István János Tóth[+] and Miklós Hajdu[*]

Factors Affecting the Corruption Risk and Intensity of Competition in Public Procurement at the Level of Local Government

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+: senior research fellow at IE CERS and director at CRCB (istvanjanos.toth@crcb.eu)
*: PhD student at Corvinus University of Budapest and research fellow at CRCB (miklos.hajdu@crcb.eu)

Abstract

This paper investigates the level of corruption risk and intensity of competition of public tenders at the municipal level in Hungary. It analyses the relationship of these factors with the level of human capital, economic development, and settlement size. The paper's novelty is the sub-national level, and that the research is based on microdata (contract level data), whereas the earlier research has typically been based on perception data and investigated these issues at the country level. We use Hungarian public procurement data from 2014 to 2018. The database of the analysis contains 16 thousand public procurement contracts of 291 Hungarian cities. The related raw data regarding public procurement contracts for municipalities was extracted from the Hungarian Public Procurement Authority's homepage by the Corruption Research Center Budapest (CRCB). The results suggest that the level of risk of corruption is higher in the smaller settlements and settlements with lower levels of human capital. Behind this, we suppose two mechanisms.
On the one hand, if the level of education and income in a town is higher, it is easier for the local government to recruit well-educated and experienced public procurement experts from the local labor market and expand the local administration staff government, well-educated experts. These experts will act efficiently, and they are better able to help the local government of towns control corruption in public procurement more effectively. On the other hand, if a town has a higher level of education, a higher income level, and a higher business density, it is more likely that the local citizens, the local entrepreneurs, can force the local authorities to control corruption. As a type of white-collar crime, public procurement corruption is often carried out through complex transactions that better-educated people more easily understand. Also, public procurement corruption requires knowledge of abstract concepts (e.g., market price, competition, rent, welfare loss, Etc.), which are more understandable to educated people. Therefore, in towns with insufficient education, low income, and weak business density, the local social actors that could enforce corruption control are naturally weaker.

JEL classification: D73, H57, H72

Keywords: public procurement, intensity of competition, corruption risk, local government, Hungary

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Authors:
István János Tóth & Miklós Hajdu

Head of research:
István János Tóth

Corruption Research Center Budapest
e-mail: info@crcb.eu
internet: http://www.crcb.eu/

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Introduction

This paper examines corruption risks and competition intensity at a municipal level based on Hungarian public procurement data[1]. It analyzes the relationship of these with the level of human capital, economic development, and settlements' size. The paper's novelty is that it uses the sub-national level data instead of national-level data and that the research is based on microdata (contract level data). In contrast, the earlier research has typically been based on perception data and investigated these issues at the country level.

One of the main characteristics of good governance is its ability to control corruption. Within this, well-functioning public institutions can conduct public procurement with low corruption risks and high competition. According to the OECD, public procurement is one of the areas most affected by corruption (OECD, 2016). Thus, it is essential to analyze public procurement corruption and enable governments to fight against corruption in this area at the local level.

To achieve this goal, we must first measure corruption risk and competition intensity based on micro-level hard data. We need to look at how municipalities' socio-economic characteristics and their size influence how they can control corruption risks and increase the intensity of competition in public procurement.

The study also aims to help the central government by analyzing the links between corruption risk, the intensity of competition, local governments' openness, settlement characteristics (level of human capital, economic development, the strength of the local business community, and the size of settlement).

We analyze the factors that promote higher-level control of corruption risk and enforce public procurement competition at the local level. Where, in what settlements, and how the central government should act to achieve these goals?

To analyze the above questions, we use Hungarian public procurement data from 2014 to 2018. The database contains the data of 16,000 public tenders of 291 Hungarian cities. The related raw data regarding public procurement contracts for municipalities was extracted from the Hungarian Public Procurement Authority's webpage[2] by the Corruption Research Center Budapest (CRCB).

Besides corruption risks and intensity of competition, the institutional quality of the Hungarian cities is considered well: the transparency and information-richness of their homepage as a proxy of the local government's openness.

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[1] The present study is part of the Corruption Research Center Budapest (CRCB) research program financed by the Hungarian National Scientific Found (the identification number of the grant agreement: OTKA, K116860) and donation of Hungarian citizens. The municipal website's survey was carried out by CRCB in collaboration with the Budapest Institute (https://bit.ly/2YkeF02) and financed by the Open Society Initiative for Europe (OSIFE). The research is also part of Miklós Hajdu's Ph.D. thesis at the Doctoral School of Sociology of the Corvinus University Budapest.

[2] See: https://www.kozbeszerzes.hu/adatbazis/keres/hirdetmeny/

Literature

The empirical analysis of corruption in a cross-national context was begun based on the corruption perception indices prepared by business risk analysts and polling companies (Treisman, 2000). One of the primary sources of data characterizing corruption in different countries is the Corruption Perception Index (CPI) of Transparency International (Transparency International, 2017). The yearly publication of the CPI was begun in 1995, and its latest values were calculated for 176 countries. CPI is a widely-used tool by scholars, journalists, and policy-makers for assessing the extent of corruption, even though it has several weaknesses leading to controversial results and interpretations (Barrington, 2014). Also, the CPI methodology was revised several times, which affects the comparability of its values over time (Rohwer, 2009).

The Control of Corruption index of Worldwide Governance Indicators (WGI) reported by the World Bank also includes data concerning corruption perceptions (The World Bank, 2017). The project covered more than two hundred countries since 1996, and its indicators are also constructed based on multiple perception-based data sources, like surveys of firms and households, subjective assessments of commercial business information providers, NGOs, multilateral organizations, and public-sector bodies (Kaufmann, Kraay, and Mastruzzi, 2011). This index is also affected by several methodological issues (Kaufmann, Kraay, and Mastruzzi, 2006).

Some essential points of the general criticism towards these subjective perception indices are that perceptions may or may not be linked to the experience (Rose and Peiffer, 2012). They may be distorted by developments on broader domains, for example, by economic growth (Kurtz and Schrank, 2007) or because respondents who are taking part in corruption may be motivated to underreport its extent, or those who are not involved lack accurate information (Golden and Picci, 2005). Also, instead of relying on their own experiences, the respondents may formulate their opinions based on the media coverage of corruption cases (Lambsdorff, 2001).

Fazekas, Tóth, and King (2014) discussed a new, objective method in assessing the presence of corruption, called corruption risk indicators. Such indicators are constructed by identifying 'red flags' in specific administration fields that restrict transparency. This method utilizes administrative data available in practically every developed country and avoids the pitfalls of both perception-based indicators and previous 'objective' measures of corruption. It creates an estimation of institutionalized grand corruption that is consistent over time and across countries. The proposed research will rely on this assumption; corruption risks will be considered based on public procurement data and indicators characterizing the transparency of data publication on official homepages. This kind of information can be used as proximity measures for the level of corruption and the quality of bureaucracy on local governments' level by relying on the

Weberian approach that bureaucratic rules are described in advance, and if such guidelines are missing or weak, then corruption thrives.

Based on our experiences, it can be concluded that the methodology concerning the corruption risk and competition intensity indicators is proven to be a fruitful field for research on the domains of public procurement (Fazekas et al. 2014; Fazekas et al. 2016, Tóth and Hajdu, 2017b, 2018a, 2018b). Other papers also use this approach (Szűcs, 2017; Pertold, and Paluga, 2017; David-Barrett, and Fazekas, 2016; Broms et al. 2017). The quality of data published on the local governments' websites also gives relevant information on local government behavior concerning transparency and controlling corruption (Kelemen et al. 2014).

Additionally, the online data gathered and published, for example, by Google, has excellent potential in collecting objective information characterizing the level of corruption from the viewpoint of the public online interest towards it. Google Trends[3] provides data about online search queries concerning keywords and search terms that are used, for example, for predicting economic indicators (Choi and Varian, 2012), measuring interest in particular topics (Le Nghiem et al., 2016). However, the analyses based on Google Trends also have some serious pitfalls. An application using its data for predicting the spread of flu was intensively criticized (Lazer et al., 2014).

Numerous studies aimed to analyze the relationship between corruption and specific economic, social, and political indicators on a macro level. Most of these papers focus on the consequences of corruption; the ones that study its causes based on empirical evidence seem to be rare. However, it has to be emphasized that these causal links are not always clear. Empirical research dealing with country-level data suggests that corruption is lower in a country where the population is more educated (Treisman, 2000). Other research that analyzed corruption at the local level concluded similar results: substantial social capital predicts a low level of corruption (Wachs et al., 2018). Nevertheless, papers are pointing out that corruption hurts public spending efficacy in education (Suryadarma, 2008) and enrollment rates (Dridi, 2014). Moreover, most of the papers aim to find a correlation between corruption and specific macro indicators that focus on economic characteristics, not on socio-demographic features.

