CORRUPTION
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BUDAPEST

Corruption risks, intensity of competition and estimated direct social loss in public procurement of Zagreb - 2011-2016

Final report

Budapest, September 2017

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Corruption risks, intensity of competition and estimated direct social loss in public procurement of Zagreb - 2011-2016

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Executive Summary

- The research carried out by CRCB for the CMS is based on the analysis of 5,922 contracts of 4,483 public procurement issued by Grad Zagreb and Zagreb Holding between 2011 and 2016. During the data extraction, we could identify 1,197 winner companies on these tenders which are also the subject of the investigation.

- The following questions will be examined in the study: (i) What are the tendencies regarding the strength of competition and the corruption risks during the analysed time period? (ii) Which companies or groups of companies were the most successful on the tenders? Does the public procurement won by these companies differ from the rest by the corruption risks and the strength of competition? (iii) How are public procurement affected by the election years? How do the corruption risk and the intensity of competition in public procurement change in pre-election and in election years? (iv) To what extent can we estimate the direct social losses due to corruption and low intensity of competition in the period of 2011-2016? How does the direct social losses differ between the two analysed issuer (i.e. Grad Zagreb and Zagreb Holding?)

- In the analysis we are using the Big Data approach to download all public procurement data of the aforementioned issuers from the official portal of the Croatian Public Procurement Authority. After the data extraction, we put the main information of all tenders to a structured database. We expand this database with company level data (ownership, personal ties and balance sheet data) from the Bisnode database. Then, after data cleaning, using statistical methods we analyse the corruption risks and intensity of competition from the aspect of the public procurement tenders and the winner companies as well.

- The total sum of net contract values suddenly increased between 2011 and 2013 (from 678 to 6,362 million HRK). Since a sudden decrease between 2013 and 2014 (from 6,362 to 3,480 million HRK) no clear tendencies or breakpoints could emerge until 2016.

- There are no clear breakpoints and permanencies in the yearly lists of the companies realising the biggest incomes from the public procurement of the City of Zagreb and Zagreb Holding.

- Tenders with single bidder generally involved companies that have less success in other procurement between 2011 and 2015.

- The corruption risk of public procurement increased significantly during the period. The share of tenders without competition increased from 25% to 34% between 2011 and 2016.

- Regarding the share of tenders without competition and comparing Zagreb's data with data of other European capitals, it can be seen that in Zagreb the

share of non-competitive tenders is much higher than in Ljubljana, Prague, Paris or especially in Vienna or Amsterdam.

- In 2011-12, the tenders launched by Zagreb Holding had higher corruption risk than the tenders of the City of Zagreb. Since 2013, the City of Zagreb is the one with public procurement with higher corruption risks.

- During the period the intensity of competition decreased considerably at public procurement of the City of Zagreb.

- The results point out that the prices of public procurement are remarkably more distorted when there is no competition compared to those successful tenders with competition. The strength of price distortion increases significantly with the increase of corruption risk.

- The net contract prices of public procurement launched by Zagreb Holding are remarkably more distorted then ones of the City of Zagreb.

- There is a significant difference in price distortion among the contract prices in each year. While in 2013 (the year of the previous local elections) and in 2015 the first digits of net contract prices are very far from the expected (theoretical) distribution, in 2011, 2012, 2014 and in 2016 they fit well.

- The results pointed out that 27% of the total amount of money spent by public procurement was spent without competition. This high level shows that in Zagreb between 2011 and 2016 the competition practically did not exist in more than the quarter of the cases where public money was spent on public procurement.

- The amount spent without competition is considerable, approximatively 5 billion HRK in the whole period. The highest amount was spent without competition in 2013 by the Zagreb Holding (1.9 billion HRK).

- The median level of rate of direct social loss related to net contract value (DSLR) has moved between 31-35% during the whole period. The tenders launched by Zagreb Holding had higher median rate of direct social loss in 2011 (36-39%) and lower ones between 2013 and 2016 (28-33%).

- According to the method used we estimate that the total direct social loss in the whole period reached 1.47 billion HRK in public procurement of Zagreb Holding and 1.23 billion in tenders of City of Zagreb respectively. We estimate the highest amount of DSL, 813 million HRK in 2013 at tenders launched by Zagreb Holding.

- At tenders launched by the City of Zagreb the direct social loss increased from 90 million HRK (in 2011) to 419 million HRK in 2016, one year before the local elections.

- Concerning the economic branches the most suspicious tenders were in the IT sector. Here was the highest rate of tenders without competition; the indicators of price distortion showed high level of distortion: the highest level of rounded price and the highest level of declination of the distribution

of first digits from the theoretical distribution, and finally highest level of rate of direct social loss.

- Comparison of public procurement data of some European capitals on corruption risks and intensity of competition points out considerable differences. The results point out that Zagreb has the worst figures amongst European capitals concerning corruption risks and intensity of competition of public procurement.

- The analysis of public tenders launched by the Zagreb City and Zagreb Holdings in the period of 2011-2016 points out that these public tenders were characterized by high corruption risks and low intensity of competition. As a result the social loss is significant. The analysis also points out that a group of Croatian companies are likely to incorporate the above mentioned characteristics of procurement procedures into their expectations, and tenders with low intensity of competition and high corruption risk play an important role in their business strategy.

- Our results also underline the need for a regular empirical analysis of the intensity of competition and corruption risks of Croatian public procurement - this could be the first step towards an increase of social welfare.

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Contents

Introduction

The research carried out by CRCB for the CMS is based on the analysis of 5,922 contracts of 4,483 public procurement issued by Grad Zagreb and Zagreb Holding between 2011 and 2016. During the data extraction, we could identify 1,197 winner companies on these tenders which are also the subject of the investigation. The following questions will be examined in the study:

1. What are the tendencies regarding the strength of competition and the corruption risks during the analysed time period?

2. Which companies or groups of companies were the most successful on the tenders? Does the public procurement won by these companies differ from the rest by the corruption risks and the strength of competition?

3. How are public procurement affected by the election years? How do the corruption risk and intensity of competition in public procurement change in pre-election and in election years?

4. To what extent can we estimate the direct social losses due to corruption and low intensity of competition in the period of 2011-2016? How does the direct social losses differ between the two analysed issuer (i.e. Grad Zagreb and Zagreb Holding?)

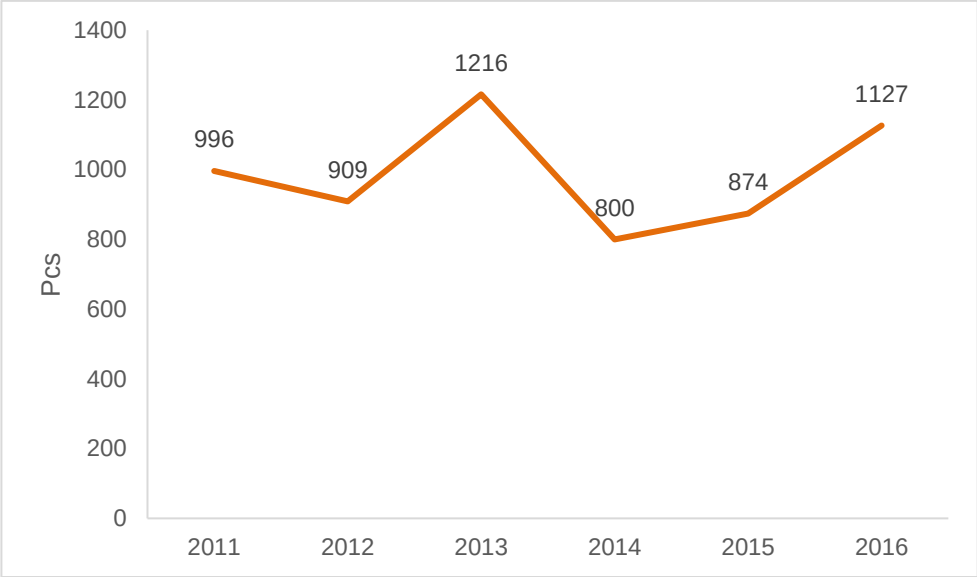
We are using the Big Data approach to download all public procurement data of the aforementioned issuers from the official portal of the Croatian Public Procurement Authority (https://eojn.nn.hr/Oglasnik/). After the data extraction, we put the main information of all tenders to a structured database. We expand this database with company level data (ownership, personal ties and balance sheet data) from the Bisnode database. Then, after data cleaning[1] using statistical methods we analyse the corruption risks and intensity of competition from the aspect of the public procurement tenders and the winner companies as well.

[1] For details, see Appendix 1 on issues concerning the data published by the Croatian Public Procurement Authority.

1. General tendencies between 2011 and 2016

Regarding the number of contracts, a major decrease can be observed between 2013 and 2014. The total number of contracts was moving between 800 and 1216 per year between 2011 and 2016 (see Fig. 1.1.).

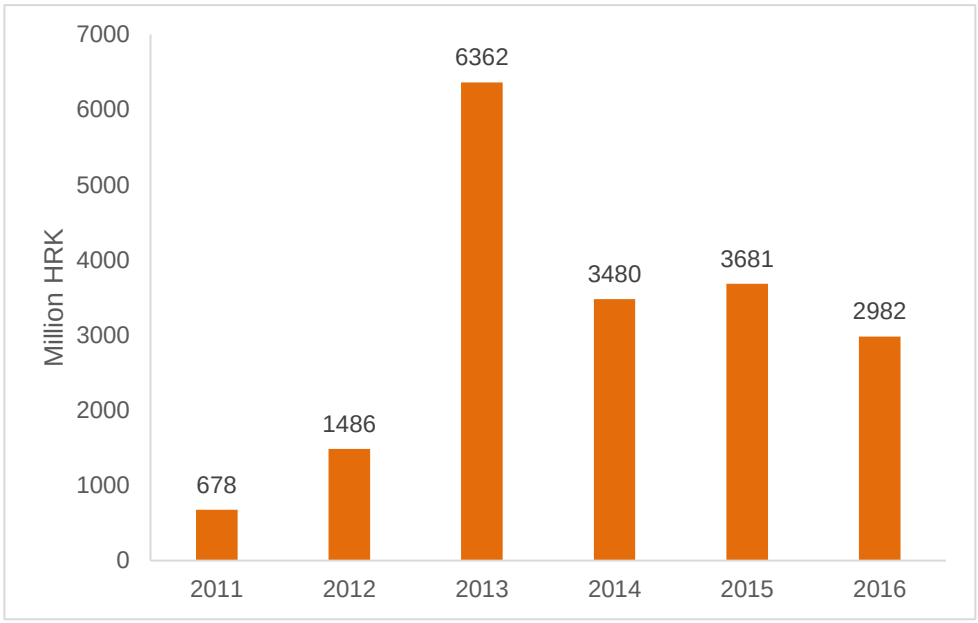
Figure 1.1.: Yearly number of contracts between 2011 and 2016, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

The total sum of net contract values suddenly increased between 2011 and 2013 (from 678 to 6,362 million HRK). Since a sudden decrease between 2013 and 2014 (from 6,362 to 3,480 million HRK) no clear tendencies or breakpoints could emerge until 2016 (see Fig. 1.2.). We have to note that there were local elections in 2013 and also there will be such elections in 2017 – a rise in the yearly sum of the net contract values can be expected for the years of the elections.[2]

Figure 1.2.: Aggregated net contract values per year between 2011 and 2016, million HRK, N = 5,922

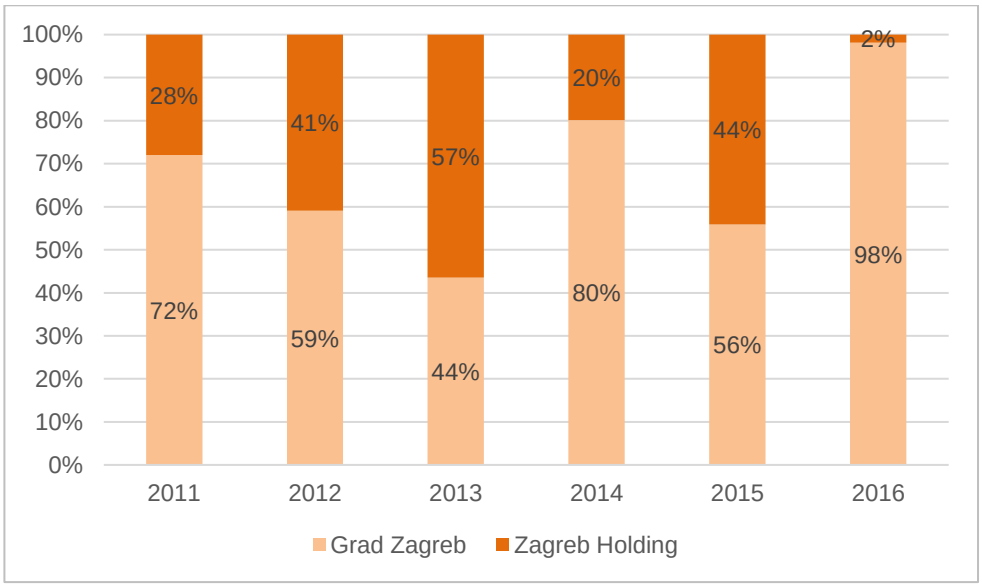


Source: CRCB own calculation based on data of EPRCRC

[2] This assumption matches with the scientific results concerning the effects of electoral cycles and public expenses. Several papers investigate this topic on the macro level – for instance see: Belo, et al. 2013; Bove, et al. 2016. The present study points out such effects on the micro-level (i.e. on the level of public procurements) what can be regarded as a novelty on this field.

Most of the tenders were issued by Grad Zagreb in nearly every analysed year (the only exception was 2013); the ratio of contracts linked to Zagreb Holding was extremely low (1%) in 2016 (see Fig. 1.3.), because from 2016 City of Zagreb acts as a central body for public procurement of Zagreb Holding.

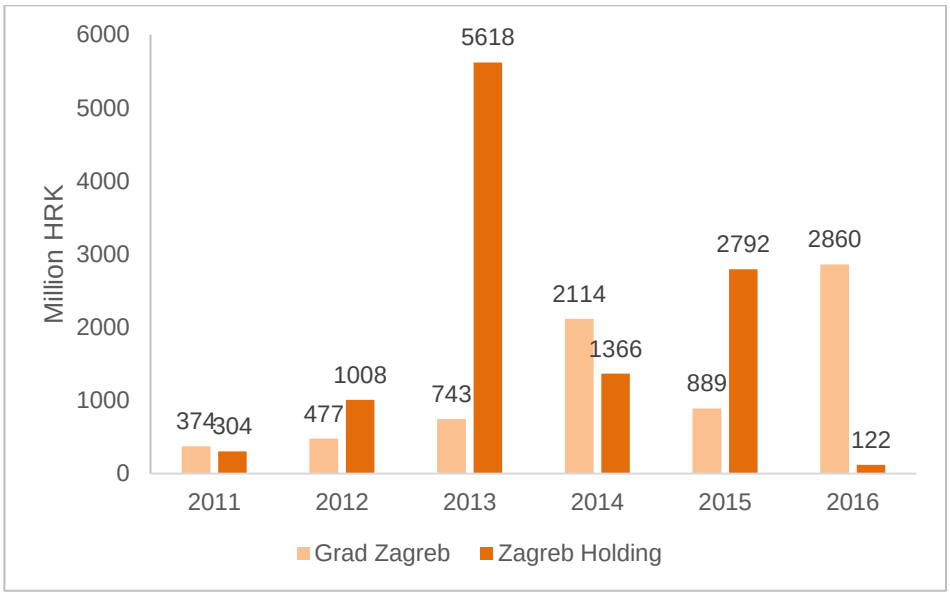
Figure 1.3.: Distribution of contracts by issuer between 2011 and 2016, %, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

Even though the procurement between the two issuers was nearly equally distributed in 2013, the sum of the values of the contracts issued by Zagreb Holding significantly exceeds the sum that stands for the contracts of Grad Zagreb during this year – that may be affected by the influences of the local elections in 2013 – (see Fig. 1.4.).

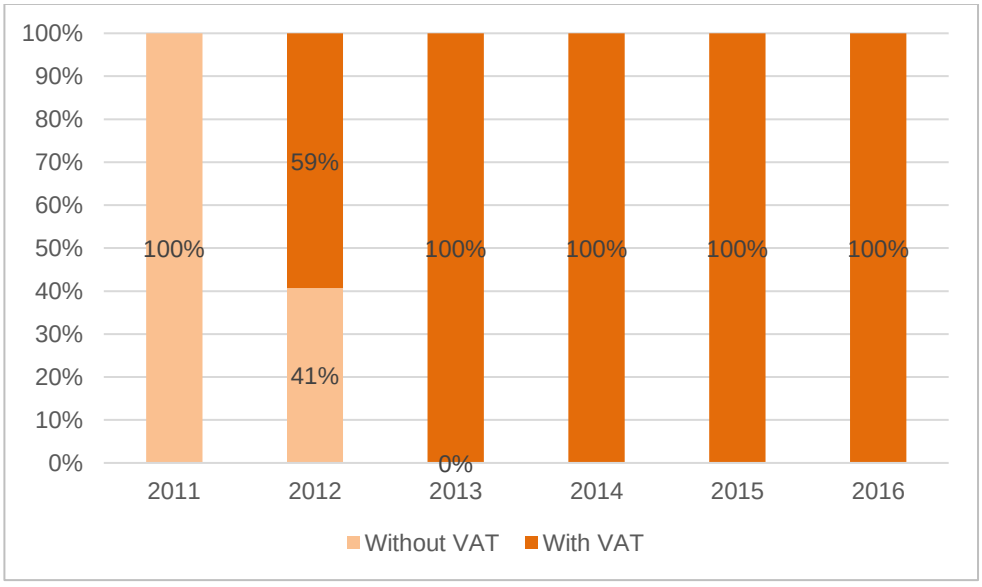
Figure 1.4.: Aggregated net contract values per year by issuer between 2011 and 2016, million HRK, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

In 2011, all of the contract values were expressed without the inclusion of VAT, but after a switch in 2012, all of the contract values include the VAT since 2013 (see Fig. 1.5.).

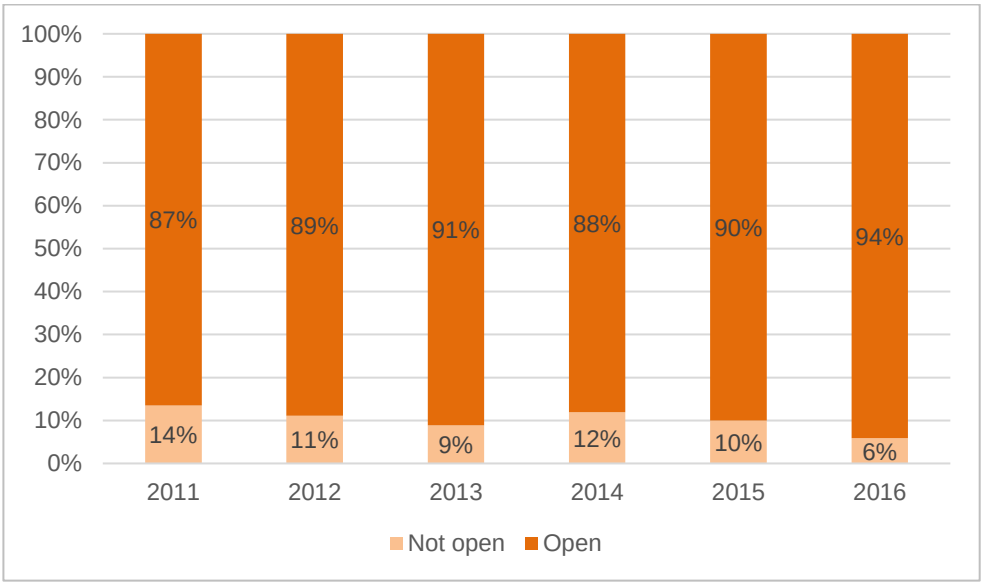
Figure 1.5.: Distribution of contracts by VAT in their values between 2011 and 2016, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

The share of contracts deriving from open procurement procedures was constantly high during the observed period (87%-94%) (see Fig. 1.6.).

Figure 1.6: Share of contracts deriving from open procurement procedures between 2011 and 2016, N = 5,920

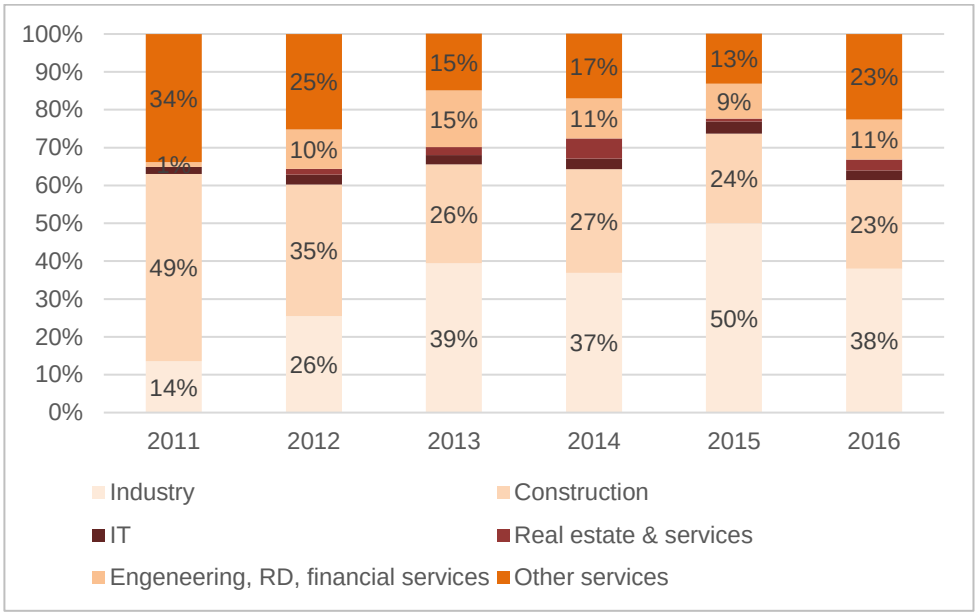


Source: CRCB own calculation based on data of EPRCRC

Notes:
1) The following types of procurement were considered as open: 'Otvoreni' and 'Otvoreni postupak'.
2) The following types of procurement were considered as not open: 'Pregovarački bez prethodne objave', 'Pregovarački postupak bez prethodne objave', 'Pregovarački postupak s prethodnom objavom', 'Sklapanje ugovora bez prethodne objave poziva na nadmetanje (u slučajevima navedenim u Odjeljku 2 Priloga D1)', 'Sklapanje ugovora o javnim uslugama iz Dodatka II.B.'.

The distribution of contracts between the different sectors shows considerable variability during the analysed time period; the most dominant sectors are the construction (23%-49%), the industry (14%-50%) and the area of other services (13%-34%) (see Fig. 1.7.).

Figure 1.7.: Distribution of contracts by sector between 2011 and 2016, N = 5,840



Source: CRCB own calculation based on data of EPRCRC

2. Analysis of the winner companies

There are no clear breakpoints and permanencies in the yearly lists of the companies realising the biggest incomes from the public procurement of Grad Zagreb and Zagreb Holding[3]. The TOP15 lists for the most significant winner companies[4] are barely overlapping with each other. Table 2.1. shows the ratios how the TOP15 lists[5] correspond between the analysed years – major overlap can be seen only between 2013 and 2015 (33%).

Table 2.1: Ratio of correspondence between the lists of the TOP15 winner companies between the analysed years (2011 and 2016)

	2011	2012	2013	2014	2015	2016
2011	100%	27%	20%	20%	7%	13%
2012	27%	100%	20%	13%	7%	20%
2013	20%	20%	100%	27%	33%	20%
2014	20%	13%	27%	100%	0%	20%
2015	7%	7%	33%	0%	100%	7%
2016	13%	20%	20%	20%	7%	100%

Source: CRCB own calculation based on data of EPRCRC

There are no companies that appeared continuously on the TOP15 lists of the analysed years. However, there are several companies that enter the TOP15 list in different, non-consecutive years:

- TEHNIKA d.d. (2011 and 2016)
- IKOM d.o.o. (2011 and 2014)
- USLUGA d.o.o. (2012 and 2016)
- PUGAR d.o.o. (2013 and 2015)
- VODOTEHNIKA d.d. (2012, 2014 and 2016)
- KONČAR - ELEKTRIČNA VOZILA d.d. (2013 and 2015)
- GUT d.o.o. (2013 and 2015)

[3] Only the pubic procurements with one winner are taken into account in this chapter (N=3,923) as there is no information available in the data we had extracted about how the contract value was divided between multiple winners.
[4] Winner companies with the highest aggregated net contract values were considered as the most successful ones in every analysed year.
[5] See the lists themselves in Table 2.2.

- TIGRA d.o.o. (2013 and 2015)
- INA INDUSTRIJA NAFTE d.d. (2013 and 2016)
- HEP-OPSKRBA d.o.o. (2014 and 2016)

In addition, some companies appear on the TOP15 lists in only two consecutive years:

- MEŠIĆ COM d.o.o. (2011 and 2012)
- HM-PATRIA d.o.o. (2011 and 2012)
- TEMEX d.o.o. (2012 and 2013)

Furthermore, a few companies appear on the lists in both consecutive and non-consecutive years:

- PRIVREDNA BANKA ZAGREB D.D. (2011, 2013 and 2014)
- PETROL d.o.o. (2013, 2014 and 2016)

Finally, ZAGREBAČKA BANKA d.d. is the only company that appear on the lists of several consecutive years as it was among the TOP15 winner companies between 2011 and 2014. Also, it is worth to highlight that GEORAD d.o.o. appears on the top lists between 2011 and 2013 and also between 2015 and 2016.

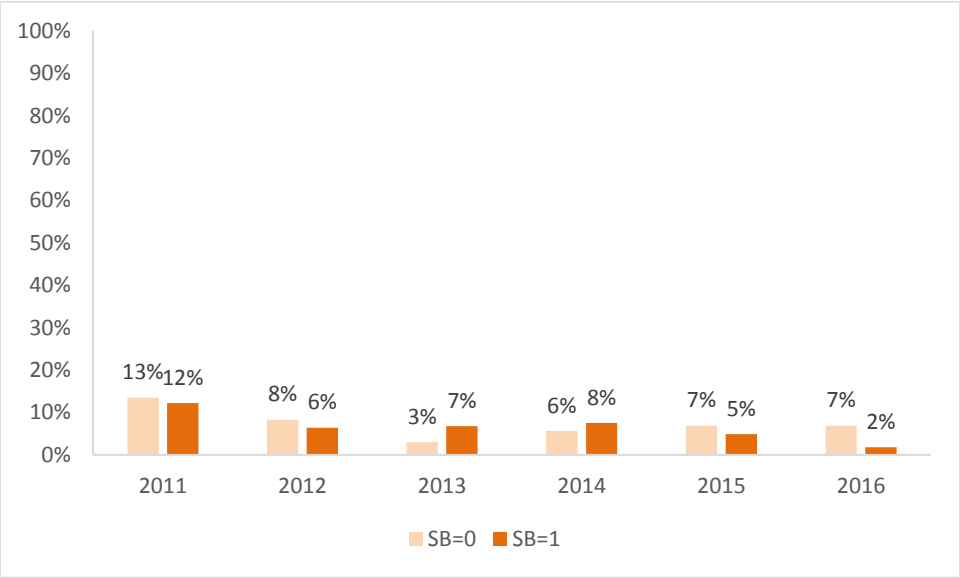
Table 2.2.: The TOP15 winner companies based on the aggregated net contract values per year between 2011 and 2016

Rank	2011	2012	2013	2014	2015	2016
1	TEHNIKA d.d. (50295231 HRK)	APIS d.o.o. (82230000 HRK)	UniCredit Leasing Croatia d.o.o. (617629645 HRK)	LUKOIL CROATIA d.o.o. (544848151 HRK)	KONČAR - ELEKTRIČNA VOZILA d.d. (131848762 HRK)	INA INDUSTRIJA NAFTE d.d. (265671478 HRK)
2	ZAGREBAČKA BANKA d.d. (35177154 HRK)	USLUGA d.o.o. (59409572 HRK)	ZAGREBAČKA BANKA d.d. (251537089 HRK)	PETROL d.o.o. (313746764 HRK)	PUGAR d.o.o. (127139138 HRK)	PETROL d.o.o. (260701285 HRK)
3	VODOPRIVREDA ZAGREB d.d. (29129370 HRK)	VODOTEHNIKA d.d. (51233866 HRK)	ERSTE & STEIERMARKISCHE S-LEASING d.o.o. (243132840 HRK)	CRODUX DERIVATI DVA d.o.o. (301098997 HRK)	P.G.P. d.o.o. (126961715 HRK)	HEP-OPSKRBA d.o.o. (155440961 HRK)
4	PRIVREDNA BANKA ZAGREB D.D. (18612429 HRK)	GEORAD d.o.o. (46582478 HRK)	HYPO ALPE ADRIA LEASING d.o.o. (185632354 HRK)	HEP-OPSKRBA d.o.o. (185837895 HRK)	TEGRA d.o.o. (102854428 HRK)	TEHNIKA d.d. (146760938 HRK)
5	MEŠIĆ COM d.o.o. (17551198 HRK)	ZAGREBAČKA BANKA d.d. (42837783 HRK)	PUGAR d.o.o. (160137088 HRK)	PRIVREDNA BANKA ZAGREB D.D. (159731459 HRK)	GEORAD d.o.o. (99968280 HRK)	ELECTUS DGS d.o.o. (102298025 HRK)
6	IKOM d.o.o. (16612875 HRK)	MEŠIĆ COM d.o.o. (42540028 HRK)	KONČAR - ELEKTRIČNA VOZILA d.d. (155264063 HRK)	ERSTE & STEIERMÄRKISCHE BANK d.d. (84605550 HRK)	GUT d.o.o. (97101047 HRK)	USLUGA d.o.o. (45682625 HRK)
7	DEKRA ZA PRIVREMENO ZAPOŠLJAVANJE d.o.o. (16237368 HRK)	AMB GRADNJA d.o.o. (36055837 HRK)	GEORAD d.o.o. (141869036 HRK)	VODOTEHNIKA d.d. (49853839 HRK)	ŠUŠKOVIĆ-GRAĐENJE d.o.o. (94266135 HRK)	PROJEKTGRADNJA d.o.o. (45138398 HRK)
8	GIP PIONIR d.o.o. (14638468 HRK)	HM-PATRIA d.o.o. (33610771 HRK)	HYPO-LEASING KROATIEN d.o.o. (135930784 HRK)	GRADSKA PLINARA ZAGREB - OPSKRBA d.o.o. (45807293 HRK)	GTM d.o.o. (94125452 HRK)	VIADUKT d.d. (36200857 HRK)
9	HM-PATRIA d.o.o. (14502454 HRK)	INSTAL PROM d.o.o. (31815856 HRK)	PETROL d.o.o. (135170489 HRK)	ZAGREBAČKA BANKA d.d. (45159874 HRK)	PRIGORAC GRAĐENJE d.o.o. (93805070 HRK)	DUKAT d.d. (36112272 HRK)
10	V GRUPA d.o.o. (12293026 HRK)	NERING d.o.o. (30182617 HRK)	GUT d.o.o. (130939468 HRK)	IKOM d.o.o. (38544031 HRK)	TIGRA d.o.o. (91593741 HRK)	PI VINDIJA d.d. (35186933 HRK)
11	GOLUBOVEČKI KAMENOLOMI d.o.o. (10913450 HRK)	KINDER GRADNJA (29816396 HRK)	TIGRA d.o.o. (114969139 HRK)	KING ICT d.o.o. (29291771 HRK)	EKO-MIKS d.o.o. (90792956 HRK)	GEORAD d.o.o. (34406832 HRK)
12	SPEKTAR GRADNJA d.o.o. (10608992 HRK)	PLANGRAD d.o.o. (29530074 HRK)	PRIVREDNA BANKA ZAGREB D.D. (114571270 HRK)	ERSTE & STEIERMARKISCHE S-LEASING d.o.o. (26763105 HRK)	HVAR d.o.o. (89996251 HRK)	METRONET TELEKOMUNIKACIJE d.d. (34300898 HRK)
13	TEH-GRADNJA d.o.o. (9977336 HRK)	TEMEX d.o.o. (28451816 HRK)	TEMEX d.o.o. (110689500 HRK)	BIROMAX d.o.o. (26648317 HRK)	M SOLDO d.o.o. (88812530 HRK)	MONTER STROJARSKE MONTAŽE d.d. (30642974 HRK)
14	GEORAD d.o.o. (9709604 HRK)	SKEN-MONT d.o.o. (28356480 HRK)	INA INDUSTRIJA NAFTE d.d. (108651563 HRK)	RAIFFEISEN LEASING d.o.o. (24065694 HRK)	NISKOGRADNJA DONJI JALŠEVAC d.o.o. (81725438 HRK)	VODOTEHNIKA d.d. (29641687 HRK)
15	UPS AGENCIJA ZA PRIVREMENO ZAPOŠLJAVANJE d.o.o. (9418100 HRK)	HIDROCOMMERCE d.o.o. (27320559 HRK)	ĆIBO-PROMET d.o.o. (105096984 HRK)	DIJANEŽEVIĆ AUTOPRIJEVOZ I GRADNJA d.o.o. (23054616 HRK)	HP-HRVATSKA POŠTA d.d. (79058990 HRK)	ŠKOLSKA KNJIGA d.d. (27524334 HRK)

Source: CRCB own calculation based on data of EPRCRC
Note: the aggregated net contract values are in parentheses

There are no systematic differences regarding the ratio of tenders won by the top winner companies between the groups of procurement with single and several bidders (see Fig. 2.1.) during the analysed time period. In 2013 and 2014, the top winners tended to win more of the tenders with single bidder (in 2013 and 2014). Conversely, in 2011, 2012, 2015 and 2016, the presence of the top winners was more prevalent among the tenders with several bidders.

