How to Improve Effectiveness of Anti-corruption Expertise: A Public Procurement Case

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บทคัดย่อ

บทความนี้ ชี้ให้เห็นถึงความจำเป็นของวิธีการใหม่ในการต่อต้านการทุจริต เป็นการวิเคราะห์ถึงโอกาสที่ตัวแทนจะมีพฤติกรรมที่ทุจริต และประเมินแรงจูงใจที่จะทำให้เกิดพฤติกรรมสุจริต โดยบทความมีข้อเสนอเกี่ยวกับคุณภาพของกฎข้อบังคับ

บทความนี้ แสดงเงื่อนไขกติกาที่แตกต่างกัน 2 วิธี ในการต่อต้านการทุจริต กฎกติกาแรกใช้กฎข้อบังคับใหม่ และกฎกติกาที่สอง ใช้กับกฎข้อบังคับที่ใช้อยู่ในปัจจุบัน โดยมีข้อมูลเกี่ยวกับพฤติกรรมตอบสนองของตัวแทน (agents) ทั้งสองกรณี การวิเคราะห์เริ่มจากการสร้างแบบจำลองแสดงความพึงพอใจของสังคม (society's preferences) และนำมาเปรียบเทียบกับความพึงพอใจของตัวการ (principal's preferences) ที่อยู่ในแบบจำลองพร้อมกับกฎข้อบังคับใหม่ที่นำเสนอ บทความนี้เน้นความสัมพันธ์ระหว่างวิธีการเสนอแนะในการต่อต้านการทุจริตและการใช้กรอบทฤษฎีตัวการตัวแทน (principal-agent) ในแบบจำลอง โดยมีสมมติฐานเกี่ยวกับความสุจริต/ทุจริตของตัวการและตัวแทน

กฎกติกาแรกของการต่อต้านการทุจริตถูกนำมาประยุกต์ใช้กับกฎเกณฑ์ 2 ประเภท ในการกำหนดตัวผู้ชนะการประมูล นอกจากนี้ ยังใช้วิธีการที่สองในการต่อต้านการทุจริต โดยประยุกต์ใช้กับการประมูลราคาในการจัดซื้อจัดจ้าง

คำสำคัญ: การจัดซื้อจัดจ้าง การทุจริต ความเชี่ยวชาญในการต่อต้านการทุจริต แบบจำลองตัวการ-ตัวแทน พฤติกรรมกึ่งทุจริต กฎการให้คะแนนแนวเส้นตรง

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Abstract

The paper highlights the need for a new approach to anti-corruption expertise. The analysis of opportunities for *mala fide* behavior of agents and evaluation of incentives for their *bona fide* behavior must be supplemented by the assessment of proposed regulation quality.

In the paper two different algorithms of the extended anti-corruption expertise are introduced: the first is applied to a new regulatory tool, and the second to an existing tool for which some information on agents' reaction is available. In both cases the expertise begins from the modeling of society's preferences and comparing them with the Principal's preferences which are modelled on the base of proposed regulation. The relationship between proposed algorithms of anti-corruption expertise and the typology of principal-agent models, based on the assumptions of *bona / mala fides* of the Principal and the Agent, is underlined.

The algorithm of extended anti-corruption expertise of the first type is applied to two legal instruments regulating the determination of the winner in a tender. The second type algorithm for anti-corruption expertise may find application in the price English auction in public procurement.

Keywords: public procurement; corruption; anti-corruption expertise; principal-agent model; quasi-corruption; linear scoring rule.

1. Introduction

In the hierarchy of legal acts, the effect of which is aimed at combating corruption, the highest level document is the United Nations Convention against Corruption, adopted by Resolution 58/4 of the General Assembly on 31 October 2003.

Article 5, paragraph 3 of this document sets out the international legal framework for anti-corruption expertise: "Each State Party shall endeavor to periodically evaluate relevant legal instruments and administrative measures with a view to determining their adequacy to prevent and fight corruption".

At the level of Russian Federation (hereafter "RF"), the cornerstone instruments are the Federal Law #172-FL "On anti-corruption expertise of legal acts and drafts of normative legal acts" (hereafter "172-FL") and the Decree of the Government of the RF No. 96 with the same title, which approved the rules and techniques of anti-corruption expertise.

In accordance with Federal law, anti-corruption expertise of normative legal acts and drafts of normative legal acts are carried out "…in order to identify factors, which favor the corrupt behavior of agents, and their subsequent elimination. These factors

are the provisions of normative acts (draft laws and regulations), which establish for the law enforcer unreasonably wide margin of appreciation,or the possibility of unjustified use of exceptions to the general rule, as well as provisions dealing with uncertain, intractable, and (or) the onerous requirements for citizens and organizations and those thus creating conditions for corruption" (Article 1).

From the above, it follows that the subject of anti-corruption expertise is the identification and elimination of opportunities for corruption or, more broadly, *mala fide* behavior of law enforcers. Thus, the problem of assessing the quality of the proposed regulation, in the sense that this regulation really enables the agents to choose the best alternative for society, currently remains outside the scope of anti-corruption expertise.

It should be noted that the expertise can be aimed at the separate tools introduced by regulatory acts as well at their totality up to the regulatory act in general.

It seems reasonable to separate the anti-corruption expertise of regulatory tools, which have been introduced into the practice for the first time (the expertise of the first type), from the expertise of tools with the accumulated practice of enforcement in the framework of the corresponding country's regulation system (the expertise of the second type). For example, anti-corruption expertise of amendments to existing legal acts belongs to the second case.

In the RF, the "Law on Placement of Orders for Supplying Goods, Executing Works, and Providing Services for State and Municipal Needs" (Federal Law #94-FL, hereafter "PPL-1"), which came into force on 01.01.2006, had introduced auction as the primary procurement method. PPL-1 had originally introduced auction in the live outcry form, and subsequently, faced with multiple cases of *mala fides* of suppliers, replaced live auctions with e-auctions. Since by the time of enacting the law, the Principal had no information about the contracting authorities' response on the new regulation tool, then at that time only anti-corruption expertise of the first type could be applied.

