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# From corruption to state capture:

## *A new analytical framework with empirical applications from Hungary*

*Working Paper Series: CRCB-WP/2014:01, GTI-WP/2014:01*

*November 2014, Budapest, Hungary*

The Corruption Research Center Budapest was created in November 2013 in response to the growing need for independent research on corruption and quality of government in Hungary. The central aim of the Center is to systematically explore the causes, characteristics, and consequences of low quality of government, corruption, and regulatory failure using an inter-disciplinary approach. In addition, the Center also aims to help citizens to hold governments accountable through the use of robust evidence. Our unique research approach combines qualitative and quantitative methods to analyse micro-level actor behaviour and generates novel hard data on the phenomena under scrutiny.

Corruption Research Center Budapest split up in September 2015 into 1) Corruption Research Center Budapest and 2) Government Transparency Institute. This working paper is the joint work of the researchers of the two institutes.

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## ABSTRACT

### From corruption to state capture: a new analytical framework with empirical applications from Hungary<sup>3</sup>

State capture and corruption are widespread phenomena across the globe, but their empirical study is still highly challenging. This paper develops a new conceptual and analytical framework for gauging state capture based on micro-level contractual networks in public procurement. To this end, it first establishes a robust measure of corruption risks in public procurement transactions focusing on relationships between pairs of issuers and suppliers. Second, it searches for clusters of high corruption risk organisations in the full contractual network of issuers and suppliers. These clusters and the density of corrupt links in them suggest state capture. Third, it employs this analytical framework to systematically explore how the radical change in governing elite composition in Hungary in 2009-2012 impacted on patterns of state capture. Findings indicate the feasibility and usefulness of such micro-level approach to corruption and state capture. Better understanding the network structure of corruption and state capture opens new avenues of research and policy advice on anti-corruption efforts, budget deficit, market competition, and democratic contestation.

JEL classification: D72, D73, H57

Keywords: public procurement, institutionalised grand corruption, social network analysis, state capture, elite power struggle

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<sup>3</sup> The authors would like to express their gratitude for two EU funded projects at the Budapest Corvinus University (TAMOP 4.2.2.B and ANTICORRP (Grant agreement no: 290529)) even though they relied extensively on their voluntary contributions for realising this project. They would also like to express special thanks to colleagues at the Corruption Research Center Budapest working on the Hungarian public procurement database (PP) for over three years, especially Kinga Csizmás, Ágnes Czibik, Zoltán Kelemen, Gyenesse Jenő, Tamás Uhrin, and Johannes Wachs.

## 1. Introduction

There has been intense scholarly interest in state capture across the globe, although virtually every study has had to rely either on qualitative data lacking sufficient breath, or on survey data lacking sufficient reliability. These methodological weaknesses have spawned a rich theoretical literature with relatively meagre empirical material to evaluate it. With the availability of reliable micro-level data on institutionalised grand corruption in public procurement (e.g. Fazekas, Tóth, and King 2013a), scholars can begin to rigorously test theories of state capture and investigate the underlying actor networks and corrupt transactions.

It is our starting point that state capture is not just widespread corruption. Rather, its essence lies in a distinct network structure in which corrupt actors cluster around certain state organs and functions. By analysing the distribution of corrupt transactions and clustering of high corruption risk actors, we can establish the degree of state capture. For example, it becomes possible to distinguish between local and global capture where in the first case only some public and private organisations enter into a capture relationship with their ‘islands’ relatively autonomous, while in the second case, captured organisations are linked to each other and a national-level elite controls them.

In order to bridge the long standing gap between state capture theory and empirical data:

*This paper develops a new conceptual and analytical framework for gauging state capture based on micro-level contractual networks in public procurement.*

The goal of this analytical framework is to determine precisely whether state capture took place in a particular context, as in Hungary in 2009-2012. If state capture occurred, its anatomy is naturally of interest.

Establishing the structure and degree of state capture opens up many ways for analysing its determinants and effects. In order to demonstrate the usefulness of our novel approach, the relationship between the organisational structure of the governing elite and the structure of state capture are explored. This is a highly relevant question on its own as, as for example many anti-corruption efforts fail because they misdiagnose corruption as a formal principal agent problem and miss the elite-driven character of state capture (Persson, Rothstein, and Teorell 2013).

Pursuing these ends extends our current knowledge at least in three ways: first, it gives a well-documented and widely deployable toolkit for scholars to measure corruption and analyse the structure of state capture. This, hopefully, will generate further scholarly interest in the empirical study of state capture. Second, it also provides a novel empirical test for the theories of state capture, in particular on how elite composition impacts on state capture. This is a crucial question as it has wide-ranging ramifications for many economic, social, and political factors. Third, Hungary, while only considered a case used for demonstration, can provide wider lessons for other transition economies. In particular, its recent backsliding both economically and in terms of democratic freedoms can serve as a cautionary tale for other polities.

Findings point out the conceptual and empirical validity of the proposed approach to state capture. Applying the framework to Hungary in 2009-2012 reveals that high corruption risk actors cluster together across two electoral cycles suggesting partial capture of the Hungarian state by elite groups. The more central position of high corruption risk subgroups in 2011-2012 compared to 2009-2010 coincides with a more centralised governing party's coming into office. Governing elite structure, thus, appears to be a powerful force shaping the structure of rent extraction with wide-ranging ramifications for anti-corruption efforts, budget deficits, market competition, and democratic contestation.

Even though the main focus of this analysis is public procurement corruption, findings can also provide indication of corruption in a more general sense as public procurement represents one of the principal vehicles for rent extraction across the globe. This is reflected, for example, in corruption surveys where public procurement is systematically named as the most corrupt area of government activities (OECD 2007, 9). Such a central role in rent extraction shouldn't come as a surprise given the high degree of discretion in public procurement decisions and the large portion of public spending involved: between 20% and 50% of OECD countries' public budgets (OECD 2011 table 40.2). While robust evidence is lacking, corrupt rents earned through particularistic allocation of public procurement contracts are most likely directly linked to political party finances hence to democratic party competition (OECD 2014; Transparency International 2012).

The paper is structured as follows: It first establishes a robust measure of corruption risks in public procurement transactions focusing on binary relationships between issuers and suppliers. Second, it constructs a contractual network of organisations to demonstrate the non-random distribution of corruption risks. Third, it systematically explores how the change in elite group internal composition (i.e. from decentralisation to centralisation) impacts the network structure of rent extraction in public procurement.

## 2. Conceptual framework and hypotheses

While there are many competing definitions of corruption (Johnston 1996), we adopt a broad definition which is adept at capturing high-level political corruption in situations where even some regulations could be enacted to serve rent extraction. Thus, in the context of public procurement, institutionalised grand corruption refers to the allocation and performance of public procurement contracts by bending prior explicit rules and principles of good public procurement in order to benefit a closed network while denying access to all others (for a related discussion see Kaufmann and Vicente 2011; Mungiu-Pippidi 2006). This arguably broader definition of corruption than simple bribery in public administration is well fitted to the context of public procurement where political discretion is broad and political and technocratic actors necessarily co-determine decision. Prior explicit rules and principles provide the benchmark for an impartial and universalistic allocation of public resources as opposed to partiality and particularism along friendship or kinship lines (Rothstein and Teorell 2008). In addition, prior explicit rules mandate an open access and fair competition for public procurement contracts which must be violated by corrupt groups if they are to generate corrupt rents and allocate them to members of their network (North, Wallis, and Weingast 2009). Such a definition of corruption highlight impartiality and open access is

directly measured by the Corruption Risk Index (CRI) developed by earlier scholarship (Fazekas, Tóth, and King 2013a)

Similar to corruption, there are many definitions of state capture, many of which focus on law making instead of public spending (Hellman et al. 2000; Irina, Yakovlev, and Zhuravskaya 2005). At the heart of these is a group phenomenon whereby some members of the business and/or political elite appropriates some parts or functions of the state and uses its resources to the benefit of the group and to the detriment of the public good (Grzymala-Busse 2008). This understanding of state capture does not imply whether it is business capturing the state, or the other way around, or both at the same time. In the context of public procurement, state capture is most likely targeting public organisations which manage the distribution and performance of contracts as these are the primary sources of rents to be extracted. When a public organisation is captured by private interests, it loses its autonomy to act in interest of public goals which manifests in its inability to contract competitively achieving low price and high quality.

Hence, it is possible to link institutionalised grand corruption to state capture in the domain of public procurement by focusing attention on the distribution and clustering of corruption and network relations of key actors (Uribe 2014). On the one hand, corruption *without* state capture as measured in public procurement is understood as institutionalised grand corruption distributed across the organisational network randomly and roughly evenly. On the other hand, state capture as measured in public procurement is defined as institutionalised grand corruption clustered on certain public organisations which lose their autonomy fully or nearly completely. This implies that the simple quantitative characteristic - amount of corruption - does not automatically translate into state capture; rather its particular distribution is what matters. Hence, varying distributional characteristics of corruption can lead to a qualitatively different state operational logic. Clusters of high corruption transactions can arise both at the level of an individual organisation, implying that it is only that particular organisation which is captured (local capture), While it can also arise at the level of multiple organisations implying that there is a larger part of the public sector captured (global capture). Theoretically, the extent of state capture can range from a single captured organisation to the capture of every single organisation.

As linking corruption to state capture through organisational networks is a theoretical novelty, below we further discuss the exact network configurations we are analysing. In order to convincingly link institutionalised grand corruption to state capture by referring to the network structure of organisations, it is imperative to embed this relationship in a thorough understanding of what the networks truly represent. The network of organisations consists of public organisations and private firms where each tie represents a contractual relationship between the two. Institutionalised grand corruption as measured by CRI is a characteristic of the contracts linking public organisations to private firms. In this sense, a high corruption contract represents corrupt bonding between the decision makers in public and private organisations which creates trust between them while also allowing for direct rent extraction. Thus, the clustering of high corruption contracts among certain organisations signals that the involved public and private elites have managed to seize control of government contracting to their own benefit. The degree and strength of such a clustering measure the extent of state capture ranging from partially appropriated state to a near complete blending of private interests and state functions (Wedel 2003).