As for the socio-economic factors mitigating or obstructing corruption, empirical evidence suggests that countries with protestant or British traditions, the more developed economies, and those with higher imports – and thereby more affected by spillover effects – are less corrupt (Treisman, 2000). Furthermore, the democracies that exist for a long time seem to be less corrupt; however, the current degree of democracy is not a significant predictor of corruption. Besides, federal states are proven more corrupt.

Regarding the consequences of corruption, it has been pointed out that higher perceived corruption is linked to lower investments and economic growth

[3] https://trends.google.com/

(Mauro, 1995). Countries with more corruption tend to have a larger shadow – or in other terms unofficial – economy (Johnson, Kaufmann and Zoido-Lobaton, 1998) and public debt (Cooray, Dzhumashev, and Schneider, 2016). Also, concerning the post-communist countries, it can be concluded that corruption was a crucial obstacle in the consolidation of democratic institutions and the open market economies (Shleifer, 1997).

Several recent studies deal with the Central and Eastern European region but still concentrate on corruption's economic relations. For instance, Gamberoni, Gartner, and Giordano (2016) investigated the role of corruption in the business environment in explaining the total factor productivity (TFP) in nine Central and Eastern European countries in 2003-2012. They found a positive relationship between corruption growth and both labor and capital misallocation dynamics. These links are more robust in a smaller country — the lower the degree of political stability and civil liberties, the lower the quality of its regulations. As input misallocation is one of the determinants of productivity growth, the study points out that the relationship between changes in corruption and TFP growth is negative.

Apart from the aspects above, the political relations of corruption is also a frequently analyzed field. An analysis of partisan favoritism and corruption risks in public procurement done by David-Barrett and Fazekas (2016) compares Hungary and the United Kingdom. They pointed out that public procurement is highly vulnerable to political influence in Hungary. However, in the United Kingdom, there was no evidence for systemic political control. Around 50-60% of the market is controlled by companies that win despite a lack of prior success and exhibit high corruption risk in Hungary's tenders. This ratio is about 10% in the United Kingdom.

Corruption has become a fundamental problem in Hungary, as several studies have emphasized it. The commonly referred composite corruption perception indices of the Transparency International (Ligeti, Martin, and Nagy, 2016) and the World Bank (The World Bank, 2015) both indicate the increasing degree of corruption in Hungary[4].

Apart from these subjective indicators, the analyses of objective measures of corruption risk also highlight Hungary's disturbing tendencies. For instance, it was revealed that the speed of the legislative procedure significantly fastened after the government change in 2010 that may provide ground for ad-hoc, self-serving, and tailored law-making (Alberti et al., 2015). Also, research on the Hungarian public procurement revealed that the strength of competition and the transparency of the procurement methods declined between 2010 and 2015, thereby increasing the risk of corruption (Tóth and Hajdu, 2016, 2018). In cross-Indicators, models and hypothesisobjective measures regarding the potential of controlling corruption, underlined the troublesome situation in Hungary, as there

[4] See the webpage of the Transparency International (https://www.transparency.org/country/HUN) and the Control of Corruption Index of the Worldwide Governance Indicators (www.govindicators.org).

are only four countries that can be characterized by worse rankings in the EU[5] (Mungiu-Pippidi and Dadašov, 2016).

Also, public opinion research indicates that young people associate corruption with politics (Csőzik, 2014; Laki and Szabó, 2014), and a survey of top managers of mid-size and large companies also reveals the presence of corruption in business from several aspects (Limbek et al., 2015).

Indicators, models and hypothesis

Corruptions risk and intensity of competition

We measure the corruption risk by three indicators. The first of these shows the occurrence of non-competitive tenders , *sb* (single bidder). First, we look at each public contract whether one or more bidders have submitted a bid for. If there was only one bidder, the contract was awarded without competition.

Thus, the *sb* for a contract *i*th is has the following values:

$sb_i = 0$, if there were more bidders
$sb_i = 1$, if there was only one bidder during the tender.

Then, taking into account the period 2015-2018, the average sb (SB) for each *j*th municipality is calculated in the following way:

$$SB_j = \sum_{i=1}^{n_j} \frac{sb_i}{n_j}$$

where is n_j the number of contract in the *j*th local government in the given period.

The literature on corruption in public procurement considers the single bidder indicator or the proportion of non-competitive public procurement as one of the most important indicators of detecting the risks of corruption (Heggstad et al. 2010; OECD, 2016; Fazekas et al. 2014). This assumption is supported by the empirical analysis of corrupt tenders revealed by authorities (Tóth and Hajdu, 2018a). If there is no competition, the corrupt actors will have much more possibilities for carrying out a corrupt transaction than having more bidders at the tender.

Another indicator for measuring the risk of corruption is whether the tender was conducted in an open or non-open procedure (ltr). If the tender was open, it began with a call for tenders or with an announcement. At that time, a wide range of companies in the market was informed about the public tender. If the procedure was not open, only the contractors selected in advance by the

[5] For the values of the index see: http://integrity-index.org

contracting authority could have known of the tender. Of course, in the second case, the risks of corruption are higher than in the first.

Thus, the *ltr* for contract *i*th has the following values:

$ltr_i = 0$, if there was a call for bids (a tender with the announcement)

$ltr_i = 1$, if there was no call for bid (a tender without the announcement).

We then calculate the average *ltr* (*LTR*) for each *j*th municipality in the 2015-2018 period:

$$LTR_j = \sum_{i=1}^{n_j} \frac{ltr_i}{n_j}$$

where is n_j the number of contract in the *j*th local government in the given period.

The lack of transparency (LTR) shows the proportion of non-transparent tenders that have not been conducted in an open procedure. Empirical research and the OECD and the European Commission's recommendations show that this is an important and generally applicable criterion for analyzing the corruption risks in public procurement (Fazekas et al., 2016; OECD, 2016; European Commission, 2018).

The weak negative correlation (the value of Spearman's rank correlation coefficient is -0.1247) between the two indicators (SB and LTR) suggests that they represent different aspects of corruption risk. Therefore, we combined these two indicators, and we created a third indicator, the Corruption Risk Index, with two components (cr2).

The *cr2* for contract *i*th has the following values:

$$cr2_i = \frac{sb_i + ltr_i}{2}$$

We then calculate the average *cr2* (*CR2*) for each *j*th local government in the 2015-2018 period:

$$CR2_j = \sum_{i=1}^{n_j} \frac{cr2_i}{n_j}$$

where is n_j the number of contract in the *jth* local government in the given period.

Deriving information from the number of bids (*nb*) for the number of bidders for a given tender, we constructed an indicator which measures the intensity of

competition (*ici*, index of competition intensity). This indicator has missing value if *nb = 1* because we assume that if there is only one bid, then there was no competition that could be measured – such cases is analysed by the single-bidder indicator (*sb*). We calculate for every *i*th contract the *ici* with the following formula:

ici_i = lg(10) if the number of bidders less or equal to 10, and
ici_i = 1, if the number of bidders greater than 10

This calculation model is appropriate with the intuitive idea that the increase of intensity of competition is more significant, for example, between three and four bidders than between eight and nine bidders.

We then calculate the average *ici* (*ICI*) for each *j*th local government in the 2015-2018 period:

$$ICI_j = \sum_{i=1}^{n_j} \frac{ici_i}{n_j}$$

The indicator of corruption risks (CR2) and the intensity of competition (ICI) per town are not strongly and negatively correlated with each other (the value correlation coefficient is -0.3032), showing that the level of corruption risk in a given municipality does not directly and correctly predict the overall strength of competition in the same municipality. So, it is worth analyzing the two indicators separately.

Apart from the corruption risks related to public procurement, another aspect of the local government's institutional quality is taken into consideration: the transparency and the information-richness of their homepage (the Municipality Openness Index, MOPI). For defining the MOPI for every j local government of towns, we use the following 15 elementary indicators as one i mopi component:

- Can we reach the website in any other language than Hungarian? (yes-no)
- Is there a web map on the website? (yes-no)
- Is there a search engine on the website? (yes-no)
- Are there any public procurement contracts on the web site? (yes-no)
- Are there annual plans for public procurement? (yes-no)
- Are there annual summaries for public procurement? (yes-no)
- Can we reach the preliminary agenda of the next Representative Body meeting? (yes-no)
- Can we reach the minutes of the Representative Body meetings? (yes-no)
- Can we reach the preliminary agenda of the next Financial Body meeting? (yes-no)
- Can we reach the minutes of the Financial Body meetings? (yes-no)
- Is there any information about project financed by the EU on the website?

