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**RELATIONSHIP BETWEEN CORRUPTION EXPECTATIONS, SOCIAL
CAPITAL AND TRUST: MODELLING AND ESTIMATIONS**

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Problem description

The term ‘corruption’ has a long history. According to several sources, it was first mentioned by Aristotle, from Latin *corruptus*, past participle of *corrumpere*, to destroy. There is no doubt that abuse of official position for personal gain, actions of other economic agents related to this concept (for example, bribe givers) and many other things that are included in the modern concept of corruption, were known even before Aristotle, but these phenomena remain relevant to study nowadays, minimizing their negative impacts.

A lot of attention is paid to anti-corruption policy all over the world because of its long history and high influence on everyday life. Nevertheless, according to different estimations of corruption level and its dynamics the problem remains burning for most of countries. For example, in 2017 Russian Federation was at 135st place of 180 in Corruption Perception Index rating, which is computed by Transparency International and grades countries by the level of cleanliness from corruption and by efficiency of anti-corruption measures. Anti-corruption policy is set in Russia not only by government, but also by non-governmental organizations. The national anti-corruption plan includes not only formal measures to strengthen monitoring and control, but also an impact on ethical and moral norms. Despite several measures taken, a high level of corruption is observed in the country, and the analysis of corruption relations and the reasons for their occurrence remains relevant to society.

It is also worth mentioning that in latest years there has been a huge progress in cross-disciplinary investigations, where mathematical and instrumental methods are applied to economic, psychological, political, institutional studies.

In our opinion, the study of the relationship between corruption expectations, social capital and trust in society has both theoretical and applied value. The scientific significance lies in expanding the prerequisites about the possible motivation of economic agents to illegal activities in cases where they do not behave rationally. From a practical point of view, the identified relationships

can be applied to the architecture of anti-corruption policies, using the opportunity to influence corruption expectations through social capital.

Literature review

There are several ways of corruption research in the existing literature. Theoretical works usually model corruptive behavior of economic agents, empirical reveal regularities by countries, regions, forms of corruption. Research can be devoted to anti-corruption policy, the causes of corruption and its outcomes.

The experience of different countries in anti-corruption policy is presented, for example, in research of Izotova et al. (2017), Ageev, Kuzmenko (2016), Hutler, Shah (2000), Leak (1999), Meagher (2004). As usual, the severity of punishment, the state of economy and politics, cultural aspects are claimed to be the reason for failure.

The works of Okhotsky (2009), Galitsky, Levin (2008), Bystrova, Silvestros (2000), Luo (2006), Johnston (1986), Nye (1967) are devoted to social and political consequences of corruption. From the economic point of view corruption often touches upon welfare growth, mainly by limiting the competition (Lopukhin (2010); Mauro (1995)), or, on the contrary, by giving opportunities for optimising economic interactions when formal institutions happen to be ineffective (Levin (2008); Ahlin, Pang (2008); Méndez, Sepúlveda (2006); Leff (1964)). Mathematical methods, for example game theory modelling, is often used for measuring outcomes and in forecasting (Ahlin, Pang (2008); Levin, Ciric (1998); Ugolnitsky, Usov (2014)). Expert assessments of losses from corruption are presented, for example, in the report of INDEM (1998).

Researchers claim that the reasons for corruption flourishing are the readiness of formal institutions for the market economy that came after socialism, the openness of the economy (Treisman (2000), Levin, Satarov (2000), Varese (1997)), and cultural and religious factors (Porta et al. (1996)). The link between corruption, trust and economic inequality, the level of social capital in post-soviet countries are mentioned as well (Rothstein, Uslaner (2005), Rose-Ackerman (2001a)).

In empirical works researchers more and more often turn to individual surveys of people or firms (Andrienko (2002); Svensson (2003)) because corruption happens to be highly latent and official statistics gives lower estimations and no way to reveal the reasons for the phenomenon. Macroeconomic phenomena form because of individual actions, whereas individual opinions result from the idea of general corruption level.

Cross-disciplinary approach in this field requires using formal mathematical methods and including in the models not only formal cost-benefit motivation, but also personal or social factors. INDEM research that huge corruption is no more a rational action, but mostly a social phenomenon explained for example by anomie theory of Durkheim. But in the existing research social aspects are usually included in case studies, and these works lack formalization (Dasgupta (2000), Uslaner (2008)).