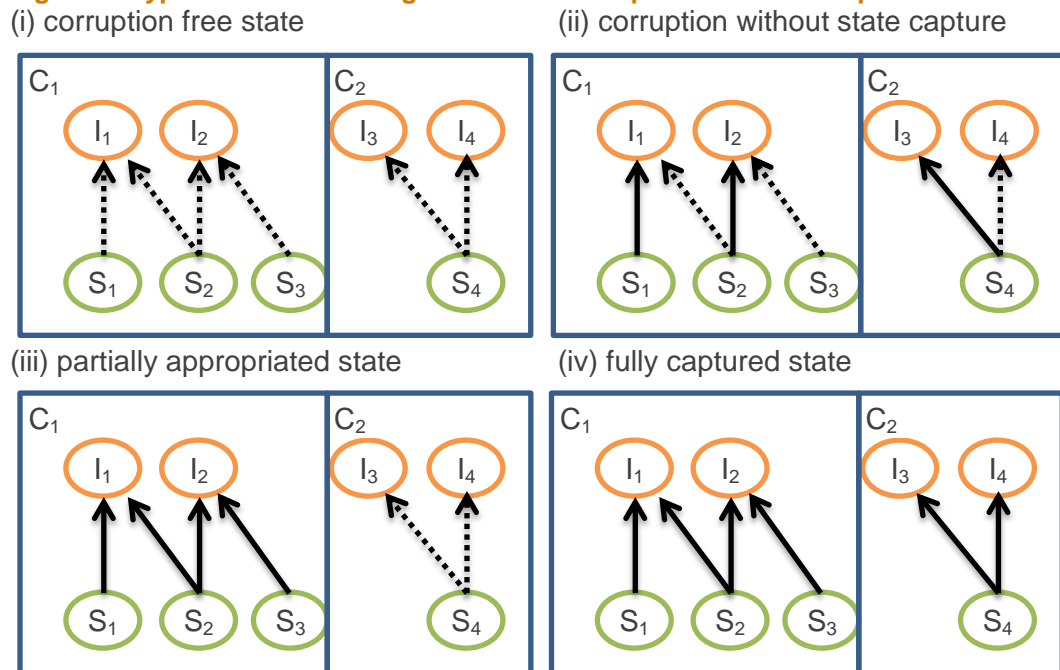
The different distributions of corruption and state capture are depicted in Figure 1 in a simplified form in order to shed more light on our proposed link between corruption and state capture. Here,  $I_1$ - $I_4$  represent 4 different issuers (public organisations),  $S_1$ - $S_4$  represent 4 different suppliers (private organisations), the dashed arrows between them denote low corruption risk contracts, and the solid arrows indicate high corruption risk contracts.  $C_1$  and  $C_2$  are two clusters of contracting organisations. In the top left (i) panel, a corruption-free state is depicted consisting of two contractual clusters, each of which is largely free of corruption, hence state capture doesn't occur either. In the top right (ii) panel, corruption displays a random pattern without being organised into clusters of corrupt organisations. As each cluster of contracting organisations has both high and low corruption links, no state capture occurs. Such pattern points at occasional weaknesses of the integrity framework without an extensive breakdown of institutional autonomy.

In the bottom left (iii) panel, corruption is organised along the lines of clusters of contracting organisations with one cluster ( $C_1$ ) only harbouring high corruption contracts while the other cluster ( $C_2$ ) only low corruption contracts. In this situation, public organisations  $I_1$  and  $I_2$  are likely to have lost all of their institutional autonomy in disbursing public funds through public contracting, while  $I_3$  and  $I_4$  have managed to maintain their contracting autonomy. Because some public organisations are captured while others are not, this state can be denoted as a partially appropriated state (Wedel 2003). If cluster  $C_1$  had consisted of only one public organisation, it could have been denoted as local capture. As the cluster already contains 2 public organisations it represents some way away from local capture towards global capture.

In the bottom right (iv) panel, every contract is of high corruption risks rendering the state fully captured, that is clusters represent global capture. As there are two separate contractual networks, the network configuration suggests an oligarchic structure whereby different captor groups target different set of organisations. Nevertheless, this notion would also have to be confirmed by the analysis of the personal networks of key office holders in the clustered organisations. It is possible that the lack of contractual link is the product of market and/or geographic separations while personal ties assure a single captor group.



**Figure 1. Typical network configurations of corruption and state capture**



*Note: dashed lines indicate low corruption risk contracts, solid lines indicate high corruption risk contracts*

The above 4 types are of highly simplified nature compared to the empirical data we analyse. There are three notable extensions to these models: first, clusters and cluster boundaries are more likely to be of a probabilistic nature where clusters are characterised by a dense network of contractual links within them, but there are also some sparse relations among them. Second, clusters may only differ in the degree of corruption risks of their within-cluster contractual relationships; that is some clusters are expected to have more dominantly high corruption risk contracts while others more dominantly low corruption risk contracts within them. Third, actual indicator of corruption risks (CRI) of contractual relations is not binary rather a continuous measure which makes the analysis much more fine-tuned than the simple binary categorisation of contracts.

Using the above conceptualisation of state capture, this paper applies the novel approach to the relationship between governing elite composition and the structure of state capture. The starting point is that in a typical case, captor groups have different degrees of centralisation, some more resemble a loose coalition of diverse actors (i.e. oligarchy), while others a highly centralised group with a strict hierarchical structure (i.e. hierarchy). Internal organisation determines the degree to which they are capable of collective action such as managing rent extraction. Hence, we can hypothesize that captor groups organise the structure of rent extraction in line with their internal composition. That is, decentralised captor groups would organise rent extraction in public procurement in a decentralised way which is reflected in the organisational network as multiple distinct clusters of high corruption organisations. While, a centralised captor group would organise rent extraction in public procurement in a centralised way. This would have to be reflected in the organisational network as a tightly knit cluster occupying the centre of the graph. Hungary with a drastically changing elite composition and public procurement practice in 2010 following the landslide victory of the conservative party (Fidesz) can serve as an appropriate testing ground for theory. In this context, the competing hypotheses to be tested are:

$H_0$ : Elite centralisation of 2011-2012 did not change network centrality position of captured organisations;

$H_1$ : Elite centralisation of 2011-2012 made captured organisations more central in the network.

### 3. The data

#### 3.1. Public procurement data of Hungary, 2009-2012

The database derives from Hungarian public procurement announcements of 2009-2012 (henceforth referred to as PP). The data represent a complete database of all public procurement procedures conducted under Hungarian Public Procurement Law. PP contains variables appearing in 1) calls for tenders, 2) contract award notices, 3) contract modification notices, 4) contract completion announcements, and 5) administrative corrections notices. As not all of these kinds of announcements appear for each procedure, hence, there is missing data in PP for some observations. For example, the type of procedure used determines whether a call for tender is published or not, implying that the variables deriving from the call for tender are missing. Nevertheless, contract award announcements are mandatory in every tender, hence PP has data from contract awards consistently.

The place of publication of these documents is the Public Procurement Bulletin which is accessible online<sup>4</sup>. As there is no readily available database, we used a crawler algorithm to capture the text of every announcement. Then, applying a complex automatic and manual text mining strategy, we created a structured database which contains variables with clear meaning and well-defined categories. As the original texts available online contain a range of errors, inconsistencies, and omissions, we applied several correction measures to arrive at a database of sufficient quality for scientific research. For full description of database creation, see Fazekas & Tóth (2012a) in Hungarian and in Fazekas & Tóth (2012b) in English.

As contract award notices represent the most important part of a procedure's life-cycle and they are published for each procedure under the Hungarian Public Procurement Law, their statistics are shown in Table 1 to give an overview of the database. It is noticeable that number and total value of contracts awarded has declined in the observation period. This is due to two parallel developments: 1) because of budget cuts since 2010, total public spending has declined; and 2) public procurement transparency has decreased since the new government entered office in 2010 (Lukács and Fazekas 2014).

**Table 1. Main statistics of the analysed data – contracts**

	2009	2010	2011	2012	Total
Total number of contracts awarded	10918	17914	14070	10342	53244
Total number of unique winners	3987	5617	5587	4923	13557
Total number of unique issuers	1718	2871	2808	2344	5519
Combined value of awarded contracts (million EUR) *	4604	3834	1856	1298	11592

Source: PP

Notes: \* = a 300 HUF/EUR uniform exchange rate was applied for exchanging HUF values.

<sup>4</sup> See: <http://www.kozbeszerzes.hu/nid/KE> (in Hungarian)



### 3.2 Network data of Hungary, 2009-2012

This public procurement database allows for very detailed and complex network analyses as there are at least three distinct actors recorded: 1) public organisations or issuers, 2) private organisations or suppliers/winners, and 3) procurement advisors or brokers. Networks can be constructed using contracts as defining an edge, but other links are also possible such as co-participation in a bid or consortium, issuers procuring together, shared company ownership, or shared set of managers or board members. The fact that the database records transactions on a daily basis opens up the possibility of a wide range of analyses.

In order to concentrate on the aspects of the available rich dataset most relevant to research goals, a subset of actors and edges were selected for analysis (Table 2). First, only two types of actors were selected resulting in a two-mode or bipartite network structure: issuers and winners. While there has been a lot of scientific discussion about the crucial role of informality and the consequent secondary importance of formal structures, public as well as private organisations still represent specific investments into means of rent extraction for corrupt groups. By implication, network analysis focusing on organisational networks is capable of capturing the most relevant means and structure of high-level rent extraction and corruption. Second, the analysed database only records contracts of at least 1 million HUF (or roughly 3300 EUR). Below this threshold contracts are considered to be too small for high-level politics to interfere which of course doesn't mean that there is no corruption involved in the award of these contracts. Third, only those organisations are analysed which have at least 3 contracts awarded in at least one of the two observation periods as the market behaviour of organisations with less than 3 contracts in a roughly 1 and a half year period is generally too erratic creating a lot of random noise for pattern identification. This is also true for the calculation of the Corruption Risk Index (CRI) of each transaction, by implication network data and corruption measurement both refer to the same sample (Fazekas, Tóth, and King 2013a).