(yes-no)
- Are there any aggregate tables about the not normative subsidies? (yes-no)
- Are there any aggregate tables about public procurement, the investments, the service orders, the property sales, the transfer of property rights or about the concessions? (yes-no)
- Are there any calls for tender for public procurement, service orders, rents or real estate sales? (yes-no)
- Is there any information on the webpage on the regulation for the public procurement under the threshold? (yes-no)

These indicators ($mopi_i$) can hold only two values: zero if a webpage has deficiency from the given point of view, and one if it has the given function or information. And then, the formula of the MOPI for every j local government is the following:

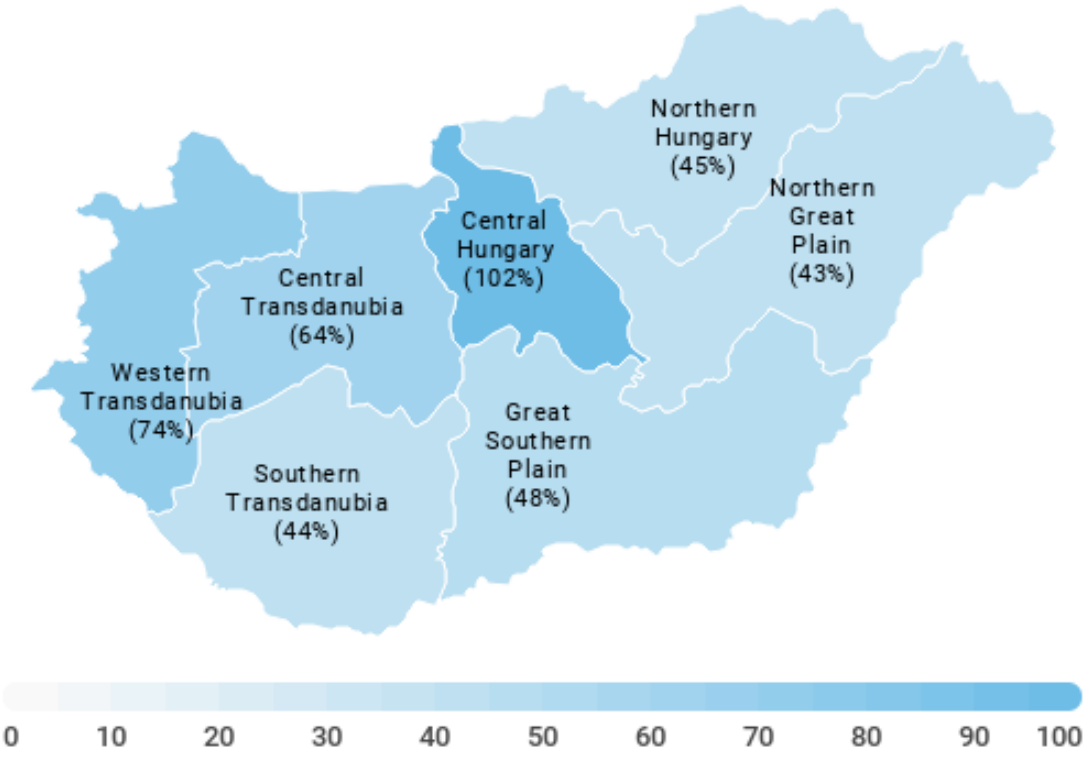
$$MOPI_j = \sum_{i=1}^{15} \frac{mopi_i}{15}$$

Thus, the composite index (MOPI) can also be considered a kind of transparency indicator (the higher score of the index indicates the more transparency). The MOPI shows the importance of a given municipality to openness. In this way, the MOPI can be interpreted as an indicator of the application of modern governance methods.

Social and economic indicators of settlements

The economic and indicators of the Hungarian regions show significant differences in economic development within the Hungarian regions. The west part of Hungary, close to the border with Austria, and the central region, which surrounds the country's capital, Budapest, are much more developed than the rest of the country (see Figure 1.).

Figure 1: GDP per capita in PPS of the Hungarian regions, %, (EU28=100), 2013



Source: Eurostat (https://ec.europa.eu/eurostat/news/themes-in-the-spotlight/regional-gdp)
The number of towns situated in Central and Western Transdanubia and Central Hungary is 118 (40.5%), and the number of the analysed municipalities from the rest of the country is 173 (59.5%).

Among the socio-economic that reflect the economic and social development, education, income level, entrepreneurial density, and size of the settlement were taken into account in the analysis. To measure the impact of the town's human capital on the local government's capacity to control corruption risk and enforce competition intensity in a public tender, we use the level of education and the

average taxable level income as a proxy. To measure the level of education by towns, we see the adult population's ratio holding at least high-school graduation (GRADE_RATE). For measuring the income level of the town population, we use the average level of taxable income per taxpayer by towns (INCOME). We take into consideration the strength of the business community, which could also be an indicator of the town's human capital. It requires specialized education and knowledge to run a business. We measure that ability's strength by the business density per 1000 inhabitants by town (BUSINESS_DEN) [6]. Moreover, finally, we have to consider the size of the town, measuring it by the number of inhabitants. We put the logarithmic function of the town population into the analysis (LNPOP).

Models

As we described in the introduction, our analysis aims to examine the relationship between the strength of control of corruption risks and the intensity of competition in public procurement with towns' social and economic backgrounds. We considered the human capital - the average taxable income per taxpayer -, and the density of enterprise essential factors in this point of view. To examine the above relationships first, we run estimations with all indicators of the corruption risks, the openness of local government, and the intensity of corruption with the social and economic factors as level of education, average taxable income per capita, and the number of business per 1000 person (business density) in every case controlled by the town population:

$$I = \beta_0 + \beta_1 MOPI + \beta_2 LNPOP + \varepsilon$$
$$I = \beta_0 + \beta_1 GRADE\_RATE + \beta_2 LNPOP + \varepsilon$$
$$I = \beta_0 + \beta_1 INCOME + \beta_2 LNPOP + \varepsilon$$
$$I = \beta_0 + \beta_1 BUSINESS\_DEN + \beta_2 LNPOP + \varepsilon$$

Where the I means the indicators of the openness of local government or the level of corruption risks, or intensity of competition (SB, LTR, CR2, and ICI respectively).

Then we calculate the effects of openness (MOPI), the human capital (GRADE_RATE), and the strength of the business community (BUSINESS_DEN) independently from the average level taxable income. The level of education, the average taxable income per taxpayer, and the business density are highly autocorrelated. Education (as a proxy of human capital) has a substantial impact

[6] We extracted these indicators from the T-STAR database of the Hungarian Central Statistical Office managed by the DATABANK of the Institute of Economics Hungarian Academy of Sciences.

on the latter two factors. First, we estimate each indicator by using the average level of taxable income per taxpayers as an explanatory factor:

$$MOPI = \beta_0 + \beta_1 INCOME + \varepsilon_{MP}$$
$$GRADE\_RATE = \beta_0 + \beta_1 INCOME + \varepsilon_{GR}$$
$$BUSINESS\_DEN = \beta_0 + \beta_1 INCOME + \varepsilon_{BD}$$

Then, we run estimations using the effects of MOPI, GRADE_RATE, and BUSINESS_DEN independent from INCOME:

$$I = \beta_0 + \beta_1 \varepsilon_{MP} + \beta_2 LNPOP + \varepsilon$$
$$I = \beta_0 + \beta_1 \varepsilon_{GR} + \beta_2 LNPOP + \varepsilon$$
$$I = \beta_0 + \beta_1 \varepsilon_{BD} + \beta_2 LNPOP + \varepsilon$$

In this way, we can separate the direct effect of human capital on the control of corruption from its indirect impacts through income level and eliminate the problems caused by autocorrelation.

Hypothesis

In line with international literature, we attach great importance to human capital and economic development in the fight against corruption. The highest level of human capital at the local level predicts the highest level of control of corruption. This relationship as a spillover effect works in many ways: through the level of organizational quality of local governments, the local labor market for educated employees, civic activity, business self-organization, e.t.c.

Like the earlier studies that look at corruption risk at the country level, we expect that education level positively impacts the control of corruption because the more educated citizens and entrepreneurs can force more local authorities more effectively to control corruption. The educated people more easily and quickly recognize the long-term destructive social and economic effects of corruption and therefore act more forcefully. Besides, a higher level of education also implies a higher level of expertise within the local government apparatus, which is reflected in the local governments' organizational structure and organizational culture, thus positively influencing the higher level of control of corruption.

On the other hand, we expect that the local municipalities with openness achieve more open governance principles to control corruption.

Finally, we expect that where the entrepreneurial values are strong, i.e., the business density is higher, public procurement corruption is less frequent, and more intense competition in public tenders.

DATA

We use the public procurement database built by Corruption Research Center Budapest (CRCB), which contains all Hungarian public tenders from 2005-2018 (this contains a total of 214,667 public procurement contracts. To include only one electoral period in the dataset (2014 was a municipal election in Hungary), we use only the data from 2014 to 2018. Of the 100,630 public contracts awarded during this period, we considered those in which the local governments of Hungarian towns were the issuer. We found a total of 16,161 such contracts.

There are 345 towns in Hungary (not considering Budapest), but 54 had less than ten public procurement contracts between 2014 and 2018. These municipalities were dropped (see their list in the Annex), so the settlements' final number is 291.