On the contrary, by the time of enacting of the new Russian PPL – Federal Law "On the contract system in the procurement of goods, works and services for state and municipal needs" (Federal Law #44-FL, hereafter "PPL-2"), which came into force on 1 January 2014, with more than three years of implementation experience with e-auctions, there was a body of information regarding their performance. Hence, in this case we could apply anti-corruption expertise of the second type.

The rest of the paper is structured as follows.

In Part 2 the *dramatis personae* of the public sector agency model - society (or basic Principal), government (Principal) and contracting authority (Agent) and their preferences, defined as a corresponding set of alternatives, are introduced.

Bona fide and *male fide* principals (agent) are differentiated according to the extent of divergence of their preferences from those of society. Then, emerging from the principal *bona fides* identification, the extended anti-corruption expertise are defined as anti-corruption expertise.

Then, two different algorithms of extended anti-corruption expertise are introduced: the first is applied to a new regulation tool, whilst the second is applied to an existing regulatory tool for which information on practical experience in enforcement is available. In both cases the expertise starts from the modeling of society's preferences and comparing them with the principal's preferences generated by the proposed regulatory tool.

Part 3 comprises a case study of extended anti-corruption expertise applied to the new regulatory tool. We consider the linear scoring rule in the form of "Highest bid – Lowest bid scoring", which is applied in the Russian Federation in public procurement and in the procurement stage of public-private partnership projects.

Subsections 3.1-3.5 illustrate the function of the algorithm of expertise, while subsection 3.2 models society preferences. It is important to note that society's preference order is not obtained by aggregation of public buyer preferences (Arrow, 1963, p. 23). Instead we posit some assumptions about society's preferences, considering the society rather as a private buyer spending his own money, and who has no concern over third party claims (Moszoro and Spiller, 2012).

In subsection 3.4 we prove that if there are only two bidders then the principal, who prescribes comparison of their bids by the linear scoring rule, is *mala fide*. This fact is extremely important in the institutional context of the Russian Federation because the average number of bids/tender is about 2.

Finally, Part 4 offers some policy implications of the paper's findings.

2. Methods, Models, Algorithms

Methodological frameworks for modeling corrupt behavior are typically based on the "Principal-Agent" model: "Pathologies in the agency/principal relation are at the heart of the corrupt transaction" (Rose-Ackerman, 2008, p. 330). This model was developed to describe processes in the private sector and understands the agency relationship as "a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform

some service on their behalf which involves delegating some decision making authority to the agent" (Jensen and Meckling, 1976, p. 308). Accordingly, the principal faces the task of shaping a system of incentives for the agent, in which agent's preference relation, defined on a corresponding set of alternatives, coincides with preferences of the principal.

In turn, the starting point for modeling public sector processes is the assumption that to meet public needs the political élite (principal) delegates some decision-making authority to government agencies or other public entities (agents). In contrast to the private sector, the use of the "Principal - Agent" model in the public sector has its own specifics related to the fact that in a democracy the political élite, in turn, is also an agent, elected for the achievement of social objectives. Thus, the ideal preferences in this case are not the preferences of the political élite, but the preferences of society; thus we have good reason to denote the society as a basic principal.

We begin by assuming that the basic principal, the principal, and the agent (hereafter, in the figures mostly, BP, P, and A, respectively) equally identify a set of corresponding alternatives Ă, and on this set their preference orders $\succeq_{BP}$ (BPPO), $\succeq_{P}$ (PPO), , $\succeq_{A}$ (APO), correspondingly, are defined.

Definition 1. We state that the principal (agent) is *mala fide* (MF) if its preference order is different from the basic principal's preference order: $\succeq_{P} \neq \succeq_{BP}$ ($\succeq_{A} \neq \succeq_{BP}$), and *bona fide* (BF) if otherwise.

Consider the problem of anti-corruption expertise of a legal act, enacting a new regulatory tool for which there is no law enforcement practice. It appears that in this case the first step in anti-corruption is to determine the *bona fides* of the principal. Indeed, if the principal is *bona fide*, the vesting of the agent with the principal's preference order will inevitably lead to the achievement of public objectives, and if otherwise, will prevent their achievement.

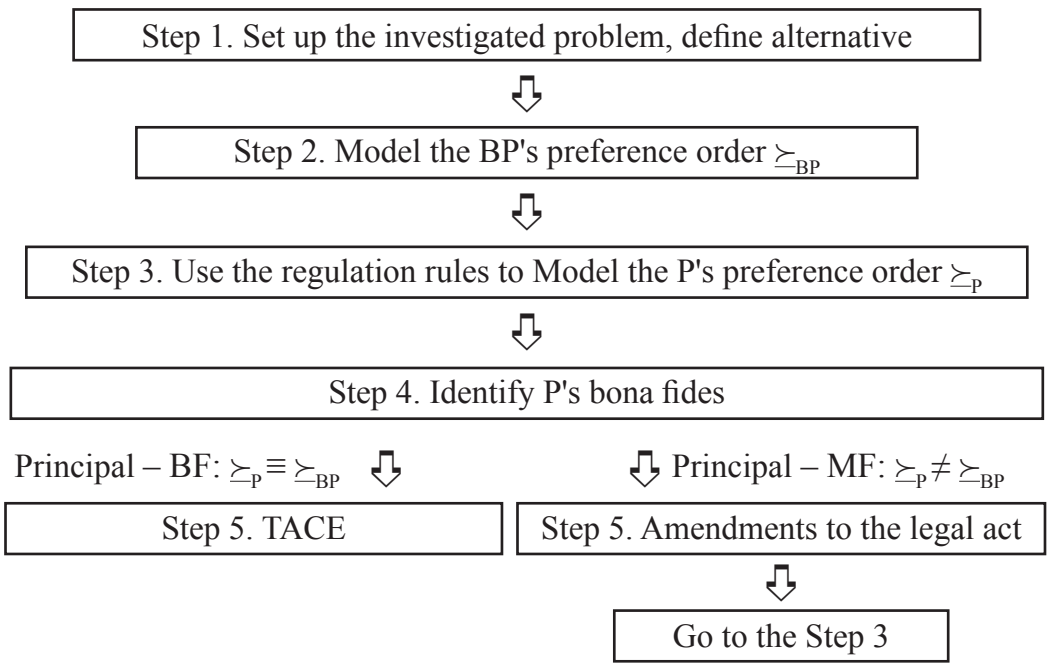
To determine the *bona fides* of the principal it is first necessary to posit hypotheses about the properties of society's preferences, build a model of BPPO, then, based on the proposed regulation, model the PPO, and, finally, determine the extent to which they match or differ.