In order to harness the changing elite configuration resulting from the change of government in May 2010, two roughly equal time periods were selected: 1/1/2009 – 31/4/2010 capturing the socialist government's almost one and a half years in office and 1/1/2011 – 31/7/2012 capturing the first roughly one and a half years of the conservative government in office. Note that the immediate roughly half a year after the change of government 1/5/2010 – 31/12/2010 is excluded from the analysis as it is considered to be a transitory period. This is so because public procurement tenders often have about half a year time span between launch and final contract award and incoming governments typically take a few months to establish their new regime in public procurement such as implementing new rules and appointing new officials to key posts.

In Table 2, the number of edges is lower than the number of contracts as any pair of organisations could have concluded more than one contract in each period. Multiple contracts between the same two actors within each period were aggregated to represent one edge per period.

The two networks are by and large of the same size with the network representing 2011-2012 period containing somewhat more edges and actors, but much smaller contract value.

This is because public procurement spending greatly decreased after the 2010 elections reflecting budget cuts across the whole public sector.

**Table 2. Descriptive statistics of network sizes of the two periods, 2009-2010 and 2011-2012**

	N contract	N issuer	N winner	N edge	total contract value (million EUR)*
2009-2010M4	8121	887	1244	5365	2,089.75
2011-2012M7	7748	973	1491	5602	991.44

Source: PP

Notes: \* = a 300 HUF/EUR uniform exchange rate was applied for exchanging HUF values.

The two periods are treated as two distinct networks not only because the underlying governing elites have almost completely changed, but also because the organisational actors and their positions changed fundamentally. Only about one third of organisations are present in both networks (Table 3), with suppliers displaying a particularly low level of overlap between the two periods. These statistics are broadly in line with interview evidence pointing at a wholesale restructuring of the public procurement market under the new conservative government. In addition, network position of organisations present in both networks changed considerably.

**Table 3. Overlap of organisations in the networks of the two periods, Hungary, 2009-2012**

periods	N			%		
	total	issuers	suppliers	total	issuers	suppliers
2009-2010 only	1,057	381	676	30.02	28.14	31.2
2011-2012 only	1,392	469	923	39.53	34.64	42.59
both periods	1,072	504	568	30.45	37.22	26.21
Total	3,521	1,354	2,167	100	100	100

Source: PP

We can claim that elite configuration under the two periods is fundamentally different as both the governing parties have different internal organisation and the public administration structures they created are very different. The socialist governments between 2002 and 2010 consisted of a coalition of the socialist party (MSzP) and the liberal party (SzDSz) with 3 different prime ministers in the period. The party leadership has changed on multiple occasions in this period. The conservative party (Fidesz) has formed government de facto on its own while the party has always been led by Viktor Orbán, twice prime minister. While party and government leadership turnover and coalition governments are far from the only indicators of governing elite centralisation, they both point in the same direction. The socialist governing elite was most likely a more decentralised elite group than the conservative governing elite.

This picture is further strengthened by the centralisation of the public administration under the conservative government. There was a strong centralising push in public services in 2010-2012 by reallocating many previously locally managed services to the centre such as primary and secondary education. In a similar vein, most local public services such as issuing permits which were previously managed by municipalities have been transferred to regional or national centres. Finally, the national ministries were reorganised under only 8 ministries with 3 'top' ministries managing most substantial areas. This move was openly praised by top government officials as a way to effective governance. Even though reorganising the state serves only as a proxy for elite configuration and elite preferences, it

clearly points at a more centralised direction under the conservative government when compared with the previous socialist government.

#### 4. Measuring institutionalised grand corruption: focus on the individual organisation

The starting point for identifying state capture is to develop a robust measure of institutionalised grand corruption at a dyadic level; that is by looking at the relationship between any pair of issuers and winners.

Corruption Risk Index (CRI) measures the probability that the principle of open access is violated in the process of awarding and performing public procurement contracts in order to serve corrupt rent extraction by a select few (Fazekas, Tóth, and King 2013a). In other words, it expresses the probability of issuers pretending that tenders are competitive as prescribed by law while restricting competition to award contract to a well-connected bidder on a recurrent basis. CRI is a composite index of elementary corruption risk indicators capturing 'corruption techniques' such as tailoring eligibility criteria to fit a single company or using exceptional procedure types to limit openness of competition (Fazekas, Tóth, and King 2013b). It reflects a corrupt rent extraction logic where elementary corruption techniques are systematically used for restricting access and recurrently benefiting the same winner.

Corruption measurement and in fact analysis of state capture is made possible by the fact that public procurement is a highly transparent area of public spending compelling actors to reveal at least some traces of their corrupt actions. By implication, publicly available organisation and transaction-level data allows for constructing a robust measure of corruption.

CRI is constructed in a three steps:

- 1) A long list of elementary corruption indicators is identified (30+ indicators) which are proven to indicate corruption in *some* cases, using qualitative methods like review of international academic literature, media content analysis, review of court judgements, and key informant interviews (Fazekas, Tóth, and King 2013b).
- 2) Indicators from the long list are selected which prove to be systematically linked to restricted access as captured by single bidder contracts as *well* as to recurrent contract award to the same company as captured by winner contract share over 12 months. Regression analysis controlling for alternative explanations such as market specificities and low state capacity is used for identifying such indicators (Fazekas, Tóth, and King 2013a). In practical terms, corruption indicators that are significant and substantial in *both* regression models are selected<sup>5</sup>.

CRI is calculated as the weighted sum of selected elementary corruption risk indicators where each elementary indicator is weighted to reflect its strength in predicting lack of competition and recurrent contract award. In addition, CRI is normed in order to fall in the 0-1 band. For the list of components and their weights see Table 4.

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<sup>5</sup> Each of the two generic regressions analyses are run with multiple specifications in order to check for robustness.

The resulting CRI can take any value between 0 and 1, where 0 means minimal or no corruption risk and 1 means maximal corruption risk observed. The Hungarian CRI has been validated using a range of 'hard' measures of corruption and rent extraction such as profitability, political connections and company registration in tax heavens (Fazekas, Tóth, and King 2013a). The international version of CRI has been validated using subjective measures of corruption and company survey evidence on corruption in bidding (Charron et al. 2014).

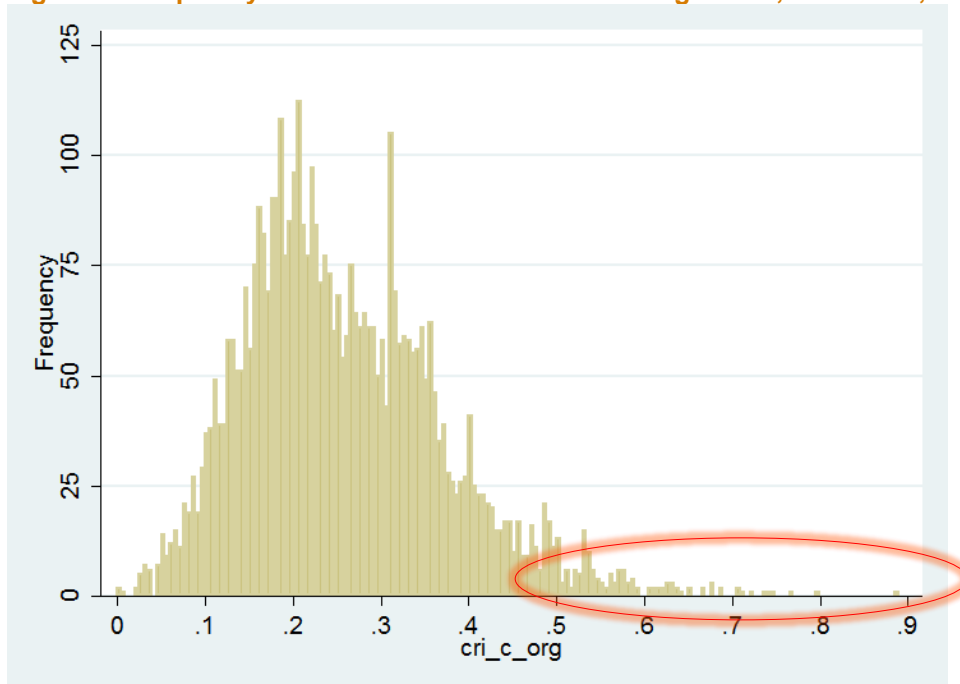
**Table 4. Component weights of CRI**

Variable	component weight
<b>single received/valid bid</b>	0.096
<b>no call for tenders published in official journal</b>	0.096
<b>procedure type</b>	
ref. cat.=open procedure	0.000
1=invitation procedure	0.048
2=negotiation procedure	0.072
3=other procedures	0.096
4=missing/erroneous procedure type	0.024
<b>length of eligibility criteria (deviation from market average)</b>	
ref. cat.=length<-2922.125	0.000
1= -2922.125<length<=520.7038	0.024
2= 520.7038<length<=2639.729	0.048
3= 2639.729<length	0.072
4= missing length	0.096
<b>short submission period</b>	
ref. cat.=normal submission period	0.000
1=accelerated submission period	0.048
2=exceptional submission period	0.072
3=except. submission per. abusing weekend	0.096
4=missing submission period	0.024
<b>relative price of tender documentation</b>	0.000
ref. cat.= relative price=0	0.000
1= 0<relative price<=0.0004014	0.000
2= 0.0004014<relative price<=0.0009966	0.096
3= 0.0009966<relative price<=0.0021097	0.064
4= 0.0021097<relative price	0.032
5=missing relative price	0.000
<b>call for tenders modification</b>	0.096
<b>weight of non-price evaluation criteria</b>	0.000
ref. cat.= only price	0.000
2= 0<non-price criteria weight<=0.4	0.000
3= 0.4<non-price criteria weight<=0.556	0.048
4= 0.556<non-price criteria weight<1	0.096
5=only non-price criteria	0.000
<b>procedure annulled and re-launched subsequently</b>	0.096
<b>length of decision period</b>	
ref. cat.= 44<decision period<=182	0.000
1= decision period<=32	0.064
2= 32<decision period<=44	0.032
4= 182<decision period	0.096
5= missing decision period	0.000
<b>contract modified during delivery</b>	0.096
<b>contract extension(length/value)</b>	
ref. cat.= c.length diff.<=0 AND c.value diff.<=0.001	0.000
2= 0<c. length d.<=0.162 OR 0.001<c.value d.<=0.24	0.096
3= 0.162<c. length diff. OR 0.24<c.value diff.	0.000
4= missing (with contr. completion ann.)	0.048
5= missing (NO contr. completion ann.)	0.000
<b>winner's contract share</b>	0.096

