CERGE
Center for Economic Research and Graduate Education
Charles University Prague

Economic Impact of Voting and Procurement Rules

Ján Palguta

Dissertation

Prague, September 2016

Dissertation Committee:

Randall K. Filer (CERGE-EI, Charles University; City University of New York, Chair)

Daniel Münich (CERGE-EI, Charles University, Local Chair)

Libor Dušek (University of Economics in Prague)

Filip Pertold (CERGE-EI, Charles University)

Gérard Roland (University of California, Berkeley)

Referees:

Sergei Guriev (Sciences Po, Paris)

Thorvaldur Gylfason (University of Iceland)

Table of Contents

Abstract

In the first chapter of this dissertation, I examine the impact of increasing the number of parties in political representation bodies on public spending and selection of politically-connected suppliers in public procurement. By exploiting plausibly exogenous variation in the vote share of parties near the representation threshold in Czech municipal elections, I find that municipalities having more parties represented in their councils allocate fewer procurements to corporate donors of political parties, attract more suppliers to procurement tenders and reduce procurement prices. The impact of broader party representation is pronounced in politically competitive councils, but is not related to whether marginally represented parties are incumbent or not.

The second chapter presents evidence of how policies that create opportunities to avoid open competition in procurement lead to the manipulation of procurement values. We exploit a policy reform in which public bodies were given autonomy to preselect potential contractors below newly defined discretionary thresholds. Manipulation is revealed through bunching of procurements just below the thresholds in construction works and services, and to a lesser degree, in goods. Among manipulated contracts, we document a threefold increase in the probability that procurements are allocated to anonymous firms, which can hide their owners. This sorting violates assumptions behind regression-discontinuity designs.

The third chapter explores strategic voting behavior of individuals in small collective decision-making bodies. I use computation-based simulations to quantify the vulnerability of the ten most common voting rules to strategic voting manipulation. I study how the ability of the strategic voter to swing the voting outcome in her favor changes when she loses full information about other voters' preferences. I find that Condorcet-consistent rules are most resistant to strategic voting, followed by elimination procedures and the simplest voting rules. The voting results can be more easily manipulated, when the size of the committee is smaller and more alternatives are considered. I find that a minimal reduction in strategic voter information about other voters' preferences severely inhibits the possibility of strategic voting.

Abstrakt

V první kapitole dizertační práce zkoumám, jak počet politických subjektů v zastupitelských orgánech měst a obcí ovlivňuje veřejné výdaje a výběr dodavatelů s politickými konexemi ve veřejných zakázkách. V kapitole porovnávám zastupitelstva měst a obcí, ve kterých se některé ze stran a hnutí umístily v blízkosti hranice pro vstup politických subjektů do zastupitelstva. Metodou regresní diskontinuity zjišťuji, že zastupitelstva s větším počtem zastoupených politických stran zadávají méně zakázek dodavatelům, kteří politické strany sponzorují. Tato zastupitelstva rovněž dosahují vyšší cenové úspory v zakázkách a otevírají je většímu počtu nabízejících dodavatelů. Vyšší počet stran ovlivňuje veřejné zakázky především v zastupitelstvech s vyšší mírou soutěže mezi politickými stranami.

Druhá kapitola ukazuje, jak reformy zákona o veřejných zakázkách, které vytvářejí příležitosti pro vyhýbání se otevřené soutěži v zakázkách, vedou k manipulacím s hodnotou zakázek. Kapitola využívá reformu veřejných zakázek z roku 2006, která dala veřejným zadavatelům možnost předvybírat do soutěže potenciální dodavatele pod nově definovanými limity v hodnotě zakázek. Manipulace zakázek se projevily jejich kumulacemi těsně pod limity pro stavební práce a služby, a méně u dodávek zboží. U manipulovaných zakázek došlo k trojnásobnému nárůstu pravděpodobnosti, že zakázky budou zadány anonymním firmám, které skrývají své konečné vlastníky. Toto třídění porušuje předpoklady pro využití metody regresní diskontinuity na limitech ve veřejných zakázkách.

Třetí kapitola zkoumá strategické hlasování jednotlivců v malých kolektivních orgánech. Kapitola využívá simulace voličských preferencí, aby kvantifikovala odolnost deseti nejběžnějších volebních procedur vůči manipulacím výsledků hlasování skrze misreprezentaci preferencí voličů. V kapitole zkoumám, jak se mění schopnost strategického voliče manipulovat s výsledkem hlasování, když ztratí plnou znalost hlasovacích preferencí ostatních členů hlasovací komise. Mezi hlavní zjištění patří, že nejodolnější vůči strategickému hlasování jsou hlasovací procedury konzistentní s kritériem Condorcetova vítěze, dále eliminační hlasovací procedury a nakonec nejjednodušší hlasovací pravidla. Hlasovací výsledek lze manipulovat tím snadněji, čím menší je kolektivní orgán a čím vyšší je počet posuzovaných alternativ. Minimální omezení informovanosti strategického voliče o preferencích ostatních voličů výrazně znesnadňuje strategické hlasování.

Acknowledgements

I would like to express my gratitude to everyone who has helped me in my dissertation work and throughout my studies.

I am very grateful to my supervisor, Randall K. Filer, who has provided me with his continuous guidance, advice, and encouragement. I would also like to thank the members of my dissertation committee, Daniel Münich, Libor Dušek, and Gérard Roland, for their advice and comments, which helped me shape, improve and finish my work. I am especially grateful to Filip Pertold, who spent an incredible amount of time trying to teach me how to write academic papers. Many thanks belong also to other professors and researchers at CERGE-EI and to my former supervisor at the Institute of Economic Studies at the Charles University, František Turnovec, who introduced me to the field of my research and provided me with much initial advice and inspiration.

Great thanks go also to my fellow students and friends at CERGE-EI, especially to Vojtěch Bartoš, Jana Cahlíková, Peter Čižmár, Klára Kalíšková, Dáša Katreniakova, Tomáš Lichard, Tomáš Miklánek, Lenka Pavlíková and Branislav Žúdel, for inspiring discussions, advice and encouragement, that made my studies lighter and more enjoyable. Most of all, I would like to thank my family for their support, love and patience.

All errors remaining in this text are my responsibility.

Prague, Czech Republic Ján Palguta

September, 2016

Introduction

This dissertation examines the economic impact of voting and procurement rules. The first chapter studies how electoral representation thresholds affect the number of political parties in public representation bodies, and how the number of parties represented shapes public spending and the selection of suppliers in public procurement. The second chapter studies the economic impact of policies that create opportunities to avoid open competition in procurement. The third chapter inspects the vulnerability of the most common voting rules to strategic voting manipulation.

The impact of voting and procurement rules has been widely studied in the literature in public economics and political science, which have produced many important insights over the last few decades. On numerous instances, however, the literature has stumbled upon challenges estimating the impact of voting and procurement rules without bias, mainly due to the non-random nature of elections, public procurement regulations, and other public and political institutions.

