writing scripts, ideally imagined the future state of the system is generated by its initial state, assumes it as his ideal projection in the forthcoming interval of time *t*. Moreover, it is assumed that specific actions will be taken for the movement of the system to one described in scenario states. That is why it is possible to consider scenario writing as a point-multiple mapping (M) of an existing (or any other given) system to the set of its desired states I:

$$M(g, s) \rightarrow O(s), \qquad (1)$$

where:

s — is a vector describing the state of the system;

O(s) — one of the many desired states of the system: $O(s) \in I$;

g — vector of parameters of actions carried out to transfer the system from the initial state to the desired one.

M — is a point-multiple mapping, because, depending on the action policy, the system can be moved from its initial state to one of several different states in the future. It means that development is a multivariate issue.

Let J be a set of possible action strategies[8]. Then $M(g_j, s) \rightarrow O(g_j, s)$. Here $O(g_j, s)$ is one of

[3] URL: http://www.businessdictionary.com/definition/system.html.

[4] Under the state of the system, we understand the set of characteristics of the system, describing its elements and relationships. To set the state of a system is to determine the totality of its features.

[5] "Tool … means everything that serves to achieve the goal; to any intended action. In every case, there is a distinction between intention, means and end» (Dal', 1955, p. 177).

[6] For the socio-economic system, this provision is confirmed by the conflicts of goals and non-identity of the interests of society, its groups and members, the enterprise and its employees, etc.

[7] The term "scenario writing" means a method by which one tries to establish a logical sequence of events and show how the future state of a system can be deployed step by step from the existing state of the system. (Jantsch, 1970, p. 276).

[8] The choice of the set J is ultimately determined by the characteristics of the target state and the means available to achieve them. Only those actions that lead to the realization of the goal are taken.

the many desired states of the system achieved when actions g_j (j = 1, 2, 3,..., m) are performed.

It is clear that the decision to choose a strategy is made by experts. As initial data, they have a description of the initial state of the system, scenarios of its movement (development) and an approximate quantitative assessment of the final desired state in which the system should go. Making decisions (choosing a strategy of action), experts implement their knowledge, experience and information. Since such decisions are taken by the person and depend on his abilities, so far as they are subjective. At the same time, these decisions are partly objective, as they are based on the expert's experience.

Below the author propose one of the possible methods of finding a sequence of desired states, maximising the total expected gain of the system development in a given time interval.

Let a scenario be written for some initial state of the system, and the states, to which the system can go, are defined and described for each time interval t = 1, 2, 3,..., T. Let us denote by i(t) (i(t) = 1, 2, 3,..., L(t)) the index of possible states of the system in the time interval t (I will call it 'a situation index').

Suppose (assumption H1), that all the peculiarities of the historical evolution of the system in the time interval from $\tau = 0$ to $\tau = t\text{-}1$ are reflected in the characteristic of its state in the time interval t.

Herewith, the movement of the system in time occurs sequentially (assumption H2): $i(0) \to i(1) \to i(2) \to \ldots \to i(t) \to \ldots i(T\text{-}1) \to i(T)$.

In general case, the development of the system is not deterministic and occurs with some degree of probability. Let us suppose we know the probabilities of the transition of the system from state i(t-1) to state j(t), denote them $b_{i(t-1),\, j(t+1)}$. These values are nonnegative, and their sum is one for all j and t:

$$b_{i(t-1),\, j(t)} \geqslant 0, \sum_{i=1}^{L(t)} b_{i(t-1),\, j(t)} = 1 \text{ for all } j \text{ and } t. \quad (2)$$

Taken together, they form a transition matrix $B_{i(t-1),\, j(t)} = \{b_{i(t-1),\, j(t)}\}$, whose element values $b_{i(t-1),\, j(t)}$ can be determined heuristically or based on expert's estimates. Besides, they may reflect the opinions (decisions) of experts on the transfer of the system in a particular state.

Let us give an example. Assume that k_1 experts of total N experts decide to transfer the system from state i(0) to the first possible state — i(1), k_2 experts about transferring it to the second, the third k_3, etc., k_h in the h-th state (where $\sum_{j=1}^{h} k_j = N$). Then the probabilities of transition from state i(0) to the first, second, etc., the h-th state will be equal to k_1/N, k_2/N,..., k_h/N. It is easy to see that $\sum_{j=1}^{h} k_j/N = 1$, $k_j/N \geqslant 0$. If it is impossible to transfer the system from state i(t-1) to state j(t), the probability of such a transition is zero: $b_{i(t-1),\, j(t)} = 0$.

This interpretation of probabilities differs from the understanding of probabilities as relative frequencies of occurrence of an event. However, the definition in terms of frequencies does not appear to be the only one[9]. In our case, we are not dealing with relative frequencies, but with decisions about the choice of behaviour. In other words, in our interpretation, the concept of probability is associated not with the relative frequencies of the occurrence of the event, but with particular human behaviour in decision-making. With the help of these probabilities, we try to take into account the importance of those characteristics of states. Those qualitative features that are not reflected in the gain function. At the same time, we proceed from the fact that the person making the decision can assess the state as a whole, take into account the whole set of qualitative and quantitative characteristics, commensurate and incommensurable elements, that he does not base his choice only on gain function.

It seems obvious the number of states into which a system can pass, depends on the level of its development, its initial state, the environment in which it is located, and external

[9] Mathematical probability theory is a field of mathematics, and we should approach it "like any other branch of mathematics, considering it as an abstract, non-contradictory system of conclusions arising from a small number of axioms. Therefore, taken on its own, the theory of probability has nothing to do with the observed events, and the mathematician does not have to interpret probability in terms of events." (Morris, 1971, p. 52).

influences on the system. The higher the level of development of the system, its resistance to external influence, the more multivariate is its development in the future. It is an especially characteristic feature for a developed technical, technological and socio-economic system in the context of rapidly occurring innovation and structural shifts.

According to assumption H1, all the features of the historical development of the system are reflected in the characterisation of the system state in time interval *t*. Therefore, it seems legitimate to consider the probability of transition of a system in some state only depends on the condition of the system immediately before the transition. Based on this, we assume (hypothesis H3) that the probability of transition from state i(t-1) to state j(t) does not depend on how the system came to state i(t-1)[10]. Then, given the assumption H2, the probability of occurrence of a system at state *i* in time interval *t* (denote it by $p_{i(t)}$) is calculated by the conditional probability formula:

$$p_{i(t)} = \sum_{i=1}^{L} p_{j(t-1)} \times b_{j(t-1),\, i(t)};$$

$$p_{i(0)} = 1;\ \sum_{i=1}^{L} p_{i(t)} = 1,\ \forall\ i, t. \qquad (3)$$

Let qualitatively formulated goal in each state i(t) of the system described in the scenario, the achievement of which is intended to provide the system under consideration, can be approximately characterised by some value $r_{i(t)}$. The increment of this quantitative characteristic when transferring the system from state i(t-1) to state j(t) is called the payoff function of such a transition ($f_{i(t-1),\, j(t)}$):

$$f_{i(t-1),\, j(t)} = r_{j(t)} - r_{i(t-1)} \qquad (4)$$

In terms of content, the gain function can show the benefits (growth rates, profits, utility increments, efficiency gains, cost reductions, increased security, reduced risks, etc.) or cost increments (labour, working time, financial and material resources, etc.) obtained when a system passed from one state to another.

The expected gain from the transition from state i at time interval t-1 to state j in the next time interval t is calculated as follows:

$$u_{i(t-1),\, j(t)} = a(t) \cdot p_{i(t-1)} \times b_{i(t-1),\, j(t)} \times f_{i(t-1),\, j(t)}, \qquad (5)$$

where

a(t) — weighting coefficients, $a(t) \in [0, 1]$.

Total expected gain during the transition of the system from the initial time (t = 0) in a finite time (T) along the trajectory of (i(1), i(2), i(3), ..., i(T)) is given by the expression:

$$U(i(1), i(2), i(3), \ldots, i(T)) = \sum_{t=1}^{T-1} u_{i(t-1),\, j(t)} \qquad (6)$$

The system's states {i*(t)} = (i*(1), i*(2), i*(3), ..., i*(T)} on which the value of the total expected gain U reaches its maximum, we call the desired states.

The parameter U(i(1), i(2), i(3), ..., i(T)) in the formula (6) is discounted to some point in time the total expected gain in the transition of the system from state i(0) to a state i(1), from a state i(1) to a state i(2), ..., from a state i(T-1) to a state i(T).

So, for each time interval t = 1, 2, 3, ..., T there are given the following parameters: the set of alternative states of the system i(t)}, transition matrix $P_t = \{p_{i(t),\, i(t+1)}\}$ and gain matrix $F_t = \{f_{i(t),\, i(t+1)}\}$. It is required to find a sequence of transitions from one state to another {i*(t)} = (i*(1), i*(2), i*(3),..., i*(T)}, in which the value of the total expected gain reaches its extreme value:

$$U(i(1), i(2), i(3), \ldots, i(T)) \rightarrow \text{extremum}. \qquad (7)$$

For the case of maximising the total expected gain, I propose the following method of finding the best sequence of transitions[11].

[10] The process under consideration differs from the homogeneous Markov process only in that the transition probabilities $b_{i(t-1),\, j(t)}$ depend on time *t*.

[11] For the case of minimising U(i(1), i(2), i(3), ..., i(T)) minimising the function "max" in expressions (7)–(13) is replaced by the function "min". To find the best sequence of transitions from the initial state to the desired state, one can use algorithms developed in graph theory to find the critical path.

First we find the calculated values $u_{j(t)}$ and $e_{i(t-1), j(t)}$:

$$u_{j(1)} = \max_{i(0)=1,2,3,\ldots,L(t)} u_{i(0), j(1)}, \ \forall j; \quad (8)$$

$e_{i(1), j(2)} = u_{j(1)} + u_{i(1), j(2)}$, $\forall$ i, j, if the transition from i(1) to j(2) is possible, and $e_{i(1), j(2)} = 0$, if such a transition is not possible. (9)

$$u_{j(2)} = \max_{i(1)=1,2,3,\ldots,L(t)} e_{i(1), j(2)}, \ \forall j; \quad (10)$$

$e_{i(2), j(3)} = u_{i(2)} + u_{i(2), j(3)}$, $\forall$ i, j, if the transition from i(2) to j(3) is possible, and $e_{i(2), j(3)} = 0$, if such a transition is not possible. (11)

And so on until:

$$u_{j(T-1)} = \max_{i(T-2)=1,2,3,\ldots,L(t)} e_{i(T-2), j(T-1)} \ \forall j; \quad (12)$$

$e_{i(T-1), j(T)} = u_{i(T-1)} + u_{i(T-1), j(T)}$, $\forall$ i, j, if the transition from i(T-1) to j(T) is possible, and $e_{i(T-1), j(T)} = 0$, if such a transition is not possible. (13)

In the general case:

$$u_{j(t-1)} = \max_{i(t-1)=1,2,3,\ldots,L(t)} e_{i(t-2), j(t-1)}, \ \forall j; \ t = 3, 4, \ldots, T; \quad (14)$$

$e_{i(t-1), j(t)} = u_{j(t-1)} + u_{i(t-1), j(t)}$, $\forall$ i, j, t = 3, 4, ..., T, if the transition from i(t-1) to j(t) is possible, and $e_{i(t-1), j(t)} = 0$, if such a transition is not possible[12]. (15)

Then for T we look for such j*(T) that:

$$e_{i(T), j^*(T)} = \max_{\substack{i(T-1)=1,2,3,\ldots,L \\ j(T)=1,2,\ldots,L}} e_{i(T), j(T)}. \quad (16)$$

Then for t = T-1, T-2,..., 4, 3 we find such i*(t-1) that:

$$u_{i^*(t-1), j^*(t)} = \max_{i(t-1)=1,2,3,\ldots,L(t)} u_{i(t-1), j^*(t)}. \quad (17)$$

Indices i*(t) (t = 1, 2,..., T) give us the required trajectory of the system to the desired state.

In the following part of the article, I will give A numerical example of the proposed algorithm.

After determining the sequence of transitions, we should clarify the set of elements of the system. It is then possible to proceed with the preparation of a programme for the transfer of the system to the selected state.

In general, the sequence of actions to make decisions about the transfer of the system from one state to another includes:

Analysis of external requirements to the system in question (requirements from a more General system, a higher system, etc.);

Qualitative formulation of the purpose and objectives of translation;

Definition of a set of elements of the system (its constituent objects, subjects, links) necessary for the implementation of the goals and tasks;

Description of the range of opportunities for the development of a system fulfilling the quality objectives (scriptwriting);

Select desired state;

Quantitative representation of the target;

Setting the desired state parameters;

Determination of the sequence (mode) of the transfer of the system from the initial state to the desired;

Clarification of the set of elements of the system.

An Example of Using the Proposed Algorithm for Determining the Desired State and the Best Path of Transition to It

Consider five-time intervals (T = 5), in each of which the system can be in one of four states. For each of them, the values of the elements of the probability matrix of transition from position *i* in the time interval t-1 to position *j* in the time interval t (Table 1) and the values of the elements of the matrix of gain functions in such a transition (Table 2). For simplicity, we assume that there is no discounting of gains (a(t) = 1, $\forall$ t).

Knowing the probabilities of transition from one state to another, using the formula (3) we find the probabilities of occurrence the system in state *i* in the time interval t (Table 3).

In the next step, using the expression (5), we calculate the size of the expected gains when moving from one state to another (Table 4).

Table 6 shows the transition path that maximises the total expected gain and the values of the latter. In Tables 4 and 5, the corresponding

[12] When solving the problem on the minimum of U(i(1), i(2), i(3), ..., i(T)) and there is no transition from i(t-1) to j(t-1), parameter $e_{i(t-1), j(t)}$ should be set as a very large number.

Table 1

Values of the elements of the probability matrix of the system transition from one state to another

Transition probability matrix $B_{i(t-1), j(t+1)}$	Situation index i(t-1)	Situation index j(t)			
		1	2	3	4
$B_{i(0), j(1)}$	1	0.6	0.0	0.0	0.0
	2	0.4	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0
$B_{i(1), j(2)}$	1	0.5	0.3	0.2	0.0
	2	0.0	0.2	0.6	0.2
	3	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0
$B_{i(2), j(3)}$	1	0.3	0.3	0.3	0.1
	2	0.1	0.2	0.2	0.5
	3	0.3	0.4	0.2	0.1
	4	0.1	0.2	0.3	0.4
$B_{i(3), j(4)}$	1	0.7	0.0	0.3	0.0
	2	0.1	0.4	0.1	0.4
	3	0.6	0.2	0.0	0.2
	4	0.3	0.4	0.2	0.1
$B_{i(4), j(5)}$	1	0.4	0.2	0.2	0.2
	2	0.1	0.2	0.5	0.2
	3	0.0	0.0	0.9	0.1
	4	0.2	0.3	0.1	0.4

Source: Compiled by the author.

Table 2

The values of elements of the payoff functions matrix

Payoff functions matrix $F_{i(t-1), j(t+1)}$	Situation index i(t-1)	Situation index j(t)			
		1	2	3	4
$F_{i(0), j(1)}$	0	110	100	0.0	0.0
$F_{i(1), j(2)}$	1	90	50	100	0.0
	2	0.0	200	60	200
	3	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0
$F_{(2), j(3)}$	1	70	70	70	210
	2	120	150	140	30
	3	200	60	130	190
	4	140	90	50	40
$F_{i(3), j(4)}$	1	40	0.0	120	0.0
	2	100	60	170	100
	3	100	100	0.0	100
	4	130	80	160	150
$F_{i(4), j(5)}$	1	100	200	150	0.2
	2	150	70	30	0.2
	3	0.0	0.0	70	0.1
	4	120	70	170	0.4

Source: Compiled by the author.

Table 3
The probability of occurrence of the system in the state i in the time interval t – $p_{i(t)}$.*

Situation index	**Time index *t***			
i	1	2	3	4
1	0.6	0.30	0.232	0.4038
2	0.4	0.26	0.302	0.2596
3	0.0	0.36	0.238	0.1454

Source: Compiled by the author.
* Figures in tables 3–5 rounded.

Table 4
Expected gain $u_{i(t-1),\,j(t)}$ from a state to a state transition

State change: i(t-1) → i(t)	**Time index t**				
	1	**2**	**3**	**4**	**5**
0 → 1	**66**				
0 → 2	*40*				
0 → 3	X				
0 → 4	X				
1 → 1		**27.0**	6.30	6.496	**16.152**
1 → 2		*9.0*	**6.30**	X	**16.152**
1 → 3		12.0	6.30	8.352	12.114
1 → 4		X	6.30	X	**16.152**
2 → 1		X	3.12	3.020	3.894
2 → 2		16.0	7.8	7.248	3.634
2 → 3		*14.4*	7.28	*5.134*	3.894
2 → 4		16.0	3.90	12.080	10.484
3 → 1		X	21.6	**14.280**	X
3 → 2		X	8.64	4.760	X
3 → 3		X	9.36	0.000	9.160
3 → 4		X	6.84	4.760	*1.745*
4 → 1		X	*1.12*	8.992	4.589
4 → 2		X	1.44	7.296	4.015
4 → 3		X	1.20	7.296	3.250
4 → 4			*1.28*	*3.420*	*2.294*

Source: Compiled by the author.
Note: the sign X in tables 4 and 5 denotes that the probability of transition from state i(t-1) to state j(t) is zero (see Table 1).

Table 5
Calculated values $u_{j(t)}$ and $e_{i(t-1),j(t)}$

State change: i(t-1) → i(t)	Time index t				
	1	**2**	**3**	**4**	**5**
			$e_{i(t-1),j(t)}$		
1 → 1	66.0	**93.0**	99.3	105.8	**123.8**
1 → 2	X	75.0	99.3	X	**123.8**
1 → 3	X	78.0	99.3	**107.7**	119.8
1 → 4	X	X	99.3	X	**123.8**
$u_{j(t)}$	66.0	93	99.3	107.7	123.8
2 → 1	44.0	X	63.1	70.8	83.8
2 → 2	X	60.0	67.8	75.0	83.5
2 → 3	X	*58.4*	67.2	72.9	83.7
2 → 4	X	60.0	63.9	79.9	90.3
$u_{j(t)}$	44	60.0	67.9	79.9	
3 → 1	X	X	21.6	35.9	X
3 → 2	X	X	8.6	26.4	X
3 → 3	X	X	9.4	21.6	45.0
3 → 4	X	X	6.8	26.4	37.6
$u_{j(t)}$			21.6	35.9	45.0
4 → 1	X	X	*1.1*	10.3	14.9
4 → 2	X	X	1.4	8.7	14.3
4 → 3	X	X	1.2	8.7	13.6
4 → 4	X	X	1.3	*4.9*	*12.6*
$u_{j(t)}$			1.4	10.3	14.9

Source: Compiled by the author.

Table 6
The best trajectory of the system transition from the initial state to the desired one. The case of maximisation of the total expected gain

Indicator	Time index t				
	1	**2**	**3**	**4**	**5**
Pathway 1	0→1	1→1	1→3	3→1	1→1
Pathway 2	0→1	1→1	1→3	3→1	1→2
Pathway 3	0→1	1→1	1→3	3→1	1→4
Gain	66	27	6.3	14.28	16.152

Source: Compiled by the author.

Table 7

The best trajectory of the system transition from the initial state to the desired one. The case of minimising the total expected costs

Indicator	Time index t				
	1	2	3	4	5
Pathway	0→2	1→2,3	4→1	2→1	34
Gain	40.0	9.0	1.12	3.02	1.75

Source: Compiled by the author.

values of the parameters $u_{j(t)}$ and $e_{i(t-1), j(t)}$ are shown in boldface.

In the example above, there are three trajectories maximising the total expected gain. All of them give the same total expected win equal to 129.732. Accordingly, according to the selected criterion, three states can be called desirable: i(5) = 1, i(5) = 2 and i (5) = 4. To select one of them, you should develop and apply new criteria that are different from the applied gain function.

The best trajectory for the case of minimising the value of the total expected gain function is shown in Table 7. In Tables 4 and 5 corresponding parameter values $u_{j(t)}$ and $e_{i(t-1), j(t)}$ are shown in italics. In this example, such a trajectory and the desired state were the only ones, $\sum_{t=1}^{T-1} u_{i(t-1), j(t)} = 62.994$.

In conclusion, we note that it is impossible to expect that the most desirable state chosen based on the proposed method will be the best from the point of view of all reasonable counterarguments. The technique considered, using the judgment of experts, only provides recommendations for the adoption of the course of action in which the highest increment in the quantitative characteristics of the goal is expected to be obtained.

References

Dal', V. (1955). Explanatory dictionary. Vol. 4. [Tolkovyj slovar']. Moscow: Gos. izd-vo inostrannyh i nacional'nyh slovarej. 683 p.

Jantsch, E. (1970). Technological Forecasting in Perspective. [Prognozirovanie nauchno-tekhnicheskogo progressa]. Moscow: "Progress".

Johnson, R. A., Kast, F. E., & Rosenzweig, J. E. (1971).The Theory and Management of Systems. [Sistemy i rukovodstvo]. Moscow: "Sovietskoe radio".

Kazantsev, S. V. (1972). To the question about the ratio of goals and system. [K voprosu o sootnoshenii celi i sistemy]. In: Program Approach to Planning and Management of the National Economy [Programmnyj podhod k planirovaniyu i upravleniyu narodnym hozyajstvom], Novosibirsk, pp. 98–113.

Morris, W. T. (1971). *Management Science. A Bayesian Introduction*. [Nauka ob upravlenii. Bajesovskij podhod]. Moscow: "Mir".

National standard of the Russian Federation. (2005). RF GOST R 52292–2004. "Information technology. Electronic information exchange. Terms and definitions". [Nacional'nyj standart RF GOST R 52292–2004 «Informacionnaya tekhnologiya (IT). Elektronnyj obmen informaciej. Terminy i opredeleniya»]. Moscow: IPK Izdatel'stvo standartov.

Sadovsky, V. N., & Yudin, E. G. (1969). *Researches on the General Theory of Systems*. [Issledovaniya po obshchej teorii sistem]. Moscow: "Progress".

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Алгоритм определения целевого состояния системы и наилучшей траектории перехода

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Аннотация. В планировании и управлении обычно решают задачу перевода объекта из состояния, в котором он находится в данный отрезок времени (заданного, начального или исходного), в другое состояние (желаемое, целевое или запланированное). В статье делается попытка определить алгоритм нахождения последовательности перевода некоего объекта из заданного состояния в желаемое. При этом исходное состояние объекта известно, оно реально существует. Будущих состояний может быть много, и они существуют лишь в виде образов, представлений и идей разработчиков плана или его заказчиков. Предполагается, что переход из исходного состояния в желаемое возможен. Вариантов переходов может быть много и из них надо выбрать лучшую последовательность. Разработанный и представленный автором статьи алгоритм учитывает большой спектр возможных переходов от одного состояния к другому и представляет собой точечно-множественное отображение исходного состояния объекта в множество его желаемых состояний. Рассмотрены и предложены разные варианты перевода объекта из одного состояния в другое и последовательность переводов, при которой суммарный ожидаемый выигрыш от изменения состояния объекта в заданный отрезок времени достигает своего экстремума — максимума или минимума. Приведен пример траектории перевода объекта из заданного в одно из его возможных желаемых состояний, при прохождении которой достигается ожидаемый результат.
Ключевые слова: алгоритм; цель; оценка; система; последовательность переходов; табулирование
JEL Classification: C51, E17, E61

Статья подготовлена по результатам исследований, выполненных за счет бюджетных средств по государственному заданию Финансовому университету.

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The Role of the State Treasury in the Implementation of the Fiscal Policy to Ensure Microeconomic Stability and Social Security (Research in Vietnam)

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Abstract

In the period 2011–2016, Vietnam's macroeconomy had not been stable; social security had not witnessed any improvements from the previous period while the state budget was targeted at a large number of objectives such as economic growth, inflation control, assuring security, national defence and social security. During this period, the role of the State Treasury was essential in managing and monitoring cash flow, regulating state budget spending and making it effective for the economy to implement fiscal policy and macroeconomic stability as well as ensuring social security. Accordingly, given the current constraints of fiscal policy, what are the orientations for the State Treasury in performing its operational activities to stabilise the macroeconomy and ensure social security?

Keywords: State Treasury operations; fiscal policy; macroeconomics; social security
JEL Classification: E62, E63, G28, I38

1. Background

Vietnam is a developing country and is in the process of finalising its public finance structure financial policy reform, with continuous reference to and learning from both developed and developing countries in the world. It can be most clearly observed in the period of rapid economic growth over a decade from 1997–2007 to the period of recession from 2008–2009 and the economic recovery period from 2010–2016. The complex changes of the global and domestic financial economy, a series of macro policies to stabilise economic growth, control inflation and ensure social security have been launched. However, at present, the process of completing the four key policies in general and the fiscal policy in particular that influence on the socio-economic situation has many shortcomings due to the widespread involvement of tax authorities, the State Treasury, the State Bank of Vietnam, the Ministry of Finance, the Ministry of Planning and Investment, etc. To implement the fiscal policy effectively, many conditions need to be fulfilled by the related State authorities and the consistent collaboration of the Monetary policy to implement such national financial policy. It is the ultimate goal that all countries and financial systems aim to have effective coordination to achieve.

In the implementation of fiscal policy, the management of state budget revenue and expenditure is to be aligned with the macro-economic objectives such as economic growth, inflation control, unemployment reduction and payment balance maintenance. To implement these objectives for the State Treasury effectively, there should be coordination of authorities in those areas such as finance, tax, treasury, customs and banking. And the State Treasury plays a vital role in the management of cash flow, monitoring the "turning on/off" the valve of the state budget expenditures together with the financial institutions to create effects and efficiency on the economy's implementation of fiscal policy as well as stabilising macro-economy and ensuring social security. However, to promote the role of the State Treasury in implementing the

Table 1
State budget revenue in the period of 2011–2016 and 2017–2018 estimate

Unit: billion dong

Year	2011	2012	2013	2014	2015	2016	2017 (estimate)	2018 (estimate)
Total State budget revenue balance	721,804	734,883	828,348	877,697	996,870	1,107,381	1,212,180	1,319,200
Domestic revenue	443,731	477,106	513,090	593,560	740,062	886,791	990,280	1,099,300
Revenues from crude oil	110,205	140,106	120,436	100,082	67,510	40,186	38,300	35,900
State budget revenue balance from export, import	155,765	107,404	129,385	173,005	177,293	172,026	180,000	179,000

Source: State Treasury of Vietnam.

policy, it is necessary to analyse and clarify the principle of impact, the role and function of each department in implementing the policy, as well as current restrictions. So, it can be clear about where the State Treasury is standing and what tasks it is supposed to manage to change the fiscal policy towards macro stability and social security.

2. Status of Implementation of Fiscal Policy by the State Treasury

With a management system sticking to the target, the development strategy of State Treasury, as well as the mission to collect State budget, achieved a positive outcome with the annual total State budget revenues in the period from 2011–2016 generally completing the assigned budget. Furthermore, most of the budget revenue items were exceeded by 1.51 per cent to 21.31 per cent that contributed to ensuring the budget for capital expenditure, supporting the implementation of economic growth, social, security and defence policies. At the same time, this sets a ground for the government-oriented salary reform. Following that, State budget collection has contributed to ensuring inflation control, economic growth, employment increase and unemployment reduction.

Accompanying with State budget collection, controlling the state budget spending is also one of the most important tasks that determine the economic development and social security stability. State budget spending has generally risen sharply in almost all countries of the world, but the growth rates of state budget expenditures and revenues are usually higher than the rate of economic growth. Following that trend, the increase and decrease in spending on social security will be affected.

In the period from 2011 to 2016, the Government has followed a prudent fiscal policy, tightened its control over public investment, increased control of expenditure to improve the efficiency of using state budget in combination with restructuring the State budget expenditures. Similar to budget revenues, the total state budget expenditures have also increased in the period 2011–2016. In general, the state budget spending in this period was always significant, with the total spending increasing continuously to reach VND 1,295,061 billion in 2016, more than 1.6 times of the budget spending in 2011. The State Treasury system has exercised consistently and strictly its control and payment for budget expenditures (especially expenditures in ODA projects, advance payments to accelerate the progress of unfinished projects), timely met the needs of the units using the budget and ensured strict management of state budget expenditures.

However, the size of government spending is considerably large: the increase in Government spending in 2011–2016 had a positive impact on the economy in the short-term but created long-term uncertainties such as inflation and financial risks due to inefficient spending and difficulties to ensure the effective operation of the financial system. It is noteworthy that investment expen-

Table 2
State budget expenditures in the period of 2011–2016 and 2017–2018 estimate

Unit: billion dong

Year	2011	2012	2013	2014	2015	2016	2017 (estimate)	2018 (estimate)
Total State budget revenue balance	787,554	978,463	1,088,153	1,103,983	1,262,870	1,295,061	1,390,480	1,523,200
Capital expenditure	208,306	268,812	271.680	248,452	236,832	296,451	357,150	399,700
Repayment of debt and aids	111,943	105,838	112,055	131,940	150,000	175,784	100,200	113,818
Regular expenditure	467,017	603,372	704,165	723,292	790,168	822,343	896,280	940,748

Source: State Treasury of Vietnam. (From 2017, debt repayment includes interest only, not including due principal).

ditures are still spreading out and has failed to focus on the quality and effectiveness of investment projects, causing waste of capital investment. Besides, budget deficits have been used as a tool of fiscal policy to stimulate economic growth over the years, while forecasts and statistics, fiscal policy control as well as the utilisation and management of the State budget are still limited, not tight and effective enough.

The mobilisation of capital also positively affected the fiscal policy in the recent period. Accordingly, from 2011 to 2015, the total mobilised capital from the government bond market was about 907 trillion VND with an average growth rate of 36 per cent per year, accounting for 55 per cent of the domestic capital mobilised capital to the state budget. Outstanding government bond market value increased from VND 202 trillion by the end of 2011 to VND 678 trillion by the end of 2015 (over three times).

The management of the budget fund was effectively implemented as the State Treasury carefully coordinated with the local budget collecting departments to boost the reform of administrative procedures in the field of State budget revenue collection through the expansion of Internet transactions, ATMs, collection via POS (POS).

3. The State Treasury's Professional Operations Aiming to Stabilise Macro-Economy and Social Security Through the Implementation of Fiscal Policy

In the prior period, the State Treasury and the Vietnam Government have made a lot of efforts in managing policies and controlling investments in a manner that is conducive to taxation, revenue control as well as capital mobilisation and treasury management. The State Treasury system has played an important role in restructuring the economy, enhancing corporate governance and production capacity, minimising negative impacts of world socio-politics fluctuation. At the same time, this has set the ground for economic development in the period of 2018–2020 as the growth rate of investment has been recovering and increasing in all three sectors of the economy such as public sector, non-public sector and foreign direct investment sector. The impact of these above-mentioned activities on economic growth is quite evident with the average economic growth rate in the period 2011–2017 was estimated at 6.08 per cent, and in 2018, it is expected to reach 6.85 per cent. Although it has not achieved the target set out primarily due to the negative impact of the global economic crisis and the global financial downturn, the export has been rapidly increased, the trade balance has improved and most remarkably, the inflation situation has been adequately controlled.