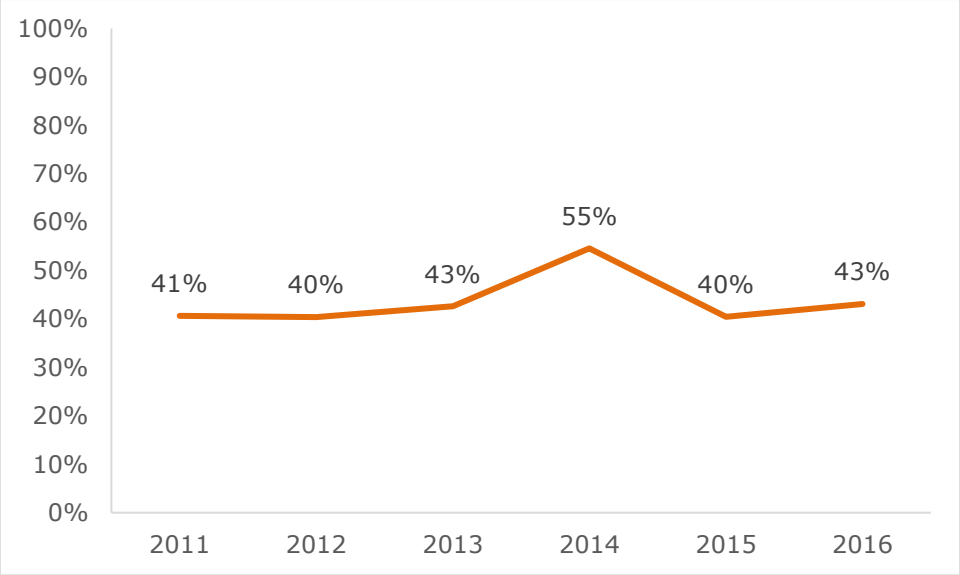
Figure 2.1.: Proportion of tenders won by the greatest winners in the given years by single bidder (SB), between 2011 and 2016, N=5,260



Source: CRCB own calculation based on data of EPRCRC
SB = 0, more than one bidder
= 1, only one bidder

Considering the ratio between the sum of the net values of the public procurement won by the companies belonging to the TOP15 lists and total aggregated values in analysed years, we can see a peak (55%) in 2014, in the year after the last local government elections; this finding suggests that in that year the money transferred via public procurement became more concentrated to the most significant winners.

Figure 2.2.: Ratio of sum of net contract values of tenders won by companies belonging the TOP15 greatest winners and the total aggregated net contract values per year between 2011 and 2016, N=5,260



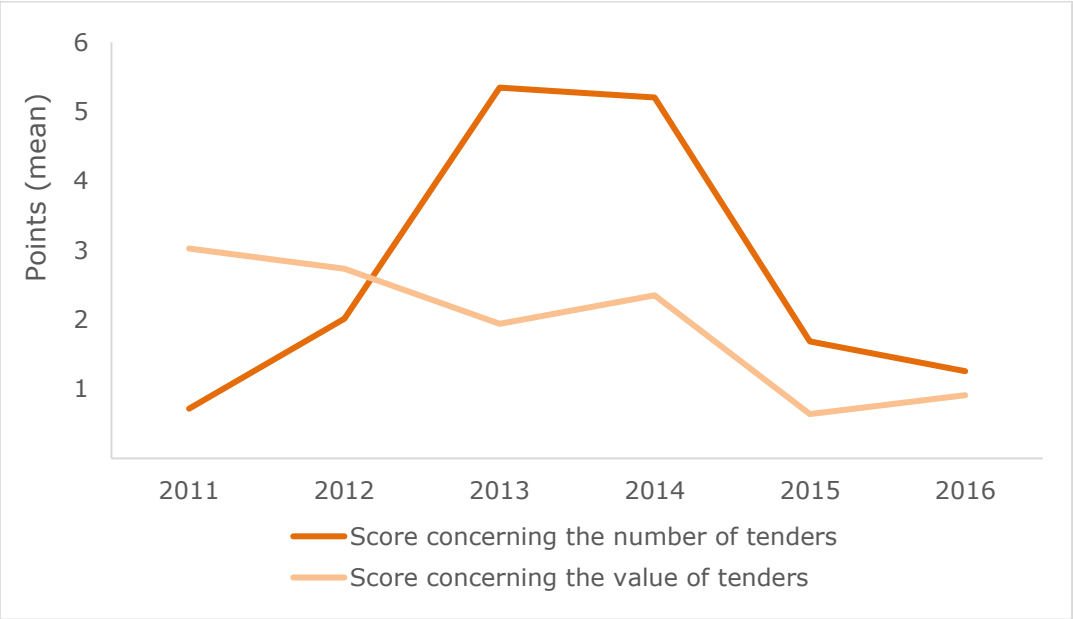
Source: CRCB own calculation based on data of EPRCRC
Note: the groups of the greatest winners are based on the net values of the public procurement aggregated to the level of winners in every year – see Table 2.2 for the lists.

In addition, we evaluated the performance of all of the winner companies on the public procurement. We calculated two scores for all of the winners in each year. The first one is based on the ratio between the number of tenders they had won and the total number of procurements in the given years. As for the second score, we calculate the ratio between the amount of money the given companies won on the tenders and total aggregated net contract values of the public procurement in every analysed year. Higher values of the scores indicate that a certain company won more tenders (or more money on tenders), so the higher scores mean high level of homogeneity and high level of concentration and the lower scores mean more heterogeneity and low level of concentration. For the sake of better interpretability, instead of the aforementioned ratios we publish the Z-

transformed[6] variants of these indicators[7].

The indicator based on the number of tenders suggests that the winners of the public procurement had become less fragmented or in other terms less diverse between 2011 and 2013 (see Fig. 2.3.). This tendency reversed after 2014. However, the scores concerning the value of the tenders show a decreasing tendency during the analysed time period. This result points out that the distribution of the money on the tenders launched by the two issuers (Zagreb Holding and City of Zagreb) became less concentrated.

Figure 2.3.: Average scores measuring winner companies' performance on public procurement between 2011 and 2016, N=5,260



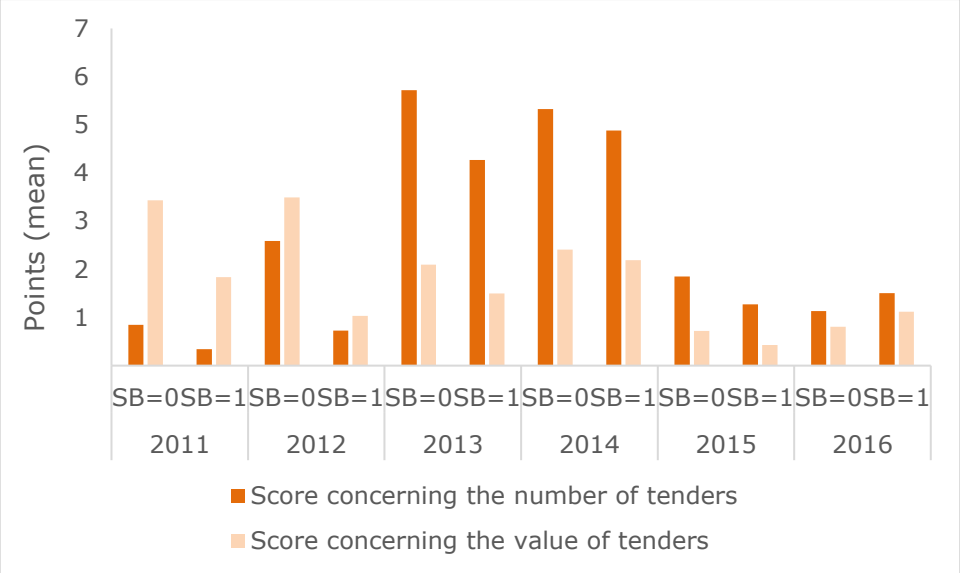
Source: CRCB own calculation based on data of EPRCRC
Note: the higher values indicate the better performance on public tenders.

Furthermore, in the case of tenders with single bidder these average performance scores tend to be lower between 2011 and 2015 (see Fig. 2.4.). Therefore, it can be concluded, that on tenders without competition the companies with lower performance on public procurement tended to win during this time period; in other words, the tenders with single bidder generally involved winners that had less success on other procurement. Although, regarding 2016, the opposite conclusion can be drawn, as the mean public procurement performance scores of the winners were higher

[6] Z-transformation makes indicators more understandable and comparable. For details, see: https://en.wikipedia.org/wiki/Standard_score
[7] As these indicators characterize the winner companies, the standardization was done on the aggregation level of companies. Therefore, the distributions of the scores is not standard normal on the aggregation level of public procurements.

in the cases of the tenders without competition.

Figure 2.4.: Average scores measuring winner companies' performance on public procurement by number of bidders, between 2011 and 2016, N=5,260



Source: CRCB own calculation based on data of EPRCRC
Notes:
1) the higher values indicate the better performance on public tenders.
2) SB=0 indicates more than one bidder, SB=1 indicates single bidder.

3. Corruption risks and intensity of competition

In this section, first we focus on the measurement and the analysis of corruption risks of public procurement tenders and then we deal with how the intensity of competition changed over the analysed period.

The share of single bidder contracts is one other important indicator of corruption risk. The study of corruption risks is the study of the conditions of corruption. If somebody wants to be corrupt, then he/she sets up conditions to generate corruption. The corruption risk means that these conditions for corruption exist in the examined public procurement.

The analysis of corrupt and collusive behaviour with hard data is an important new approach in the empirical research dealing with public procurement. In this report, we measure the corruption risk using an indicator which indicates the lack of competition during the tenders: there was only one bidder in the tender.

Measuring the prevalence of single bidder contract we constructed an indicator Single Bidder (SB) using the following rule:

SB = 1 if the tender was conducted with only one bidder

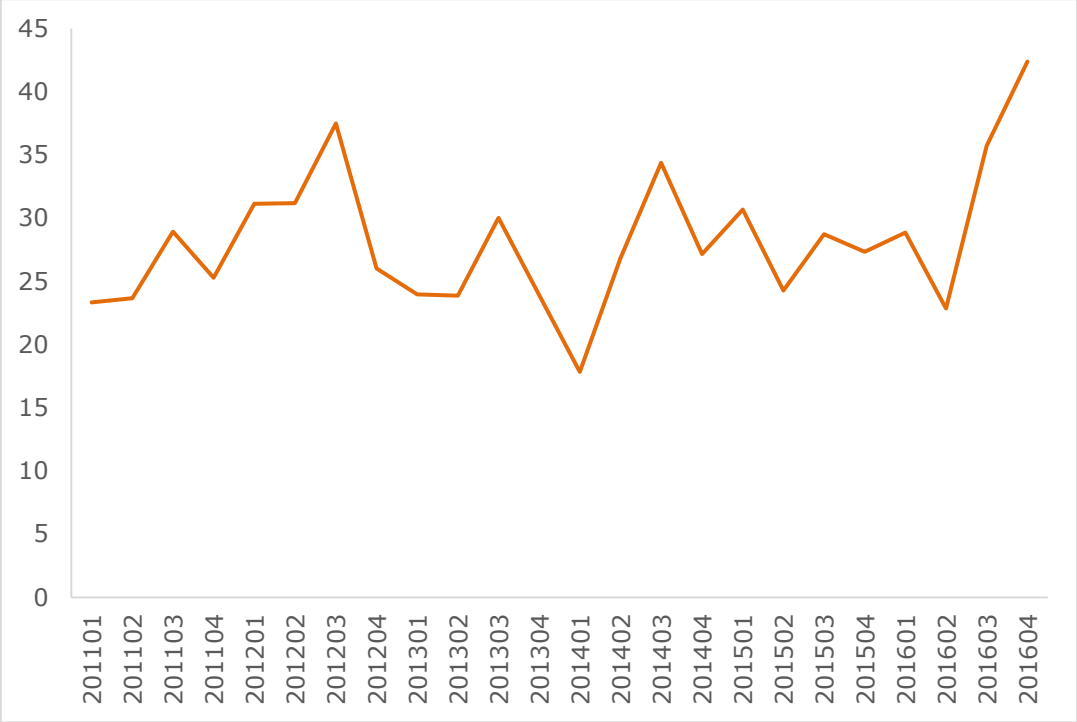
SB = 0 if there were more than one bidder.

In the tenders launched by the City of Zagreb and Zagreb Holding the share of tender with single bidder, i.e. tenders without competition, raised significantly, 9 percentage points between 2011 and 2016 (see Fig. 3.1 and 3.2.). This is a solid mark of rising tendency of corruption risk over the period.

There is significant difference amongst European countries in this regard. Budapest performs better than Zagreb based on the national public procurement data: the former has less tenders without competition than the latter (see Fig. 3.3.).

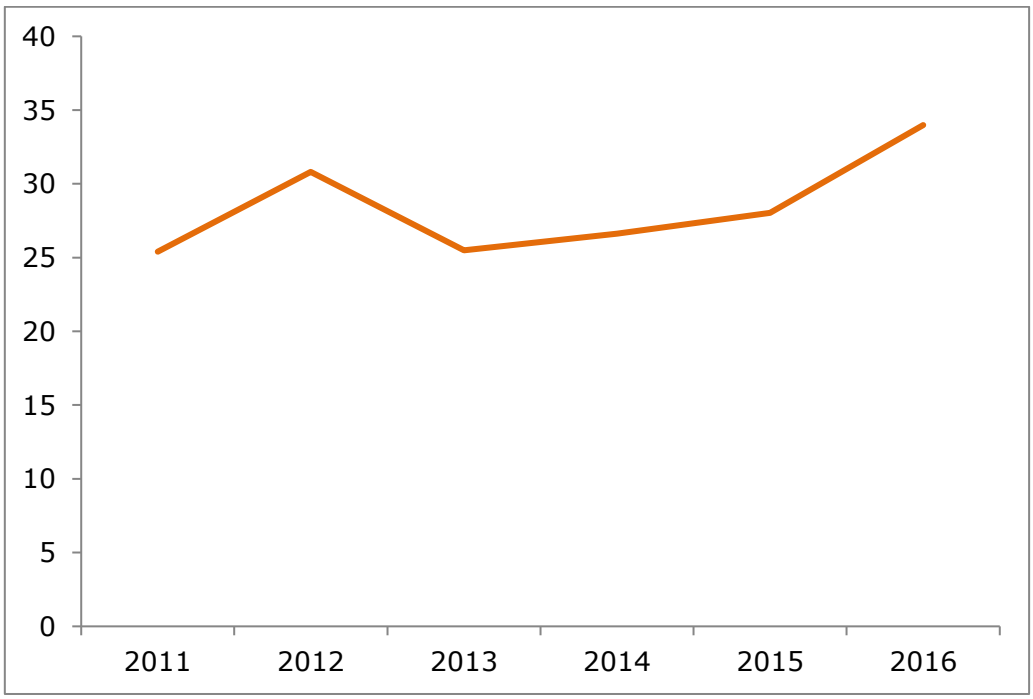
Regarding the data based on the European TED database which contains only tenders with large contract values we have to point out that the Zagreb's figures are better than the figure of Warsaw and much weaker than the figures of Ljubljana, Prague, Budapest or Rome and especially Paris, Vienna or Amsterdam (see Fig. 3.4. and Fig. 3.5.). In the latter three capitals the share of tenders without competition varied between 2 and 15 percent in the period of 2006-2015.

Figure 3.1.: Share of tenders without competition (SB) by quarter, 2011-16, %, N = 5,922



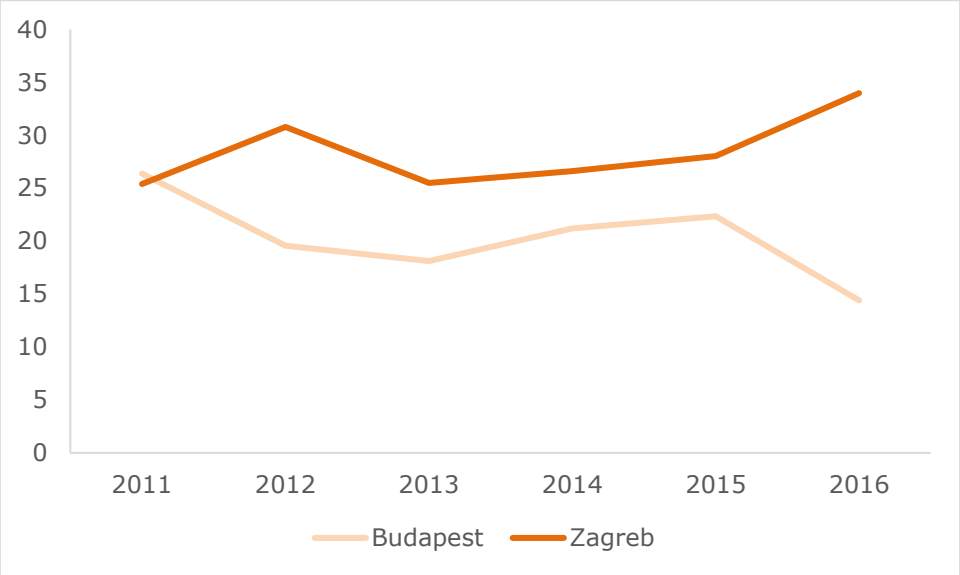
Source: CRCB own calculation based on data of EPRCRC

Figure 3.2.: Share of tenders without competition (SB) by year, 2011-16, %, N = 5,922



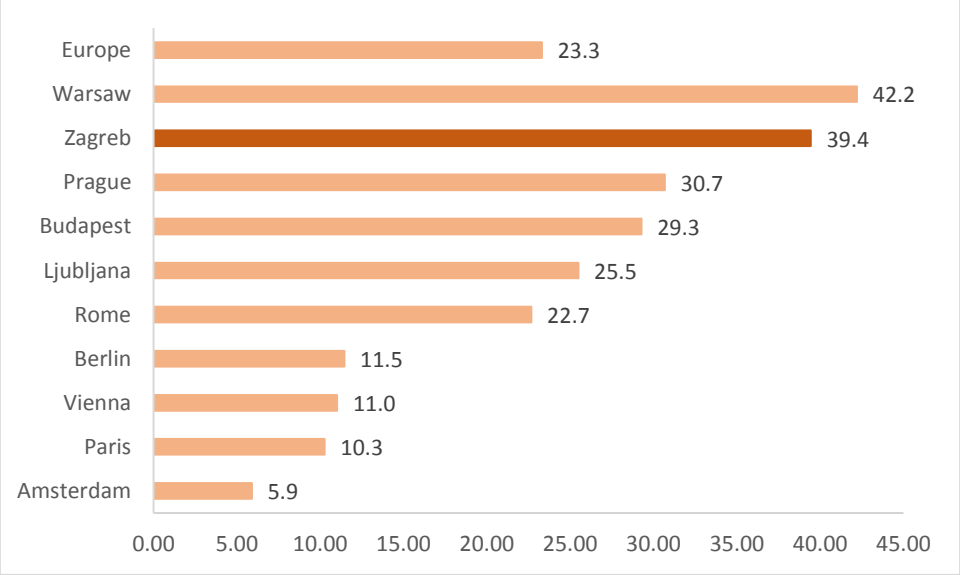
Source: CRCB own calculation based on data of EPRCRC

Figure 3.3.: Share of tenders without competition (SB) in Zagreb and in Budapest, 2011-16, %, N = 5,922 (for Zagreb) and N = 2,849 (for Budapest)



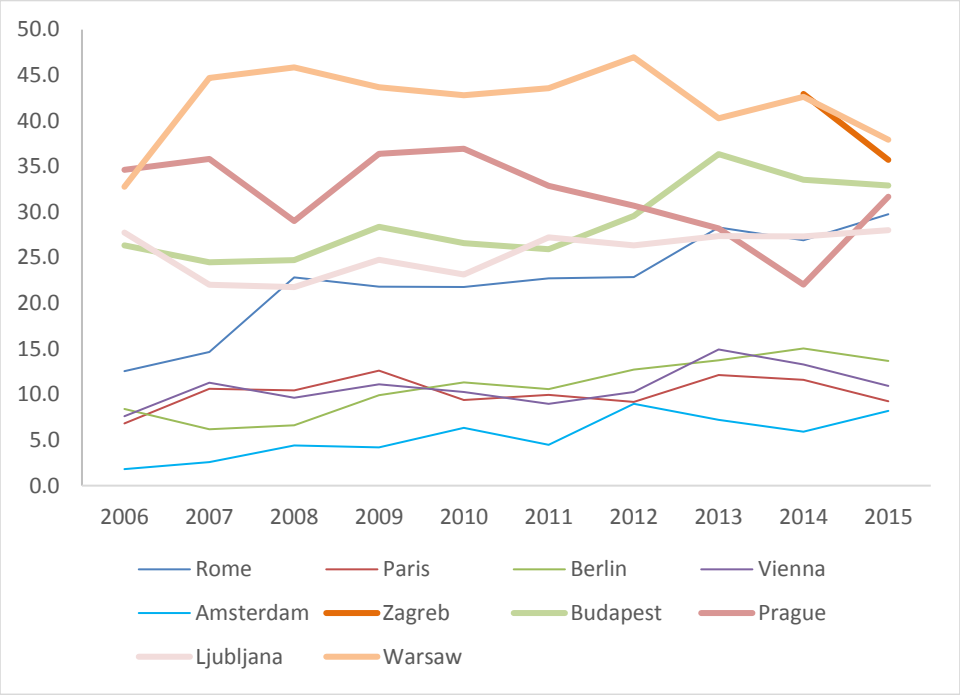
Source: CRCB own calculation based on data of EPRCRC and MaKAB

Figure 3.4.: Share of tenders without competition (SB) in Europe and in several European capitals, % , between 2006-15, N = 3,407,027



Source: CRCB own calculation based on TED database

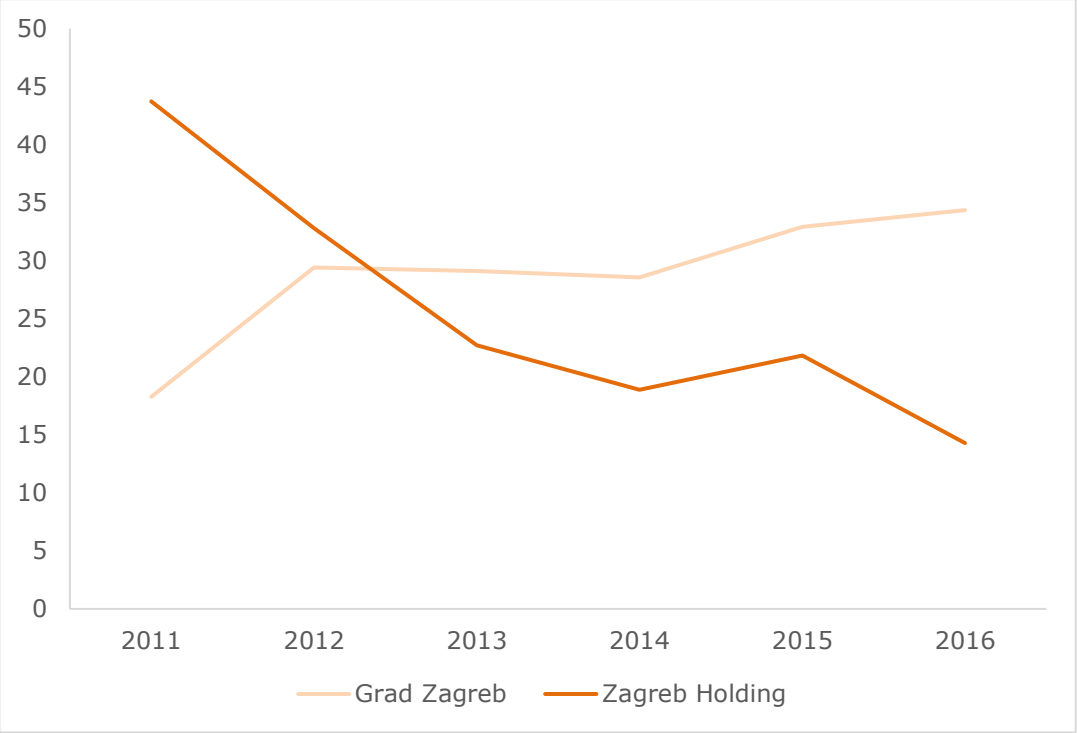
Figure 3.5.: Share of tenders without competition (SB) by year in several European capitals, 2006-2015, % , N = 3,407,027



Source: CRCB own calculation based on TED database

At the beginning of the period, in 2011-13, there was a large difference between the public tenders of the City of Zagreb and Zagreb Holding regarding corruption risks, as the latter performed much worse. However, as single bidding became rarer in the public procurement of Zagreb Holding, and in the meantime, the City of Zagreb can be characterized by opposite tendencies, since 2013 the City of Zagreb is the one with public procurement with higher corruption risks. By the end of the period, the difference became large again between the two issuers (see Fig. 3.6.).

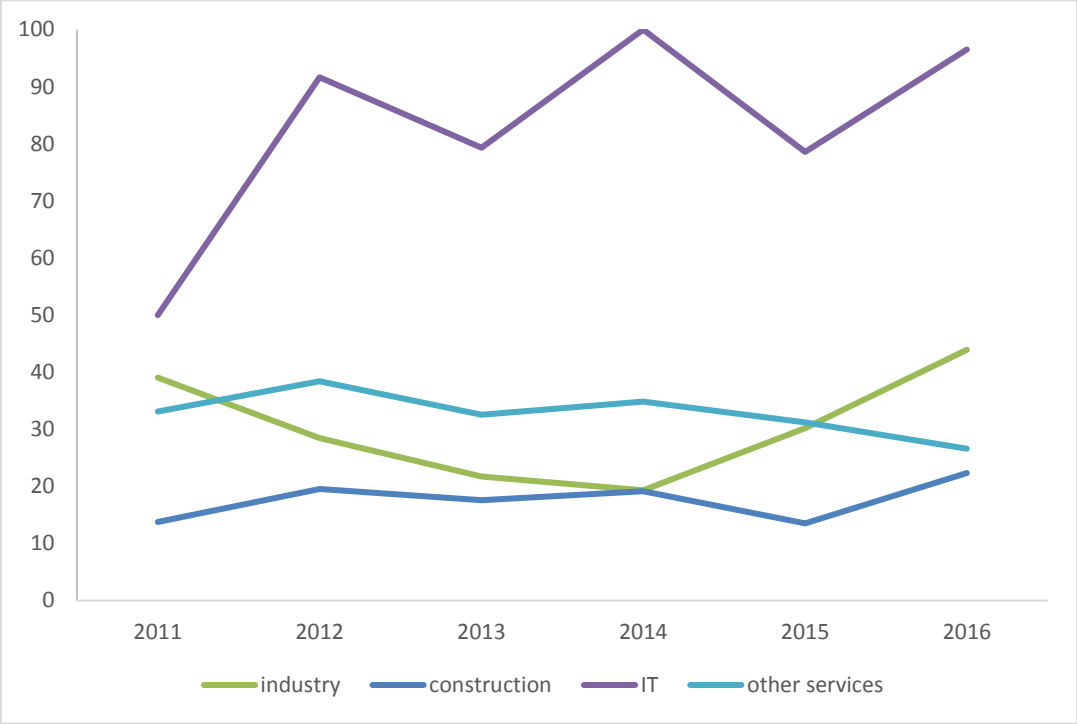
Figure 3.6.: Share of tenders without competition (SB) by year and issuer, 2011-16, %, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

Amongst economic branches the share of tenders without competition is the highest in the IT sector and it is the lowest in the construction (see Figure 3.7.).

Figure 3.7.: Share of tenders without competition (SB) by year and sector, 2011-16, %, N = 5,840



Source: CRCB own calculation based on data of EPRCRC

Deriving information form the number of bidders *b,* we constructed two indicators which measure the intensity of competition (Indicator of Competitive Intensity)[8]. Two indicators were defined in the following ways (see Table 3.1.).

[8] See: CRCB, 2016 and Tóth & Hajdu 2016.

Table 3.1.: The definition of Indicator of Competitive Intensity (ICI and ICI2)

	condition	function
ICI	*if b = 2*	*ICI = lg2*
	if b = 3 or b = 4	*ICI = lg[(3+4)/2]*
	if b = 5 or b = 6	*ICI = lg[(5+6)/2]*
	if b = 7 or b = 8	*ICI = lg[(7+8)/2]*
	if b > 8	*ICI = 1*
	if b = 1	*ICI = 99, missing value*
ICI2	*if b = 2*	*ICI = lg2*
	if b = 3 or b = 4	*ICI = lg [(3+4)/2]*
	if b = 5 or b = 6	*ICI = lg [(5+6)/2]*
	if b > 6	*ICI = 1*
	if b = 1	*ICI = 99, missing value*

Note: b: number of bidders

The table 3.2. shows the distributions of tenders launched by the City of Zagreb and Zagreb Holding by value of indicators of competitive intensity (ICI and ICI2).

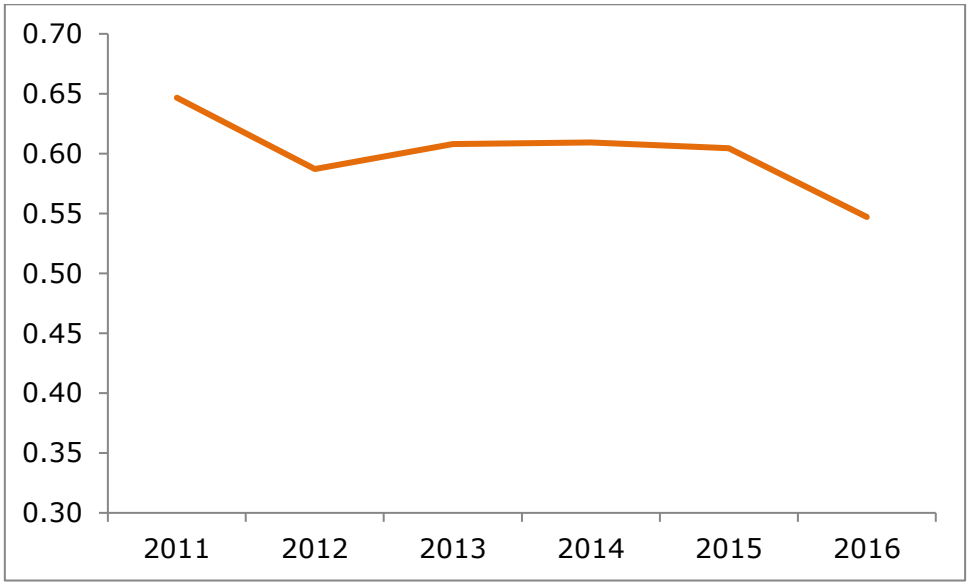
Table 3.2.: The distribution of tenders by the Indicator of Competitive Intensity (ICI and ICI2) and issuers, 2011-16, N = 4,238

			Issuers		
			Grad Zagreb	Zagreb Holding	Total
ici	,30	Count	704	318	1022
		% within issuer	24,7%	22,9%	24,1%
	,54	Count	939	500	1439
		% within issuer	32,9%	36,1%	34,0%
	,74	Count	678	312	990
		% within issuer	23,8%	22,5%	23,4%
	,88	Count	332	149	481
		% within issuer	11,6%	10,8%	11,3%
	1,00	Count	199	107	306
		% within issuer	7,0%	7,7%	7,2%
ici2	,30	Count	704	318	1022
		% within issuer	24,7%	22,9%	24,1%
	,54	Count	939	500	1439
		% within issuer	32,9%	36,1%	34,0%
	,74	Count	678	312	990
		% within issuer	23,8%	22,5%	23,4%
	1,00	Count	531	256	787
		% within issuer	18,6%	18,5%	18,6%
Total		Count	2852	1386	4238
		% within issuer	100,0%	100,0%	100,0%

Source: CRCB own calculation based on data of EPRCRC

During the period the intensity of competition decreased considerably from 0.65 to 0.55 (See Fig. 3.8.).

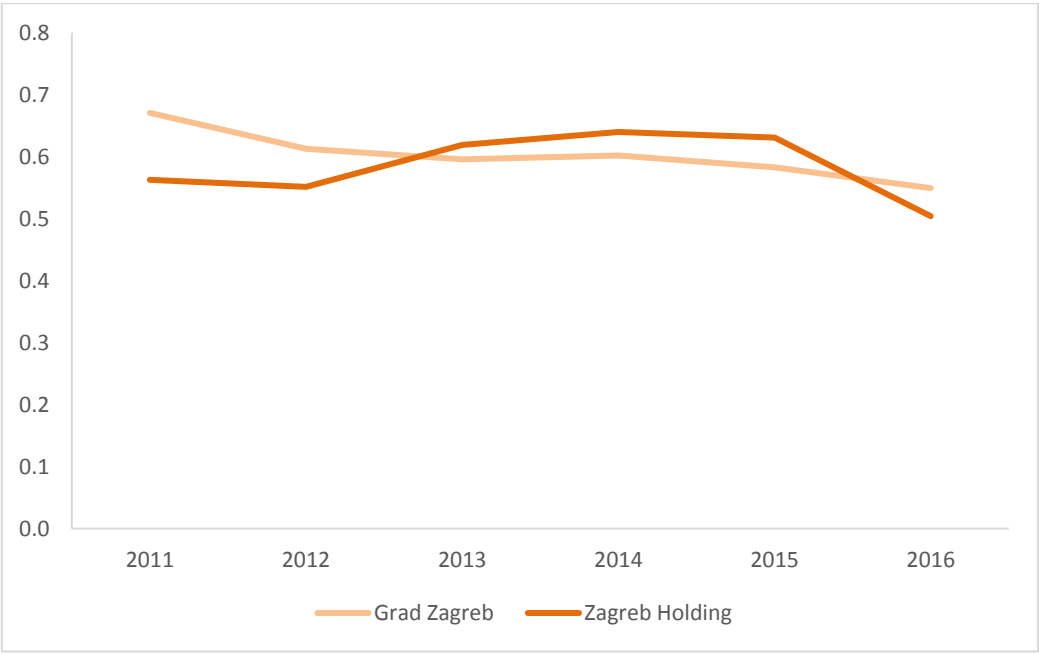
Figure 3.8.: The average value of Indicator of Competitive Intensity (ICI) by year, 2011-16, N = 4,238



Source: CRCB own calculation based on data of EPRCRC

At the beginning and at the end of the period (in 2011-12 and 2016), the intensity of competition was higher at the tender launched by City of Zagreb than Zagreb Holding. However, between 2013 and 2015, the level of the competition intensity became higher in the case of the public procurement of Zagreb Holding (see Fig. 3.9.).