In the first case, traditional anti-corruption expertise (TACE) aimed at the identification and elimination of corruptive factors is further applied, and in the second one it is necessary to preliminary develop appropriate amendments to the legal document in question.

Definition 2. Anti-corruption expertise, which includes in its algorithm the identification of the principal's *bona fides*, is denoted as the extended anti-corruption expertise (EACE).

Thus, we can depict an algorithm for extended anti-corruption expertise of a new regulatory tool (first type EACE).

Figure 1: Algorithm for extended anti-corruption expertise of a new regulatory tool



We now move on to the consideration of anti-corruption expertise of a legal act that applies a regulatory tool for which there is already practical enforcement experience. The enforcement practice can provide information on which the modeling of agent's preference order can be based; the algorithm of extended anti-corruption expertise becomes more complicated than in Figure 1.

Suppose that following the steps 1-4 of the above stated algorithm we have revealed the *bona fides* of the principal. Let us move to the identification of the agency problem's existence.

If the accumulated legal practice does not give us reason to consider agents as *mala fide*, we obtain a model that is trivial in terms of the agency relationship ($\succeq_P \equiv \succeq_A \equiv \succeq_{BP}$). Let us call this the 'Conflict-free model': the agent has the opportunity to choose and is prone to selection of the optimal alternative for society.

When the assumptions for the conflict-free model are true, the need for traditional anti-corruption expertise disappears, and researchers tend to focus on the study of the effectiveness of public contracts, trying to identify the most completely sources of agency costs and assessing their value (Laffont, Tirole, 1993), (Moszoro, Spiller, 2012).

Let us assume that law enforcement practice allows us to identify the existence of agents who violate the rules and, possibly, regulatory policies: $\succeq_A \neq \succeq_p$. They are obviously *mala fide*: $\succeq_A \neq \succeq_p \equiv \succeq_{BP}$. Models based on the assumption of the principal's *bona fides* and agent's *mala fides* ($\succeq_P \equiv \succeq_{BP}$, $\succeq_A \neq \succeq_{BP}$) are called models of bureaucratic (Jain, 2011, p. 3) or administrative (in the terminology of World Bank) corruption.

Models of bureaucratic corruption are most frequently used in the study of public procurement issues. However, in this case the agent is endowed with discretionary power and budget to carry out procurement. In this situation two of three necessary conditions of corrupt behavior arise (Aidt, 2003, p. F633): first, the relevant public official possesses the authority to design or administer regulations and policies in a discretionary manner; such discretionary power can allow him the extraction of existing rents or creation of new rents that can be extracted.

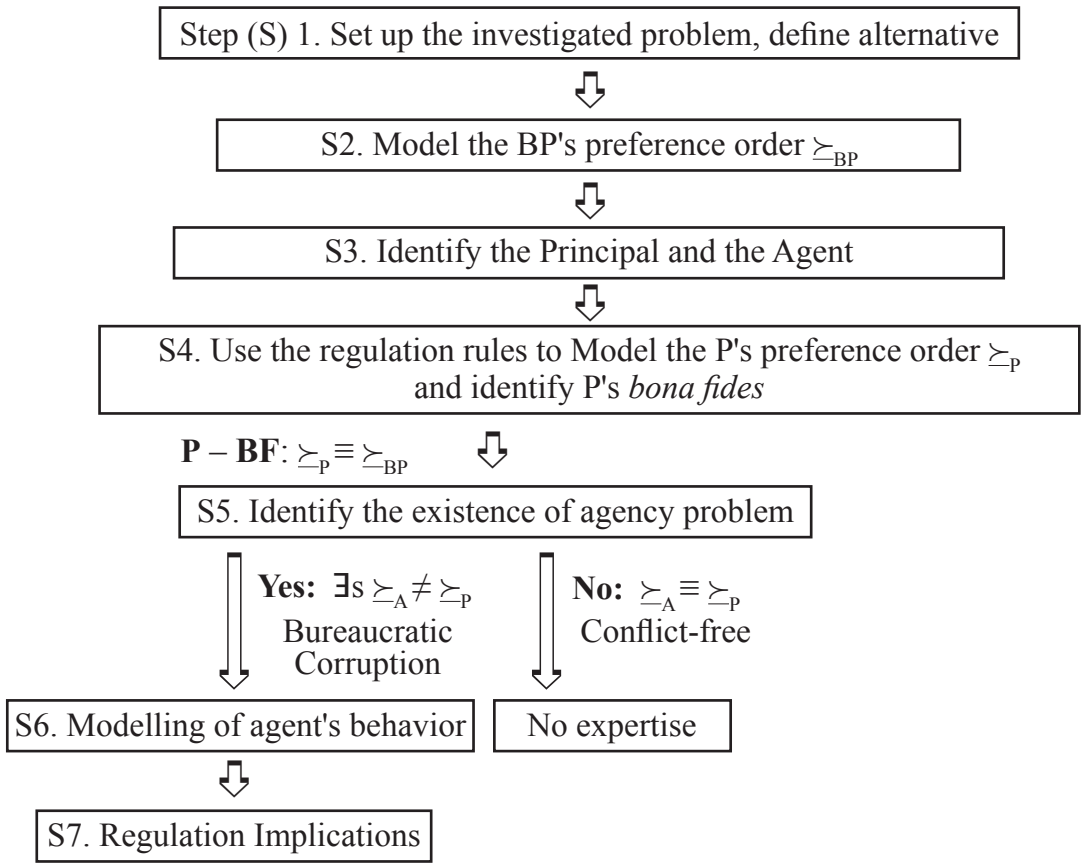
In pioneering research based on the assumptions of the principal's *bona fides* and the agent's *mala fides*, Rose-Ackerman examined the situation in which a private individual attempts to corrupt a bureaucrat in order to obtain a government contract (Rose-Ackerman, 1975, p. 187). In this case the agent is considered as a potential "bribee," and the actual level of corruption is determined by how well the institutions governing the (corruptible) bureaucracy are designed (Aidt, 2003, p. F635).