The CPI dropped from 18.13 per cent in 2011 to 1.84 per cent in 2014 and 0.6 per cent in 2015 — the lowest for 14 years. In particular, the price index calculated by each commodity group has also changed significantly according to the objectives of fiscal policy and allocation of the state budget for each sector, mainly for groups of commodity such as food and beverage and related services, medical goods and services. In 2011, inflationary pressure led to fiscal policy tightening. In the

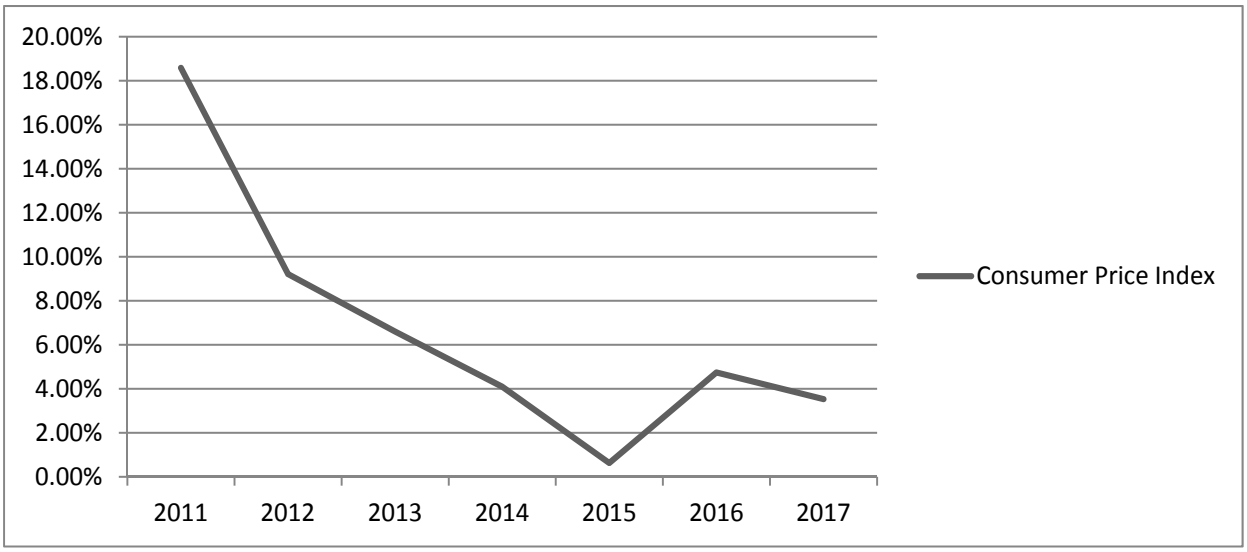

Fig. 1. Monthly consumer price index in the period from 2011 to 2017

Source: General Statistic Office of Vietnam.

period 2012–2017, fiscal policy was stabilised and actively targeted at the stable economic growth combined with inflation control. It could be seen that fiscal policy in this period had accomplished the main objective set by the government, however, due to the negative relationship of macroeconomic objectives, the target had not been thoroughly implemented from time to time.

For the purpose of ensuring social security, the State Treasury has taken specific steps such as controlling state budget revenues and expenditures following closely the decision to reform public pay; achieving social assistance policy with 2.7 million beneficiaries in 2015 equivalent to 3 per cent of the population; increasing state budget expenditures for social insurance annually; adjusting the resources for social welfare by the State Treasury based on the socio-economic policy objectives of each period and the balance of state budget revenue (accounting for 55 per cent of total social welfare expenditure); improving the utility infrastructure and its reciprocal fund from the state budget annually; improving people's ability to approach and use basic social services remarking a highlight in social welfare in Vietnam. However, in the implementation of fiscal policy to ensure social security, the State Treasury's activities also have certain limitations such as failure of fiscal policy in completely directing to social welfare policy; overlap in revenue and expenditure policy and in implementation of programs in the social welfare system; unclear segregation of authority; rigid policies that have not taken into account the characteristics of unofficial sector labour.

4. Measurement of the Relationship Between Fiscal Policy and Macro-Economic Stability and Social Welfare

a. Model for assessing the impact of fiscal policy on macro-economic stability

Based on the State Budget's finalised Data from 2000 to 2015 of the State Treasury, the authors have quantified the impact of fiscal policy on macroeconomic stability and social welfare in Vietnam as follows:

To assess the impact of fiscal policy on macroeconomic stability, the authors have examined the elements of fiscal policy among government expenditure items such as capital expenditure, regular expenditure and expenditure for education, health and the part representing the economic growth, i.e. GDP. To measure macroeconomic stability, the authors have used the ARCH-GARCH model to measure the impact of fiscal policy on the variance of GDP growth.

The data used to run the model have been collected from data of Vietnam's macroeconomic variables over the period 2000 to 2015 (Source: The General Statistics Office of Vietnam, ADB and Treasury Vocational Training School). The variables used in the model are described in Table 3.

Variables stop testing

To assess the suitability of the variables before entering the model, the authors have examined the variable stop testing (by Dickey-Fuller unit tests).

Table 3
The variables used in the ARCH-GARCH model

Variables	Symbol	Positive/Negative
Dependent Variables		
Stability of GDP growth rate (variance of R_{GDP})	∂^2_{RGDP}	
Independent Variables		
The growth rate of regular government expenditure	R_{CTX}	(+)
The growth rate of capital expenditure	R_{CDT}	(+)
The growth rate of Government expenditure on Health and Education	R_{CEH}	(+)

Table 4
Result of the unit tests

Variables	C Constant, t Tendency	Lag	T result	Probabilities
R_{GDP}	No constant and intercept	4	–4.74*	0.0001
R_{CTX}	No constant and intercept	4	–3.24*	0.0068
R_{CDT}	No constant and intercept	4	–3.43*	0.0018
R_{CEH}	No constant and intercept	4	–3.13**	0.0034

*: Significant at 1%

**: Significant at 5%

Table 5
Result of co-integrated relations

Unlimited Co-integrated level testing (Trace statistics)				
Hypothesis		**Trace statistics**	**0.05**	
Co-integrated relation vector	**Value**	**Statistic**	**Limited value**	**P-value**
No value*	0.840236	42.28514	29.79707	0.0011*
At least 1 value	0.337864	9.272060	15.49471	0.3408
At least 2 value	0.097719	1.850933	3.841466	0.1737

* Significant at 1%

Verification of co-integrated relations

Since the proposed variables in the model are stopped (according to the unit test results above), the authors have continued to test the integration of the variables (Table 5).

From the result table, we can see that between GDP growth, regular expenditure and government investment have co-integrated relation.

Distributed-lag model testing

To determine the distributed-lag of the proposed variables in the model, the authors have used the tests to find the most appropriate lag.

The test results have indicated that the appropriate lag for the model is 1. This lag is relevant to macroeconomic variables in Vietnam.

Table 6
Result of distributed-lag model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–166.7934	NA	31,339.81	18.86593	19.01433	18.88639
1	–147.6450	29.78645*	10,376.71*	17.73833*	18.33191*	17.82018*
2	–140.6737	8.520392	14,468.43	17.96375	19.00251	18.10698
3	–131.9485	7.755750	20,042.35	17.99428	19.47823	18.19890

*: Significant at 1%

Table 7
Impact of the increase in regular expenditure and capital expenditure on the stability of GDP growth

Variables	Coefficient	Standard deviation	Probability
R_{CDT}	–0.0051	0.0025	0.0572
R_{CTX}	0.0352	0.0153	0.0364
C	6.8285	0.5428	0.0000
AR(1)	0.3266	0.2186	0.1559
MA(1)	0.9629	0.0286	0.0000
R^2	0.5600	Durbin-Watson Test	1.400082
Inverted AR Roots	0.33	Inverted MA Roots	–0.96

Estimate the impact of fiscal policy-related factors on the stability of GDP growth

The impact of capital expenditures and regular expenditures on the stability of GDP growth we show in Table 7.

The estimated results in Table 1.5 show that the coefficient $R^2 = 0.56$, the model is appropriate and such variables as the growth rates of regular and government expenditures can explain 56% of the variance of GDP growth rate stability. While regular expenditure has a positive effect on the stability of economic growth, capital expenditure has the opposite effect. It may be appropriate for Vietnam, where public investment overwhelms private investment that can cause significant fluctuations in economic growth.

b. A model for assessing the impact of the fiscal policy on social security

To determine the impact of fiscal policy on social security, the authors have also examined the elements of fiscal policy in the Government expenditure items: capital expenditure, regular expenditure and spending on education and medical; and a representative factor of social security which shall be assigned the value of 1 if the percentage of rural households participating in voluntary health insurance is higher than 50 per cent, assigned a value of 0 if the percentage of rural households participating in voluntary health insurance is lower than 50 per cent. Therefore, to evaluate the impact of fiscal policy on social security, the authors have used the Logit model to quantify this relationship.

Model Logit (Maddale, 1984) p_i is determined by:

$$p_i = \frac{e^{\beta_0+\beta_1 X_{1i}}}{1+e^{\beta_{01}+\beta_1 X_{1i}}} = \frac{e^{X_i\beta}}{1+e^{X_i\beta}} = \frac{\exp(X_i\beta)}{1+\exp(X_i\beta)}$$
$$X = (1, X_1);\ X_i = (1, X_{1i});\ b' = (b_0, b_1). \quad (1)$$

In the above model, p_i is not a linear function of independent variables.

Application of the Logit model in analysing the impact of fiscal policy on social security objectives

The variables included in the model are listed in Table 8.

Since the logit model is nonlinear with independent variables and the dependent variable Y shall accept the value of only either 0 or 1, it is not possible to directly apply the least squares (OLS) to estimate the coefficients of the model.

The authors have, therefore used the Maximum Likelihood Estimation method to estimate the coefficients of βi of the model. Table 9 summarises the results obtained from the Logit model.

Table 8
Describe the variables included in the Logit model

Variable name	Symbol	Expected positive/ negative
Dependent variables	ASXH	
Independent variables		
The growth rate of regular government expenditure	R_{CTX}	(+)
The growth rate of capital expenditure	R_{CDT}	(+)
The growth rate of Government expenditure on Health and Education	R_{CEH}	(+)

Table 9
Estimation of Logit model

Independent variable	Regression coefficient (βi)	Standard variance	Wald statistic	P-value
Intercept	–30.740*	7.349	17.498	0.000
R_{CEH}	1.150*	0.362	10.076	0.002
R_{CDT}	0.531***	0.224	2.115	0.073
R_{CTX}	0.019***	0.016	2.007	0.096
2-log likelihood		113.206		
Cox & Snell R^2		0.525		
Nagelkerder R^2		0.657		
Homer & Lemeshow Tess	Chi-square	10.18	Sig.	0.0023

* Significant at 1%

** Significant at 5%

*** Significant at 10%

The Wald verification and Homer & Lemeshow verification show that the model is appropriate and the coefficients of the independent variables are statistically significant. The growth rate of regular government expenditure and the growth rate of capital expenditure is significant at 10 per cent, while the growth rate of government spending on health and education is significant at 1 per cent. And whether the coefficients are negative or positive is essential in line with expectations.

In terms of the magnitude of the coefficients, we see that the regression coefficient of the growth rate of government spending on health and education is highest (1,150), which suggests that rural households' participation in voluntary health insurance in the future depends on the government' investment into resolving health and education issues to increase public confidence in the government. The variable that has the least impact on the availability of voluntary health insurance by rural households is the steady increase in government spending, which suggests that excessive spending increases are frequent. It does not necessarily meet the needs of social security of people, especially people in rural areas. Also, this result reflects a problem in Vietnam today that is inefficiency in the regular sources of government expenditure in Vietnam.

5. Recommendations

With a view of sticking to the objectives and activities of fiscal policy, the direction of the State

Treasury system should be adjusted, monitored and supported by the Ministry of Finance, the Ministry of Planning and Investment and relevant agencies in accordance with the following recommendations:

• To review, reform and synchronise documents and administrative procedures in the management of the State budget. In this regard, it is required to continue implementation of E-government in accordance with Resolution No 361/NQ-CP dated 14 October 2015 by the Government on application of information technology in reducing public administrative procedures, enhance the mechanism to operate Tabmis (***Treasury and Budget Management Information System***) and connection network among the financial agencies; strengthen the efficiency of preparing, allocating and assigning the medium-term state budget in line with the Law on State budget 2015; complete the policy of investment in capital construction, national target programs to ensure the quality, economy and timeliness; supplement legislation to stipulate suitable expenditure level as well as conditions, subjects of expenditures in the locality level.

• To focus on revenue management for fast and timely collection. The management of budget collection requires the enhancement of efficiency through continuous study and revision of taxation and fee policy to boost the revenue collection to 21–23 per cent GDP and the tax and fee collection annual average growth rate by 16–18 per cent. Achieving this target requires the cooperation of the State Treasury and taxation and customs authorities.

For the State Treasury, finalisation of accounting system on Tabmis to achieve the best performance under the Law on State Budget 2015 should be paid attention. Administrative procedures and forms of the State Treasury should be further clarified to both facilitate the units managing the funds and help the State Treasury units to ensure that the expenditure control is safe, accurate and able to avoids risks for accountants at each State Treasury.

Tax agencies, customs and related departments and agencies should concentrate on directing the implementation of solution to increase revenues; review, adjustment and supplement of the provisions of the tax law must be suitable to the practical situation; control over the transfer of prices of FDI enterprises, significant value-added tax refund amounts in the past years; and promptly handling cases of fraud to avoid losses.

• Improve the quality of control of the State budget expenditures. Accordingly, it is necessary to provide the regulations and limits about advance estimates for the next year and a reasonable balance between revenue and expenditure in some localities. At the same time, it is necessary to limit the expenditures with the change of sources and also those using the list of cash disbursement and encourage annual expenditure saving to control better the cash flow of the units and avoid the risk of loss that may occur.

• Enhance the efficiency of operation of mobilizing state budget capital, proposing basic solutions such as diversifying the maturity of Government bonds, flexible interest rates for each bidding session, coordinating effectively between the State Treasury and the related units in the issuance of Government bonds, which may be deployed through many channels such as direct issuance via the State Treasury, bidding through the Securities Trading Centre, tender through the Transaction Centre of State Bank, underwriting.

• Develop human resources for operational activities of the State Treasury; develop quality personnel of the State Treasury; improve professional qualification, capability and technical knowledge of managers and direct staff. The head should be not only good at professional practice but also have a vision and adaptiveness to every change in the socio-economic progress of the country and the region.

In short, considering the reality of the past few years, it is difficult to analyse the direct and indirect relationship between the roles of the State Treasury and the implementing and stabilising macroeconomics and social security. The fiscal policy alone is not enough to achieve macroeconomic stability. Besides, that there are also other macroeconomic policies aiming to stabilise the macroeconomy with four major indicators in growth, inflation, unemployment and balance of payments and social security policies with the social equality as the ultimate goal. As such, the roles of the State Treasury are not entirely decisive but still play an essential role in contributing to the effectiveness of the fiscal policy and others.

References

Annual state budget report from 2011 to 2016. The State Treasury of Vietnam.

83/2015/QH13. Law on State Budget promulgated by the National Assembly on 8 December 2015.

56/2006/QH11. Resolution of the National Assembly on the five-year socio-economic development plan 2006–2010.

11/NQ-CP. Resolutions on major measures to control inflation, stabilise the macro economy, and ensure social security.

Chanda A.K., Maddala G.S. (1983). Methods of estimation for models of markets with bounded price variation under rational expectations. Economics Letters, 47, 181–184 [Erratum in Economics Letters, 15 (1984), 195–196]

Engle, Robert F. (1982). Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation. Econometrica. 50:4, pp. 987–1007.

Maddala, G. S. (1988). Introduction to econometrics. Macmillan Publishing Co., New York. New York, USA.

Maddala, G. S. (1983). Limited Dependent and Qualitative Variables in Econometrics. Cambridge University Press, Cambridge.

Report of the Ministry of Labor, Invalids and Social Affairs 2000–2014.

Роль государственного казначейства в реализации фискальной политики по обеспечению микроэкономической стабильности и социальной защищенности во Вьетнаме

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Аннотация. В статье дан всесторонний анализ деятельности государственного казначейства по стабилизации макроэкономики и развитию социального обеспечения в 2011–2016 гг., когда экономика Вьетнама испытывала серьезные проблемы. В этот период государственная казна играла важнейшую роль в управлении денежными потоками и их контроле, в регулировании расходов госбюджета и обеспечении эффективности бюджетной политики и макроэкономической стабильности. Поскольку средства госбюджета были в основном сосредоточены на решении задач, связанных с экономическим ростом, контролем над инфляцией, обеспечением безопасности и укреплением национальной обороны, деньги на социальное обеспечение направлялись по остаточному принципу и эта сфера не претерпела существенных положительных изменений по сравнению с предыдущим периодом. Рассматривая современную бюджетную политику Вьетнама, характеризуя и оценивая деятельность государственного казначейства по стабилизации макроэкономики и повышению уровня социального обеспечения, авторы отмечают позитивные сдвиги в решении вопросов, связанных с финансированием государственных социальных программ.

Ключевые слова: государственное казначейство; фискальная политика; макроэкономика; социальное обеспечение

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High-Frequency Trading in the Modern Market Microstructure: Opportunities and Threats*

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Abstract

The article covers some ideas about the research on high-frequency trading and financial market design. The topic is time-relevant because today there exists a need to convince traders that there is a simple structural floor in the way that the financial markets are designed. The article reveals the significance of trading on the floor that the foremost fundamental constraint is limited time. The author proves that time on the financial market feels, to some extent, infinite when someone counts it in millions of seconds, but time is nevertheless finite. The author then gets into the actual research on high-frequency trading in the financial market design. The motivation for this project is to analyse activity among high-frequency trading firms by which investments of substantial sums of money are understood as economically trivial speed improvements. The theoretical significance of the research's outcomes lies in outlaying the systemic approach to dealing with stochastic control problems in the context of financial engineering. The practical relevance of the paper lies in the mechanism that allows solving problems surrounding optimal trading, market microstructure, high-frequency trading, etc. The article concludes by talking about the issues in the modern electronic markets and by giving lessons to dealing with them in the long run.

Keywords: financial engineering, financial innovations, high-frequency trading, world financial market
JEL Classification: F37

Introduction

It is worth going through some of the main features of the US equity markets today because they are quite different than they were five or ten years ago (Arner & Taylor, 2009).

First, markets are predominantly electronic. The trading happens on computers. Electronic trading has equity that dominates as the other primary mechanism of the exchange.

Second, there is an idea to think of the exchange as a mechanism for centralising trade by bringing buyers and sellers together, so that there are not search frictions. What has happened in the US in the past five years is that the opposite turn has occurred in that trading has become decentralised or fragmented (Beder, 2009). In particular, for various reasons, there is no one primary exchange. It used to be that for any specific stock which is traded either on NASDAQ or NYSE, but now there is a handful of them, and they are all important in a sense that each of those exchanges accounts for at least 5 per cent of equity trading. So, there are many venues, and the trade is no longer centralised (Chorev & Babb, 2009).

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Most of the venues are organised as exchanges. They account for about 70 per cent of trade, and these exchanges are operated typically as electronic limit order books in the sense of an open market. People can submit orders to buy and sell, and they attach prices, and when prices cross, there is trade (Elyanov, 2009).

It is opposed to the dealer market or a specialist market, which is the way historically the New York Stock Exchange was organised. About 30 per cent of trade occurs on alternative kinds of venues. There are things like electronic crossing networks (ECNs), dark pools, internalisation, OTC market makers, etc.

Finally, the most striking feature is that the participants are increasingly automated. It used to be that if there was a hedge fund and there was a portfolio manager, and he/she wanted to buy a million dollars' worth of Google, there was also some entity who is a trader, and he/she knows how this sort of these things works (Griesgraber, 2009). Now computers do that. On the by-side, there are investors under the rubric of algorithmic trading who either themselves or on an agency basis present themselves as service providers by brokers. They will take large parallel orders and slice them, dice them over time and across exchanges, and then trade them.

Earlier the traders who were providing liquidity, the market makers, used to be human traders. Now in most of these markets, they often go to the rubric of high-frequency trading. One dominant kind of frequency trading is essentially providing liquidity and providing market-making services. Overall, these are all quite recent trends.

The interactions between an algorithmic trader and a high-frequency trader are challenging to predict. There was the famous flash crash of May 2010. The US Securities and Exchange Commission (SEC) reported that what happened was that in about five minutes, the market fell 5 per cent based on no news or fundamental information whatever. Then in the next five minutes, it recovered. It is a blip that came about from some pathological interaction between an algorithmic trader and high-frequency traders (Reinhart & Rogoff, 2011).

It raises two classes of essential questions. One is from the perspective of the system, policymakers, regulators, etc. who deal with issues such as: Is there a need in dark pools? Is it reasonable to have so many exchanges? Issues of class two come at the level of individual participants where there is no possibility to solve these decision problems.

If someone is trying to buy some stock, he/she has to decide whether they are going to use a dark pool or whether they are going to use an exchange? How is it possible to accomplish this?

There are two specific problems related to high-frequency trading in market microstructure.

The first is understanding the importance of latency. The second is understanding the role of dark pools in markets.

Latency is the delay between making a trading decision and its implementation. If someone decides to buy a hundred shares of Google, and he/she transmits that order to NASDAQ, how long it takes before that quantity is taken from the order book? Similarly, there is an order outstanding, and someone wants to cancel it. How long does it take between when someone makes that decision, and when those long orders are pulled from the matching engine and are no longer eligible for execution? It used to be the domain of IT-people, but in the past few years, it centred the public discussion. That is the idea of collocation (Yefremenko, 2007).

High-frequency traders often confound other investors by issuing and cancelling simultaneously. Maybe it is good to be able to trade quickly, although bullying does not sound so good. It is the technological arms race that separates winners and losers and how fast they can move.

Why is latency important? It is crucial to value the importance of low latency, and phrase it a different way: what is the cost associated with having latency?

Before 1980, it used to be that if someone put an order to buy a stock, it would take two minutes for that to occur. Later it came down to about 20 seconds. As of 2007 latency numbers came in hundreds of milliseconds. If someone is making trading decisions on that time scale, that is not humans, that are the computers that are trading with each other (Pisani-Ferry & Sapir, 2010).

In another couple of years, there will be the single-digit millisecond. So, if someone wants to send news from Chicago to New York, the speed of light limits them. That cannot happen faster than five milliseconds. If someone wants to be trading in less than a millisecond, that means there is a need for physical proximity.

The trend is to go even below that — a technology has driven it. Different exchanges emerged that offer technology benefits relative to income benefits. It is best to make personal decisions with the latest information possible. For example, if the traders are looking to sell 100 shares of Apple stock, the price that they are willing to sell at depends on the price other people are willing to sell or buy it. It depends on the price at different exchanges.

So, as traders digest more recent information, that will alter the price. There will be some advantage to having low latency. If there are two traders, and they are doing very similar trading strategies, typically the winner takes all. The fastest will get all the profits, and the other will get knocked out. That offers certain advantages. Depending on who they are, these different effects might kick in. How does investor benefit from having access to the latest information in terms of lowering costs? Here is a model. It can be called a stylised execution problem.

There is a trader who wishes to sell 100 shares over a very short time horizon, for example, 10 seconds. It is a problem that every trader faces at one level or another, and as was described earlier, the value that the trader perceives evolves, and the price at which the trader wants to get the share depends on this value. To figure how best to sell these 100 shares, the trader has to observe this valuation process. And if someone adds latency, that introduces a tracking error.

The trader does not precisely know what the value is. He/she only knew the value a millisecond ago. Because of that, he/she has to alter his/her actions, and that creates a cost, so latency becomes friction. What they do is they quantify the cost associated with latency. If they look at this execution problem and look at the transaction costs in the presence of latency, they will see how much worse that is. If they had known their latency in advance, they would normalise.

It depends on the volatility of the stock. The more volatile the stock is, the more critical the latency is. The more liquid the stock is, the more significant the latency is. That latency goes from being about 20 per cent of transaction costs to being 1 or 2 per cent. Does this make sense? Is this significant? It needs interpretation. For example, there is the stock, and the situation is normalised so that the bid offer was a penny. Most stocks in the US have a bid offer of a penny. What that thing is suggesting is that the value of decreasing latency from the human timescale to the machine timescale is about 20% of a penny or 20 mills. That seems a tiny number. But it is important to guess how much high-frequency traders make, people who have invested in being able to trade on this kind of timescale. Nobody really knows that, but self-reported numbers are of the same mode of magnitude (Mel'yantsev, 2015).

Earlier, where there was no ability to trade electronically, and the traders wanted to form it out, they wanted to pay an investment bank to trade for them and presumably they would have made that investment.

Latency is potentially crucial to all investors. It is a fundamental problem, the problem of selling 100 shares in 10 seconds. But how important it is, it depends on what the rest of the costs are. If they are at the most efficient cost level in terms of the commissions they have negotiated, latency is worth about as much. On the other hand, if they are retail investors, they are not paying five mills per share traded, they are paying 10 dollars to each trader. Those orders in magnitude are more than any of these. So, from their perspective, for a retail investor, this does not matter. The commissions and other things they are paying dominate the value of latency (Lane, Milesi-Ferretti, 2011).

Dark Pools

Dark pools are an alternative trade mechanism. If one thinks about a limit order book they want to buy, typically there is an offer price which is higher than the price at which they could sell, which is a bid price. There is a bid offer spread, a limit order book or an exchange. Someone is providing liquidity who may be a high-frequency trader, and they are going to charge for that, and this bid offer spread is what they charge.

What is an alternative mechanism? The idea of a dark pool is instead of having these intermediaries posting orders, i.e., people who directly trade with each other, there is just an anonymous pool where some people can declare they want to buy, some people can declare they wish to sell, and if there is a match, they will be matched with each other, and it will occur at the mid-market. It means no transaction costs. If the traders are trying to

buy on an exchange with a market order, they are going to execute for sure. If they put an order into a dark pool, they will get it at a better price. It is a trade-off that occurs in many markets. It is a trade-off between uncertain trader at a better price, i.e. the dark pool, or guaranteed trade at a worse price.

For example, in an eBay auction, the people typically can pay a price premium, get the item they want with certainty, or they can participate in the auction, get it cheaper, or they will not get it (Kose, Prassad, Rogoff, & Wie, 2009).

What is very specific about it here is a simple stylised model in a financial context where investors have two options. One is a guaranteed market where someone can trade with certainty, but they pay a transaction cost, they pay the bid-offer spread. It is a dealer market or electronic order book. The second option is a dark pool. Here someone puts the order into one of these electronic crossing networks. If a trade occurs, it occurs at mid-market. It has zero transaction cost. But they are not sure it is going to happen. So, there is a need to evaluate these two alternatives. The key ingredient in this model is information ladders. It might be important for a couple of reasons.

First of all, if the stock is going up, and someone is pretty sure that the stock is going up, that is going to affect whether someone wants to trade with certainty, or they will be uncertain. For example, if they are confident, they are willing to pay the transaction costs, and they want to trade with certainty. The information matters here. However, other people's information matters also, because when they trade, they are trading with others in the case of a dark pool. If they are systematically trading with people who have more information than the other traders, maybe that is not going to work out for them so well in the end. One critical thing is going to be modelling information. There is a need to have a model where there are three kinds of traders or speculators. Everybody observes a signal about what is going to happen with the price. The speculators are just trying to make money of the price swings. On the other hand, they have intrinsic buyers and sellers. They also would like to buy low and sell high. However, they have their reasons to trade. They have idiosyncratic desire to trade (Lebedeva, 2013).

There is an equilibrium in this model, and there are some predictions. For example, the more information traders have, the more they are willing to go to the guaranteed marketplace. If they are very well informed, and they know the price is going to go up, they want to buy with certainty. On the other hand, if they are less informed if they have little or no information, they are trading only on idiosyncratic reasons.

The traders are willing to trade in a dark pool; they are eager to take that risk as it does not make sense for them to pay transaction costs. If someone imagines a world with a dark pool and a world without the dark pool, transaction costs will be higher in the presence of a dark pool. Where are these transaction costs coming from? It is a bid offer spread which is going to be set by market-makers, who are trying to make money. If they have a dark pool present, those market-makers are going to end up systematically losing more money. They are going to widen their spreads to compensate for that.

The presence of a dark pool is going to deteriorate the quality of the guaranteed market. Investors in the dark pool are going to experience adverse selection. If someone trades in the guaranteed market, no matter whether the price is going up or down, they are going to get that share. If they trade in the dark pool, they are not sure, if they will or not, but if they are trying to buy, what will happen is typically when the market is going down, their order will get filled, and when the market is going up, it will not (Khmelevskaya, 2015).

So, precisely in the circumstances where the people do not want to trade because they could have bought it cheaper later, they will trade and otherwise, they will not. A naïve person will look at dark pools and say there are no transaction fees; they are trading on the mid-market. Because they are not trading for sure, and because their trades are going to be correlated with what happens to price afterwards, they are paying an adverse selection fee. It is implicit. It is not explicit like the bid-offer spread. Statistically, they are paying this fee. It can be of the same order of magnitude as the bid-offer spread. So, the dark pool is not as good as it looks, because it decreases welfare (Jorda, Schularick & Taylor, 2009).

The Technology of High-Frequency Trading (HFT)

In 2010, Spread Networks Co. invested 3 million dollars in digging a high-speed fibre optic cable connecting financial markets in New York City to financial markets in Chicago. The failing feature of this cable is that it was dug in a relatively straight line. The straightness of this line shaved round ship data transmission time by three milliseconds, by 3000th of a second. To put that into context, blinking an eye takes several hundred milliseconds (Kemenyuk, 2009).

Economists have been working on this project for over three and a half years, which is more than a hundred billion milliseconds. Three milliseconds do not sound much. Industry observers described it as an eternity. The joke at the time was that the next innovation would be to dig a tunnel, go through the earth, right around the earth because that will further shave data transmission time. This joke materialised. The spread cable is already obsolete. It is not a tunnel through the earth, but because light travels faster through the air than through fibre optic cable, there is special relativity that one should be talking about.

Micro-waves have further shaved data transmission time. The time is now down to eight-and-a-half milliseconds. The Einstein bound is eight milliseconds round chip between these two markets. Other races are occurring throughout the financial system, sometimes measured as finally as millions or even billions of seconds (Helleiner, 2009). In the last few months alone, the most recent innovation has been laser beams which have the speed properties of microwaves, but more reliable in bad weather. There have been announcements to do with the release of public information early by firms like BusinessWire.

In this project, the arms race is looked at from the perspective of market design. It is an academic approach which takes for granted that participants in the market act rationally and in their self-interest concerning market rules. They take seriously the possibility that the rules themselves are flooded.

HFT is a rational optimising concerning market rules. Are the market rules themselves optimal? At a deeper level, the question is: what is it about a market design that induces the arms-race-like behaviour in this design system? The central point is going to be that the arms race among high-frequency trading firms is a symptom of a simple structural floor in market design. This floor is continuous-time trading.

Continuous-Time trading means that people can trade, buy themselves stock or buy themselves futures contracts or buy themselves anything else at literally any instant during the trading day or instant measured as finally as computers allow. What the industry is going to propose as an alternative is to make time discrete. More specifically, the industry is going to suggest replacing the continuous-time limit order book market (Dorrucci & McKay, 2011).

The order books are the predominant market design used by financial exchanges today with discrete-time, which can be called frequent badge auctions. These are the uniform price double auctions conducted very frequently at a discrete-time throughout the day. It is a massive document, a massive argument with four parts. The first thing worth showing is some empirical evidence that continuous markets do not work as they are expected to work at very high-frequency time scales.

There are two ways to quantify this phenomenon. One is to ask what the correlation exists between these assets at different time horizons? At horizons of a few seconds or more, the correlation is essential. They should be perfectly correlated. They track the same index, but at a millisecond, the correlation is less than 0.01 (Chen, Milesi-Ferretti, & Tressel, 2012).