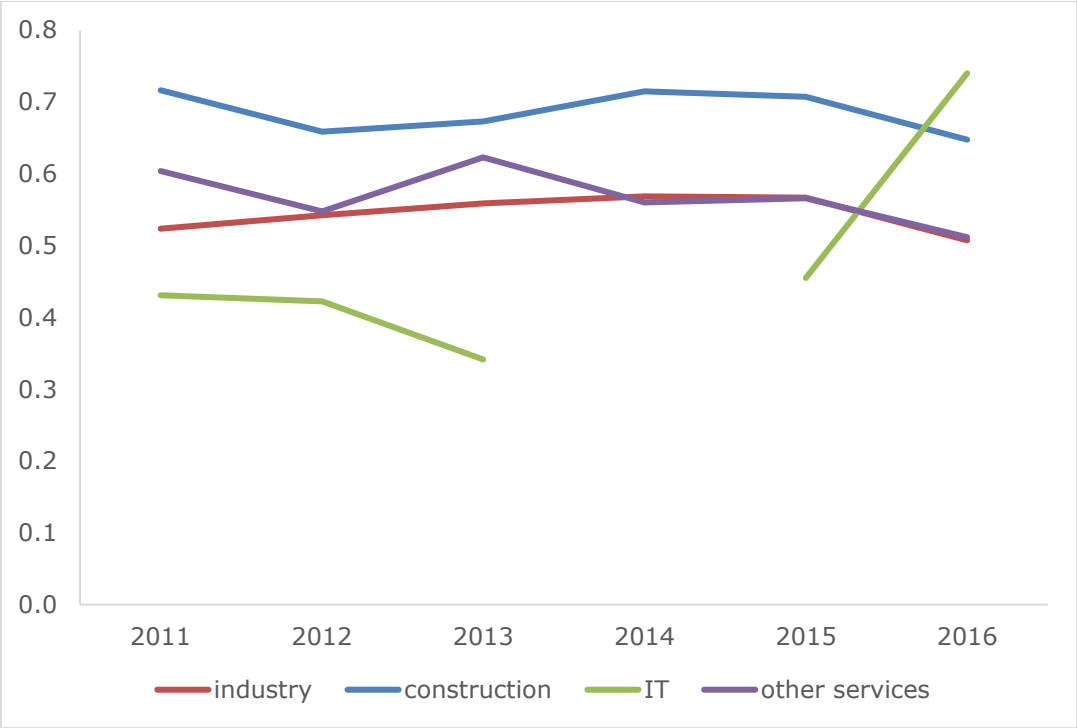
Figure 3.9.: The value of Indicator of Competitive Intensity (ICI) by year and issuer, 2011-16, N = 2,954



Source: CRCB own calculation based on data of EPRCRC

There was significant difference in the intensity of competition amongst industrial sectors: at tenders in construction that was higher and at tenders in IT sectors was lower during the period except in 2016 (see Fig. 3.10.).

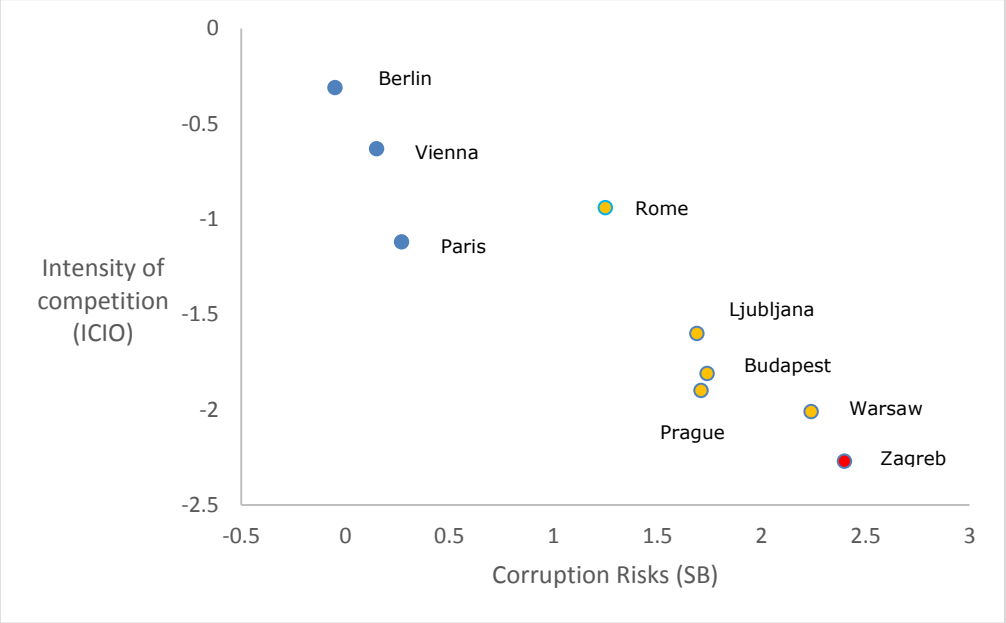
Figure 3.10.: The value of Indicator of Competitive Intensity (ICI) by quarter, 2011-16, N = 4,185



Source: CRCB own calculation based on data of EPRCRC
Note: There were only 24 tenders in the IT sector during the whole period

When we take into consideration the composition effects of public tenders by contract value, sector, year of tender and we count Amsterdam's data as reference, we could properly compare the corruption risk and intensity of competition of public tenders launched by the EU capitals. In figure 3.11 we show the level of corruption risks against of intensity of competition (ICI) of several European capitals. The results point out that Zagreb has the worst figures amongst European capitals concerning corruption risks and intensity of competition of public procurement.

Figure 3.11.: Corruption Risks and Intensity of Competition in selected EU Capitals, 2006-15, N = 3,407,027



Source: CRCB own calculation based on TED database
Note: the coefficients of logit and ordered logit are on the x and y axis. The estimation were controlled by sector, year, and the logarithm of contract value; the reference capital was Amsterdam

4. Price distortion

In this section, we focus on the analysis of contract prices to detect price distortion or overpricing. We interpret the price distortion as a sign of corruption risk. We use two methods to detect this phenomenon: we analyse the rounded data in contract prices (i), the observed distribution of first digits of contract price against to Benford's distribution (ii).

Rounded data in contract prices

Rounded contract prices can be regarded as an indicator of existence of price distortion[9] and a sign of corruption risk. We constructed four indicators for this analysis: *ROUND10, ROUND10* and *ROUND100*. We defined them in the following way:

RND10 = 1, if the net contract price is divisible by 10 without remainder (the contract price is rounded), else 0
RND100 = 1, if the net contract price is divisible by 100 without remainder (the contract price is rounded at hundreds), else 0
RND1000 = 1, if the net contract price is divisible by 1000 without remainder (the contract price is rounded at thousands), else 0.
PRM3_1 = 1, if the net contract price is divisible by 3 without remainder, else 0.

[9] The analysis of rounded data is one of tool the tools of fraud analytics to detect irregarities in prices. See Miller, 2015, Nigrini, 2012 and Spann, 2013.

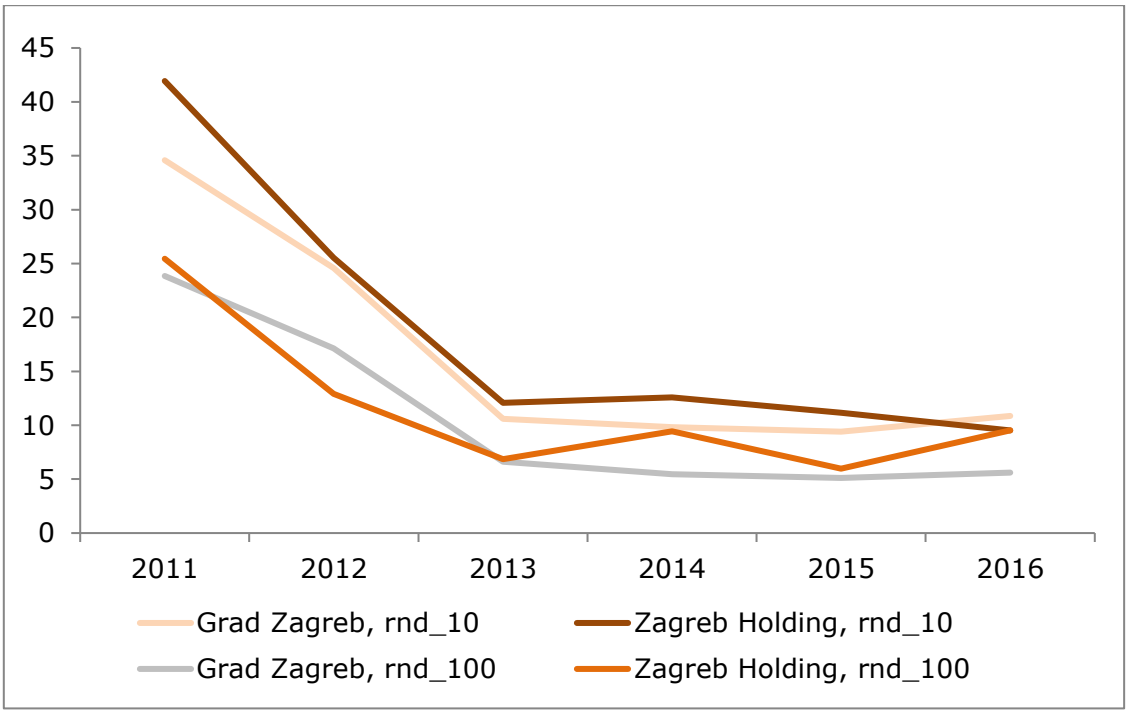
The share of rounded net contract prices dropped significantly between 2011 and 2013, and thereafter practically stagnated (see Fig. 4.1. and 4.2.).

Figure 4.1.: Share of rounded net contract price by year, % 2011-16, N = 5,922

Source: CRCB own calculation based on data of EPRCRC

The data show that in the public procurement launched by Zagreb Holding, the net contract prices were rounded more often than the prices of public procurement by the City of Zagreb in the most of the years. Therefore, we can assume a stronger price distortion of the former (see Fig. 4.2.).

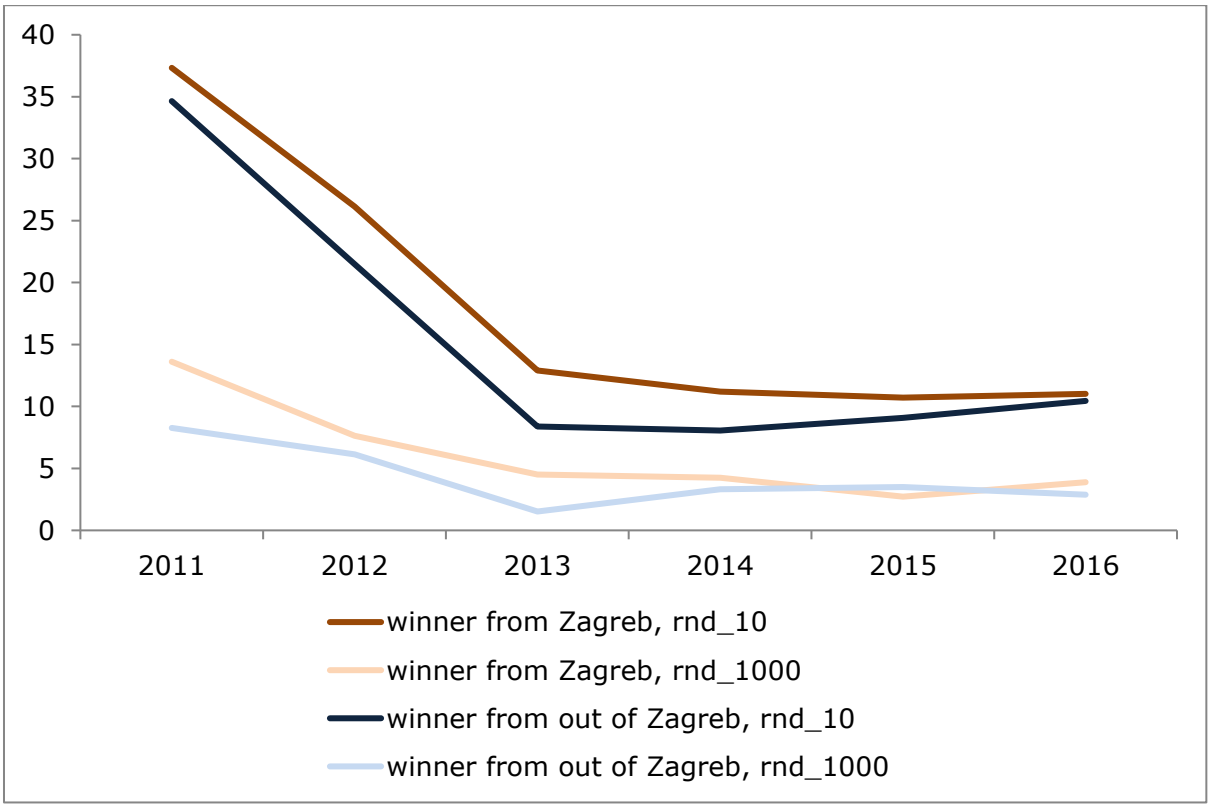
Figure 4.2.: Share of rounded contract price by year and issuer, % 2011-16, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

On the other hand, concerning the intensity of competition, it is important to note whether a local business (company from Zagreb) or a business from the countryside (outside Zagreb) was the winner. In the latter case, the existence of stronger competition in a wider market can be assumed. The net contract prices are less rounded where the winner was a business out of outside Zagreb, than in the cases of the companies' price from Zagreb (See Fig. 4.3.).

Figure 4.3.: Share of rounded contract price by year and the seat of winning company, %, 2011-16, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

Overall, it can be stated that the likelihood of rounded contract values and thus the likelihood of price distortion is greater in the tenders issued by Zagreb Holding and awarded by the Zagreb companies than other tenders. The ratio of rounded prices (with rounded by 100) in tenders launched by the Zagreb Holding was 10.8%, and by the City of Zagreb was 10.4%; and amongst the winners for companies from Zagreb was 11.5% and for the companies outside of Zagreb was only 8.4% (see Table 4.1.).

The differences in the use of rounded prices are quite large by the level of intensity of competition: in tenders with high level of competition, the winners are rounded off at a lower rate than the tenders with high level of intensity of competition (8.6% against 11.5% for rounding 100).

There are considerable differences in price distortions amongst economic branches: the use of rounded data in the IT sector is the most widespread, around half of the tenders' net contract prices (45.3%) are rounded up to 10 kunas and nearly one-third are 29.3% to 100 kunas in the analysed period.

Table 4.1.: Share of rounded price by several group of tenders, %, 2011-16, N = 5,922

	round_10	round_100	round_1000
Issuer: Grad Zagreb	16.5*	10.5	5.6
Issuer: Zagreb Holding	18.9*	10.8	5.5
Winner company is from Zagreb	18.5*	11.5*	6.2*
Winner company is form outside of Zagreb	14.4*	8.4*	3.9*
Low intensity of competition (ICI=0.301)	17.8*	11.4*	7.2*
High intensity of competition (ICI=1)	13.5*	8.6*	3.2*
Industry	10.8*	5.8*	2.9*
Construction	6.5*	1.7*	0.7*
IT	45.3*	29.3*	15.3*
Other services	31.1*	21.9*	12.1*

Notes: *: the value of chi^2 is significant at $p < 0.05$ level
+: the value of chi^2 is significant at $p < 0.1$ level
Source: CRCB own calculation based on data of EPRCRC

The estimation of odds of rounding prices and prices which can be divided into three shows that lack of competition or weak competition increases the chances that the net contract value contains some degree of rounding (See Table 4.2.). We can assume then that the highest level of rounding is a clear sign of the greater chance of price distortion.

Table 4.2.: Estimation of rounded price (ROUND_10 and ROUND_1000) and PRM3_1 by binary logistic estimation, 2011-16

variables	ROUND_10	ROUND_1000
ICI	-0,197	-1,111*
Winner: from Zagreb	0,048	0,074
Issuer: Zagreb Holding	0,206	0,188
Industry	-1,185*	-1,499*
Construction	-2,391*	-3,351*
IT	0,571	0,098
Other services	ref.	ref.
Logarithm of net contract value (lnncvx)	-0,122*	-0,043
2011	2,171*	1,990*
2012	1,015*	0,811*
2013	-0,211	-0,151*
2014	-0,062	0,025
2015	0,015	-0,104
2016	ref.	ref.
constant	0,190	-1,569*
N	4,185	4,185
Model Chi-square	812.2*	387.055
-2 Log likelihood	2835.834	1278.931
Nagelkere R Square	0.303	0.269

Notes: *: $p < 0.05$
+: $p < 0.1$

Source: CRCB own calculation based on data of EPRCRC

Analysis of the first digits

Using the second method, we analyse the price distortion by the distribution of the first digit in the contract prices based on Benford's law[10].

According to Benford's law (also known as the First-Digit Phenomenon) in a non-artificially generated set of numbers (in any numeral system) the first digits in each, local values are distributed neither arbitrarily nor uniformly; the distribution instead follows the distribution set by Benford's law[11]. The distribution of first digits in the decimal system (1,..,9) according to Benford's law is in Table 4.3.

Table 4.3.: The distribution of first digit according to the Benford's law in the decimal system

First digit	%
1	30.1
2	17.6
3	12.5
4	9.7
5	7.9
6	6.7
7	5.8
8	5.1
9	4.6

The economist Hal Varian first suggested in 1972 that Benford's law could be used to detect possible fraud in socio-economic data, and that it the performance of forecasting models could be evaluated[12]. Mark Nigrini pointed out 25 years later that Benford's Law is useful in forensic accounting and auditing as a tool to detect fraud and collusion[13]. Ever since, Benford's Law has been common and it is a widely used method in several areas of social research for fraud detection[14].

For the analysis of irregularities in public procurement, we can use the information on procurement prices because these are public (a); and as such these may carry information on the process of price formation (b). Our

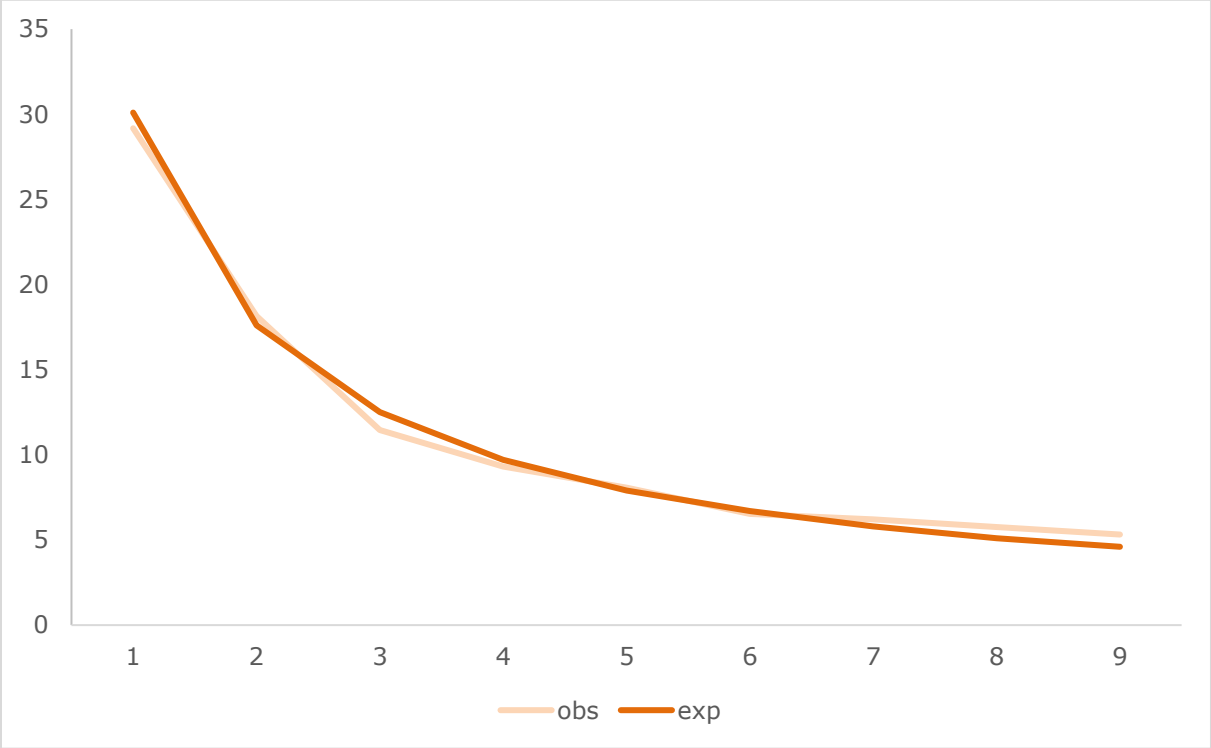
[10] In the description of the concept of this method for the detection of price distortion we are using partially our earlier work. See CRCB, 2016.
[11] A set of numbers is said to satisfy Benford's law if the leading digit d (in 10 digit system, $d \in \{1, ..., 9\}$) occurs with probability: $P(d) = \log_{10}(d+1) - \log_{10}(d) = \log_{10}(1 + 1/d)$. See https://en.wikipedia.org/wiki/Benford%27s_law
[12] See Varian, 1972
[13] See Nigrini, 1996; Drake, Nigrini, 2000; Durtschi, et al., 2004.
[14] See Nigrini, 2012; Miller,2015; Kossovsky, 2015

research questions related to the price formation are the following: whether the price formation differs significantly amongst different group of public procurement created by intensity of competition (i), the risks of corruption (ii) and the two issuers (City of Zagreb and Zagreb Holding).

We examine these relationships with comparison of observed first digit's distribution to theoretical (Benford's) distribution of contact prices of tenders in several analysed groups of the Hungarian public procurement.

The analysis of first digits indicates that the contract prices of all public procurement launched by the two issuers fit the theoretical distribution for the whole period (2011-16) (see Figure 4.4).

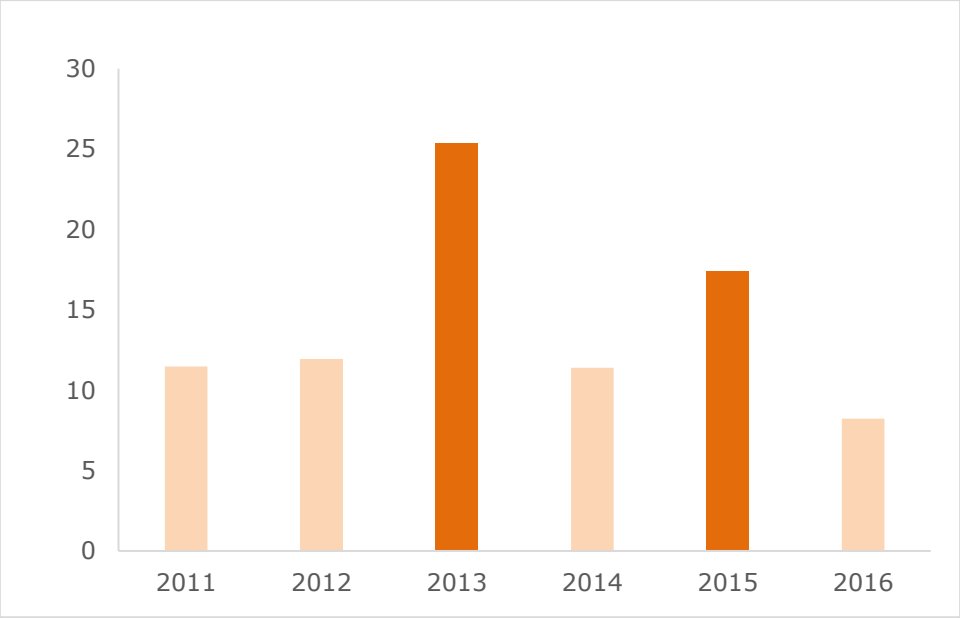
Figure 4.4.: The expected and observed distribution of first digits in net contract value, %, 2011-16, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

There is significant difference in price distortion among the contract prices in each year. While in 2013 (the year of the previous local elections) and in 2015 the first digits of net contract prices are very far from the expected (theoretical) distribution, in 2011, 2012, 2014 and in 2016 they fit well (see Fig. 4.5.).

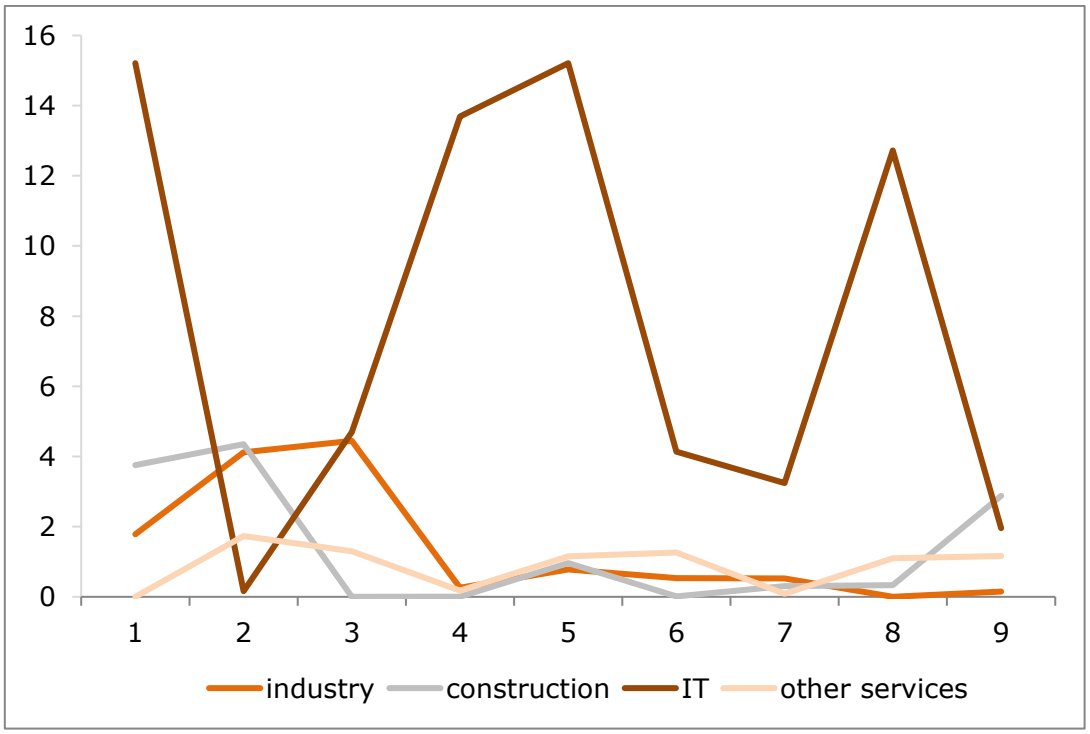
Figure 4.5.: The weight of price distortion: the squared error (SE) of contract prices of PPZ from the theoretical (Benford's) distribution by year, 2011-16, N = 5,922



Source: CRCB own calculation based on data of EPRCRC
Note: the bars in red do not fit the expected (Benford's) distribution
PPZ: Public Procurement of Zagreb Holding and City of Zagreb

The construction and the sector of other services have the smallest level of price distortion while in the IT sector the observed distribution of first digits has extremely high level of difference from the theoretical distribution (see Fig. 4.6.). Amongst the sectors, only the prices of IT sector do not fit the theoretical model[15]. The high level of the former is certainly related to the high level of overpricing in this sector.

Figure 4.6.: The weight of price distortion: the squared error (SE) of contract prices of PPZ from the theoretical (Benford's) distribution by sectors, 2011-16, N = 5,922

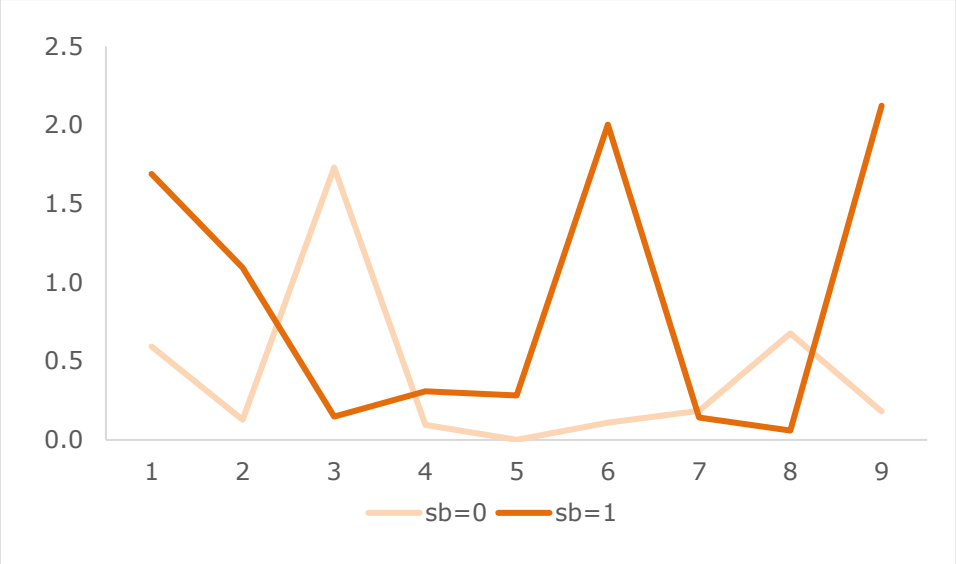


Source: CRCB own calculation based on data of EPRCRC
Note: the horizontal (x) axis: the first digits
the vertical (y) axis: squared error of observed and expected percentiges: (obs – exp)(obs - exp)*

Our results also point out that the prices of public procurement are remarkably distorted when there is no competition compared to those successful tenders with competition. So, the results indicate that the strength of price distortion increases significantly with the increase of corruption risk (see Fig. 4.7.).

[15] The MAD value is 0.0254 which is far over the threshold (0.012) suggested by Nigrini.

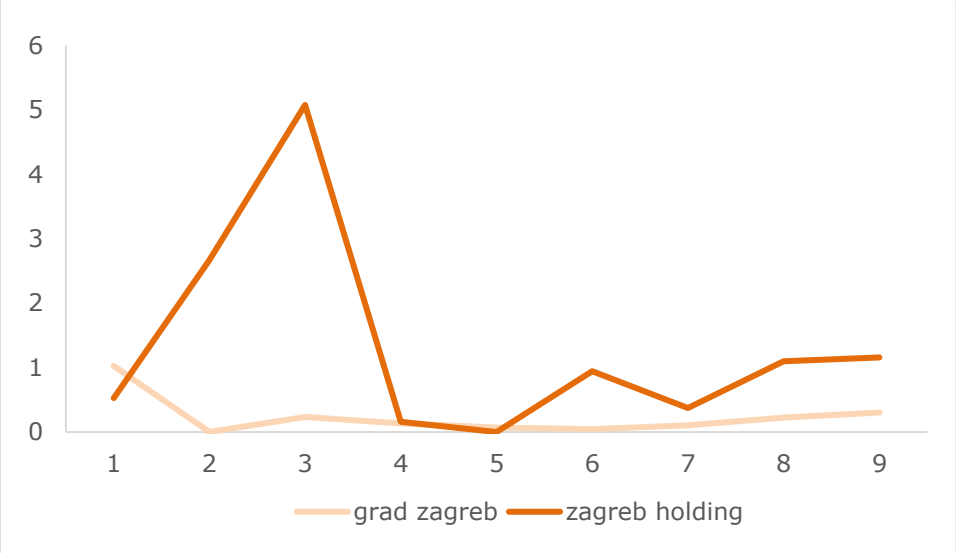
Figure 4.7.: The squared error between the expected (Benford's) and observed distribution of first digits by first digits and the indicator of corruption risk (SB), 2011-16, N = 5,922



Source: CRCB own calculation based on data of EPRCRC
Note: horizontal (x) axis: the first digits
vertical (y) axis: squared error of observed and expected percentiges: (obs – exp)(obs - exp)*

And finally, our results also point out that the net contract prices of public procurement launched by Zagreb Holding are remarkably more distorted then onces of City of Zagreb (See Figure 4.8).