As CRI is defined on the level of individual public procurement tenders, it is most appropriately used as the edge weight in the organisational contractual network. As any two organisations can have more than one contract linking them within the same period, edge weights were calculated as the arithmetic average of the contracts constituting the edge between the actors.

In order to have a first simplistic glance at the distribution of corruption risks and state capture, CRI is aggregated to characterise winning firms (aggregation per issuer follows the same logic and yields similar insights). Figure 2 depicts the distribution of winners according to their average CRI scores throughout the whole 2009-2012 period. The distribution doesn't deviate extensively from a normal distribution, albeit it has a long tail to the right. These are companies with exceptionally high CRI: higher than 0.4-0.5 which implies a consistently high corruption risk contracting activity across the board which could translate into high risk of local or global state capture. This initial evidence lends itself to an interpretation that there is at least some state capture happening in Hungary.

**Figure 2. Frequency distribution of winners according to CRI, 2009-2012, N=4430**



Source: PP

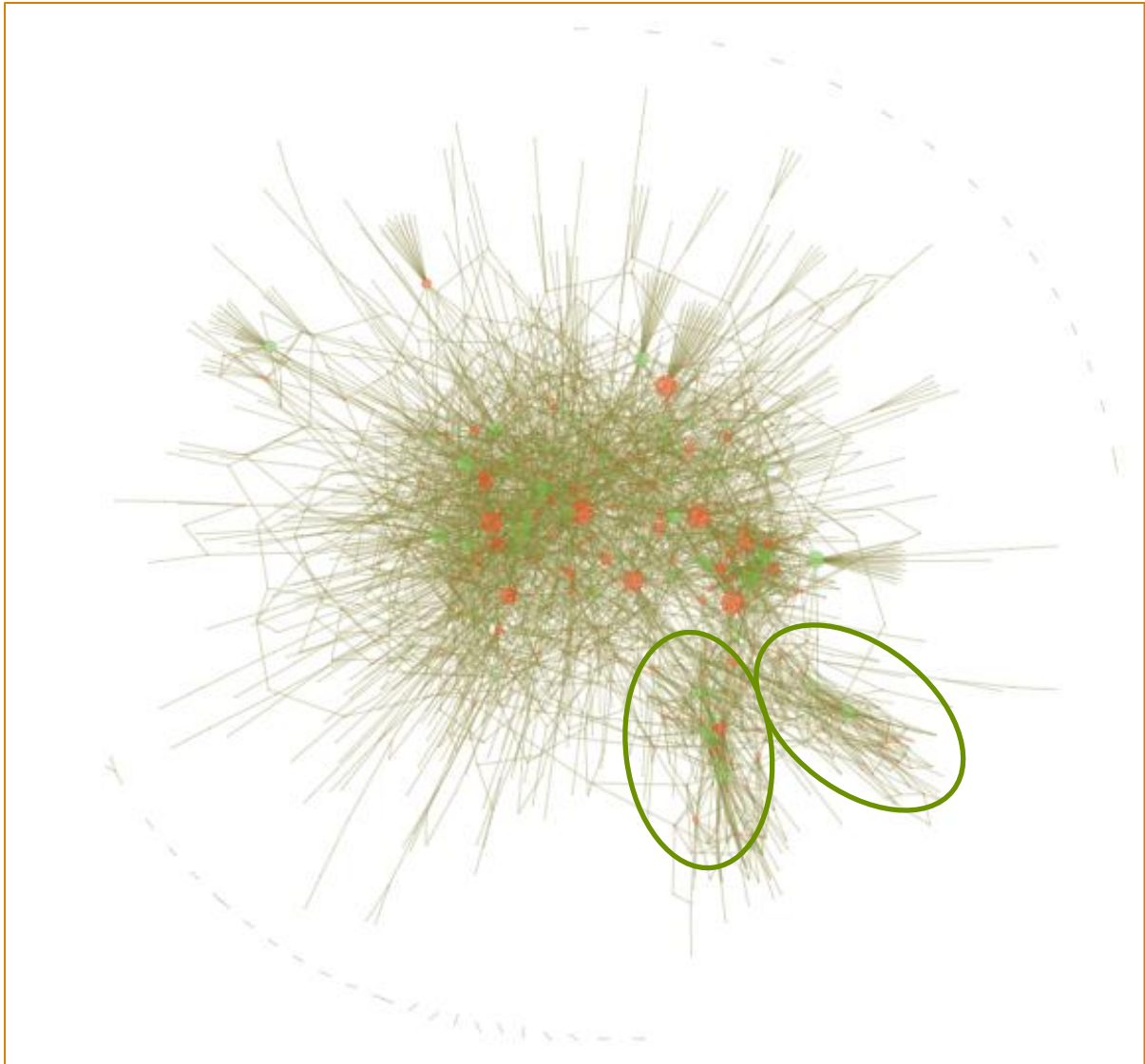
## 5. Identifying state capture patterns

This section makes the leap from corruption in binary contractual relationships to state capture defined by network structure. This entails first describing the total contractual network; second directly representing and visually inspecting the sub-graphs of high and low corruption risk contracts hypothesized (Figure 1); third, formally clustering organisations in terms of the corruption risks of their contracting activities; and finally exploring the network of captured organisations. Networks analysis and visualisation were conducted using R 3.0.2 igraph package.

Figure 3 and Figure 4 represent the total contractual networks of both periods with red vertices representing suppliers and green vertices denoting issuers. Vertex size reflects degree centrality and vertex location is a function of network closeness, specifically Fruchterman-Reingold layout function. Edge width reflects corruption risks (CRI) of the contracts underlying each edge. Green circles in each figure highlight some clusters which are identifiable by visual observation.