The data regarding the quality of the Hungarian municipalities' homepages (MOPI) was collected by Corruption Research Center Budapest (CRCB) between January and March 2018. During the websites' examination, the coders had to check the availability of information and certain functions that may help the citizens know about the work, the plans, and specific local governments' decisions. Finally, a composite index was created based on 15 binary indicators (*mopi*), marking if a webpage provided a kind of information or not.

Table 1. Number of public contract by year in Hungary

year	Freq.	Percent	Cum. %
2014	21,982	21.84	21.84
2015	22,078	21.94	43.78
2016	16,485	16.38	60.17
2017	17,045	16.94	77.10
2018	23,040	22.90	100.00
Total	100,630	100.00	

Note: without framework agreements
Source: CRCB's public procurement database

Figures 1a-d show the histogram of the corruption risk indicators and the indicator of competition intensity (SB, LTR, CR2, and ICI). Figure 2 shows the distribution of town by MOPI, and the 3a-d its distribution by taxable income,

business density, level of education, and population. Table 2 shows the main statistics of the analyzed indicators (see table 2).

Table 2. The main statistics of the indicator analysed

Name of indicator	Mean	Median	Standard deviation	N
Tenders with single bidder (SB)	0.22	0.20	0.1448	291
Non-open procedures, or lack of transparency (LTR)	0.87	0.90	0.1359	291
Indicator of Corruption Risks, with two components (CR2)	0.55	0.54	0.0948	291
Index of Competition Intensity (ICI)	0.47	0.47	0.0602	291
Municipality Openness Index (MOPI)	0.47	0.47	0.1899	291
Level of education (GRADE_RATE)	44.56	43.9	10.5979	291
Business density (BUSINESS_DEN)	60.92	59.0	20.8890	291
The taxable income per taxpayers, million HUF (INCOME)	2.30	2.25	0.4277	291
The logarithm of town population (LNPOP)	9.24	9.13	0.9051	291

Source: own calculations based on the CRCB's public procurement database

The average value of the share of tenders with a single bidder (SB) is 0.22 what means that within 291 towns falling into the scope of the analyses, the mean ratio of the contracts awarded without competition was 22% (see Figure 2a). This result is lower than the national average (0.30).

The mean ratio of the public procurement contracts deriving non-transparent procedures (LTR) is 0.87, and based on the Figure 2b is visible that in most of the town, this ratio is relatively high, most of all if we compare that with the national average in this period (0.63).

The composite corruption risk indicator (CR2) has an average of 0.55, which is slightly higher than the national average (0.46) (Figure 2c).

Fig. 2a-d: The histograms of the corruption risk indicators and index of competitive intensity

Fig. 2a. SB

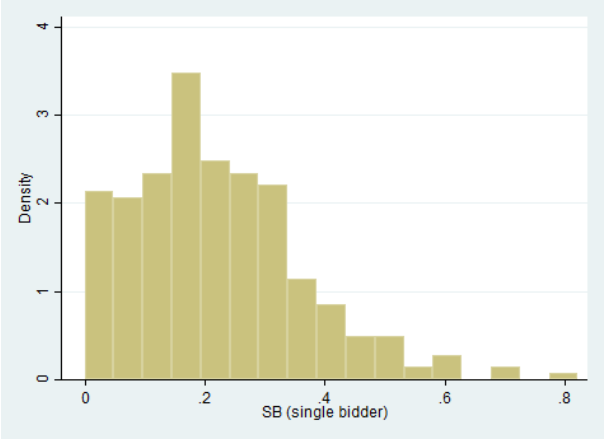


Fig. 2b. LTR

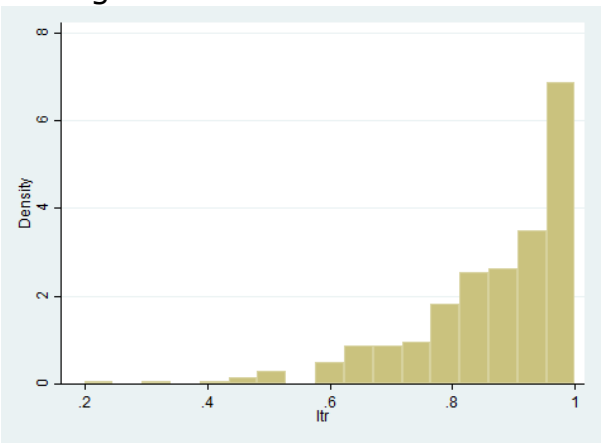


Fig. 2c. CR2

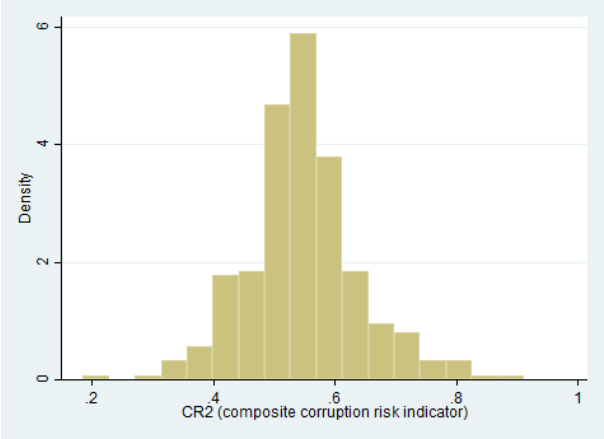
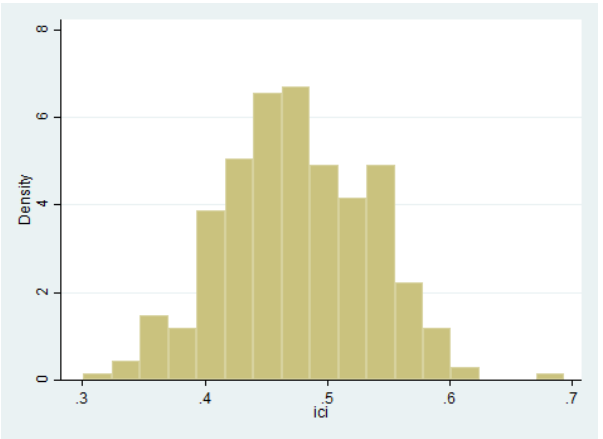


Fig. 2d. ICI



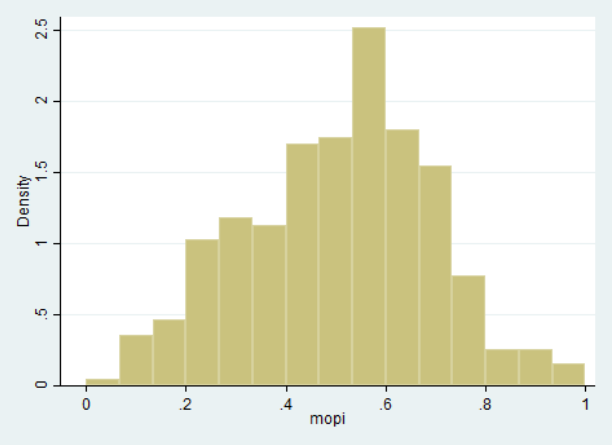
Source: own calculation based on the data of the Corruption Research Center Budapest

The index of competition (ICI) intensity has an average of 0.47 and follows a normal distribution based on the results of the tests of normality[7] (see Figure 2d). This result is approximately the same level as the national average of ICI (0.50).

The next figure (figure 3) shows the distribution of the Municipality Openness Index (MOPI) within the Hungarian towns. The average value of the index ranging between 0 and 1 is 0.45, its median is 0.47, and the standard deviation is 0.19.

[7] We used the Kolmogorov-Smirnov test with the Lillefors significance correction and the Shapiro-Wilk test.

Fig. 3: The histogram of the MOPI



Source: own calculation based on the data of the Corruption Research Center Budapest

Figures 4a-d show the distribution of the analyzed municipality level factor, which can explain the strength of control of corruption and the enforcement of intensity of competition. The first indicator (Figure 4a), a proxy of the human capital, is the adult population ratio, holding at least high-school graduation per city (GRADE_RATE)[8]. This ratio's mean value is 43%, its median is 42%, and the standard deviation is 10.7. The second indicator (Figure 4b) shows the business density, the number of enterprises operating in the analyzed town per 1000 inhabitants (BUSINESS_DEN). The mean value is this indicator 61, and its median is 59. There are considerable differences amongst the Hungarian towns concerning the average taxable income level (Figure 4c). The mean amount of taxable income is 2.3 million HUF (7800 USD), and its median value is 2.25 million HUF (7600 USD). There are huge differences concerning the population. The smallest town has 1800 inhabitants and the largest one 203,000 inhabitants. The main population of the towns is 17,000 inhabitants, and the median value is only 9,300 inhabitants.

[8] The source of this variable is the population census held in 2011 by the Hungarian Central Statistical Office.