Modern studies of bureaucratic corruption have developed the ideas of Rose-Ackerman and are usually associated with modeling of agency costs and / or analysis of the specificity of the information asymmetry between involved parties (e.g., (Lambert-Mogiliansky, Majumdar and Radner, 2007), (Coppier, Piga, 2006)).

Thus, if the bureaucratic corruption has been identified, modeling the behavior of agents is made to satisfy the aims of traditional anti-corruption expertise: to identify and eliminate opportunities for corrupt behavior, and to assess and strengthen the incentives for the agent's *bona fides*.

We can now depict the algorithm of the second type EACE in the case of the *bona fide* principal (Figure 2).

Figure 2: Algorithm of extended anti-corruption expertise of a regulatory tool with accumulated enforcement practice: the case of the bona fide Principal



The bureaucratic corruption model implicitly assumes that the political élite has developed regulatory rules relying solely on the interests of its principal, society. At the same time, consideration of the political élite as an agent hired by society naturally leads to the perception of politicians as "…maximizing agents who pursue their own selfish interest rather than as benevolent agents seeking to maximize aggregate welfare" (Grossman and Helpman, 1994, p. 48). Corruption, directly related to activities of the political élite, was termed "grand corruption" (Rose-Ackerman, 1996), unlike petty corruption, which is treated in the bureaucratic model.

In attempting to develop the typology of corruption models, A. Jain offers to dispose the cases of corrupt behavior in between bureaucratic corruption and grand corruption – two extreme forms, limiting the scale of corruption activity (Jain, 2011, p. 3).

In the EACE of a legal act, involving the use of regulatory tool for which there is certain enforcement

practice, improvement the regulation rules, and, possibly, regulatory policy are heavily dependent on the specific of agent behavior.

These models, based on assumptions of *bona fides* ($\succeq_P \neq \succeq_{BP}$) and continue to consider *mala fide* agent ($\succeq_A \neq \succeq_{BP}$), then, depending on whether the agent is prone to break the existing regulation ($\succeq_A \neq \succeq_P$) or not ($\succeq_A \equiv \succeq_P$), we must distinguish between two types of models.

In the 'queue model' (Lui, 1985) and the 'auction model' (Beck and Maher, 1986) corrupt bureaucrats try to correct pre-existing government failures. In these models the agent's actions violate accepted rules of regulation, allowing us to identify differences in preferences between the principal and agent ($\succeq_A \neq \succeq_P$) and, correspondingly, the existence of the agency problem.

These models, based on assumptions of *mala fides* of both principal and agent, form a class of "efficient corruption" models ($\succeq_P \neq \succeq_{BP}$, $\succeq_A \neq \succeq_{BP}$, $\succeq_A \neq \succeq_P$) (Aidt, 2003, p. F633).

As an example of this kind of corruption, Nye viewed corruption of factory managers in the Soviet Union, which gave some flexibility to the centralized planning system (Nye, 1967, p. 420), and Laffont and Tirole – some instructions of USA Department of Defense (Laffont, Tirole, 1993, p. 476).

It seems that in the case of efficient corruption the modeling of the agent's behavior must be primarily aimed at identifying and eliminating the sources of regulatory inefficiency and, accordingly, to the conversion of efficient corruption into bureaucratic corruption. In this case, the result of the anti-corruption expertise is a changing of both regulatory legal acts and regulatory policies.

Nevertheless, the principal can create a system of incentives for the agent, which will warn the latter against taking any action in opposition to existing institutions. This kind of model ($\succeq_P \neq \succeq_{BP}$, $\succeq_A \equiv \succeq_P$) can be called a model of totalitarian corruption.

Thus, in the case of totalitarian corruption, anti-corruption expertise should be reduced to a regulatory impact assessment and to identifying they underlying reasons for the ineffective regulation: vertical corruption (Jain, 2001, p. 73-74) or bounded rationality (Simon, 1961, p. xxiv). It should result in a change in regulatory policy and practices, especially in terms of the expansion of discretionary powers and responsibilities of agents.

However, the linear approach of Jain, which limits the scale of corruption activity to bureaucratic corruption and grand corruption (Jain, 2011, p. 3), is not quite satisfactory for constructing a typology of models of corrupt behavior, due in particular, to the many different forms of grand corruption.

Let us therefore attempt to constructa typology of models of corrupt behavior, based on a combination of assumptions about *bona/mala fides* of principal and agent. We combine the above models in Table 1.

Table 1: Main directions of corrupt behavior modeling

Principal	Agent	Model Title
Bona Fide $\succeq_P = \succeq_{BP}$	Bona Fide $\succeq_A \neq \succeq_{BP}$	Bureaucratic corruption $\succeq_A \neq \succeq_P$
Mala Fide $\succeq_P = \succeq_{BP}$	Mala Fide $\succeq_A \neq \succeq_{BP}$	Efficient Corruption $\succeq_A \neq \succeq_P$
		Totalitarian Corruption $\succeq_A = \succeq_P$
Bona Fide $\succeq_P = \succeq_{BP}$	Bona Fide $\succeq_A = \succeq_{BP}$	Conflict-free model $\succeq_A = \succeq_P$

Analyzing Table 1, we see four of the five theoretically possible directions of modeling corrupt behavior: BM (principalis *bona fide*, agent is *mala fide*), M1M2 (M1 ≠ M2), M1M2 (M1 = M2) and BB.

Let us consider the model MB, based on the assumptions of principal's *mala fides* and agent's *bona fides* ($\succeq_P \neq \succeq_{BP}$, $\succeq_A \equiv \succeq_{BP}$).

Definition 3. Bona fide agent's actions violating the rules of regulation created by the mala fide principal will be referred to as 'quasi-corrupt behavior'.

Definition 4. The model, which examines bona fide agent's behavior in institutional conditions created by *mala fide* principal, will be referred to as the 'quasi-corruption model'.

It follows from Definition 3 that in conditions of quasi-corruption agents have broader discretionary power than in totalitarian case. Analysis of the applicationof this power may thus enable us to determine the main directions of changes to regulatory policy and, respectively, regulatory rules.