This thesis contributes to the current literature by providing novel estimates of the economic consequences of selected voting and procurement rules, while addressing the endogeneity of public and political institutions. In particular, the first chapter offers new evidence about the impact of having broad political representation on public spending and selection of politically-connected suppliers in public procurement. This chapter uses a novel method to deal with the endogeneity of political representation, namely, it uses quasi-random variation in the vote share of political parties near the representation threshold in proportional elections. The second chapter provides new estimates of the economic impact of policies which create opportunities to avoid open competition in public procurement. The timing of the introduction of these policies enables me to isolate their effect on manipulative behavior in procurement from other factors that can lead to economic distortions. The third chapter provides new insights into the effect of having complete information about the preferences of all voters in small committees on the vulnerability of the most common voting rules to manipulation by strategic committee memebrs. The exogenous simulation of voters'

preferences enables me to study the impact of withholding some information from the strategic voters on their chances to swing the voting outcome into their favour by misrepresenting their voting preferences.

The first chapter builds upon the idea that voters use elections to screen and discipline politicians. In such case, increasing the number of political parties that are able and willing to monitor the behavior of each other should enhance electoral accountability and improve the efficiency of public spending. In order to test this hypothesis, I compare municipal councils in the Czech Republic where some parties scored either just below or just above the electoral representation threshold. This empirical strategy enables me to show that local councils with more parties represented behave in a more politically accountable manner. In particular, they allocate fewer procurements to suppliers which are donors of political parties. At the same time, local councils with more parties achieve higher price savings in procurements and make their auctions more competitive by attracting more suppliers into their auctions. The impact of broader party representation is pronounced in politically competitive councils and in councils where the strongest party has low bargaining power. The results highlight the value of political competition as an important pre-requisite for political accountability in elections.

The second chapter, a joint work with Filip Pertold, is forthcoming in the *American Economic Journal: Economic Policy*. In this chapter, we exploit a policy reform which instituted new legislative thresholds in public procurement. Below these thresholds, public officials gained the discretion to preselect potential contractors into restricted auctions. Above the thresholds, public authorities had to run open, transparent auctions. The chapter contributes to the existing literature by showing how the establishment of discretionary thresholds led to distortions in the behavior of procurement officials, who started to manipulate the values of procurements. This manipulation led to bunching of procurements just below the newly defined thresholds. We find greater bunching in sectors where setting the value of procurements is less transparent, such as in the construction and services sectors. At the same time, we find that the introduction of discretionary thresholds is associated with an increase in the probability that procurements are allocated to anonymous firms that lack transparency about their owners. This sorting violates the assumptions necessary for regression discontinuity designs in procurement.

The third chapter, which is published in the *Czech Economic Review*, explores strategic voting behavior of individuals in small collective decision-making bodies. The chapter simulates the ten most common voting rules and quantifies how often they deliver a manipulated voting outcome due to strategic misrepresentation of voting preferences by strategic voters. The chapter studies how the ability of the strategic voter to manipulate the voting outcome changes when the strategic voter loses some information about other voters' preferences. The explicit simulation of the preferences of all voters enables me to show that Condorcet-consistent rules are most resistant to strategic voting manipulation, followed by elimination procedures and the simplest voting rules. The smaller the size of the committee and the more voting alternatives are considered, the more easily the voting outcome can be strategically manipulated. Importantly, I find that a minimal reduction in strategic voter's information about other voters' preferences severely inhibits her ability to strategically misrepresent her voting preference. This result softens the dismal theoretical predictions of the theory of public choice, which claims that all non-dictatorial and universal voting rules can be subject to strategic voting manipulation.

1 Chapter

Does Party Representation Matter for Public Procurement? Evidence from Regression Discontinuity Design

1.1 Introduction

In democratic theory, political parties are screened and disciplined through competitive elections (Manin, Przeworski and Stokes 1999). If voters can use information from competing political parties to oust sub-performing incumbents from their office, then increasing the number of parties that are willing and capable of delivering information to voters can promote electoral accountability and improve the efficiency of public spending (Gordon and Huber 2007; Gordon, Huber and Landa 2007; Ferraz and Finan 2008, 2011; Ashworth 2012).

Estimating the impact of having more political parties in political representation on public spending, however, poses a challenging empirical problem. New parties tend to become established and represented particularly when satisfaction with political incumbents is low, which can lead to reverse causality concerns. The democratic nature of electionscan also lead to omitted variable bias due to unmeasured voter preferences. [1,2]

[1] Using cross-country variation to identify the effect of the number of the represented parties is just as difficult, whereas barriers to political representation that likely reduce the number of the represented parties seldom change and tend to be highly correlated with other political institutions across countries.

[2] For work that stresses the endogeneity of other political institutions, see for example Aghion, Alesina and Trebbi (2004) and Trebbi, Aghion and Alesina (2008).

This chapter builds on the methodological framework of Pettersson-Lidbom (2008) and Folke (2014) to develop a regression discontinuity (RD) design to estimate the causal impact of increasing the number of political parties in political representation on expenditures and selection of politically-connected suppliers in public contracting. Exploring these issues is important as dozens of modern democracies use some type of proportional elections, which tend to generate multi-partisan representation (Duverger 1954). In addition, OECD countries alone redistribute 13% of GDP in public procurement markets (OECD 2013), which can provide fertile ground for administrative inefficiencies and political corruption (Bandiera, Pratt and Valetti 2009).

I address the endogeneity of political representation by exploiting the minimum requirement on the vote share that qualifies parties for seat allocation in political representation bodies. Assuming that sufficiently close to the representation threshold the seat allocation can be viewed to be as good as random, then the representation bodies with some parties scoring sufficiently close to either side of the threshold can be viewed as equal in all aspects, except for a different number of the represented parties. Any observed differences in policy outcomes on the opposite sides of the threshold can thus be attributed to the effect of broader representation, which is identified separately from the effects of institutional factors and electoral selection.

Although the methodology is intuitively simple and applicable in many countries, the empirical design still needs to take into account that political representation is jointly determined by the vote shares of all political parties. This study therefore implements the discontinuity design in a fuzzy form (Campbell 1969), which can account for the fact that exceeding the threshold does not guarantee seats for every party automatically, e.g. in small councils where several parties barely exceed the threshold.

This empirical strategy is applied to data that include information about all political parties running in the 2006 municipal elections in the Czech Republic. I connect these data to information about all construction procurements awarded by the local councils during the 2006-2010 electoral term. The data contain details about individual procurements, including information about contract prices, bidder competition, and the use of specific contract-award procedures. Their shortcoming is that they do not include information about procurement quality and contract renegotiations, which precludes overall analysis of the impact of broader party representation. On the other hand,

I match the data to detailed information about procurement suppliers, including information about all post-electoral corporate donations to all political parties.