Figure 4.8.: The squared error between the expected (Benford's) and observed distribution of first digits by first digits and issuers, 2011-16, N = 4,483



Source: CRCB own calculation based on data of EPRCRC
Note: horizontal (x) axis: the first digits
vertical (y) axis: squared error of observed and expected percentiges: (obs – exp)(obs - exp)*

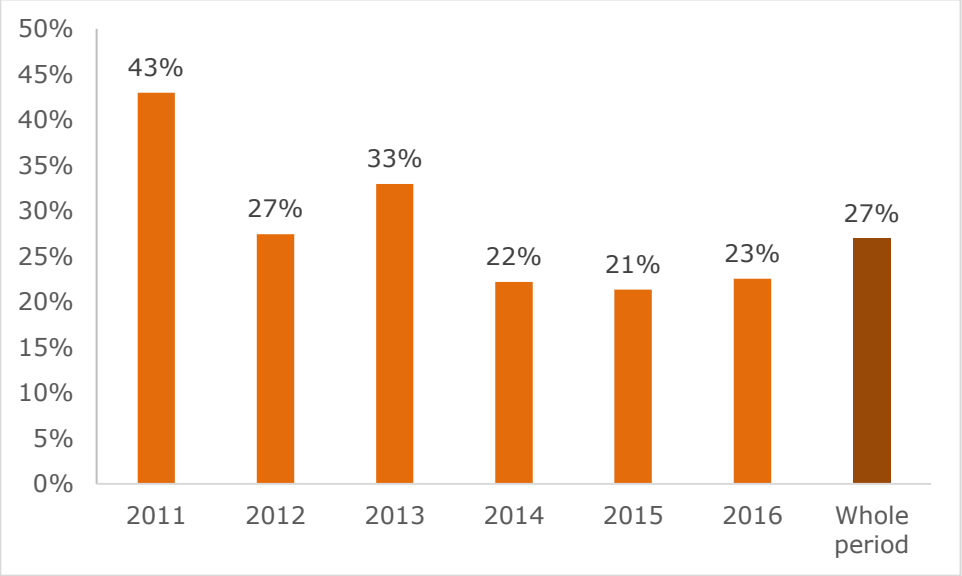
5. Estimation of direct social loss

Two methods were used to estimate the direct social loss associated with public procurement corruption. First, we calculated the amount spent by the two issuers (City of Zagreb and Zagreb Holding) without competition, that is, with high corruption risks (i), then we used the net estimated value and net contract value and their difference as a tool, to estimate the strength of competition and the expected price drop relative to estimated value at tenders with high level of competition (ii).

Money spending without competition

For the first estimate, we simply calculated how much money was spent without competition. The larger the amount of money without competition is the greater the social loss is. The results point out that approximately 27% of the total amount of the money spent on public procurement was spent without competition during the whole period (see Fig. 5.1.). We have to consider that level quite high: in Zagreb between 2011 and 2016 the competition practically did not exist at more than the quarter of public money spent on public procurement. The highest value (43%) was in 2011 and the lowest one (21%) in 2015.

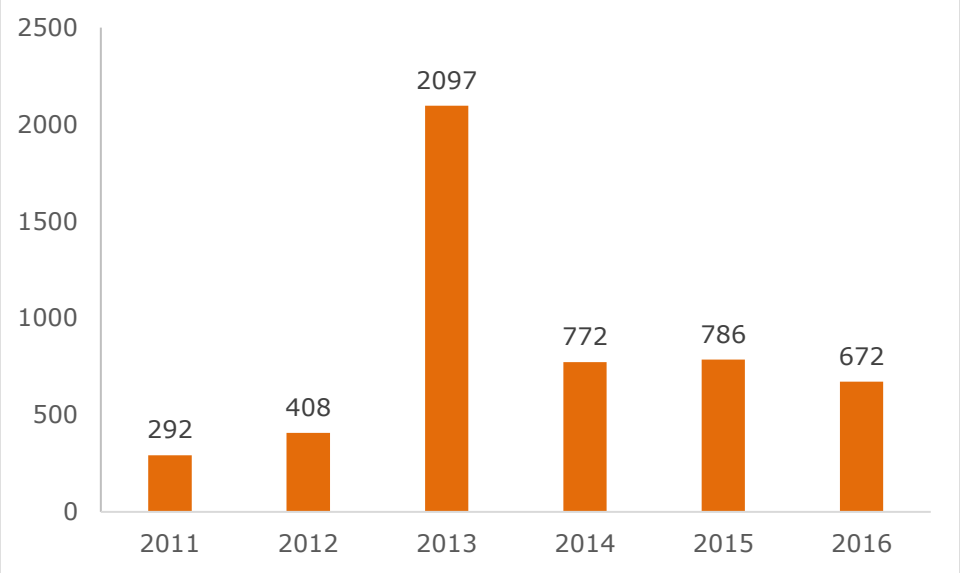
Figure 5.1.: The share of money spent in PPZ without competition, %, 2011-16, N = 5,922



Source: CRCB own calculation based on data of EPRCRC

According to these results, the amount spent without competition is considerable, approximatively 5 billion HRK in the whole period. The highest amount was spent without competition in 2013 by the Zagreb Holding (see Fig. 5.2. and 5.3.)

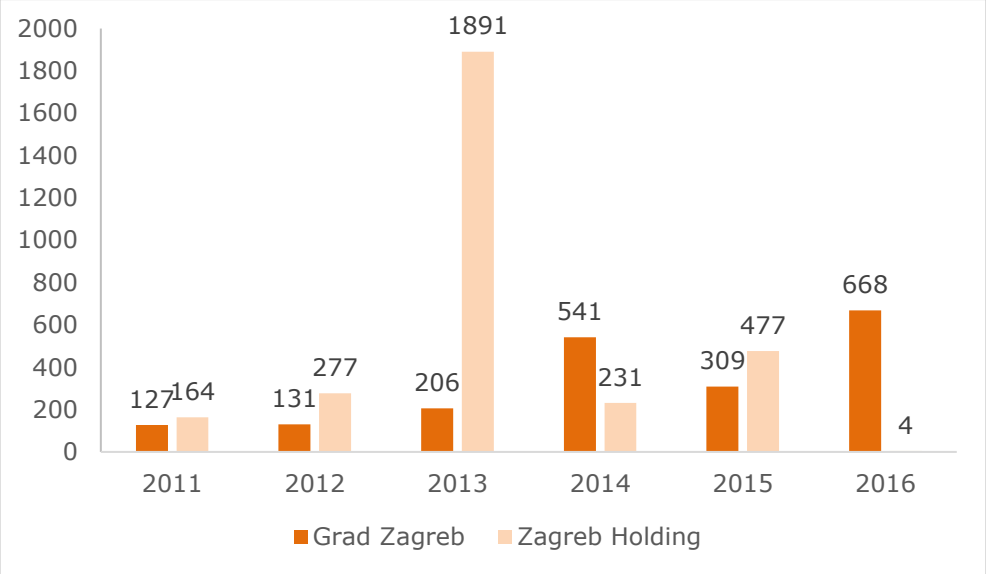
Figure 5.2.: The sum of the value of PPZ without competition, in million HRK, 2011-16, N = 1,684



Source: CRCB own calculation based on data of EPRCRC

The values from 2013 are related to urban transport (bus and tram) purchases. The Zagreb Holding entrusted several banks with leasing services without competition (see tables A4.1. and A4.2. in Appendix 4). For these transactions the public tenders were organised strangely on the same day (i) and for the purchase of the same service (ii) and only one bidder participated in each (iii).

Figure 5.3.: The sum of the value of PPZ without competition by issuer, in million HRK, 2011-16, N = 1,684



Source: CRCB own calculation based on data of EPRCRC

Analysis of relative price drop to estimated value

To estimate the direct social loss due to corruption, we calculated the magnitude of price drop of the contract price compared to the estimated value using the following formula:

$$RPRD = \frac{(P^* - P)}{P} * 100 \qquad (1)$$

Where P^* is the estimated net value and P is the net contract price of the tender.

We consider this indicator as a new measure of intensity of competition: the greater value of RPRD (i.e. greater magnitude of price drop) is the higher level of intensity of competition can be traced in the public tenders. The low or zero value of RPRD means low level or lack of competition.

The rate of price drop correlates strongly with the indicators of corruption risk and the intensity of competition. In tenders with low corruption risk (SB=0) and high level of intensity of competition (ICI) the net contract prices dropped significantly at a higher rate compared to the estimated price than where the corruption risks remained high and the intensity of competition was rather weak.

The concept of the estimation is based on the assumption that there is a chance that the corruption risk of any tender can stay low and the intensity of competition can reach a high level. Observing the rate of price drop in the tenders with low corruption risk and high level of competition we can mark out these high rates as reference points, as outcomes of the "ideal" or "clean" public procurement process. In this way we can estimate in case of every tender how much the estimated price should have dropped compared to this reference level. According to this concept we can estimate the rate of direct social loss in the given tender if we extract the observed rate of price drop ($RPRD_{observed}$) from the reference rate, which came from the "ideal", non-corrupt cases, ($RPRD_{reference}$):

$$DSLR = RPRD_{reference} - RPRD_{observed}$$

So, for every i tenders, where we have data on RPRD, we calculate the rate of direct social loss ($DSLR_i$) as follows:

$$DSLR_i = RPRD_{max} - RPRD_i$$

And the multiplication of the $DSLR_i$ by the net contract value (NCV_i) of the $_i$ tender gives us the amount of social loss for every $_i$ tender. And finally, this way it could be easier to calculate the aggregate direct social loss for all *n* tenders:

$$DSL = \sum_{i=1}^{n}(DSLR_i * NCV_i)$$

Using this method we have to confront several limitations. First, the used method is incapable of detecting certain forms of corruption. Focusing on the relative price drop from the estimated price we could not detect the corruption cases which were related to so called "white elephant" projects and the social losses of these projects (i)[16]. Second, the corruption indicators and proxies of intensity of competition which we have been using in the analysis certainly do not measure every form and type of corrupt activities (ii). Obviously, there are such forms of corrupt activities which are beyond our scope (i.e. collusion and bid rigging which are used very frequently in the construction sector).

Using the concept presented above we calculated two estimations. In these

[16] The concept of "white elephant" projects is well known in the corruption literature (Rose-Ackermann, 2006; Rose-Ackerman-Soreide, 2011). These are projects without any social benefit or those that are ruined shortly after their completion.

estimations we used different assumptions concerning the reference rate ($RPRD_{max}$) which happened in case of the "ideal", non-corrupt public tenders.

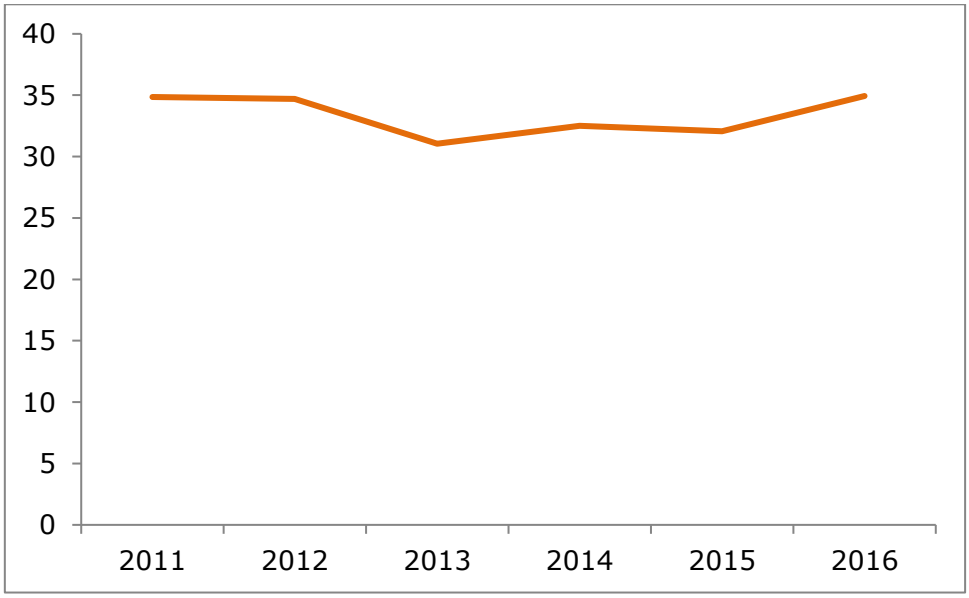
First we calculated the median value of RPRD for all tenders grouped by the level of corruption risk and then according the level of indicator of competitive intensity (ICI2), (See Table 5.1.).

For the estimation we use the $RPRD_{max}$= *47.02* value as the reference (benchmark) value. With this decision we assume that the tenders where there are competition (SB=0) are the "normal" solutions for public money spending, i.e. the tenders with low corruption risk are the "normal" against those where there was only one bidder (and thus the corruption risk was high). This assumption is much weaker than if we considered tenders with high intensity of competition to be "normal", and we would have accepted the RPRD value at highest intensity of competition (79.1) as the reference value.

Table 5.1.: The median value of RPRD at several group of tenders defined by corruption risks and intensity of competition, 2011-16, N = 5,071

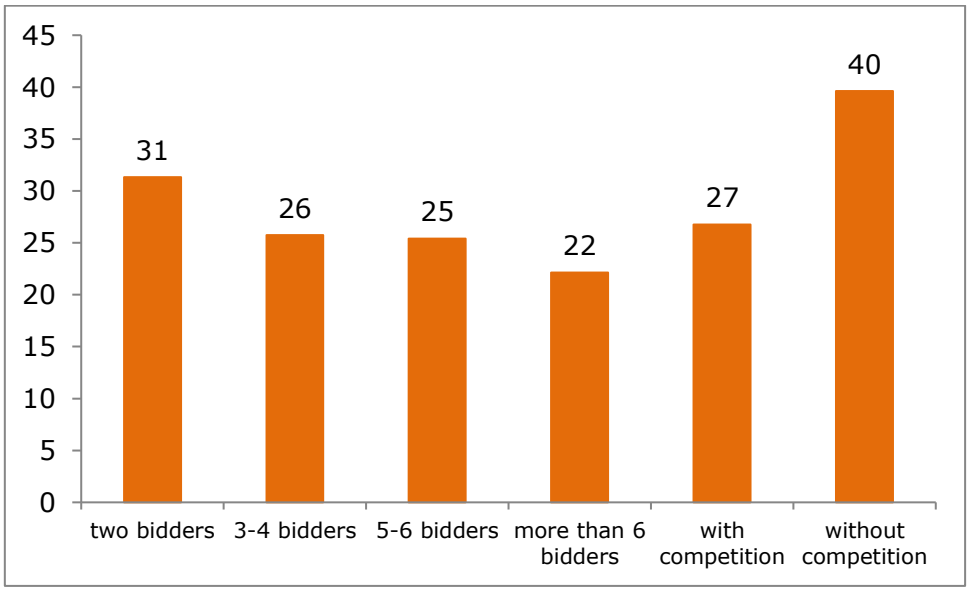
Group of tenders	Median value of RPRD	N
tenders with competition (SB = 0)	47.02	3608
tenders without competition (SB = 1)	8.72	1463
low level of intensity of competition (ICI2=0.301)	28.61	845
ICI2 = 0.54	43.08	1238
ICI2 = 0.74	54.43	866
high level of intensity of competition (ICI2 = 1)	79.10	659

Figure 5.4.: The median value of the ratio of estimated direct social loss in net contract value by year, %, 2011-16, N = 3,076



Source: CRCB own calculation based on data of EPRCRC
Note: the reference value of relative price drop (RPRD) is 0.4702

Figure 5.5.: The median value of the ratio of estimated direct social loss (DSLR) in net contract value by level of competition, %, 2011-16, N = 1,804



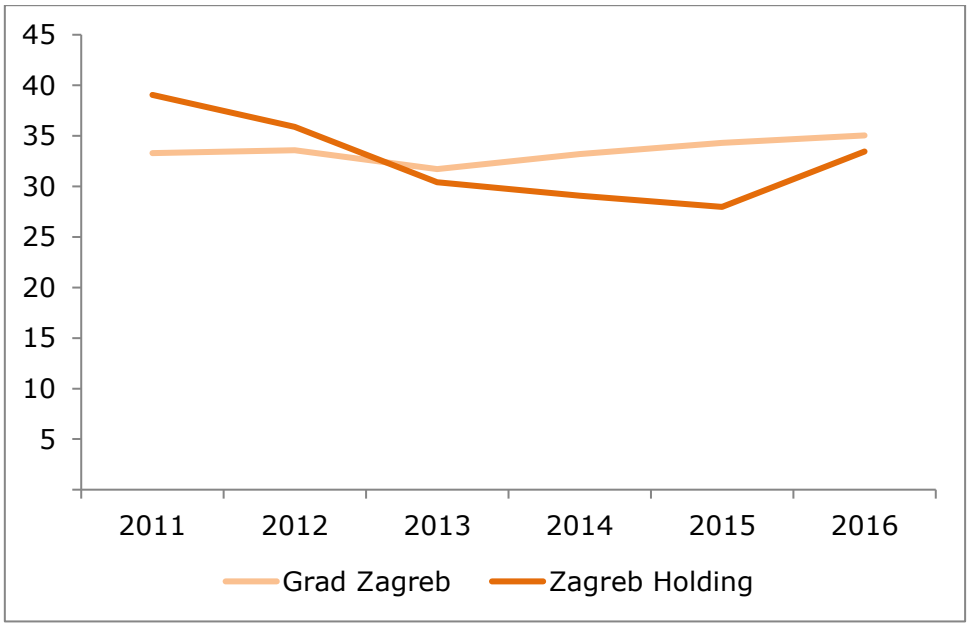
Source: CRCB own calculation based on data of EPRCRC
Note: the reference value of relative price drop (RPRD) is 0.4702

The median level of DSLR has moved between 31-34% during the whole period (see Fig. 5.4.). The estimated direct social loss differs significantly amongst tenders defined by intensity of competition and corruption risk

(see Fig. 5.5.). We estimate the lower median of social loss at tenders with high level of competition, i.e. more than 6 bidders (22%) and the highest level at tenders where there was no competition (40%).

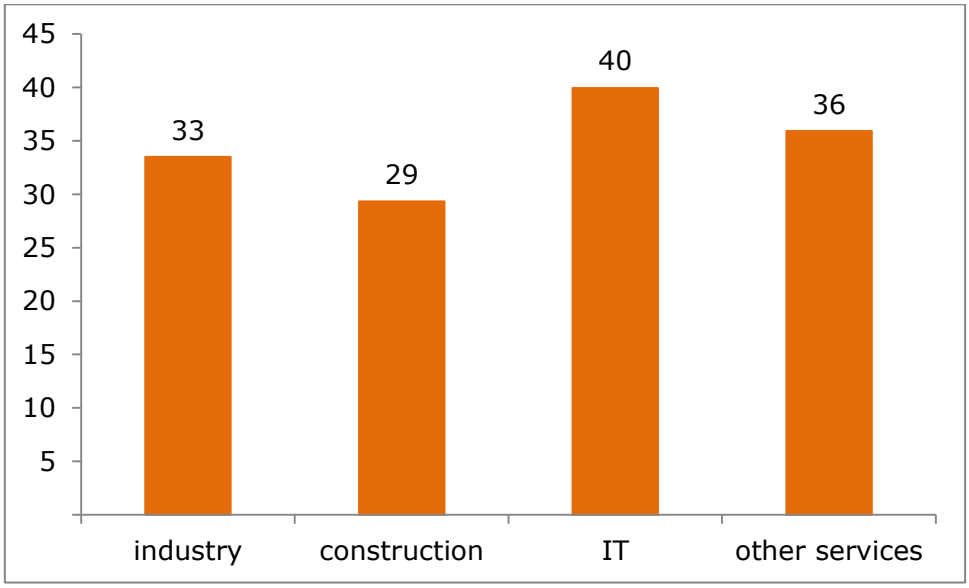
The tenders launched by Zagreb Holding had higher median value in 2011 and 2012 (36-39%) and lower ones after 2013 (30-33% in comparison to Grad Zagreb (see Fig. 5.6.). Amongst the economic sectors, we can observe the highest level of DSLR in the IT sector (the median value was 40%), and the lowest one at construction (29%) (See Fig. 5.7.).

Figure 5.6.: The median value of the ratio of estimated direct social loss in net contract value by issuer, %, 2011-16, N = 3,076



Source: CRCB own calculation based on data of EPRCRC
Note: the reference value of relative price drop (RPRD) is 0.4702

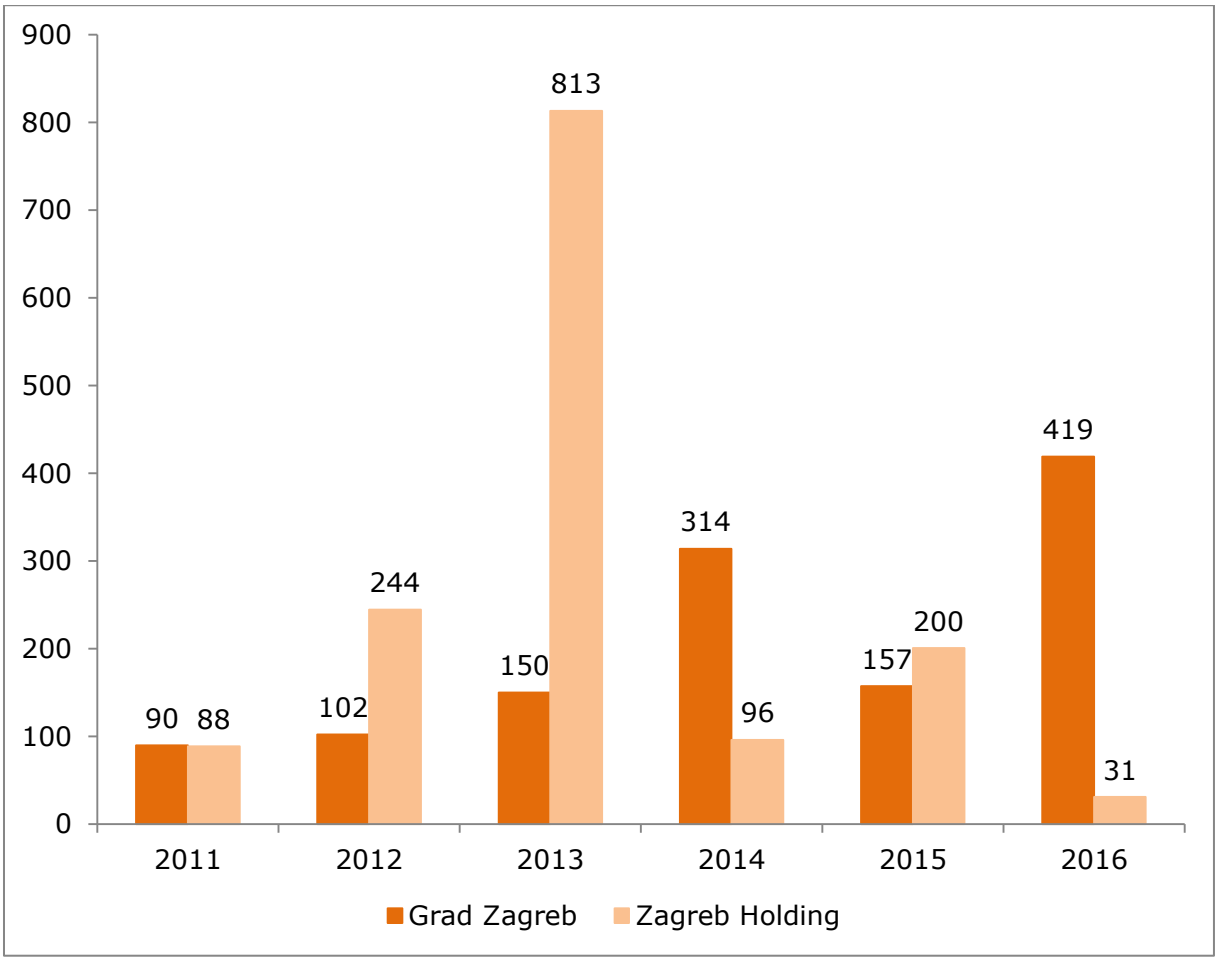
Figure 5.7.: The median value of the ratio of estimated direct social loss in net contract value by sector, %, 2011-16, N = 3,027



Source: CRCB own calculation based on data of EPRCRC
Note: the reference value of relative price drop (RPRD) is 0.4702

Finally, according to the method used we estimate that the total direct social loss in the whole period reached 1.47 billion HRK in public procurement of Zagreb Holding and 1.23 billion in tenders of City of Zagreb respectively. We estimate the highest amount of DSL, 813 million HRK in 2013 at tenders launched by Zagreb Holding (See Fig. 5.8.). Concerning the City of Zagreb the estimation shows a rising tendency of the weight of direct social loss from 90 million HRK in 2011 to 419 million HRK in 2016 one year before the local elections.

Figure 5.8.: The estimated direct social loss by issuer, million HRK, 2011-16, N = 3,076



Source: CRCB own calculation based on data of EPRCRC
Note: the reference value of relative price drop (RPRD) is 0.4702

6. Corruption risks: an analysis at the winner company level

The issuers (City of Zagreb and Zagreb Holding) have given the company tax number in 5,260 of the 5,922 public tenders analysed. In these cases we could look up the turnover data in the years 2011-15 from the database of Bisnode[17]. (The data of 2016 were not available yet.). Thus, finally we get data on 1,040 of the 1,197 winner companies and in the analysis we used aggregated data of the whole analysed period. Our two main indicators were the followings:

1. TSLS_SUM: total net sales
2. EXSLS_SUM: total export sales

And, we used four indicators from the public tender database created by CRCB:

3. NCVALUE_SUM: total net contract value
4. N_SUM: number of tenders won by the winner company
5. SB_SUM: number of tenders won by the winner company, there were only one bidder
6. DSL_SUM aggregate value of direct social loss in tenders won by the winner company

In the next step we constructed the following four indicators at company level used the indicators 1-6:

7. The relative weight of total net contract value in total net sales:
   PPR = NCVALUE_SUM / TSLS_SUM * 100

8. The share of export turnover in total net turnover:
   EXPR = EXSLS_SUM / TSLS_SUM * 100

9. The weight of direct social loss in total contract value of all tenders won by the winner company:
   DSLR = DSL_SUM / NCVALUE_SUM * 100

10. The share of tender won by the winner company as single bidder in total number of tenders won:
    AV_SB = SB_SUM / N_SUM * 100

[17] See http://www.bisnode.hr/

Our aims in this company-level analysis are to detect the links between the share of aggregated contract value of public tenders in the winner company's total net turnover and the weight of corruption risks at tenders won by this given company.

If we detect positive correlation, either this points out that the appearance in the public procurement market is predetermined by the expectation that in this market the intensity of competition may be low and the corruption risks may be high, and finally, in such environment a company which uses these opportunities can win easily and it can quickly increase their net turnover. Or, such results can simply mean that the success of the winning companies, which can be measured here by the aggregated contract value related to the public tenders per total turnover ratio, is significantly supported by the special environment which the given company creates: weak competition and high risk of corruption.

If there is no such relationship, this suggests that the fact of high corruption risk and low intensity of competition or expectations about them do not play a role in the strength of involvement of companies in the public procurement market.

The other issue is the relationship between the ratio of direct social loss in aggregated contract value and the strength of involvement of winner company in the public procurement market. If in case of companies which connectivity to the public procurement market is relatively strong, and the ratio of direct social losses at tenders won by these companies is relatively high, then this relationship clearly implies the attractiveness of a special market segment (i.e. public procurement) which is characterised by high corruption risk and low level of intensity of competition.

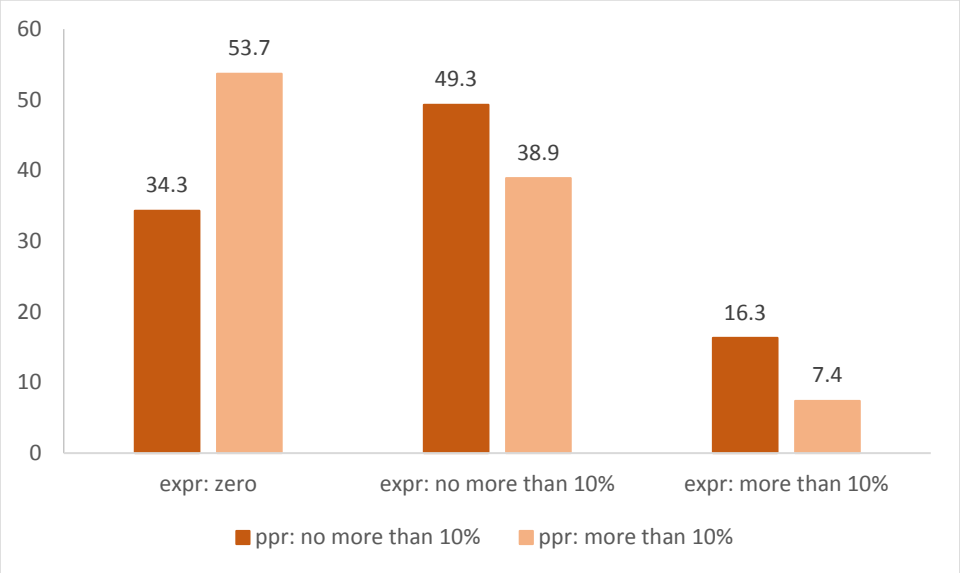
In addition, we can consider a clear sign of such relationship as the negative link between the strength of the presence on the public procurement market (PPR) and the share of export turnover (EXPR).

The companies which export their products are exposed to stronger competition in the export markets than in the domestic market or the public procurement market. The negative link between the two indicators (PPR and EXPR) underlines that companies that are more present in export markets are less likely to turn to the public procurement market. In addition, companies with strongest involvement in the public procurement market export significantly less. This relationship may be merely a result of the sectoral effect (e.g. a construction company specializing in large projects has rarely high export rate) or explanations due to considerable expected difference regarding the intensity of competition between the two markets.

The distribution of PPR, EXPR, AV_SB, and DSLR is a power function-like, and therefore we calculated their values converted to ordinal variables.

The results confirm the negative correlation between the export share and the weight of the presence in the public procurement market: in companies where the public procurement market plays a minor role the share of export in total turnover is higher than where public procurement plays highest role. The latter ones typically do not export or export only a small proportion (see Figure 6.1).

Figure 6.1.: The share of export in total net turnover (EXPR) by weight of total contract value of public tenders in total net turnover (PPR), %, 2011-15, N = 861



Source: CRCB own calculation based on data of EPRCRC
Chi2 (2): 14.990, p < 0.01

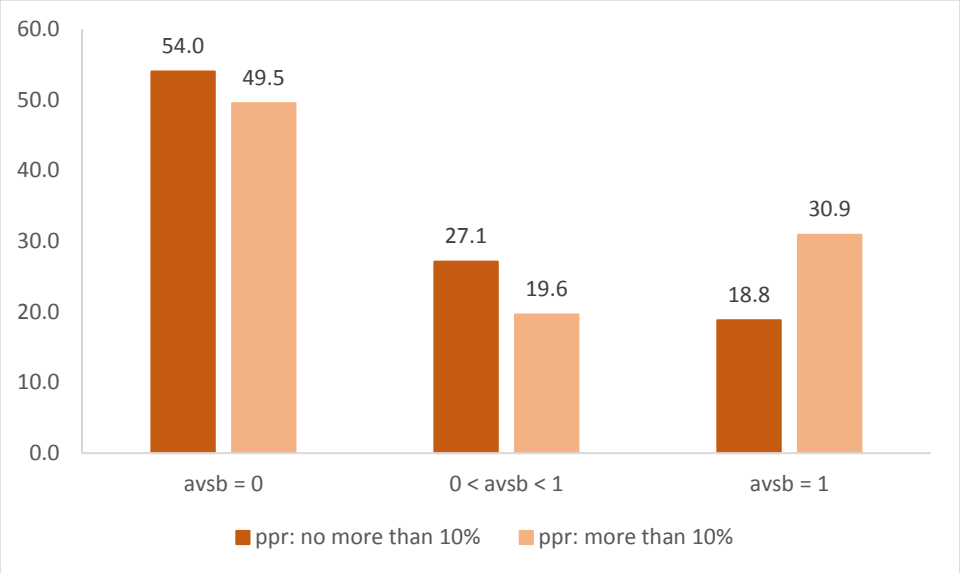
The results also point to the existence of a positive link between corruption risks of public tenders and its importance in total sales of the company (see Figure 6.2). If the role of the public procurement market is greater within the company's sales, the company typically won public tenders characterized by high corruption risks. So either the anticipated or expected high corruption risk encourages the entry to the public procurement market for the future corrupt companies, or all companies are trying to reach the public procurement market, but the corrupt companies are far more successful and thus their involvement in this market segment is stronger compared to others.

The positive relationship between direct social loss and the importance of public procurement market is also significant (Figure 6.3). There is no significant difference between winning companies regarding social losses

below 40%. But there is high difference where the direct social loss is higher than 40%. For companies with highest share of public procurement market (more than 10% of sales revenue), the share of tenders with a social loss more than 40% is much higher (24%), compared to those in which public procurement market has little role (11.5%).

Consequently, the share of wasted money (social loss) is higher in public tenders won by companies strongly connected to the public procurement market. This phenomenon is clearly related to the weak competition and high corruption risks.

Figure 6.2.: The share of tender won the winner company as single bidder (AV_SB) in total number of tender by the weight of total contract value of public tenders in total net turnover of the company (PPR), %, 2011-15, N = 878



Source: CRCB own calculation based on data of EPRCRC
Chi2 (2): 8.479, p < 0.05

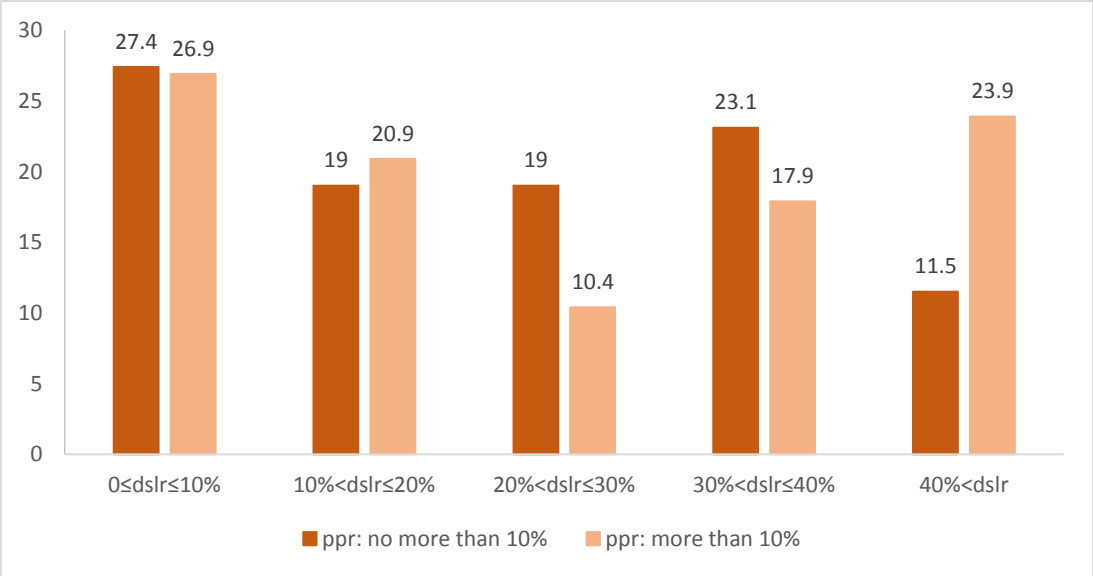
Thus, companies are able to reduce competition and create favourable conditions for corrupt transactions for which public procurement is an important market, and the total contract value earned here gave more than 10% of their net sales between 2011 and 2015. The incentives for companies relying more on public procurement are stronger and their experience is greater in creating favourable environment for corruption than for companies that are only slightly involved in public procurement market (see Table 6.2.).