It's worth mentioning that both theoretical and empirical works lack exploring bribe giver behavior. However, in addition to extortion of a bribe by an official, corruption may take the form of bribery initiated by the bribe giver, therefore, it is necessary to pay attention to the analysis of her motivation. From this point of view, it is of interest to study not facts of corruption, but corruption perceptions at the individual and public levels. An understanding of the mechanisms of formation of corruption expectations and opportunities to influence them is required.

Objectives of the research

Corruption expectations are presented in this work by a formal indicator of corruption perceptions built on social surveys. By corruption perceptions we mean indirect estimations. By corruption expectations we mean indirect estimations based on social surveys data.

Social capital is presented in this work by formal quantitative indicators including trust evaluations. By social capital we mean the amount of links between members of the society and the result of interactions between them. According to

one of the approaches to social capital definition, it includes networks, norms and trust.

The aim of this research is to reveal at individual and group level the relationship between corruption expectations and social capital, including trust. To approach this goal the following objectives were achieved:

1. Empirical test of the hypotheses about relationship between corruption perceptions and social capital on micro and macro data, using new regression model specifications, that consider social capital as an explaining variable.

2. Introducing the measure of social capital influence on the rate of corruption expectations diffusion, by suggesting the network empirical model that can be used in the lack of dynamic data.

Methodology and main findings

In the first chapter, based on the author's review and analysis of existing research, the terminology is introduced, possible relations between the studied objects are examined, and hypotheses on the relationship between the perception of corruption by economic agents, social capital, and trust in society are suggested.

The following statements about the relationship between corruption and social capital prevail in the literature: low trust in public systems is accompanied by high levels of corruption; developed social ties with weak formal institutions, for example, in post-socialist countries, contribute to the growth of corruption; interpersonal and public trust have different relationship with the level of corruption expectations.

However, there are works that have different results, for example, there are no definitive conclusions about the relationship between horizontal trust and corruption. In addition, in existing studies, the relationship between corruption and social capital is mainly studied in case studies or macroeconomic research, while little attention is paid to microdata. A relatively small amount of research has been carried out on Russian data. The lack of attention to microdata also leads to the fact

that the behavior of the briber, particularly her corruption expectations, is weakly studied.

The review of the literature suggests that the issue of the motivation for the participation of economic agents in corruption lacks significant research, which, in the context of an active fight against corruption in Russia, indicates the relevance of this study.

In the present work, based on the studied literature and considering the points of view missing in it, the following hypotheses are put forward.

1. Social capital indicators have significant relationship with corruption expectations. In the existing literature there are results concerning the relationship between social capital and facts of corruption, the direction of communication in various studies is different. The objective of this work is to identify the relationship of social capital exactly with corruption expectations and to determine the direction of this relationship.

2. The level of corruption expectations depends on the structure of social networks of potential bribe givers. The literature has results demonstrating that corruption may be the result of a habit or a social norm, therefore it is important to determine the significance of the environment in shaping corruption expectations.

The next two chapters are devoted to testing these relationships on micro and macro data using the methodology suggested in this research.

In the second chapter the hypothesis on the relationship between corruption perceptions and social capital is tested. To perform that new specifications of regression models are suggested.

On the macro level nonparametric estimations on the data by country show the relation between corruption perceptions and key economic indicators. The analysis on the data of Corruption Perception Index and shadow economy gives significant difference between transition and developed economies (according to the World Bank classification). It is also mentioned that the relation between shadow economy and corruption can be both complementary and substitutional.

We also notice that the growth of formal institutions leads to decrease of corruption expectations (see Table 1).

Table 1

Estimation with institutional indicators. Explained variable — Corruption Perception Index. Reduced table: only institutional variables. RE — random effects, FE — fixed effects, «+» — significantly positive, «-» — significantly negative, «no» — insignificant. Significance at 10%.