My results show that having broader party representation reduces the probability that procurements are allocated to corporate donors of political parties. Municipalities with more parties represented in their councils also allocate procurements at lower prices and spend a lower share of their budgets on public procurement. Comparing the RD results to point estimates from ordinary least squares (OLS), I find that the OLS method underestimates the impact of broader party representation on contract prices and selection of political donors as procurement suppliers.

These results can be viewed as concrete illustration how the size of public spending and the preference of public officials to select politically-connected firms as procurement suppliers can be subject to the composition of political representation. The observed bias arising due to endogenous representation formation underscores the importance of using quasi-random variation for estimating party representation effects. Although I cannot assess the impact of broadening the representation on procurement quality and contract renegotiations, the results seem to agree with the literature suggesting positive effects of broad party representation on public spending efficiency.

The chapter brings further important results by examining characteristics of procurements that can potentially drive low contract prices and less probable selection of political donors as procurement suppliers. I find that public officials in local councils with more parties attract more suppliers to procurement tenders and more frequently use discretionary procurement procedures that allow public officials to autonomously invite firms to procurement.[3] My findings thus suggest that the observed impact of broader representation on procurement outcomes is likely driven by higher competition among suppliers and selective invitations of firms that do not have political connections.

I further inspect three potential mechanisms behind the estimated party representation effects. First, I find that broadening representation by non-incumbent parties cannot explain my results. I

[3] Using discretion to pre-select suppliers is considered common in private-sector procurement (Kelman 1990). In this way, procurement officials can disregard suppliers who e.g. had delivered low quality in the past or those who may seem undesirable due to their political connections.

observe lower procurement prices and restricted allocation of contracts to political donors irrespective of whether marginally represented parties are incumbent parties or not. Second, I find that the selection of political donors as procurement suppliers drops due to broader party representation only in councils where political competition is expected to be higher on average. More specifically, I categorize local councils according to the victory margin of the winning party, which serves as a proxy for the intensity of the political competition. Finally, the results are also consistent with the hypothesis that broader political representation affects procurement outcomes through lowering the bargaining power of the dominant parties within councils. The political bargaining power is generally driven by the likelihood that parties are pivotal in coalition formation. Once I classify parties according to the Shapley-Shubik (1954) bargaining power index, I observe that the probability of allocating procurements to political donors drops due to broader party representation particularly in councils where the strongest party has lower bargaining power and therefore likely needs other parties to form a coalition.

My evidence thus agrees with the literature that studies sources of electoral accountability, e.g. models in the spirit of Barro (1973), Ferejohn (1986) or Banks and Sundaram (1993) predict an increase in accountability if the difficulty of retaining an elected office increases, such as in cases in which parties can better monitor each other due to their presence in the representation bodies. This literature recognizes that parties may not always have proper incentives and ability for mutual monitoring (Kunicova and Rose-Ackerman 2005). However, in line with the literature I find that the impact of broader party representation is pronounced in councils in which the incentives for mutual monitoring are strongest due to intensive political competition.

The results are further in line with the literature studying how party representation effects arise in proportional systems; e.g. in the models of political bargaining (Austen-Smith and Banks 1988; Snyder, Ting and Ansolabehere 2005), party representation drives the distribution of bargaining power among parties and subsequent policies. In this study, broader party representation improves procurement outcomes and constrains the selection of politically-connected suppliers particularly when the bargaining power of dominant parties is relatively weaker.

The chapter perhaps most closely relates to the literature that uses discontinuity designs to estimate the impact of party representation in proportional systems (Folke 2014) and the impact of partisan power control in majoritarian systems (Lee, Moretti and Butler 2004). To the best of my

knowledge, this study is the first to exploit an electoral representation threshold, although such thresholds are common in proportional systems. In line with the previous literature, I find evidence of party representation effects in the context of European municipalities (Pettersson-Lidbom 2008; Folke 2014), which stands in contrast to the lack of such evidence from US cities (Ferreira and Gyourko 2009). According to my results, having more parties in political representation matters just as much as specific partisan policy positions.

Finally, the chapter relates to the literature examining the returns to political connections, particularly when these returns take the form of public procurements (Goldman, Rocholl and So 2013; Baltrunaite 2016). This chapter complements and adds to this literature as it is the first to estimate the impact of the broadness of party representation on the allocation of procurements to political donors.

The remainder of the chapter is organized as follows. Section 1.2 discusses the institutional framework of the electoral and public procurement systems in the Czech Republic. Section 1.3 describes the data. Section 1.4 lays out the empirical strategy for identifying the effects of broadening party representation. Section 1.5 presents the results and the empirical analysis of party representation effects on spending and selection of political donors as procurement suppliers. Section 1.6 examines potential mechanisms underlying the party representation effects. Section 1.7 summarizes and concludes.

1.2 Institutional Background

Electoral system Czech Republic is a democratic country with regular, free and open elections. In the local elections, which are the focus of this chapter, members of approximately six thousand municipal councils are elected directly for four-year terms. The elections are proportional with a 5% representation threshold, which is an important element in the identification strategy as exceeding the threshold is a strong predictor for the representation of political parties in local councils.[4]

[4] The actual allocation of council seats is calculated using d`Hondt's method, which does not guarantee council seat(s) automatically to every party above the representation threshold. The seat allocation ultimately depends on the vote

Many different political subjects run in the local elections— these are either parties organized at the national level, civic local-level movements or individual candidates. Political parties draw up candidate lists on their own, bound by the rule that they cannot propose more candidates than there are seats in the local council.[5]

In Czech elections, voters can split votes across party lines using preferential votes.[6] The possibility of preferential voting creates a direct link between individual performance of politicians and their reappointment, which gives incentives to individual politicians to perform well by putting in more effort and scrutinizing the behavior of their opponents (Persson and Tabellini 2000). Furthermore, the opportunities for mutual monitoring are even stronger in elections in small districts (Chang and Golden 2007), as in the majority of municipalities in the Czech Republic.[7]

Municipal public procurement Public procurement is one of the largest public spending processes in the Czech Republic. Annually, about 16% of GDP (USD 31 billion in 2010) is spent on the procurement of goods, construction work, and services, making the Czech public procurement market one of the largest among OECD countries (OECD 2013). Municipalities represent a substantial fraction of this market as they annually spend more than 5% of GDP on public procurement.

Politicians represented in local councils hold primary responsibility for municipal procurement. Council members vote on decisions concerning the planning of procurements, the selection of suppliers, and the oversight over the execution of the procured contracts. In particular, council members approve the content of planned procurements and their value, which should approximate the expected financial obligations. Council members also approve the choice of contract-award procedures, which range from open auctions to negotiations with directly approached suppliers (see Table 1.A.1 in the Appendix for details about procurement procedures). Open auctions are expected to increase transparency, boost competition and promote equal access among potential suppliers, but they also reduce public officials' flexibility to eliminate undesirable suppliers from

share of all parties above the representation threshold and on the council size. The electoral system provides no seat premium to the party (coalition) that wins the elections.