If someone takes the perspective of a Chicago observer treating New York as the recent past or a New York observer treating Chicago as the recent past, or if special relativity is just ignored altogether, the correlation completely breaks down at high enough frequency as one. Then the second way to quantify this phenomenon is to ask how often this breakdown in pricing relationships creates free money. Does it create technical arbitrage opportunities? What can be seen here at this moment is buying cheap in New York and selling expensive in Chicago, which is an essentially riskless profit opportunity. There are in order of 800 such opportunities per day.

The typical intuition about arbitrage, especially about obvious arbitrage opportunities is that almost the same security is trading in two different markets at two different prices. The intuition about obvious arbitrage opportunities is that they get competed away. The first thing is to

look at the duration of these technical arbitrage opportunities throughout the data.

Each day has 23.4 million milliseconds. The prices should move together, but the prices get out of track as well, and money can be made buying the cheap one, selling the expensive one. The duration of these arbitrage opportunities has come down over time. In 2005 they lasted on the order of 100 milliseconds on average. By 2011, it was sub-10 milliseconds, i.e. less than one-one-hundredth of a second. If there is a fifty-millisecond arbitrageur in 2005, that is whenever prices were dislocated for at least 50 milliseconds; they could get that arbitrage. In 2005 they were state-of-the-art and got almost everything. By 2011, they are entirely obsolete, and traders get virtually nothing.

Durations have come down overtime. But profitability per arbitrage opportunity has remained relatively constant. There is nothing in the market design that allows prices to move at the same time. The people still make just as much money per arbitrage opportunity at the end of the data as at the beginning of the data. The exceptions include a blip-up during the financial crisis in 2008 (Afontsev, 2014). And the bigger the price movements, the more common are significant price dislocations.

2008 was the best year in history to be a high-frequency trader. Profits were lower pre-2008 and also post-2008.

Frequency does change overtime very substantially, but it is explained almost perfectly by just asking how volatile the market was on a particular day. It is a complementary way of looking at the same phenomenon as this.

If one looks though, at one millisecond, one sees that in all years at high enough frequency correlations entirely fall apart, and again there is nothing in the market design that allows security prices to move at the same time. These results suggest that the arms race should be viewed as something of a constant of the market design rather than a profit opportunity that gets competed away overtime. These correlation curves show that competition overtime, i.e. the high-frequency speed race. It increases the speed which information makes it from one security's price into another security's price but does not eliminate the underlying phenomenon that prices cannot move at the same time.

Correlations break down at high enough frequency. In the technical arbitrage, a way to interpret that is that competition does increase the speed requirements for capturing arbitrage opportunities. It raises the bar, but competition cannot eliminate the arbitrage opportunity, it does not reduce their size, and it does not affect their frequency. Frequency is affected by volatility, but not by speed competition *per se*. These facts are going to be taken to inform and then also explain the theoretical model (Andronova, 2012).

The thing one really would not like to emphasise is that it suggests the tip of the iceberg in the race for speed. There are hundreds of pairs of securities that are very similar to the S&P 500 pairs or highly correlated. In fragment to equity markets, there are even simpler trading opportunities. The same stock can take as an example that trades on thirteen different exchanges and fifty different dark pools. All of those prices should move exactly together, but nothing in market structure allows them to run at the same time, and one can make money buying the cheap and selling the expensive one (Titarenko & Petrovskiy, 2015).

Correlations that are high but far from 1 can be exploited in a statistical sense. There is a race to get to the top of the order book, which is an artefact of fat tick sizes. It shows up in a lot of contracts that trade on the Chicago Mercantile Exchange, which has fat ticks. Interestingly, there is a discussion in Washington about mandating a larger tick size in US equities with a theory that will invigorate the market for small cap stocks and equity research. From the frequency perspective widening the tick's scope exacerbates the race to get to the top of the book. There is a race to respond to public news like a Fed announcement at 2 p.m. When the Michigan Consumer Confidence number comes at 10 a.m., there is also a race to react. There is no need to try to put a precise estimate of the total prize in the race, but common sense suggests a lot of money is on the line (Semedov, 2015).

The Model of High-Frequency Trading

The theory models are going to do two things: one is going to be a critique of continuous trading. And the second is going to help articulate what exactly is wrong with prepetition based on the speed. What are precisely the economic consequences of this race for speed?

It is a very simplified model which tries to help explain the facts and then serve these two related purposes. At the core, it is a straightforward model. It makes some crucial points. There is a security X that trades on a continuous order book market. There is a publicly observable signal Y of the value of security X. There is a need to make a purposely very strong assumption that security X is perfectly correlated to public signal Y. Moreover, at any moment in time, one can causelessly liquidate X and get Y.

There is a best-case scenario for price discovery and liquidity provision in a continuous-time market. There is a model in which it should be economically trivial to provide liquidity in the market for X. This model does not have asymmetrical information. It does not have inventory costs. It does not have the usual sources of costly liquidity provision. X and Y are understood as a matter for four pairs of securities that are highly correlated.

Signal Y involves the compound Poisson jump process. There are two types of participants in the model: investors and trading firms. Investors represent N users of financial markets, i.e. mutual funds, pension funds, hedge funds, etc. They arrive randomly to market and, needing to buy one unit of this security X; they have a random arrival rate lambda invest. It is equally likely that they need to buy a unit versus selling a unit. They are very mechanical. They trade at market immediately upon arrival.

The other participants in the model are trading firms or equivalently high-frequency traders, algorithmic traders, etc. They do not have an intrinsic demand to buy or sell X. They are traders that want to buy low and sell high. Their goal is to maximise profits per unit time. The number of trading firms is exogenous. There is capital coming in, trading firms present in the market, and then later the entries will be endogenised or allowed for costly entry by investing in a speed technology.

Latency should be taken into account at first in a straightforward and stylised way, again towards building up the best case for the performance of a continuous market. Initially, there is no latency in observing why. So, whenever this security, that whenever this single Y jumps around, everybody in the game sees it immediately for free.

Moreover, there is no latency in submitting orders to the exchange. If someone decides at some time that they want to send an order to the exchange to buy, their order reaches the exchange at precisely that time. If the order to buy and the order to sell reaches the exchange at the same time, the exchange processes these two requests one at a time. It is called serial processing.

Part of the best-case scenario is assuming away latency. Given this model set-up, there is no asymmetric information. There are no inventory costs. Everybody's risk is neutral. That complication is going to lead to a healthy outcome which should be economically trivial to provide liquidity in the market for X. But that is not what happens in a continuous limit order book, due to a phenomenon which can be called sniping.

Suppose single Y jumps from Y lower bar to Y upper bar. The price in Chicago of the e-money futures goes up two ticks. It is the moment in which the correlation between Y and X temporarily breaks down. The world changed. The market jumped a couple of ticks. The quotes are now incorrect. The traders send a message to cancel old quotes and replace them with new quotes based on the new public information.

But at the same time, other trading firms try to snipe the still quotes. Again, the world is changing. Someone sends a message to cancel these quotes. At the precise same time, all of the traders and the other trading firms send a message to buy at the ask price. The ask is too low relative to the information. Since continuous markets process these requests in serials, one at a time, in order of arrival, it is possible that one of the requests to trade at this old price is going to reach the exchange before the request to cancel these quotes and replace them with new quotes based on the latest information. It is not only possible but probable because one of the traders tries to cancel and everybody else attempts to exploit the still quotes. It is an asymmetry.

When there is a big jump, liquidity providers get sniped with high probability N minus one over N. If there are 100 trading firms, it is 99 out of 100 chances that they get sniped when there is a big jump. In a continuous market, there is symmetrically observed public information, and these jumps in Y create technical arbitrage opportunities.

Everybody understands equally well that X is worthwhile. Y jumps at the same time, and yet somebody is going to make money from the first

message process to trade at the old price. It is not supposed to exist in an efficient market. There should not be such simple arbitrage opportunities in an adequately designed market, and it is closely associated with the correlation breakdown phenomenon. The reason for this is that equilibrium, the cost of getting picked off by all of the traders are being passed on to investors. It is a cost of doing business. It is a cost of liquidity provision. The traders get an equilibrium in which N trading firms provide liquidity to real investors. It provides bids and asks.

Trading firms are going to be indifferent between these two roles and equilibrium, and in practice, most of the high-frequency trading firms perform both roles, mutually throughout the day. There are some exceptions to that. The difference between the price at which one is going to buy and the price at which one is going to sell is going to have to compensate for the risk of getting picked off by all of the traders. If someone works through math, they get an equation that describes the bid-ask spread, which creates revenue for a trader from investors. Investors come along and pay the bid-ask spread. That is good news for the trader as a liquidity provider. That compensates for the risk of getting sniped by all of the traders.

As a subtle economic interpretation on the left-hand side of this equation is the revenue from investors due to a non-zero bid-ask spread. On the right-hand side of this equation, there are the rents to trading firms from this technical arbitrage that are caused by the market design. What happens if so far investors show up wanting to buy themselves one unit? Or what happens if investors show up wanting to buy themselves two units? Or want to buy or sell a million shares? If someone is a liquidity provider, and they provide a profound order book, they provide a million shares at the bid and a million shares at the ask.

There is a jump where the traders are all going to try to pick one off for all million shares because it is free money for all of them times a million. The costs of providing a deep book scale correlate linearly with how deep of a book someone provides. But not all investors want to buy themselves a million shares. Many want to buy themselves just a hundred shares. The benefits of providing a deep book do not scale. This sniping cost causes not only a non-zero bid-ask spread; it also causes markets to be unnecessarily thin. One is not going to be able to provide a million-share book; rather, they are going to charge a considerable price for quoting that much depth because they are worried about getting picked off.

The next thing they do in the model is endogenising entry. So far, it is free to observe innovations in Y, and there is just some exogenous number of trading firms. There are a hundred trading firms in the market. Now everybody can observe innovations in Y at slow latency for free, at the latency of delta slow. They can pay a cost, a speed cost to observe innovations in Y faster. It is going from the slow cable to spread networks cable. They are going from the spread networks cable to microwaves or from 2012 microwaves to 2014 microwaves.

In equilibrium, the traders get a very similar structure — everybody snipes. Fast-raters are indifferent between the two roles. When one works through the math, they are going to skip these equations. They get a subtle characterisation of equilibrium where the total revenue from investors that the liquidity provider earns equals the total expenditure on speed by high-frequency trading firms.

Continuous trading creates these technical arbitrage opportunities, say, 20 billion dollars a year. And then high-frequency trading firms invest real resources of three million dollars cables.

In the equilibrium of the model, all the rents from these technical arbitrage opportunities get soaked up and get dissipated in competition to realise arbitrage.

There are equivalents in the arbitrages between prize and the speed race, the amount expanded on this speed race and the end cost to real investors. One should always keep in mind that profits in financial markets have to come from somewhere. In the model, they are coming from end investors.

The model points to two market failures. One is the phenomenon called sniping. Technical arbitrage opportunities are simply embedded in the design of continuous limit order book market. These are opportunities that should not exist in the efficient market and allow earning rents from symmetrically observed public information.

Everyone has intuition. If someone is a hedge-fund analyst, and he/she figures out something about a company that nobody else in the market knows, they can make money from that. But in this model, one can figure out something that

the rest of the market knows. The traders can make money from that. A second market failure is that this free money creates a speed race. Mathematically for those traders, this is a prisoners' dilemma.

The arms race in the model is constant. Nothing in the analysis depends on whether the difference between fast-raters and slow-traders is seconds or milliseconds or microseconds and nanoseconds. Instead, this sniping phenomenon is an equilibrium feature of continuous trading. It does not get competed away.

The model encourages a constructive way of thinking about high-frequency trading firms. In the model HFTs endogenously decide to perform two roles: a useful role and a negative role. The useful role is in providing liquidity and enhancing price discovery for real investors. It is providing liquidity in the market for X.

The negative role is sniping still-quotes. When the market changes picking off old prices, these sniping still-quotes look like zero-sum HFT. Frequent batch auctions preserve the useful function, the price discovery and liquidity provision but eliminate the rent-seeking function.

Markets today are more liquid than they were in the pre-HFT era. It is a lot cheaper to trade in 2014 than it was in the 1990s. But there is a vast information technology revolution as financial markets switched from humans toward electronic bases. All gains were realised in the relatively early stages of the IT-revolution.

Conclusion

The take-away from the empirical record is that information technology has been unambiguously good for markets, but there is no evidence that the speed race has been good for markets. The research suggests that the speed race has been negative, at least in recent years, at a millisecond or microsecond level.

There is an alternative to continuous trading which can be called frequent batch auctions. At a high level, frequent batch auctions are very analogous to current practice to continuous limit order book trading with the vital exception that time is discrete. Stocks trade in a penny, meaning that it is a discrete price increment. The trader is not allowed to bid a millionth of a penny more than the other one is to jump ahead in the queue. There is a discrete price increment.

Discrete time necessitates batch processing.

The proposal is to divide the day into equal intervals, say, a hundred milliseconds. During this interval, traders submit bids and asks. The same language is currently of a price quantity in a direction. Orders can be freely cancelled, withdrawn and modified any moment in time. At the end of each interval, the exchange batches together.

Supply and demand either do not cross or they do — if they do not cross, then there is no trade. All orders remain outstanding for the next batch interval. Most stocks have no trading activity. Instead, what one can see as a market participant are a supply and demand.

The other case is that supply and demand do cross at some price, say p*, in which case the logic is one of a uniformed price auction. In the 1960s, it was initially proposed by Milton Friedman and adopted in the 1990s by the US Treasury for the US Treasury market auctions.

If a trader bids more than p* or higher or someone else asks lower, one transacts the full quantity at p* at, say, 10 dollars, at the uniformed price of the auction. If one bids precisely 10 dollars, one might get rationed.

The suggested rationing rule is to respect time priority. If the order has been sitting in a book for ten seconds and the other order is new to the book in this trading interval, the previous order has precedents of the latter. But if the first order and the second order reach the exchange at the same interval, they can be treated equally.

The market clears at price p*. The auction is very similar to continuous limit order book trading. After the auction is computed, the price is announced, the quantity of the supply and demand curves are announced, and there are some more details about the information policy. Why is a frequent batch auction an attractive alternative to continuous trading? There are two reasons for that. The first, the apparent reason is that frequent batching reduces the value of a timing speed advantage. In the discrete time, the market is trading one per second, and one trader is a hundred millionth of a second faster than the other one.

The second, more obscure reason why frequent batching is attractive is that it transforms competition on speed into competition on price and eliminates the sniping phenomenon. Suppose someone is trying to provide liquidity. There is a jump in the public signal Y, so there are either

many jumps or the Fed makes an announcement at 2 p.m. What is evident to all participants is that the market is going to tick up several points. In the continuous market, there is a race to pick up still-quotes at these incorrect prices. In the batch market, there is an auction.

The trader gets the buy, the other one pays, and the former will be able to make the rent. Pure speed competition is designed away. Competition is based on price. In equilibrium, the benefits of frequent batching relative to continuous trading eliminates sniping, which enhances liquidity. Narrower bid/ask spreads go in greater depth. It stops a socially wasteful arms race.

The cost is that investors have to wait to transact.

The equilibrium analysis focuses on liquidity and a socially wasteful arms race. Another case for discrete time trading is based on computational advantages. Continuous time trading implicitly assumes that computers and communications technology are infinitely fast. If an event happens on the NYSE, the NASDAQ knows about that immediately.

All of this is a manifestation of the fact that the information does not travel instantaneously fast. It takes a few hundred microseconds or a couple of milliseconds to get from one place to the other. Discrete time respects these computational and communications limits. For an algorithmic trader, discrete time means one sees what happens on the market at time t. One has a block of time to think about it, or for the algorithm to think about it and make decisions at t+1, and then one sees what happened at t+1 or t+2.

Programming is a clean environment, whereas, in the continuous market, one does not know what they are going to learn. One also does not know what information others in the market have.

For exchanges, continuous trading creates a computationally impossible task. Exchanges invariably get back-logged. If there is a lot of activity exchanges, it takes time to process that activity. In discrete time the computation is trivial.

For a regulator in a continuous market, it is difficult to parse the audit trail. It takes months for regulators to figure out what triggered the flash crash, and even today, the understanding of that day's events is far from complete. There is a discrete time of the simple audit trail. It happens at t or t+1. Once per hundred milliseconds is very different in terms of the audit trail which yields from once per nanosecond. A nanosecond is too small relative to noise in communications and computing time.

There have been multiple other policy responses to the high-frequency arms race, for example, the Tobin tax.

To summarise, one looks at the arms race in the perspective of market design. The traders do not think the root problem is evil high-frequency trading firms. First of all, continuous time markets are in fiction. Correlations break down. There are frequent technical arbitrage opportunities. Second, these technical arbitrage opportunities induce a never-ending speed race, which looks like a constant of the design. The bar gets higher each year, but it does not compete away.

The theoretical model shows that the root causes market design. There is continuous limit order book trading. The arms race is an equilibrium feature of the design. It harms liquidity and is socially wasteful.

The research shows that frequent batch auctions are an attractive market design response and an equilibrium that eliminates sniping. It stops the arms race and enhances liquidity and has computational advantages. The costs of that are that investors have to wait to trade.

There are two essential parameters in the model: tick size in time and tick size in price. The question is how a regulator or exchange owner would optimally choose those parameters. The model assumes away that tick size in price. It treats the tick size in prices being arbitrarily fine. And this is indiscrete time auction.

There is a clear need to have a discrete tick size in continuous markets. There is an economic model of what the optimal tick size is. A finer tick size should be chosen, which means more accurate price discovery, although one does not have a concrete way of thinking about it.

In the end, Milton Friedman once said, *"…it is really hard to change policy, there is enormous inertia in the private sector and especially regulatory arrangements as an inertia of the status quo. And it is only upon a crisis that there is real change."* And he also said, *"…our job as economists is to develop good ideas and then to keep them active, keep them part of public discussions. So, that when a crisis hits, people reach for a good idea rather than reaching for a lousy idea."*

References

Afontsev, S. A. (2014). Dominirovaniye dollara: est' li al'ternativy [Dollar's dominance: Are there any alternatives?]. *Rossiya v global'noi politike*, *4(12)*, 120–129.

Anrdonova, N. E. (2012). Osnovniye predposilki i perspektivy konvertiruyemosti rublya i formirovaniye mezhdunarodnogo finansovogo tsentra v Rossiyskoi Federatsii [Basic causes and prospects of the rouble's convertibility and the formation of the international financial centre in the Russian Federation]. *An Economic Review of the Republic of Tatarstan*, *4*, 5–10.

Arner, D. W., & Taylor, M. W. (2009). The Global Financial Crisis and the Financial Stability Board: Hardening the Soft Law of International Financial Regulation. *University of New South Wales Law Journal, 32(2)*, p. 489.

Beder, S. (2009). Neoliberalism and the Global Financial Crisis. *Social Alternatives*, *28(1)*, p. 18.

Chen, R., Milesi-Ferretti, G. M., Tressel, T. (2012). Euro Area Debtor Countries: External Imbalances in the Euro Area. *IMF Working Paper*, 2012, *12(236)*, 1–22.

Chorev, N., & Babb, S. (2009). The Crisis of Neoliberalism and the Future of International Institutions: A Comparison of the IMF and the WTO. *Theory and Society, 38(5)*, 459–484.

Dorrucci, E., & McKay, J. (2011). The international monetary system after the financial crisis. *European Central Bank Occasional Paper Series*, *123*, p. 10.

Elyanov, A. Ya. (2009). Mirovoi ekonomicheskiy krizis i razvivayushchiyesya strany [World economic crisis and emerging economies]. *Mirovaya ekonomika i mezhdunarodniye otnosheniya*, *10*, 24–32.

Griesgraber, J. M. (2009). Reforms for Major New Roles of the International Monetary Fund? The IMF Post-G-20 Summit. *Global Governance*, *15(2)*, p. 179.

Helleiner, E. (2009). Special Forum: Crisis and the Future of Global Financial Governance. *Global Governance*, *15(1)*, p. 1.

Jordà, Ò., Schularick, M., & Taylor, A.M. (2011). Financial crises, credit booms, and external imbalances: 140 years of lessons. *IMF Economic Review*, *59(2)*, 340–378.

Kemenyuk, V.A. (2009). Poryadok posle krizisa: kakim yemu byt'? [An order after the crisis: how should it look like?]. *Mezhdunarodniye protsessi*, 3(7), 1.

Khmelevskaya N. G. (2015). Prioritety vneshnetorgovoi politiki Rossii v orbite ekonomicheskogo sotrudnichestva BRIKS [The priorities of foreign trade policy of Russia in the orbit of economic cooperation of the BRICS]. *Economic policy*, 2(10), 93–109.

Kose, M. A., Prasad, E., Rogoff, K., Wie, S.-J. (2009). Financial globalization: A reappraisal. *IMF Staff Papers*, 1(56), 8–62.

Lane, P. R., Milesi-Ferretti, G. M. (2011). External Adjustment and the Global Crisis. *IMF Working Paper*, 11(197), 3–18.

Lebedeva, M., M. (2013). Aktory sovremennoi mirovoi politiki: trendy razvitiya [The actors of the modern world politics: development trends]. *Review of MGIMO University,* 28(1), 38–42.

Mel'yantsev, V., A. (2015). Sravnitel'niy analiz modeley razvitiya Kitaya, Rossii i Zapada [The comparative analysis of the development models in China, Russia and the West]. *Mir peremen*, 3, 177–180.

Pisani-Ferry, J., Sapir, A. (2010). Banking Crisis Management in the EU: An Early Assessment. *Economic Policy*, 25, 341–373.

Reinhart, C. M., Rogoff, K. S. (2011). From Financial Crash to Debt Crisis. *American Economic Review*, 101(5), 1676–1706.

Semedov, S., A. (2015). Mesto Rossii v mirovoi politike i ekonomike [The place of Russia in world politics and economy]. *Aktual'niye voprosi innovatsionnoi ekonomiki,* 9, 9–10.

Titarenko M. L., Petrovskiy V. Ye. (2015). Rossiya, Kitai i noviy mirovoi poryadok [Russia, China and the new world order]. *Mezhdunarodnaya zhizn',* 3, 23–43

Yefremenko, I.N. (2007). Osnovniye napravleniya transformatsii mirovoi finansovoi arkhitekturi v usloviyakh finansovoi globalizatsii [Main directions of the world financial architecture's transformation in the conditions of financial globalization]. *Finasi i kredit*, *41(281)*, 43–51.

Высокочастотная торговля в современной микроструктуре финансового рынка: возможности и угрозы

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Аннотация. В статье описаны основные положения исследования высокочастотной торговли и организации финансового рынка. Тема актуальна в связи с тем, что в настоящее время существует необходимость создания инструментов для участия в торговле упрощенными структурными продуктами, составляющими структуру рынка. В статье выявлена значимость биржевой торговли в ее зависимости от фундаментальной ограниченности времени на финансовом рынке. Автор доказывает, что время на финансовом рынке имеет иное измерение и по внешней видимости обладает бесконечностью, поскольку исчисляется в миллионах секунд, но при этом остается редким ресурсом. Впоследствии автор переходит к основному исследованию высокочастотной торговли в структуре финансового рынка. Цель статьи — проанализировать деятельность компаний, занятых в сфере высокочастотной торговли, которые осуществляют масштабные инвестиции в усовершенствование методов функционирования в жестких временных рамках. Теоретическая значимость результатов исследования заключается в изложении системного подхода к решению проблем стохастического характера в контексте финансового инжиниринга. Практическая значимость статьи состоит в разработке механизма, который позволяет решать проблемы, связанные с оптимальной торговлей, микроструктурой рынка, высокочастотной торговлей и др. В заключении автор систематизирует уроки из опыта современной электронной торговли на финансовом рынке и их решения в долгосрочном периоде.
Ключевые слова: финансовый инжиниринг; финансовые инновации; высокочастотная торговля; мировой финансовый рынок
JEL Classification: F37

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Management Issues in Loan Syndications Banking

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Abstract

This article covers the key management issues in the loan syndications banking business. A syndicated loan is provided to a borrower by a group of commercial or investment banks. The global syndicated loan market is from one perspective, the primary funding source for corporations and on the other — one of the leading businesses for the global banks. There exist some unique challenges that must be responded by banks from a managerial and strategic perspective to establish and maintain leadership in the important business due to the features, structures, and industrial organisation of the market. We first consider how the loan syndications business is structured in a global bank, its functions and competitive advantages. Then we discuss the ways banks can implement an effective strategy and maintain leadership and growth in the market. Finally, we propose solutions to dealing with commoditization in banking: (i) adding more value-added services to the client offering; (ii) bundling of services in order to realize cross-selling opportunities and maximize share-of-wallet; (iii) further segmentation and customization of the client base (by industry/relationship/services consumption). By adopting these strategies, banks can successfully fight the commoditization magnet and increase the profitability of their loans syndications businesses.

Keywords: banking industry; syndicated loans; bank management; commoditization; international capital markets
JEL classification: G24

The Loans Syndications Business

The syndicated loans market is one of the most important funding sources for corporations and financial institutions. Based on the information provided by (Bloomberg, 2018), the volume of the global syndicated loans market totalled USD 4.9 trillion in 2018, demonstrating a 9.4 per cent increase compared to 2017. During the year, the total number of deals decreased by 3.6 per cent to 8,359. JP Morgan ranked as the top global syndicated loans book-runner with 10.2 per cent market share. The bank acted as book-runner in 1,336 deals in 2018. Bank of America Merrill Lynch and Citi ranked second and third with 9.2 per cent and 5.7 per cent of market share respectively.

A syndicated loan is provided to a borrower by a group of commercial or investment banks. Its main features are: (i) one set of documentation (multi-party facility agreement); (ii) the financing terms are identical for all lenders; (iii) equal ranking of all lenders; (iv) information flow and payments are channelled via one bank, the Facility Agent (Shutter, 2017). The deal is arranged by a leading international loan market banks, called the Coordinator. The Coordinator structures the transaction to suit the financing needs of the borrower and arranges a senior syndicate of banks that are called the Mandated Lead Arrangers. Then these banks, in the roles of Book-runners, run the syndication process in the global loan market, inviting investors to join the loan as Lenders (Tarasov, 2017). Based on the deal information package, that includes documents describing the business and financials of the borrower, the Lenders make the decision as regards their commitments in

the deals. Following the signing of the Facility Agreement that is drafted by an international legal firm, the transactions are closed, and the funds are provided to the borrower.

In this article, we present an overview of management issues in loan syndications. The mission of the business is to provide syndicated financing solutions to the clients of the bank (Altunbas, Gadanecz & Kara, 2006). The products are corporate loans, financial institutions loans, real estate finance, pre-export finance, project finance, advisory services (Caselli & Gatti, 2017). Syndicated loans are one of the key offerings of all major international banks that are active in the corporate banking and capital markets businesses. Inside the bank, the loans syndications business is organised as a department inside the global financing business (Davis, 2002).

The functions of the Loan Syndications department include loan structuring and negotiations with the borrowers, preparation of the information package, participation in the drafting of acceptable loan documentation, running the syndication process among the investor base. An additional essential function is the management of the syndicated loans portfolio (Francis & Kim, 2013). Since several parties are involved in a loan transaction (borrowers, investors, legal firms), a point fundamental to the success of the execution process is efficient management of the execution process in the role of the Coordinator. Another important aspect is the sectors that are covered by the department. These usually include natural resources, industrials, telecom, technology, distribution, transport, retail, financial institutions. As follows, such a structure envisages a vertically integrated loans business, providing a broad range of financing solutions to the client base (Iannotta, 2010).

The business is highly competitive, with all major international banking groups targeting the leading corporations and financial institutions that have investment-grade credit ratings and are therefore acceptable from a credit risk perspective (Dennis & Mullineaux, 2000). These companies require high-quality service, low cost of borrowing, and massive funding capacities from banks, as well as advanced cross-selling products (interest rate and foreign currency derivatives (Wystup, 2017)) and services (advising on optimal capital structure, M&A transactions (Allen, Peristiani & Saunders, 2004)). Therefore, the competitive position of a bank in the loan market is determined by (Schwert, 2018): (i) cost of funding; (ii) capital capacity; (iii) ability to provide an integrated service offering.

The loan syndications business, if organised the right way, can lead to significant asset creation (growth of the balance sheet) and shareholder value creation (measured as the Return on Equity) for the bank. It can, therefore, be placed in the upper-right quadrant of the "mission critical/growth" framework in Figure 1, being a mission critical business (most corporate clients and financial institutions require syndicated loans) with high growth potential (in terms of selling additional products and services to existing borrowers).

Application of the Concept of Strategic Leadership and Ambidexterity

The syndicated loans market is a highly competitive one. All global banks view it as imperative to their corporate business offering and are ready to allocate significant resources (capital, headcount, technology) to gain market share (usually measured as the total amount of loans executed). For context, additional KPIs for loan syndications include the total number of deals, net banking income, cost-to-income ratio.

Based on the Bloomberg data, we can evaluate the strategic strength of the loan syndications business of a global bank using the following managerial framework:

- Attain and maintain leadership in the global syndicated loans market (measured as being in the top-10 banks with a market share exceeding 3.0 per cent).
- Annually execute more than 500 transactions, with a total volume of more than USD 125 billion.
- Diversification of the business in terms of industries (natural resources, industrials, telecom, technology, distribution, transport, retail, financial institutions) and loan products (corporate and financial institutions loans, real estate, pre-export and project finance transactions).
- Achieve the KPI targets set internally by the management of the bank.

For this strategy to be successful, there should be an alignment with the external environment to ensure customer value creation. The external environment is represented by other banks, funding requirements of borrowers, and the economic

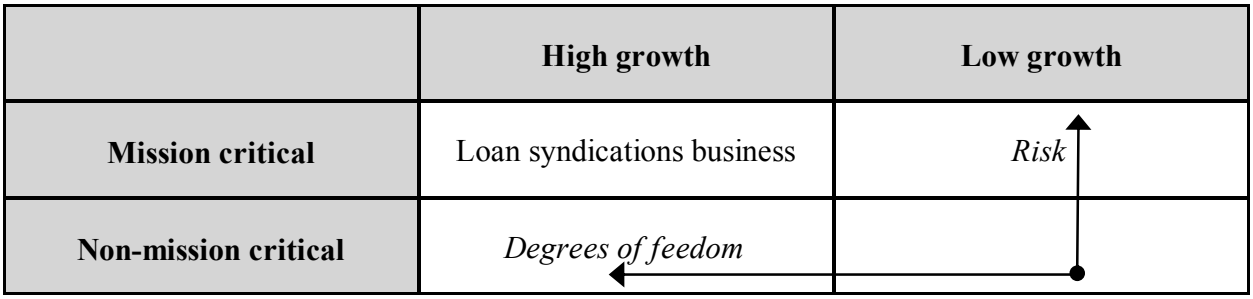

Fig. 1. Strategic positioning of the loan syndications business in a global bank.

Source: The author.

conditions in the financial markets. Customer value is the ability of the bank to efficiently meet the funding requirements of the borrowers in terms of loan structure (amount, price, tenor), execution services, and additional products.

To achieve market leadership, banks face several challenges, including (i) effective strategy implementation; (ii) maintenance of leadership and growth in the market; (iii) dealing with commoditization. These challenges are covered in the following sections.

As per (O'Reilly & Tushman, 2011): "central to the ability of a firm to survive over time is its ability to exploit existing assets and positions in a profit-producing way and simultaneously to explore new technologies and markets — to configure and reconfigure organisational resources to capture existing as well as new opportunities". It is also a tool to manage the tension between the mission, the external context (strategic steps made by competing banks) and the internal context (the restructuring of the interior business of the bank).