The analysis of public tenders launched by the Zagreb City and Zagreb Holdings in the period of 2011-2016 points out that these public tenders were characterized by high corruption risks and low intensity of competition. As a result the social loss is significant. The analysis of corruption risks and market orientation at winning company level also points out that a group of

Croatian companies is likely to incorporate the above mentioned characteristics of procurement procedures into their expectations, and tenders with low intensity of competition and high corruption risk play an important role in their business strategy.

Our results also underline the need for a regular empirical analysis of the intensity of competition and corruption risks of public procurement - this could be the first step towards an increase of social welfare.

Figure 6.3.: The rate of direct social loss (DSLR) by the weight of total contract value of public tender in total net turnover of the company (PPR), %, 2011-15, N = 625



Source: CRCB own calculation based on data of EPRCRC
Chi2 (4): 10.454, p < 0.05

Table 6.1.: Ordered logit estimation of corruption risks (AVSBO), 2011-15, N = 878

variables	AVSBO
PPRO=1 (PPR<10%)	Ref.
PPRO=2 (PPR >= 10%)	0.406+
N_SUM	0.026*
Cut1	0.323
Cut2	1.575
N	878
Log likelihood	-878.3886
LR Chi2 (2)	14.45
Prob > chi2	0.0007
Pseudo R Square	0.0082

*Notes: *: p < 0.05*
+: p < 0.1
Source: CRCB own calculation based on data of EPRCRC

References

ACFE. 2016. Report to the Nations on Occupational Fraud and Abuse, 2016 Global Fraud Study. Association of Certified Fraud Examiners, USA: Austin, Texas.

Belo, F., Vito, D., Galab, V., Lic, J. 2013. Government spending, political cycles, and the cross section of stock returns, Journal of Financial Economics, Volume 107, Issue 2, February 2013, Pages 305–324. https://doi.org/10.1016/j.jfineco.2012.08.016

Bove, V., Efthyvoulou, G., Navas, A. 2016. Political cycles in public expenditure: butter vs guns, Journal of Comparative Economics, Available online 1 April 2016, https://doi.org/10.1016/j.jce.2016.03.004

Chvalkovska, J., Fazekas, M., Skuhrovec, J., Tóth, I. J., King L. P. 2013. Are EU funds a Corruption Risk? The Impact of EU Funds on Grand Corruption in Central and Eastern Europe. In: Pippidi-Mungiu, A. Controlling Corrution in Europe. The Anticorruption Report 2. Oplanden, Berlin & Toronto: Barbara Budrich Publishers. pp. 68-89.

Czibik, Á., Fazekas, M., Tóth, B., Tóth I. J. 2014. Toolkit for detecting collusive bidding in public procurement. With examples from Hungary. Working Paper Series: CRCB-WP/2014:02. CRCB, Budapest, 2014. http://bit.ly/2aDRYM7

Durtschi, C. - Hillison, W.- Pacini, C. 2004. "The Effective Use of Benford's Law to Assist in. Detecting Fraud in Accounting Data", Journal of Forensic Accounting, Vol V. pp. 17-34, http://bit.ly/1QSUOER.
Drake, P. D. – Nigrini, M. J. 2000. "Computer assisted analytical procedures using Benford's law", Journal of Accounting Education, Vol. 18. no. 2. pp. 127-146;

Fazekas, M., King, L. P., Tóth, I. J. 2013. Hidden Depths. The Case of Hungary. In: Pippidi-Mungiu, A. Controlling Corrution in Europe. The Anticorruption Report 1. Oplanden, Berlin & Toronto: Barbara Budrich Publishers. pp. 74-82.

Fazekas, M., and Tóth, I. J. 2016. "From Corruption to State Capture. A New Analytical Framework with Empirical Applications from Hungary". Political Research Quarterly, June 2016, vol. 69. no. 2. pp. 320-334,
http://bit.ly/2qO7Hiy, doi:10.1177/1065912916639137.

Fazekas, M., Tóth, I. J., King, L. P. 2016. "An Objective Corruption Risk Index Using Public Procurement Data". European Journal on Criminal Policy and Research, First Online: 25 April 2016 doi:10.1007/s10610-016-9308-z.

Fazekas, M. - 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.

Kossovsky, A. E. 2015. Benford's Law. Theory, the General Law of Relative Quantities, and Forensic Fraud Detection Applications. Hackensack, New Jersey, USA: World Scientific

Miller, S. J. (ed.). 2015. Benford's Law: Theory and Applications. Princeton, New Jersey, USA: Princeton University Press

Nigrini, M. J. 1996. "A taxpayer compliance application of Benford's law". Journal of the American Taxation Association. Vol. 18. no 1. pp. 72–91.

Nigrini, M. J. (ed.). 2012. Benford's Law. Applications for Forensic Accounting, Auditing, and Fraud Detection. Hoboken, New Jersey, USA: John Wiley & Sons

Spann, Delena D. 2013. Fraud Analytics: Strategies and Methods for Detection and Prevention, Hoboken. New Jersey, USA: John Wiley & Sons

Szánto, Z., Tóth, I. J., Varga, S. 2012. The social and institutional structure of corruption: some typical network configurations of corruption transactions in Hungary. In: Vedres, B., Scotti, M. .eds. Network in Social Policy Problems. Cambridge, UK: Cambridge University Press.

Rose-Ackerman, S. (ed.) .2006. International Handbook on the Economics of Corruption, Edward Elgar, Cheltenham, UK.

Rose-Ackerman, S. – Soreide, T. 2011. International Handbook on the Economics of Corruption. Volume Two. Edward Elgar, Cheltenham, UK.

Tóth, I. J., Hajdu, M. 2016. Competitive Intensity and Corruption Risks in the Hungarian Public Procurement 2009-2015. Paper presented at the University of Cambridge, „Data for Policy" Conference, http://bit.ly/2b8p8kW

Tóth, I. J., Hajdu, M. 2017. Intensity of Competition, Corruption Risks and Price Distortion in the Hungarian Public Procurement – 2009-2016. The report prepared for the EU Comission.

Varian, H. R.1972.: "Benford's law", The American Statistician, 26. Vol. no.3. pp. 65–66.

Abbrevations

CRCB	Corruption Research Center Budapest
DSL	Direct Social Loss
DSLR	Ratio of Direct Social Loss relative to Net Contract Value
EPRCRC	Electronic Public Procurement Classifieds of the Republic of Croatia
HRK	Croatian Kuna
ICI	Indicator of Competitive Intensity
MAD	Mean Absolute Deviation
MaKAB	Database of Hungarian Public Procurement
NCV	Net Contract Value
RPRD	Relative price drop compared to the estimated value
SB	Public tender with single bidder
TED	Tenders Electronic Daily – This is the online version of the 'Supplement to the Official Journal' of the EU, dedicated to European public procurement (http://ted.europa.eu/TED/main/HomePage.do)
PPZ	Public Procurement of Zagreb Holding and City of Zagreb

Appendix 1: Problems and errors of the official data publication

The Croatian Public Procurement Authority published data about 4,653 public procurement issued by Grad Zagreb and Zagreb Holding in total between 2011 and 2016. As several contracts may belong to one procurement, our analysis was based on a contract level dataset, that contains 6,172 cases in total. However, during our analysis, we had to filter out 250 cases because *0 HRK* was indicated as the contract value. We assume that these tenders were not valid, therefore we excluded them from the analysis. In addition, the net contract value was more than ten times higher than the estimated contract value in the case of 41 public procurement. As we suspect that this phenomenon occurred because of mistyping the decimal separator or some other kind of mistake during the publication of data, in these cases we taken into consideration the estimated contract value as the actual net contract value.

Furthermore, we would like to indicate that there may be some additional misreported contract values based on the relation between the net contract values and the estimated values (see Table A1.1.). However, because there is no clear general justification for filtering out these tenders, we decided to keep them in the analysis. We suggest the one-by-one analysis of these cases when contract price was published faulty by the Croatian authorities (see them in Table A1.2.) as a further step of the research in order to reveal the reasons of the inconsistencies.

Table A1.1: Number of suspicious cases by year where the net contract value (NCV) exceeds the estimated value (EV)

	NCV is more than 1.5 times higher than EV	NCV is more than 2 times higher than EV	NCV is more than 3 times higher than EV	NCV is more than 5 times higher than EV	**NCV is more than 10 times higher than EV**
2011	3	3	3	2	**2**
2012	36	22	13	9	**3**
2013	120	81	38	12	**8**
2014	46	29	16	9	**5**
2015	83	46	24	16	**7**
2016	90	70	48	29	**16**
Total	378	251	142	77	**41**

Source: CRCB
Note: the cases in bold are excluded from the analysis.

Table A1.2: List of cases where the net contract value (ncvalue) exceeds significantly the estimated value (c_value_est)

id	date_	issuer	w_name	c_value_est	ncvalue	sb	x2	x3	x5
167	201101	1	PRONGRAD BIRO d.o.o.	11382	46000	0	1	1	0
1143	201211	1	Georad d.o.o. i Geodist d.o.o.	718214	1966182	0	1	0	0
4465	201209	2	Siemens d.d.	600000	1643470	1	1	0	0
3557	201210	2	PEEK PROMET d.o.o.	300000	677016	0	1	0	0
3821	201206	2	PEEK PROMET d.o.o.	350000	927347	1	1	0	0
4465	201209	2	PEEK PROMET d.o.o.	350000	2050294	1	1	1	1
3759	201206	2	FANOS d.o.o. Za projektiranje i inženjering u prometu	300000	1289250	1	1	1	0
4465	201209	2	FANOS d.o.o.	350000	1079625	1	1	1	0
4465	201209	2	SEMAFOR d.o.o.	100000	464719	1	1	1	0
3799	201206	2	USLUGA d.o.o.	7000000	59409572	1	1	1	1
3693	201211	2	BENUSSI d.o.o.	900000	1941692	0	1	0	0
4498	201209	2	GRA-PO d.o.o.	600000	4380628	1	1	1	1
3435	201210	2	Poljoopskrba tehno d.d.	300000	620100	0	1	0	0
3435	201210	2	Poljoopskrba tehno d.d.	300000	707092	0	1	0	0
3668	201210	2	Poljoopskrba tehno d.d.	300000	620100	0	1	0	0
3668	201210	2	Poljoopskrba tehno d.d.	300000	707092	0	1	0	0
3693	201211	2	AUTO-SAFIR d.o.o.	900000	2878440	0	1	1	0
3579	201210	2	Finvest corp d.d.	1000000	9620058	0	1	1	1
3712	201212	2	Purić d.o.o.	1000000	5540481	1	1	1	1
3762	201206	2	R-PIM d.o.o.	450000	2331803	1	1	1	1
3900	201312	2	Industrooprema d.o.o.; MIK-ELING d.o.o.	2500000	18355110	0	1	1	1
4304	201305	2	DOMEL d.o.o.; GRAĐPROM d.o.o.	50000000	114908494	0	1	0	0
4304	201305	2	GEORAD d.o.o.	50000000	122107828	0	1	0	0
3853	201311	2	P.G.P. d.o.o.	5000000	11632457	0	1	0	0
4304	201305	2	TEMEX d.o.o.	50000000	110689500	0	1	0	0

4304	201305	2	TIGRA d.o.o.	50000000	108880702	0	1	0	0
4304	201305	2	PUGAR d.o.o	50000000	158867531	0	1	1	0
4449	201303	2	Drager Safety d.o.o.	160000	326189	1	1	0	0
3871	201311	2	VUGRINEC d.o.o.	800000	2276700	0	1	0	0
3993	201308	2	DETA PRUT d.o.o.	1000000	2040389	0	1	0	0
4350	201306	2	RESNIK-BETON d.o.o.	4000000	8250141	1	1	0	0
3915	201312	2	RO-TEHNOLOGIJA d.o.o.	1200000	6042127	1	1	1	1
3908	201312	2	Industrooprema d.o.o.	600000	1848658	0	1	1	0
3874	201311	2	VODOSKOK d.d.	400000	949036	0	1	0	0
4024	201310	2	VODOSKOK d.d.	170000	509386	0	1	0	0
4328	201306	2	VODOSKOK d.d.	900000	2430947	0	1	0	0
4486	201302	2	VODOSKOK d.d.	1400000	3882502	0	1	0	0
4041	201310	2	EOL GRUPA d.o.o.	800000	2824894	1	1	1	0
3853	201311	2	GUT d.o.o.	5000000	33838421	0	1	1	1
4397	201307	2	O-K-TEH d.o.o.	160000	324245	1	1	0	0
4305	201302	2	VATRO PROMET d.o.o.	1000000	2167130	0	1	0	0
4325	201306	2	KEFO d.o.o.	800000	1683940	0	1	0	0
4349	201306	2	SITOLOR d.o.o.	300000	721144	0	1	0	0
3913	201312	2	AUTO ENIGMA d.o.o.	600000	1465302	1	1	0	0
3863	201311	2	AUTO-MAG d.o.o.	585000	2319186	0	1	1	0
3863	201311	2	AUTO-MAG d.o.o.	350000	722020	0	1	0	0
3908	201312	2	AUTO-MAG d.o.o.	600000	2520721	0	1	1	0
3969	201308	2	Auto - Mag d.o.o.	800000	1966479	0	1	0	0
4031	201310	2	AUTO-MAG d.o.o.	690000	2594433	0	1	1	0
4338	201306	2	ELEKTRO - KOMUNIKACIJE d.o.o.	200000	628928	0	1	1	0
3901	201312	2	GRA-PO d.o.o.	800000	2231128	0	1	0	0
4304	201305	2	NERING d.o.o.	50000000	101200781	0	1	0	0

3916	201312	2	SHIMADZU d.o.o.	300000	1100144	1	1	1	0
3871	201311	2	SMIT - COMMERCE d.o.o.	800000	2718608	0	1	1	0
3886	201311	2	SMIT - COMMERCE d.o.o.	600000	2200108	0	1	1	0
4346	201306	2	SMIT-COMMERCE d.o.o.	600000	2576398	0	1	1	0
4400	201307	2	SMIT-COMMERCE d.o.o.	500000	1213488	0	1	0	0
4036	201310	2	URIHO Zagreb	4000000	19222080	0	1	1	0
4009	201310	2	ZAGREBAČKO ELEKTROTEHNIČKO PODUZEĆE d.d.	500000	2275650	0	1	1	0
3907	201312	2	ZAGREL RITTMEYER d.o.o.	380000	1955383	1	1	1	1
4033	201310	2	AUTO HRVATSKA PRODAJNO SERVISNI CENTRI d.o.o.	1600000	4612838	0	1	0	0
4370	201307	2	AUTO HRVATSKA PRODAJNO SERVISNI CENTRI d.o.o.	120000	261601	0	1	0	0
4315	201306	2	AUTO-SAFIR d.o.o.	800000	1877699	0	1	0	0
4363	201306	2	Auto Safir d.o.o.	500000	1018482	0	1	0	0
4338	201306	2	BELINAMONT d.o.o.	200000	418385	0	1	0	0
4411	201303	2	CEE STROJEVI d.o.o.	800000	1966830	0	1	0	0
4394	201307	2	ECCOS INŽENERING d.o.o.	1700000	5825908	1	1	1	0
4059	201311	2	ELEKTROCENTAR PETEK d.o.o.	4000000	15792779	0	1	1	0
4009	201310	2	ELTRA MG	500000	2194969	0	1	1	0
3871	201311	2	GOLUBOVEČKI KAMENOLOMI d.o.o.	800000	2637848	0	1	1	0
4393	201307	2	Habeić doo	280000	825605	1	1	0	0
3900	201312	2	KONČAR - INEM d.o.o.	2500000	12068524	0	1	1	0
4370	201307	2	MAN IMPORTER HRVATSKA d.o.o.	300000	623384	0	1	0	0
4370	201307	2	MAN IMPORTER HRVATSKA d.o.o.	150000	395221	0	1	0	0
4450	201302	2	MB SERVIS, Obrt za održavanje i popravak motornih vozila, strojeva, opreme i trgovinu, vlasnik Davor Žaler	600000	2692173	0	1	1	0
4033	201310	2	MIKRA MATIK AUTODIJELOVI d. o. o.	1600000	3328721	0	1	0	0
4305	201302	2	PASTOR TVA d.d.	1000000	2386713	0	1	0	0
4284	201305	2	R-PIM d.o.o.	200000	421320	1	1	0	0
4323	201306	2	ROBERT BERGER vl.obrta "BERGER"	800000	2534207	1	1	1	0

4033	201310	2	Tahograf d.o.o.	1600000	4561503	0	1	0	0
3912	201312	2	TED d.o.o.	300000	916894	1	1	1	0
3975	201309	2	TRA-MONT d.o.o.	90000	188917	1	1	0	0
4059	201311	2	WELLMAX d.o.o.	4000000	14680312	0	1	1	0
4346	201306	2	X-PANEL d.o.o.	600000	2442497	0	1	1	0
4305	201302	2	Zaštita i sigurnost d.o.o.	1000000	2338627	0	1	0	0
3969	201308	2	ADA-SERVIS d.o.o.	800000	2708614	0	1	1	0
4304	201305	2	ĆIBO-PROMET d.o.o.	50000000	105096984	0	1	0	0
4363	201306	2	INTERPART SP d.o.o.	500000	1385588	0	1	0	0
4389	201307	2	LAKMUS d.o.o.	250000	506147	0	1	0	0
4346	201306	2	SAVA-PROMET d.o.o.	600000	2723240	0	1	1	0
4059	201311	2	SREBRA SYSTEM d.o.o.	4000000	15517675	0	1	1	0
4063	201311	2	Tehmar d.o.o.	200000	425423	0	1	0	0
4304	201305	2	ŽUPANIJSKE CESTE ZAGREBAČKE ŽUPANIJE d.o.o.	50000000	102989906	0	1	0	0
3785	201402	2	GIP PIONIR d.o.o.	1670000	4124878	0	1	0	0
3785	201402	2	Vodograd-I.G.	1670000	3701904	0	1	0	0
3802	201401	2	VODOTEHNIKA d.d.	1450000	5112816	1	1	1	0
3953	201401	2	GRADATIN d.o.o	300000	1589293	0	1	1	1
1855	201407	1	TROL DK d.o.o.	600000	1687500	1	1	0	0
1888	201407	1	TROL DK d.o.o.	600000	1687500	1	1	0	0
2003	201409	1	Industrooprema d.o.o.	2400000	4851995	0	1	0	0
3949	201401	2	Voith Turbo d.o.o.	4500000	14255739	1	1	1	0
3961	201401	2	ENERGOREMONT,d.d.	1450000	7210420	1	1	1	0
3838	201405	2	PELMEN d.o.o.	800000	2520181	0	1	1	0
2113	201411	1	Agro-Honor d.o.o.	2300000	5952188	0	1	0	0
2070	201410	1	AUTO-MAG d.o.o.	600000	2869541	0	1	1	0
3790	201402	2	AUTO-MAG d.o.o.	300000	1067838	0	1	1	0

2111	201411	1	GRA-PO d.o.o.	600000	3488282	1	1	1	1
3953	201401	2	GRA-PO d.o.o.	300000	1835878	0	1	1	1
2128	201411	1	SAMOBORKA D.D.	3500000	7203621	0	1	0	0
2142	201411	1	SAMOBORKA D.D.	3500000	7203621	0	1	0	0
2113	201411	1	Bilo Zagreb d.o.o.	2300000	6930309	0	1	1	0
3775	201401	2	CONTROLMATIK d.o.o.	600000	1364550	1	1	0	0
2003	201409	1	DALEKOVOD-PROIZVODNJA d.o.o.	2400000	4849022	0	1	0	0
3831	201405	2	DRAŽEN KOVAČIĆ, vl. obrta "SERVIS IMP CRPKE"	350000	758803	0	1	0	0
3956	201401	2	ELEKTROCENTAR PETEK d.o.o.	300000	732615	0	1	0	0
2054	201410	1	TERRA JASKA d.o.o.	1250000	7687060	0	1	1	1
3845	201407	2	Biromax d.o.o.	12500000	26648317	0	1	0	0
4214	201508	2	PEEK PROMET d.o.o.	350000	3208830	1	1	1	1
4251	201510	2	PEEK PROMET d.o.o.	350000	3208830	1	1	1	1
4217	201508	2	P.G.P. d.o.o.	50000000	112857319	0	1	0	0
4101	201511	2	DELTRON d.o.o	510000	1108631	0	1	0	0
4101	201511	2	DELTRON d.o.o	100000	674222	0	1	1	1
4217	201508	2	PUGAR d.o.o.	50000000	127139138	0	1	0	0
4251	201510	2	FANOS d.o.o.	350000	1312453	1	1	1	0
4075	201510	2	GRADATIN d.o.o	1000000	2991813	1	1	0	0
2298	201504	1	MBM d.o.o.	440000	1797750	0	1	1	0
2298	201504	1	MBM d.o.o.	440000	1845075	0	1	1	0
4070	201510	2	Industrooprema d.o.o.	1000000	2824186	0	1	0	0
4178	201507	2	Industrooprema d.o.o.	600000	3217323	0	1	1	1
2333	201506	1	VODOSKOK d.d.	4300000	9055500	0	1	0	0
4163	201507	2	VODOSKOK d.d.	25000	56250	0	1	0	0
4203	201508	2	VODOSKOK d.d.	25000	56250	0	1	0	0
4073	201510	2	M.B. AUTO d.o.o.	100000	251025	0	1	0	0

2294	201504	1	TOI TOI d.o.o.	2200000	4740281	1	1	0	0
4181	201507	2	DILJEXPORT d.o.o.	2000000	4507384	1	1	0	0
4131	201512	2	KEFO d.o.o.	500000	1827062	0	1	1	0
4070	201510	2	AUTO-MAG d.o.o.	1000000	3295376	0	1	1	0
4201	201508	2	AUTO-MAG d.o.o.	800000	1690999	0	1	0	0
4247	201509	2	AUTO-MAG d.o.o.	1400000	5829625	1	1	1	0
4082	201510	2	GRA-PO d.o.o.	800000	6343332	1	1	1	1
4131	201512	2	Kuna Corporation d.o.o.	500000	1744117	0	1	1	0
4157	201506	2	MAXMAR GRUPA D.O.O.	4000000	11213079	0	1	0	0
4249	201510	2	RASCO d.o.o.	1200000	6824185	1	1	1	1
4188	201507	2	SMIT-COMMERCE d.o.o.	1400000	2932354	0	1	0	0
4131	201512	2	AnAs d.o.o.	500000	2072901	0	1	1	0
4073	201510	2	AUTO HRVATSKA PRODAJNO SERVISNI CENTRI d.o.o.	100000	209612	0	1	0	0
4102	201511	2	BERGER ELEKTROMEHANIKA vl. Robert Berger	1000000	2509297	0	1	0	0
4073	201510	2	CIAK TRUCK d.o.o.	200000	496400	0	1	0	0
4139	201512	2	Eccos-inženjering d.o.o.	750000	2176971	1	1	0	0
4124	201512	2	MAN IMPORTER HRVATSKA d.o.o.	250000	689831	0	1	0	0
4073	201510	2	MIKRA MATIK AUTODIJELOVI d. o. o.	200000	460613	0	1	0	0
4172	201507	2	NIVAG EXPORT d.o.o.	2000000	12581225	1	1	1	1
4177	201507	2	REDOX	2000000	5015758	1	1	0	0
4217	201508	2	Tegra d.o.o.	50000000	102854428	0	1	0	0
4178	201507	2	BIZMUT D.O.O.	600000	3477248	0	1	1	1
4178	201507	2	KOVING D.O.O.	600000	3307945	0	1	1	1
4152	201601	2	TEMEX d.o.o.; GIP PIONIR d.o.o.; GEAMEDITOR d.o.o.	1000000	2166038	0	1	0	0
3227	201612	1	INSTAL-PROM d.o.o.	1500000	3517258	0	1	0	0
2738	201604	1	TERMORAD d.o.o.	20000	43059	0	1	0	0
3160	201611	1	Peek promet d.o.o.	500000	3091725	1	1	1	1

3236	201612	1	Deltron d.o.o.	180000	1120028	1	1	1	1
2961	201609	1	VIATOR d.o.o.	1590000	3305531	0	1	0	0
3095	201610	1	VIATOR d.o.o.	1590000	4917919	0	1	1	0
2961	201609	1	ORYX GRUPA d.o.o.	1590000	3984431	0	1	0	0
3095	201610	1	ORYX GRUPA d.o.o.	1590000	6269559	0	1	1	0
3096	201610	1	Mato el-d d.o.o.	220000	514303	0	1	0	0
2819	201606	1	Vodotehnika d.d.	1450000	6829137	1	1	1	0
3138	201611	1	Elektrokem d.o.o.	1560000	5095824	1	1	1	0
3160	201611	1	Elektrokem d.o.o.	300000	636098	1	1	0	0
3169	201611	1	Elektrokem d.o.o.	1560000	5095824	1	1	1	0
3160	201611	1	Fanos d.o.o.	500000	1215188	1	1	0	0
2791	201606	1	Gradatin d.o.o.	2100000	4685916	1	1	0	0
3160	201611	1	Semafor d.o.o.	150000	1435547	1	1	1	1
2626	201602	1	Ro tehnologija doo	2500000	7400824	1	1	0	0
2697	201604	1	MBM d.o.o.	1200000	10518980	1	1	1	1
4151	201601	2	Industrooprema d.o.o.	200000	663504	0	1	1	0
4151	201601	2	Industrooprema d.o.o.	400000	873874	0	1	0	0
2855	201607	1	AUTOBUS d.o.o.	500000	2253990	1	1	1	0
3028	201609	1	Autobus d.o.o.	1500000	3474453	1	1	0	0
4148	201601	2	AUTOBUS d.o.o.	1500000	3202633	1	1	0	0
3188	201612	1	Vodoskok d.d.	2200000	6543404	0	1	0	0
3188	201612	1	FDS-TRGOVINA d.o.o.	2200000	7080000	0	1	1	0
3218	201611	1	FDS-TRGOVINA d.o.o.	1600000	13051300	0	1	1	1
3093	201610	1	USLUGA d.o.o.	10000000	45682625	1	1	1	0
2664	201603	1	Voith Turbo d.o.o.	4500000	14252733	1	1	1	0
2770	201605	1	TOKOS d.o.o.	1590000	3759656	0	1	0	0
2804	201606	1	ENERGOREMONT,d.d.	1450000	10932839	1	1	1	1

2908	201608	1	C.I.A.K. d.o.o.	17000	138281	0	1	1	1
2908	201608	1	C.I.A.K. d.o.o.	10000	25781	0	1	0	0
2908	201608	1	Kemokop d.o.o.	6000	50625	0	1	1	1
2908	201608	1	Kemokop d.o.o.	10000	30375	0	1	1	0
2833	201607	1	PELMEN d.o.o., Zagreb, Garićgradska 14	650000	1868446	1	1	0	0
3095	201610	1	Auto Benussi d.o.o.	1590000	8868131	0	1	1	1
2753	201605	1	AUTO ENIGMA d.o.o.	450000	1773707	0	1	1	0
2921	201608	1	AUTO-MAG D.O.O.	600000	2930986	0	1	1	0
2983	201609	1	GRADITELJ SVRATIŠTA d.o.o., Zagreb, Ivana Česmičkog 16	1000000	2008650	0	1	0	0
3218	201611	1	HENNLICH industrijska tehnika	1600000	12137767	0	1	1	1
2693	201604	1	KONČAR-ELEKTRONIKA I INFORMATIKA d.d.	1500000	4212659	1	1	0	0
2577	201601	1	KUDUMIJA TRADE	1000000	2085178	1	1	0	0
3096	201610	1	OBRT SERVIS IMP CRPKE, vl. Darko Kovačić	220000	569128	0	1	0	0
4147	201602	2	Smit-Commerce d.o.o.	250000	2144900	0	1	1	1
3096	201610	1	ZAGREBAČKO ELEKTROTEHNIČKO PODUZEĆE D.D.	650000	2603972	0	1	1	0
2864	201607	1	Zagrel Rittmeyer d.o.o.	600000	1883739	1	1	1	0
3096	201610	1	ELTRA MG d.o.o.	650000	2522109	0	1	1	0
4151	201601	2	KOVING D.O.O.	200000	681713	0	1	1	0
3096	201610	1	MENDIS-PROJEKT d.o.o.	220000	607425	0	1	0	0
3096	201610	1	MENDIS-PROJEKT d.o.o.	650000	2528344	0	1	1	0
2908	201608	1	Metis d.d.	12000	67500	0	1	1	1
3218	201611	1	MILENIUM TRADE D.O.O.	1600000	13051478	0	1	1	1
3188	201612	1	Vodoplast promet d.o.o.	2200000	6669354	0	1	1	0
1211	201212	1	BOLČEVIĆ-GRADNJA d.o.o., Sesvetski Kraljevec, Dugoselska 57, MGV d.o.o., Zagreb, Slimska 11	288000	513243	0	0	0	0
3557	201210	2	PEEK PROMET d.o.o.	300000	575419	0	0	0	0
3703	201211	2	Vodotehnika d.d.	13000000	19624955	0	0	0	0
4132	201208	2	INDUSTROOPREMA d.o.o.	500000	770297	0	0	0	0

3954	201208	2	I.B. JAZBINA d.o.o.	1000000	1968750	0	0	0	0
3703	201211	2	VODOSKOK d.d.	13000000	19850505	0	0	0	0
3468	201210	2	ENERGOREMONT,d.d.	450000	770351	1	0	0	0
3634	201210	2	ENERGOREMONT,d.d.	450000	770351	1	0	0	0
3435	201210	2	Elektrocentar Petek d.o.o.	300000	466765	0	0	0	0
3668	201210	2	Elektrocentar Petek d.o.o.	300000	466765	0	0	0	0
3701	201211	2	KOR d.o.o.	1450000	2758744	1	0	0	0
3788	201207	2	TISAK DA-DA d.o.o.	110000	182063	0	0	0	0
4509	201209	2	TISAK DA-DA d.o.o.	110000	182063	0	0	0	0
4132	201208	2	VELEKEM d.d.	500000	860320	0	0	0	0
3857	201311	2	ELICOM d.o.o.	300000	463420	0	0	0	0
4304	201305	2	GTM d.o.o.	50000000	85074159	0	0	0	0
3853	201311	2	GEORAD d.o.o.	5000000	8394597	0	0	0	0
4304	201305	2	GIP PIONIR d.o.o.	50000000	84928313	0	0	0	0
4305	201302	2	HRT-ŠARIĆ d.o.o.	1000000	1980795	0	0	0	0
4304	201305	2	Hvar d.o.o.	50000000	87096103	0	0	0	0
3875	201311	2	SIGNALGRAD d.o.o.	500000	832500	0	0	0	0
1669	201311	1	TITAN CONSTRUCTA d.o.o.	80000	127464	0	0	0	0
4304	201305	2	AMB gradnja d.o.o.	50000000	96547594	0	0	0	0
4358	201306	2	VODOSKOK d.d.	1450000	2577266	0	0	0	0
4400	201307	2	VODOSKOK d.d.	500000	848050	0	0	0	0
4315	201306	2	GUMIIMPEX-GRP d.d.	800000	1525375	0	0	0	0
4304	201305	2	GUT	50000000	97101047	0	0	0	0
3863	201311	2	AUTO-MAG d.o.o.	460000	703864	0	0	0	0
4031	201310	2	AUTO-MAG d.o.o.	267000	525411	0	0	0	0
4304	201305	2	BOLČEVIĆ-GRADNJA d.o.o.	50000000	98077219	0	0	0	0
4304	201305	2	Graditelj svratišta d.o.o.	50000000	78732338	0	0	0	0