[5] Council size is proportional to the population living in a municipality and ranges from 5 to 55.

[6] Jurajda and Münich (2014) provide detailed description of the electoral rules in the Czech Republic, including those regarding the use of a preferential vote.

[7] The council size in the Czech Republic is lower than 15 seats in 80% of municipalities in the sample.

procurement, such as those who delivered low quality in the past or those who might seem undesirable due to their political connections (Kelman 1990; Bulow and Klemperer 1996; Europe Economics 2006; Calzolari and Spagnolo 2009; Helper and Henderson 2014). The council members thus choose multiple parameters of procurements that can affect the selection of suppliers, contract prices and the amount of procurement spending.

Political corruption and oversight in procurement Czech public procurement has been often criticized for a high prevalence of political corruption.[8] Although two public institutions are responsible for the oversight of public procurement, the Czech constitution restricts one of these, the Supreme Audit Office, in its capacity to impose sanctions on municipal councils, while the other institution, the Czech Antitrust Office, has been known for its passive and formalistic approach (Transparency International 2009).

The responsibility for procurement oversight thus lies mainly with politicians elected to councils. Council members can inspect procurements both during and after the contract-allocation process. If they suspect administrative inefficiencies or risk of misappropriation of public resources, they can voice their concerns at regular council meetings, in the media or in their political campaigns. Politicians not represented in the councils face severe obstacles in monitoring municipal procurement. Their barriers to information include administrative, financial and time constraints, among others. The representation of political parties in councils therefore facilitates oversight, as it provides access to information to individuals who possess the actual oversight capability.

Financing of the political parties The financing of political parties is regulated by national legislation, which requires all political parties to disclose information about their activities and economic income. Parties receive finance either internally, such as from membership fees and the sale of property, or externally, such as from banking loans, public and private contributions (Titl, Palanský and Skuhrovec 2014). In 2014, on average 16% of overall revenues of political parties came from private contributions, individual or corporate, which are fully voluntary and unlimited

[8] The World Economic Forum (2011), for example, ranked the Czech Republic as 123rd among 142 countries in terms of the extent to which politicians show favoritism toward well-connected firms. A series of anecdotal corruption cases illustrate the link between the misallocation of public procurements and corporate donations of political parties (The Economist 2011, 2013).

in value. State contributions, accounted on average 40% of party revenues and were paid out to parties based on their seat shares in parliamentary and regional elections.

1.3 Data

The empirical analysis combines data on municipal procurement, elections, corporate donors of the political parties and other covariates.

Procurement data The procurement data originate from the register of public procurements administered by the Ministry of Regional Development. The data include information about all individual construction procurements awarded by the municipalities between the 2006 and 2010 elections,[9] provided that these procurements were covered by the Public Procurement Act. The database therefore mandatorily contains information on procurements that are expected to cost more than legislatively-set minimum planned value and does not contain data on contracts procured through legislative exemptions.[10]

The data contain detailed information about procurements, including unique IDs of the municipalities in charge of the procurements, planned values of the procurements and the contract prices, the type of contract-allocation procedure, the number of bidders, as well as unique IDs of the contract-awarded suppliers. The final sample consists of nearly 3,000 procurements, worth approximately CZK 56.1 billion (approximately USD 2.8 billion).

Table 1.1 shows descriptive procurement characteristics. The average planned value is CZK 22.5 million. Contract prices are on average 8.45% lower than planned values, reflecting the average participation of 6 bidding suppliers in procurement competitions. Approximately one third of contracts (30.5%) are procured in transparent open auctions and 11.6% in restricted auctions. Far more frequent is the discretionary simplified procedure, which is used to award 53.5% procurements. Other procurements (4.5%) are allocated using negotiations with suppliers approached directly.

[9] Earlier data do not cover the entire 2002-2006 electoral period and therefore are not used in the analysis.
[10] The minimum planned value for collecting data about construction procurements was set by national legislation to CZK 6 million during the entire sample period.

TABLE 1.1

Descriptive Statistics in Public Procurement

	Total	Political donors	Other suppliers
Procurement expenditure:			
Planned value of procurement (mil. CZK)	22.48	23.12	22.28
	(27.3)	(26.3)	(27.6)
Contract price of procurement (mil. CZK)	18.78	19.69	18.51
	(24.68)	(25.63)	(24.38)
Difference between contract price and planned value of procurement (% of latter)	-8.45	-6.16	-9.15
	(33.02)	(51.9)	(24.49)
Competition / openness in procurement:			
Number of bidders	5.98	6.03	5.97
	(3.54)	(3.51)	(3.55)
Type of procurement procedure:			
Share of open auctions	30.45	30.15	30.54
	(46.03)	(45.93)	(46.07)
Share of restricted auctions	11.64	14.24	10.86
	(32.02)	(34.97)	(31.12)
Share of simplified discretionary procedures	53.46	53.48	53.45
	(49.89)	(49.92)	(49.89)
Share of negotiated procedures without publication	4.45	2.12	5.15
	(20.62)	(14.42)	(22.11)
Observations	2,989	699	2,290

Notes: Data on public procurements are from the register of public procurements, which is administered by the Ministry of Regional Development of the Czech Republic.

Data on corporate donations to political parties I complement the procurement data with information about all individual corporate donations to all political parties between the 2006 and 2010 local elections,[11] which is available from the Parliament of the Czech Republic. The data include unique IDs of donors, the amount of the contributions, and the recipient party identities. The party donations are recorded at the national level and therefore the allocation of municipal procurements to party donors does not necessarily imply connections between firms and specific municipalities. The data cover 1,891 donations, totaling CZK 198.7 million (approximately USD 10 million). The median donation is CZK 30,000.

[11] The 2006 local elections took place on October 20-21, 2016; hence the data on 2006 donations are not used in the analysis.