Effective Strategy Implementation in Loan Syndications

In this section we consider the key development phases of the Loan Syndications department: (i) establishment; (ii) diversification; (iii) expansion; (iv) crisis; (v) post-crisis. We consider the key parameters of the business: organisation structure, headcount, functionality, number of deals, loan portfolio size. Note, we provided the numerical examples for illustrative purposes to demonstrate the scale and dynamics of the business.

1. Establishment

In our example, the Loan Syndications department is established as part of the Global Financing division of an international bank. This stage involves setting-up the internal processes, strategy, and managerial accounting. The clients are limited to the largest corporations. During this phase, the department is focused on two functions: participation as Lender in corporate syndicated loans in the primary market and acquisition of commitments in corporate syndicated loans in the secondary market.

The average number of transactions per annum is five corporate syndicated loans. Total headcount at this stage is three bankers (including one department head). In terms of timing, the first phase can take two years. The accumulated loan portfolio is USD 300 mln.

2. Diversification

At the second stage, the department is growing and diversifying its products offering, client base and transactional functions. In addition to corporate syndicated loans, syndicated real estate finance transactions are executed. Financial institutions, in addition to corporations, are being serviced. The department starts playing a more advanced role in transactions, taking on the Mandated Lead Arranger status.

The total number of deals executed annually is 10:

- Five syndicated corporate loans.
- Three syndicated financial institutions loans.
- Two syndicated real estate finance transaction.

The structure of the department includes three units: Corporate Loans, Financial Institutions loans, Real Estate finance. The total headcount is seven bankers, with two bankers in each unit and one department head. There is a corresponding refinement of the internal processes and documents. The diversification stage usually lasts three years. The accumulated loan portfolio is USD 500 million.

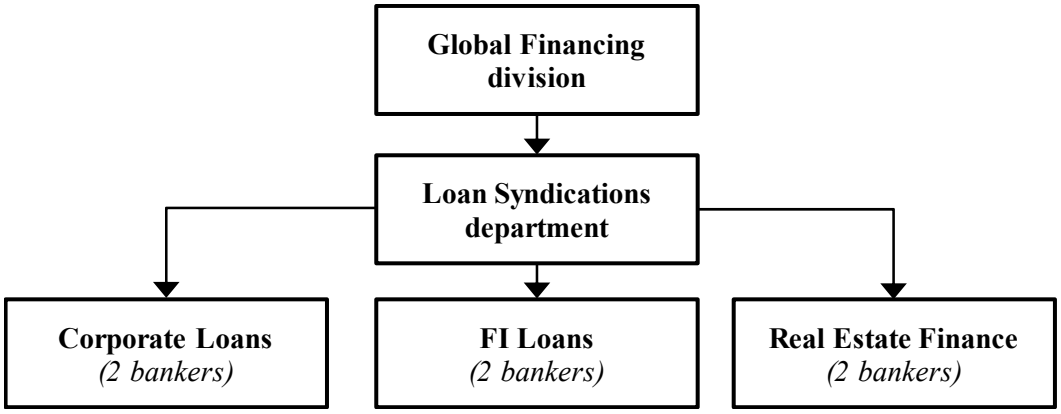

Fig. 2. The organisation structure of the Loan Syndications department in the diversification phase.

Source: The author.

3. Expansion

In many ways, this is the key development stage, with several significant events. Firstly, two new products are added to the spectrum: pre-export finance (specialised financing focused on secured loans for leading exporters) and project finance (long-term greenfield transactions for industry, transport, and infrastructure). In terms of functionality, there are three principal themes: (i) acting as Coordinator; (ii) managing the accumulated loan portfolio of the department (which at this stage exceeds USD 1,000 million); (iii) selling loan commitments in the secondary market.

The transactional activity of the department can be summarised in the following way:

- Ten syndicated corporate loans.
- Five syndicated financial institution loans.
- Three syndicated real estate transactions.
- One syndicated pre-export finance deal.
- One syndicated project finance deal.

The organisation of the department includes two additional units: Structured Finance and Portfolio Management. Total staff is ten bankers (three in Corporate Loans, two in Financial Institutions loans, two in Real Estate Finance, one in Structured Finance, one in Portfolio Management, one department head). A successful expansion phase should last five years. At the end of this period, the loan portfolio totals USD 1,500 million.

4. Crisis

Like all financial markets, the syndicated loan market is characterised by a crisis. During such periods, activity comes to a halt, and the focus of the business is on restructuring. In the considered case, there is limited activity in syndicated corporate loans and structured finance, no new business in syndicated financial institutions loans, partly restructuring in portfolio management, substantial restructuring in real estate finance.

The deal flow in this crisis environment includes:

- Three syndicated corporate loans.
- Two syndicated pre-export finance deals.
- Ten syndicated corporate and real estate loans restructurings.

This market scenario has several significant implications for the Loan Syndication department:

- Since financial institutions are profoundly affected by the crisis, this unit is closed.
- The Real Estate finance unit, with legacy loan portfolio and staff, is wholly transferred out of the Loan Syndications department to the Restructuring department.
- The syndicated corporate loans unit is combined with the structured finance unit into the new Corporate & Structured Finance unit with a focus on staff optimisation and capital allocation.
- A lawyer and a credit analyst are added to the Portfolio Management unit that is now called the Support unit.

The total headcount of the department is eight bankers (four in the Corporate & Structured Finance unit, three in the Support unit, one department head). The crisis phase usually lasts 2–3 years. The size of the loan portfolio decreases to USD 800 million.

5. Post-crisis

Further, a new strategy should be formulated for the Loans Syndications department. It includes

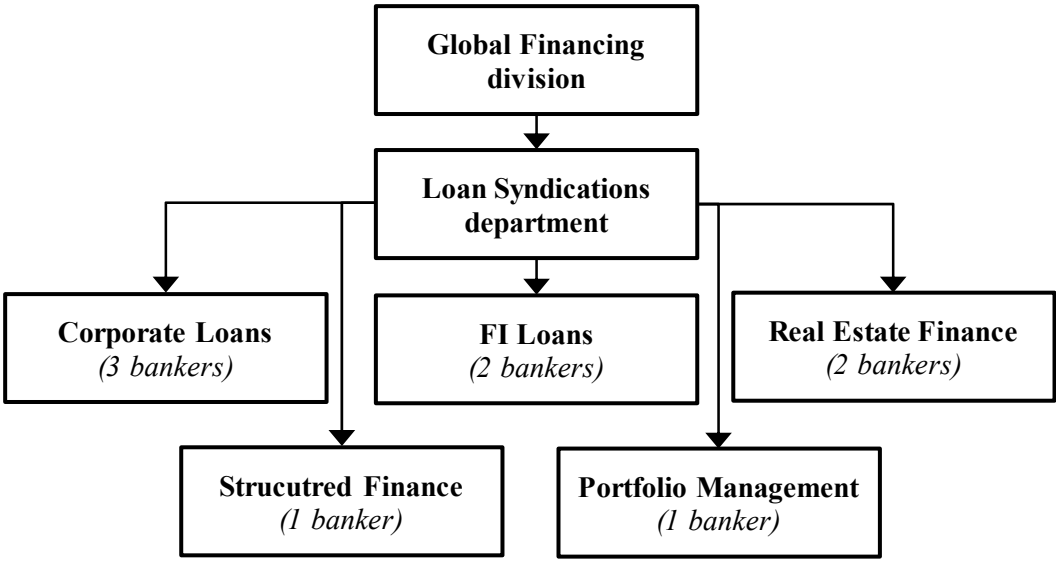

Fig. 3. The organisation structure of the Loan Syndications department in the expansion phase.

Source: The author.

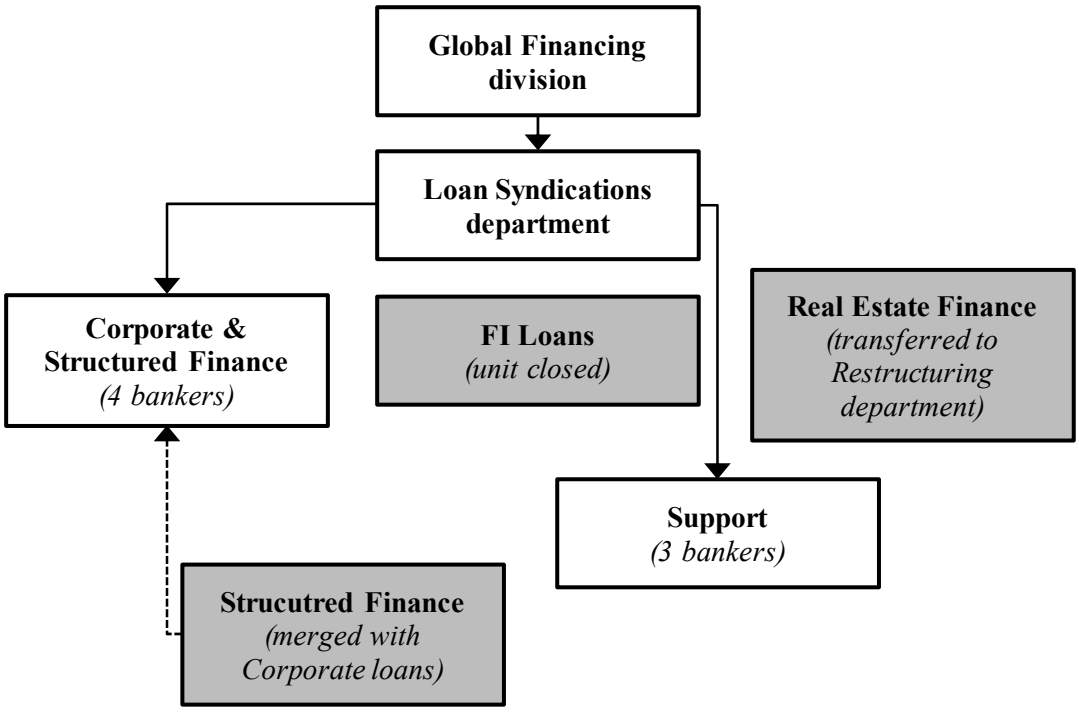

Fig. 4. The organisation structure of the Loan Syndications department in the crisis phase.

Source: The author.

the most important lessons of the crisis and focuses the business on new market realities.

This strategy includes the following components:

• Achieve leadership in the syndicated corporate loans and structured finance markets, measured as top-10 market share.

• Execute annually up to 12 syndicated corporate loans, five syndicated structured finance deals, with the achievement of the KPIs regarding net banking income and asset creation for the bank. The total size of the syndicated loans portfolios should be USD 1,200 million.

• Expand the Support unit, to provide legal and credit analysis input for a smoother execution process (previously these functions were done by the Legal and Credit Analysis departments of the banks), as well as back-office functions for the management of the portfolio.

• Establish an Advisory unit that will work with the clients of the bank to provide services

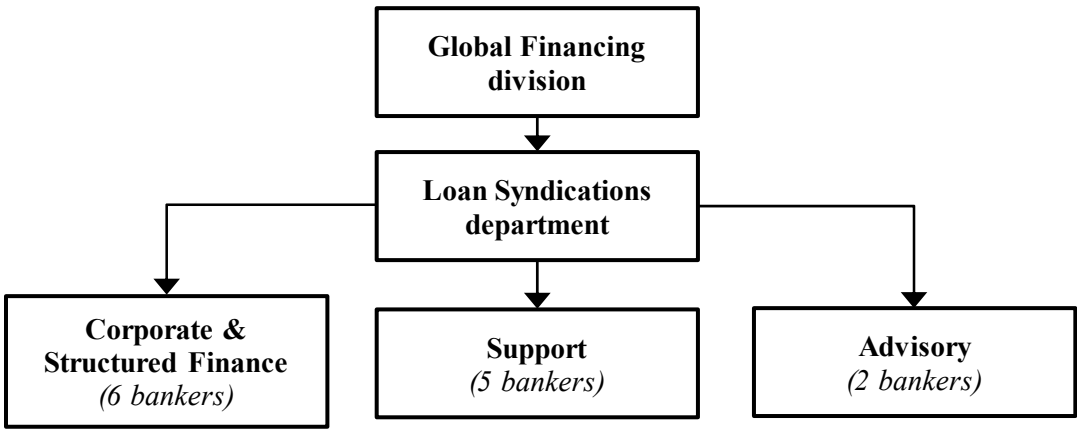

Fig. 5. The organisation structure of the Loan Syndications department in the post-crisis phase.

Source: The author.

on optimal capital structure and mergers & acquisitions.

• The total headcount of the department 14 bankers (six in the Corporate & Structured Finance unit, five in the Support unit, two in the Advisory Unit, one department head).

Based on the description of the five development phases, we can present the following illustration of the strategic evolution of the loan syndications business:

We can return to Fig. 1 and demonstrate how strategy and target structure for the Loan Syndications department reflects its importance in the "mission critical/growth" framework:

• High risk: the establishment of the middle-office support function in the form of Legal and Credit Analysis team is clearly intended to create a focused response to the two most significant risks in syndicated and structured finance transactions: (i) legal risks arising from the bank becoming a party to loan documentation; (ii) credit risk from lending to Borrowers.

• The high degree of freedom: in addition to the middle-office, the creation of the back-office and the advisory unit are intended to create a vertically-integrated efficient structure, with a limit on time-consuming interaction with other departments of the bank (legal, operations, risk) that may be involved in loan deals.

Regarding the main difficulties in implementing this strategy, the following issues may be highlighted:

• Internal: (i) limitations on capital available for loan deals; (ii) risk-management constraints; (iii) conflicts with other departments within the bank involved in working with corporate customers.

• External: (i) macroeconomics (liquidity, funding needs); (ii) competitive pressures (banks offering lower pricing); (iii) force majeure events like the global 2008 financial crisis that had a significant effect on the financial market.

Fighting the Commodity Magnet and the Process of Commoditisation

A significant challenge for global banks is that the syndicated loans market is becoming highly commoditised. This is due to several factors: (i) more international banks entering the loan market leading to intense competition for top borrowers; (ii) borrowers becoming more sophisticated by "understanding the product by doing deals" and expanding the number of relationship banks; (iii) generally, falling financing costs for the top borrowers.

By analysing the industry, the following factors can be proposed as key for differentiation in the market:

• Capital that is allocated for syndicated lending activity (availability of capital is the most important competitive factor for banks).

• Cost of funds for banks that are directly correlated to the financing costs for borrowers.

• Availability of additional high-quality services for clients.

The first two points are strategic issues for all global banks, affecting all business lines. We can, therefore, focus on the third point: services. For the formulation of a strategic response to commoditization, leading loan market banks are adopting the following strategy to differentiate themselves from competitors:

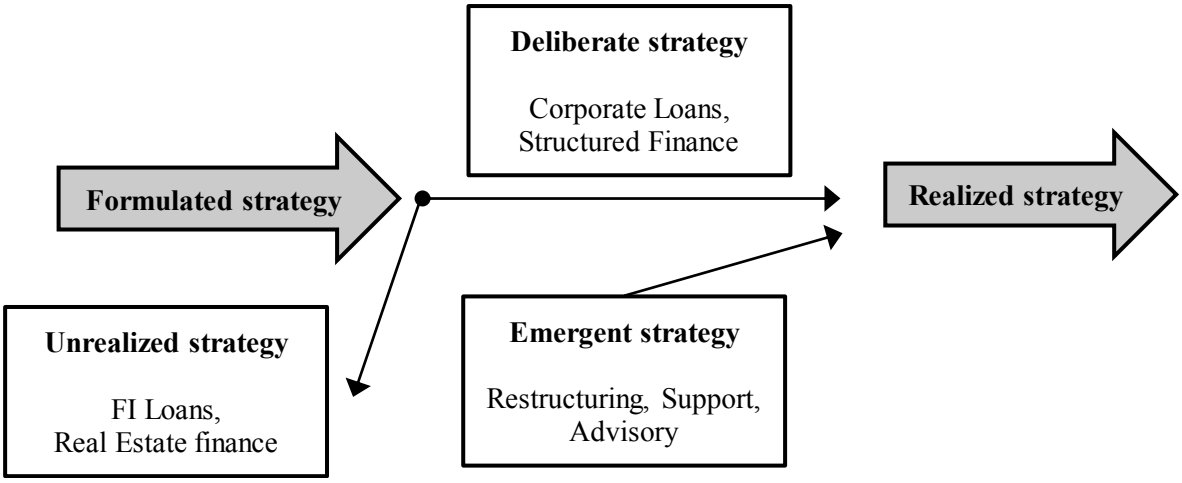

Fig. 6. "Formulated versus Realized" strategy of the Loan Syndications department.

Source: Compiled by the author.

• Adding more value-added services to their corporate offering: advisory, deal coordination, agency services, derivatives, currency operations, loan management, legal support.

• Bundling of services to realise cross-selling opportunities and maximise share-of-wallet.

• Further segmentation and customisation of the client base (by industry/relationship/services consumption) to formulate the best-bundled offering for each client.

For such a value-added strategy, a competence-based view of marketing, as outlined in (Matthyssens, Vandenbempt, & Weyns, 2009), is particularly important, since "especially when selling professional services, the marketer cannot rely solely on technology upgrades, but needs to grow several competences simultaneously", including consistent bundles of 'processes and systems', 'assets, knowledge and capabilities' and 'culture and organization' that have to be built in order to sustain a value-added marketing strategy.

Several value-innovation initiatives for industrial companies are summarised in (Matthyssens, VandenbemptБ & Berghman, 2006). If we apply this approach to the loan syndications business, we can outline the following bundling initiative: banks increasingly want to be present in every stage of the financing process. This is done by expanding the loan offering to "both sides" of the loan deal, as well as additional services during the execution process: (i) pre-execution, advisory on best debt raising solution and subsequent structuring of the deal; (ii) execution: handling the investor base, covering the legal issues; (iii) post-execution: management of the transaction by offering payment/currency services, derivatives, portfolio management.

In addition to this, banks are also increasing their role in the execution process: preparing the legal documentations, drafting the marketing materials, handling communication with the relationship banks of the borrower. These initiatives lead to a stronger relationship with the client that ultimately leads to higher fees and a realisation of the cross-sale strategy.

Such an expansion of the offering requires substantial resources in products, human capital and IT, as well as a strong organisational structure that functions without major bottlenecks. However, such investment does pay-off as by executing several successful deals for its client, the bank acquires a sound reputation in the market and further build upon its unique offering.

In the "typology of service" framework in (Matthyssens & Vandenbempt, 2010), banks try to tailor their offering to cover the funding and services needs of the client as widely and deeply as possible, acting as "value partners" offering customised services to their clients. It is done by providing an integrated process solution (running the deal "from A to Z") and concentrating on lucrative tailor-made services like hedging and legal advice.

Summarising, by bundling high commoditised products and services (provision of loans, agency functions, currency services) with low commoditised ones (advisory, structuring, derivatives), banks can successfully fight the commoditization magnet and increase the profitability of their loans syndications businesses.

References

Allen, L., Peristian, S., & Saunders, A. (2004). The Role of Bank Advisors in Mergers and Acquisitions, *Journal of Money, Credit, and Banking*, *36(2)*, 197–224.

Altunbas, Y., Gadanecz, B., & Kara, A. (2006). *Syndicated Loans: Hybrid of Relationship Lending and Publicly Traded Debt*. Palgrave Macmillan.

Bloomberg. Global Syndicated Loans 2018. Retrieved from https://data.bloomberglp.com/professional/sites/10/Bloomberg-Global-Syndicated-Loans-League-Tables-FY-2018.pdf

Caselli, S., & Gatti, S. (2017). *Structured Finance: Techniques, Products and Market*. Springer.

Davis, S. (2002). *Investment Banking: Addressing the Management Issues*. Palgrave Macmillan.

Dennis, S., & Mullineaux, D. (2000). Syndicated Loans. *Journal of Financial Intermediation*, *9(4)*, 404–426.

Francis, J., & Kim, D. (2013). *Modern Portfolio Theory: Foundations, Analysis, and New Developments*. Wiley, 554 p.

Iannotta, G. (2010). *Investment Banking: A Guide to Underwriting and Advisory Services*. Springer.

Matthyssens, P., & Vandenbempt, K. (2010). Service Addition as Business Market Strategy: Identification of Transition Trajectories. *Journal of Service Management*, *21(5)*, 693–714.

Matthyssens, P., Vandenbempt, K., & Berghman, L. (2006). Value Innovation in Business Markets: Breaking the Industry Recipe. *Industrial Marketing Management*, *35(6)*, 751–761.

Matthyssens, P., Vandenbempt, K., & Weyns, S. (2009). Transitioning and Co-evolving to Upgrade Value Offerings: Competence-based Marketing View. *Industrial Marketing Management*, *38(5)*, 504–512.

O'Reilly, C., & Tushman, M. (2011). Organizational Ambidexterity in Action: How managers Explore and Exploit. *California Management Review*, *53(4)*, 5–22.

Schwert, M. (2018). Bank Capital and Lending Relationships. *The Journal of Finance*, *73(2)*, 787–830.

Shutter, A. (2017). *A Practitioner's Guide to Syndicated Lending*. Sweet & Maxwell.

Tarasov, A. (2017). Underwriting Syndicated Loans in the Russian Market. *Review of Business and Economic Studies*, 3, 45–51.

Wystup, U. (2017). *FX Options and Structured Products*. Wiley.

Вопросы менеджмента в банковском синдицированном кредитовании

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Аннотация. Исследованы ключевые аспекты организации и управления синдицированного кредитования в банке. Дан всесторонний анализ особенностям международного рынка синдицированного кредитования, который одновременно является крупнейшим источником финансирования для корпораций и одним из ключевых сегментов банковского бизнеса. Предложены проверенные практикой решения, позволяющие банкам успешно реагировать на современные вызовы коммодитизации (добавление к базовым банковским продуктам высокодоходных услуг; объединение услуг для получения максимального дохода от каждого клиента; сегментация клиентской базы с целью соответствия интегрированного предложения потребностям различных клиентов). Используя данные рекомендации, банки могут успешно развивать бизнес синдицированного кредитования, увеличивая прибыль и долю рынка.

Ключевые слова: банковский бизнес; синдицированные кредиты; банковский менеджмент; коммодитизация; международные рынки капитала

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The Use of Theory and Methods of Behavioural Economics in the Process of Making Financial Decisions

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Abstract

This article discusses some issues connected with studies of the behavioural factors when making financial decisions. Therefore, it is possible to take into account factors that are inexplicable in traditional models. The main goal of our research was verification of the hypothesis market participants make financial decisions based on their experiences, intuition, stereotypes, illusions, emotions and not only on the criterion of financial gain and rational assumptions. After all, such diverse behaviour *en masse* influences the financial system as a whole. The practical significance of reported here study is the identification of errors in the application of classical economic theory and the possibilities of their further elimination. An effective behavioural model to avoid negative consequences is the primary tool in making financial decisions. In the first part, the author analyses the theoretical basis of her study. The second part examines the main problems associated with classical economic theory and presents the main mistakes in making financial decisions. Particular attention the author paid to the study of the behaviour of investors and managers. The third part described the research of behavioural mechanisms in making financial decisions with specific examples and implementation of the use of mathematical models.

Keywords: behavioural economics; decision-making; investor; homo economicus; rational decisions; irrationality
JEL Classification: D03, D53, G02, G11, G14

Introduction

The performance of any financial and economic entity, its long-term success and a stable position on the market are primarily determined by the effectiveness of financial policies, the quality and adequacy of financial decisions. The classical economic theories assume that the process of making financial decisions is an absolutely rational one. However, classical economic theories do not take into account the fact that there are humans at the centre of any financial processes.

Thus, the main problem is that economists use models that replace the notion of "ordinary person" with "rational person". In contrast to the ideal "rational person", "ordinary people" make mistakes and take wrong decisions. Therefore, economic models and theories give erroneous forecasts and lead to negative consequences.

The general assumption made under the particular research question is that people making decisions, including top management, do not always act rationally. In most cases, people make decisions based on experience or intuition. The classical theory does not take into account these factors. Thus, making such decisions is inefficient and does not lead to the desired financial results. We should also take into consideration the possibility of irrational behaviour. Therefore, in our

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research, we used methods of analysis and evaluation of behavioural factors determining the financial decision-making process.

Consequently, we want to check how people make rational financial decisions in the modern world. The behavioural finance implies an approach in which not all participants of the market are entirely rational. The behavioural theory rejects the idea of individual rationality. Analysing and systematising this knowledge lead to optimisation the process of making financial decisions and reducing negative consequences.

Moreover, models based on the classical economic theory believe that a person makes decisions oriented towards the possible optimal result. Furthermore, they assumed that a "rational person" makes this or that choice impartially — that he/she does not overestimate his capabilities. However, the reality is not so perfect: an economist (a man by nature) does not act impartially in making decisions.

The Theory of Moral Sentiments is a 1759 book written by Adam Smith, a central figure of the classical political economy. This book is about human feelings, their influence on relationships between people, about attitudes towards wealth. Thus, one of the founders of economic theory as a science openly recognised the significance of human nature.

Nevertheless, the classical model of economic behaviour based on the concept of "rational man" exists and develops over the years. For a long time, adherents of the classical theory responded to criticism with the approach which ignored empirical inferences. Over time, such observations have generated the new direction of researches. There appeared scientific papers describing improper decisions and their consequences in the financial sphere such as managing retirement savings, choosing a mortgage loan, investing in the stock market, corporate management of companies, "booms", "bubbles" and market crashes leading to financial crises. The behavioural approach to economics and finance emerged as a renewed approach to economic research that recognises and takes into account the human factor.

In the literature, the question of corporate behavioural finance and its impact on financial decision-making is well examined and proved by various studies. *Behavioural Finance: Psychology, Decision-Making, and Markets* (2009) is a study written by Lucy Ackert and Richard Deaves. They focused on understanding how human behaviour influences the decisions of individual and professional investors, markets and managers.

Misbehaving: *The Making of Behavioural Economics* (2016) by Richard Thaler, who is the Nobel Prize winner in economics in 2017 for his contribution to the field of behavioural economics. The author manages to focus on the fact that a person is not a robot who thinks solely based on laws and theories. The study presents a large number of real-life examples. Moreover, Thaler tested his theories and conclusions in real business and solved bankruptcy problems.

Beyond Greed and Fear: Understanding Behavioural Finance and the Psychology of Investing (2002) is the study of Hersh Shefrin is the study of how psychology impacts finance. The author identified three areas of difference between behavioural finance and traditional knowledge of finance. While based on the conventional financial doctrine, subjects of financial relations use mathematical and statistical methods and make the right decisions, in behavioural finance, subjects can use heuristic methods of knowledge processing and, as a result, make wrong decisions.

1. Theoretical Aspects of Behavioural Economics and Finance

1.1. Factors contributing to the emergence and development of behavioural finance

The financial concepts of the 1940s did not allow for the existence of a capital market. Each Financial Contract is unique, and comparison with ordinary market rates is meaningless. In the 1950s, the stock market was not such a large capital supplier as the companies themselves. Economists at the time did not consider the stock market a suitable subject for serious research. And until the 1960s, stock prices were studied mainly by statistics (Chuvakhin, 1960). In the 1950s, the business administration doctrine focused on the relationship between finance and accounting. Administrators of that time believed that financial and investment transactions are reflected primarily in the balance of assets and liabilities. Investors were mostly interested in the return on equity (ROE) and the return on investment (ROI). Nowadays, managers remind about maximising ROE as an all-consuming business goal. The main disadvantage of this approach is that the endless details hide the true goals of the company.

Driven by new developments and mechanisms in the financial market, a scientific revolution took place in the second half of the 1950s — the first half of the 1960s. A massive increase in researches on the stock market began. Neoclassical finances started to replace 'old' finances since the latter could not answer essential questions:

The law of the market is the law of a single price. Then how is it possible that different financing options can be offered to the same firm at different prices in the same market?

Why are accounting, financial statements and coefficient analysis so important, although newspaper columns about stock prices are more important for shareholders?

What can an unrealised profit say about a firm if investors are only interested in the yield generated by the added value and dividends relative to the market value?

Therefore, a new finance paradigm should have appeared and emerged. Since the capital market is perfect, it is the only appraiser of any financial event. This statement is a paradigm of neoclassical finance since the neoclassical economy puts the perfect market at the centre of all its theories. The approach incarnated in neoclassical finances was revolutionary. There appeared new answers to old questions.

Then the neoclassical theory of finance began to form. Neoclassical economics had a strong influence on financial science. It assumes the existence of a capital market perfect in any sense. Modigliani and Miller, who promoted market thinking, formed a hypothesis that is still not refuted in our time. They realised that the price reflects the attractiveness of the product for the entire population in a market economy. It means that the market value of the firm (market capitalisation) is the price of this common stock multiplied by their number in circulation in the market. Thus, maximising capitalisation is the best that managers can do for shareholders. It was a revolutionary discovery. Neither ROE nor long-term benefits are already key variables. The main thing is the added value determined by positive cash flow. Accounting profit only allows you to specify the forecast of this stream.

Shleifer called the theory of an efficient capital market the "consequence of equilibrium in competitive markets with fully rational investors" (Shleifer, 2018, p. 369). The theory of an effective market is based on three main ideas:

1) Rational investors evaluate stocks in a rational way.

2) Irrational investors may enter into random transactions that level each other and do not affect stock prices. Such investors are called noise-traders and transactions — noise.

3) Rational investors liquidate the deviations created by transactions of irrational investors of stock prices. The process of eliminating anomalies by investors is called arbitration.

On this basis, it is argued that the stock market is extremely effective in reflecting information about individual companies, industries and the entire economy. News spreads quickly, equally accessible to all market participants and instantly reflected in prices. From here, you can make two conclusions:

The arrival on the market of new information about the shares of a particular company causes an immediate correction of the fundamental value, and with it the price of shares;

Prices will not change until new information on fundamental value arrives on the market.

In the theory of rational expectations, rational expectations are identical to the forecast, which absorbed all the available information and is therefore optimal. The results of the forecast differ randomly, but not systematically, from the results of market equilibrium. Accordingly, rational expectations do not differ regularly or predictably from equilibrium results. Predicting the future, people do not make systematic mistakes. Forecast errors are random.

Thus, all investors, small and large, should control risk by of income. Everybody should have a standard portfolio of assets called a market portfolio. Striving for the exact coincidence of their portfolios with the real market portfolio and realising the passive strategy of portfolio management, they will act rationally. Thus, even uninformed people can buy and sell at any time, without fear that they will be deceived by more informed market participants like insiders. An effective market protects the uninformed and therefore attracts the "masses". It is a democratic market.

At the same time, market participants should be warned if the market is inefficient: "The current price may not reflect the true value, which is known only to a few informed participants." However, it is very doubtful that there would be a significant number of those who want to take part in that type of market. In an inefficient market, the public should not engage in direct transactions but

should delegate to experts the right to trade at their own expense. But then access to the market is difficult, and market activity will be the privilege of a few insiders and professionals. The market in such conditions will cease to exist as a key institution of modern society.

Let's try to consider a person, not a market, as the centre of the financial and economic world. People control the economy and finance. The rational and irrational components of our choice are transferred to the economy and finance and influence the process of making financial and economic decisions. The behavioural approach examines the influence of social, cognitive and emotional factors on the economic and financial decisions of individuals and institutions and the implications of this influence on market variables (prices, profits, allocation of resources).