	All		Transaction economies		Others	
	RE	FE	RE	FE	RE	FE
Control for corruption	+	+	+	+	+	+
Government efficiency	+	+	+	no	no	+
Policy efficiency	+	+	+	+	+	+
Role of law	+	+	+	no	no	no
Political stability	+	no	no	no	no	no
Freedom of speech	-	no	-	no	no	+
Obs.	1595	1595	1276	1276	319	319

Source: author's estimations based on World Bank data and data of Buehn, Schneider (2012).

Including trust variables in the model (WVS data, see Table 2) shows that there is a significant relationship between social capital and corruption perceptions. Therefore, the results on the macro level confirm the approach that considers corruption not only as an economic but also as an institutional phenomenon.

Table 2

*Estimation with trust indicators. Explained variable — Corruption Perception Index. Reduced table: only trust variables and shadow economy. *** - significance at 1%.*

	Standard trust	In-group trust	Out-group trust	Honesty	Non-specific trust	Generalized trust
Shadow ec. (% of GDP)	-0,559*** (0,0968)	-0,723*** (0,152)	-0,672*** (0,151)	-0,749*** (0,141)	-0,632*** (0,140)	-0,589*** (0,151)
Trust	44,66*** (9,315)	98,18*** (30,17)	87,71*** (20,23)	53,63*** (18,47)	80,28*** (16,04)	119,3*** (23,11)
Obs.	660	353	344	358	358	344

Source: author's estimations based on World Bank data, WVS data and data of Buehn, Schneider (2012).

Estimations on individual data (RLMS-HSE¹, 2006) involve social capital in trust variables and lack of fear to lose job. These characteristics reflect cognitive social capital. Model estimations (see Table 3) show insignificance of income and

¹ "Russia Longitudinal Monitoring survey, RLMS-HSE", conducted by the National Research University Higher School of Economics and ZAO "Demoscope" together with Carolina Population Center, University of North Carolina at Chapel Hill and the Institute of Sociology RAS

significance of interpersonal trust, whereas at macro level the welfare was significant.

Table 3

Estimations for informal payments

Reduced table: only key variables. Explained variable is informal payment for the services listed in the head of the table. «+» — significantly positive, «-» — significantly negative, «no» — insignificant. Significance at 15%.

Variable	Housing management	Registration of property	Registration of civil status	Police	Courts	Road police
Real income	no	no	no	no	no	–
Distrust to management	+	+	+	no	no	no
Lack of fear to lose job	no	–	–	–	–	+
Female	no	no	no	–	no	no
Single	no	–	no	no	–	no
Has subordinates	no	–	no	+	no	no
Governmental job	no	–	no	no	+	no

Source: author's estimations based on RLMS-HSE data.

The existence of relationship between formal and informal institutions was tested in this work for the same year (2006) on the data on European Social Survey. The distributions on interpersonal trust in Russia, Ukraine and European countries (including Estonia, that has also socialist past) were compared. For Russia and Ukraine there is a local maximum in the lower trust area, which is not typical for other countries in the survey.

The results of the second chapter allow to talk about the importance of institutional environment for corruption perceptions.

In the third chapter the hypothesis on the change of corruption perceptions depended on the structure of social links is tested. A method of empirical estimation of corruption perceptions diffusion is suggested, that considers social networks characteristics in absence of dynamic data. The structure of social networks allows to estimate social capital of the explored group quantitatively.

We suggest estimating the level of social capital and its relationship with corruption expectations on the structure of social network, where the members of the group are the nodes of the network and social links are the edges. Following

Adali (2010), we consider the frequency, the destination and the aim of the interactions. As for each network the density of answers is different, we suggest the algorithm of choosing the number of questions to build the network. The aim of the algorithm is to get the network of one connected component.

The suggested method is the following. Let $\theta_i \in [0, 1]$ be an individual characteristic of agent i , reflecting his or her (subjective) level of corruption expectations, A is the contingency matrix with elements a_{ij} , \tilde{A} is the same matrix normalized for each node by the number of outgoing links, has elements

$$\tilde{a}_{ij} = \frac{a_{ij}}{\sum_{k=1}^n a_{ik}}, \quad \tilde{A}^T \text{ is contingency matrix normalized for each node by the number}$$

of incoming links. Then reciprocal influence of agents is suggested to be estimated by the following system of equations:

$$\theta = \alpha \tilde{A} \theta + (1 - \alpha) \tilde{A}^T \theta + \varepsilon, \quad (3)$$

where θ is the vector of characteristics with the size $1 \times n$, n is the number of nodes in the network, α is the scalar weight of outgoing links, $(1 - \alpha)$ is the scalar weight of incoming links, therefore measures the influence of linked nodes on the characteristics of the agent, ε is the vector of individual deviation from the average.