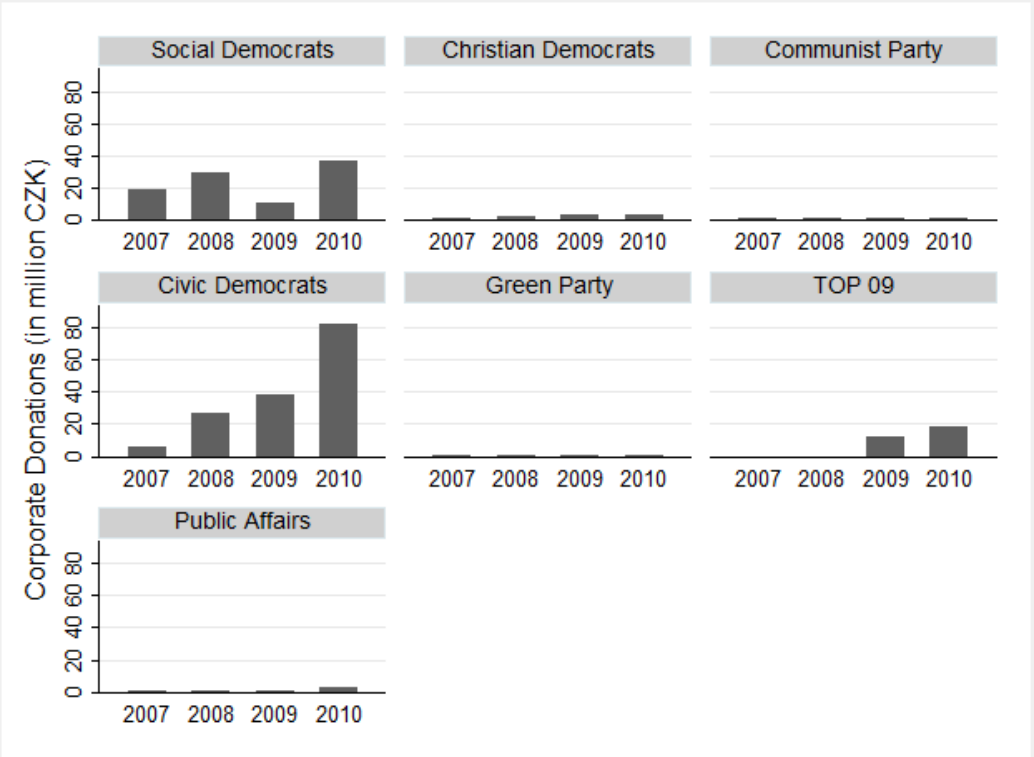
Figure 1.1 describes the donations according to the individual parties. The largest recipients were the Civic Democrats and the Social Democrats, the two dominant parties in the Czech parliament in the 2006-2010 period, as shown in Figure 1.2.

Of all corporate donations, 250 donations worth CZK 20.0 million can be linked to procurements awarded by municipalities. The largest recipient of the linked donations is the Civic Democratic Party, which received 72.1% of the donation value. The second largest recipient is the TOP09 party with 11.4%. The Social Democrats received 7.8%, Christian Democrats 6.4%, and Public Affairs received 2.3%.

Electoral data I further link the data with information from the 2006 municipal elections, which is available from the Czech Statistical Office. The election data cover information about the identity of all candidate subjects, electoral turnout, as well as the vote shares and seat distributions in the individual municipal councils.

FIGURE 1.1

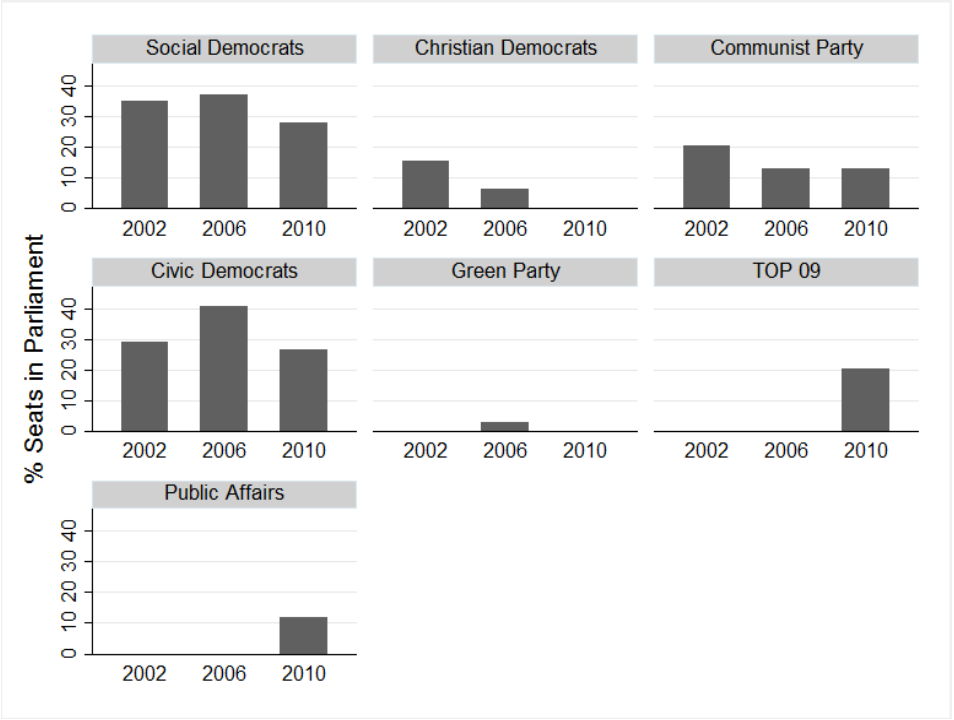
Corporate Donations to Political Parties, 2007 - 2010



Notes: The figure plots corporate donations to political parties in million CZK. The local elections occurred in 2006 and 2010. Data are from the Office of the Parliament of the Czech Republic.

FIGURE 1.2

Party Representation in the Parliament of the Czech Republic, 2002-2010



Notes: The figure plots seat shares of political parties in the Parliament of the Czech Republic. Data are from the Statistical Office of the Czech Republic.

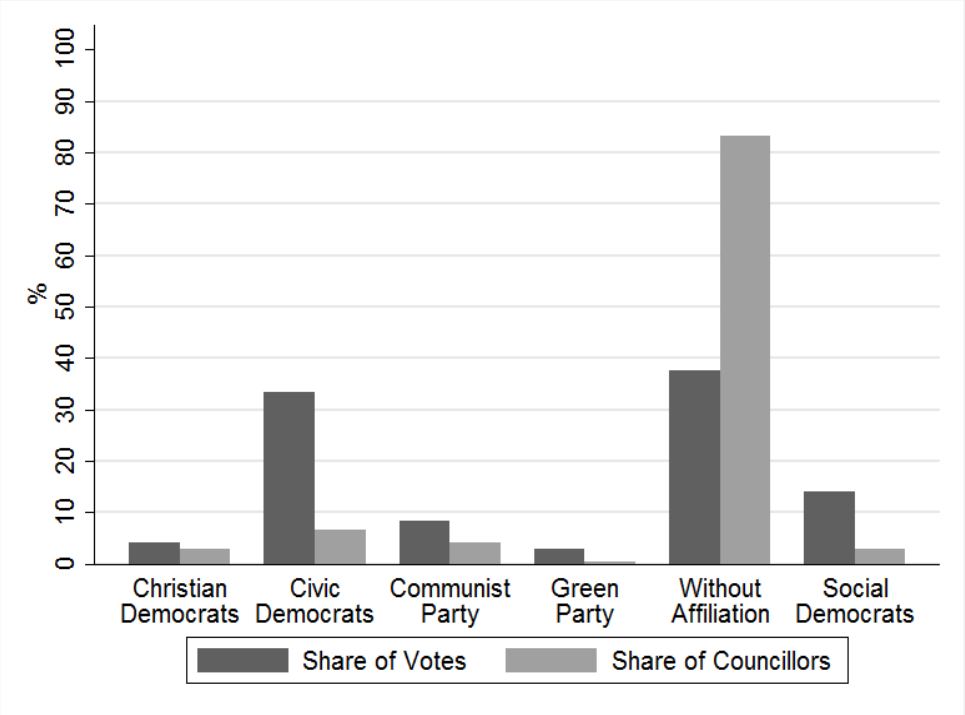
Figure 1.3 plots the aggregate election results— the vote shares and seat shares attributed to individual political subjects. The largest vote share was received by civic candidates without political affiliation to parliamentary parties (37.7%). Second largest vote share was received by the Civic Democrats (33.4%), followed by the Social Democrats (13.9%), the Communist Party (8.3%), the Christian Democrats (4.0%), and the Green Party (2.8%). The figure shows a notable disparity between the vote share and seat share, which stems from the fact that national-level parties received the majority of votes in large cities, where the number of council seats is small compared to the overall number of seats distributed in all councils. A large majority of the council seats was attributed to the candidates from local-level civic movements (83.2%).