One of the most important trends in modern science is a change in the forms of rationality as a fundamental postulate of neoclassical theory. The concept of rationality and irrationality, understanding their influence on the forms of economic and financial activity, are changing radically. Scientists, based on the results of psychological research in the field of decision making, prove that people do not always behave rationally, even in their interests because of such behavioural features as self-control problems, inability to distinguish between profit and loss, difficulties in choosing between large sets of parameters, complex products, asymmetry in the perception of gains and losses, etc. In this regard, many of the results of behavioural research are relevant, and more and more research on the subject appears.

In a conventional, classical economy, the assumption of rationality means that in everyday life, people compare all the alternatives that appear to each other (on any subject), and then choose the best one.

Within the framework of behavioural economics, the methodological approach is initially associated with the criticism of rationality in human behaviour, whose abilities are limited due to inaccessibility of complete information and susceptibility to habits and emotions. Researchers emphasise two crucial aspects of economic behaviour:

Non-rationality is a temporary state of the subject.

Irrationality has systematic patterns that can be measured.

Considering the rational and irrational in human behaviour, B. Hert writes: "Irrationality is a more fundamental normative concept than rationality. To call an act irrational is to declare that it should not be done; if the act is qualified as rational, then it still does not follow that it must be performed, since two (or more) rational alternatives are possible. Undoubtedly, each person, in any case, should act rationally, but this only implies that no one should ever perform irrational actions, and not at all that any rational perspective should be realised. If I have doubts as to whether this act is rational or irrational, I would rather call it rational. At the same time, it is quite possible that one would consider rational actions as such the other people would prefer to call irrational. This discrepancy, generally speaking, is unimportant, unless one decides that any concession to others is irrational. The main thing for me is not to include such a deed into the class of the irrational that someone else considers rational" (Chernyavsky, 2014, p. 22).

Causes of irrational behaviour:

The juxtaposition of the present and the future. People are not predisposed to perceive reality through the prism of a long-term perspective.

Abstraction of money as a concept. One of the most powerful psychological barriers of a person is the difficulty of perceiving the alternative cost of money.

Behavioural economics points to regular failures in rational behaviour, systematic errors of economic participants when making decisions, and in this regard studies such phenomena as:

"Herd behaviour",
"Contamination by ideas",
"Degraded thinking",
"Collective euphoria",
"Collective fear".

One of the main areas of research in behavioural economics is heuristics. Heuristics is an algorithm for solving the problem. The basic idea is that human time and mental abilities are limited. As a result, a person uses a simple (heuristics) method of solving a problem to make a particular judgment or make a decision. Imagine the question of how common the name Wang is. All answer that the name is rare, except for those who live in China, where the name Wang is found very often. Considering that China is the world's populous country, on a global scale, this name is quite common. To decide how common a particular phenomenon

is, people usually ask themselves how often they have met. However, this method does not work in cases where the actual frequency of repetition of an event does not correspond to the one that can be observed in its daily life (as is the case with the name Wang).

Frames are another key focus of research. The frame is an abstract concept, implying "the analysis of various integrity (social, cultural) and then the assembly of structures as a set of interacting elements". Traditionally, human actions are considered as depending on the situation in which they are produced, and on the personal characteristics and qualities of the person who performs them. The concept of a frame introduces one more — the semantic angle of their consideration, speaking as a framework of social representations, within the framework of which a person determines for himself the situation in which he acts.

The third direction of behavioural economic development is market inefficiency. These are decision making errors in the market that lead to various market anomalies, including incorrect pricing, inefficient allocation of resources.

Three closely interrelated components are, as a rule, selected by scientists:

1) The decision of a person is usually preceded by perception, understanding, understanding of the situation and oneself in it, that is, cognitive components;

2) Subjective attitude, coloured feelings, that are emotional components;

3) The action or, conversely, its containment, that is, effectively dynamic components.

The main problems of economic theory solved in the framework of behavioural economics and finance:

An assumption about the axiom of independence for the theory of expected utility that does not meet reality conditions of the environment in which it is now located;

The premise of the homogeneity of all goods (the effect of the initial stock: the agent appreciates the benefits that he had initially been, more than those that he can acquire as a result of the exchange; thus, non-standard situations arise around the point of the initial stock);

The imperfection of human memory and computational abilities, which is fraught with failure to achieve the best possible result;

The problem of discounting (in reality, agents are more focused on short-term interests than on planning the far horizon).

The central question to behavioural finance research is "Why do market participants systematically make mistakes?" These errors affect prices and profits, which leads to market inefficiency. Besides, behavioural finance looks at how other participants in market relations are trying to gain from inefficiency. The main reasons for inefficiency are, firstly, the excessive and insufficient reaction to information that sets market trends (in exceptional cases, the economic bubble and the market crash) — secondly, limited attention of investors, excessive self-confidence, excessive optimism, herd instinct and noise trading. Technical analysts view behavioural economics and behavioural finance as the basis of technical analysis. Thirdly, the critical issue is the asymmetry between the decision to accumulate and save resources, known as the "bird in hand" paradox, and the fear of loss, unwillingness to part with valuable property. The trap of irrecoverable costs manifests itself in such an investor's behaviour as reluctance to sell stocks, provided that this nominally results in a loss. It can also explain why housing prices rarely and slowly fall to the level of market equilibrium in a period of low demand. The experimental financial theory uses an experimental method, in which an artificial market is created with the help of modelling software to study the decision-making process of people and their behaviour in financial markets.

Nobel laureate Herbert Simon took a big part in the devaluation of the classical theory of rational choice. This scientist, relying on the work of Modigliani and Miller on the theory of the company, set himself the task "to replace the global rationality of economic man with a kind of rational behaviour that is compatible with the access to information and the computational capacities that are actually possessed by organisms, including man, in the kinds of environments in which such organisms exist (…) and propose definitions of 'rational choice' to become a real decision-making processes…" (Simon, 1955, p. 99).

Applying the tools of the theory of rational choice with reality, Simon concluded that people make not optimal, but convenient decisions. That is, they rationally satisfy, rather than rationally optimise their needs. Behavioural economics, built on this idea, rejects the role of limited optimisation in the decision-making process. Limited rationality has

become the central theme of behavioural economics and finance.

In the 1990s, modern finances have undergone extensive and sophisticated empirical testing. The results are disappointing for the profession of a standard economist. The nature of the criticism of the efficient market theory can be judged by the words of Jonathan Berk: "The hypothesis of an efficient market (…) was an important part of the modern financial economy and remained an influential intuition, but as a formal construct, it experienced a period of its usefulness for the financial economy. I show that most forms of a hypothesis are not testable, and in tested forms, a hypothesis is easily refuted by data. The idea of unpredictable profitability is erroneous and holds back research on the financial economy … There is growing evidence that some market participants receive substantial economic rent from trade. The time has come to revise the paradigm and recognise that profitability is predictable …" (Berk, Stanton, & Zechner, 2008).

Economists wondered why models suddenly falter, why people do not behave in the way prescribed by the theory of rationality, which suggests that the market rate of an asset falls with its investment value. However, market prices depend on the opinion of the public, which, as we found out, is not always logical. Financial markets are too volatile because they react to a variety of news. It is how Keynes hypothesis appeared about excessive volatility.

The 1980s became a period of critical academic discussions about the viability of efficient market models in the light of econometric studies of price properties, revenues and dividends. Mainly actively discussed was the issue of excessive stock price volatility concerning the forecast issued by these models. In the theory of rational economics, behavioural assumptions were almost not considered.

The anomalies discovered in the course of testing the theory of rationality at worst could be considered insignificant deviations from a fundamental truth. But excessive volatility posed a greater danger to the whole concept than, for example, calendar effects on the stock market. Empirical evidence in favour of excessive volatility suggests that prices change without any fundamental reason.

In the early 1980s, Schiller tested the Keynes hypothesis. He reasoned that if the stock price equals the expected present value of future dividends, as required by a rational economy, then it should not change as much as this value itself. Schiller's plan was a direct application of a simple statistical principle: a good prediction has less variance than the predicted variable.

Using data on the stock prices of American companies for 100 years, Schiller compared the variance of prices with the variance of discounted dividends (after removing the trend) and found what Keynes predicted: the standard deviation of prices (forecast) was five times greater than the standard deviation of discounted dividends. This result, terrible for a rational economy, was confirmed by more sophisticated tests that took into account the non-stationarity of prices and discounted dividends (West & Shiller, 1991, p. 269).

These results inspired those who sought reasons for price volatility beyond a rational economy, particularly in behavioural finance. The collaboration of finance and other social sciences, known as behavioural finance, has greatly enhanced knowledge of financial markets. Reasoning about the achieved influence of behavioural finance, it is essential to apply the correct standards. Of course, one should not expect that these studies will open up a method for quickly and reliably extracting big money from the inefficiency of financial markets. However, the theory of an efficient market can be refuted since it can lead to a radical misinterpretation of such important events as large bubbles in the stock market. Thus, rationality is discredited, and many economists and financiers are moving away from the idea of "rational markets".

Previously, many economists have ignored ideas about a person's limited ability to solve complex problems. They were quite satisfied that the existing models were not accurate enough and that the forecasts built on these models contained errors. In the statistical models used by economists and financiers, this problem is solved by the fact that the "error" of calculations is included in the equation. So, classical economists argue that errors resulting from limited rationality can be ignored. The behavioural approach suggests that such errors are not accidental, studies and systematises them, creates new methods based on the knowledge gained and applies them in practice.

1.2. The history and evolution of the behavioural economics and theory of finance

Economic science gradually expands the levels of analysis of the theory and practice of the econom-

ic and financial life of society. Under the influence of globalisation and informatisation of society in modern conditions, there is a complication, evolutionary expansion and the emergence of a new scientific direction of behavioural research, which means the synthesis of psychology, economics and finance, the interrelation of human psychology and the behaviour of market participants.

Studies of the role of a human in the economic and financial areas of activity required a more in-depth analysis of the mental and cognitive aspects of human activity, the influence of these aspects on the algorithm for making financial decisions. The model of a rational economist, conveniently placed at formal economic structures, has ceased to be satisfied due to the apparent inconsistency with reality.

However, if the role of a human in shaping economic and financial relations (his psychology, preferences, mistakes, etc.) is so significant, if a person creates an economy, then the question arises: what place do objective laws occupy in the real economy, and therefore in its theoretical versions? That is, how can the behaviour of people in the economic and financial world based on predetermined exogenous circumstances be explained (predicted, foreseen)? Behavioural economics and finance in studies of recent years have shown that people's preferences are endogenous, while in the classical theory they were accepted as unchanged and externally given. It means that they are subject to change, more importantly, they can form, change "inside" the activities of people under the influence of various factors, also perceived by the behavioural model as endogenous. It became apparent that objective circumstances have given from the outside (defined by the classical paradigm as objective laws) are not capable of adequately explaining the behaviour of economic actors and their consequences, and therefore cannot adequately perform forecast functions. The relation between the objective and the subjective as the main component of the method of the economic theory requires a new approach.

The distinctive characteristics of behavioural economic theory as a separate scientific direction are in the rejection of the "three whales" — the prerequisites of rationality, the pursuit of self-interest and balance. Behavioural economics is being shaped as a new direction, within which attention has been shifted from developing formal models of rational behaviour of an individual in various situations of choice to the process of their experimental and empirical testing, to determine the degree of consistency (divergence) of traditional economic theory and patterns derived from it the facts of economic activity. The behavioural approach, inherent in the activities of various subjects: from the individual and the company to the markets and regions, is systematically reproduced, complicated, and reveals the underlying motives of the agents who do not always follow the canons of the traditional economy.

The first ideas of behavioural economics are reflected in the works of famous economists: Adam Smith (1723–1790), one of the founders of economic theory as a science, Alfred Marshall (1842–1924) — one of the founders of the neoclassicism, John Keynes (1883–1946) — founder of macroeconomics as a separate science. In the works of these authors, the theory of a rational "economic man", whose purpose is to obtain benefits and income, was formed. The defining feature of the concept is rationalism and egoism; that is, the desire of the subject to maximise their benefit. The idea of "economic man" dominated economic theories for an extended period. J. Keynes first expressed the concept that irrational factors influence financial and economic processes.

However, more profound studies of irrational principles were possible only at an interdisciplinary level. Thus, Keynesian theory contributed to the formation of such models that suggested too unrealistically high cognitive capabilities of the individual. Subsequently, in the controversy of new classics with new Keynesians, the latter put forward provisions on price rigidity and nominal wages as opposed to their flexibility and the possibility of a quick automatic transition to a new equilibrium. Another idea — the complete rationality of individuals (and their expectations) — was not taken into account as an object of constructive criticism. The framework of this concept did not confuse the researchers as long as the researchers were economists.

Institutionalists Thorstein Veblen, John Commons, John Dewey believed that the rational approach is not the only thing that determines economic and financial behaviour, the essential elements in comparison with it are institutions, habits and customs. T. Veblen in his concept of conspicuous consumption explains the wasteful spending on goods or services with the primary goal to demonstrate consumer's wealth, and such

behaviour serves as a means of achieving or supporting a certain social status. Veblen believed that individuals are constantly driven by competition, they are in a state of constant comparison their way of consuming with the other's way, determining through their consumption their position in society and the position of those around them. From the institutionalists' point of view, this behaviour is the primary determinant of consumer activity in households. Scientists have identified several effects associated with conspicuous consumption, in particular, the impact of Veblen: the increase in consumer demand because the product has a higher price that consists of two components. First, the real and prestigious prices; second, the effect of snob and effect of following the majority.

At the beginning of the 20th century, a separate branch of psychological knowledge appeared — economic psychology. The development of the industrial branch of economic psychology is associated with the name of Hugo Münsterberg, and the marketing branch that received the initial development in Western psychology was laid by Gabriel Tarde. It covers the psychological problems of exchange, distribution and consumption. One of the most prominent representatives of the marketing branch of economic psychology was the American psychologist George Katona.

Behavioural game theory has made a significant contribution to the development of behavioural economics. Behavioural game theory is a direction of game theory that evaluates the behaviour of other people and suggests their further actions to make profitable decisions (Camerer, 2001).

This line of research focuses on three areas (ibid.):

Mathematic theories explaining the social interaction of people at the auction and the establishment of trust between them;

Limitations of strategic behaviour and cognitive ability to account for the steps of competitors;

Modification of strategies in the process of training people in practice.

The use of mathematical mechanics of game theory in the field of economics and finance in the second half of the last century proved to be extremely fruitful. To the greatest extent, this was manifested in those sections of the theory, the object of consideration of which is the strategic interaction of economic and financial agents among themselves in various conditions and the desire to solve the arisen conflict situation in the most optimal way.

Principles of game theory:

The principle of rationality;

Principle of general knowledge;

Principle of elimination of dominated strategies.

The game theory proves that if players do not change their strategy, sooner or later they will come to some equilibrium state in which the gain can no longer increase by continuing to follow the chosen line of conduct.

The game with the ultimatum (was invented in 1982). This simple game situation has attracted enormous attention of scientists precisely because the results of experimental research were significantly different from the predictions of the formal game theory, which implies that the individual follows only his interest.

The game has two players and $ 100 bills for one dollar. The first participant comes to the second participant and offers absolutely any amount of these $ 100 at their discretion (a participant can offer zero). The second player has a choice: agree to the division proposed by the first player; or refuse sharing and then no one gets anything, $ 100 is taken away by the organisers of the game. Participants cannot enter into negotiations. As a rule, a rational player will settle for any amount that is more than zero — it is better to get at least one dollar instead of nothing. If he is offered a zero, he does not make a difference to agree or refuse, and he will still receive 0, regardless of his decision. Based on this, the most logical decision of the first participant will be to offer the second one $ 1 and take $ 99 to himself. However, these arguments are considered from the point of view of rationality and the theory of the games. Moreover, in real life, emotions, justice and greed will also influence the decision-making process.

Zero or 1$ are offered very rarely because it is necessary to ensure that the second player agrees to the division. Most often, the first players offer the second from 30 to 50 per cent of the total. If the proposed amount is less than 30 per cent, then people begin to refuse more often (Henrich et al., 2004). The lower the amount offered, the higher the probability of the second player refusing to share. Although, as we said above, it would be rational to agree to any amount. Some people think that the offer is too small an amount of offence and adhere to the principle "no one gets the money",

thus punishing the first player for greed. Results are affected by age, culture, education, aggressiveness, lifestyle, etc. Factors such as communication and familiarity between players influence. The closer the connection, the closer the distribution of money will be to a fair 50/50 (Sanfey, 2003). The experiments conducted by Morewedge, Krishnamurti and Ariely (2014) showed impressive results — the participants in the experiment who are intoxicated are more likely to reject unfair proposals than sober ones. Studies conducted in India in 2011 showed that the greater the amount to be divided, the fewer people refuse to distribute (Andersen, Ertaç, Gneezy, Hoffman, & List, 2011).

Nash equilibrium — such a situation in which none of the players can increase their winnings, unilaterally changing their decision. In other words, the Nash equilibrium is a position whereby the strategy of both players is the best response to the actions of their opponent. An example of the Nash equilibrium is the situation on the oligopoly market when firms have to make non-cooperative decisions. There are two oligopolistic firms in the industry — Firm A and Firm B. If both these firms could agree with each other and raise prices on their products, they would receive a high profit of $ 5 million. However, these firms are primarily competitors, and each has prerequisites to break its contract by lowering the price and thereby capturing a part of the market and getting even more profit of $ 7 million. Naturally, after such actions of an opponent, the profit of another company has decreased and will be, for example, $ 1 million. But in a real situation, trying to reduce risks and get around an opponent, each company will select low prices and make a profit of $ 3 million each, reaching Nash equilibrium (see Fig. 1):

Pareto efficiency or Pareto optimality. A situation in a cooperative game in which a group of players gets the maximum win (equally for all who have cooperated), but any player has the opportunity to make a move unilaterally, increasing his winnings by reducing the winnings of other players. Under this rule, the right to all changes that do not cause any additional harm is recognised. In economics, a situation where Pareto efficiency is achieved is a situation when all the benefits from the exchange of the parties have been exhausted (Barr, 1992).

John von Neumann and Oskar Morgenstern, the founders of game theory, believe that the behaviour of an individual consumer depends on the behaviour of the other participants in the relationship. It follows that in the process of interaction between subjects about the consumption and distribution of disposable income, even stable belief systems can collapse, and then other people's behaviours are chosen. The results of research by economists gave an additional argument in favour of the fact that human nature is characterised not only by a desire for material interests but also by a desire for justice and cooperation with other people.

Company A \ Company B	Low prices	High prices
Low prices	$3 mln / $3 mln	$1 mln / $7 mln
High prices	$7 mln / $1 mln	$5 mln / $5 mln

Fig. 1. Oligopoly pricing.

Source: The author.

As an independent direction, behavioural economics in Western scientific literature appeared in the 1960–70s and actively developed by prominent psychological scientists Daniel Kahneman, Amos Tversky, Paul Slovic and economists George Akerlof, Robert James Shiller, Dan Ariely, Richard Thaler.

In the Russian economic studies, the first researches in the field of economic psychology belong to V. Sokolinsky, A. Kitov, S. Malakhov. A fundamental contribution to the theory of psychological economics was made by B. Raizberg, who identified three main areas of research: the psychology of monetary behaviour, the psychology of labour behaviour, and managerial psychology.

From the standpoint of behavioural economists, it is essential to explain the functioning of the economy and good governance, taking into account the psychological characteristics of human behaviour: changes in feelings, impressions and moods. The economic theory without taking into account subjective factors and the irrational beginning creates an erroneous understanding of economics and finance, which in practice can lead to negative results and loss.

1.3. Theoretical aspects of the decision-making process under risk and uncertainty

In the standard model of the information economy, time and effort required to solve problems are treated as expenses. Behavioural research-

ers have studied in more detail how decisions are made in situations of expanding the selection and complication of products. Some findings showed that consumers use relatively simple rules of heuristics; that is, they ignore some possible options due to a large amount of labour-intensive information. Economic and financial agents use heuristics to optimise the decision-making process in such situations, especially in conditions of time constraints, when decisions should be made quickly. In many cases, this is an effective way to achieve an optimal solution. However, these "rules" can also lead to incorrect results.

Economic agents often face solutions that involve some degree of uncertainty. An obvious example is buying insurance when consumers pay a fixed amount to limit costs in the event of an accident (for example, a car accident or severe health problems). There is also a significant degree of uncertainty about the future, when economic agents borrow, make savings and investment decisions. Traditional economic models suggest that consumers, faced with the problem of choice with an uncertain outcome, evaluate the possible results depending on the probability of their occurrence and make a choice with the highest expected benefit, that is, maximise the expected utility. At the same time, consumers evaluate risky decisions in an appropriate manner.

Deviations in the behaviour of economic agents explain the "Prospect theory" by Daniel Kahneman and Amos Tversky, associated with decision-making under risk. They called it a prospect theory because it highlights how people make decisions based on their prospects. The prospect theory reads as follows:

There is a value function of subjective value that reflects how people value different things for themselves.

There is a second component — the weighting function, which reflects the attitude of people to probability (Kahneman & Tversky, 1979, p. 263).

This model is based on three cognitive principles of consumer choice:

The assessment of possible consequences is carried out in relation to the neutral point of reference, or level of adaptation.

The principle of desensitisation works in assessing the dynamics of wealth.

The principle of non-acceptance of losses. Consumers are ready to incur additional costs to avoid significant losses but are not ready to go to such expenses to achieve great success. Losses are experienced more than gain.

Based on experimental data, scientists derived a value function, which was determined in terms of deviations from the original value. The curve is convex upward for winnings and concaves downward for losses, which means risk aversion to winnings and riskiness to lose, and the value function has a steeper slope on losses than on winnings (see Fig. 2).

The asymmetry of the perception of winnings and losses is due to the fact that the human psyche perceives not so much the absolute value of its wealth, as its change, and the pleasure of winning is less than the disappointment of defeat. Costs always seem more significant than the equivalent income. Based on experimental research, the theory of perspective draws a paradoxical conclusion: people are more likely to take higher risks to avoid costs than to get an extra bonus with a lot of risk. For example, mass storage of money in the form of cash, despite recommendations for more rational use and support of the national economy, is explained by the natural feeling of "not taking costs", reinforced by negative experiences acquired during the times of hyperinflation, voucher privatisation and "financial pyramids".

A person tends to dwell on his initial choice (anchor effect), and then make decisions that are consistent with him. At the psychological level, such a mechanism serves as self-defence against the awareness of the fallacy of the decision made. In this case, the initial choice may be random, but the subsequent line of conduct will be quite natural.

An equally important effect — the effect of negative bait — is to introduce an additional choice opportunity only to capture the consumer's attention (see Fig. 3) in order to impose on it the most profitable purchase for the seller. In the first variant, the consumer selects according to the classical price-quality scheme, in the second, the consumer usually chooses case A from any options, since he compares his preferences to an anti-bait (–A).

In other words, additional information may distract consumers from more important factors, and this can adversely affect consumer choice and make them make less profitable decisions.

Moreover, such phenomena as optimism, overconfidence, availability heuristics, hindsight bias errors, turn out to be not just typical but also mass phenomena both in economic practice and in everyday life.

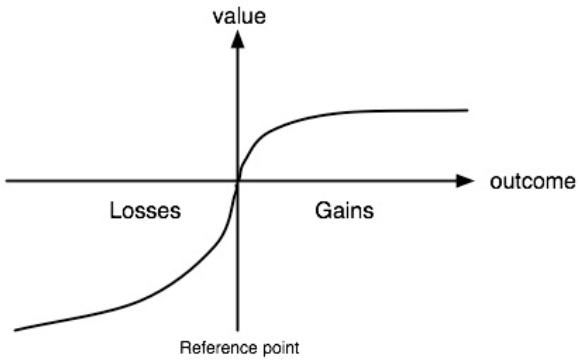

Fig. 2. The utility function in behavioural economics.

Source: Tversky & Kahneman, 1992, p. 313.

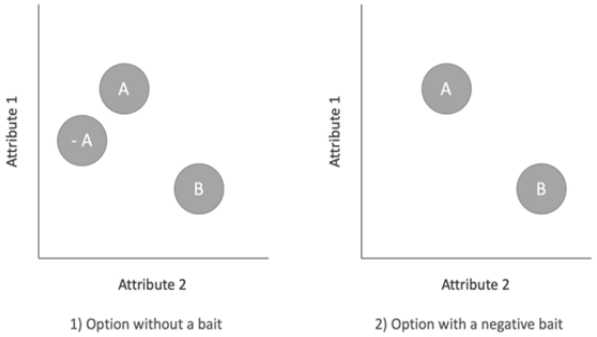

Fig. 3. The anti-bait effect when selecting from several alternatives.

Source: The author.

An interesting point in the selection process is the relative probability. Depending on the context, the circles in the centre seem to be different, although, in reality, they are absolutely identical (see Fig. 4). Behavioural researchers emphasise that this is how consumers make choices. The effect of relativity is closely related to the demonstrative effect of consumption, consumers often imitate neighbours, friends, TV stars.

The widespread use of credit cards reveals the irrationality of human behaviour. Consumers make a choice every day from several alternatives, and everyone, in principle, is able to assess the possible consequences of decisions made. People face constant trade-offs between current consumption and future consumption; Besides, the situation in which they are today depends mainly on the choices made in the past. Standard economic models of intertemporal decision-making assume that consumers choose the value of current and future consumption by discounting, which is consistent between two periods, regardless of when the consumer makes estimates. Behavioural economics argues that consumers value the present more highly than other periods. From here, they make short-sighted decisions regarding savings and loans. These consumers may, for example, take a small loan today at a higher interest rate instead of a larger loan in a year at a lower discount rate.

In a general sense, the risk is an economic category expressing relationships about achieving a certain degree of success (failure) in the implementation of its goals by a business entity, taking into an account controlled and uncontrolled factors of activity. Often the risk is understood as the probability of the occurrence of any event. If such an event occurs, three economic outcomes are possible: negative (loss, damage, loss), zero, positive (win, chance, profit). One can take this probability into account by streamlining the expected impacts according to the likelihood of their occurrence.

The risk we characterise as the unity of objective and subjective beginnings. On the one hand, it is generated by objective factors and exists independently of the will and consciousness of people. On the other hand, the risk is associated with the choice of certain alternatives by a specific person, which bears in itself the stamp of individuality, psychological make-up, personal motives. The occurrence of risk is determined by the probabilistic nature of many processes, unforeseen, accidental circumstances, the multivariance of economic relations into that business entities enter. People usually make decisions in the absence of complete information and certainty. In such a situation, there is a risk that the desired result will not be achieved. With uncertainty, the probability distribution of certain events is unknown. In this case, the estimated net benefit is calculated based on pessimistic, optimistic and intermediate estimates (George et al., 2017). Depending on the individual risk attitude, people make decisions that they consider to be correct.

Depending on the different attitude of consumers to risk, there are several types:

Risk-takers — risk-averse, easy-to-take (assuming that the gain may be less than the initial payment);

Risk-neutrals — individuals that are neutral to risk (relying on expected gains);

Riskophobes — risk opponents (investing an amount strictly less than the expected income).

In many cases, the risk is taken when external circumstances require it. However, most agents do not expect to get a big win and only seek to avoid losses. Often this leads to the choice of a slower, but more reliable course of action.

The empirical study of strategies for repayment of multiple debts described in Psychological Factors of Multiple Debt Repayment Strategies (Gagarina & Goroshnikova, 2018) with 350 respondents reflect six different decision-making groups depending on psychological traits and attitudes to risk (see Fig. 5):

Rational strategy is repayment of the debt, taking into account rational factors and only in that case a game is completed with a positive outcome.

Semi-rational respondents try to reduce the total amount of debt, their actions are analytical but still not totally rational, and they are more risk-taking higher curiosity and flexibility.

In terms of chaotic strategy, respondents have multiple errors in fulfilment of the task of paying off multiple debts; they are less open to new experience, not curious and flexible.

Aversive strategy respondents reduce the total number of arrears more typical for women than for men. Respondents make some mistakes.

Distributive respondents pay off all or some debts not wholly closing them.

Ignorance of small numbers. Respondents with a strategy for paying off debts ignoring small amounts turned out to be more benevolent.

Behavioural economics explains any economic phenomena on any scale through the lens of psychology, rationality/irrationality and behavioural mechanisms.

Irrational beginning — the management of non-economic motives, irrational behaviour, persistence in delusions, spontaneous determination to act, disorder, illogic. Irrationality, as an integral feature of economic behaviour, must be taken into account when modelling. Hence, the causes of the crisis: well-established ideas, changes in attitudes, approaches to business, loss of trust, a sense of justice, ignoring the role of abuse and the sale of low-quality products — do not attach importance to stories interpreting economic mechanisms.

The behaviour of agents on the market is determined by the irrational beginnings of a person, creating waves of optimism and pessimism. Behavioural economics is based on the axioms of a partial, but significant lack of understanding

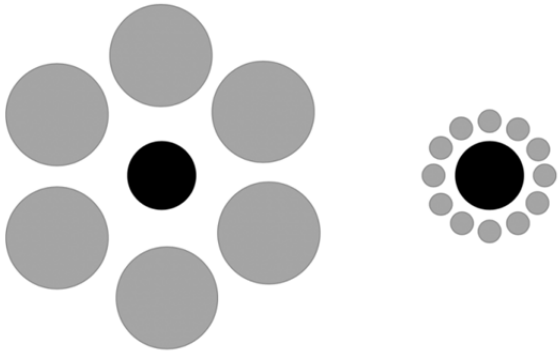

Fig. 4. Illustration of the principle of relativity in the selection process.

Source: https://epee.hse.ru. Accessed 03 April 2019.

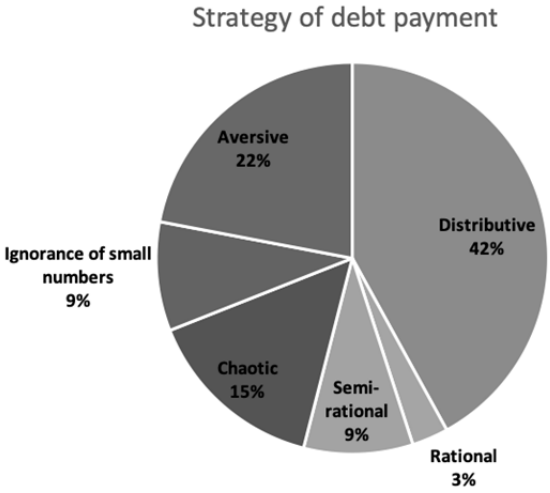

Fig. 5. Representativeness of strategies.

Source: Gagarina & Goroshnikova, 2018, p. 60.

by individuals of the laws of market functioning, which is especially evident during periods of crisis. Individuals perceive only a small part of the total amount of information due to the complexity of the economic world. Therefore, despite the desire, they cannot make the optimal choice prescribed by theory.

Testing, interpretation of economic mechanisms for any economic cycle, the ubiquity of application for different countries add a new dimension to existing models that are not able to explain the euphoria, which is replaced by pessimism. Economic reality includes many psychological variables that cannot be reflected using traditional models. Trust, honesty, optimism, irrationality, motives of behaviour, opportunism, risk, viruses, etc., are the subject of behavioural economics, which ensures the effective management of economic systems.

2. Irrationality in the Process of Making Financial Decisions

2.1. The main problems of decision making associated with the assumption of "rationality"

The traditional approach to understanding individual decision-making is based upon classical decision theory and the rational economic model. These were initially developed in economics, and they make certain assumptions about people and how they make decisions. The rational economic model of decision-making (see Fig. 6) is still popular among economics scholars in suggesting how decisions should be made. However, to understand its weakness it is necessary to list its assumptions and demonstrate how they fail to match up to reality (see Table 1).