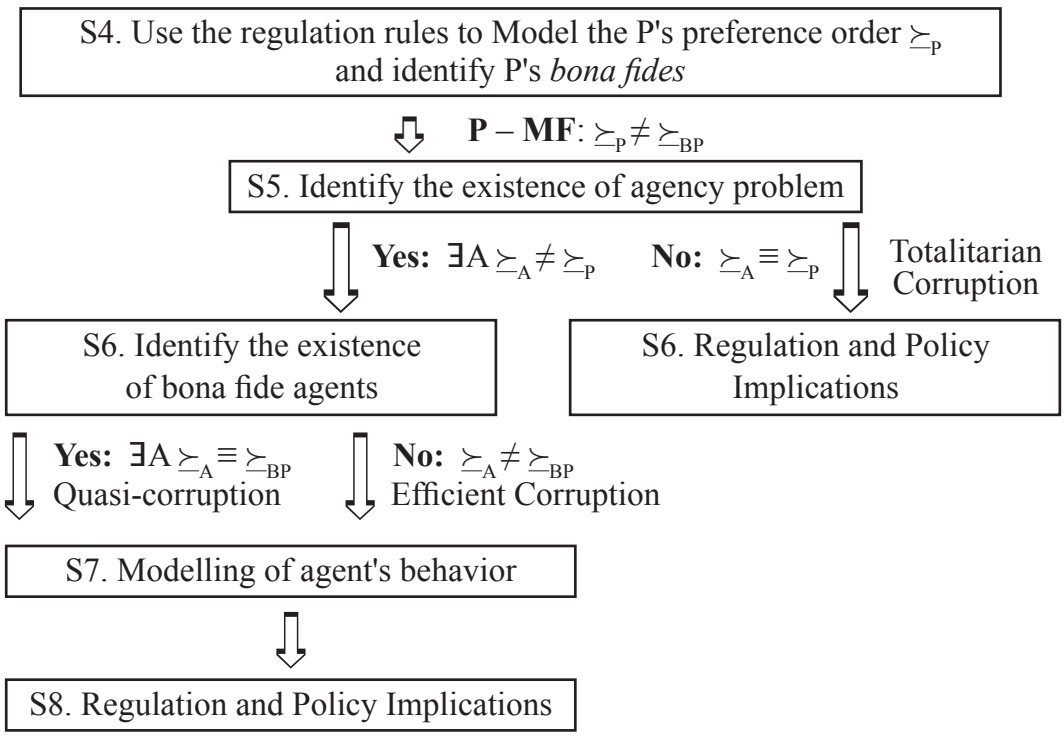
Introduction of the quasi-corruption model allows us to construct a full typology of corrupt behavior models, based on the methodology of agency relationships (Table 2).

Table 2: Typology of models of corrupt behavior, based on agency relationships methodology

Principal	Agent	Model Title
Bona Fide $\succeq_P = \succeq_{BP}$	Bona Fide $\succeq_A = \succeq_{BP}$	Conflict-free model $\succeq_A = \succeq_P$
	Mala Fide $\succeq_A \neq \succeq_{BP}$	Bureaucratic corruption $\succeq_A \neq \succeq_P$
Mala Fide $\succeq_P \neq \succeq_{BP}$	Mala Fide $\succeq_A \neq \succeq_{BP}$	Efficient Corruption $\succeq_A \neq \succeq_P$
		Totalitarian Corruption $\succeq_A = \succeq_P$
	Bona Fide $\succeq_A = \succeq_{BP}$	Quasi-Corruption $\succeq_A \neq \succeq_P$

Having constructed this typology of models of corrupt behavior, we can now develop another path of the algorithm for the second type (EACE), corresponding to the *mala fide* principal case (Figure 3). The first three steps are identical to the first model (Figure 1, Figure 2).

Figure 3: Remaining steps of algorithm for extended anti-corruption expertise for a regulatory tool with accumulated enforcement practice: the case of mala fide Principal



The Extended Anti-Corruption Expertise of Public Procurement: The Case of "Tightest Bid – Lowest Bid Scoring"

Let us apply the algorithm for EACE to two legal instruments regulating the determination of a winner in a tender. The algorithm for extended anti-corruption expertise assumes the preliminary identification of the principal's *bona fides*; thus we need to model the principal's preference order based on regulations, and compare this with the basic principal's preference order.

1. Step 1: Problem definition

Below we consider the linear scoring rule in the form of "Highest bid – Lowest bid scoring". The rule gives maximum score to the best bid and minimum score to the worst bid, and scores all other bids proportionally according to their distance from the worst bid (Dini at al., 2006, p. 309).

In Russia this rule was introduced within guidelines for assessment of bids and qualification of suppliers participating in public procurement tenders; these guidelines were enacted via a letter №AS-751/4-605 from the Ministry of Economic Development

dated 2 June 2000 (hereafter – Rule 1), and applied before the introduction of the new rules approved by Government Decree № 722 issued on 10 September, 2009.

Besides this, under the Federal Law №115-FZ on concession agreements, dated 21 July, 2005, a similar rule is still used to evaluate bids in public-private partnership projects (art. 32-5) (hereafter – Rule 2).

We shall apply the linear scoring rule to the algorithm of extended anti-corruption expertise of the first type (Figure 1) and identify whether it is possible to obtain a contract which is best for the basic principal under the conditions of the proposed regulation.

2. Step2: Mathematical modeling of basic principal's preference order

We will start from the basic principal's preference order modeling[1]. Let us assume that the basic principal is able:

1) to formalize the supplied good as a bundle of a finite number of its specifications (for simplicity reasons, let us include into the bundle the time of delivery, volume and duration of the warranty, operation and, perhaps, utilization costs etc.) $x = (x_1, x_2, ..., x_n)$, $x \in \widetilde{D}_i$, $i = 1, 2, ..., n$, $x \in \widetilde{D} \subseteq \widetilde{D}_1 \times \widetilde{D}_2 \times .... \times \widetilde{D}_n$,

then the Cartesian product $A \times B$ of sets A and B is the set of all ordered pairs (a, b), where $a \in A$ and $b \in B$;

2) to point out the feasible sets $\widetilde{D}_i$ for every specification: $x_i \in \widetilde{D}_i \subseteq D_i$, $i = 1, 2, ...,n$, $x \in \widetilde{D} \subseteq \widetilde{D}_1 \times \widetilde{D}_2 \times .... \times \widetilde{D}_n$,

The set of outcomes of the procurement procedure $A = \{(x, p) \mid x \in D, p \in [0, +\infty)\}$, where x is a formalized description of the supplied good and p is the price by which a contract is awarded, and its elements (x, p) we call, correspondingly, the set of contracts and contracts.