The value α defines the general measure of influence for the network, and ε defines the deviation of the network from the steady state, when individual components become insignificantly small.

Therefore, the formal task of α identification can be reduced to minimization of ε norm, and the estimations (if the network is close to steady state) show how important are outgoing links compared to incoming. The practical implication can be found in defining the expected state of network and the importance of opinion of the society.

Empirical analysis using the method is performed on the data of a survey conducted within this research in 2014-2015 in four Russian universities: in Nizhny Novgorod, St. Petersburg, Vladivostok and Voronezh. Each survey is

conducted for a relatively localized social group: students of the same year or study group, 6 groups in all, 370 respondents aged 20-22 years old.

The first part of the questionnaire consists of questions identifying the structure of the social network (“With whom to do go to gym?”, “Who helps you in studying?”). The second part is devoted to measuring corruption expectations, including general attitude to corruption, the evaluation of the rate of sanctions, readiness to pay bribes.

Three groups of proxy variables were formed on the answers:

1. individual loyalty to corruption;
2. the estimation of the level of corruption in the society;
3. the level of justifying corruptive actions.

The estimations are made for each proxy separately. The values of happen to differ for the groups under evaluation - probably due to their location far from the steady state or due to the difference in starting characteristics. The method suggested can be used to further testing similar diffusion of the characteristics in groups, moreover, the implication is not limited to corruption expectations, but also can be found in other studies, where peer effects are considered (Poldin et al. (2016), Ahern et al. (2014), Gaviria (2001)). Further development of this method is worth focusing on the exploration of group characteristics that have significant influence on the value of parameter: for example, network density, the number of incoming and outgoing links.

Consequently, we have achieved the following **results**.

1. The suggested specifications of econometric models revealed on the empirical data by country a negative relationship between the level of corruption perceptions and welfare, a positive relationship between the level of corruption perceptions and the weakness of formal institutions. New empirical results have been obtained, supporting the hypothesis that the corruption perceptions can be found not only in complementary, but also in substitutional relations with the size of the shadow economy. This conclusion suggests that the nature of corruption

may differ: it can be a result of excessive either insufficient control of the market. Significant differences have been revealed between corruption perceptions in developed and post-socialist countries, including those related to the different quality of formal and informal institutions and the peculiarities of the historical development of countries, for example, the socialist past. The great significance of informal institutions (trust) in comparison with the formal ones has been revealed.

2. Specifications of micro econometric models that consider cognitive social capital (trust) in the analysis of corruption expectations are suggested. Empirical estimates on Russian data showed that, unlike corruption models based on the costs and benefits theory, as well as the results obtained in the macro data analysis, an individual's income (usually considered in theoretical models as a budget constraint) has little effect on her decision to give a bribe, and the key factors are institutional — in particular, a significant relationship has been identified between trust and the level of corruption perceptions at the individual level.

3. Based on the suggested method of empirical analysis of the spread of corruption expectations about indicators of structural social capital (networks) in the absence of dynamic (in time) observations on the network, it was demonstrated that an individual's environment has a significant impact on her attitude to corruption. Therefore, including social capital in microeconomic analysis is useful to study the spread of corruption expectations. This method can also be applied to the analysis of other forms of deviant behavior and other phenomena experiencing peer group effects.

Contribution

1. In this research the hypotheses on the relationship between corruption expectations, social capital and trust are formulated and tested using the suggested complex of mathematical and analytical methods.

2. Nonparametric analysis of data by countries and applying new specifications of regression models, considering social capital, allowed to explain

the difference in corruption perceptions by historical, economic and institutional factors.

3. Micro data analysis of corruption perceptions using new specifications of regression models with social capital revealed the relationship between corruption perceptions and social capital.

4. Applying the suggested mathematical method of estimation, the peer group effect based on the system of equations in the absence of dynamic data allowed to consider the measure of influence of social capital on the diffusion of corruption expectations.

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