The classical view of decision-making employs the concepts of rationality and rational decisions, in its discussions and prescriptions. Rationality is equated with scientific reasoning, empiricism and positivism; and with the use of decision criteria of evidence, logical argument and reasoning. Rational decisions are decisions which are based on rationality, that is, on a rational mode of thinking.

The classical view has now been accepted as not providing an accurate account of how people typically make decisions. Moreover, its prescriptions for making better decisions have often been incorrect. Instead, contemporary cognitive research by psychologist has revealed how decisions are made based on heuristic models, judgements and tacit knowledge.

Descriptive models of decision-making focus on how individuals actually make decisions. Each decision made by an individual or group is affected by several factors. Some of these include:

Individual personality;

Group relationships;

Organisational power relationships and political behaviour;

External environmental pressures;

Organisation strategic considerations;

Information availability (or lack of).

The aim of these models is to examine which of these factors are the most important, and how they interrelate before a decision being made. One of the earliest, and still among the most influential descriptive models, is the behavioural theory of decision-making. It was developed by Richard Cyert, James March and Herbert Simon. It is called

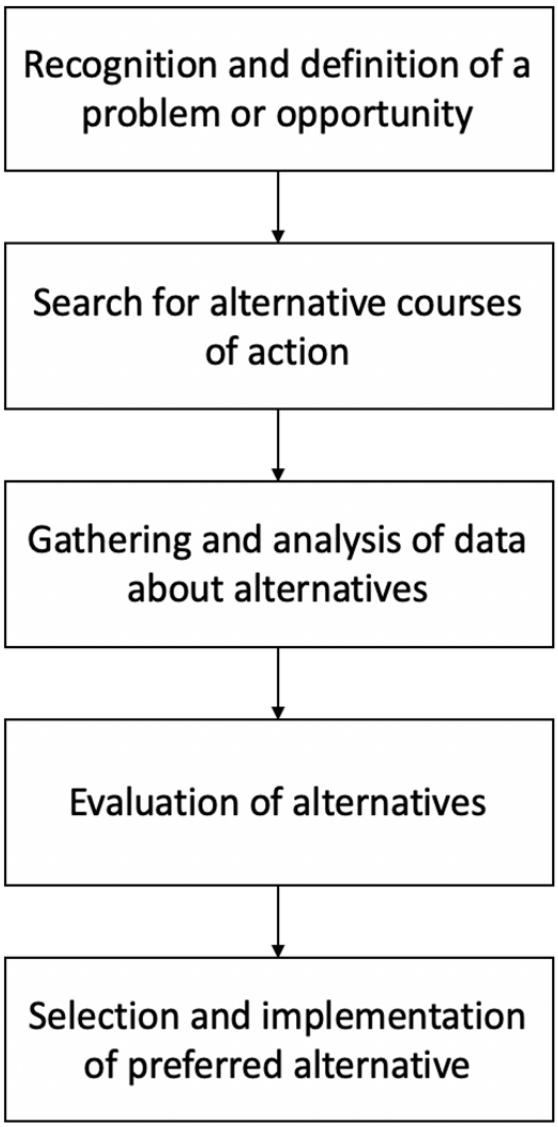

Fig. 6. Rational economic model of decision-making.

Source: Buchanan & Huczynski, 2017, p. 312.

"behavioural" because it treats decision-making as another aspect of individual behaviour. For example, if a research study interviewed brokers who bought and sold shares in the stock market to determine what factors influenced their decisions, it would be an example of a descriptive approach to decision-making. It is also sometimes referred to as "administrative model", and it acknowledges that, in the real world, those who make decisions are restricted in their decision processes, and therefore have to settle for a less than an ideal solution. The behavioural theory holds that individuals make decisions while they are operating within the limits of bounded rationality. Bounded rationality recognises that:

The definition of a situation is likely to be incomplete

It is impossible to generate all alternatives

Table 1
Rational economic model assumptions and reality

Assumption	Reality
All alternatives will be considered	Rarely possible to consider all alternatives since there are too many Some alternatives will not have occurred to the decision-maker
The consequences of each alternative will be considered	Impractical to consider all consequences Impractical to estimate many of the consequences considered Estimation process involves time and effort
Accurate information about alternatives is available at no cost	The information available is rarely accurate, often dated, and usually only partially relevant to the problem It costs money to be generated or purchased Decisions have to be made on incomplete, insufficient and only partly accurate information
Decision-makers are rational beings	Individuals lack the mental capacity to store and process all the information relevant to a decision Frequently they lack the mental ability to perform the mental calculations required

Source: Buchanan & Huczynski, 2017, p. 314.

Impossible to predict all the consequences of each option

Final decisions are often influenced by personal and political factors.

The effect of personal and situational limitations is that individuals make decisions that are "good enough" rather than "ideal". That is, they "satisfice", rather than "maximise". When maximising, decision-makers review the range of alternatives available, all the same time, and attempt to select the very best one. However, when satisficing, they evaluate one option at a time in sequence, until they alight on the first one that is acceptable. That chosen option will meet all the minimum requirements for the solution but may not be the very best (optional) choice in the situation. Once an option is found, decision-makers will look no further. The contrast between the rational decision-making described previously, and the bounded rationality discussed here is shown in Table 2.

Prescriptive models of decision-making recommend how individuals should behave to achieve the desired outcome. It makes the classical model described earlier, also a prescriptive one. Such models often also contain specific techniques, procedures and processes which their supporters claim will lead to more accurate and efficient decision-making. They are often based on observations of poor decision-making processes, where key steps might have been omitted or inadequately considered. They are developed and marketed by management consultants as a way of improving organisational performance through improved decision-making.

Victor Vroom and Philip Yetton developed one of the best known prescriptive models of decision-making, later expanded by Vroom and Arthur Jago. The focus is on decision-making situations, and on seven factors to identify the decision-making style that is likely to be most effective in any given case. It focuses on decision style, concerning how a leader decides in a given decision situation, rather than what a leader chooses to. It also concentrates on subordinate participation — the appropriate amount of involvement of the leader's subordinates in making decisions. The model consists of three main elements:

Decision participation styles.

Diagnostic questions with which to analyse decision situations.

Decision rules to determine the appropriate decision participation style.

Two key concepts underpinned the model — quality and acceptability. The quality of the decision relates to it achieving the aim; the cost of its implementation; and the time taken to implement

Table 2
Rational decision-making and bounded rationality contrasted

Rational decision-makers...	Bounded rationality decision-makers...
Recognise and define a problem or opportunity thoroughly	Reduce the problem to something that is easily understood
Search for an extensive set of alternative courses of action, gathering data on each	Develop a few, uncomplicated and recognisable solutions, comparable to those currently being used
Evaluate all the alternatives at the same time	Evaluate each alternative as it is thought of
Select and implement the alternative with the most value (maximise)	Choose the first, acceptable alternative (satisfice)

Source: The author, based on Kahneman, Diener, & Schwarz, 2003.

it. The acceptability of the decision refers to subordinates and anyone else either affected by the decision or who has to implement it. Leaders and managers generally select the highest quality decision that is acceptable.

An explanatory model of decision-making looks at what decisions were made and aims to explain how they occurred. For example, there are studies of military fiascos which examine why generals took or failed to take, certain actions. Often these made by teams have also been studied using concepts from the group level of analysis such as groupthink and group polarisation. Decisions such as whether to acquire or merge with another company have drawn upon the theories of conflict, power and politics, and have been explained at the organisational level.

The judgement heuristic and biases model represents the current thinking in decision-making. The studies have highlighted the limits to rationality and introduced the concept of bounded rationality. What else might affect the individual who makes decisions? Decision-making involves choice, and choice requires both careful thought and much information. Excessive information can both overload and delay. Many managers believe that making the right decision late is the same as making the wrong decision. Hence the process is speeded up by relying on judgement shortcuts called heuristic.

Decision-making using heuristics can be considered as a separate model and one that represents a further step away from the classical model. Robert Cialdini identified the decision-making biases and heuristics that could be used by individuals to influence the decisions made by others. He called them "weapons of influence":

Contrast. This bias of human perception affects the way that we see the difference between things that are presented one after another. If the second item is somewhat different than it actually is. If you lift a light object first, and then a heavy object, the latter will appear than it actually is.

Reciprocation. A basic norm in society is reciprocation, that is, one person must try to repay in kind in the future, what another has provided them with in the past. We are socialised from childhood to abide by the reciprocation rule or suffer social disapproval and a feeling of personal guilt. Such reciprocation leads to concession-making and allows different individuals' initial, incompatible demands to become compromised so that they finally work together towards common goals.

Commitment and consistency. Commitment is a state of being in which individuals become bound to their actions, and through these, to their beliefs. Commitment sustains action in the face of difficulties. In these circumstances, it is behaviour which is being committed. It represents a visible indicator of what people are and what people intend doing. After taking an initial decision, people will adjust their attitude to make it consistent with their action, and become committed to it.

Social proof. People decide what to believe or how to act in a situation by looking at what others believe and do. In case of uncertainty and ambiguity, they observe and follow others, especially those they perceive to be similar to themselves. Such similarity is defined in terms of status, social background, dress, manner or language. Market research suggests that 95 per cent of people are imitators, and only 5 per cent of people are initiators.

Liking. We enjoy doing things for people we like. That liking encourages us to comply with their requests. The liking bias is so powerful that the person concerned does not even have to be present for it to

be activated. Often, just the mention of a friend's or mutual acquaintance's name will be sufficient.

Authority. Each of us has a deep-seated duty to authority and will tend to comply when requested by an authority figure. Since the opposite is anarchy, we are all trained from birth to believe that obedience to authority is right. The strength of this bias to obey legitimate authority figures comes from systematic socialisation practices designed to form in people the perception that such obedience constitutes correct conduct. Different societies vary its terms of this dimension.

Scarcity. Things and opportunities that are difficult to obtain are more valued. We use information about an item's availability as a shortcut to decide quickly on its quality. As things become less available, we lose freedoms, and since we hate this, we react against it and want these things more than dimension.

As individual decision-makers, we all use judgement heuristics to reduce the information demands placed upon us. Considerable mental activity is saved by summarising past experiences into the form of heuristic and using them to evaluate the present problems. Similarly, managers in organisations substitute such simplifying strategies to save having to collect complex information and analyse it. While helpful in many situations, heuristics can lead to errors and systematically biased judgements. Although the three main biases have been discussed, many other errors, fallacies and biases exist. People have ideas about the order, randomness, chance and so on. Studies have shown how peoples' judgements become biased and hence, less rational.

2.2. The main mistakes made on the stock market

Adherents of the classical theories of financial markets against the researchers of irrationality in financial markets have always heard many accusations. Most of them consisted in the fact that the facts of the irrational, ineffective behaviour of operators in the market are unsystematic in nature and, ultimately, are regulated and levelled by the rest of the market. Is it really so? Does the market really have the ability to swallow a non-standard investment activity? Or does it function with systematic errors that investors are not aware of, who are influenced by the same deviations? To understand this crucial issue, scientists in the field of behavioural finance conducted a considerable amount of research. Empirically, it was proved that when they find themselves in situations where they need to make an investment decision or to make a prediction, operators in the market tend to make the same mistakes repeated from one time to another.

As such, the effects, which will be discussed below, do not have any market pegs. They take place in any stock market, be it the USA, Russia, or the other side. They are determined by the stereotypes of financial thinking, the lack of necessary diversification of financial knowledge, in some cases, the routine of the work performed, and, consequently, the narrowing of the skills used and the required amount of knowledge. All this leads to the fact that most of the operators, regardless of a national peg, get into a situation when the methodology they use is not applicable for making a successful investment decision.

Many investors do not anticipate what impact they may have on the results of their investment activities. As a source of collecting, analysing and processing large amounts of information a person without loss of quality, a person does not fit very well. This position of many scientists is reflected in practice when time after time, a person shows his inability to process numerical arrays and make the right investment decisions.

Some behaviourists believe that this phenomenon is caused by the fact that in the modern digital, information space, a person lives by entirely different laws than his ancestors, who lived thousands of years ago and the main choice for them lay in the area of their natural, biological needs and needs. This position may seem absurd, but it undoubtedly has the right to life, because, as practice shows, the individual is still inclined to use the mechanisms of dismemberment and simplification of information used by our ancestors. The concrete way in which these mechanisms of a person's adaptation to the problem before him are expressed and what results their use leads to will be discussed later.

When carrying out financial activities, there is always uncertainty on a scale. It is almost impossible to take into account the totality of factors that determine the functioning of a process, whether it is pricing or risk identification. To be able to apply any measures to minimise the effect of uncertainty on the processes, one should calculate the probability of occurrence of a particular event.

However, financial market participants use vast flows of information in their work and make their

decisions according to them, and the calculation of the exact probability becomes a very laborious process. Again, if this process is accelerated by reducing the number of factors taken into account, then the final value of the probability of an event occurring will only be approximate and not capable of reflecting the real chance of a particular event occurring.

In such cases, many operators take a different route to avoid substantial labour costs. Moreover, the determination of the probability for operators becomes dull, and it becomes possible to apply this method to future similar situations. The ease of application of the heuristic approach and application determines the breadth of its distribution in the financial and domestic environment.

The heuristic approach is to apply any operator skills, be it his previous experience, sensations or expectations to solve problems, usually requiring the use of more complex mechanisms for its solution.

The efficiency of heuristics directly depends on the situation in which it is applied. Some are quite effective; others are the opposite. Concerning financial markets, it can be assumed that heuristics are not a rational solution. There are three types of heuristics most commonly used:

1) Access heuristics

2) Representative heuristics

3) Heuristics of fastening and adaptations.

Considering the heuristics of representativeness, one must, first of all, determine the essence of this concept. This heuristic is a judgment about a process or person based on stereotypes. The danger of frequent use of this heuristic is that representativeness initially ignores some factors that most often are decisive in making the right decision or judgment.

These factors include:

A) Misconception about the chance

B) Insensitivity to basic probabilities

C) Insensitivity to predictability

D) Insensitivity to sample size

E) The illusion of significance.

Let us briefly consider these factors in turn. The misconception of a chance is because many operators believe that if there is any random process, then the generation of events by them in a long and short period will be identical. It is wrong. An example is a coin flip, an example of a classic and vividly demonstrating an incorrect interpretation of a chance. At the subconscious level, many believe that a sequence of eagle-tail-eagle-tail-tail is more likely than a tail-tail-tail-eagle-tail.

Mathematically, this statement has no basis, since the subsets of a process do not always bear the characteristics of a common set. They can cause serious deviations, which are only aggravated by the small sample size.

Because of this phenomenon in the financial markets, there are two effects, the effect of the "hot hand" and the "player's delusion". The first is to re-evaluate one's capabilities because of the consistent onset of operator-friendly events that were generated by a random process. As a result, this leads to de-mathematisation when making important investment decisions and losses.

The second, "the player's delusion" is the opinion formed by the operator that the chance is a self-regulated value, and at certain predetermined intervals, each deviation in one direction will be levelled by movement in another.

These effects are the result of not understanding the law of large numbers. Kahneman and Tversky gave this phenomenon the name of the "law of small numbers", which says that people will consider even small samples to be representative of those from which they are derived.

Insensitivity to basic probabilities. The next factor that is not taken into account when using representativeness heuristics is the size of the initial probability of an event. It would seem, how can a person, evaluating various scenarios, not take into account the most fundamental information. It is empirically proven to be possible. To do this, let's consider one study (Kahneman, Slovic, & Tversky, 1999) conducted by scientists to confirm the existence of this systematic error.

Were randomly recruited respondents who were asked to determine the profession of a person by his characteristics. One respondent was told that in a sample of 100 people, 70 were lawyers, 30 were engineers, and other respondents, on the contrary. For example, the following characteristic was proposed: "John is 29 years old. He is married and has no children yet. Active and purposeful, he is satisfied only with success, and constant movement forward. He is highly respected by his colleagues."

As can be seen, no specific information indicating John's occupation was provided, therefore, the likelihood that he is a lawyer or engineer should

remain unchanged within the previously specified ratio. As a result of the study, it turned out that both groups of respondents indicated approximately the same probability that this person is a lawyer — 0.5. Initial probabilities were ignored. But it should be noted that such results were achieved only in cases when the respondent was provided with additional information that did not carry any useful information. If there was none, the respondents were close to real probabilities by their estimates. This phenomenon has been confirmed several times, both through research among ordinary respondents and among professional market participants. As a conclusion, one can say that a person objectively assesses probabilities only when he has only the basic necessary information. In a situation where the operator has any additional pseudo-information, his ability to correctly assess the possibilities of developing a certain process is reduced to a minimum.

Insensitivity to predictability. Quite often, operators in financial markets are faced with the task of predicting the size of any quantities, whether it is the price of a stock, the size of profits in the future, the demand for any services. In this case, without having the ability to quickly and mathematically calculate these values, the operator gives his picture of the development of events, using the moment information about the object of forecasting.

It is possible to take as an example the situation when a person has a description as issuer, without specifying specific indicators of its activity. Of course, if the description of this company is positive, any person will consider the future high profits of this company more representative than the losses. And, accordingly, *vice versa*.

Here lies the analyst error. Based on what it is possible to give a high assessment of the future results of the enterprise, without having mathematical tools and current performance indicators?

Insensitivity to sample size. One of the most common mistakes, partly described earlier, is the substitution of the law of large and small numbers in the mind of an individual. Because of this, there are often cases when errors occur in the prediction of all sorts of phenomena. Insensitivity to sample size is one of the factors that characterise the heuristic of representativeness. Take an example. If the task is to determine the likelihood that the average height of randomly selected ten men will be 180 centimetres, it is quite natural to apply in this case information about the average of these indicators among all men in general. It turns out that, statistically, the respondent denies the possible deviation of this sample, about which he has no information, and uses his empirical data to determine the probability in a situation where he is not able to reliably determine the probability. Thus, as a result of the experiment, the probability data obtained from respondents were approximately equal for samples of 10, 100, and 1000 people.

In addition to this common aspect of forecasting, there is also a phenomenon called the "conservatism effect". We give an example clarifying its action.

In 1968, this effect was studied by the American scientist Ward Edwards in his paper (Edwards, 1968). And there he gave the results of the next experiment. Suppose we have two bags, in each of which there are 1000 chips, in one of them there are 700 red and 300 blue, in the other — 700 blue and 300 red. If we take a coin and throw it to determine the bag that we take for the experiment, then the probability that we take the bag with the prevailing blue chips is 0.5. Then, the respondent needs to determine the probability that this bag is really with 700 blue chips, provided that of the 12 elongated chips, 8 were blue, and 4 red. Naturally, the probability that this "blue" bag is now higher than 0.5. If you give a probability of this equal to 0.7 or 0.8, then you fall into the group of the majority of respondents, and the majority is wrong in your assessment. The exact probability is 0.97.

The illusion of significance. In light of the above, it is already clear that people often abuse the reduction of the outcome of the forecast to the description of the process. And the operator's confidence is the higher, the higher their similarity. Therefore, if there is an opportunity to identify the process and its result, then the operator will always do it, regardless of the quality, completeness and statute of limitations of the description of this process.

The last moment is especially remarkable. Even if the operator is aware that the description of the process by which he needs to make a prediction, is lagging behind reality or contains any distortions, to save time, which he, he believes, can spend on other matters, he will often ignore this moment will give a prediction as if this information did not exist. It is this moment when the investor is so confident that he evaluates the uncertain process according to his description despite the scarcity of information on it and is called the "illusion of significance".

Based on the preceding, we can conclude that it is rare when an investment decision is truly justified. Most often, the aforementioned heuristics are used for this. However, there is an effect of even deeper primitivistic of the investment choice. This effect is called the home bias.

It is quite natural that in everyday life, people rely on verified information, use things they are used to. If the individual is given a choice between using two things-substitutes, one of which is well known to him, then most often the choice will be made towards the latter.

This behaviour is also present in financial markets. According to statistics, market participants in different countries invest their money in the assets of the state of which they are citizens. Forming his portfolio from any national instruments, the investor naively believes that he is well-diversified, which is wrong. It would be reasonable to say that it is necessary to diversify a portfolio based on considerations of the share of different countries in the global financial market.

Let us take the example of a domestic investor. According to the above principle, at first glance, it appears that it is better not to invest money in the Russian stock market. Of course, this is not the case, especially in the case of limited investment funds. However, according to the theory of portfolio investment, a set of assets from one investor cannot be called fully diversified. After all, all the papers of one national market are equally affected by country risk, which was especially clearly demonstrated by the crisis in the United States. Let this example be in some way unique, because the collapse in the United States has pulled other markets along with itself, but it is vividly demonstrating the essence of national diversification. Financial crises in different countries are not always related in time, and when constructing a portfolio of securities of the leading stock markets of the world, this will allow insuring against the loss-making of the entire portfolio.

Many operators in various segments of the financial market in one way or another overestimate their ability to predict a particular event. Faced in practice with the phenomenon for which they observed and about the features of the development of which they had some idea, investors often use the ultimate significance of this process to work out a hypothesis. That is, they build their model for the development of this process, which is not always true.

The investor, having obtained the result, is trying to integrate this value into the existing information system. Having laid out the processes that affected the outcome, the investor understands the weight of each of the factors in the final result. He becomes all clear, especially if he knows the methodology. The thought arises that, as it should be thought, the investor could predict the same outcome until the moment when its value would be known.

This deviation is dangerous because, as a rule, such situations are used by the investor to make a "routine" out of it, that is, to use the experience gained to apply to future situations.

It begins to bring negative consequences as soon as the evaluation methodology starts to lose sight of any factors affecting the outcome. This deviation at the micro-level of the investor takes place at the beginning of his activity, then it decreases to the extent of his influence on the activity, and after a more or less long period, he begins to influence his work as he gains experience in a certain area and, therefore, the investor's excessive confidence in his ability to predict the outcome of a process.

To materialise the concept of "excessive self-confidence" and give it a financial justification, consider some statistical data on the US stock market and try to identify the relationship of its revaluation and financial results from this effect.

In 2001, scientists Brad M. Barber and Terrance Odean (2000) conducted a statistical study of the financial activities of 38,000 households operating in the securities market to buy and sell these securities through broker companies. The sampling period was six years and was carried out from 1991 to 1997.

In the standard practice for the analysis of trading activity is used an indicator called the "annual turnover of the portfolio". It is measured as a percentage and shows what proportion of the securities portfolio was sold and replaced with other securities. For example, an indicator of 50 per cent indicates that exactly half of the stock portfolio has been sold. If the figure is 250 per cent, then this means a double updating of the portfolio and the subsequent replacement of another half of the portfolio assets replaced.

For a deeper structure of the study, they introduced gender and family divisions; as a result, there were four groups: single men and women, married men and women.

For single men, the annual portfolio turnover is 85 per cent, for married men, 73 per cent, for mar-

ried women, 53 per cent, for single women, 51 per cent. One can see how much lonely men develop a trading activity. Only 15 per cent of their securities in the portfolio per year were found by men from this group to be suitable for themselves and their investment strategy. However, one should note that since the rates are annual, it is quite possible that for the next year, those papers were replaced in the investment portfolio by others.

For the interrelation of gender, self-confidence and financial performance indicators, it is necessary to consider the study of Odean and Barber (2000) concerning the connection of trading activity with the financial result. For this purpose, 78,000 households that used brokerage services were included in the sample.

First of all, the meaning of trading in the stock market for a single investor is the extraction of income. At the same time, since the investor uses the paid services of a broker, then he faces the need to cover and commission. The size of the commission, of course, varies depending on the number of transactions initiated by the client. So, more deals — more commission. And the profit from resale should also significantly exceed the size of the broker's commission. And, accordingly, it is logical to assume that the yield from active trading should exceed the yield from passive portfolio management, that is, buy and hold strategies.

Investors from the sample were ranked by the rate of updating the securities portfolio into five groups, 20 per cent of investors in each. The first group, with the least high rate of renewal, is about 2.4 per cent per year. The last, for the most active group, an indicator of annual portfolio renewal held at the level of 250 per cent. For these groups, the average yearly rate of return was calculated. For all five groups, the yield was close to or equal to 18.7 per cent.

It turns out that all efforts to select paper, buy, and sell securities are in vain, without bringing additional returns that justify the high costs of active portfolio management. Moreover, this is a return that does not include transaction costs, taxes and other costs. After deducting payments due in all groups, it was found that the net yield for the group with the lowest renewal rate is 18.5 per cent, and for the most active, 11.4 per cent. The difference of 7.1 per cent per annum is a considerable amount, especially if you make a differentiation by the number of sums used for investment. The difference of 7 per cent per annum from $ 10,000 and $ 500,000 is incommensurable.

In addition to the purely quantitative problems considered, excessive trading activity leads to difficulties of a qualitative nature. Another mini-study was conducted on the most active trading group. The average yield of the paper sold and purchased for this group was determined for four months and one year. It turned out that the paper sold would have yielded a yield of 2.6 per cent for investors from this group for four months, while the purchased one would be 0.11. In one year, the loss of profitability from such an operation is 5.8 per cent.

This phenomenon suggests that the most active investors tend to sell even the most profitable of their assets in favour of low-quality securities. We would repeat that this study did not take into account the lots of purchases and sales of securities, but only the focus of the transaction and the characteristics of the papers participating in it. Potentially profitable securities in practice turned out to be assets of worse quality than those that were sold earlier.

Accordingly, very often increased investment activity affects the highest-quality securities for portfolio renewal, which most negatively affects the financial result. Excessive self-confidence in the financial market is manifested in the form of a biased assessment of the risk associated with the activities of the investment operator. As a rule, there is an overestimation of the favourable outcome for an operator of an event, and an underestimation of a negative one.

That is, recalling that the group of single men correlates with the rate of portfolio renewal at 85 per cent with the group of households whose returns are at the level of 11 per cent per annum, it is logical to assume that the lower returns for them turn into less risk. It is a consequence of Markowitz's theory, the classical rule of any market, higher profitability should be sought in riskier assets, and *vice versa*. However, is this true in this particular case? The use of the coefficient of beta, as the indicator characterising the risk of a portfolio, turns out that single men have the highest beta coefficient and single women the lowest, that is, the papers are weakly correlated with the market movement.

It turns out that by buying papers with a higher risk, investors acquired low returns. It is since operators from this group had a high share in their portfolios of recently emerged companies, so-called

small stocks, which, due to the characteristics of the organisation of their issuer, have a risk higher than the market average. Shares of such companies are acquired in anticipation of their rapid growth, which is not guaranteed by anyone. A rational investor seeks to limit the share of such securities in his portfolio, at least until he is convinced that a particular security paper is reliable in terms of risk and attractive in terms of its profitability.

It is where the relationship between gender, risk acceptance, over trading and financial results are revealed. Apart from the need to sufficiently diversify the portfolio, single men, who share the greatest trading activity, tend to sell their most liquid and high-quality securities in favour of small company stocks, hoping for a big gain, but in fact receive higher risk for low returns, which is even lower than the strategy of passive paper holding. In itself, the knowledge that overtrading leads to a final financial result that is less than the result of passive portfolio management of many scientists plunged into shock, but in addition to this, the relationship between overtrading and gender factor further enhances the impression of the results of empirical research by scientists.

2.3. The main problems of management performance

If an investor understands that his knowledge of the stock market and micro control is not enough to effectively invest in securities, more often, he transfers his money to the funds in trust management. At the same time, as a rule, they choose a fund that meets its investment preferences, the concepts of the risk/return ratio. After that, one could say that in the future, the funds will generate flows with precisely those characteristics that the founder of trust management expects.

However, it is not so. Unfortunately, the work of management companies is also extremely susceptible to individual behavioural deviations, which will be proved further by the example of a similar situation in the US market. The fact is that it is in trust management that the ineffectiveness of another concept of efficient markets about investor rationality is most clearly manifested. A rational investor equally avoids risk in loss situations and profit situations. In practice, the acceptance of risk in these situations is asymmetric.

For the representativeness of the experiment, Kathryn Sullivan (1997) invited to participate in an experiment to identify the characteristics of making financial decisions to 119 managers, each of whom had 20 years of experience in the financial sector and for at least six years occupied his current place. As a result, 96 financial managers took part in the experiment. Each of them had a task to choose two alternatives in five different situations, and the managers were warned that there was no right option; therefore, they ensured the originality of their investment decision during the polarisation of the experiment to the real market situation.

1) In the first experiment, the respondents were tasked to decide the condition of a probable loss of 600 thousand dollars. Managers in the condition of realisation of profits had the choice to save $ 200 in the first case or with a probability of 1/3 to save all 600 thousand, and with a probability of 2/3 to lose them.

Managers in the condition of realisation of losses were asked to choose

A) Lose 400 thousand dollars

B) With a probability of 1/3 not to lose anything, and with a probability of 2/3 to lose everything.

As you can see, the conditions for managers in terms of losses and profits are the same, with a difference only in the formulations. That is, in principle, there should be no difference in making an investment decision. However, according to the results of the experiment, 63 per cent of managers in the condition of profits chose a guaranteed profit, but in the situation of the realisation of losses assumed the risk (75 per cent).

2) The second experiment was intended to reveal the features of decision making in situations where the magnitude of profits or losses is greater. And again, the same tendency was observed as in the previous experiment, in terms of profits about 78 per cent avoid risk, in terms of losses the same 72–77 per cent assume this risk. There was again asymmetry of risk.

3) In the third experiment, the goal was to find out how the respondents react to risk, if they are given a different formulation of the problem, in terms of costs and costs. The appearance of this experiment is due to the desire to find out how much the manager links the costs with the profit from them. If he equates them to losses, then according to previous survey data, we can expect to assume the risk. If, on the contrary, conservatism regarding risk should be expected.

Managers were divided into two groups: one was proposed the wording in terms of profits, the other — in costs. Profitable wording narrated about product A, which is in steady demand in the market, and which with a probability of 100 per cent will bring 420 thousand dollars in its production. There is also a product B, which with a probability of 75 per cent will bring 520 thousand dollars, and 25 per cent — nothing.

The wording in terms of costs offered respondents the successful completion of the project with any choice, but in the first case it was necessary to spend an additional 420 thousand dollars to complete the project, and another with a probability of 75 per cent would require an even higher amount — 570 thousand, but at the same time 25 per cent of cases no additional cost is required. Again, we see the symmetry of the construction of the problem with the difference of formulations. According to the results of the experiment, 88.2 per cent were avoided in terms of risk profits, and 62 per cent in terms of costs.

Contrary to the results of the first two experiments, in unprofitable terminology, the percentage of risk managers is much lower. Costs reduce the financial result from the investment activity of the manager. But, since the experiment clearly states that the result will be positive in any case, the respondents choose the risk-free option. In this particular case, risk avoidance is excessive. Therefore, risk-taking by managers is demonstrated when the probabilities of losses and gains from the adoption of any investment policy are formulated and mathematically calculated.

4) In the fourth experiment, the task was to choose one of two investment opportunities, and both in terms of profits and in terms of costs, the net profit, in any case, was equal to 325 thousand dollars. Profitable wording was slightly modified and sounded like investment returns, and accordingly changed the wording in terms of costs.

In terms of profits: there is a product A, which is in constant demand, and which will bring 575 thousand dollars in the case of the choice of its production. There is also commodity B, which has recently appeared on the market and the boundaries of the demand for it have not yet been precisely defined. However, after marketing research, it turned out that with a probability of 70 per cent in its production, you can get 665 thousand dollars, or with a probability of 30 per cent — 365 thousand dollars. Both those and other options demand additional investments at a rate of 250 thousand dollars.