The initial (maximum) contract price, usually should be included in the procurement notice, is denoted by p_0. Let us introduce into consideration the set $\tilde{A} = \widetilde{D} \times [0, p_0]$, each point of which $a=(x, p)$ represents an acceptable contract for the basic principal.

Suppose that for a set $X\left(\tilde{A} \subseteq X\right)$ a preference order $\succeq_{BP}$ of the basic principal is defined, with the following assumptions about its properties.

1. BPPO is reflexive (Varian, 1992, indifferent between every two identical contracts.

Given the above assumption that the bundle of good's specifications containsall specifications essential to the buyer, it is natural to assume that, by comparing the two contracts that match the content, terms and cost of

[1] *This section is a simplified consideration of the principal's preferences modeling. A more rigorous consideration can be found in Ivanov (2015).*

delivery, he considers them as indifferent to each other.

2. BPPO is complete and transitive *(Ibid.)*.

Russian public procurement legislation requires that the contracting authority must be able to rank received bids based on the tender documentation. Hence, agent's preferences are supposed to be complete and transitive, and, *a fortiori*, the basic principal's preferences must possess these properties.

Thus, given these assumptions, the preferences of the basic principal on the set of contracts A can be represented by his indifference map - a symbolized set of indifference sets of the subject on which the arrow indicates the direction in which lie strictly more highly preferred alternatives for him (Ivanov, 2015).

Consider a bidding round for the purchase of differentiated goods. We restrictourselves to the case that considers all qualitative characteristics beginning from the second as selection criteria. This assumption means that any two acceptable contracts $\left((x,p)\in\widetilde{A}\right)$, which differ by values of characteristics x_i (i = 2, 3, ..., n) only, are indifferent to each other.

Thus, the quality of purchased goods may be described by a single numerical characteristic $x_1=q$ and, respectively, any contract can be represented as an ordered pair of numbers: $a = (q, p)$. We assume that q varies in the set $[q_0, +\infty)$ and the contract, which *ceteris paribus* corresponds to the larger value of characteristic q, is strictly more highly preferred for the basic principal.

Definition 5. That contract $a^1=(q_1, p_1)$ dominates contract $a^2=(q_2, p_2)$ $(a^1 \neq a^2)$, if both inequalities $q_1 \geq q_2$ and $p_1 \leq p_2$ are true.

Definition 6. The preference order is strictly monotonic[2], if for any contracts a^1 and a^2 such that a^1 dominates a^2 then $a^1 \succ a^2$.

Let us additionally assume that BPPO is strictly monotonic, continuous (Varian, 1992, p. 95) and convex *(Ibid*, p. 96).

Since by the monotonicity assumption, an arbitrarily small increase (decrease) of the contract price (*ceteris paribus*)gives to the basic principal a strictly less (more) preferable contract, the set of indifferences, representing his preference order, does not contain interior points, and the term "indifference set" may be replaced by the term "indifference curve".

Thus, given these assumptions, the basic principal's indifference curves are the graphs of strictly monotonically increasing, continuous, concave functions and his indifference map appears as shown in Figure 4.

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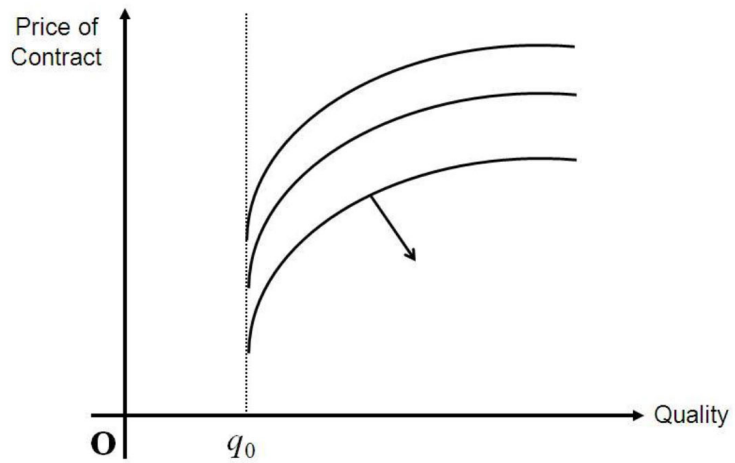
[2] *This definition differs from the traditional definition of strong monotonic preference order (Varian, 1992, p. 96); however, since it does not lead to confusion, the name of the property has not changed.*

Figure 4: Basic principal's indifference map: the case of differentiated goods



Thus, the indifference map tells how much extra money society is ready to pay for extra quality, as well as how much it is not ready.

3. Step 3: Identification of the principal and agent

The main features of the modern Russian public procurement system were formed under the influence of PPL-1. When the Law came into force, the Ministry of Economic Development was authorized to develop public procurement policy (in other words, to serve as a coordinator of public procurement policy); at the same time the Federal Antimonopoly Service was empowered with a monitoring role. The Co-ordinator and the Monitor, as bureaucrats, played such an active role in interpretation and implementation of PPL-1 that we have to identify them closer to the principal than to the agent.

As a result, the Russian Federation developed a system of regulation of public procurement with the aggregate Principal consisting of political and legal élites, Coordinator and Monitor and the aggregate Agent comprising regional public procurement authorities and bodies governed by public law.

We refer to the regional public procurement authorities as an agent because, on the one hand, their discretionary powers are very limited, and, on the other hand, they were authorized not only to coordinate and control regional public procurement but also to act as a public buyer.

4. Step4: Mathematical modeling of the principal's preference order

Let us move to the modeling of the principal's preference order if he prescribes to apply the linear scoring rule.

We suppose that there are two awarding criteria (quality and price) and the principal's preference order can be modeled by utility function, which attributes to each supplier's bid $a=(q, p)$ the following score:

$$U(a) = w_q Q + w_p P, \quad (1)$$

where: w_q and w_p are calculated as the weights of awarding criteria defined by the agent under some restrictions establishedby the principal. Q and P are defined as the scores of the same scale, assigned to the values of criteria according to the scoring rule.