Panel (a) in Table 1.2 describes electoral outcomes that were determined prior to the seat allocation in the municipalities. Column (2) shows that average voter turnout was 39%. On average, 4.8 parties per municipality ran in the elections, and on average 13.7 seats were distributed among political parties represented in the councils.

Fiscal outcomes and demographic characteristics Finally, I obtain data on municipal demographics from the Czech Statistical Office and data on municipal fiscal policies from the Czech Ministry of Finance. The fiscal data include information about the annual fiscal revenues, expenditures and budget deficits for all municipalities. The demographic data describe council size, municipal population, and other demographic characteristics, such as average age and the share of the male population in municipalities. Panels (b) and (c) in Table 1.2 describe the fiscal and demographic data, respectively.

FIGURE 1.3

Electoral Results in Local Councils, 2006 Elections



Notes: The figure plots shares for all local councils in 2006 local elections. Data are from the Statistical Office of the Czech Republic. The disparity between vote shares and party representation in councils is mainly due to parliamentary parties gaining most of their votes in large cities, where the number of council seats is very small compared to the overall number of seats distributed in all local councils

.

TABLE 1.2

Pre-treatment Characteristics

	All the sample			4 percentage point spread in vote share				
	obs.	mean	st. dev.	obs.	mean	st .dev.	RD estimate	SE on estimate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A - Electoral outcomes (prior to seat allocation)								
Voter turnout	1,302	0.39	0.10	369	0.35	0.08	-0.003	[0.009]
Number of parties in race	1,302	4.75	2.96	369	6.96	2.15	-0.526	[0.583]
Number of seats in council	1,302	13.68	6.16	369	18.99	7.18	0.259	[0.556]
B - Fiscal outcomes (pre-election term)								
Log tax revenue per capita	1,300	8.92	0.25	368	9.01	0.20	0.008	[0.019]
Log capital revenue per capita	1,278	6.35	1.59	368	6.72	1.25	0.041	[0.150]
Log subsidies per capita	1,300	8.41	0.99	368	8.83	0.56	-0.001	[0.038]
Log spending per capita	1,300	9.67	0.45	368	9.86	0.33	0.007	[0.019]
Total deficit per capita (in ths. CZK)	1,300	-0.29	4.43	368	-0.07	2.59	-0.297	[0.238]
C - Demographic characteristics								
Population size (in ths.)	1,302	4.33	10.72	369	11.46	18.05	0.175	[1.567]
Average resident age	1,302	39.49	1.86	369	39.36	1.55	0.269	[0.251]
Average resident male ratio	1,302	0.50	0.02	369	0.49	0.01	0.003	[0.002]

Notes: Data on municipal public finance are from the Ministry of Finance of the Czech Republic. Electoral data and demographic caharacteristics are from the Statistical Office of the Czech Republic. Column (7) reports the coefficient for the number of parties represented in local council estimated by local polynomial regressions as specified in Eq. (2) when the respective characteristic is used as the dependent variable, for quadratic polynomial, and a bandwidth h (the width of the window of observations used in the regression) of 4 percentage points. Column (8) reports the RD robust standard errors.

1.4 Empirical Strategy

In this section, I discuss how I implement the regression discontinuity (RD) design to study the impact of increasing the number of parties in political representation on public procurement outcomes, including the allocation of procurements to political donors and the overall procurement expenditure. The main rationale for using the discontinuity design is that it can address the potential endogeneity of political representation; e.g. as new parties tend to form particularly in municipalities where the satisfaction with the performance of political incumbents is low, ordinary least squares (OLS) estimates may suffer from reverse causality concerns.

The RD framework generally addresses the potential endogeneity by relying on the existence of a continuous variable that assigns observations to a discontinuous treatment. If some observations pass a certain threshold level of the assignment variable, they are more likely to be included in the treatment group; otherwise they are included in the control group. The objective is to compare the outcomes for observations whose value of the assignment variable is "just below" and "just above" the treatment threshold as they will have on average similar characteristics except for the treatment. In other words, those observations slightly below the threshold serve as a counterfactual for those slightly above as the assignment to treatment will be as good as random in a neighborhood of the threshold. In my context, the institutional rule of allocating seats in the local councils according to the electoral vote share of political parties constitutes an ideal situation for the use of RD methodology as parties qualify for council seat-allocation only if their vote share exceeds the representation threshold.

Exceeding the representation threshold, however, does not predict perfectly the representation of parties in the local councils. Some parties may not be allocated seats even if they exceed the threshold, e.g. in small councils in which several parties barely exceed the threshold. The ultimate allocation of seats eventually depends on the vote share of all other parties above the representation threshold and on the council size. One therefore needs to use the RD design in a fuzzy form (Campbell 1969; Hahn, Todd and van der Klaauw 2001; van der Klaauw 2002; Imbens and Lemieux 2008; Lee and Lemieux 2010) as the fuzzy RD design can account for the imperfect determination of party representation due to exceeding the threshold.