Fig. 4a-d: The histograms of education (GRAD_RATE), business density (BUSINESS_DEN), taxable income per taxpayer (INCOME) and population (LNPOP) in the town analysed

Fig. 4a. GRADE_RATE

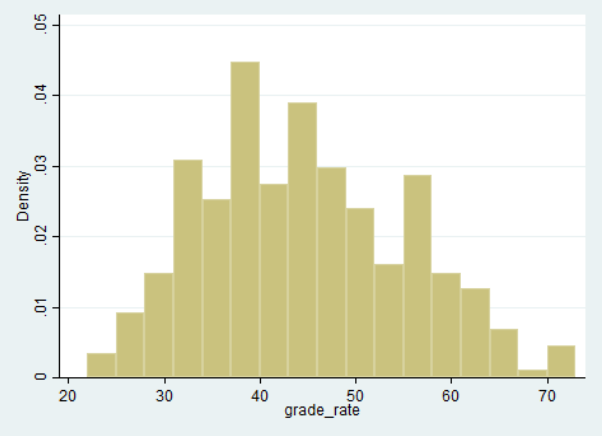


Fig. 4b. BUSINESS_DEN

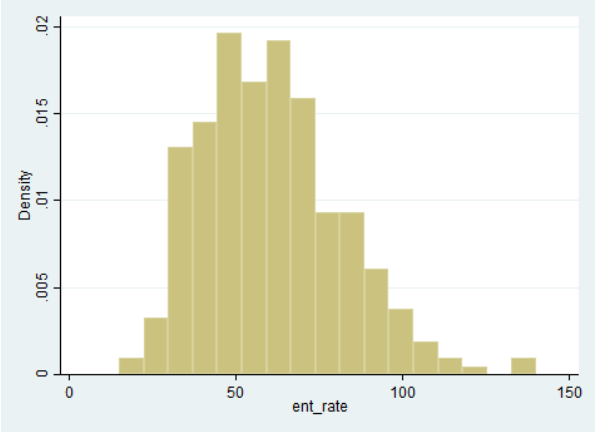


Fig. 4c. INCOME

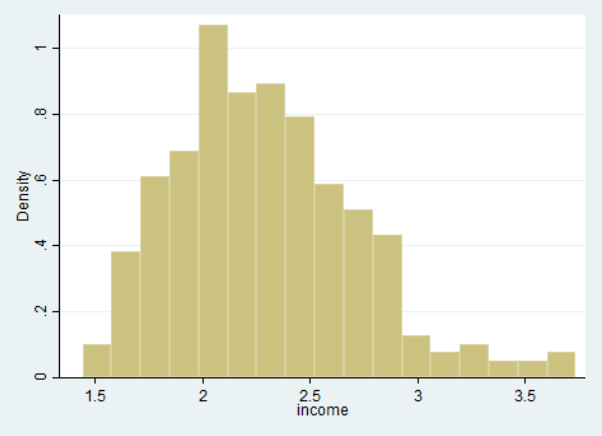
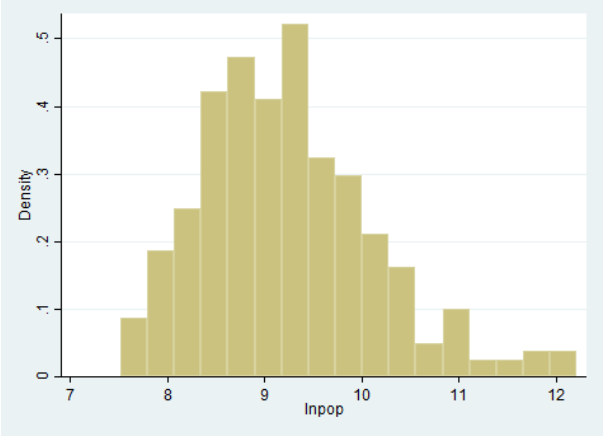


Fig. 4d. LNPOP



Source: data of the Hungarian population census held in 2011 downloaded from the Regional Development and Territorial Information System (TeIR) and T-STAR

The analyzed indicators differ significantly by disparities of regional development. There are a higher corruption risk (and lower competitive intensity) and lower local government openness in the less developed regions than in the developed ones. Not surprisingly, the level of education, the average taxable income per taxpayer, and the business density much higher in the more developed part of the country (see Table 3.)

Table 3. Mean value of the analyzed indicators by developed and less developed regions

	Developed regions (Central Hungary, Central Transdanubia, Western Transdanubia)	Less Developed regions (Northern Hungary, Northern Great Plain, Great Southern Plain, Southern Transdanubia)
	Number of town = 118	Number of town = 173
Single bidder, SB	0.20	0.24
Lack of transparency, LTR	0.86	0.87
Indicator of competitive intensity, ICI	0.53	0.56
The openness of local government, MOPI	0.51	0.45
Level of education, GRADE_RATE	49.31	41.33
Taxable income, INCOME	2.60	2.10
BUSINESS_DENSITY	70.53	54.36
Population	17,255	16,680

Source: authors' own calculation

Results

The correlation coefficients amongst the analyzed indicators show a weak negative relationship between SB and LTR, which also means that it is worth considering both in the analysis of corruption risks in public procurement (see Annex 3). The moderately strong negative correlation between corruption risks (CR2) and the intensity of competition (ICI) indicates that the strength of control of corruption does not predict absolutely the intensity of competition in public procurement. There is a weak negative correlation between the openness of local government and the level of corruption risks (-0.1887), and there is a similarly weak but positive relationship between the level of openness and the enforcement of the strength of competition (0.1573).

Concerning the level of openness, the results of estimations support only the relationships with the occurrence of non-transparent procedures (see Table 4). The greater the openness, the less the municipalities use non-transparent procedures, which restricts from the very beginning the competition in public tenders. The restricted impact of openness to the level of corruption risks suggests that the local government's openness has a minimal effect on corruption control. Creating openness is not a sufficient measure in the fight against corruption.

Estimating the share of the contract with a single bidder (SB) has weak results. The ratio of contracts with the single bidder (SB) is only correlated with the towns' economic development (grasped by the average taxable income per taxpayer in the town). In the settlements where the incomes are high, the local

governments' public procurement can be characterized with significantly lower corruption risk (see Table 4 and Table 5). This relationship also means that more developed towns with a wealthier population have better control over corruption.

Our results show that human capital has a positive impact on the control of corruption risk. The towns with more educated inhabitants, highest business density and highest average taxable income per taxpayer could reduce corruption risk than towns with a lower level of education, business density, or average income. The results support our hypothesis and meet the country-level empirical studies' results: the highest human capital, the lower level of corruption risk, and the highest level of intensity of competition in public procurement (see: in Table 4 and Table 5 the results concerning the estimations of LTR, CR2, and ICI). Therefore, the results suggest that these relationships are valid not only between countries but also within countries.

The results concerning LTR and CR2 also show that the corruption risks decrease with the town's size: the small towns seem to reduce less the corruption risks and enforce the strength of competition than the larger ones. Procurement without transparent procedures involves more corruption risks as only some preselected actors will be notified about tenders on the related market. However, open procedures require more preparation and have higher administrative costs. Indeed, the larger settlements' local governments have greater administrative capacities (they can employ more public procurement experts) and can handle more tenders with open procedures that involve higher administrative costs.

Table 4. Results of estimations

	SB (robust regression)			
	1	2	3	4
MOPI	-0.4775	-	-	-
GRADE_RATE	-	-0.0021	-	-
BUSINESS_DEN	-	-	-0.006	-
INCOME	-	-	-	-0.0433**
LNPOP	0.0009	0.0081	0.0006	0.0044
Constant	0.224***	0.2276***	0.2393***	0.2684***
N	291	291	291	291
	LTR (quantile regression)			
	1	2	3	4
MOPI	-0.0876*	-	-	-
GRADE_RATE	-	-0.0018**	-	-
BUSINESS_DEN	-	-	-0.0011***	-
INCOME	-	-	-	-0.0244
LNPOP	-0.0542***	-0.0515***	-0.0564***	-0.0605***
Constant	1.4462***	1.4597***	1.4880***	1.5221***
Pseudo R^2	0.1315	0.1329	0.1368	0.1300
	CR2 (robust regression)			
	1	2	3	4
MOPI	-0.0427	-	-	-
GRADE_RATE	-	-0.0018***	-	-
BUSINESS_DEN	-	-	-0.0005**	-
INCOME	-	-	-	-0.0365***
LNPOP	-0.0220***	-0.0162**	-0.02248***	-0.0197***
Constant	0.7676***	0.7764***	0.7842***	0.8109***
	ICI (robust regression)			
	1	2	3	4
MOPI	0.0190	-	-	-
GRADE_RATE	-	0.0016***	-	-
BUSINESS_DEN	-	-	0.0008***	-
INCOME	-	-	-	0.0376***
LNPOP	0.0123***	0.0041	0.0826**	0.0068*
Constant	0.3510***	0.3621***	0.3508***	0.3241***