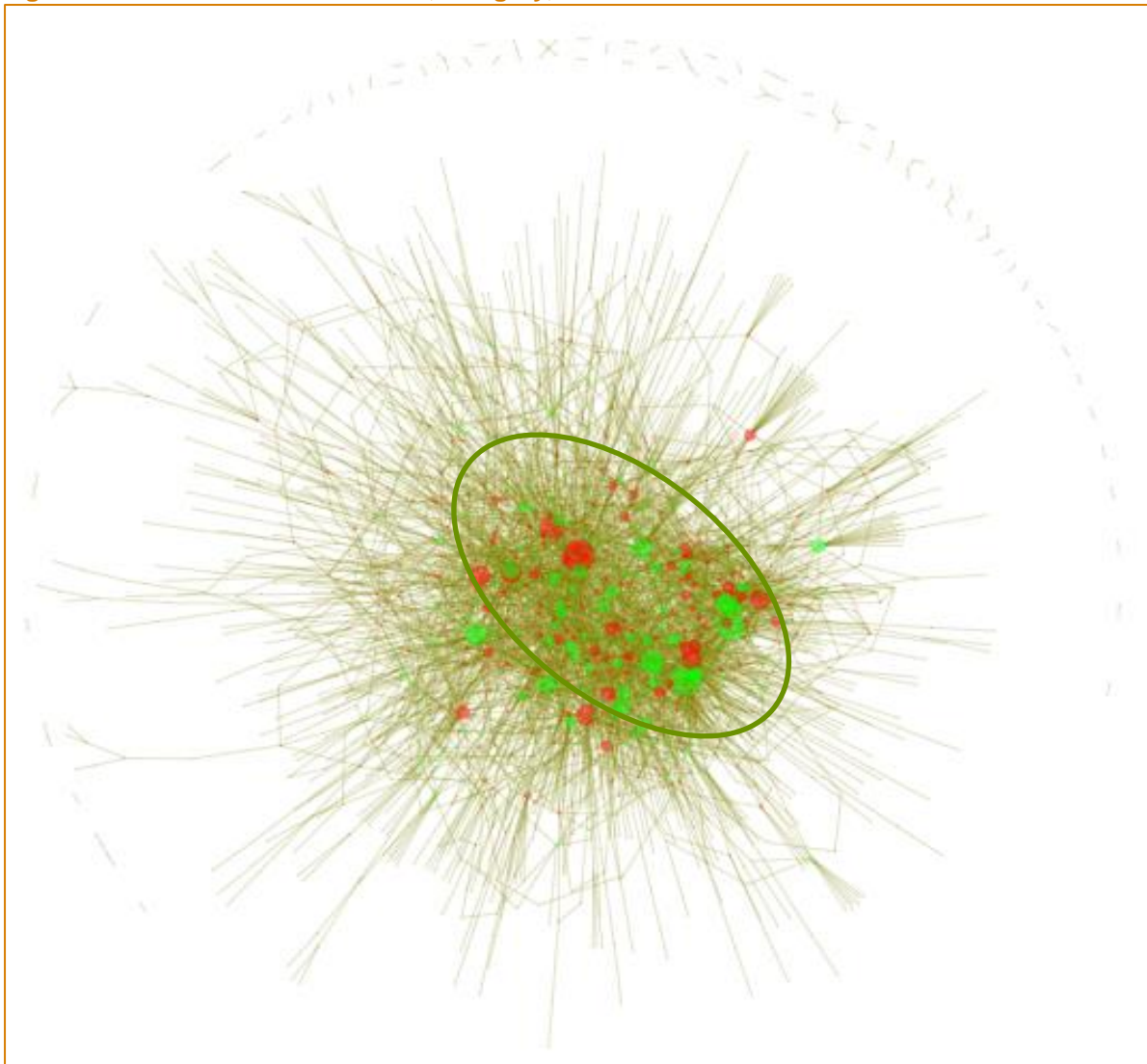


Figure 3. Total contractual network, Hungary, 2009M1-2010M4



Source: PP

**Figure 4. Total contractual network, Hungary, 2011M1-2012M7**



Source: PP

The contractual networks of both periods are fundamentally similar as described by elementary network summary statistics (Table 5.). This underlines the continuity of government contracting in spite of radical change in governance since 2010. Nevertheless, before the comparative analysis of the two periods (see section 6), the 2009-2010 network appears to have a number of sub-centres away from the core of the graph (see the circles on Figure 3). This is also reflected in the somewhat higher transitivity score for 2009-2010. Whereas the 2011-2012 network is much more centralised with dense clusters very close to the core (see the one large circle on Figure 4). These differences shouldn't come as a surprise given the strong centralising tendencies in the Hungarian public administration since May 2010.

**Table 5. Elementary network descriptive statistics per period, Hungary, 2009-2012**

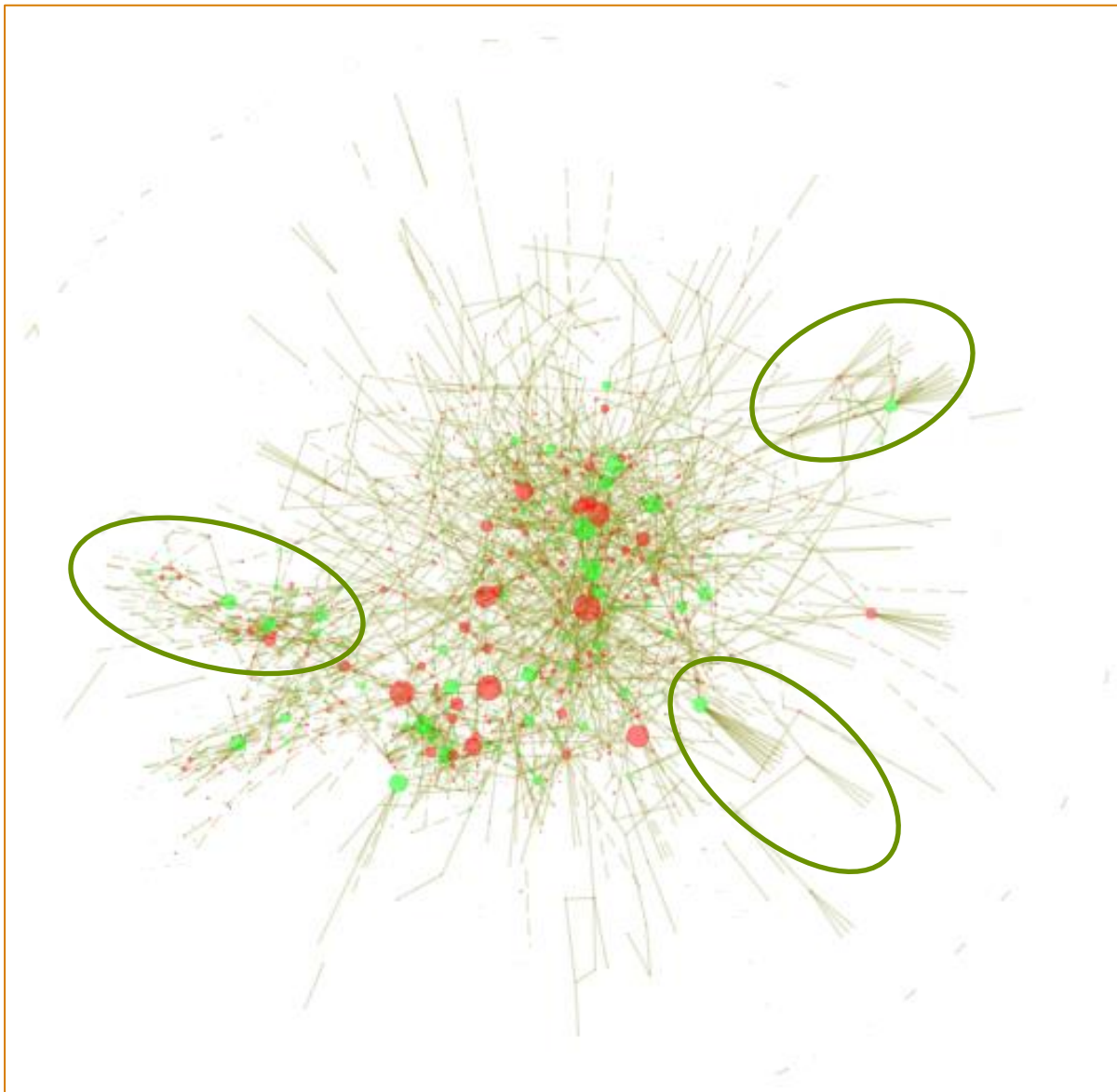
	Density	Avg. Dist.	Radius	Diameter	Fragment.	Transitiv.	Norm. Dist.
2009M1-2010M4	0.004	5.284	1	13	0.071	0.277	0.308
2011M1-2012M7	0.003	5.449	1	17	0.119	0.263	0.317

Source: PP

In order to directly project the stylised network configurations onto the empirical data (Figure 1), high and low corruption risk contracts were denoted as those with the highest 20% CRI scores and those with the lowest 20% CRI scores respectively. The contracts with CRI scores around the mean were excluded from the representation. The resulting graphs are depicted in Figure 5 and Figure 6 for the two periods separately. The graphs created using the same color-coding and network layout as before (average CRI edges were still used for calculating network distance, but they are invisible on the graphs to make the relevant links more apparent).

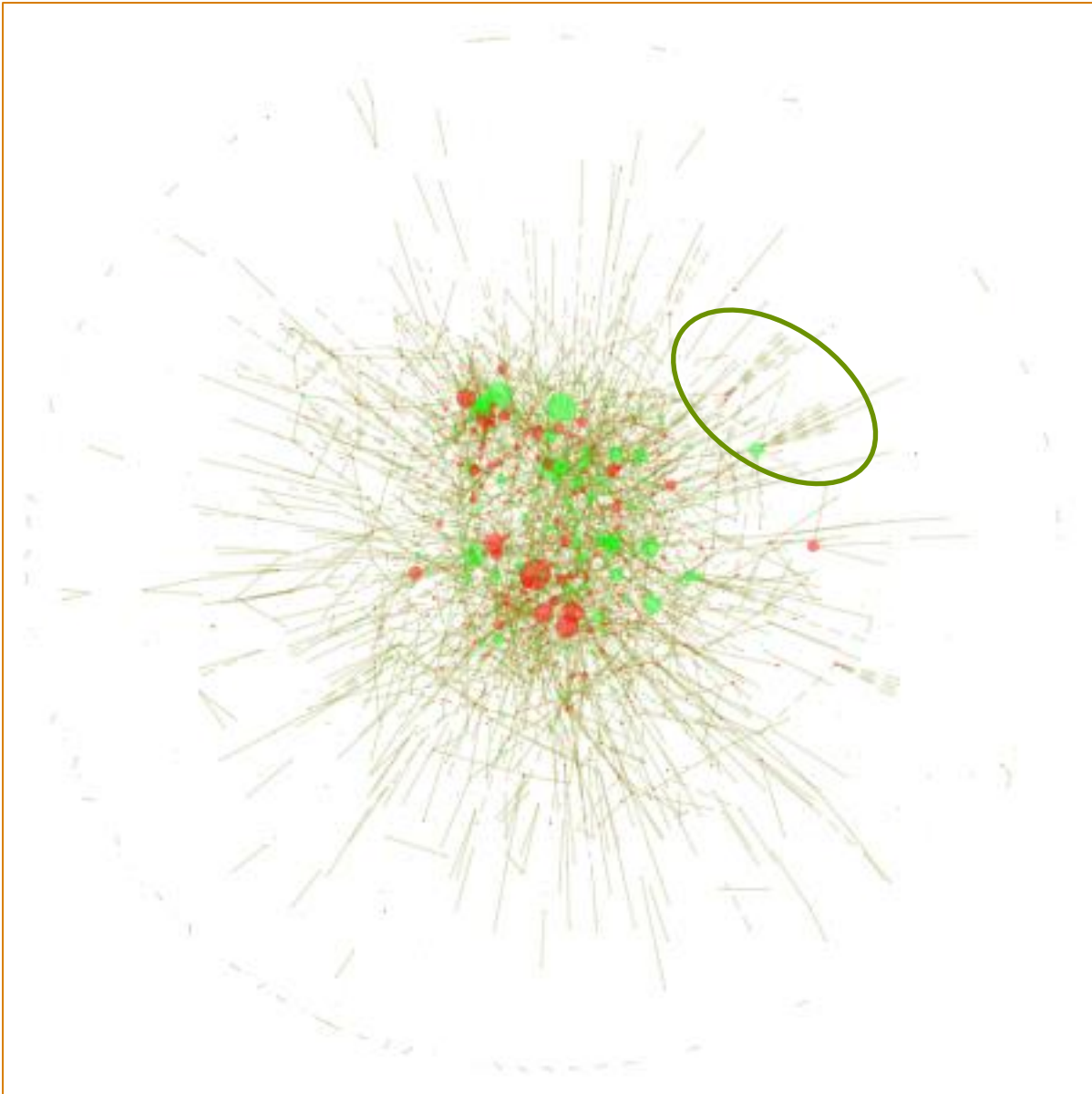
What is clearly visible on both graphs is that there are at least a few clusters of organisations which tend to be linked either by low or high corruption risk edges. Some examples are highlighted by green circles. These simple visual representations provide sufficient grounds for conducting formal cluster analysis in order to identify 'pockets of' state capture.