In practice, the fuzzy RD design can be implemented as follows. Within a narrow window around the representation threshold, [12] I regress the procurement outcome of interest— Y_i— on a measure of the broadness of party representation $\widehat{Party\ rep}$ predicted from the first-stage regression, which is outlined below. Party representation is captured by one of the main regressors of interest, such as by the number of parties represented in the council, or by the number of seats allocated to the party nearest to the threshold. Additionally, a control function, i.e., a low-order polynomial[13] in the vote share of the party nearest to the threshold, is included in the regression along with fixed effects for geographic administrative districts. The main reason for including the fixed effects is to enhance the efficiency of the estimation as there is no need to include additional covariates except for the control function to obtain unbiased estimates of the impact of broader party representation. A number of other controls (e.g., voter turnout, number of the distributed council seats, previous fiscal outcomes, and demographic covariates) are also added to Equation (1.1) as a way to check whether party representation is as good as randomly assigned. The resulting model can be formally expressed as follows:

$$Y_i = BX_i + \beta\left(\widehat{Party\ rep}\right)_i + f(Vote\ share\ .\delta) + \varepsilon_i, \tag{1.1}$$

where Y is the inspected outcome (e.g., allocation of procurements to political donors, procurement expenditures, bidder competition, etc.), X is a vector of pre-determined covariates, *f (.)* is the control function, and ε is the error term.

The first-stage regression which predicts the broadness of party representation in the municipal councils takes the following form:

$$Party\ rep_i = \Gamma X_i + \gamma \mathbf{1}[Vote\ share \geq c]_i + f(Vote\ share.\phi) + \eta_i, \tag{1.2}$$

where $\mathbf{1}[Vote\ share \geq c]$ is an indicator equal to one if a party closest to the threshold exceeds the threshold and zero, otherwise, η is the error term and other variables are as before.[14]

---

[12] Window around the threshold is symmetric and constructed such that no municipality can appear on both sides of the threshold. I examine different feasible bandwidths around the threshold. Due to the size of the representation threshold, symmetric bandwidths cannot exceed 5 percentage points.

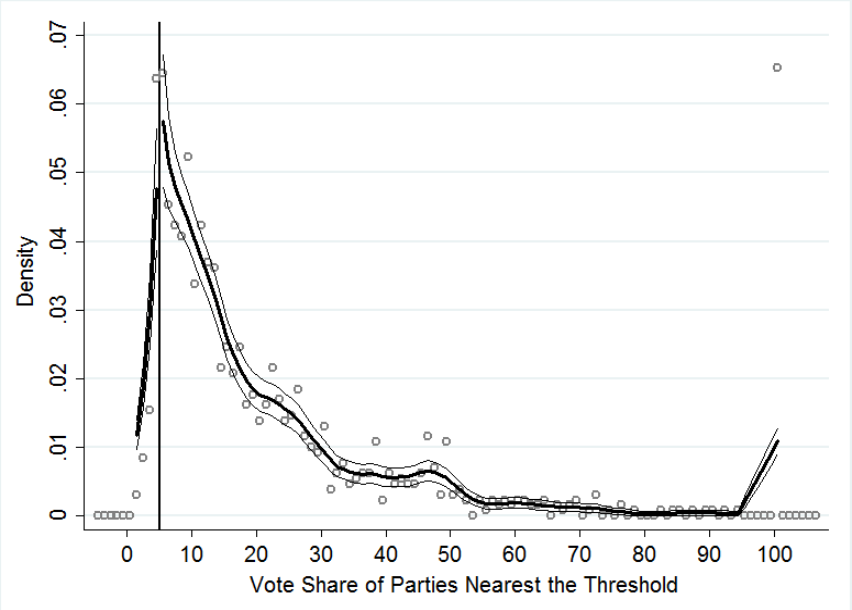
[13] The analysis uses first and second order approximations of the control function as Gelman and Imbens (2014) advise against using higher order polynomials.

[14] Estimation is implemented using Stata routines developed in Calonico, Cattaneo and Titiunik (2014a) and Calonico, Cattaneo and Titiunik (2014b).

Identification requires that parties near the threshold cannot manipulate their vote share relative to the threshold, otherwise the assignment to different party representation is no longer exogenous in the proximity of the threshold. [15] I check for such sorting using the McCrary (2008) test, which runs kernel local linear regressions of the assignment variable separately on both sides of the threshold with the null hypothesis that there is no discontinuity at the threshold.[16] Figure 1.4 shows the result of this test, which finds no evidence of such undesirable sorting. The log difference in the height of the density distribution at the threshold is equal to -0.102 with a standard error of 0.183.

FIGURE 1.4

McCrary Density Discontinuity Test



Notes: The scatter-plot is the histogram of the vote share of parties in municipalities that scored the closest to the electoral threshold. The solid line below the empirical distribution is a local linear smoother fitted to the empirical distribution, estimated as in McCrary (2008). The figure shows confidence intervals of the estimator. The estimate of the difference in height at the threshold is -0.102 with a standard error of 0.183.

[15] Snyder (2005) and Caughey and Sekhon (2011) demonstrate that there is sorting in very close elections to the US House of Representatives. Given that exceeding the representation threshold does not automatically guarantee the allocation of seats in the representation bodies, this type of sorting is less likely in proportional elections compared to a majoritarian election system (Folke 2014).

[16] The frequency distribution of the vote share of all parties in all municipalities is provided in Figure 1.A.1 in the Appendix.

Furthermore, identification requires that all relevant factors other than the treatment vary continuously at the threshold. To assess the plausibility of this assumption, Table 1.2 examines whether covariates determined before the seat-allocation are balanced across the threshold. In particular, the table uses a series of placebo tests which try to detect the impact of the party representation on the pre-determined covariates. The placebo tests are run by estimating Equations (1.1) and (1.2), where the number of parties represented in the local council is predicted as the first-stage outcome in Equation (1.2) and the pre-determined covariates serve as the dependent variables in Equation (1.1). The regressions use a linear form of the control function and a bandwidth of 4 percentage points in the assignment variable. No significant results should be found if the covariates vary smoothly at the threshold. Column (7) in Table 1.2 shows the estimated placebo effects, while column (8) reports the corresponding standard errors. The table strongly suggests that municipalities with a party barely exceeding the threshold are a valid control group for the municipalities with a party barely below the threshold. To provide a more complete view as to how the pre-determined covariates vary around the representation threshold, Tables 1.A.2 and 1.A.3 in the Appendix repeat this analysis based on alternative bandwidth choices. These tables present qualitatively identical results.