In terms of damages, as usual, identical conditions were proposed, otherwise formulated. It was said that with any choice, the project will be successful and will bring 575, etc., the difference is only in the volume of funds required for additional investments. In the first variant, another 250 thousand dollars must be spent on the completion of the project, in the second with a probability of 70 per cent — 160 thousand dollars, 30 per cent — 460, etc. Again, the same conditions cause imbalances in the investment decisions of financial managers. In terms of profits, 21.6 per cent took the risk, 78.4 per cent avoided. Respectively, in terms of losses — 38.2 per cent and 61.8 per cent. As you can see, most investors chose to avoid risk, that is, in the wording of profits, to get a guaranteed profit, and in the case of costs, it is guaranteed not to spend more.

5) In the fifth experiment, researchers still put respondents in the conditions for the realisation of profits and costs. In the formulation of profits, the terms were set in such a way that it is possible to choose between two alternatives, for which with a 70 per cent probability there will be a high level of market demand and 30 per cent a low one. The difference between the projects is only in absolute values of the profits that the manager will receive. In the case of high demand for the goods, he makes a profit of 465 thousand dollars, but if the demand for the goods is small, then their size will be 155 thousand dollars. Alternative commodity B has a less profitable ability depending on market conditions. With high demand, the manager receives 384 thousand dollars, with low — 344 thousand dollars. The deviation of the first alternative is higher and much more to be a representative for identifying a disposition to risk. The choice of the manager of the second option is pure risk avoidance.

Managers in terms of the implementation of losses were requested, at the request of state regulatory authorities, to consider two options for recycling, which are produced by the company manager. The first option implies a 70 per cent chance that it will take 465 thousand dollars; 30 per cent — 155 thousand dollars. Alternative B offers a 70 per cent chance of a cost of 384 etc., 30 per cent — 344 etc. As in all previous experiments, the conditions are identical, and the difference is expressed only in the formulation.

According to the results of the experiment, in terms of profits, 86.5 per cent of respondents

avoided risk, accepted — 13.5 per cent. In terms of costs, the choice of respondents was divided approximately equally, accepted the risk of 51.4 per cent, chose to avoid, 48.6 per cent.

For the first time during the five studies, the share of investors who take over and who refuse to take risks is approximately equal in terms of losses. However, this is because the losses are encoded in the form of the requirement of government agencies. In a normal situation, it is difficult to expect large profits from the recycling of your waste.

It is real, to a certain extent, representative data obtained from top managers of management companies. These data, in the same way, can show us the degree of the irrationality of investment activity of funds in the USA, empiricism that cannot be interpreted ambiguously because the research conditions for managers were given the simplest ones. Asymmetry in decision making is apparent, and it can be said with absolute certainty that having, at least, approximately similar alternatives in a real situation, the financial result from the investment decision would be even worse, because, in addition to individual behavioural deviations, noise information is added, erroneously interpreted by the manager because of its uselessness.

In fact, the mechanism of transferring funds to trust management, their multiplication, and the management of funds in the management company in any American, Russian (Russian in particular) and any other market is entangled in a strong network of irrationality or rather a cognitive irrationality. Let us start with the clients of mutual funds. What is the potential customer guided by when choosing the right fund? The ratio of risk/return, performance, recommendation, reputation. Of all this spectrum of factors, the first is more or less determining. Recommendations and advice are not any reliable information, because they come from a person subject to deviations and biased judgments to the same extent as the client. Information on performance indicators in various sources sometimes differs significantly, and therefore they are de facto nothing more than noise information, suitable only for compiling the most generalised picture of the foundation's activities. This behaviour has nothing to do with rational investment. Yes, and managers of funds of any market due to the nature of the activities are very susceptible to the influence of cognitive deviations. There are seven main problems of investing in various funds:

1) *Forecasting*. There is a tremendous amount of evidence that it is impossible to accurately predict any outcome of a process that is remote in time. And despite this, the market is fed up with all sorts of forecasts, analysts, and other unreliable information.

The reason for this lies in many factors, among which are excessive self-righteousness, excessive optimism at certain stages of the financial market. Forecasting is now one of the foundations of financial activity, without which practice cannot be imagined. It turns out that despite the fact that the overwhelming majority of market participants are mistaken in their forecasts due to both the system's inability to determine the price of an asset in the most accurate way in the future, and due to the imperfection of the methodology they use, it's still everyday mass media on financial markets are filled with regular attempts to predict the outcome of any process. It may seem meaningless. In no case should we forget that the forecast is noise, no more than someone's personal opinion on what is happening, suitable only for familiarisation, the formation of his own opinion, and not for copying and applying in his investment activity.

Figures 7 and 8 clearly show the quality level of analysts' forecasts for values of different nature. The first graph shows the forecasts of experts regarding inflation using the GDP deflator. The second graph shows the projections of the 10-year paper yield. It means that the respondents could not guess not only the level of the yield of the paper but also the direction of movement of this yield. In particular, 55 per cent of the forecasts for increasing profitability were differently directed with real movement, that is, in 55 per cent of cases, for a particular moment, the upward forecast coincided with a downward movement of paper.

If it is difficult to predict the movement of any particular paper, even using the entire array of available information on it, it is logical to assume that the movement of an index will be easier to predict. Fig. 9 shows how this hypothesis is true. The S&P500 index on the graph is correlated with forecasts for its movement. Experts believe that the retrospective data is well tolerated for the future, as a result of which such a gap between the actual movement of the index and forecasts for two years is obtained.

As one of the main factors influencing the forecasting process, one can identify excessive self-

confidence. Figure 10 illustrates the results of a survey in which students and professionals associated with the stock market were asked to choose a paper in which the respondent is confident, and which, in his opinion, will grow over the next three months. As can be seen, the share of students who have guessed such papers is significantly higher than the share of stock market professionals. It follows from this that market experience is not always a guarantee of good forecast quality, and the direction of movement of securities is not as apparent as it may seem.

2) *The illusion of knowledge*. The financial market is always dominated by the desire to get more and more information. In scientific literature, this phenomenon is called gluttony. It is exceptionally widely believed that possessing a large volume of information allows one to be always ahead of the market and to show positive results. Of course, this is the case; an uninformed participant is in any case, less effective than an informed participant. But do not overestimate the value of owning a variety of information. It can be differentiated by its quality. Yes, and its functionality is also in question. Very often, instead of adjusting the investment decision, the additional information only increases the investor's confidence that he is right. Therefore, the principle "the more, the better" in this case is not applicable.

Figures 11 and 12 reflect the results of a study on the effect of the amount of information on research participants. The purpose of the experiment was to identify how accurately a professional psychologist can determine a person's behaviour, his character, by periodical portions of information about his life, habits, and so on.

At first glance, there is no connection with the financial sphere. However, returning to the results of the study, it can be noted that as the amount of information available to psychologists increases, the quality of their assumptions does not increase, that is, they still make wrong conclusions, but with each stage and with each new information their confidence is correct, it is getting stronger. Fig. 12 shows those who changed his/her opinion after receiving new information about the object of observation. The tendency to increase self-righteousness is clearly expressed.

This experiment confirms the fact that additional amounts of information are interpreted not as information to the consideration or revision of

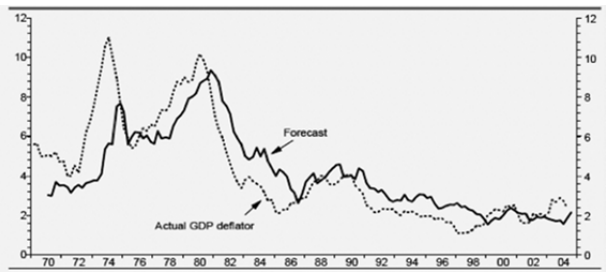

Fig. 7. US GDP deflator and forecasts.

Source: Bloomberg.com. (2019). About US Real GDP. Available at: https://www.bloomberg.com/quote/EHGDUSY: IND. Accessed 5 March 2019.

Fig. 8. Consensus one year ahead bond yield forecasts and reality (per cent).

Source: Russo & Schoemaker, 1989, p. 97.

their position regarding any phenomenon, but as a means of confirming it. The ability of large amounts of information of different quality to influence investment decisions is underestimated and is not sufficiently taken into account.

3) *All sorts of meetings, roadshows*. Many companies pay great attention to organising meetings with potential investors. However, such meetings are unlikely to be a real investment burden for the investor. There are certain issues that need to be taken into account for meetings with company representatives to bring real value. First, as mentioned earlier, more information does not mean better performance. Secondly, managers are also subject to cognitive errors, and their point of view is almost always excessively optimistic about the nature of their activities and the results that can be obtained from investing. Thirdly, for an investor who is still hesitant about any decision, the information that will be in line with his desires is dominant. Fourthly, according to research data, after such meetings, many investors admit that the representative type of the company's management played a significant role in the investor's decision

making. It is a non-financial aspect that inclines many market participants towards a solution that might not be the best one on the market. And fifth, there is always the risk of receiving inaccurate information, altered, or in any other way adjusted to increase attractiveness. And not still the investor has the opportunity to check the quality of the information received.

In confirmation of the above, it is advisable to bring these studies, which is carried out every quarter among the 500 largest US companies. Their CFOs are asked a lot of questions, one of which is: "Assess the potential of the economy and your company for the next quarter". In all cases, managers evaluated the potential of their company above the market, which indicates a high degree of confidence in their capabilities; that they can all replay the market (see Fig. 13). From this follows the conclusion that the managers of the reassessment of their management skills and financial results of the company.

4) *Self revaluation*. The factor is related mainly to the previous one; his/her self revaluation is more "elongated" in the time interval. Successes on any lengthy period can lead to the fact that the methodology of activity can be simplified, superoptimism and excessive trust in the manager's ability to assess and process market information, confidence in the ability to 'read' the market, outpace it will appear. To buy at the bottom and sell at the top for a long time is impossible, even having an idea about the peculiarities of the "crowd" behaviour, that is, studying behavioural finances.

5) *Short term and replay*. Since many operators confuse information with noise, and at the same time try to get ahead of the market, excessive trading activity occurs. In turn, it leads to a reduction in the holding period of the paper in the portfolio. On the New York Stock Exchange, for example, the average term for holding a paper in a portfolio is 8–9 months. That is, the result of such a paper is a function of the change in prices for it during this period, and this period may not be representative of the previous or subsequent ones. Such financial activities are more speculative than investment.

Figures 14 and 15 show how much the holding period of securities in US mutual funds has changed over the past 90 years. If you pay attention to the 50–60s, you can see that the funds operated as long as possible at that time, and the NYSE papers

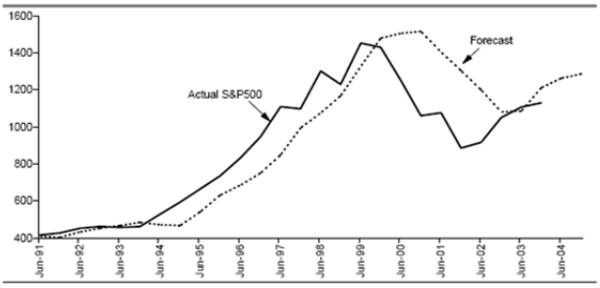

Fig. 9. S&P500 Index Forecast.

Source: Russo & Schoemaker, 1989, p. 97.

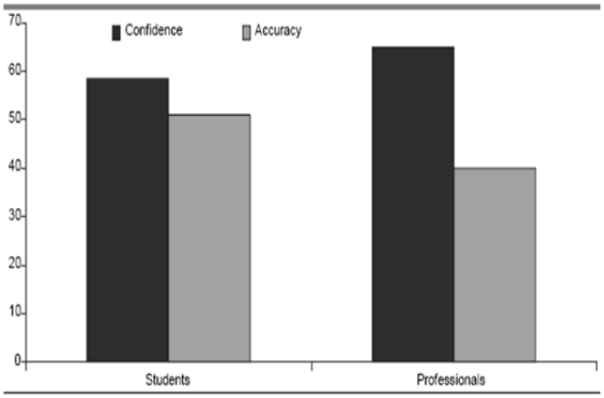

Fig. 10. Average Accuracy and confidence considering stock selection (%).

Source: https://www.drkwresearch.com. Accessed 8 Apr. 2019.

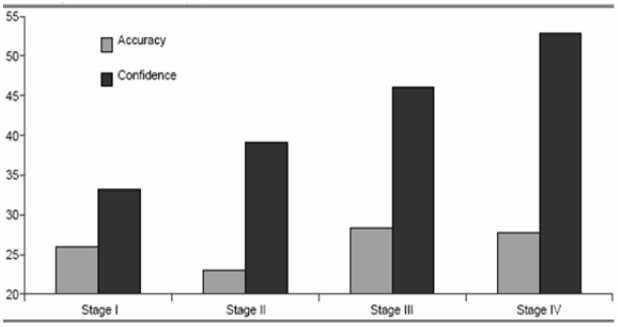

Fig. 11. Increase confidence as the volume of available information increases.

Source: Slovic, 1991.

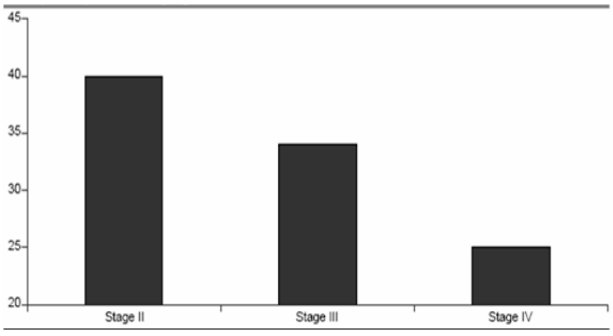

Fig. 12. The share of experts who change their opinion each round.

Source: Slovic, 1991.

were held for seven to eight years on average, as opposed to the current annual similar indicators.

6) *Trustfulness*. Associated with previous problems, this one is also crucial. It is necessary initially to be sceptical about the received information, changing its opinion in relation to it as other information comes from other sources confirming it. Many investors believe that they can accurately distinguish reliable information from poor-quality information. However, there are no grounds for this, and to differentiate between incorrect information and correct information, you need to have a particular array of information that will allow you to decide on the reliability of the information received. Associated with previous problems, this one is also crucial. It is necessary initially to be sceptical about the received information, changing its opinion in relation to it as other information comes from other sources confirming it. Many investors believe that they can accurately distinguish reliable information from poor-quality information. However, there are no grounds for this, and to distinguish between incorrect information and correct information, you need to have a particular array of information that will allow you to decide on the reliability of the information received.

7) *Group judgment*. This problem is hidden until the results of the application of group judgments in the financial sphere become clear. There is an opinion that the decision taken in the group differs in the qualitatively better side from the individual and allows achieving better results. It is a much deeper problem than it seems. Of course, with zero investor awareness, a group decision is definitely better than its unreasonable individual one. However, if the operator has some experience in working in the market, and his ability to receive information quickly and without cost is high, then the need for group actions should be carefully assessed. One would expect the group to level individual cognitive delusions, but, instead, the group only reinforces them. Gathering in a group, investors have already predetermined the task to come to any decision along the path of least resistance. The group reduces the variability of opinions. On the way to making an investment decision, the group always becomes a victim of the "anchoring effect", that is, any information that intersects in any way with their vision, they begin to interpret as confirming their predictions.

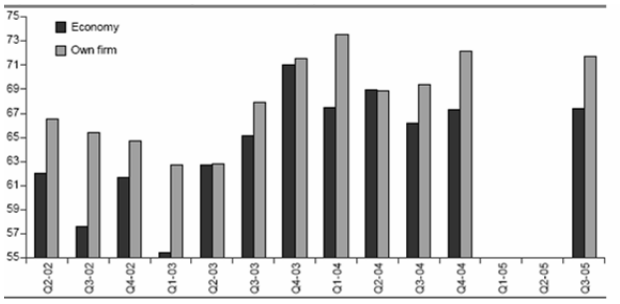

Fig. 13. Optimism over the economy and own firm (%).

Source: Cfosurvey.org. (2019). Duke CFO Global Business Outlook. Available at: http://www.cfosurvey.org. Accessed 8 April 2019.

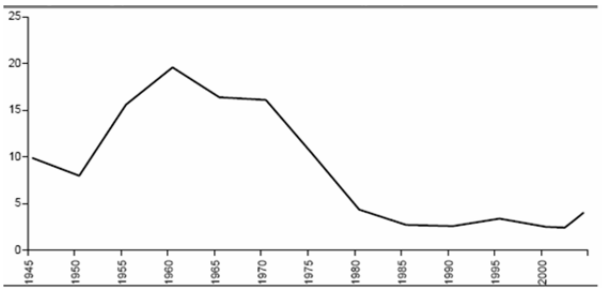

Fig. 14. Average holding period of US mutual fund investors (years).

Source: Bogle, 2005, p. 37.

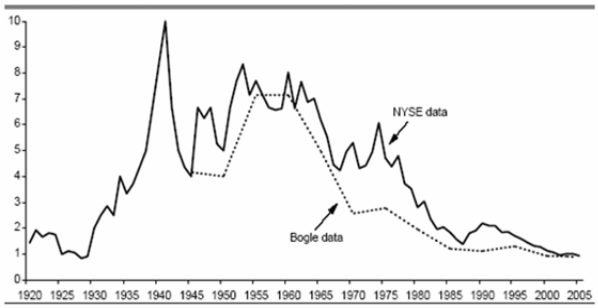

Fig 15. The average holding period of NYSE listed stocks (years).

Source: Graham, Harvey, & Rajgopal, 2004.

3. Impact of the Theory and Methods of Behavioural Economics and Finance in Practice

3.1. Use of behavioural tools in the process of making financial decisions

To understand the essence of the findings of Shiller, you must first think about what determines the price of shares. Suppose a particular fund decided to buy a block of shares and keep them forever. In other words, these shares are not going to be resold, and therefore the fund can receive profit from these securities only in the form of dividends after some time. The value of the shares must be equal to the "current value" of

all dividends that the fund will receive in the future after the purchase of shares, i.e. this is the amount in which the cash flow is estimated after the necessary adjustments, taking into account that the money tomorrow will cost less than the money today. Although because we do not know precisely how much profit in dividends a certain block of shares will bring, the share price is only a forecast, reflecting market expectations regarding the present value of all future dividend payments.

A rational forecast has an outstanding property: as it should be on stock quotes, the forecast cannot fluctuate more than the object of the forecast. Robert Shiller, now a professor at Yale University, published the results of his research in 1981.

Shiller got his results when he applied this principle to the stock market. He collected data on stock quotes and dividends since 1871. Then, for each year after 1871, he calculated what he called the "expropriational" forecast for the flow of future dividends that would go to someone who wanted to buy a portfolio of all the securities that existed at that time. To do this, he took data on the number of dividends that were paid and discounted them for the required year. Having corrected for the well-established trend, according to which, over a long period, quotes show growth, Schiller found that the present value of dividends was very stable. But stock prices, which we must interpret as attempts to predict the current cost of dividends, fluctuated very strongly.

A practically flat line on the chart shows the dynamics of changes in the current value of dividends, while the bouncing line reflects the real value of the shares, both of which were corrected to eliminate the long-term effect of the increase in value over the long term (see Fig. 16).

In his article, Shiller asked himself the question "Do stock prices fluctuate enough to explain their subsequent changes in dividends?" Based on Figure 16, the answer to this question is positive. The results of Schiller provoked a strong reaction in financial circles and published articles. Some authors criticised the method of Schiller and his conclusions.

On Monday, October 19, 1987, Robert Shiller's idea that financial markets were too volatile was confirmed. On that day, quotes dropped significantly worldwide. It all started in Hong Kong and then expanded to the West, as the exchanges opened in Europe and then in the USA. In New York, stocks collapsed by more than 20 per cent. Monday, October 19, is of critical importance because, on this day, nothing unusual happened in the field of finance or any other. No war has begun, no political leader has been killed, and nothing remarkable has happened. However, stocks fell around the world, and no one could say why. Price fluctuations continued for the next few days. In America, the S&P500 index of large companies scored 5.3 per cent already on Tuesday, jumped another 9.1 per cent on Wednesday and again fell by 8.3 per cent on Monday, the 26th. In the rational world, quotes change only as a result of the reaction to the news, and during that week the only news was that prices "jumped".

If quotes are so susceptible to volatility, then they are, to some extent 'wrong'. It is difficult to argue that the price is at the close of trading on Thursday, October 15, and the price at the close of trading next Monday (which is already 25 per cent lower) can be rational indicators of true value, given the lack of news. Thus, the idea that the market price is always correct is refuted.

When Shiller wrote his first article, he did not think to give explanations in terms of the behavioural approach. He merely communicated facts that are difficult to explain rationally. However, in 1984 he wrote the article "Stock Prices and Social Dynamics", in which the idea was developed that social phenomena can influence stock quotes just as they do in the fashion world.

In the hypothesis of an effective market, apart from the principle that price is always correct; there is also the principle that the market cannot be replayed. Schiller's research also has a bearing on this principle and refutes it.

To understand the reason, it is necessary to pay attention to some of the conclusions obtained from studies of value investment. Valuable stocks, where even securities with extremely low P/E ratios can be, show a return that exceeds the market average. You can also calculate the P/E ratio for the entire market. The question arises: does the same principle work, that is, is it possible to outplay the market if you buy stocks when they are relatively cheap and wait until they become relatively expensive?

To solve this issue, Shiller preferred to use the method, which consisted in dividing the index of stock quotes (such as S&P500) by the average yield over the past ten years. He prefers this method of retrospective monitoring of profitability because it allows smoothing the temporal fluctuations that occur during the business cycle. The graph of the obtained coefficient is depicted in Fig. 17.

Evaluating the events in hindsight from the chart, you can see what the investor's strategy should be. It is important to note that when the market deviates from the historical trend, in the end, it returns to the average. In the 1970s, stock prices were fairly low but eventually recovered, and by the end of the 1990s, prices seemed rather high, but ultimately, they fell. Thus, in the long-term dynamics of the P/E index, which Shiller demonstrated, there is indeed some predictive power. However, this predictive power is not very accurate.

Was Shiller's warning correct, or was he wrong? Since his warning was made four years before the market swooped down, we can say that he was mistaken for a long time before being right. This inaccuracy means that the long-term dynamics of the price/earnings ratio cannot serve as a full guarantee of profitable deals. Anyone who would follow Shiller's advice in 1996 and bet on a falling market would have suffered a loss before there was a chance for a profitable deal.

The same conclusion is correct for the real estate market. The work that Robert Shiller did with Karl Case is now the widely known Case-Shiller Index of property prices. Before this index, real estate price indicators were not very reliable, since the set of houses sold in a particular month could be very different, distorting the average. At the core of the Case-Shiller Index are recurring sales of the same house, to control the type of house and its location.

Long-term growth in property prices (see Fig. 18), where real estate price data collected by the government before 2000 is used, after which Case-Shiller data became available, so both data sources are used here.

The graph shows a moderate increase in housing prices throughout the study period until the 1990s and after that a sharp rise. Besides, after a long period during which the index of the ratio of the price of buying a home to the rental price of identical housing fluctuated around the 20:1 mark, housing prices differed sharply from this long-term trend. Having this data before his eyes, Shiller warned about the danger of a real estate price bubble, which eventually happened. However, at that time no one could be sure whether it was a bubble, or something changed in the economy, as a result of which much higher purchase price/rental price ratios were established as a new norm.

It should be clarified that the inaccuracy of these passes does not mean that they are useless. When

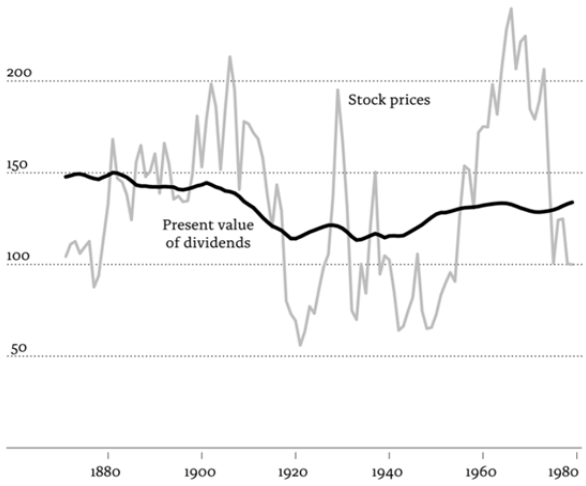

Fig. 16. Are Stock Markets Too Volatile?

Source: Shiller, 1980, p. 292.

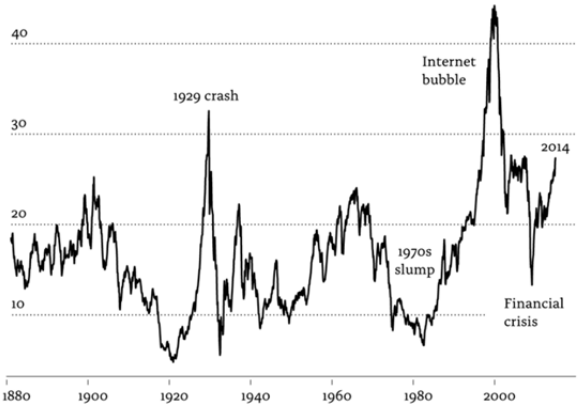

Fig. 17. Long-Term Stock Market Price/Earnings Ratios.

Source: Home Page of Robert J. Shiller. Available at: http://www.econ.yale.edu/~shiller. Accessed 9 May 2019.

prices strongly deviate from the historical level, it does not matter in which direction the predicted value is hidden in these signals. The more the price deviates from the historical level, the more seriously these signals should be perceived. Investors should be cautious in pouring money into a market that signals of overheating, but investors should also not expect a quick profit, relying on an accurate forecast of market dynamics. It is much easier to determine the presence in the price bubble than to say when it will burst. Investors are rarely able to earn by calculating the time changes in market dynamics.

3.2. A mathematical approach to behavioural decision-making

A model of investor sentiment will be considered to explain the problems of the stock market. This model is centred on beliefs.

There are two stable pricing regularities: a weak price response to a single news item, for example, the earnings of stock issuers, and an overreaction to a series of specific news. In the model below, the reaction is weak, if the expected return after the good news should exceed the expected return after the bad news, and excessive, if the expected return after a series of good news is less than the expected yield after a series of bad news.

Some problems in the stock market are the result of systematic errors committed by investors during the use of public information to form expectations for future cash flows. Their model takes into account two heuristics triggered by updating the original beliefs: conservatism (the tendency to underestimate the new information) and a special version of representativeness, called the "law of small numbers" (the belief that even small samples reflect the properties of the maternal population).

When a company announces unexpectedly good revenues, conservatism suggests that investors react sluggishly; the stock price and subsequent returns will rise slightly. After a series of announcements of good earnings, the representativeness will cause investors to over-react, and the stock price will become too high compared to the fundamental value.

The reason is that after many periods of good revenue, the law of small numbers tends investors to think (believe) that this is a company with a particularly rapid increase in revenue. Therefore, they forecast the high revenue in the future. In the end, the company cannot be average. According to the law of small numbers, if a company is average, then its revenue would be average even in short samples. Once the stock price is too high, the subsequent return is too low on average, and in the long run, reversals (price changes in the opposite direction) and the effect of scaled price ratios (scaled price ratios — rate to profit, book value to market and other price-to-cash flow ratios. Stocks with an underestimate after scaling tend to show increased returns in the future) is expected.

To reflect these ideas mathematically, we developed a model with a representative and risk-neutral investor, where revenue dynamics follow a random walk process. Investors, however, do not use such a process to predict revenue. They think that at any time the revenue is generated by one of two modes:

1) Revenue returns to its average, normal value, more than in reality; good news will change badly;

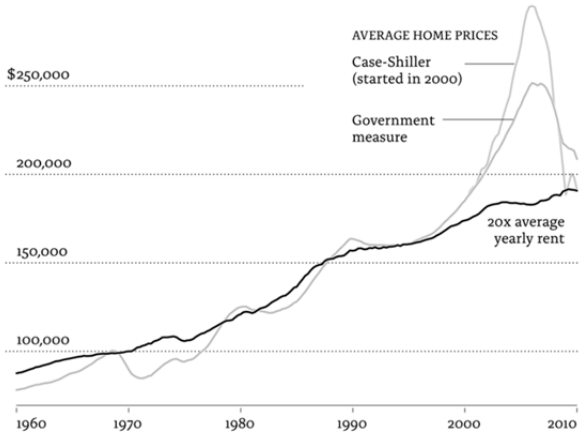

Fig. 18. Long-term dynamics of housing prices and rental prices in the US.

Source: Klyuev, 2008, p. 20.

2) Revenue has a more stable trend than in reality; good (bad) news will be followed by another good (bad) news.

The investor believes that the revenue generated in this way varies exogenously with time and sees its task in determining which mode is generating revenue now. This approach offers one way to simulate deviations when updating beliefs.

A model with trend captures the effect of representativeness, allowing investors to give the trend more weight than they should. Conservatism means that people may underestimate the latest news about good revenue in the light of past beliefs. In other words, when the news is positive, they begin to act, assuming that in the next period the news will be at least partially negative, that is, they believe in the return mode.

We turn to the consequences for pricing process. Since the model participant is a representative investor, the share price is simply the investor's expected inflow (in his pocket) of discounted earnings for future periods:

$$P_t = E_t\left\{\frac{N_{t+1}}{1+\delta}+\frac{N_{t+2}}{(1+\delta)^2}+\ldots\right\},$$

where N is revenue and $\frac{1}{1+\delta}$ is a discounting factor.

In this case, the expectations are the expectations of the investor who is unaware that the dynamics of the proceeds follow the random walk process. Otherwise, because in the case of the random walk process $E_t\left(N_{t+j}\right)=N_t$, the price would be equal to N_t/δ.

In the model used, the price deviates from the true value of the paper, since the investor uses

not the random walk model, but a combination of the aforementioned modes to predict revenue. In this case, the price is satisfied by the following expression:

$$P_t = N_t / \delta + y_t \left(p_1 - p_2 \pi_t \right),$$

where p_1 and p_2 are constants and depended on π_H, π_L, λ_1 and λ_2; π_H, π_L — probabilities of changes in revenue for the better (*H*) and worst (*L*); λ_1 and λ_2 — probability of changing one mode to another.

Interpretation is simple; N_t / δ is the price in the case of using the random walk model to predict revenue; $y_t \left(p_1 - p_2 \pi_t \right)$ — deviation from the fundamental value.

Firstly, if the price P_t responds poorly to the news on revenue on average, the constant cannot be too large relative to the constant p_2. y_t is good news. A weak reaction means that on average a deviation $y_t \left(p_1 - p_2 \pi_t \right)$ must be negative. If π_{avg} is the average probability, the above implies that $p_1 < p_2 \pi_{avg}$. In this sense p_1 cannot be too large in relation to p_2.

Secondly, if P_t responds beyond measure to a series of equivalent news, p_1 cannot be too small in relation to p_2. Let the investor receive a series of good news. Excessive reaction means that the price must be higher than the fundamental value. Moreover, after a series of equivalent news π_t is usually low (*L*), indicating a low weight of the first model (return to average) and a high weight of the second model with a trend. π_{low} is a typical low value of π_t, then overreaction requires $y_t \left(p_1 - p_2 \pi_t \right)$ to be positive or $p_1 > p_2 \pi_{low}$. From the first and second paragraph the following equality follows:

$$p_2 \pi_{low} < p_1 < p_2 \pi_{avg}.$$

This model shows that the interaction of the formation of investor beliefs and the true revenue model can explain two different empirical regularities — a weak reaction to certain news and an overreaction to a series of equal news. The model is based on psychological evidence and at very different values of its parameters generates the reaction of both types.