**Figure 5. Contractual network using low and high CRI contracts only, Hungary, 2009M1-2010M4**



Source: PP

Figure 6. Contractual network using low and high CRI contracts only, Hungary, 2011M1-2012M7



Source: PP

In order to reliably identify clusters of high and low corruption risk organisations, we identified organisation types based on their corruption behaviour; then, we mapped these actors onto the contractual networks to see where they are located, how closely they are associated with each other.

We clustered supplier and issuer organisations in one step based on each organisation's average CRI and the relative standard deviation of CRI (clustering procedures carried out with stata 12.0). Clustering based on these two variables allowed us to capture to what degree each organisation's ego network fits the homogenous or heterogeneous corruption

patterns hypothesised. While the above theory suggested clean, fully captured and mixed clusters, the clustering algorithms<sup>6</sup> instead revealed four groups (Table 6):

- Clean organisations: low average corruption with low variability of performance;
- Occasionally corrupt organisations: low average corruption with highly variable performance indicating that there are occasional deviations from the low corruption standard contracting practice;
- Partial capture: high average corruption with high variability indicating that there are still low corruption contracts which, nevertheless, represent the deviation from a high corruption norm.
- Full capture: high average corruption with low variability of performance indicating that corrupt exchanges represent the norm in the organisation's contracting practice.

**Table 6. Clusters' mean value of the clustering variables, Hungary, 2009-2012**

cluster/stat	2009M1 – 2010M4		2011M1 – 2012M7	
	CRI(stand.)	Relative st.dev.of CRI	CRI(stand.)	Relative st.dev.of CRI
Clean	0.268	0.103	0.226	0.117
occasional corruption	0.242	0.517	0.240	0.481
partial capture	0.304	0.304	0.314	0.282
full capture	0.549	0.140	0.459	0.119
Total	0.332	0.260	0.312	0.244

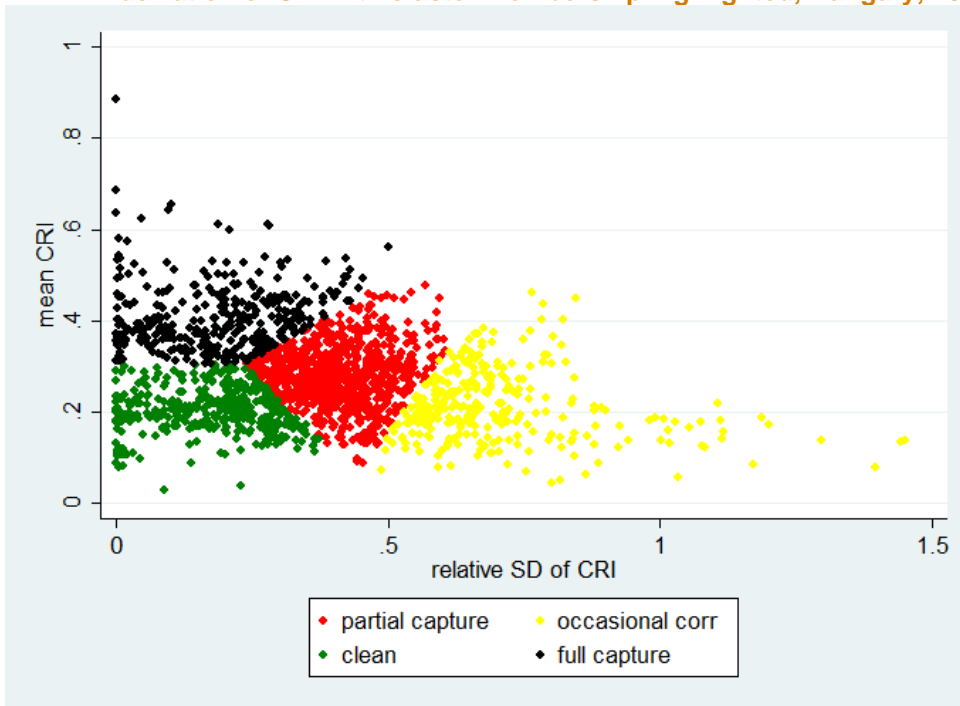
Source: PP

These clusters are also depicted according to their characteristic variables in Figure 7 and Figure 8 for both periods. These point out that there are no clear borders between clusters in spite of them being statistically significant; rather there is a continuous distribution of organisations along the dimensions of state capture. While there are many organisations of low average corruption risks with occasionally corrupt contracts the opposite is relatively rare in the data: there are few organisations which have high corruption risks on average, but occasionally conduct a low corruption contracting procedure.

<sup>6</sup> We first implemented a hierarchical clustering procedure to identify the optimal number of clusters (relying on Calinski/ Harabasz pseudo-F and Duda/Hart indices). Then using k-means clustering, the final clusters were identified. Euclidian distance measure was used.

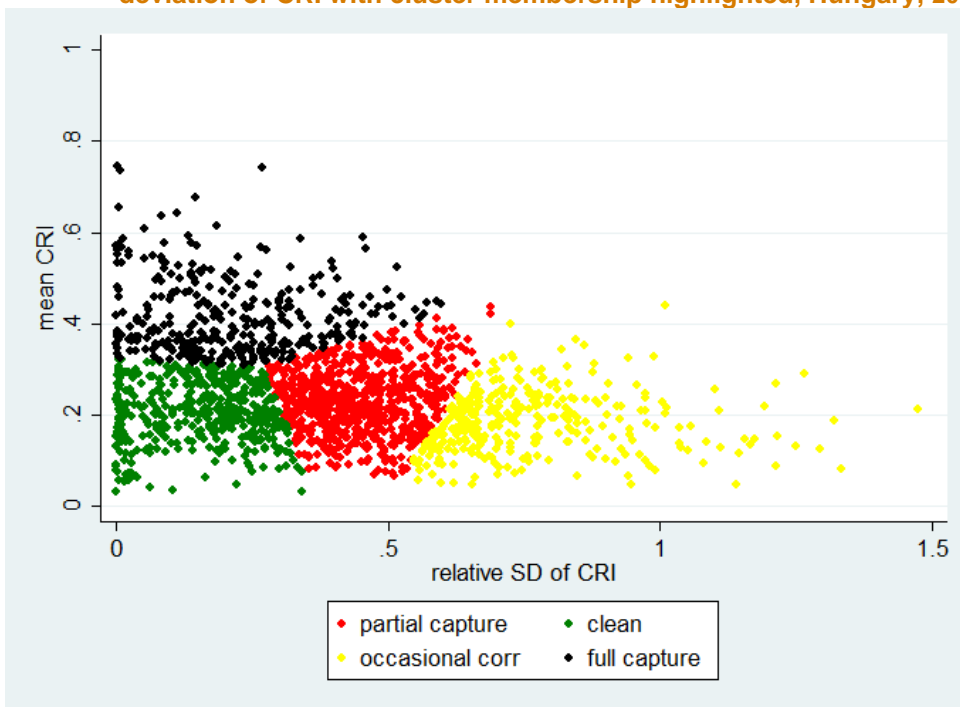


**Figure 7. Distribution of organisations according to average CRI and relative standard deviation of CRI with cluster membership highlighted, Hungary, 2009M1-2010M4**



Source: PP

**Figure 8. Distribution of organisations according to average CRI and relative standard deviation of CRI with cluster membership highlighted, Hungary, 2011M1-2012M7**



Source: PP

Comparing the two periods, there is no considerable difference in terms of proportions of each group: about 60 percent of organisations are partially or fully captured in Hungary (Table 7). This is a surprisingly high figure, but it also signals that the Hungarian state is not fully captured, but rather there is a range of organisations with mixed track record. This



indicates that the norm of ethical universalism is only partially established and there are organisations where opposing norms are in conflict.