Suppose that selecting stage of the tender have passed N ($N > 1$) suppliers with bids (q_1, p_1), …, (q_N, p_N). We designate

$$q_{\min} = \min_{1\le i\le N} q_i, \quad q_{\max} = \max_{1\le i\le N} q_i, \quad p_{\min} = \min_{1\le i\le N} p_i, \quad p_{\max} = \max_{1\le i\le N} p_i.$$

Let us begin with a variant of the rule applied in RF for public procurement tenders (Rule 1). In this case the scoring rule takes the following expression:

$$Q_i = 1 + \frac{q_i - q_{\min}}{q_{\max} - q_{\min}}(10-1) = 1 + \frac{q_i - q_{\min}}{q_{\max} - q_{\min}} \times 9, \; P_i = 1 + \frac{p_{\max} - p_i}{p_{\max} - p_{\min}} \times 9, \quad (2)$$

where: q_i and p_i denote the i-th supplier's quality and price bids, Q_i and P_i are the i-th supplier's quality and price score.

It is clear that for both criteria that Rule 1 assigns to the worst bid score 1, and to the best bid, a score of 10. The rule was named the "linear scoring rule" as is evident from the geometric interpretation in Figures 5a-5b.

Figure 5a: Rule 1 for the increasing criterion

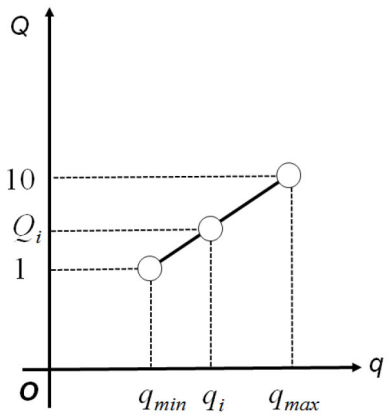
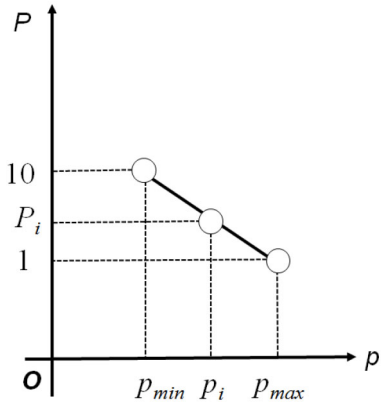


Figure 5b: Rule 1 for the decreasing criterion



Let us consider the variant of linear scoring rule which is applied in RF for concession tenders (Rule 2). In this case the rule takes the following expression:

$$Q_i = \frac{q_i - q_{\min}}{q_{\max} - q_{\min}}, \; P_i = \frac{p_{\max} - p_i}{p_{\max} - p_{\min}}. \qquad (3)$$

It is clear that for both criteria the Rule 2 assigns to the worst bid a score of 0, and to the best bid a score of 1 (Figures. 6a-6b).

Figure 6a: Rule 2 for the increasing criterion

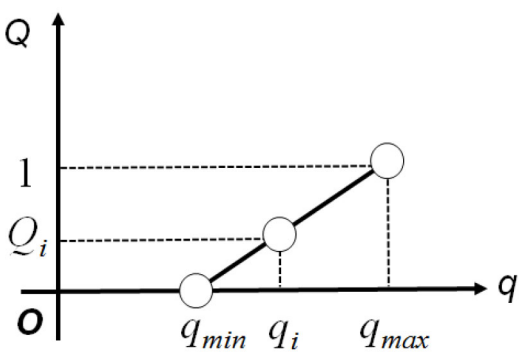
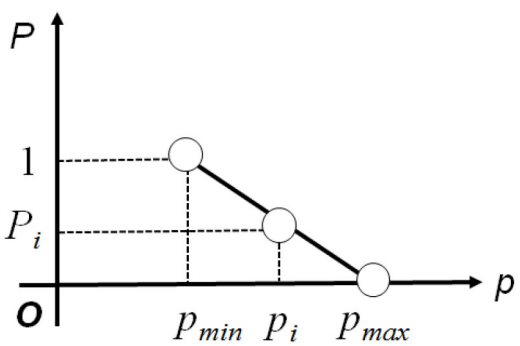


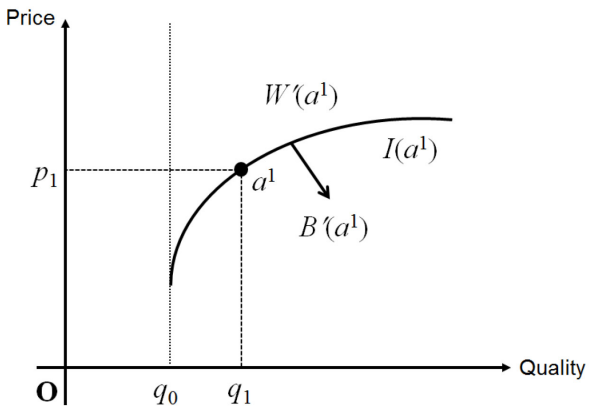
Figure 6b: Rule 2 for the decreasing criterion



Proposition. If the selecting stage of the tender has passed two bidders, and the principal prescribes to compare their bids by the linear scoring rule, then the principal is *mala fide*.

Proof. Let us consider an arbitrary contract $a_1 = (q_1, p_1)$ $(q1 \geq q_0)$. The BPPO can be modelled by the ordinal sets of contract a_1 (strictly better set $B'(a_1)$, indifference set $I(a_1)$, and strictly worse one $W'(a^1)$) (*Fig.* 7).

Figure 7: Basic principal's ordinal sets



Let us consider an arbitrary contract $a_2 = (q_2, p_2)$ $(q_2 \geq q_0)$, different from a_1. The Principal assigns scores to bids following way (1): $U(a) = w_q Q + w_p P$.

We assume that $w_q > w_p$ (the other case $w_q \leq w_p$ is considered the same), and the linear scoring rule is applied in the form of Rule 2 (the other case is considered the same).