The model that will be given below describes the factors that influence the decision-making process of investors. In a paper written by Guney and Hussain (2007) about measuring equity mispricing, financial constraints, market timing and targeting behaviour of companies, investigated market timing theory for UK based firms. They proposed that managers increase debt (equity) issues during periods of undervaluation (overvaluation).

Managers, thus, seem to time issues strategically out of necessity rather than being able to do so. Both the timing of issues and repurchasing are influenced by reaching target leverage. The evidence suggests that managers are clearly aware of the cost of being off-target and weigh this against the benefit gained from timing the market.

Their initial sample comprises all U.K. firms available from 1984 to 2008. He also excludes financial firms. The final sample includes of 11,201 firm-year observations.

Variables used in this model are same book leverage (BL), the net debt issues (Δdbl), the net equity issues (Δe), SIZE, Tangibility of assets (TANG), R&D and CAPEX are proxies for growth options defined as research and development expenses scaled by total assets, and capital expenditure divided by total assets, respectively. Profitability (PROF) is the earnings before interest, taxes and depreciation over total assets.

The authors expand the model used by Shyam-Sunder and Myers (1999) and include a measure of valuation to proxy for timing. The model used regresses the net debt issued on the financing deficit and is defined as DEF_{it} for firm *i* in year *t* as follows: DIV_{it} is cash dividends, I_{it} is net investments, ΔW_{it} is net working capital, and C_{it} is cash flow after interest and taxes. The sum is identical to net debt issued (Δd_{it}) and net equity issued (Δe_{it}).

$$DEF_{it} = DIV_{it} + I_{it} + \Delta W_{it} - C_{it} = \Delta d_{it} + \Delta e_{it}.$$

The authors measure mispricing with the ratio of intrinsic value (*IV*) to the current market

$$V_{equity} = \sum_{t=1}^{\infty} \frac{FCFE_t}{\left(1 + r_e\right)^t}$$

$$V_{equity} = \sum_{t=1}^{\infty} \frac{FCFE_t}{\left(1 + r_e\right)^t} = \sum_{t=1}^{N} \frac{FCFE_t}{1 + r_e^t} + \frac{Terminal\,Value}{\left(1 + r_e\right)^N},$$

price (*MP*). Intrinsic value is measured as follows:

$$Terminal\,Value = \frac{FCFE_N \left(1 + g\right)}{\left(r_e - g\right)}.$$

Where *g* is the long-term *FCFE* growth. Given that *FCFE* occurs throughout the year, we make adjustments as follows:

$$V_{equity} = \left[\sum_{t=1}^{N} \frac{FCFE_t}{(1+r_e)^t}\right](1+r_e)^{0.5} = \left[\frac{FCFE(1+g)}{1+r_e^t}\right](1+r_e)^{0.5}.$$

$FCFE_t$ is free cash flow to equity at time *t,* and r_e is the cost of equity. *FCFE* is the sum of net income plus depreciation minus change in non-cash working capital minus capital expenditure minus principal repayments of debt capital plus new debt issued.

$$Misvaluation = \frac{IV_{it}}{MP_{it}}$$

The final model is:

$$\Delta dbl_{it} = \alpha + \beta_1 DEF_{it} + \beta_2 UNDVD_{it} + \\ + \beta_3 (UNDVD \times DEF)_{it} + \varepsilon_{it}.$$

Thus, this model shows a strong dependence of company valuation on risks. At the same time, investors look at the above factors and make decisions about whether to invest in a company or not.

Company valuation also depends on growth factors. The higher the growth of the company, the more attractive it looks to the investor, although this is not always the best option, since the growth of the company does not always reflect its stability, and the growth factors may be random (for example, inflation). In this case, the effect of an overly acute reaction can also occur investors have made an overly optimistic outlook on the future growth of some companies, but at the same time, they too low the rest. If so, then the subsequent investment of money by investors in 'good' companies and the withdrawal of money from 'bad' companies is a simple regression to the mean.

Companies that have demonstrated high returns for several years in a row acquire a reputation as a 'good' company and will continue to increase. On the other hand, companies that have been lagging in the past few years are labelled 'bad companies'. Thus, a stereotype is formed at the corporate level.

Indirect evidence of the overreaction of investors existed for a long time — in particular, this is a long-standing strategy of "investing in value" that Benjamin Graham was the first to practice. Graham was a professional investor and professor at Columbia University. Graham is often called the progenitor of an investment strategy in value, the essence of which is to search for securities that are priced below their real long-term value. The trick is to know how to calculate them. One of the mechanisms for determining the high cost or cheapness of the securities proposed by Graham is to calculate the price/earnings ratio (P/E), where the price per share is divided by the annual yield per share. If this ratio is high, investors pay too much per dollar of profit, and, indirectly, a high ratio is an indicator of rapidly growing stock returns to justify the current high price. If profits do not grow as fast as expected, the stock price will fall. Accordingly, in the case of a low ratio of securities, the market predicts that profits will remain low or even decline even more. If the yield starts to grow or remains the same, the stock price will rise.

One study from Graham illustrates the effectiveness of his method (Graham, 1976, pp. 20–23). Since 1937, Graham took the shares of 30 companies in the Dow Jones index for industrial companies (several major American companies) and ranked them based on the P/E ratio. After that, he formed two portfolios — one of the stocks of 10 companies with the highest P/E ratios, and the second of the stocks of 10 companies with the lowest P/E ratios. The result showed that cheap securities yielded more income than securities from the expensive price group, while with a significant margin. For the period from 1937 to 1969, $10,000 invested in cheap securities rose in price to $66,900, while the portfolio with expensive securities rose only to $25,300. If the entire portfolio of 30 companies were acquired, the yield would be $44,000. Although not explicitly, Graham essentially offered a behavioural explanation for this phenomenon.

Cheap securities were unpopular or non-preferred, while expensive securities were in demand and fashionable. If you act contrary to market trends, Graham argued, you can replay the market, although not always. He drew attention to the fact that his strategy of buying the cheapest Dow Jones companies for industrial companies would not have worked in the earlier period, from 1917 to 1933, and he warned that an underestimation resulting from an oversight or prejudice could last for an excessively long time, and the same applies to overpriced prices caused by excessive enthusiasm or artificial incentives. This advice would have been worthwhile to use during

the technology bubble in the late 1990s, when the cost-investing strategy worked extremely poorly since most of the expensive securities of Internet companies continued to grow in value, leaving the boring value stocks far behind.

By the early 1980s, most financial economists considered the Graham approach obsolete. The simple strategy of buying cheap securities had an apparent discrepancy with the efficient market hypothesis, and Graham's methods could hardly be called modern. Data on the profitability of various companies were collected manually. Now researchers use digital databases with which they could conduct much more extensive research, and the results obtained by analysing a small number of companies in a relatively short period, as it was Graham, were no longer taken seriously.

It is not that everyone rejected Graham's assertion about the value of investments in value; instead, the point was that the efficient market theory of the 1970s argued that value investment could not work. But it worked. Later, Professor Sanjoy Basu published competent research on investing in value, the results of which fully confirmed the validity of the Graham strategy (Basu, 1983).

3.3. Barriers to the development of a behavioural approach

Having considered the theoretical and practical basis of behavioural finance, we can conclude that there is still a very long way to the effectiveness of markets and rationality of investors. The system of making profits is currently built precisely on numerical imbalances, which are evident to most market participants. Few people can recognise a quality investment alternative.

Behavioural finance is a new development, a lot of research is still underway, and there is a lot of work ahead in this area. However, the overwhelming majority of studies indicate the imperfection of the behavioural models of operators in the securities market and others, without putting forward specific measures on what needs to be done. Studies are indicative. In this regard, how useful can any innovative thought or theory in the financial market be, if it has no visible practical application? How to use the achievements in the field of behavioural finance, if the authors of the publications do not give specific instructions on specific measures to "beat the market" and extract increased profitability from their operations?

It is worth noting that very many market participants, mainly practitioners, do not have any idea at all about the existence of a behavioural approach to the activities in which they are engaged day after day. It is these operators, or rather the features of their investment activity, that are the subject of ongoing research in the field of financial psychology.

It cannot be said that the results of the research can somehow be "applied" or "used." After examining the most common market errors, the investor will have to do work to eliminate or minimise their own. The process is time-consuming, lengthy, and does not guarantee an increased financial result. It will be difficult for the operator to find out in numerical terms between the decision taken in the typical situation according to ordinary standards and when making a decision that takes into account possible behavioural deviations of the investor and with a more comprehensive methodology for analysing the effectiveness. The operator will only be confident that his decisions are based on fundamental factors that are effective in the long term. For a rational investor, it is not known how the market may behave in the future, yet the possibilities of analysis and forecasting are to a certain extent limited. Whereas irrational investors, for the most part, misuse the advancement of forecasts, operations with dubious information, and operate under the influence of many behavioural deviations that they are unaware of, or do not think about.

Several factors hinder the widespread and widespread knowledge of financial psychology. Generally, they can be grouped into macro-level factors and micro-level factors.

Because any direction is created to somehow influences the established order of things, this direction has to have all the required characteristics to ensure work within its framework. Behavioural finance is an element of the system that empirically denies the applicability of the theory of efficient markets with its initial assumptions about investor rationality and equal access to information for them.

Research in this area, as mentioned above, are indicative. Scientists, to reveal the systematic nature of any deviation, spend a lot of time and labour on collecting statistics, analysing, processing, and grouping it, to create the depth of research, and to draw some conclusion from the total amount of work done. As a rule, there is indeed a systemic deviation in the operators' investment activity, based on statistics, the reasons for the existence

of this deviation are explained in principle, and further research continues on some related issue.

In the minimum number of publications you find any recommendations for the practical application of the results of the work done. This situation has developed for several reasons. First, initially, information about the presence of errors when making an investment decision does not carry any value. The specificity of the financial market is that someone wins, and someone loses. There is always an opportunity, a chance to make a profit without delving into the causes of their past failures and without drawing appropriate conclusions from them. For example, the widespread "Monte-Carlo Simulation" (Towards…, 2019), when an investor neglects the law of small numbers and makes decisions based on his feelings, without even trying to assess the probability of the desired event correctly, will be of little importance if he eventually "guesses" the outcome of the event.

The state of affairs could be different if scientists applied examples of their research to real-life practise to research. They explained how to counteract the influence of a particular effect, cited an approximate methodology or sequence of actions taken to avoid common deviations.

However, nothing like this happens. Assessing how much time (in some cases up to 10 years) scientists spend on analysing and identifying any example of irrationality, it is doubtful that an individual investor will be able to quickly find the optimal system for analysing the event of interest, adjust the process of evaluating and making an investment decision and firmly stick to it in the future, given the various variations and modifications of the situation.

Moreover, even many disparate mathematical substantiations of their research would not be enough to popularise and expand the applicability of the behavioural approach in financial markets. Works and mathematical methods should correlate with each other; you need to be able to take into account the influence of factors of one type on the investor's activities.

Thus, the conclusion suggests the following: for the behavioural approach to become widespread among market participants, it is not enough to observe the mistakes of investors from different years, even if they can be systematised and generalised, and based on which you can draw some conclusions with practical value. The behavioural approach needs to have a mathematical superstructure to the mathematical apparatus of the concept of an effective market.

Otherwise, unfortunately, the concept of "behavioural finance" serves as an additional source of knowledge for the investor, which should be specially noted, of an individual, and not of a legal one, for the reasons described above.

The next factor that has the most negative impact on the prevalence and use of this is the degree of publicity of works studying the behaviour of investors and their delusions. The range of sources through which publications reach readers, research and various analyses of market activity is limited even in the United States to just a few publications among which *The Journal of Finance*, *Journal of Political Economy* accounts for about 40 per cent of publications, with a large number of publications directly to behavioural Finance does not apply, but they are integrated into the system of cognitive knowledge due to the possibility of correlating research results in such publications with the psychology of investing. Moreover, the practice adopted by many publications, which consists in posting long-standing articles from the journal's numbers on the website of the publication, is not applicable. Articles for some time are in the paid access.

Naturally, such limited resources of information negatively affect the development of a behavioural approach in financial thought. The paper version of leading publications is difficult to get outside the USA and work in the periodical financial press, even in rare cases when the behavioural topic is touched upon, most often boils down to recommendations for more careful diversification of the portfolio and thinking about each investment decision. Due to the limited journal space, the work loses the depth of research and becomes a means of general development.

Therefore, at the current moment, to be able to study any publications on the topic, it is necessary that there exists a direct interest from the investor, his time spent searching for work in the original paper or electronic version. Other sources are not well suited to be an information resource in this area, due to the limited material in most sources.

There are a large number of investors and professional participants in the financial market whose interests, investment preferences and activity methodology differ significantly. It is so because these

participants have different needs in the market, each in its way evaluates the quality of the paper, and everyone considers the optimal 'urgency' of the paper also differently.

The active type of an individual investor, for example, as previously noted, is characterised by a high rate of portfolio renewal. This particular investor considers this type of activity to be optimal, and he will also be on the market in the future, apart from emergencies, such as crises, most likely. But with a high rate of portfolio renewal, the investor plays on short-term fluctuations in the price of the instrument, where the fundamental characteristics of the paper may not appear. Accordingly, he can get either speculative profit or loss.

The relationship of this particular case with the development of behavioural finance, at first glance, is weak. However, if we recall any more or less significant work in the field of investor psychology, then it will become clear that all the studies that were conducted by scientists are long-term in nature. To identify any behavioural abnormalities, scientists usually needed time with statistical data of at least five years. How can an active investor apply the achievements of a behavioural approach to his high-intensity work in the market, while at the same time maintaining a highly updated portfolio? No, it is impossible. Of course, high intensity will lead to a higher error threshold for the investor, however, in the short-term period, the significance of the effect of cognitive deviations on the investor's activities will be minimal. As a result, an active manager will have almost the same financial result and knowledge of his own mistakes, which does not have a financial dimension. Such a disposition, as mentioned above, will occur under the assumption that the activity of portfolio management will not decrease.

On the other hand, the strategy of holding a portfolio for a long time, conservatism in managing its securities in the markets of different countries is also quite common, especially in the USA rather than Russia, where the percentage of passive and active portfolio management is both qualitative and quantitative different. Quite often, investors buy a package of securities, best in their characteristics at a certain point, and then simply receive their dividends, coupon payments, and so on, without making changes in the portfolio even when the securities sharply lose in price, or a scandal is associated with the issuer In any case, a situation arises when the value of the securities, the size of the cash flow from the securities in the portfolio decreases. But this is also a case of investor psychology in the market due to its cognitive deviations. And this is not a question of choosing the most profitable tool and managing your portfolio, but a matter of selecting the option of investing temporarily free funds.

As a result, not all investors find it possible, or advantageous, to use research in cognitive finance for portfolio management. Many estimate the cost of a more detailed and meticulous approach to investing higher than the profits from such behaviour in the market. Accordingly, it is not always, from the investor's point of view, to spend time studying a large number of works and publications, while it does not bring tangible, visible improvement in the financial result.

It was noted above that it would take a long time for an individual investor to adapt his breeding investment activity following the experience of financial psychology research. The time lost to re-profiling its activities may be reflected in the omission of the benefits from any transaction.

For a financial market participant, such as a company, or a bank, this is generally not applicable and unacceptable. Even if the participant decides to revise the principles of his activity, then it will cost a lot of time, money, you may have to update the staff of the units responsible for risk analysis and investment decisions. At this time, the participant will lose the competitive advantages associated with the reorganisation, and it is unlikely that the activity of such a participant in the 'noise' market will lead to something good, since the findings, and, accordingly, when focusing on the fundamental and noise information can be completely different. In the short run, the company will almost certainly experience problems with the selection of securities; for this, it will be necessary to form a particular selection policy.

In a real market, to obtain a positive financial result, it is necessary to minimise the role of experience, retrospective data, partnership agreements and other factors on the choice of the investment object. The assessment should be carried out not only by spot (current) indicators but also take into account prospects. In general, when choosing an investment object, the mathematical-analytical approach should prevail. If the investor's cognitive deviation is a fact, then the prevention of the influence of these deviations on the investor's activities is the mathematisa-

tion of processes, the use of various mathematical models that are part of different software, to which many market participants have access. Again, here it is worth noting the difference between the USA and Russian markets in this nuance. Since the share of investors in the United States is different both in its large number as compared to Russia and in their more profound differentiation among different segments of the population, it turns out that in any case, investors who do not use additional software for analysis and choosing the desired tool, it turns out that there are more such participants in the USA than in Russia. From the Russian market, this statement is supported by the fact that due to the youth of the domestic market, individual investments are made primarily by employees of companies associated with the stock market. It turns out that despite this quantitative limitation, local investors have better access in terms of percentage to the means of mathematical analysis than their foreign counterparts. Accordingly, their potential ability to choose an instrument is higher, relying on its fundamental advantages, rather than on the noise information that wraps it. This opportunity always has a positive impact on the final result of the investor, since even a loss on the instrument will be determined at the macro level, fundamentally, and the responsibility for it will rest with the investor, who in time adopted an appropriate strategy that minimises potential losses.

Conclusion

During half a century history of behavioural finance it has occupied an important place in financial and economics science. Hundreds of empirical and theoretical studies that have identified systematised and described in detail all sorts of manifestations of irrationality when making decisions have proved the right to the existence of a behavioural approach to the analysis of financial activity that is impossible to ignore. Behavioural finance ideally fit into the already existing concept of financial space, revealing errors and irrationality.

Most modern capital market theories are based on the so-called concept of homo economicus (rationality of economic agents), which imposes certain evident and hidden limitations on the practical side of their implementation.

Studies and research in the field of behavioural economics and finance continue to appear every year, the mathematical base of the approach is getting stronger, there are more and more features, and patterns of influence of the individuality and personality of a specific market participant on the financial decision-making process are identified. The main question in this regard is how long will last the further development of the behavioural approach? Will this development ever be reflected in a more or less significant change in the current algorithm for making final decisions? If the development of behavioural finance continues, then, most likely, at some point, theorists and practitioners of the financial world will need to integrate cognitive finance into their activities in some way, to supplement primary educational literature with behavioural finance.

The generally accepted rational model of stock markets describes not how investors make decisions in reality, but how they should do it. That is the hypothesis of an effectively functioning market abstracted from the personal characteristics of the participants in this market and the psychology of crowd behaviour. In contrast to this point of view, a different perspective on the behaviour of investors prevails in cognitive (behavioural) psychology. It is believed that the process of human decision-making is directly influenced by subconscious factors. Among them are such as mental models (heuristics), emotions, crowd influence, etc.

The theory of behavioural finance has proven and postulated that in the process of forming their future expectations (that is, the market vision), market participants often resort to not exact mathematical calculations and independent analysis of available information but use the so-called rule of thumb or heuristics, that is, simplified solution strategies complex problems with limited information. Such behaviour in the financial and economic markets in some situations may be justified and even necessary. However, in most cases it leads to preconceived future expectations and irrationality of actions.

Not all economists have abandoned their commitment to efficient market theory. But the behavioural approach is now taken seriously. On many issues, the dispute between rational and behavioural has been central to publications on financial economics for more than two decades. Focusing on the data is what makes this debate continue to be valid and productive.

Most economic theories do not proceed from empirical observations; instead, they are based on

axioms of rational choice, regardless of whether or not these axioms have any relation to what we observe in our daily life. The theory of rational behaviour cannot proceed from empirical data because entirely rational people do not exist.

The combination of facts that are difficult or impossible to reduce to the theory of an effective market, behavioural research — all this contributed to the fact that the field of finance has become an area in which the statements about the invisible hand have undergone a severe review. Financial markets as an area of research are an indication of how a data-based economy can lead to the development of a new theory. The discovery begins with the detection of anomalies. It is impossible to call the completed work on the formation of a new version of finance, based on empirical data, but it is rapidly developing.

However, the principles of behavioural economics and finance can be applied with advantage now.

In a rational world, investor makes financial decision to maximise their risk-return trade-off. They have all the information they need on estimated return and risk, and they make their choices according to this information. In traditional theories of financial investment decisions are based on the assumption that investors act rationally. It means that their behaviour is rational — so they earn returns on the money they put in stock markets. It is essential for investors to have rational behavioural patterns to become successful in the stock market. Rational behaviour is also required to be financially successful and to overcome tendencies.

The modern theory of investors' decision-making suggests that investors do not always act rationally while making an investment decision. They deal with several cognitive and psychological errors. These errors are called behavioural biases and are there in many ways.

Thus, summing up, it is worth to say that today, it is simply impossible to deny the existence of a clear relationship between the price movements of the markets and the psychology of their participants. Only by taking into account and comprehensively studying the peculiarities of the behaviour of people as the leading market participants, can we build any kind of holistic and really functioning models of financial decision-making.

People will remain people after thousands of years, so the study of human nature and human behaviour now is of paramount importance and is, in fact, the formation of a kind of foundation for the further construction of the building of behavioural science.

References

Acharya, V. V., & Lambrecht, B. M. (2015). A Theory of Income Smoothing When Insiders Know More Than Outsiders. *The Review of Financial Studies, 28(9)*, 2534–2574.

Andersen, S., Ertaç, S., Gneezy, U., Hoffman, M., & List, J. (2011). Stakes Matter in Ultimatum Games. *American Economic Review, 101(7)*, 3427–3439.

Bailey, M., Cao, R., Kuchler, T., & Stroebel, J. (2017). The Economic Effects of Social Networks: Evidence from the Housing Market. *Journal of Political Economy*, forthcoming.

Baker, M., Mendel, B., & Wurgler, J. (2016). Dividends as Reference Points: A Behavioural Signaling Approach. *The Review of Financial Studies, 29(3)*, 697–738.

Barber, B., & Odean, T. (2000). Trading is hazardous to your wealth: the common stock investment performance of individual investors. The Journal of Finance, 2(LV), 773–806.

Barr, N. (2012). *Economics of the Welfare State*. 5th ed. Oxford University Press.

Basu, S. (1983). The relationship between earnings' yield, market value and return for NYSE common stocks. *Journal of Financial Economics, 12(1)*, 129–156.

Bell, A. M., Chetty, R., Jaravel X., Petkova, N., & Van Reenen, J. (2017). Who Becomes an Inventor in America? The Importance of Exposure to Innovation. NBER Working Paper 24062.

Berk, J., Stanton, R., & Zechner, J. (2008). Human Capital, Bankruptcy and Capital Structure. SSRN Electronic Journal.

Bloom, N., & Van Reenen, J. (2007). Measuring and Explaining Management Practices across Firms and Countries. *The Quarterly Journal of Economics, 122(4)*, 1351–1408.

Bogle, J. (2005). The Mutual Fund Industry 60 Years Later: For Better or Worse? *Financial Analysts Journal, 61(1)*, p. 37. Available at: http://johncbogle.com/wordpress/wp-content/uploads/2010/04/FAJ-Better-or-Worse-60th-anniv.pdf. Accessed 12 March 2019.

Buchanan, D., & Huczynski, A. (2017). *Organizational behaviour*. Harlow: Pearson.

Camerer Colin F. (2001). Behavioural Game Theory: Thinking, Learning, and Teaching. California Institute of Technology. Pasadena, CA.

Cfosurvey.org. (2019). Duke CFO Global Business Outlook. Available at: https://www.cfosurvey.org/.

Chernyavsky, A. D. (2014). Rationality and irrationality in economics. *Internet-journal Naukovedenie, 4(23)*.

Chuvakhin, N. (1960). Efficient Market Hypothesis and Behavioural Finance — Is A Compromise In Sight? Retrieved from http://ncbase.com/papers/EMH-BF.pdf

Cortes, K., Duchin, R., & Sosyura, D. (2016). Clouded Judgment: The Role of Sentiment in Credit Origination. *The Journal of Financial Economics, 121(2)*, 392–413.

Drkwresearch.com. (2019). Available at: https://www.drkwresearch.com.

Edwards, W. (1968). Book Review: European Behavioural Decision Theory, as SPUDM-14 displayed It. CONTRIBUTIONS TO DECISION MAKING: I. Jean-Paul Caverni, Maya Bar-Hillel, F. Hutton Barron, & Helmut Jungermann, eds. Amsterdam: Elsevier Science. Journal of Behavioural Decision Making, 9(4), 301–303.

Gagarina, M., & Goroshnikova, T. (2018). Psychological Factors of Multiple Debt Repayment Strategies. *Review of Business and Economics Studies, 6(3)*, 57–64.

George, S., Sheynin, J., Gonzalez, R., Liberzon, I., & Abelson, J. (2017). Decision-Making under Risk in Obsessive-Compulsive Disorder and Anxiety: A Cumulative Prospect Theory Model. *Biological Psychiatry, 81(10)*, p. S 127.

Graham, B. (1976). A Conversation with Benjamin Graham. *Financial Analysts Journal*, 32(5), 20–23.

Graham, J., Harvey, C., & Rajgopal, S. (2004). The Economic Implications of Corporate Financial Reporting. *SSRN Electronic Journal*, 14–15. Available at: https://faculty.fuqua.duke.edu/~charvey/Research/Published_Papers/P89The_economic_implications.pdf. Accessed 9 May 2019.

Guney, Y., & Iqbal-Hussain, H. (2007). Capital Structure and Market Timing in the UK. Retrieved from https://www.cass.city.ac.uk/__data/assets/pdf_file/0006/56373/2A_Guney.pdf

Heaton, J. B. (2002). Managerial Optimism and Corporate Finance. *Financial Management, 2(31)*, 33–45.

Henrich Joseph et al. (2004). Foundations of Human Sociality. New York: Oxford University Press.

Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica, 2(47)*, 263–292.

Kahneman, D., Diener, E., & Schwarz, N. (2003). Well-being. New York: Russell Sage Foundation.

Kahneman, D., Slovic, P., & Tversky, A. (1999). Judgement under uncertainty. Cambridge: Cambridge University Press.

Klyuev, V. (2008). What Goes Up Must Come Down? House Price Dynamics in the United States. IMF Working Papers WP/08/187.

Kumar, A. (2009). Who Gambles in the Stock Market? *The Journal of Finance, 64(4)*, 1889–1933.

Ma, Y., Sraer, D., & Thesmar, D. (2018). The Aggregate Cost of Systematic Forecast Errors. Working Paper. Retrieved from https://pdfs.semanticscholar.org/22b6/5ca4b77966600b4b29496ab25aace46f97b8.pdf?_ga=2.175599650.1690134518.1568984329–1623766573.1511244473.

Malmendier, U., Nagel, S., & Yan, Z. (2017). The Making of Hawks and Doves: Inflation Experiences on the FOMC. Working Paper. Retrieved from https://pdfs.semanticscholar.org/0981/5cd5805bb26f8b368d86d5d23fcfaf906680.pdf

Morewedge, C., Krishnamurti, T., & Ariely, D. (2014). Focused on fairness: Alcohol intoxication increases the costly rejection of inequitable rewards. *Journal of Experimental Social Psychology, 50*, 15–20.

Pouget, S., J. Sauvagnat, and S. Villeneuve (2017). A Mind Is a Terrible Thing to Change: Confirmatory Bias in Financial Markets. *The Review of Financial Studies 30 (6),* 2066–2109.

Russo, J. Edward, & Schoemaker, Paul J.H. (1989) Decision traps: Ten barriers to brilliant decision making and how to overcome them. New York: Doubleday.

Sanfey, A. (2003). The Neural Basis of Economic Decision-Making in the Ultimatum Game. *Science, 300 (5626)*, 1755–1758.

Schmidt, B. (2015). Costs and Benefits of Friendly Boards During Mergers and Acquisitions. *The Journal of Financial Economics 117(2)*, 424–447.

Schneider, C., & Spalt, O. G. (2016). Conglomerate Investment, Skewness, and the CEO Long- Shot Bias. *The Journal of Finance 71(2)*, 635–672.

Schoar, A., & Zuo, L. (2017). Shaped by Booms and Busts: How the Economy Impacts CEO Careers and Management Styles. *The Review of Financial Studies 30(5)*, 1425–1456.

Shiller, R. (1980). The Use of Volatility Measures in Assessing Market Efficiency. Cambridge, Mass.: National Bureau of Economic Research. NBER Working Paper No 565.

Shiller Robert J. Home Page. Available at: http://www.econ.yale.edu/~shiller/.
Shleifer, A. (2000). Inefficient Markets: An Introduction to Behavioural Finance. Oxford University Press UK.
Simon H.A. (1955). A Behavioural Model of Rational Choice. *The Quarterly Journal of Economics, 1(69)*, 99–118.
Slovic, P. (1991). Problems of Policy Implementation in Distributed Decision Systems. In R. Weissinger-Baylon & J. March, eds. *Political-military decision making*. New York: Pitman. Retrieved from https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/20633/229.pdf?sequence=1&isAllowed=y.
Sullivan, K. (1997). Corporate managers' risky behaviour: risk taking or avoiding? *Journal of Financial and Strategic Decisions, 10(3)*, 63–74.
Shyam-Sunder, L., & Myers, Stewart C. (1999). Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics, 2(51)*, 1999, 219–244.
Taleb Nassim. (2005). What Do We Know — The Scandal of Prediction. Available at http://web.archive.org/web/20130729205852id_/http://itc.conversationsnetwork.org/shows/detail786.html
Thaler, R. (1985). Mental Accounting and Consumer Choice. *Marketing Science 4(3)*, 199–214.
Thaler, R. H. (1988). Anomalies: The Winner's Curse. *The Journal of Economic Perspectives 2(1)*, 191–202.
Thaler, R. H. (1999). Mental Accounting Matters. *Journal of Behavioural Decision Making 12(3)*, 183–206.
Thaler, R. H. (2015). Misbehaving: The making of behavioural economics. New York, NY: W W Norton & Co.
Thaler, R. H., & Sunstein, C. R. (2003). Market Efficiency and Rationality: The Peculiar Case of Baseball. *Michigan Law Review 102(6)*, 1390–1403.
Torngren, G., & Montgomery, H. (2004). Worse Than Chance? Performance and Confidence Among Professionals and Laypeople in the Stock Market. *Journal of Behavioural Finance, 5(3)*, 148–153.
Towards Data Science. (2019). The house always wins: Monte Carlo Simulation. Available at: https://towardsdatascience.com/the-house-always-wins-monte-carlo-simulation-eb82787da2a3.
Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty, 5(4)*, 297–323.
Warusawitharana, M. and T.M. Whited (2016). Equity Market Misvaluation, Financing, and Investment. *The Review of Financial Studies 29(3),* 603–654.
West, K., & Shiller, R. (1991). Market Volatility. *Economica, 58(230),* 269.

Теория и практика поведенческой экономики в процессе принятия финансовых решений

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Аннотация. В статье рассмотрены вопросы, связанные с изучением поведенческих факторов при принятии финансовых решений. Цель исследования — проверка гипотезы о том, что участники рынка принимают финансовые решения, основываясь на своем опыте, интуиции, стереотипах, иллюзиях, эмоциях, а не только на критериях финансовой выгоды и рациональных предположениях. Исследованы и обобщены поведенческие механизмы и основные ошибки инвесторов и менеджеров при принятии финансовых решений на основе классической экономической теории. Приведены конкретные примеры реализации финансовых решений с использованием математических моделей. Практическая значимость данного исследования — выявление ошибок в применении классической экономической теории, возможности и способы их устранения. В качестве основного инструмента принятия финансовых решений представлена эффективная поведенческая модель, позволяющая избегать негативных последствий.
Ключевые слова: поведенческая экономика; принятие решений; инвестор; homo economicus; рациональные решения; иррациональность