**: p < 0.1 **: p < 0.05 ***: p < 0.01*

Source: authors' own calculation based on the CRCB's data

Table 5. Results of estimations (effects independent from income level of town population)

	SB (robust regression)		
	1	2	3
E_MOPI	-0.0378	-	-
E_GRADE_RATE	-	-0.0014	-
E_BUSINESS_DEN	-	-	-0.0001
INCOME	-0.0467**	-0.0487**	-0.0447**
LNPOP	0.0077	0.0079	0.0047
constant	0.2240***	0.2276***	0.2393***
	LTR (quantile regression)		
	1	2	3
E_MOPI	-0.0742	-	-
E_GRADE_RATE	-	-0.0019	-
E_BUSINESS_DEN	-	-	-0.0011**
INCOME	-0.0405**	-0.0309	-0.0385*
LNPOP	-0.0510***	-0.0528***	-0.0560***
constant	1.4462***	1.4597***	1.4880***
Pseudo R^2	0.1315	0.1329	0.1368
	CR2 (robust regression)		
	1	2	3
E_MOPI	-0.0305	-	-
E_GRADE_RATE	-	-0.0016*	-
E_BUSINESS_DEN	-	-	-0.0002
INCOME	-0.0390***	-0.0405***	-0.0372***
LNPOP	-0.0172***	-0.0163***	-0.0195***
constant	0.7676***	0.7764***	0.7842***
	ICI (robust regression)		
	1	2	3
E_MOPI	0.0068	-	-
E_GRADE_RATE	-	0.0010*	-
E_BUSINESS_DEN	-	-	0.0005**
INCOME	0.0380***	0.0404***	0.0399***
LNPOP	0.0063	0.0043	0.0056
constant	0.3510***	0.3621***	0.3508***

**: p < 0.1 **: p < 0.05 ***: p < 0.01*

Source: authors' own calculation based on the CRCB's data

Our results also point out that the level of education independent of income level significantly impacts corruption risk (Table 5). While other factors independent of the income level – the E_MOPI measuring the local government's openness

and the enterprises' density (E_BUSINESS_DEN) – were not significant predictors of the CR2. This result means that the level of education impacts indirectly through the income level on the control of corruption risks and directly, regardless of income level. We think that this result also points out the importance of human capital in the fight against corruption.

Also, the business density (in terms of the number of enterprises per 1000 inhabitants) is in a negative relationship with the ratio of the non-transparent procurement procedures (LTR) and the composite indicator of corruption risks (CR2). We can interpret this that the more significant, more robust business sector or local business associations may force local governments to launch more transparent tenders through their organizations and informal connections.

Concerning the intensity of competition (ICI), our results point out that the ICI has a significant relationship with the towns' human capital: the competition is higher in towns with the highest level of education, highest income level, and more robust business density. The relationship between business density and competitive strength is evident: the market competition in public procurement may be stronger where more enterprises can be found.

The impact of human capital may prevail in several ways. In the towns with a high level of human capital, the ratio of the non-transparent tenders is smaller, and this leads to the increasing number of applicants to the tenders (the correlation between the two factors is -0.1795, $p<0.05$), as the competition is more robust in the cases of the open procedures. It is also possible that in towns with the highest level of human capital, the market economy's values reign more intensively, and their local governments give greater importance to the market competition.

For the ICI, a direct effect of education also can be demonstrated. The level of education directly and through income levels affects local governments' ability to enforce the strength of competition in public procurement.

Conclusions

Our results underline that the corruption risks are various problems with many factors, and several factors should be taken into account when measuring them. The lack of competition is essential in this respect and whether a transparent procedure has been used in public procurement. This result confirms our previous research results (Fazekas et al., 2014) and the validity of the OECD's recommendations, the EU Commission.

Another lesson of the analysis is that high levels of corruption risk in public procurement in a local government do not necessarily imply low levels of intensity of competition. It is worth examining the strength of competition in public procurement at the local level, regardless of corruption risk.

The third important finding is that, contrary to our expectations, there is only a limited relationship between the municipality's openness – its positive attitude to open governance – and the level of risk of corruption. We could only confirm that the municipality's greater openness is in the expected relationship with public procurement transparency. The more open the municipality is, the higher the proportion of transparent public procurement. The impact of the politics of open government on public procurement seems to be limited. The policy of openness does not seem sufficient to control corruption risks or increase public procurement intensity. Other measures should complement these politics.

The fourth and perhaps the most important result of the research is that the level of risk of corruption is higher in the settlements with lower human capital levels and smaller settlements. Behind this, we assume two mechanisms. On the one hand, if the level of education and income in a town is higher, it is easier for the local government to recruit well-educated and experienced public procurement experts from the local labor market and expand the local administration staff government by well-educated experts. These experts will act efficiently, and they are better able to help the local government of towns control corruption in public procurement more effectively. On the other hand, if a town has a higher level of education, a higher income level, and a higher business density, it is more likely that the local citizens, the local entrepreneurs, can force the local authorities to control corruption. As a type of white-collar crime, public procurement corruption is often carried out through complex transactions that better-educated people more easily understand. Also, public procurement corruption requires knowledge of abstract concepts (e.g., market price, competition, rent, welfare loss, etc.), which are more understandable to the educated. Therefore, in towns with insufficient education, low income, and weak business density, the local social actors that could enforce corruption control are naturally weaker.

Finally, what is the lesson of the above for a central government? In any case, a central government must consider the following if it would like to reduce corruption risks in public procurement at the local level:

• Settlements do not have equal chances to ensure control over their procurement activity.

• Special attention should be focused on settlements where the local business sector is not strong enough to extend transparent procurement.

• Those local governments should also be helped, which cannot recruit enough procurement experts because of their small size and low economic development.

Mitigating the risks of corruption requires measures at the local level that are different from those used by governments at the national level, taking into account the significant territorial differences in social and economic development.

References

Alberti, É. et al. 2015. Impact Assessments Public Consultation and Legislation in Hungary 2011-2014. Budapest. Available at: https://bit.ly/2PKhQuo.

Balogh, V., Fleck, D. M., Purczeld, E., and I. J. Tóth. 2016. Hungarian Municipalities Abide by the Law? Budapest. Available at: https://bit.ly/3rBhVyx.

Barrington, R. 2014. Measuring Corruption – A Discussion of Methodology. Available at: http://www.transparency.org.uk/measuring-corruption-discussion/ (Accessed: 28 May 2017).

Broms, R., C. Dahlström and M. Fazekas. M. 2017. *Procurement and Competition in Swedish Municipalities.* Gothenburg. Available at: https://bit.ly/2DSCkbK.

Choi, H. and Varian, H. 2012. "Predicting the Present with Google Trends", *Economic Record.* Blackwell Publishing Ltd, 88(s1), pp. 2–9. doi: 10.1111/j.1475-4932.2012.00809.x.

Cooray, A., Dzhumashev, R. and Schneider, F. 2016. "How Does Corruption Affect Public Debt? An Empirical Analysis", *World Development*. Elsevier Ltd, 90. doi: 10.1016/j.worlddev.2016.08.020.

Csőzik, R. 2014. "Politika, minek nevezzelek? A magyar egyetemisták és főiskolások politikáról alkotott szociális reprezentációja", in Szabó, A. (ed.) *Racionálisan Lázadó Hallgatók II.* Szeged: Belvedere Meridionale, pp. 58–70. Available at: https://bit.ly/3vgO28S.

David-Barrett, E. and Fazekas, M. 2016. Corrupt contracting: Controlling Partisan Favouritism in Public Procurement. 49. Available at: https://bit.ly/31acTvk.

Dridi, M. 2014. "Corruption and Education: Empirical Evidence", *International Journal of Economics and Financial Issues*, 4(3), pp. 476–493.

European Commission. 2018. Single Market Scoreboard. Public Procurement. https://bit.ly/2GMCfaO

Fazekas, M., Tóth, I. J., and King, L. P. 2014. *Anatomy of Grand Corruption: A Composite Corruption Risk Index Based on Objective Data.* Budapest. Retrieved March 5, 2019, from https://bit.ly/3ve2v5G.

Fazekas, M. , Tóth, I. J. and King, L. P. 2016. "An Objective Corruption Risk

Index Using Public Procurement Data". *European Journal on Criminal Policy and Research*, 22(3):369–97. Retrieved March 5, 2019, from http://dx.doi.org/10.1007/s10610-016-9308-z.

Fazekas, M. 2017. *Assessing the Quality of Government at the Regional Level Using Public Procurement Data.* Brussels. Retrieved March 5, 2019, from https://bit.ly/2VPCJpx.

Fazekas, M. and Tóth, I. J. 2017. *Corruption in EU Funds? Europe-wide evidence of the corruption effect of EU-funded public contracting*. In: Bachler, J., Berkowitz, P., Hardy S., Muravska, T.: *EU Cohesion Policy. Reassessing Performance and Direction*, Routledge, London & New York., pp. 186-205.