4270	201304	2	KOM - TRADE d.o.o.	3500000	6941543	0	0	0	0
4304	201305	2	M.Soldo d.o.o.	50000000	92854031	0	0	0	0
4328	201306	2	POLJOOPSKRBA-TEHNO d.d.	900000	1657016	0	0	0	0
4400	201307	2	POLJOOPSKRBA-TEHNO d.d.	500000	865638	0	0	0	0
4304	201305	2	Prigorac-građenje d.o.o.	50000000	98744391	0	0	0	0
4486	201302	2	SMIT - COMMERCE d.o.o.	1400000	2206975	0	0	0	0
3859	201311	2	SMIT-COMMERCE d.o.o.	300000	456028	0	0	0	0
4304	201305	2	Šušković-građenje d.o.o.	50000000	90966188	0	0	0	0
4400	201307	2	Trgometal d.o.o.	500000	975153	0	0	0	0
4304	201305	2	ZAGORJE GRADNJA d.o.o.	50000000	83526188	0	0	0	0
4325	201306	2	Anas d.o.o.	800000	1507481	0	0	0	0
4315	201306	2	AUTO HRVATSKA d.d.	800000	1450226	0	0	0	0
4028	201310	2	CONTROLMATIK d.o.o.	570000	1076759	1	0	0	0
4370	201307	2	MAN IMPORTER HRVATSKA d.o.o.	180000	304205	0	0	0	0
4370	201307	2	MAN IMPORTER HRVATSKA d.o.o.	140000	225147	0	0	0	0
3875	201311	2	TI KEM d.o.o.	500000	796875	0	0	0	0
4304	201305	2	EKO - MIKS d.o.o.	50000000	90792956	0	0	0	0
3859	201311	2	Gutta Hrvatska d.o.o.	300000	501773	0	0	0	0
3875	201311	2	ITT - Rijeka d.o.o.	500000	881250	0	0	0	0
4304	201305	2	PALIĆ INŽENJERING d.o.o.	50000000	87322219	0	0	0	0
4304	201305	2	Turković d.o.o.	50000000	77129686	0	0	0	0
4328	201306	2	VEKTRA d.o.o.	900000	1354613	0	0	0	0
2170	201412	1	Zajednica ponuditelja SOKOL MARIĆ d.o.o., BILIĆ-ERIĆ d.o.o. i V GRUPA d.o.o.	813000	1502813	0	0	0	0
2177	201412	1	Zajednica ponuditelja SOKOL MARIĆ d.o.o., BILIĆ-ERIĆ d.o.o. i V GRUPA d.o.o.	813000	1502813	0	0	0	0
3845	201407	2	Narodne novine d.d.; Tip-Zagreb d.o.o.; ZVIBOR d.o.o.	12500000	24372674	0	0	0	0
3845	201407	2	NOVI URED d.o.o.; STUBLIĆ IMPEX d.o.o.	12500000	24657096	0	0	0	0
1952	201409	1	MBM d.o.o.	2200000	4236830	1	0	0	0

3790	201402	2	Industrooprema d.o.o.	300000	486662	0	0	0	0
3819	201403	2	Industrooprema d.o.o.	500000	907300	0	0	0	0
3834	201405	2	Industrooprema d.o.o.	300000	572766	1	0	0	0
2106	201411	1	VODOSKOK d.d.	1100000	2061405	0	0	0	0
3818	201403	2	VODOSKOK d.d.	350000	579938	0	0	0	0
2166	201412	1	EOL GRUPA d.o.o.	2000000	3255441	1	0	0	0
2003	201409	1	OMNIMERKUR d.o.o.	2400000	4586486	0	0	0	0
3952	201401	2	Trgometal d.o.o.	4000000	7855542	0	0	0	0
2024	201409	1	BENNINGHOVEN GmbH & Co. KG	2000000	3707546	1	0	0	0
2026	201409	1	BENNINGHOVEN GmbH & Co. KG	2000000	3707546	1	0	0	0
3793	201402	2	KOMOP d.o.o.	5000000	9351573	1	0	0	0
2059	201410	1	METALNO PLASTIČNA GALANTERIJA	700000	1147631	1	0	0	0
4239	201509	2	Kamenolom Gorjak d.o.o.; GOLUBOVEČKI KAMENOLOMI d.o.o.; HOLCIM MINERALNI AGREGATI d.o.o.	62000000	93140625	1	0	0	0
4190	201507	2	PEEK PROMET d.o.o.	500000	948863	1	0	0	0
4217	201508	2	GTM d.o.o.	50000000	88343269	0	0	0	0
2461	201509	1	GEORAD d.o.o.	1730880	3057129	1	0	0	0
4217	201508	2	GEORAD d.o.o.	50000000	81197981	0	0	0	0
4217	201508	2	TIGRA d.o.o.	50000000	91593741	0	0	0	0
4217	201508	2	Hvar d.o.o.	50000000	87096103	0	0	0	0
2266	201503	1	Pismorad d.d.	1500000	2370113	0	0	0	0
4101	201511	2	PAMAJO d.o.o.	100000	165004	0	0	0	0
2333	201506	1	VODOTEHNIKA d.d.	11500000	18375844	0	0	0	0
4190	201507	2	ELEKTROKEM d.o.o.	500000	829284	1	0	0	0
2304	201504	1	DETA PRUT d.o.o.	1000000	1781194	0	0	0	0
2309	201504	1	MBM d.o.o.	3000000	5077369	1	0	0	0
2392	201509	1	Industrooprema d.o.o.	2000000	3009383	0	0	0	0
2333	201506	1	VODOSKOK d.d.	11500000	18655431	0	0	0	0

4073	201510	2	M.B. AUTO d.o.o.	200000	323751	0	0	0	0
4217	201508	2	GUT d.o.o.	50000000	97101047	0	0	0	0
2277	201503	1	O-K-TEH d.o.o.	800000	1266116	1	0	0	0
4245	201509	2	ARBORI CULTURA d.o.o.	50000	83597	0	0	0	0
4097	201511	2	ELEKTRO-KOMUNIKACIJE d.o.o.	500000	787126	1	0	0	0
4217	201508	2	M. SOLDO d.o.o.	50000000	88382625	0	0	0	0
4118	201512	2	PA-EL d.o.o.	1000000	1910203	1	0	0	0
4217	201508	2	Prigorac-građenje d.o.o.	50000000	91226203	0	0	0	0
4123	201512	2	SMIT-COMMERCE d.o.o.	1500000	2420308	0	0	0	0
4217	201508	2	Šušković-građenje d.o.o.	50000000	90966188	0	0	0	0
4160	201506	2	URIHO - Ustanova za profesionalnu rehabilitaciju i zapošljavanje osoba s invaliditetom	9000000	16854387	1	0	0	0
2266	201503	1	Elektrocentar petek d.o.o	1500000	2601866	0	0	0	0
4078	201510	2	HIDRAULIKA KURELJA d.o.o.	3500000	5436764	0	0	0	0
4238	201509	2	HIDROMEHANIKA d.o.o.	450000	769998	0	0	0	0
4200	201507	2	Končar - Električna vozila d.d.	6500000	10070325	1	0	0	0
4167	201507	2	Zagreb plakat.d.o.o.	550000	1009349	1	0	0	0
4217	201508	2	EKO-MIKS d.o.o.	50000000	90792956	0	0	0	0
4123	201512	2	HIDROCOM d.o.o.	1500000	2371453	0	0	0	0
4217	201508	2	NISKOGRADNJA DONJI JALŠEVAC d.o.o.	50000000	81725438	0	0	0	0
4217	201508	2	PALIĆ INŽENJERING d.o.o.	50000000	76630875	0	0	0	0
4217	201508	2	Turković d.o.o.	50000000	77139061	0	0	0	0
2333	201506	1	Vodopromet d.o.o.	11500000	18941200	0	0	0	0
2735	201604	1	KING ICT d.o.o.; Info-kod d.o.o.; MR servis d.o.o.	2000000	3597308	1	0	0	0
2738	201604	1	TERMORAD d.o.o.	20000	39853	0	0	0	0
2814	201606	1	GEORAD d.o.o.	1700000	3044479	0	0	0	0
2738	201604	1	Deltron d.o.o.	20000	32625	0	0	0	0
2613	201602	1	PUGAR d.o.o.	880000	1395737	0	0	0	0

2649	201602	1	PISMORAD D.O.O.	500000	810000	0	0	0	0
2649	201602	1	SIGNALGRAD d.o.o.	500000	768750	0	0	0	0
2653	201603	1	Deta prut d.o.o.	600000	1039097	1	0	0	0
2838	201607	1	Gradatin d.o.o.	3000000	5372413	0	0	0	0
2792	201606	1	EOL grupa d.o.o.	2000000	3771150	1	0	0	0
2680	201602	1	TEHNIX d.o.o.	600000	1051887	1	0	0	0
3065	201610	1	AUTO-MAG D.O.O.	1550000	2873257	0	0	0	0
3068	201610	1	BOLČEVIĆ-GRADNJA D.O.O.	960000	1737555	1	0	0	0
2887	201608	1	ELEKTROCENTAR Petek, d.o.o.	500000	888213	0	0	0	0
2752	201605	1	Graditelj svratišta d.o.o.	1000000	1687500	0	0	0	0
3055	201610	1	AUTO HRVATSKA Prodajno Servisni Centri d.o.o.	2500000	4533239	1	0	0	0
2649	201602	1	CHROMOS	500000	772500	0	0	0	0
2597	201601	1	FRAGARIA PLANTA d.o.o.	450000	860723	0	0	0	0
2847	201607	1	MALI GRM d.o.o.	7500000	11414297	1	0	0	0
3091	201610	1	Oktal Pharma d.o.o.	46000	89910	0	0	0	0

Source: CRCB

Notes: sb[=1] : tender with single bidder

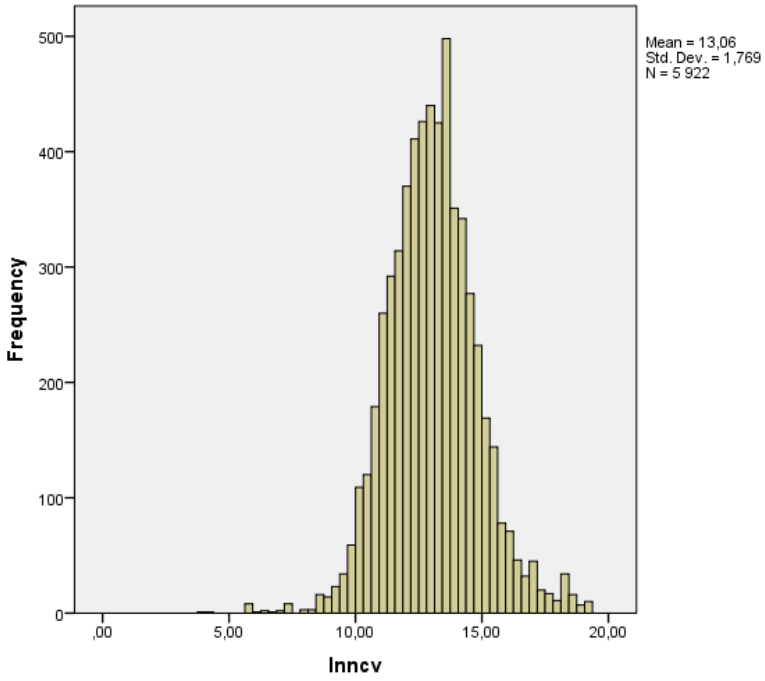
x2 [=1] : the net contract value is more than twice of the estimated value

x3 [=1] : the net contract value is more than 3 times higher than the estimated value

x5 [=1] : the net contract value is more than 5 times higher than the estimated value

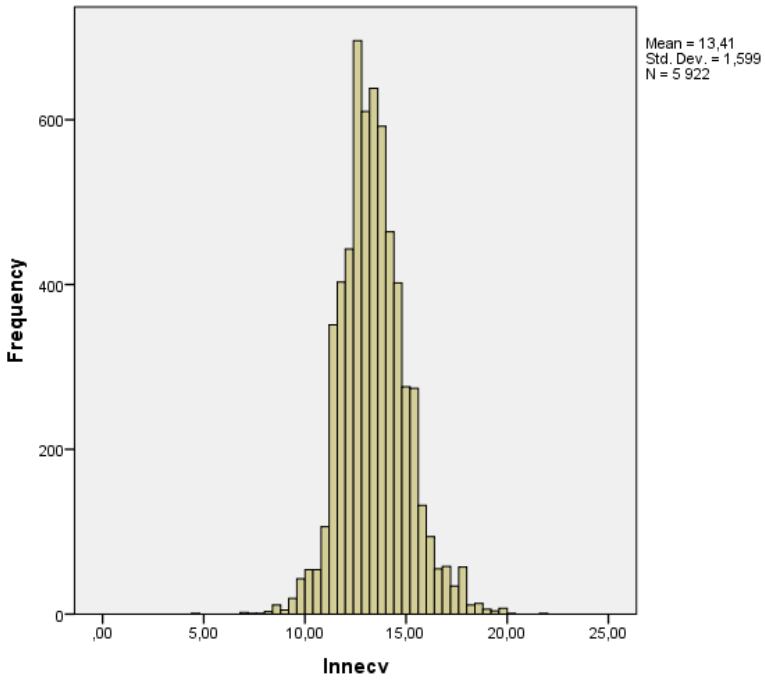
Appendix 2: Distribution of main variables

Figure A2.1.: The histogram of logarithm of net contract value (HRK), 2011-16, N = 5,922



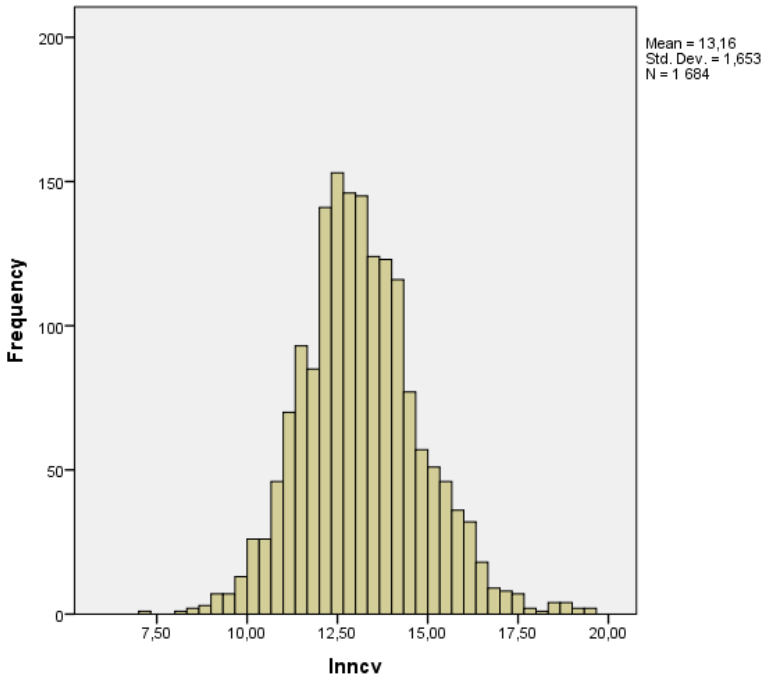
Source: CRCB own calculation based on data of EPRCRC

Figure A2.2.: The histogram of logarithm of estimated net contract value (HRK), 2011-16, N = 4,653



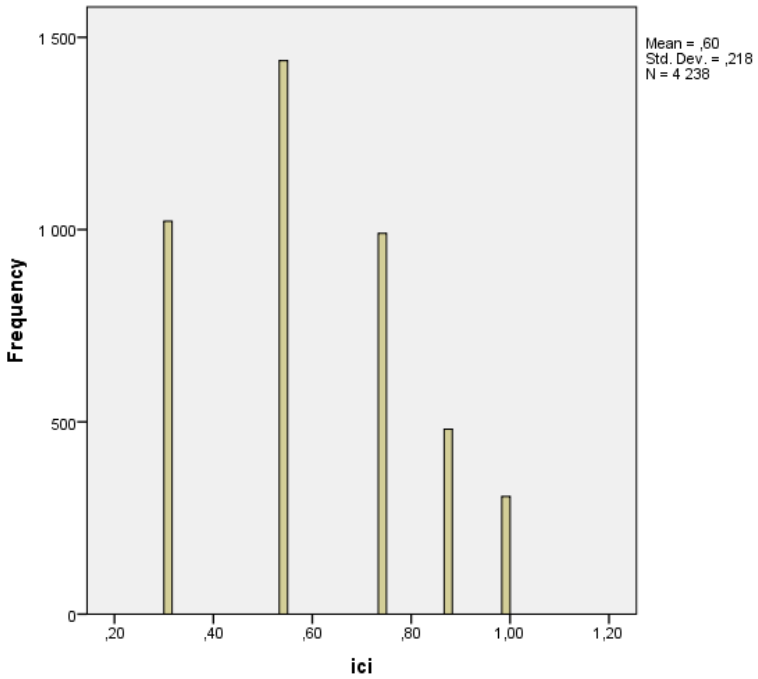
Source: CRCB own calculation based on data of EPRCRC

Figure A2.3.: The histogram of logarithm of net contract value of tenders without competition (million HRK), 2011-16, N = 1,443



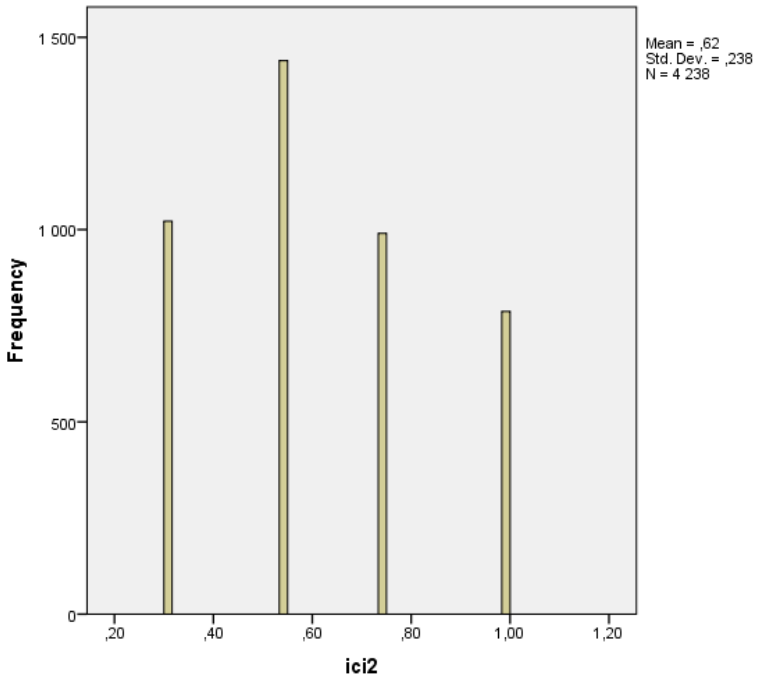
Source: CRCB own calculation based on data of EPRCRC

Figure A2.4.: The histogram of Competitive Intensity (ICI), 2011-16, N = 4,238



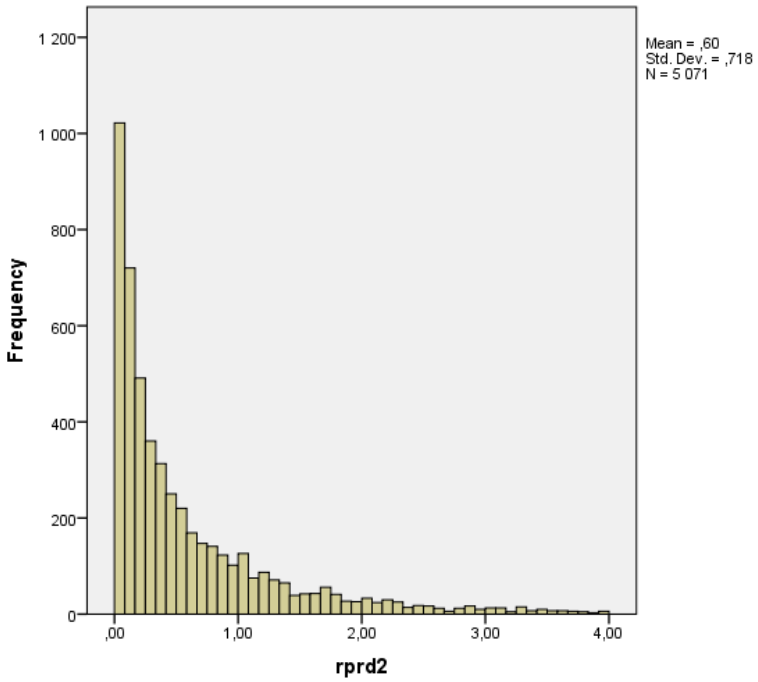
Source: CRCB own calculation based on data of EPRCRC

Figure A2.5.: The histogram of Competitive Intensity (ICI2), 2011-16, N = 4,238



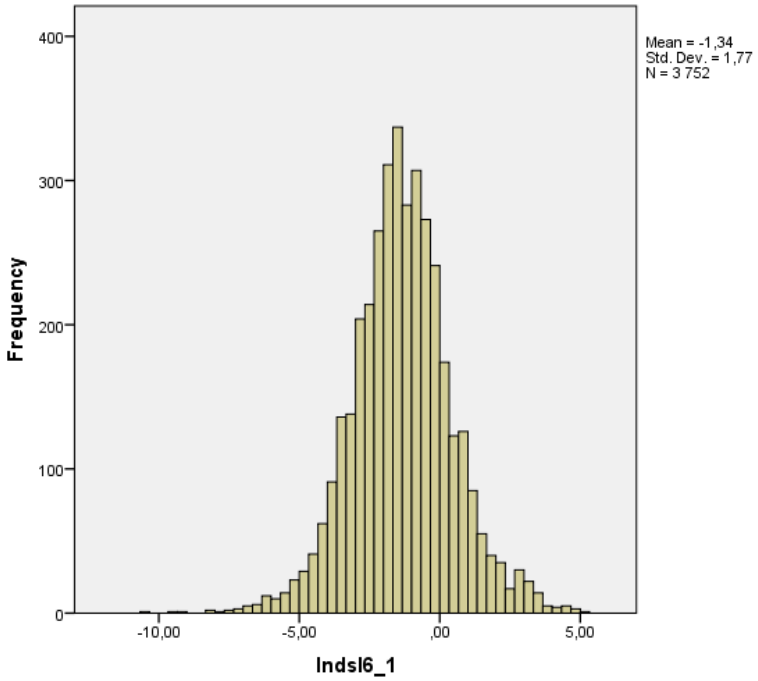
Source: CRCB own calculation based on data of EPRCRC

Figure A2.6.: The histogram of relative price drop from the net estimated value (RPRD), 2011-16, N = 5,071



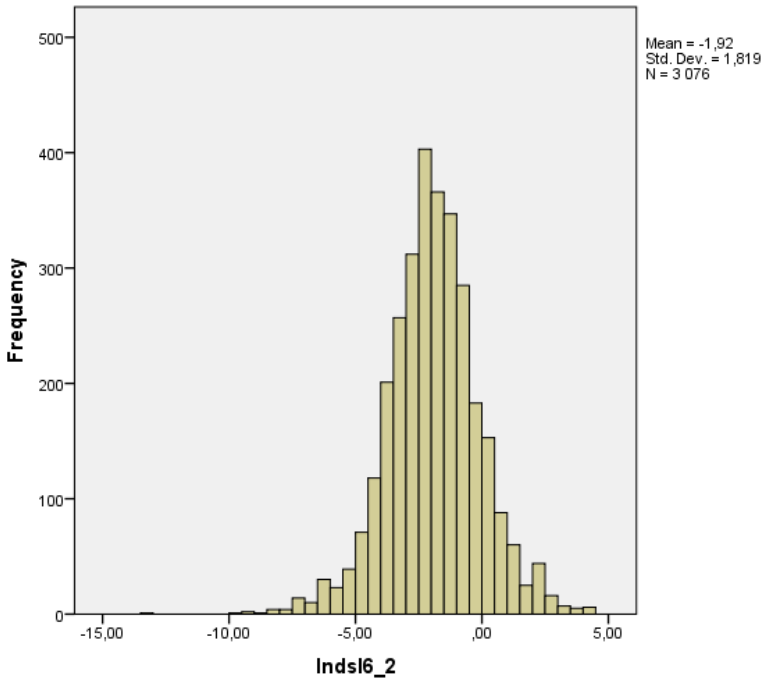
Source: CRCB own calculation based on data of EPRCRC

Figure A2.7.: The histogram of logarithm of estimated direct social loss (DSL1) in million HRK, 2011-16, N = 3,028



Source: CRCB own calculation based on data of EPRCRC

Figure A2.8.: The histogram of logarithm of estimated direct social loss (DSL2) in million HRK, 2011-16, N = 3,076



Source: CRCB own calculation based on data of EPRCRC

Appendix 3: The list the most important winners

Table A3.1. The TOP30 list of winner companies based on the amount of money won in the public procurement of Grad Zagreb and Zagreb Holding between 2011 and 2016

#	Company name	Aggregated sum of the net contract values (million HRK)
1	Petrol d.o.o.	710
2	LUKOIL CROATIA d.o.o.	658
3	UniCredit Leasing Croatia d.o.o.	618
4	INA d.d.	418
5	ZAGREBAČKA BANKA d.d.	407
6	GEORAD d.o.o.	352
7	HEP-OPSKRBA d.o.o.	346
8	PRIVREDNA BANKA ZAGREB d.d.	313
9	CRODUX DERIVATI DVA d.o.o.	301
10	PUGAR d.o.o	295
11	Končar - Električna vozila d.d.	287
12	ERSTE & STEIERMARKISCHE S-LEASING d.o.o.	270
13	GUT d.o.o.	230
14	TEHNIKA d.d.	213
15	NERING d.o.o.	213
16	TIGRA d.o.o.	212
17	Prigorac-građenje d.o.o.	206
18	GRADITELJ SVRATIŠTA d.o.o.	205
19	Hvar d.o.o.	195
20	GTM d.o.o.	191
21	Šušković-građenje d.o.o.	191
22	HYPO ALPE ADRIA LEASING d.o.o.	186
23	P.G.P. d.o.o.	168
24	GIP PIONIR d.o.o.	167
25	APIS d.o.o.	167
26	PALIĆ INŽENJERING d.o.o.	166
27	Turković d.o.o.	156
28	VODOTEHNIKA d.d.	156
29	TEMEX d.o.o.	146
30	AMB gradnja d.o.o.	145

Source: CRCB own calculation based on data of EPRCRC

Table A3.2.: The TOP30 list of winner companies based on the number of tenders won in the public procurement of Grad Zagreb and Zagreb Holding between 2011 and 2016

#	Company name	Total number of contracts
1	GEORAD d.o.o.	99
2	SPEKTAR GRADNJA d.o.o.	66
3	M.B. AUTO d.o.o.	56
4	GRADITELJ SVRATIŠTA d.o.o.,	50
5	HEDOM d.o.o.	47
6	GRADATIN d.o.o	45
7	ELEKTROCENTAR PETEK d.o.o.	45
8	VODOSKOK d.d.	44
9	Industrooprema d.o.o.	44
10	MAN IMPORTER HRVATSKA d.o.o.	44
11	AUTO-MAG d.o.o.	43
12	BOLČEVIĆ-GRADNJA d.o.o.	42
13	TEH-GRADNJA d.o.o.	40
14	INSTAL-PROM d.o.o.	40
15	MONTEL d.o.o.	40
16	GIP PIONIR d.o.o.	39
17	ZAGREBAČKI HOLDING d.o.o.	38
18	URIHO Zagreb	37
19	PEEK PROMET d.o.o.	34
20	INSTITUT IGH d.d.	33
21	Poljoopskrba tehno d.d.	32
22	NERING d.o.o.	31
23	DELTRON d.o.o	31
24	TERMORAD d.o.o.	31
25	M.Soldo d.o.o.	30
26	SMIT-COMMERCE d.o.o.	30
27	P.G.P. d.o.o.	29
28	AMB gradnja d.o.o.	28
29	ELICOM d.o.o.	28
30	MBM d.o.o.	28

Source: CRCB own calculation based on data of EPRCRC

Appendix 4: The list of single bidding companies

Table A4.1.: The list of PPZ issued by the Zagreb Holding in 2013 with single bidder

id	date_	w_name	ecv	ncvx10	ncvx10_6
4449	201303	Drager Safety d.o.o.	160000	326189	0,33
4350	201306	RESNIK-BETON d.o.o.	4000000	8250141	8,25
3915	201312	RO-TEHNOLOGIJA d.o.o.	1200000	6042127	6,04
4041	201310	EOL GRUPA d.o.o.	800000	2824894	2,82
4397	201307	O-K-TEH d.o.o.	160000	324245	0,32
3913	201312	AUTO ENIGMA d.o.o.	600000	1465302	1,47
3916	201312	SHIMADZU d.o.o.	300000	1100144	1,10
3907	201312	ZAGREL RITTMEYER d.o.o.	380000	1955383	1,96
4394	201307	ECCOS INŽENERING d.o.o.	1700000	5825908	5,83
4393	201307	Habeić doo	280000	825605	0,83
4284	201305	R-PIM d.o.o.	200000	421320	0,42
4323	201306	ROBERT BERGER vl.obrta "BERGER"	800000	2534207	2,53
3912	201312	TED d.o.o.	300000	916894	0,92
3975	201309	TRA-MONT d.o.o.	90000	188917	0,19
4028	201310	CONTROLMATIK d.o.o.	570000	1076759	1,08
1222	201301	APZ HIDRIA d.o.o., Zagrebačka 233, Zagreb, VIBA-GEO d.o.o., ELVEKO d.o.o., ABC ING d.o.o., MARKIVA PROJEKT d.o.o., URED OVLAŠTENOG KRAJOBRAZNOG ARHITEKTA Robert Duić	100000	75000	0,08
1233	201301	Zajednica ponuditelja SVEUČILIŠTE U ZAGREBU, FAKULTET PROMETNIH ZNANOSTI, GEODATA TUNEL d.o.o. i GEODATA ENGINEERING S.P.A.	250000	232500	0,23
1239	201301	EKO-DERATIZACIJA d.o.o., i SANITACIJA d.d.	230000	215340	0,22
1246	201301	Zajednica ponuditelja GEOTEHNIČKI STUDIO d.o.o. i RIJEKAPROJEKT-GEOTEHNIČKO ISTRAŽIVANJE d.o.o.	350000	263719	0,26
1260	201302	M. SOLDO d.o.o., GEOGIS d.o.o., LIPA L.P. d.o.o.	300000	215574	0,22
1262	201302	HM-PATRIA d.o.o.; BEMING d.o.o.; TEHNOPLAM d.o.o. i GRAĐEVINSKI LABORATORIJ d.o.o.	244255	228989	0,23
1288	201302	Zajednica ponuditelja AKING d.o.o., Zagreb, Hrgovići 93/a, IPT-INŽENJERING d.o.o., MARKIVA PROJEKT d.o.o.	200000	120938	0,12
1306	201302	Ured ovlaštenog krajobraznog arhitekta-Robert Duić, Zagreb, Stjepana Ljubića Vojvode 26, OIKON d.o.o., Zagreb, Trg senjskih uskoka 1-2, VIRIDO d.o.o., Zagreb, Stjepana Ljubića vojvode 26	110000	98438	0,10
1310	201302	Ured ovlaštenog krajobraznog arhitekta-Robert Duić, Zagreb, Stjepana Ljubića Vojvode 26, OIKON d.o.o., Zagreb, Trg senjskih uskoka 1-2, VIRIDO d.o.o., Zagreb, Stjepana Ljubića vojvode 26	110000	98438	0,10
1317	201303	Zajednica ponuditelja STUDIO A d.o.o., ELEKTRO EKSPERT d.o.o., S.M. INŽENJERING d.o.o., TENZOR d.o.o., INVESTINŽENJERING d.o.o., INSPEKTING d.o.o. i PROSPECTUS d.o.o.	400000	258750	0,26
1360	201304	ENERGOREMONT d.d., Karlovac, Mala Švarča 155 i TEHNOEKSPERT d.o.o., Zagreb, Vladimira Ruždjaka 9/b	2000000	1801471	1,80
1366	201304	Zajednica ponuditelja PUGAR d.o.o. i GEOMETAR d.o.o.	295000	271435	0,27

1389	201304	EKO-PLAN d.o.o., Zagreb, II. Jazbinski gaj 1/a, MJERNIK-LIMA d.o.o., Zagreb, Sprečka 33 i LAUREUS PROJEKT d.o.o., Zagreb, Horvaćanska cesta 17a	120000	73125	0,07
1397	201305	OIKON d.o.o., Zagreb, Trg senjskih uskoka 1-2, HRVATSKI PRIRODOSLOVNI MUZEJ, Zagreb, Demetrova 1	244000	203344	0,20
1408	201305	Zajednica ponuditelja DARH 2 d.o.o., Samobor, Ljubičin prolaz 3 i BRODARSKI INSTITUT d.o.o.	2100000	1921875	1,92
1420	201305	KONČAR-ELEKTRONIKA I INFORAMTIKA d.d., Zagreb, Fallerovo šetalište 22, KONČAR INŽENJERING ZA ENERGETIKU I TRANSPORT d.d. i HELB d.o.o.	1250000	1149609	1,15
1432	201306	Zajednica ponuditelja; IPZ d.d.; FANOS d.o.o., DALEKOVOD-PROJEKT d.o.o. i MAŠINOPROJEKT d.o.o.	500000	450000	0,45
1435	201306	GRADNJAPROJEKT-ZAGREB d.o.o. i Ljevaonica umjetnina ALU d.o.o.	410000	383942	0,38
1441	201306	M. SOLDO d.o.o. i GeoGIS d.o.o.	200000	186227	0,19
1442	201306	Zajednica ponuditelja HVAR d.o.o; GRAĐEVINSKI LABORATORIJ d.o.o. i ATEST KONTROLA d.o.o.	250000	233186	0,23
1443	201306	M. SOLDO d.o.o. i GeoGIS d.o.o.	200000	186227	0,19
1444	201306	Zajednica ponuditelja; IPZ d.d.; FANOS d.o.o., DALEKOVOD-PROJEKT d.o.o. i MAŠINOPROJEKT d.o.o.	500000	450000	0,45
1447	201306	Zajednica ponuditelja HVAR d.o.o; GRAĐEVINSKI LABORATORIJ d.o.o. i ATEST KONTROLA d.o.o.	250000	233186	0,23
1453	201306	GRADNJAPROJEKT-ZAGREB d.o.o. i Ljevaonica umjetnina ALU d.o.o.	410000	383942	0,38
1455	201307	Zajednica ponuditelja GRADNJAPROJEKT - ZAGREB d.o.o. i TERRACOTA d.o.o.	420000	393718	0,39
1466	201307	Zajednica ponuditelja GEOKON-ZAGREB d.d., OIKON d.o.o., PB NAGLIĆ d.o.o., REPER PLUS d.o.o. i KONSTRUKCIJE-KOSTELAC d.o.o.	1800000	1357688	1,36
1467	201307	Zajednica ponuditelja NEXE GRADNJA d.o.o., ALARM AUTOMATIKA d.o.o., KEMIS-TERMOCLEAN, S.T.P. d.o.o., GEODETIKA d.o.o. i ZEM NADZOR d.o.o.	1340893	1257088	1,26
1471	201307	Georad d.o.o., Zagreb, Kornatska 1 i Geoexpert - I.G.M. d.o.o.	5000000	2902365	2,90
1475	201307	Zajednica ponuditelja O.K.I. MONT d.o.o. i KEMIS-TERMOCLEAN d.o.o.	110000	98265	0,10
1479	201307	Zajednica ponuditelja VODOPRIVREDA ZAGREB d.d., KNEZ INVEST d.o.o., GEOKON ZAGREB d.o.o i KARST d.o.o.	1200000	1124983	1,12
1480	201307	Zajednica ponuditelja VODOPRIVREDA ZAGREB d.d. i KNEZ INVEST d.o.o.	2000000	1874747	1,87
1490	201307	INŽENJERSKI PROJEKTNI ZAVOD d.d., Zagreb, Prilaz baruna Filipovića 21, ABC ING d.o.o., LIPA L.P. d.o.o., PROMPT d.o.o., FANOS d.o.o., SONUS d.o.o.	450000	420469	0,42
1507	201308	GRADITELJ SVRATIŠTA d.o.o., Zagreb, Ivana Česmičkog 16 i M-M ELEKTRO d.o.o., Zagreb, Hrastovička 40	80000	114093	0,11
1521	201308	CSS d.o.o., Zagreb, Savska cesta 144a i SAFEGE d.o.o., Zagreb, Maksimirska 101	150000	124781	0,12
1524	201308	obrt Kinder gradnja i usluge vl. Ivan Kinder, Drenčec, Sesvetski Kraljevec, Vinka Kindera 10 i GEOFORMAT d.o.o.	280000	248954	0,25
1616	201310	PRIMAT -LOGISTIKA d.o.o., Zagreb, Hrvatski Leskovac, Zastavnice 11 i FESTTA d.o.o.	1400000	937299	0,94
1631	201310	Zajednica ponuditelja ADRIA GRUPA d.o.o. i CIJANIZACIJA d.o.o.	856271	796824	0,80
1661	201311	Zajednica ponuditelja ARHINGTRADE d.o.o. i HVAT d.o.o., Samobor	90000	71250	0,07