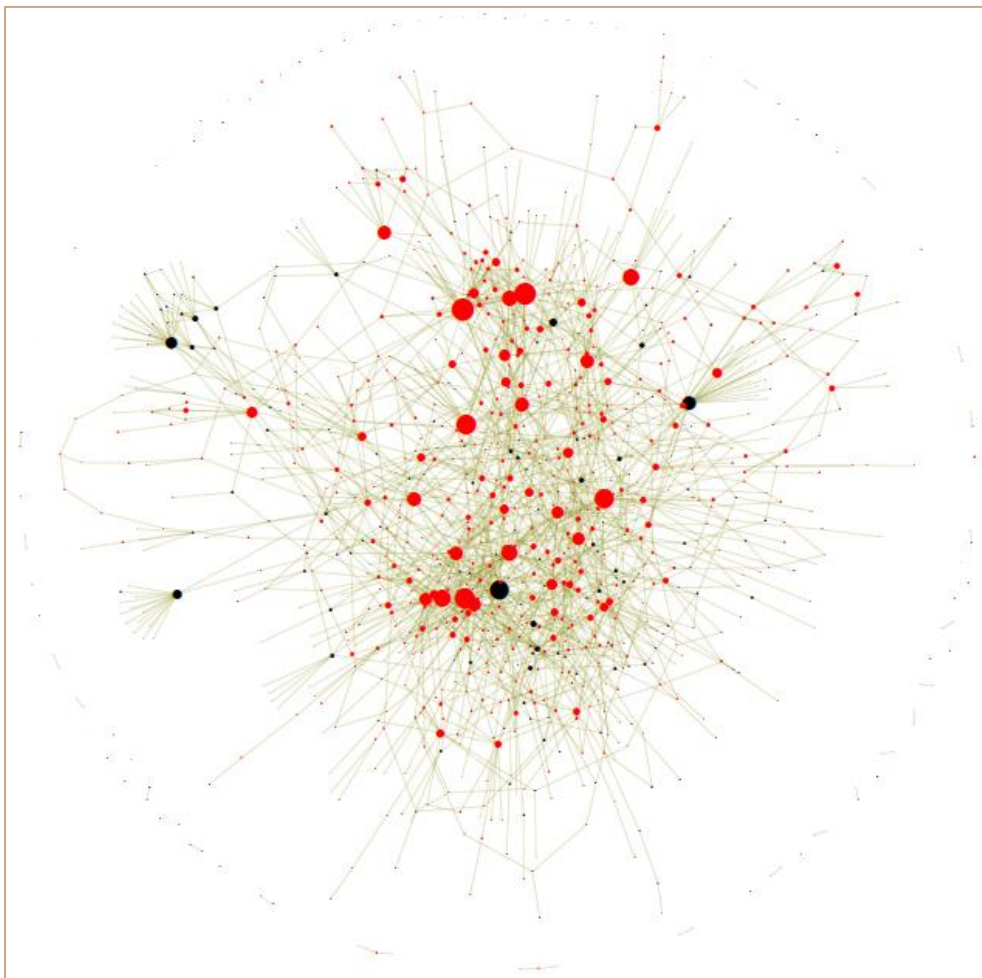
**Table 7. Number and proportions of organisations in the four clusters, Hungary, 2009-2012**

cluster/stat	2009M1 – 2010M4			2011M1 – 2012M7		
	N	%	cum. %	N	%	cum. %
clean	447	24.9	25	430	22.3	22
occasional corruption	319	17.8	43	296	15.3	38
partial capture	674	37.6	80	817	42.4	80
full capture	352	19.6	100	381	19.8	100
<b>Total</b>	<b>1,792</b>	<b>100</b>		<b>1,924</b>	<b>100</b>	

Source: PP

As a final step to gauging the degree of state capture, we removed all the non-captured organisations from the network and checked to what degree these organisations form a coherent network (see Figure 9 and Figure 10). Quite shockingly, captured organisations form a dense central network in both periods with a few isolated single nodes and smaller networks of 2-5 vertices.

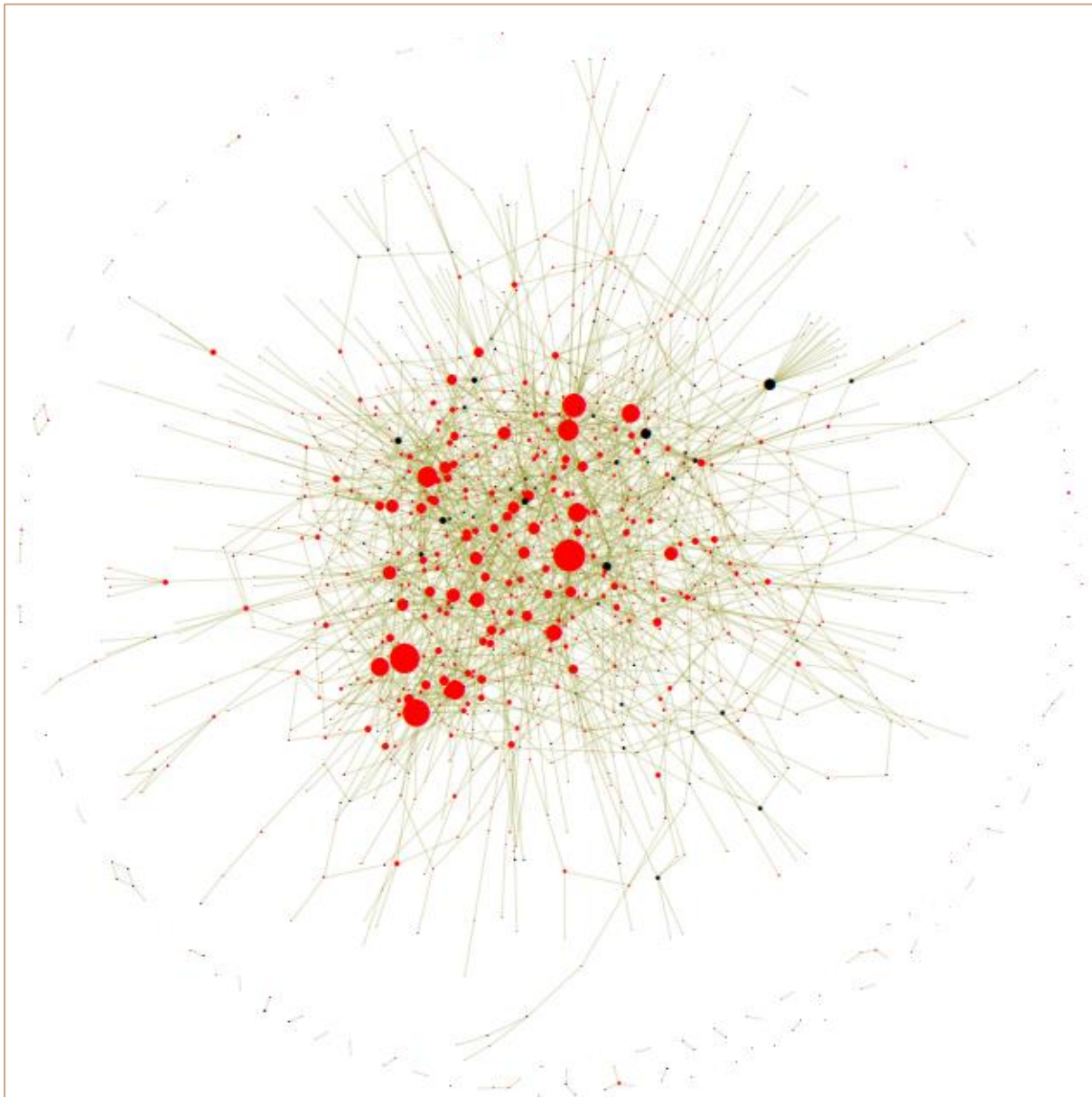
**Figure 9. Contractual network of partially and fully captured organisations, Hungary, 2009M1-2010M4**



Source: PP

Note : red vertices represent partially captured organisations and black vertices represent fully captured organisations

**Figure 10. Contractual network of partially and fully captured organisations, Hungary, 2011M1-2012M7**



Source: PP

Note : red vertices represent partially captured organisations and black vertices represent fully captured organisations

## 6. Linking state capture patterns to elite configuration

While the previous section demonstrated the logic of defining state capture in government contracting based on the network structure of corrupt transactions and actors, here we apply the framework to test a simple hypothesis: Elite centralisation of 2011-2012 in Hungary made captured organisations more central in the network. While the test remains of simple, it is nevertheless sufficient to demonstrate the empirical value of the state capture measurement methodology.

In the preceding section, it was highlighted that the 2011-2012 network is more centralised than the 2009-2010 network. While no formal test was offered, it lent some initial support to hypothesis H<sub>1</sub> on increasing centralisation of rent extraction parallel to centralisation of the governing elite.

In order to formally test the centralisation hypothesis, we look at how network position predicts corruption risks in the two periods. For this we use closeness as a simple organisational centrality measure and average organisational CRI, respectively<sup>7</sup>. Closeness in social network analysis expresses a node's normalised distance from all other nodes (Freeman 1978). While it is a global measure, it can be misleading when applied to disconnected graphs such as ours (Opsahl, Agneessens, and Skvoretz 2010), a point we will return to. Regressing closeness and closeness squared on CRI while controlling for organisation type and number of contracts awarded or received reveals that the relationship between centrality and corruption risks changed between the two periods (Table 8)<sup>8</sup>. Expressed by the large positive coefficient of the quadratic closeness variable in the 2011-2012 period, it is suggested that high corruption risks became more characteristic of central actors in 2011-2012 compared to 2009-2010. These associations, while very elementary and explaining only a fraction of total variance, lend some support to hypothesis H<sub>1</sub>.

**Table 8. Linear regressions on average organisational CRI, coefficients and t values are reported, Hungary, 2009-2012**

	2009-2010	2011-2012
Closeness	-1.227*	-1.946*
t	-1.990	-4.950
Closeness squared	1.250	2.415*
t	1.220	3.590
Organisation type=private	0.020*	-0.013*
t	3.740	-2.600
Number of contracts	0.000*	0.000*
t	2.890	-2.420
N	2052	2313
R2	0.0244	0.0847