Gamberoni, E., Ch. Gartner, C. Giordano, and P. Lopez-Garcia. 2016. *Is corruption efficiency-enhancing? A case study of nine Central and Eastern European countries*. No. 1950. Available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1950.en.pdf.

Golden, M. A. and Picci, L. .2005. "Proposal for a New Measure of Corruption, Illustrated with Italian Data", *Economics and Politics*. Blackwell Publishing, 17(1), pp. 37–75. doi: 10.1111/j.1468-0343.2005.00146.x.

Heggstad, K., Frøystad, M., and Isaksen, J. 2010. *The basics of integrity in procurement: A guidebook.* Bergen, Norway: Chr. Michelsen Institute. Retrieved March 5, 2019, from http://bit.ly/2n1shZp.

Johnson, S., Kaufmann, D. and Zoido-Lobaton, P. 1998. "Regulatory Discretion and the Unofficiai Economy", *American Economic Review*, 88(2), pp. 387–393. Available at: https://bit.ly/3epK8EZ.

Kaufmann, D., Kraay, A. and Mastruzzi, M. 2006. Measuring corruption: Myths and realities. The World Bank. Available at: https://bit.ly/1qVCjYX.

Kaufmann, D., Kraay, A. and Mastruzzi, M. 2011. "The Worldwide Governance Indicators: Methodology and Analytical Issues", *Hague Journal on the Rule of Law*. 2011/09/01. Cambridge University Press, 3(2), pp. 220–246. doi: 10.1017/S1876404511200046.

Kelemen, Z., Angyal, É. and Fazekas, M. 2014. Törvénytisztelők -e a magyar önkormányzatok? Városi önkormányzatok honlapjainak elemzése. Budapest. Available at: https://bit.ly/3cnpNgD.

Kurtz, M. J. and Schrank, A. 2007. "Growth and Governance: Models, Measures, and Mechanisms", *Journal of Politics*, 69(2), pp. 538–554. doi: 10.1111/j.1468-2508.2007.00549.x.

Laki, L. and Szabó, A. 2014. "Mi lehet a magyar fiatalok demokráciaszkepszise mögött?", in Szabó, A. (ed.) *Racionálisan Lázadó Hallgatók II.* Szeged: Belvedere Meridionale, pp. 18–39.

Lambsdorff, J. G. 2003. *Background Paper to the 2003 Corruption Perceptions Index*, mimeo: Transparency International, September 2003. Available at: https://bit.ly/2MD4cWg

Lambsdorff, J. G. 2007. *The Institutional Economics of Corruption and Reform. Theory, Evidence and Policy.* Cambridge: Cambridge University Press.

Lazer, D. et al. 2014. "The Parable of Google Flu: Traps in Big Data Analysis", *Science*, 343(6176), pp. 1203–1205. doi: 10.1126/science.1248506.

Ligeti, M., Martin, J. P. and Nagy, G. 2016. *A Korrupció Érzékelési Index és a korrupció jellemzői Magyarországon, 2016-ban.* Budapest: Transparency International. Available at: https://bit.ly/2GIVaU8.

Limbek, Z., Nyírő, Zs., Türei, G., and Verba, Z. 2015. *Integritás és korrupciós kockázatok a magyar vállalati szektorban – 2015.* Budapest: GVI. Available at: https://bit.ly/2MCn4F1

Mauro, P. 1995. "Corruption and Growth", *The Quarterly Journal of Economics*, 110(3), pp. 681–712. doi: 10.2307/2946696.

Mungiu-Pippidi, A. and Dadašov, R. 2016. "Measuring Control of Corruption by a New Index of Public Integrity", *European Journal on Criminal Policy and Research*, 22(3), pp. 415–438. doi: 10.1007/s10610-016-9324-z.

Le Nghiem, T. P. et al. 2016. "Analysis of the capacity of google trends to measure interest in conservation topics and the role of online news", *PLoS | ONE*, 11(3), pp. 1–12. https://doi.org/10.1371/journal.pone.0152802

OECD. 2016. Preventing Corruption in Public Procurement. Available at: https://bit.ly/3t9cUxH

Pertold, Filip and Ján Palguta. 2017. "Manipulation of Procurement Contracts: Evidence from the Introduction of Discretionary Thresholds." *American Economic Journal: Economic Policy* 9(2):1–44. DOI: 10.1257/pol.20150511

Rohwer, A. 2009. *Measuring Corruption: A Comparison between the Transparency International's Corruption Perceptions Index and the World Bank's Worldwide Governance Indicators*, CESifo DICE Report. Munich. Available at: https://bit.ly/2PVfB7J.

Rose-Ackerman, Susan. 1978. *Corruption: A Study in Political Economy.* New

York: Academic Press.

Rose-Ackerman, S. 1999. Corruption and government: Causes, consequences and reform. Cambridge: Cambridge University Press.

Rose-Ackerman, Susan. 2001a. "Trust, Honesty, and Corruption: Reflection on the State-Building Process." *European Journal of Sociology,* 42:27–71. Retrieved March 5, 2019, from http://www.ssrn.com/abstract=283429.

Rose-Ackerman, Susan. 2001b. "Trust and Honesty in Post-Socialist Societies." *Kyklos* 54(2/3):415–44. Retrieved from https://doi.org/10.1111/1467-6435.00161.
Schönfelder, N. and Wagner, H. 2018. "Institutional Convergence in Europe." *Economics*, Discussion Paper. No. 2018-53, July 02, 2018. Retrieved March 5, 2019, from https://bit.ly/2V9Owug.

Rose, R. and Peiffer, C. 2012. *Paying Bribes to Get Public Services: A Comparative Guide to Concepts and Measures*, CSPP Studies in Public Policy. 494. Glasgow. Available at: https://ssrn.com/abstract=2180793.

Shleifer, A. 1997. "Government in transition", *European Economic Review*, 41(3–5), pp. 385–410. doi: 10.1016/S0014-2921(97)00011-1.

Suryadarma, D. 2008. Corruption, Public Spending, and Education Outcomes: Evidence from Indonesia. Available at: https://bit.ly/2YsaXle.

Szűcs, F. 2017. *Discretion and Corruption in Public Procurement*. Retrieved March 5, 2019, from https://bit.ly/2KTvmFB.

The World Bank. 2015. *Country Data Report for Hungary, 1996-2014.* Washington. Available at: https://bit.ly/3qC7LN5.

The World Bank. 2017. *Worldwide Governance Indicators.* Available at: http://info.worldbank.org/governance/wgi/#home.

Tóth, I. J. and Hajdu, M. 2016. *Korrupciós kockázatok, átláthatóság, közbeszerzések – Magyar közbeszerzések 2009-2015 közötti adatainak elemzése*, in Kolosi, T. and Tóth, I. G. (eds) *Társadalmi Riport 2016.* Budapest: TÁRKI, pp. 33–53. Available at: http://www.tarki.hu/hu/publications/SR/2016/02toth-hajdu.pdf.

Tóth, I. J. and Hajdu, M. 2017a. *Haveri kapitalizmus Magyarországon a kommunikációs szolgáltatások piacán*, in Boda, Z. and Szabó, A. (eds): *Trendek a magyar politikában 2. A Fidesz és a többiek: pártok, mozgalmak, politikák.* Budapest: Napvilág Kiadó, pp. 344–371.

Tóth, I. J. and Hajdu, M. 2017b. *Intensity of Competition, Corruption Risks and Price Distortion in the Hungarian Public Procurement – 2009-2016.* CRCB, Budapest. Available at: http://www.crcb.eu/wp-content/uploads/2017/12/eu_hpp_2016_report_170616_.pdf.

Tóth, I. J. and Hajdu, M. 2017c. *Versenyerősség, társadalmi veszteségek és a 25 millió forintos értékhatár rejtélye 2009-2016 közötti magyar közbeszerzések statisztikai vizsgálata* (*Intensity of competition, social loss and the enigma of 25 million HUF threshold. Statistical analysis of Hungarian public procurement from 2009 to 2016*). Budapest. Retrieved March 5, 2019, from https://bit.ly/2wWe6Me.

Tóth, I. J. and Hajdu, M. 2018a. *Public tenders of Hungarian hospitals on the standard dissection table of the economic analysis. Analysis of intensity of competition, corruption risks and price distortion of Hungarian public procurement.* CRCB Research Notes: 2017:2 Budapest: CRCB, January, 2018. https://bit.ly/2tWHajj

Tóth, I. J. and Hajdu, M. 2018b. "A korrupció mérési lehetőségei – lehetséges objektív indikátorok bemutatása egy magyar példa alapján", *Magyar Tudomány*, 179(4), pp. 507–528. doi: 10.1556/2065.179.2018.4.6.

Transparency International 2017. *Perceptions Index 2016*. Available at: https://www.transparency.org/news/feature/corruption_perceptions_index_2016.

Treisman, D. 2000. "The causes of corruption: a cross-national study", *Journal of Public Economics*, 76(3), pp. 399–457. Available at: http://econpapers.repec.org/RePEc:eee:pubeco:v:76:y:2000:i:3:p:399-457.