1668	201311	IDS SCHEER d.o.o., Split, Gundulićeva 26/a i PROCESNA INTELIGENCIJA d.o.o., Split, Domovinskog rata 60	300000	274219	0,27
1670	201311	ARHINGTRADE d.o.o., STATING d.o.o. i HVAT d.o.o.	110000	73125	0,07
1675	201312	Zajednica ponuditelja VIADUKT d.d., NERING d.o.o., ŠANDRK PROJEKT d.o.o., GEORAD d.o.o., M.SOLDO d.o.o., TIGRA d.o.o., KOM-EKO d.o.o., GIP PIONIR d.o.o. i PUGAR d.o.o.	5600000	5109375	5,11
1677	201312	Zajednica ponuditelja VODOPRIVREDA ZAGREB d.d. i POLJO-PROM trgovina i usluge, vl. Z.Križanić	8800000	8249075	8,25
1681	201312	GRADNJAPROJEKT-ZAGREB d.o.o. i Ljevaonica umjetnina ALU d.o.o.	140000	131216	0,13
1693	201312	GRADNJAPROJEKT-ZAGREB d.o.o. i Ljevaonica umjetnina ALU d.o.o.	140000	131216	0,13
3855	201311	zajednica ponuditelja HIDRO-A D.O.O i ROBUR d.o.o..	300000	75938	0,08
3989	201309	Hrvatski telekom d.d.; RAO d.o.o.	4000000	3731250	3,73
4047	201309	KING ICT d.o.o.; MR servis d.o.o.	3000000	2772477	2,77
4335	201306	Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje; TEPESCO d.o.o.	900000	796641	0,80
1678	201312	Gradska plinara Zagreb d.o.o.	160000	120230	0,12
4371	201307	Gradska plinara Zagreb d.o.o.	900000	770286	0,77
1224	201301	ADRIA GASTRO d.o.o.	364275	280668	0,28
1281	201302	GEOKON - ZAGREB	270000	248063	0,25
1516	201308	ELICOM d.o.o.	4500000	4215559	4,22
1386	201304	HEDOM d.o.o.	120000	98677	0,10
1552	201309	HEDOM d.o.o.	2000000	963695	0,96
1256	201302	MT-ING d.o.o., Zagreb, Ivane Brlić Mažuranić 14	100000	81961	0,08
1234	201301	Oganj d.o.o.	2800000	2623028	2,62
1258	201302	Oganj d.o.o.	332000	303155	0,30
1415	201305	TEH-GRADNJA d.o.o.	296128	277620	0,28
4318	201306	KONZALT ING d.o.o	1800000	1235906	1,24
4269	201302	SIEMENS d.d.	300000	437733	0,44
1237	201301	MONTEL d.o.o.	178000	147675	0,15
1395	201305	GEORAD d.o.o.	485000	168341	0,17
1418	201305	GEORAD d.o.o.	376000	334281	0,33
3755	201301	GEORAD d.o.o.	100000	81801	0,08
1264	201302	HP-HRVATSKA POŠTA d.d.	199270	184515	0,18
1608	201310	HP - Hrvatska pošta d.d.	121950	112001	0,11
1410	201305	Lukoil Croatia d.o.o.	1440000	1306069	1,31
1412	201305	KBB Kardum d.o.o.	224000	209898	0,21
1666	201311	GIP PIONIR d.o.o.	677235	632952	0,63
1667	201311	GIP PIONIR d.o.o.	359970	337275	0,34
1692	201312	GIP PIONIR d.o.o.	100000	93651	0,09
1549	201309	EBC SISTEMI d.o.o.	923530	865384	0,87
1336	201303	MARINO-LUČKO d.o.o.	55013	26716	0,03
1576	201309	MARINO-LUČKO d.o.o.	100000	91286	0,09
1603	201310	MARINO-LUČKO d.o.o.	1401600	1269207	1,27
1631	201310	ID EKO d.o.o.	965668	855304	0,86

1631	201310	SANITACIJA d.d.	1253898	1172528	1,17
1631	201310	EKO-DERATIZACIJA d.o.o.	1424495	1326401	1,33
4377	201307	IN2 d.o.o.	15000000	13331250	13,33
1365	201304	MEDIJSKA MREŽA d.o.o.	1125000	1054688	1,05
1634	201310	UREDSKI SISTEMI d.o.o.	92890	84872	0,08
1431	201306	SPEKTAR GRADNJA d.o.o.	73000	72437	0,07
1434	201306	SPEKTAR GRADNJA d.o.o.	73000	72437	0,07
1560	201309	SPEKTAR GRADNJA d.o.o.	188000	167309	0,17
4318	201306	INTERKONZALTING d.o.o.	250000	233531	0,23
1571	201309	RIO TRGOVINA d.o.o.	82400	73412	0,07
4318	201306	Ing ekspert d.o.o.	250000	186469	0,19
4318	201306	Ing ekspert d.o.o.	200000	106594	0,11
4318	201306	Ing ekspert d.o.o.	500000	340931	0,34
4318	201306	Ing ekspert d.o.o.	250000	137250	0,14
1633	201310	COMBIS d.o.o.	280000	261516	0,26
1600	201309	Retel d.o.o.	424000	395674	0,40
1254	201302	NARODNE NOVINE d.d.	100000	48656	0,05
1301	201302	NARODNE NOVINE d.d.	100000	48656	0,05
1561	201309	NARODNE NOVINE d.d.	720000	646003	0,65
1474	201307	APIS IT d.o.o.	36800000	34500000	34,50
1243	201301	Zagrebačka banka d.d.	30000000	29646450	29,65
3783	201312	Zagrebačka banka d.d.	226000000	213770640	213,77
4055	201308	Zagrebačka banka d.d.	8960000	8120000	8,12
1257	201302	MEGA MONT d.o.o., Matulji, Popovićev put 2/d	165000	154118	0,15
1261	201302	FORUM d.o.o.	907086	848438	0,85
1342	201303	Georg d.o.o.	143000	120000	0,12
1361	201304	AG PLANUM d.o.o.	600000	485792	0,49
4256	201302	AG Planum d.o.o.	125000	114773	0,11
1601	201309	OIKON d.o.o.	240000	223125	0,22
1428	201305	MEDIA POLIS d.o.o.	800000	690426	0,69
1440	201306	AUTOTRANS d.o.o.	176000	149063	0,15
1448	201306	AUTOTRANS d.o.o.	176000	149063	0,15
1461	201307	Festta d.o.o.	500000	258023	0,26
3902	201312	ECOINA d.o.o.	300000	231563	0,23
1539	201308	GLAS KONCILA	562181	509815	0,51
1536	201308	KLETT VERLAG d.o.o.	302822	272084	0,27
1533	201308	NAKLADA LJEVAK d.o.o.	1218915	1082938	1,08
1528	201308	ALFA d.d.	5255797	4748761	4,75
1529	201308	Algoritam d.o.o.	1414354	1254733	1,25
1517	201308	ŠKOLSKA KNJIGA d.d.	14188475	12759812	12,76
1523	201308	Piramida K.K.D. d.o.o., Zagreb.	210000	191250	0,19
1534	201308	Drager Safety d.o.o., Zagreb, Froudeova 13	87000	65562	0,07
1582	201309	BCC SERVICES d.o.o.	150000	140063	0,14

1649	201311	INFODOM d.o.o.	600000	370219	0,37
1672	201312	BIOELEKTRONIKA	211616	188844	0,19
1684	201312	M.T.F. d.o.o.	1631562	1515636	1,52
1686	201312	M.T.F. d.o.o.	1631562	1515636	1,52
3905	201312	DETA PRUT d.o.o.	600000	570141	0,57
3869	201311	GRADATIN d.o.o	135000	103483	0,10
3904	201312	GRADATIN d.o.o	1000000	937271	0,94
3919	201312	GRADATIN d.o.o	300000	360938	0,36
3920	201312	GRADATIN d.o.o	943500	882713	0,88
4042	201308	GRADATIN d.o.o	2040000	2210479	2,21
4042	201308	GRADATIN d.o.o	490000	527715	0,53
4042	201308	GRADATIN d.o.o	175000	182088	0,18
4042	201308	GRADATIN d.o.o	220000	230411	0,23
4042	201308	GRADATIN d.o.o	330000	353052	0,35
3861	201311	MBM d.o.o.	850000	749147	0,75
3861	201311	MBM d.o.o.	510000	476719	0,48
3861	201311	MBM d.o.o.	25000	22792	0,02
3861	201311	MBM d.o.o.	130000	111469	0,11
3861	201311	MBM d.o.o.	85000	64716	0,06
3914	201312	MBM d.o.o.	400000	338772	0,34
4286	201305	MBM d.o.o.	800000	743316	0,74
3992	201308	Industrooprema d.o.o.	1980000	1803844	1,80
4000	201308	Industrooprema d.o.o.	200000	183750	0,18
4015	201310	Industrooprema d.o.o.	250000	250000	0,25
4444	201303	Industrooprema d.o.o.	668000	595313	0,60
3934	201308	Autobus d.o.o. za trgovinu i usluge	63711240	59914460	59,91
4386	201307	BETON - LUČKO RBG d.o.o.	300000	203837	0,20
4319	201306	TOI TOI d.o.o.	2100000	1964766	1,96
1535	201308	ALKA SCRIPT d.o.o.	204419	179446	0,18
4390	201307	TEHNIX d.o.o.	900000	819372	0,82
4288	201305	DEKOD TELEKOM d.o.o.	400000	519750	0,52
3946	201308	BENUSSI d.o.o.	4872036	4508670	4,51
4430	201303	PELMEN d.o.o.	110000	102989	0,10
4392	201303	AQUA INŽINJERING d.o.o.	230000	214378	0,21
4369	201307	ARBORI CULTURA d.o.o.	400000	201970	0,20
4027	201310	Auto - Mag d.o.o.	480000	400606	0,40
4061	201311	AUTOCOMMERCE HRVATSKA d.o.o.	930000	667850	0,67
4061	201311	AUTOCOMMERCE HRVATSKA d.o.o.	1435000	883019	0,88
4056	201309	BAZENI-FONTANE, vl.Edin Kahrimanović	7000000	6662370	6,66
4006	201308	ERSTE & STEIERMÄRKISCHE BANK d.d.	9424000	9063000	9,06
4044	201310	GRA-PO d.o.o.	700000	787498	0,79
1416	201305	GRADITELJ SVRATIŠTA d.o.o.	244000	228395	0,23
1565	201309	GRADITELJ SVRATIŠTA d.o.o.	2500000	1835628	1,84

1235	201301	HEP - Operator distribucijskog sustava d.o.o. ELEKTRA ZAGREB	383891	359884	0,36
1244	201301	HEP Operator distribucijskog sustava d.o.o. ELEKTRA ZAGREB	1200000	487212	0,49
1251	201301	HEP - Operator distribucijskog sustava d.o.o. ELEKTRA ZAGREB	6160000	5771394	5,77
1591	201309	HEP - Operator distribucijskog sustava d.o.o. ELEKTRA ZAGREB	8000000	7401506	7,40
1468	201307	HRVATSKI CRVENI KRIŽ - GRADSKO DRUŠTVO CRVENOG KRIŽA ZAGREB	350000	348834	0,35
1469	201307	HRVATSKI CRVENI KRIŽ - GRADSKO DRUŠTVO CRVENOG KRIŽA ZAGREB	560000	557708	0,56
1580	201309	Institut za medicinska istraživanja i medicinu rada	960000	900000	0,90
1508	201308	KING ICT d.o.o.	2350000	2185686	2,19
4003	201310	Končar - Elektronika i informatika d.d.	636000	594647	0,59
1538	201308	KRŠĆANSKA SADAŠNJOST d.o.o.	1682078	1508056	1,51
1628	201310	LJEVAONICA UMJETNINA ALU d.o.o.	1500000	1383422	1,38
1628	201310	Ljevaonica umjetnina Ujević d.o.o.	1500000	1402500	1,40
4437	201303	M-COM USLUGE d.o.o.	9000000	5904708	5,90
1489	201307	M.Soldo d.o.o.	230000	215605	0,22
1315	201303	MEŠIĆ COM d.o.o.	400000	375000	0,38
1358	201303	MEŠIĆ COM d.o.o.	299000	279368	0,28
1676	201312	NERING d.o.o.	600000	370313	0,37
1304	201302	OMEGA SOFTWARE d.o.o.	2725202	2551500	2,55
1312	201302	OMEGA SOFTWARE d.o.o.	2725202	2551500	2,55
1604	201310	OMEGA SOFTWARE d.o.o.	341000	318750	0,32
3998	201308	Oprema Radman d.o.o.	240000	94500	0,09
4257	201302	POLJO-PROM, vl.obrta Zlatko Križanić	1700000	1575844	1,58
4383	201307	POLJOOPSKRBA-TEHNO d.d.	80000	65416	0,07
3255	201303	PRIVREDNA BANKA ZAGREB d.d.	4350000	4239959	4,24
4012	201310	PRIVREDNA BANKA ZAGREB D.D.	133000000	91302800	91,30
4330	201302	PRIVREDNA BANKA ZAGREB d.d.	3223767	3184760	3,18
4355	201302	PRIVREDNA BANKA ZAGREB d.d.	9450000	9150000	9,15
4367	201302	PRIVREDNA BANKA ZAGREB d.d.	7087500	6693750	6,69
1242	201301	PUČKO OTVORENO UČILIŠTE ZAGREB	693198	673296	0,67
4366	201306	Rasco d.o.o.	1000000	1000000	1,00
3917	201312	SMIT-COMMERCE d.o.o.	700000	982452	0,98
1436	201306	Sveučilište u Zagrebu - Arhitektonski fakultet, Zavod za arhitekturu	300000	159234	0,16
1452	201306	Sveučilište u Zagrebu - Arhitektonski fakultet, Zavod za arhitekturu	300000	159234	0,16
3933	201312	URIHO Zagreb	2400000	2070188	2,07
1472	201307	VETERINARSKA STANICA GRADA ZAGREBA d.o.o.	640000	598716	0,60
3858	201311	Vodoprivreda Zagreb d.d.	2500000	1667773	1,67
4266	201304	voestalpine VAE GmbH	360000	291600	0,29
1277	201302	Zagrebački holding d.o.o., Podružnica Zrinjevac	248348	176434	0,18
1446	201306	Zagrebački holding d.o.o., Podružnica Zrinjevac	750000	696750	0,70
1454	201306	Zagrebački holding d.o.o., Podružnica Zrinjevac	750000	696750	0,70
1530	201308	ZAGREBAČKI HOLDING d.o.o. Podružnica "Vladimir Nazor"	958000	789600	0,79

1530	201308	Zagrebački holding d.o.o. Podružnica Vladimir Nazor	387000	319200	0,32
1530	201308	Zagrebački holding d.o.o. Podružnica Vladimir Nazor	352000	289800	0,29
1530	201308	Zagrebački holding d.o.o. Podružnica Vladimir Nazor	352000	289800	0,29
1530	201308	Zagrebački holding d.o.o. Podružnica Vladimir Nazor	245000	201600	0,20
1598	201309	Zagrebački holding d.o.o., Podružnica Zrinjevac	1090000	1021875	1,02
4456	201303	AGRA - TRGOVINA d.o.o.	300000	279375	0,28
4461	201303	AGRA - TRGOVINA d.o.o.	350000	324375	0,32
3891	201311	AGRO-VIR d.o.o.	1000000	912903	0,91
4451	201303	Agronom d.o.o.	360000	336963	0,34
1679	201312	Agronomski fakultet Sveučilišta u Zagrebu	140000	129375	0,13
4442	201303	Anas d.o.o.	60000	40006	0,04
3974	201309	ANING USLUGE d.o.o.	400000	372244	0,37
4379	201302	ANTON BERKENHEGER GMBH & CO.KG	100000	72833	0,07
4283	201305	APZ-Inženjering d.o.o.	245000	228750	0,23
4348	201306	APZ-Inženjering d.o.o.	245000	228750	0,23
4062	201311	ATIR d.o.o.	250000	195469	0,20
3893	201310	AUTOZUBAK D.O.O.	300000	268838	0,27
3985	201309	Bartol Komerc d.o.o.	85000	71123	0,07
4402	201307	BKS - LEASING CROATIA d.o.o.	624000	41178	0,04
3751	201301	BNB sklad d.o.o.	114600	91688	0,09
1216	201301	Computech d.o.o.	1000000	926950	0,93
3862	201311	CONSCIUS d.o.o.	1000000	878250	0,88
4025	201310	DRAŽEN KOVAČIĆ, vl. obrta "SERVIS IMP CRPKE"	200000	74400	0,07
3897	201308	ERSTE & STEIERMARKISCHE S-LEASING d.o.o.	148200205	140418219	140,42
3971	201308	ERSTE & STEIERMARKISCHE S-LEASING d.o.o.	110251279	102714621	102,71
4457	201303	FUCHS MAZIVA d.o.o.	1200000	686121	0,69
4273	201304	HIS d.o.o.	600000	541018	0,54
1583	201309	HM-PATRIA d.o.o. Oboj 47.	4038000	2591896	2,59
4289	201305	HM-PATRIA d.o.o.	530000	495047	0,50
4342	201302	HRVATSKA POŠTANSKA BANKA d.d.	7300000	6950000	6,95
1563	201309	HRVATSKE ŠUME d.o.o.	1000000	1500000	1,50
3885	201308	HYPO ALPE ADRIA LEASING d.o.o.	203767724	185632354	185,63
3970	201308	HYPO-LEASING KROATIEN d.o.o.	145201684	135294840	135,29
4004	201310	HYPO-LEASING KROATIEN d.o.o.	700000	635944	0,64
4410	201303	i4NEXT LEASING CROATIA D.O.O.	350000	327759	0,33
1352	201302	IDS SCHEER d.o.o., Split, Gundulićeva 26a	525000	491456	0,49
4490	201304	INFOART d.o.o.	870000	810000	0,81
4471	201304	INFOKOM d.o.o.	450000	333000	0,33
3931	201312	INSTALING d.o.o. za projektiranje, inženjering i izvođenje investicijskih radova	200000	187500	0,19
3980	201309	IVAN KINDER vl. obrta KINDER GRADNJA I USLUGE	800000	731129	0,73
4259	201304	Klising d.o.o.	72000	67500	0,07
4278	201304	KOMOP d.o.o.	4500000	6393948	6,39
4014	201310	Končar - Električna vozila d.d.	1000000	918750	0,92

4281	201302	Končar - Električna vozila d.d.	165540000	154345313	154,35
4019	201310	KONTROL BIRO-PRISTER d.o.o.	100000	93750	0,09
4060	201311	KUNIĆ GRADNJA d.o.o.	500000	424193	0,42
4310	201304	LIBUSOFT CICOM d.o.o.	2000000	2019150	2,02
3868	201311	Mareton d.o.o.	600000	544875	0,54
4395	201307	MAXIMA USLUGE d.o.o.	1900000	1601479	1,60
3737	201301	Nextel	320000	226800	0,23
4045	201310	OLEUM FLEX d.o.o.	500000	500000	0,50
3848	201308	OZAS - obrtnička proizvodno-uslužna, trgovinska zadruga	245280	229950	0,23
1413	201305	PIMONT GRUPA d.o.o.	1599781	1489476	1,49
1588	201309	Poliklinika za rehabilitaciju slušanja i govora SUVAG	603240	572330	0,57
1532	201308	PROFIL INTERNATIONAL d.o.o.	11308836	10053707	10,05
4018	201308	Ramljak trgovina d.o.o.	5100000	3150000	3,15
4279	201304	RECRO-NET d.o.o.	1400000	838974	0,84
4294	201305	S&T HRVATSKA d.o.o.	3000000	2812057	2,81
3878	201311	SAGOVI ZAGREB d.o.o.	1400000	1485000	1,49
4314	201306	SCHEIDT & BACHMANN-TUBS d.o.o.	400000	206870	0,21
4470	201304	SELMET	210000	192656	0,19
4013	201310	SHACKO d.o.o.	150000	127031	0,13
4040	201310	STROJOOBNOVA Obrt za servisiranje, popravak i montažu poljoprivrednih strojeva, vlasnik Tihomir Ljubić	300000	232483	0,23
1537	201308	SysPrint d.o.o.	297147	264032	0,26
4299	201305	TED d.o.o.	160000	148125	0,15
3929	201312	Tegra d.o.o.	300000	267750	0,27
4336	201306	Tegra d.o.o.	300000	268406	0,27
4345	201306	Tehnoguma d.o.o.	400000	290306	0,29
4017	201310	TEKNOXGROUP HRVATSKA d.o.o.	1000000	1000000	1,00
3745	201301	TEO-BELIŠĆE d.o.o.	600000	557625	0,56
4403	201307	TEPESCO d.o.o.	3200000	2998126	3,00
4020	201310	TERRA JASKA d.o.o.	45000	41156	0,04
1653	201311	TILIA SPORT GRUPA d.o.o.	160000	211406	0,21
3938	201312	TOM SIGNAL d.o.o.	250000	250000	0,25
3975	201309	TRA-MONT d.o.o.	327500	268199	0,27
1643	201311	UGO ŠARIĆ d.o.o.	197030	169959	0,17
3909	201308	UniCredit Leasing Croatia d.o.o.	320767886	255584782	255,58
3922	201308	UniCredit Leasing Croatia d.o.o.	580054585	255244822	255,24
3958	201308	UniCredit Leasing Croatia d.o.o.	114751331	106800041	106,80
1376	201304	Uslužni Obrt Inki Dinki	250000	112500	0,11
4364	201306	VELEKEM d.d.	900000	743026	0,74
4282	201305	VETERINARSKA STANICA SESVETE	97000	90713	0,09
4391	201307	VIS PT TEXTILE d.o.o.	400000	374546	0,37
4407	201303	WEISHAUPT - ZAGREB d.o.o.	120000	109150	0,11
4477	201304	XAGENT d.o.o.	1000000	921938	0,92

3937	201312	ZAŠTITNI SUSTAVI ZAGREB d.o.o.	653700	360036	0,36
1558	201309	ZAVOD ZA HITNU MEDICINU GRADA ZAGREBA	52600	23746	0,02
4334	201306	ZAVOD ZA JAVNO ZDRAVSTVO DR. ANDRIJA ŠTAMPAR,	145100	143140	0,14
1325	201303	Željezničko projektno društvo d.d.	250000	231750	0,23
1631	201310	EKOTOURS d.o.o.	1499669	1401244	1,40
4435	201303	PROJEKTNI BIRO NAGLIĆ d.o.o.	120000	91875	0,09
4446	201303	PROJEKTNI BIRO NAGLIĆ d.o.o.	100000	86250	0,09

Notes: *ID: tender's ID*
DATE_: date of publication of contract award
W_NAME: name of winner company
ECV: estimated contract value
NCVX10: net contract value, in HRK
NCVX10_6: net contract value, in million HRK

Source: CRCB own calculation based on data of EPRCRC

Table 4.2.: The largest tenders issued by the Zagreb Holding in industry in 2013 with single bidder

	id	description	date	id of announcement	date of announcement	cvalue, in HRK, including VAT	winner
1	3909	NISKOPODNA TRAMVAJSKA VOZILA TMK 2200 PUTEM FINANCIJSKOG LEASINGA - NAJAM 21 NISKOPODNOG TRAMVAJA	02.08.2013	2013/S 002-0004752	21.01.2013	340 779 709	UniCredit Leasing Croatia d.o.o.
2	3922	NISKOPODNA TRAMVAJSKA VOZILA TMK 2200 PUTEM FINANCIJSKOG LEASINGA - NAJAM 79 NISKOPODNIH TRAMVAJA	01.08.2013			340 326 430	UniCredit Leasing Croatia d.o.o.
3	3885	NISKOPODNA TRAMVAJSKA VOZILA TMK 2200 PUTEM FINANCIJSKOG LEASINGA - NAJAM 13 NISKOPODNIH TRAMVAJA	02.08.2013	2013/S 002-0004766	21.01.2013	247 509 806	HYPO ALPE ADRIA LEASING d.o.o.
4	3897	NISKOPODNA TRAMVAJSKA VOZILA TMK 2200 PUTEM FINANCIJSKOG LEASINGA - NAJAM 10 NISKOPODNIH TRAMVAJA	02.08.2013	2013/S 002-0004771	21.01.2013	187 224 292	ERSTE & STEIERMARKISCHE S-LEASING d.o.o.
5	3970	OTKUP AUTOBUSA JAVNOG GRADSKOG PRIJEVOZA – KLASIČNI NISKOPODNI AUTOBUSI NA POGON DIZELOM	01.08.2013			180 393 120	HYPO-LEASING KROATIEN d.o.o.
6	3958	OTKUP AUTOBUSA JAVNOG GRADSKOG PRIJEVOZA – MINI AUTOBUSI I AUTOBUSI NA POGON STLAČENIM ZEMNIM PLINOM	01.08.2013			142 400 055	UniCredit Leasing Croatia d.o.o.
7	3971	OTKUP AUTOBUSA JAVNOG GRADSKOG PRIJEVOZA – ZGLOBNI NISKOPODNI AUTOBUSI NA POGON DIZELOM	01.08.2013			136 952 828	ERSTE & STEIERMARKISCHE S-LEASING d.o.o.
8	3938	REZERVNI DIJELOVI UREĐAJA ZA OBILJEŽAVANJE HORIZONTALNE SIGNALIZACIJE MARKE HOFMANN	06.12.2013	2013/S 002-0061375	09.07.2013	115 973 793	TOM SIGNAL d.o.o.
9	4017	REZERVNI DIJELOVI I SERVIS STROJEVA MARKE CATERPILLAR	22.10.2013	2013/S 002-0061705	09.07.2013	52 241 312	TEKNOXGROUP HRVATSKA d.o.o.

Source: CRCB own calculation based on data of EPRCRC

Appendix 5: Ownership networks

The analysis of ownership networks is based on a sample containing 571 winner companies on the tenders between 2011 and 2016. This sample is complete regarding 2016, but in the cases of the preceding years, about the 60% of the winners are taken into account. The investigation revealed 86 ownership connections and 9 distinct ownership networks.

The biggest network consists of 28 companies. Three of them (HT, Addiko Bank, Institut IGH) are bridges in the network, what means that if these companies would be excluded, then the network would disintegrate. The smallest networks contain only 3 companies.

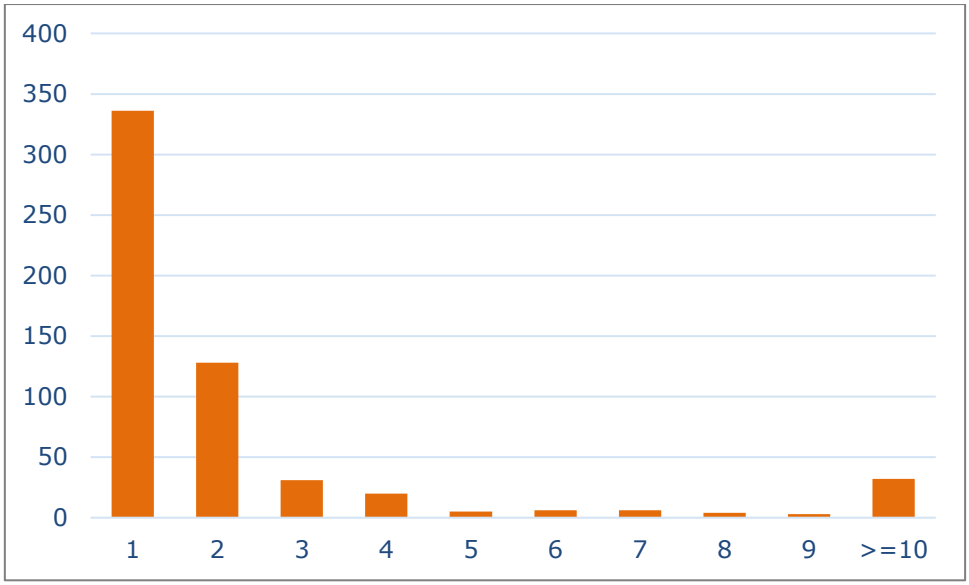
In the biggest (1st) network the most important actor is the *Addiko Bank*, it has a most central position in the network (its value of Betweeness centrality is 0.71). In the second biggest (2nd) network the City of Zagreb and the Croatian Republic (as owners) have the same important positions.