Source: PP

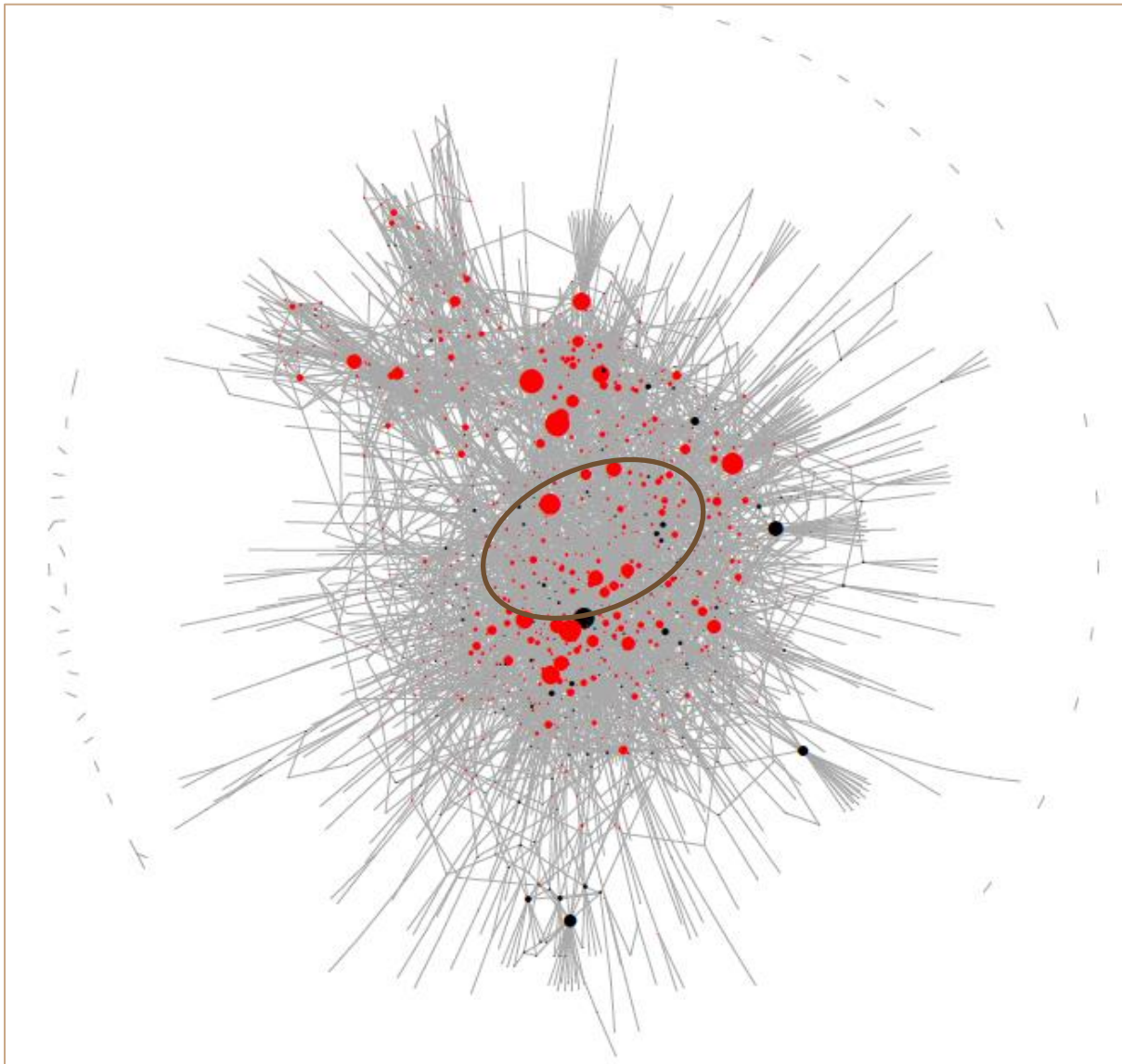
Note: \* indicates statistical significance at the 5% level

In order to directly analyse the network position of the clusters identified above, the fully and partially captured organisations are highlighted in the contractual networks of the two periods (see: Figure 11 and Figure 12). What becomes immediately visible when comparing the two periods is that many of the captured organisations move to the centre of the graph (i.e. closer to all the other nodes). While in 2009-2010 there was an almost complete absence of fully and partially captured organisations (see the circle in the middle), in 2011-2012, a number of captured organisations moved towards the centre of the graph (see the circles highlighting the groupings).

<sup>7</sup> Further indicators shall be considered later on such as local and global clustering coefficients.

<sup>8</sup> The regressions are run on a restricted sample excluding all the disconnected small sub-graphs.

Figure 11. Total contractual network with captured organisations highlighted, Hungary, 2009M1-2010M4

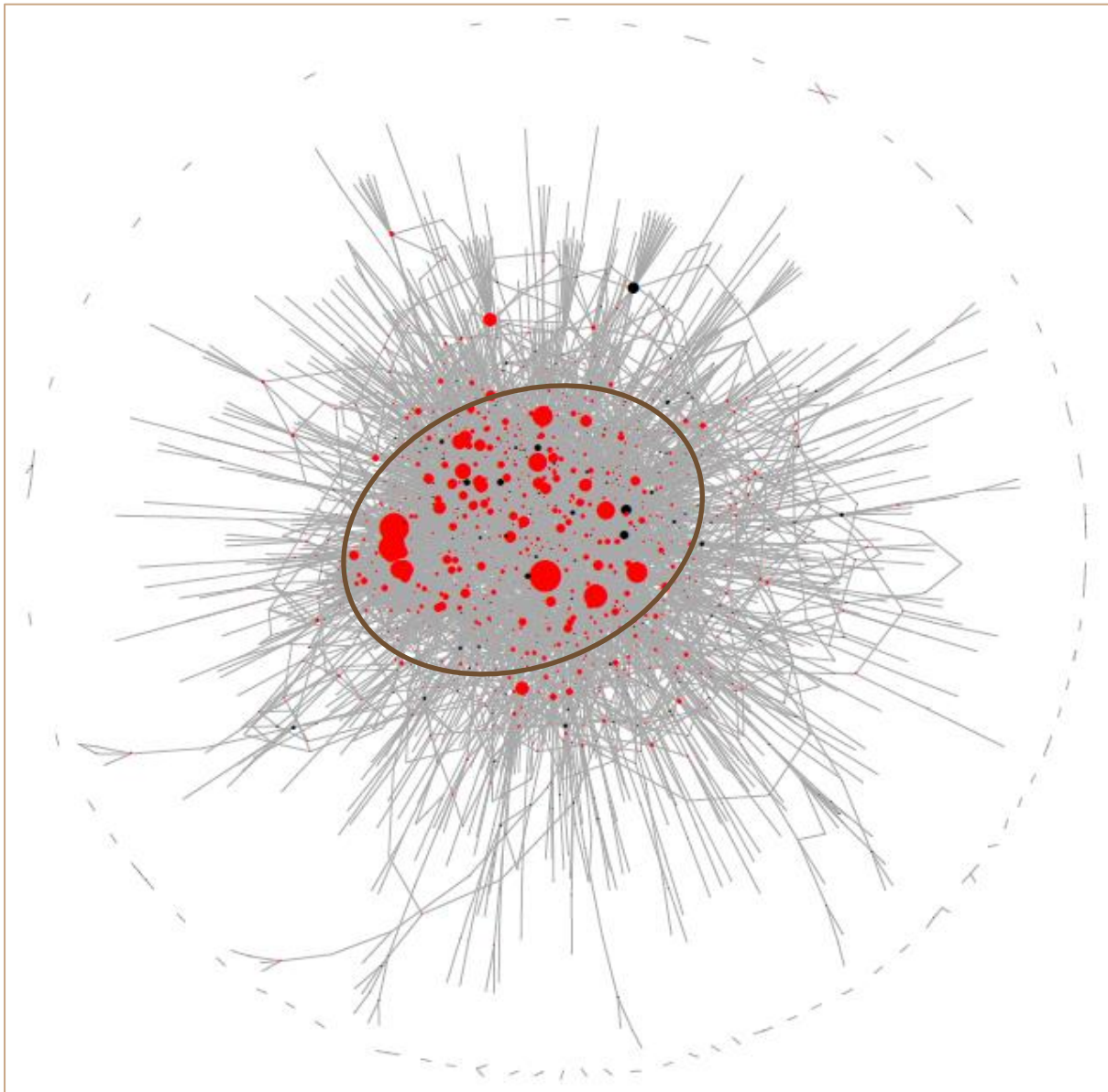


Source: PP

Note: red vertices represent partially captured organisations and black vertices represent fully captured organisations



Figure 12. Total contractual network with captured organisations highlighted, Hungary, 2011M1-2012M7



Source: PP

Note: red vertices represent partially captured organisations and black vertices represent fully captured organisations

These visual observations are further supported by the increasing average closeness of the partially and fully captured organisations (Table 9). Even though outliers substantially influence results, they indicate that state capture has become more of a core characteristic of Hungarian public spending in 2011-2012 in line with our hypothesis  $H_1$ .

**Table 9. Average centrality indices per clusters, Hungary, 2009-2012**

	Closeness	
	2009-2010	2011-2012
ref.cat.=clean		
occasionally corrupt	-54.9	65.0
t	-1.59	1.57
partial capture	-80.4*	3.8
t	-2.78	0.10
full capture	107.4*	191.0*
t	3.18	4.50
N	1792	1924
R2	0.022	0.020

Source: PP

Note: \* indicates statistical significance at the 5% level

## 7. Conclusions and further work

The discussion and analysis so far have pointed out the feasibility and usefulness of measuring corruption using transaction-level public procurement data and linking the so-measured corruption indicator to state capture. Further validating work should shed more light on the reliability and validity of this approach. Applying the measurement framework to a straightforward research problem provided further evidence for its relevance, even though it was not possible to fully explore the hypotheses.

Regarding the causal link between elite composition and structure of state capture, there is a crucial limitation. It is unclear to what degree the centralisation of corruption and state capture is the function of the reorganisation of the public administration or the governing elite structure. These two events would have equivalent consequences in network terms and they happened at the same time. However, differentiating the two causal pathways is irrelevant as long as the main concerns are the changes in state capture and the consequences it has to the society. In addition, as CRI primarily measures outright corruption and lack of competition, more sophisticated, organised forms of corruption remain largely undetected. If the structure of state capture and network position of corrupt transactions are related to the sophistication of corruption techniques, our results are likely to be biased.

As state capture is established, daily practice in approximately 60% of Hungarian public sector organisations conducting public procurement between 2009-2012 democratic governance and fair competition for procurement contracts are in serious trouble. Providing large amounts of EU funding to these organisations would most likely further increase rents extracted and their capacity to compromise democratic governance.

The networked nature of political corruption in Hungary makes any administrative fixes to corruption likely to fail. Instead a big-bang approach to anticorruption is the only realistic strategy (Rothstein 2011).



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