Wachs, J., Taha Yasseri, Balázs Lengyel, and János Kertész (2018) Social capital predicts corruption risk in towns, Cornell University, https://arxiv.org/abs/1810.05485v1

Annex

A1. Hungarian towns

Source: http://enfo.agt.bme.hu/drupal/node/8978

A2. The list of Hungarian towns

A2.1: The list of towns analysed

1	Komádi	31	Csongrád	61	Isaszeg
2	Balatonfüzfő	32	Sátoraljaújhely	62	Szendrő
3	Kaba	33	Balatonkenese	63	Hódmezővásárhely
4	Baktalórántháza	34	Hajdúszoboszló	64	Sopron
5	Ujkígyos	35	Gyöngyös	65	Őrbottyán
6	Bük	36	Örkény	66	Tab
7	Martfu	37	Komárom	67	Tát
8	Enying	38	Siklós	68	Biatorbágy
9	Felsőzsolca	39	Derecske	69	Vámospércs
10	Balmazújváros	40	Létavértes	70	Dabas
11	Szombathely	41	Balatonalmádi	71	Kisvárda
12	Hajduszoboszló	42	Zamárdi	72	Kiskőrös
13	Dunaujváros	43	Nyíradony	73	Dunaharaszti
14	Füzesabony	44	Újhartyán	74	Békés
15	Baja	45	Kozármisleny	75	Pilis
16	Hévíz	46	Pomáz	76	Fertőd
17	Cigánd	47	Kalocsa	77	Rácalmás
18	Csorna	48	Nagyecsed	78	Püspökladány
19	Pécel	49	Bonyhád	79	Kondoros
20	Ócsa	50	Szécsény	80	Gárdony
21	Mezőtúr	51	Ajka	81	Hajdúhadház
22	Mórahalom	52	Kazincbarcika	82	Bicske
23	Á• cs	53	Törökbálint	83	Dorog
24	Martonvásár	54	Balatonföldvár	84	Monor
25	Emőd	55	Piliscsaba	85	Beled
26	Vasvár	56	Makó	86	Bácsalmás
27	Mosonmagyaróvár	57	Pásztó	87	Edelény
28	Paks	58	Tiszavasvári	88	Maglód
29	Karcag	59	Dunavecse	89	Besenyszög
30	Gyula	60	Dombóvár	90	Mezőkeresztes

A2.1: The list of towns analysed (continuation)

91	Cegléd	121	Fonyód	151	Jászberény
92	Várpalota	122	Rakamaz	152	Kisköre
93	Körösladány	123	Székesfehérvár	153	Tokaj
94	Jánosháza	124	Nyírbátor	154	Vásárosnamény
95	Veszprém	125	Debrecen	155	Veresegyház
96	Zalakaros	126	Békéscsaba	156	Keszthely
97	Mezőhegyes	127	Lábatlan	157	Mór
98	Budakeszi	128	Újszász	158	Marcali
99	Pétervására	129	Fertőszentmiklós	159	Vaja
100	Letenye	130	Nyergesújfalu	160	Dunakeszi
101	Csepreg	131	Szentendre	161	Hajós
102	Füzesgyarmat	132	Szentlőrinc	162	Mátészalka
103	Nyírmada	133	Mélykút	163	Fehérgyarmat
104	Abádszalók	134	Sajószentpéter	164	Tét
105	Lenti	135	Aszód	165	Bábolna
106	Berettyóújfalu	136	Záhony	166	Pécs
107	Hajdúdorog	137	Tótkomlós	167	Mezőkövesd
108	Nyékládháza	138	Fegyvernek	168	Mezőberény
109	Üllő	139	Kőszeg	169	Máriapócs
110	Szigethalom	140	Kenderes	170	Nagykőrös
111	Nagykáta	141	Nyíregyháza	171	Biharkeresztes
112	Körmend	142	Ráckeve	172	Soltvadkert
113	Nyírtelek	143	Százhalombatta	173	Csákvár
114	Balassagyarmat	144	Kisbér	174	Tata
115	Tiszaföldvár	145	Aba	175	Kiskunfélegyháza
116	Mezőcsát	146	Siófok	176	Kaposvár
117	Pilisvörösvár	147	Lajosmizse	177	Eger
118	Szentes	148	Demecser	178	Dunavarsány
119	Ózd	149	Nagyatád	179	Alsózsolca
120	Heves	150	Tatabánya	180	Balatonfüred

A2.1: The list of towns analysed (continuation)

181	Sárvár	211	Dévaványa	241	Túrkeve
182	Csurgó	212	Szob	242	Kapuvár
183	Szikszó	213	Vác	243	Tiszaújváros
184	Harkány	214	Velence	244	Visegrád
185	Mindszent	215	Esztergom	245	Tompa
186	Sűlysáp	216	Tolna	246	Sarkad
187	Szeghalom	217	Győr	247	Sellye
188	Jászárokszállás	218	Sűmeg	248	Szigetszentmiklós
189	Jászapáti	219	Gyál	249	Pusztaszabolcs
190	Hatvan	220	Ibrány	250	Solt
191	Badacsonytomaj	221	Salgótarján	251	Jánossomorja
192	Hajdúnánás	222	Kisújszállás	252	Tapolca
193	Kunhegyes	223	Komló	253	Vésztő
194	Szekszárd	224	Vép	254	Tiszafűred
195	Rudabánya	225	Zirc	255	Gyömrő
196	Orosháza	226	Szigetvár	256	Tököl
197	Polgár	227	Újfehértó	257	Mezőkovácsháza
198	Budaörs	228	Lengyeltóti	258	Lőrinci
199	Jászfényszaru	229	Kecskemét	259	Miskolc
200	Budakalász	230	Vecsés	260	Tiszakécske
201	Tiszalök	231	Celldömölk	261	Csenger
202	Ercsi	232	Nagyhalász	262	Szerencs
203	Göd	233	Törökszentmiklós	263	Oroszlány
204	Sárbogárd	234	Putnok	264	Répcelak
205	Szarvas	235	Sárospatak	265	Nagykanizsa
206	Mohács	236	Szolnok	266	Érd
207	Diósd	237	Abony	267	Kistelek
208	Kiskunmajsa	238	Villány	268	Hajdúsámson
209	Tamási	239	Nádudvar	269	Dunaföldvár
210	Nagykálló	240	Kunszentmiklós	270	Szentgotthárd

A2.1: The list of towns analysed (continuation)

271	Albertirsa	281	Elek
272	Nagymaros	282	Encs
273	Pápa	283	Bóly
274	Zalaegerszeg	284	Bélapátfalva
275	Sásd	285	Szeged
276	Kiskunhalas	286	Gyomaendrőd
277	Kunszentmárton	287	Bátonyterenye
278	Gödöllő	288	Lébény
279	Fót	289	Balatonboglár
280	Barcs	290	Kistarcsa
		291	Kerepes

A2.2. List of towns excluded from the analysis due to issuing less than ten public procurement contracts between 2014 and 2018

Abaújszántó	Herend	Pálháza
Adony	Igal	Pannonhalma
Ajak	Izsák	Pécsvárad
Balatonlelle	Jánoshalma	Polgárdi
Balkány	Jászkisér	Rákóczifalva
Bátaszék	Kadarkút	Rétság
Battonya	Kecel	Sajóbábony
Berhida	Kemecse	Sándorfalva
Bodajk	Kerekegyháza	Simontornya
Borsodnádasd	Mágocs	Szabadszállás
Csanádpalota	Mándok	Tápiószele
Csorvás	Medgyesegyháza	Téglás
Devecser	Nagybajom	Tiszacsege
Dombrád	Nagymányok	Tura
Gönc	Nyírlugos	Verpelét
Gyöngyöspata	Onga	Zalalövő
Gyönk	Őriszentpéter	Zalaszentgrót
Halásztelek	Pacsa	Zsámbék

A3. Correlations between analysed indicators

Spearman's rank correlation coefficients

	SB	LTR	CR2	ICI
SB	1.0000			
LTR	-0.1247	1.0000		
CR2	0.6724	0.5528	1.0000	
ICI	-0.2621	-0.1795	-0.2926	1.0000

Note: all coefficient is significant at p < 0.05 level

Pearson's correlation coefficients

	CR2	ICI	MOPI	GRADE_RATE	BUSINESS_DEN	INCOME
CR2	1.0000					
ICI	-0.3032	1.0000				
MOPI	-0.1887	0.1573	1.0000			
GRADE_RATE	-0.3137	0.3197	0.3727	1.0000		
BUSINESS_DEN	-0.2208	0.3024	0.2737	0.8151	1.0000	
INCOME	-0.2627	0.2965	0.2930	0.8079	0.6288	1.0000
LNPOP	-0.2731	0.2019	0.4634	0.5001	0.3403	0.3993

Note: all coefficient is significant at p < 0.05 level