Table A5.1.: Distribution of the analysed winner companies by number of owners

Number of owners	Number of companies
1	336
2	128
3	31
4	20
5	5
6	6
7	6
8	4
9	3
>=10	32
Total	571

Source: CRCB own calculation based on data of EPRCRC

Figure A5.1.: Distribution of the analysed winner companies by number of owners



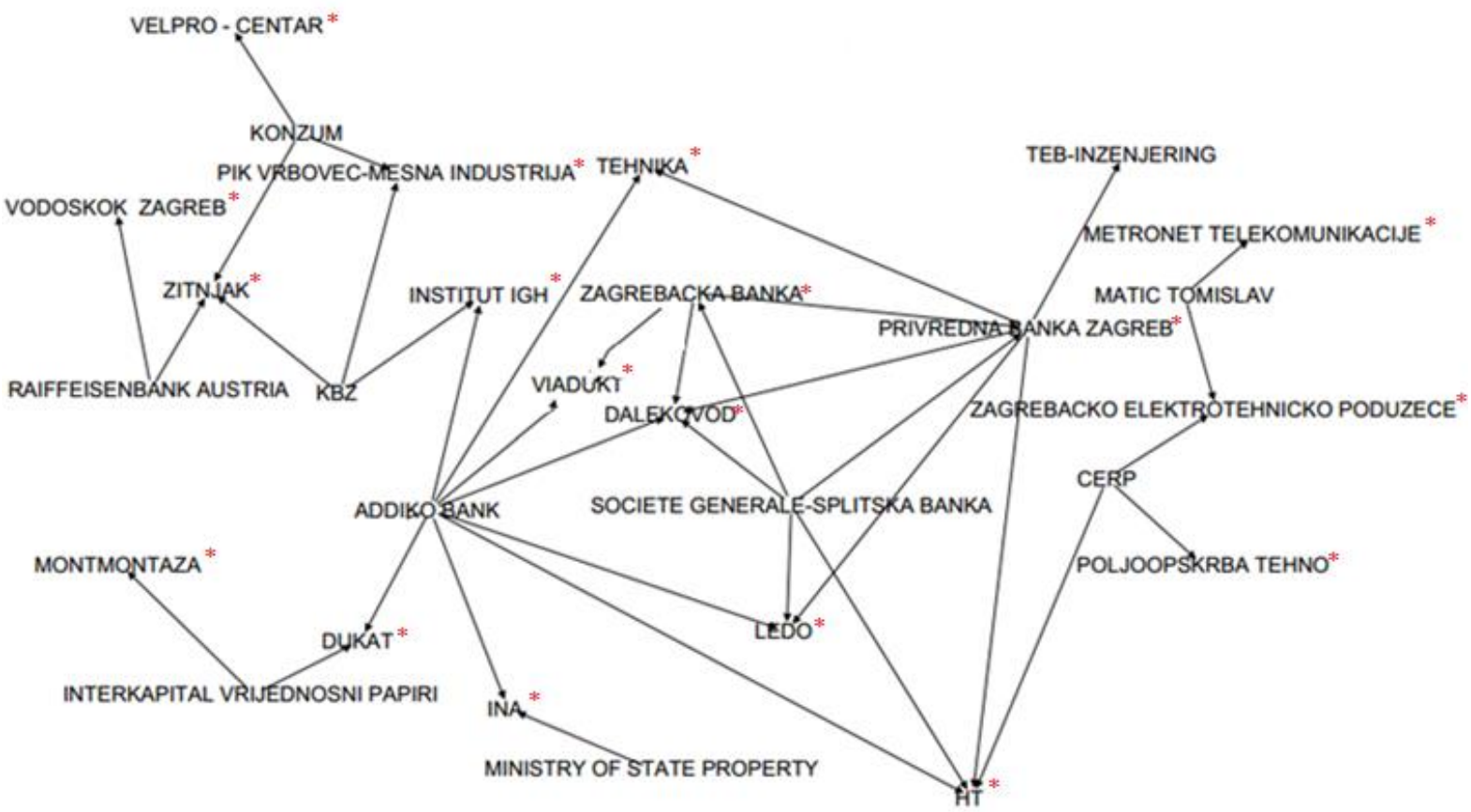
Source: CRCB own calculation based on data of EPRCRC

Table A5.2.: The number of nodes by ownership-networks, 2011-16, winners of Public Procurement of Zagreb

Network ID	*Number of nodes in the network*
1	*28*
2	*17*
3	*9*
4	*5*
5	*4*
6	*4*
7	*3*
8	*3*
9	*3*
Total	*76*

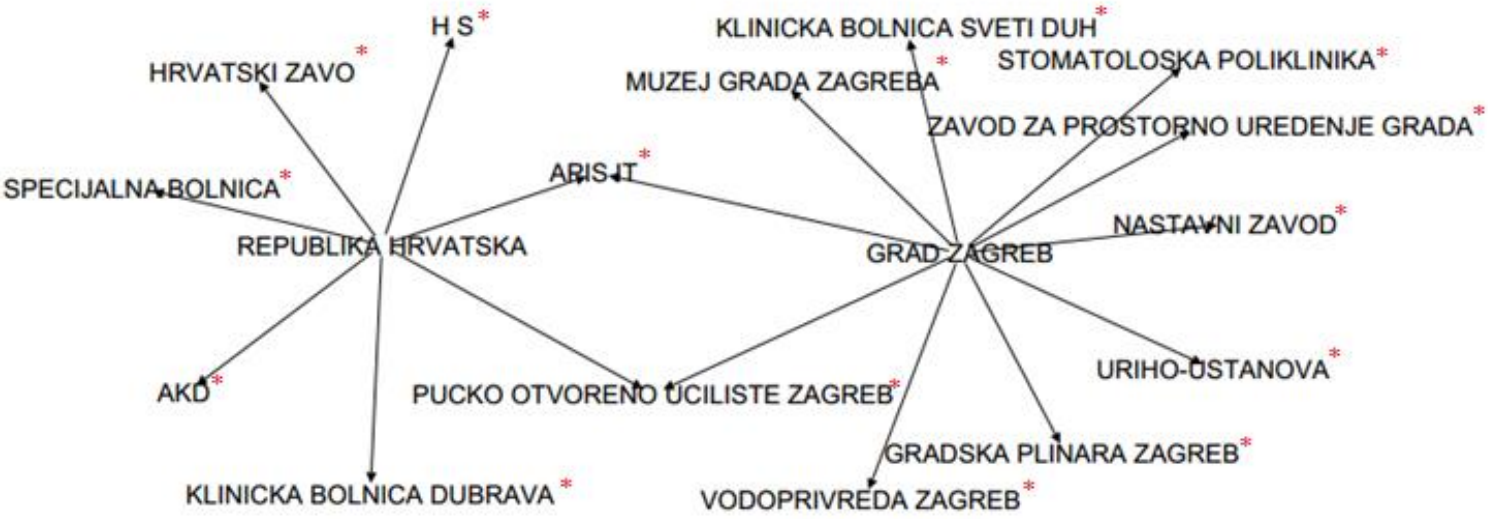
Source: CRCB own calculation based on data of EPRCRC

Network - 1



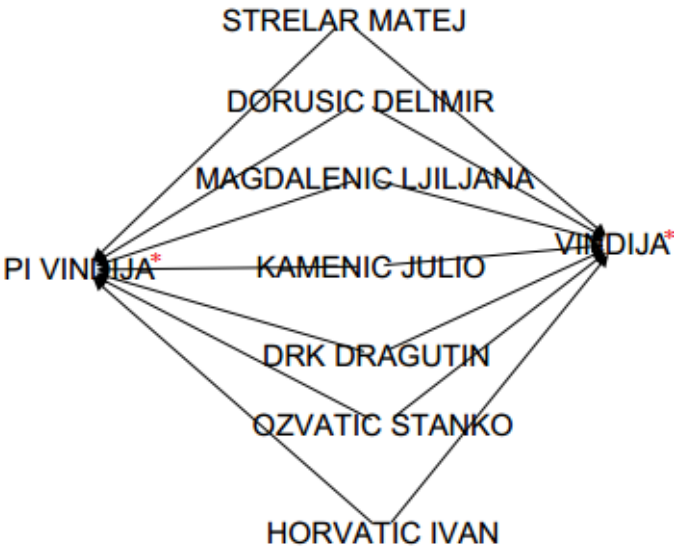
Note:
* : winner company in the period of 2011-16

Network – 2



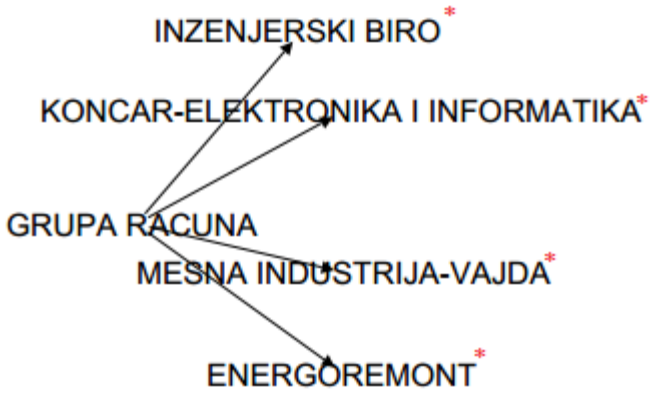
Notes:
*: winner company in the period of 2011-16
HRVATSKI ZAVO: HRVATSKI ZAVOD ZA JAVNO ZDRAVSTVO
KLINICKA BOLNICA: KLINICKA BOLNICA DUBRAVA
NASTAVNI ZAVOD: NASTAVNI ZAVOD ZA JAVNO ZDRAVSTVO DR.ANDRIJA STAMPAR
SPECIJALNA BOLNICA: SPECIJALNA BOLNICA ZA MEDICINSKU REHABILITACIJU KRAPINSKE TOPLICE
URIHO-USTANOVA: URIHO-USTANOVA ZA REHABILITACIJU HENDIKEPIRANIH OSOBA PROFESIONALNOM REHABILITACIJOM I ZAPOSLJAVANJEM

Network - 3



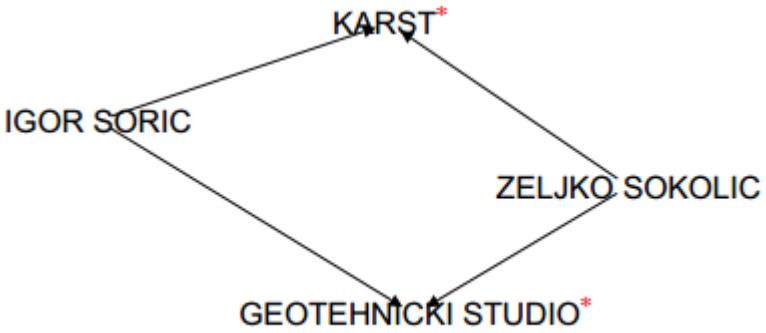
Note:
*: winner company in the period of 2011-16

Network - 4



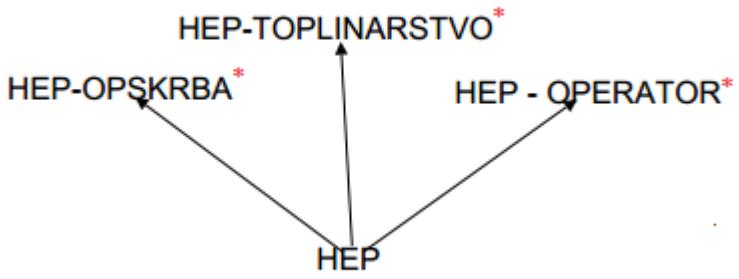
Note:
*: winner company in the period of 2011-16
GRUPA RACUNA: GRUPA RACUNA NA KOJIMA JE UKNJIZENA ISTA KOLICINA VR. PAPIRA

Network - 5



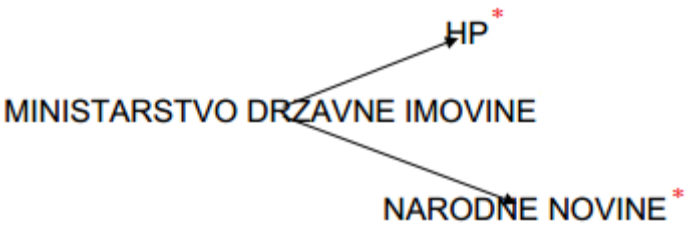
Note:
*: winner company in the period of 2011-16

Network - 6



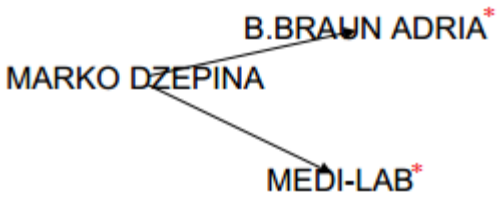
Note:
*: winner company in the period of 2011-16
HEP – OPERATOR: HEP – OPERATOR DISTRIBUCIJSKOG SUSTAVA DOO, D.P. ELEKTRA

Network - 7



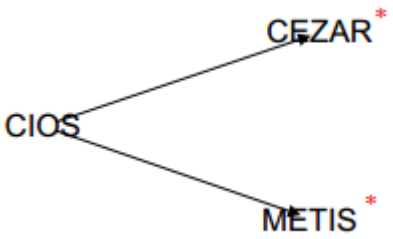
Note:
*: winner company in the period of 2011-16

Network - 8



Note:
*: winner company in the period of 2011-16

Network - 9



Note:
*: winner company in the period of 2011-16

Table A5.3.: The list of networks' nodes

*: winner company

Nodes	Node's ID	Network ID	Winner Company
INA DD	10001	1	*
INSTITUT IGH, DD, ZAGREB	1087	1	*
TEHNIKA DD, ZAGREB	1173	1	*
ZITNJAK DD, ZAGREB	1244	1	*
ZAGREBACKA BANKA DD, ZAGREB	1421	1	*
DUKAT DD, ZAGREB	1480	1	*
HT DD, ZAGREB	1663	1	*
VODOSKOK DD, ZAGREB	2002	1	*
METRONET TELEKOMUNIKACIJE DD	20103	1	*
PIK VRBOVEC-MESNA INDUSTRIJA DD	20125	1	*
POLJOOPSKRBA TEHNO	20129	1	*
PRIVREDNA BANKA ZAGREB DD	20131	1	*
ZAGREBACKO ELEKTROTEHNICKO PODUZECE DD	20186	1	*
DALEKOVOD, DD, ZAGREB	2122	1	*
TEB-INZENJERING DD, ZAGREB	2174	1	*
VIADUKT DD, ZAGREB	2267	1	*
VELPRO - CENTAR DOO, ZAGREB	2334	1	*
LEDO DD, ZAGREB	2340	1	*
MONTMONTAZA DD, ZAGREB	2354	1	*
ADDIKO BANK DD	n.a.	1	
CERP	n.a.	1	
INTERKAPITAL VRIJEDNOSNI PAPIRI DOO	n.a.	1	
KBZ DD	n.a.	1	
KONZUM DD	n.a.	1	
MATIC TOMISLAV	n.a.	1	
MINISTRY OF STATE PROPERTY / REPUBLIC OF CROATIA	n.a.	1	
RAIFFEISENBANK AUSTRIA DD	n.a.	1	
SOCIETE GENERALE-SPLITSKA BANKA	n.a.	1	
APIS IT DOO, ZAGREB	1360	2	*
H S DOO, ZAGREB	1621	2	*
GRADSKA PLINARA ZAGREB DOO, ZAGREB	163	2	*
MUZEJ GRADA ZAGREBA, ZAGREB	1741	2	*
HRVATSKI ZAVOD ZA JAVNO ZDRAVSTVO	20058	2	*
KLINICKA BOLNICA DUBRAVA, AV.GOJKA SUSKA 6	20074	2	*
KLINICKA BOLNICA SVETI DUH	20075	2	*
NASTAVNI ZAVOD ZA JAVNO ZDRAVSTVO DR.ANDRIJA STAMPAR	20109	2	*
PUCKO OTVORENO UCILISTE ZAGREB	20133	2	*
SPECIJALNA BOLNICA ZA MEDICINSKU REHABILITACIJU KRAPINSKE TOPLICE	20149	2	*

STOMATOLOSKA POLIKLINIKA ZAGREB	20156	2	*
URIHO-USTANOVA ZA REHABILITACIJU HENDIKEPIRANIH OSOBA PROFESIONALNOM REHABILITACIJOM I ZAPOSLJAVANJEM	20175	2	*
VODOPRIVREDA ZAGREB DD	20178	2	*
ZAVOD ZA PROSTORNO UREDENJE GRADA ZAGREBA	20189	2	*
AKD DOO, ZAGREB	2088	2	*
GRAD ZAGREB	n.a.	2	
REPUBLIKA HRVATSKA	n.a.	2	
PI VINDIJA DD	20124	3	*
VINDIJA DD, VARAZDIN	2072	3	*
DORUSIC DELIMIR	n.a.	3	
DRK DRAGUTIN	n.a.	3	
HORVATIC IVAN	n.a.	3	
KAMENIC JULIO	n.a.	3	
MAGDALENIC LJILJANA	n.a.	3	
OZVATIC STANKO	n.a.	3	
STRELAR MATEJ	n.a.	3	
INZENJERSKI BIRO DD, ZAGREB	1740	4	*
KONCAR-ELEKTRONIKA I INFORMATIKA DD	20078	4	*
MESNA INDUSTRIJA-VAJDA DD, ZAGREBACKA 4	20099	4	*
ENERGOREMONT DD, KARLOVAC	2314	4	*
GRUPA RACUNA NA KOJIMA JE UKNJIZENA ISTA KOLICINA VR. PAPIRA	n.a.	4	
GEOTEHNICKI STUDIO DOO	20041	5	*
KARST DOO, ZAGREB	2374	5	*
IGOR SORIC, DIPL.ING.GRAD.	n.a.	5	
ZELJKO SOKOLIC, DIPL.ING.GRAD.	n.a.	5	
HEP-OPSKRBA DOO, ZAGREB	1499	6	*
HEP - OPERATOR DISTRIBUCIJSKOG SUSTAVA DOO, D.P. ELEKTRA ZAGREB	20052	6	*
HEP-TOPLINARSTVO DOO, ZAGREB	2179	6	*
HEP DD	n.a.	6	
HP DD, ZAGREB	1146	7	*
NARODNE NOVINE DD, ZAGREB	1314	7	*
MINISTARSTVO DRZAVNE IMOVINE /REPUBLIKA HRVATSKA	n.a.	7	
B.BRAUN ADRIA DOO	20016	8	*
MEDI-LAB DOO	20093	8	*
MARKO DZEPINA	n.a.	8	
CE-ZA-R DOO, ZAGREB	2344	9	*
METIS DD	2385	9	*
C.I.O.S., DOO	n.a.	9	

Statistics about the networks

1. Density: Measures how close the network is to complete. A complete graph has all possible edges and density equal to 1.

$$D = \frac{2|E|}{|V|(|V|-1)}$$

where |E| is the number of edges and |V| is the number of vertices in the graph.

2. Degree: The degree of a node is the number of edges that are adjacent to the node.

3. Variance of the degrees:

$\frac{S^2=\sum_1^i(degree_i-\overline{degree})}{g}$, where g is the number of the network member

4. Eccentricity: The maximum non-infinite length of a shortest path between *n* and another node in the network. If *n* is an isolated node, the value of this attribute is zero.
see: http://bit.ly/2qbdSKl

5. Closness centrality: In a connected graph, the normalized closeness centrality (or closeness) of a node is the average length of the shortest path between the node and all other nodes in the graph.
see: http://bit.ly/2pCHbE4, http://bit.ly/2qbk4SA

6. Harminic closness centrality
see: http://bit.ly/2q6PUSG, http://bit.ly/2pF0wVY

7. Betweeness centrality: Betweenness centrality quantifies the number of times a node acts as a bridge along the shortest path between two other nodes.
see: http://bit.ly/2q7P6Na

Table A5.4.: Statistical analysis of the networks' nodes

Network 1

Nodes: 28
Edges: 38
Density: 0.101
Average Degree: 2.714
Variance of the degrees: 3.48

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
ADDIKO BANK	9.00	5.00	0.41	0.57	0.71
PRIVREDNA BANKA ZAGREB	7.00	7.00	0.30	0.47	0.11
ZAGREBACKA BANKA	5.00	6.00	0.32	0.45	0.04
DALEKOVOD	4.00	6.00	0.32	0.43	0.03
HT	4.00	6.00	0.36	0.47	0.34
LEDO	3.00	6.00	0.31	0.41	0.03
CERP	3.00	7.00	0.29	0.38	0.27
KBZ	3.00	7.00	0.29	0.38	0.36
ZITNJAK	3.00	8.00	0.25	0.34	0.21
KONZUM	3.00	9.00	0.20	0.30	0.08
DUKAT	2.00	6.00	0.31	0.39	0.14
INA	2.00	6.00	0.30	0.38	0.07
TEHNIKA	2.00	6.00	0.31	0.40	0.02
VIADUKT	2.00	6.00	0.31	0.39	0.00
INSTITUT IGH	2.00	6.00	0.35	0.41	0.40
ZAGREBACKO ELEKTROTEHNICKO PODUZECE	2.00	8.00	0.23	0.31	0.14
INTERKAPITAL VRIJEDNOSNI PAPIRI	2.00	7.00	0.24	0.31	0.07
PIK VRBOVEC-MESNA INDUSTRIJA	2.00	8.00	0.24	0.31	0.06
MATIC TOMISLAV	2.00	9.00	0.19	0.26	0.07
RAIFFEISENBANK AUSTRIA	2.00	9.00	0.20	0.28	0.07
POLJOOPSKRBA TEHNO	1.00	8.00	0.23	0.28	0.00
MONTMONTAZA	1.00	8.00	0.20	0.24	0.00
VELPRO - CENTAR	1.00	10.00	0.17	0.23	0.00
METRONET TELEKOMUNIKACIJE	1.00	10.00	0.16	0.21	0.00
MINISTRY OF STATE PROPERTY	1.00	7.00	0.23	0.28	0.00
TEB-INZENJERING	1.00	8.00	0.23	0.31	0.00
VODOSKOK ZAGREB	1.00	10.00	0.17	0.22	0.00

Network 2

Nodes: 17
Edges: 17
Density: 0.125
Average Degree: 2
Variance of the degrees: 6

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
GRAD ZAGREB	10.00	3.00	0.59	0.76	0.77
REPUBLIKA HRVATSKA	7.00	3.00	0.48	0.64	0.54
PUCKO OTVORENO UCILISTE ZAGREB	2.00	2.00	0.53	0.56	0.22
APIS IT	2.00	2.00	0.53	0.56	0.22
ZAVOD ZA PROSTORNO UREDENJE GRADA ZAGREBA	1.00	4.00	0.38	0.44	0.00
VODOPRIVREDA ZAGREB	1.00	4.00	0.38	0.44	0.00
VODOPRIVREDA ZAGREB	1.00	4.00	0.38	0.44	0.00
URIHO-USTANOVA ZA REHABILITACIJU HENDIKEPIRANIH OSOBA PROFESIONALNOM REHABILITACIJOM I ZAPOSLJAVANJEM	1.00	4.00	0.38	0.44	0.00
STOMATOLOSKA POLIKLINIKA ZAGREB	1.00	4.00	0.38	0.44	0.00
SPECIJALNA BOLNICA ZA MEDICINSKU REHABILITACIJU KRAPINSKE TOPLICE	1.00	4.00	0.33	0.40	0.00
NASTAVNI ZAVOD ZA JAVNO ZDRAVSTVO DR.ANDRIJA STAMPAR	1.00	4.00	0.38	0.44	0.00
MUZEJ GRADA ZAGREBA	1.00	4.00	0.38	0.44	0.00
KLINICKA BOLNICA SVETI DUH	1.00	4.00	0.38	0.44	0.00
KLINICKA BOLNICA DUBRAVA	1.00	4.00	0.33	0.40	0.00
HRVATSKI ZAVOD ZA JAVNO ZDRAVSTVO	1.00	4.00	0.33	0.40	0.00
H S	1.00	4.00	0.33	0.40	0.00

Network 3

Nodes: 9
Edges: 14
Density: 0.389
Average Degree: 3.111
Variance of the degrees: 4.32

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
PI VINDIJA	7.00	2.00	0.89	0.94	0.37
VINDIJA	7.00	2.00	0.89	0.94	0.37
HORVATIC IVAN	2.00	2.00	0.57	0.63	0.005
KAMENIC JULIO	2.00	2.00	0.57	0.63	0.005
MAGDALENIC LJILJANA	2.00	2.00	0.57	0.63	0.005
OZVATIC STANKO	2.00	2.00	0.57	0.63	0.005
STRELAR MATEJ	2.00	2.00	0.57	0.63	0.005
DORUSIC DELIMIR	2.00	2.00	0.57	0.63	0.005
DRK DRAGUTIN	2.00	2.00	0.57	0.63	0.005

Network 4

Nodes: 5
Edges: 4
Density: 0.4
Average Degree: 1.6
Variance of the degrees: 1.44

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
GRUPA RACUNA NA KOJIMA JE UKNJIZENA ISTA KOLICINA VR. PAPIRA	4.00	1.00	1.00	1.00	1.00
ENERGOREMONT	1.00	2.00	0.57	0.63	0.00
INZENJERSKI BIRO	1.00	2.00	0.57	0.63	0.00
KONCAR-ELEKTRONIKA I INFORMATIKA	1.00	2.00	0.57	0.63	0.00
MESNA INDUSTRIJA-VAJDA	1.00	2.00	0.57	0.63	0.00

Network 5

Nodes: 4
Edges: 4
Density: 0.67
Average Degree: 2
Variance of the degrees: 0

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
IGOR SORIC	2	2	0.75	0.83	0.5
GEOTEHNICKI STUDIO	2	2	0.75	0.83	0.5
KARST	2	2	0.75	0.83	0.5
ZELJKO SOKOLIC	2	2	0.75	0.83	0.5

Network 6

Nodes: 4
Edges: 3
Density: 0.5
Average Degree: 1.5
Variance of the degrees: 0.75

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
HEP	3.00	1.00	1.00	1.00	1.00
HEP - OPERATOR DISTRIBUCIJSKOG SUSTAVA	1.00	2.00	0.60	0.67	0.00
HEP-OPSKRBA	1.00	2.00	0.60	0.67	0.00
HEP-TOPLINARSTVO	1.00	2.00	0.60	0.67	0.00

Network 7

Nodes: 3
Edges: 2
Density: 0.667
Average Degree: 1.3333
Variance of the degrees: 0.22

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
MINISTARSTVO DRZAVNE IMOVINE	2	1	1	1	1
HP	1	2	0.67	0.75	0
NARODNE NOVINE	1	2	0.67	0.75	0

Network 8

Nodes: 3
Edges: 2
Density: 0.67
Average Degree: 1.33
Variance of the degrees: 0.22

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
MARKO DZEPINA	2	1	1	1	1
B.BRAUN ADRIA	1	2	0.67	0.75	0
MEDI-LAB	1	2	0.67	0.75	0

Network 9

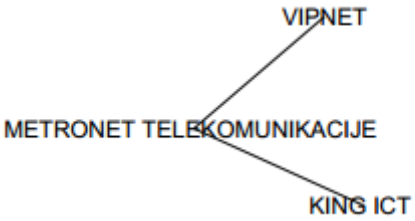
Nodes: 3
Edges: 2
Density: 0.67
Average Degree: 1.33
Variance of the degrees: 0.22

Member of network	Degree	Eccentricity	Closness centrality	Harmonic closness centrality	Betweeness centrality
CIOS	2	1	1	1	1
CEZAR	1	2	0.67	0.75	0
METIS	1	2	0.67	0.75	0

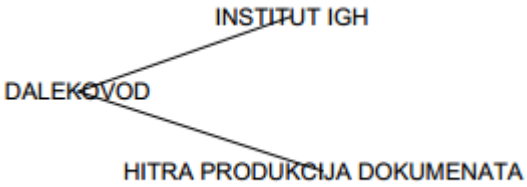
Appendix 6: Personal networks

The investigation of the personal networks is also based on the sample that was introduced in Appendix 5. In this analysis, the CEOs, the board members, the chairmen of the supervisory boards are taken into consideration as possible links between the companies. The positions and memberships that became ended before the data collection in 2017 are not taken into account. All in all, if there is a person who has any of the aforementioned positions in at least two different companies, then these companies will be linked together.
The analysis revealed 27 people who had position in several companies. As for the companies, 33 of them were linked to these people and thereby taken into consideration for the network analysis. The amount of links identified between the companies is 18.

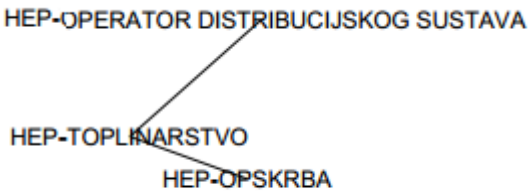
1. network



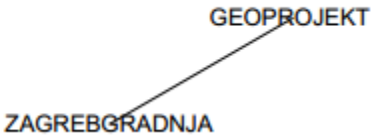
2. network



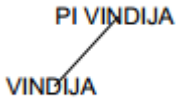
3. network



4. network

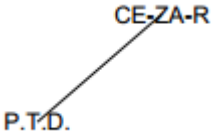


5. network

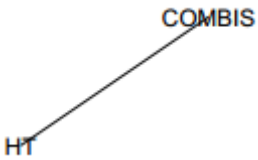


6. network

7. network

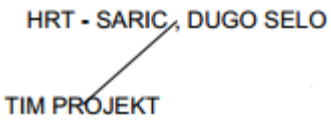


8. network



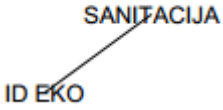
9. network

10. network



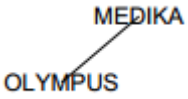
11. network

12. network



13. network

14. network



15. network

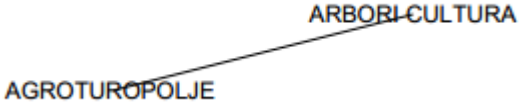


Table A6.1: Personal links between companies

Company	Company_ID	Individual	function
PI Vindija d.d.	20124	Antun Štabi	chairman of the supervisory board
VINDIJA D.D., VARAŽDIN	2072	Antun Štabi	chairman of the supervisory board
Zagrebački holding d.o.o.	20183	Bernard Mršo	member of the board
GRADSKA PLINARA ZAGREB D.O.O., Zagreb	163	Bernard Mršo	chairman of the supervisory board
GEOPROJEKT D.O.O., Zagreb	1152	Branko Vojnović	board member
ZAGREBGRADNJA D.O.O., Zagreb	1278	Branko Vojnović	chairman of the board
Zagrebački holding d.o.o.	20183	Daniela Franić	member of the board
GRADSKA PLINARA ZAGREB D.O.O., Zagreb	163	Daniela Franić	deputy chairman of the supervisory board
ALKA SCRIPT D.O.O.,	1597	Darko Simić	CEO
ALKA SCRIPT D.O.O., Zagreb	2151	Darko Simić	CEO
PI Vindija d.d.	20124	Dragutin Drk	CEO
VINDIJA D.D., VARAŽDIN	2072	Dragutin Drk	CEO
FLAMMIFER D.O.O.,	1686	Goran Pejić	deputy chairman of the supervisory board
FLAMMIFER D.O.O., Ozalj	2144	Goran Pejić	deputy chairman of the supervisory board
FLAMMIFER D.O.O.,	1686	Goran Žugec	CEO
FLAMMIFER D.O.O., Ozalj	2144	Goran Žugec	CEO
Crodux plin d.o.o.	20027	Gordana Kronja	Board member
CRODUX PLIN D.O.O., Zagreb	1922	Gordana Kronja	board member
INDUSTROOPREMA D.O.O., Zagreb	1856	Hrvoje Delaš	CEO
INDUSTROOPREMA D.O.O., Zagreb	1502	Hrvoje Delaš	CEO
NERING d.o.o.	20110	Hrvoje Rendulić	CEO
NERING D.O.O., SESVETE	1334	Hrvoje Rendulić	CEO
Crodux plin d.o.o.	20027	Ivan Čermak	Chairman of the board
CRODUX PLIN D.O.O., Zagreb	1922	Ivan Čermak	chairman of the board
GEOPROJEKT D.O.O., Zagreb	1152	Ivan Vojnović	chairman of the board

ZAGREBGRADNJA D.O.O., Zagreb	1278	Ivan Vojnović	board member
HEP - operator distribucijskog sustava d.o.o., D.P. Elektra Zagreb	20052	Ivona Štritof, dipl.ing.	Supervisory board member
HEP-TOPLINARSTVO D.O.O., Zagreb	2179	Ivona Štritof, dipl.ing.	member of the supervisory board
Metronet telekomunikacije d.d.	20103	Jiří Dvorjančanský	CEO
VIPNET D.O.O., Zagreb	1420	Jiří Dvorjančanský	board member
PI Vindija d.d.	20124	Jozo Mišetić	member of the supervisory board
VINDIJA D.D., VARAŽDIN	2072	Jozo Mišetić	member of the supervisory board
MEDIKA D.D., ZAGREB	1729	Krešimir Drašković	board member
OLYMPUS D.O.O., ZAGREB	1679	Krešimir Drašković	CEO
LEDO D.D., ZAGREB	2340	Ljerka Puljić, dipl.oec.	chairman of the supervisory board
ŽITNJAK D.D., ZAGREB	1244	Ljerka Puljić, dipl.oec.	chairman of the supervisory board
SANITACIJA D.O.O., Zagreb	2031	Mario Kuzmec	CEO
ID EKO D.O.O., ZAGREB	1215	Mario Kuzmec	CEO
Hitra Produkcija Dokumenata	20055	Marko Lesić, dipl.ing.	Chairman of the supervisory board
DALEKOVOD, D.D., Zagreb	2122	Marko Lesić, dipl.ing.	chairman of the supervisory board
Hitra Produkcija Dokumenata	20055	Marko Makek	Deputy chairman of the supervisory board
DALEKOVOD, D.D., Zagreb	2122	Marko Makek	member of the supervisory board
PI Vindija d.d.	20124	Marta Golub	deputy chairman of the supervisory board
VINDIJA D.D., VARAŽDIN	2072	Marta Golub	deputy chairman of the supervisory board
PIK VRBOVEC-MESNA INDUSTRIJA d.d.	20125	Mate Štetić	CEO
ROTO DINAMIC D.O.O., Zagreb	1180	Mate Štetić	deputy chairman of the supervisory board
INSTAL-PROM D.O.O.,	272	Mirela Hruškar	CEO
INSTAL-PROM D.O.O., Zagreb	1049	Mirela Hruškar	CEO
LEDO D.D., ZAGREB	2340	Mislav Galić, mr. sc. dipl. ing.	member of the supervisory board

ŽITNJAK D.D., ZAGREB	1244	Mislav Galić, mr. sc. dipl. ing.	deputy chairman of the supervisory board
FLAMMIFER D.O.O.,	1686	Mladen Markač	chairman of the supervisory board
FLAMMIFER D.O.O., Ozalj	2144	Mladen Markač	chairman of the supervisory bord
KING ICT d.o.o.	20073	Plamenko Barišić, dipl.ing.	Chairman of the board
Metronet telekomunikacije d.d.	20103	Plamenko Barišić, dipl.ing.	deputy chairman of the supervisory board
ARBORI CULTURA d.o.o	20006	Renata Busija	CEO
AGROTUROPOLJE D.O.O., Novo Čiče	1802	Renata Busija	CEO
COMBIS D.O.O., ZAGREB	1303	Saša Kramar	chairman of the supervisory board
HT D.D., Zagreb	1663	Saša Kramar	board member
HEP-OPSKRBA D.O.O., Zagreb	1499	Snježana Pauk	member of the supervisory board
HEP-TOPLINARSTVO D.O.O., Zagreb	2179	Snježana Pauk	member of the supervisory board
PI Vindija d.d.	20124	Spomenko Kukec	member of the supervisory board
VINDIJA D.D., VARAŽDIN	2072	Spomenko Kukec	member of the supervisory board
PI Vindija d.d.	20124	Tamara Drk-Vojnović	member of the supervisory board
VINDIJA D.D., VARAŽDIN	2072	Tamara Drk-Vojnović	member of the supervisory board
TIM PROJEKT D.O.O., Zagreb	1145	Tomislav Šarić	CEO
HRT - ŠARIĆ D.O.O., Dugo Selo	1266	Tomislav Šarić	CEO
P.T.D. D.O.O., Novaki	2385	Tonka Pripuz	member of the supervisory board
CE-ZA-R D.O.O., Zagreb	2344	Tonka Pripuz	deputy chairman of the supervisory board
INSTITUT IGH, D.D., Zagreb	1087	Vlado Čović	member of the supervisory board
DALEKOVOD, D.D., Zagreb	2122	Vlado Čović	member of the supervisory board
AKD D.O.O., ZAGREB	2088	Zdravko Janić	chairman of the supervisory board
AKD-ZAŠTITA D.O.O., Zagreb	2273	Zdravko Janić	deputy chairman of the supervisory board