Thus we have:

$$q_2 > q_1 \Rightarrow \begin{cases} U(a^1) = w_p \times P_1 + w_q \times 0 < w_q \\ U(a^2) = w_p \times P_2 + w_q \geq w_q \end{cases} \Rightarrow a^2 \succ_P a^1$$

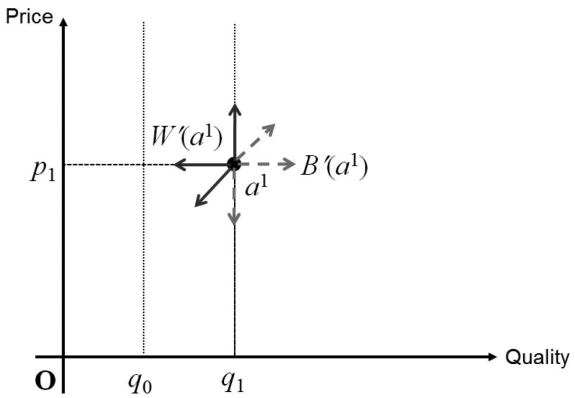
$$q_2 < q_1 \Rightarrow a^1 \succ_P a^2$$

$$\begin{cases} q_2 = q_1 \\ p_2 < p_1 \end{cases} \Rightarrow \begin{cases} U(a^1) = w_q \\ U(a^2) = w_p + w_q > w_q \end{cases} \Rightarrow a^2 \succ_P a^1$$

$$\begin{cases} q_2 = q_1 \\ p_2 > p_1 \end{cases} \Rightarrow a^1 \succ_P a^2$$

Thus, the Principal's preference order can be modeled by the ordinal sets of contract a^1 (strictly better set, indifference set (in this case $I(a^1)=a^1$), and strictly worse one) (Figure 8).

Figure 8: Principal's ordinal sets



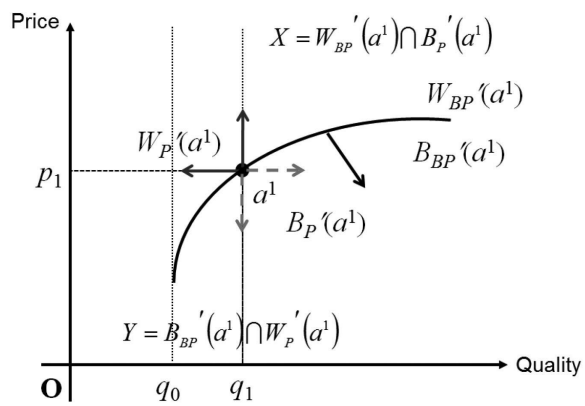
Let us introduce into consideration the set $X = W_{BP}'(a^1) \cap B_P'(a^1)$ and the set $Y = B_{BP}'(a^1) \cap W_P'(a^1)$. It is easy to prove that these sets are not empty. We shall prove it for the first set.

Actually, consider the contract $a^*=(q^*, p^*)$, such that $a^* \in I_{BP}(a^1)$ and $q^* > q_1$. Then the contracts $a=(q^*, p)$, $(p > p^*)$ belong to the set $W_{BP}'(a^1)$ and to the set $B_P'(a^1)$ at the same time.

Thus, for any contract $a^2 \in X = W_{BP}'(a^1) \cap B_P'(a^1) \left(a^2 \in Y = B_{BP}'(a^1) \cap W_P'(a^1)\right)$

we have: $\begin{cases} a^1 \succ_{BP} a^2 \\ a^2 \succ_P a^1 \end{cases} \quad \left(\begin{cases} a^1 \succ_P a^2 \\ a^2 \succ_{BP} a^1 \end{cases} \right)$ (Fig. 9).

Figure 9: The Principal's mala fides illustration



Hence, according to Definition 1, the Principal is *mala fide*. Thus, if there are only two bidders, the agent by means "Highest bid – Lowest bid scoring" cannot award a contract which is optimal for society.

5. Step 5: Amendments to the legal act

For the reasons explained above, regulatory amendments are therefore necessary. It is clear that in the case of two awarding criteria the linear scoring rule can be applied only if three or more bidders are participating in the tender.

Thus, the Principal may demand that the contracting authority designates in the tender documentation:

- the minimum number of suppliers' bids for the tender to be performed (Model Law, 53-j);
- that in the case of two bidders, who passed the selection stage, an alternative scoring rule is to be applied.

These amendments are especially important for the public procurement system of RF, which is characterized by the lack of competition (Table 3).

Table 3: Tenders' performance in RF (for federal contracting authorities)

	2010	2011	2012	2013	2014
Competition in the tenders (bids/tender)	2.18	2.07	2.04	2.24	2.27

Source: Federal State Statistical Service[3].

After making the corresponding amendments to the guidelines on assessment of bids and qualification of suppliers participating in public procurement tenders, the principal can move to the traditional anti-corruption expertise, aimed at identifying and eliminating corrupt factors.

[3] *http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/main/.*

Concluding Remarks

The paper proves the need for a change in our approach to anti-corruption expertise: an analysis of opportunities for *mala fide* agent's behavior and evaluation of incentives for his *bona fide* behavior have to be completed by the assessment of the possibility of making a best choice for society in terms of regulations proposed by the principal.

This paper has introduced two different algorithms of extended anti-corruption expertise: the first is applied to the new regulation tool (Figure 1); the second to an existing regulatory tool with accumulated enforcement experience (Figures 2-3). In both cases, the expertise starts from the modeling of society's preferences, then comparing them with the principal's preferences generated by the proposed regulation.

The paper refines the typology of models of corrupt behavior (Table. 2) based on the methodology of the agency relationships, as proposed in Ivanov (2015), and clarifies interdependence between types of corruption and the aims of agent's behavior modeling in the process of extended anti-corruption expertise.

In the paper, the algorithm of extended anti-corruption expertise of a new regulatory tool has been applied to two legal instruments regulating the determination of a winner in a tender in the RF.

A detailed explanation of the implementation of the main steps of the algorithm of extended anti-corruption expertise of a regulatory tool with accumulated enforcement practice (Figures 2-3) can be found in Ivanov (2012), where the quasi-corruption model was introduced and applied in examining the case of the use of English auctions in RF public procurement, and also in Ivanov (2015).

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