1.5 Empirical Analysis

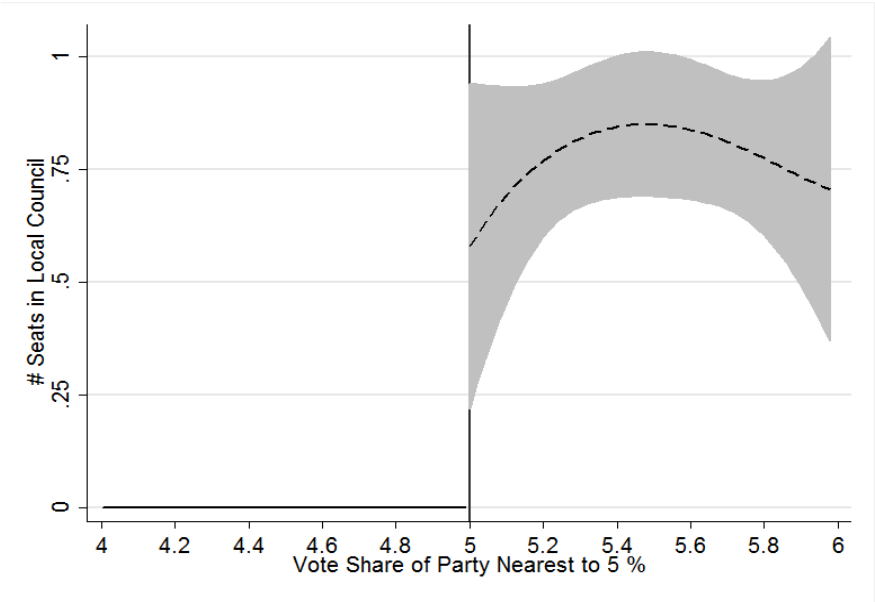
Does political party representation affect public spending and selection of politically-connected suppliers in public procurement? To assess if this is the case, I start the analysis by examining how exceeding the electoral representation threshold affects seat-allocation in municipal councils. Then I proceed to examine the impact of the broadness of party representation on the allocation of procurements to corporate donors of political parties, procurement prices and the overall procurement expenditure, bidder competition, and the choice of contract-award procedures. I always first plot unconditional descriptive evidence around the representation threshold. Then I provide more precise estimates from fuzzy discontinuity designs, which can account for the actual assignment of the council seats to the political parties. At the end of the section, I compare the fuzzy discontinuity estimates to basic OLS estimates to assess the direction of the potential OLS bias.

1.5.1 Political Representation

Figure 1.5 visually inspects the relationship between the electoral vote share and the representation of political subjects in local councils. The dashed line plots the number of seats allocated to parties that scored the nearest to the 5% threshold in each municipality. I plot the figure using kernel-weighted local polynomial smoothers with 0.5% bandwidth and the quadratic form of the polynomial, estimated separately on either side of the threshold. The grey areas correspond to 90% confidence intervals.

FIGURE 1.5

Vote Share and Allocation of Seats to Parties in Local Council

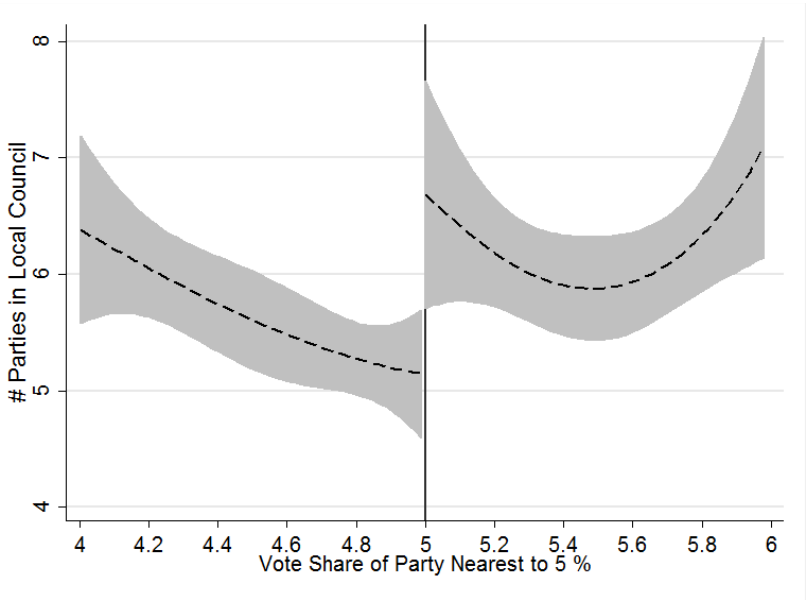


Notes: The figure shows the number of seats allocated to the party scoring the nearest to the electoral representation threshold as a function of the vote share of this party. The grey area is a 90% confidence interval. The vertical line identifies the 5% representation threshold.

The figure shows that approximately 75% of parties that barely exceed the threshold receive at least one council seat. No seat can be won if the vote share lies anywhere below the threshold. The discontinuity translates to a jump in the number of parties represented in the local councils, as shown in Figure 1.6. The number of the represented parties jumps from an average of 5.5 parties to 6.5 parties once the party closest to the threshold exceeds the representation requirement.

FIGURE 1.6

Vote Share and the Number of Parties Represented in Local Council



Notes: The figure shows the number of parties with a positive number of seats in the local council as a function of the vote share of the party that scored the nearest to the electoral threshold. The grey areas are 90% confidence intervals. The vertical line identifies the 5% representation threshold.

Table 1.3 examines the results in Figures 1.5 and 1.6 in more detail by reporting the estimates of Equation (1.2), where the number of council seats allocated to political parties nearest to the threshold and the number of parties represented in councils, respectively, serve as the dependent variables. Columns (1)-(6) report estimates for linear and quadratic specifications of the polynomial control function, over bandwidths of 2, 3 and 4 percentage points in the vote share of the party that scored the nearest to the threshold.

The table confirms the results plotted in Figures 1.5 and 1.6. Exceeding the threshold is a strong predictor of party representation, as well as for the increase in the number of represented parties. The estimated increase in the likelihood of obtaining council seats due to barely exceeding the representation threshold ranges from 67.8 to 77 percentage points. The estimates are significant at 1% in all specifications, irrespective of the control function specification and bandwidth. The estimated effect for the increase in the number of the represented parties ranges from 1.353 to 1.734 additional parties and is statistically significant at the 1% level.

TABLE 1.3

Exceeding the Electoral Threshold and Party Representation in Local Councils

	h=0.02		h=0.03		h=0.04	
	(1)	(2)	(3)	(4)	(5)	(6)
Council Seats Allocated to Party Nearest the Threshold	0.734***	0.715***	0.727***	0.694***	0.770***	0.678***
	[0.104]	[0.139]	[0.088]	[0.121]	[0.081]	[0.107]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Number of Parties in Council	1.461***	1.734***	1.353***	1.567***	1.425***	1.378***
	[0.204]	[0.254]	[0.199]	[0.235]	[0.191]	[0.234]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Polynomial	linear	quadratic	linear	quadratic	linear	quadratic

Notes: All entries report the coefficient for the binary variable indicating that the party nearest the 5% electoral threshold exceeded the threshold estimated by local polynomial regressions as specified in Eq. (2). The bandwidth h (the width of the window of observations used in the regression) in Columns (1)-(2) is 2 percentage points, in Columns (3)-(4) is 3 percentage points, and in Columns (5)-(6) is 4 percentage points. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Table 1.4 repeats the analysis from Table 1.3, where the number of council seats allocated to specific individual parties, respectively, serve as the dependent variables. The table shows that nationally less dominant parties, such as the Christian Democrats and the Communist Party, receive seats when the party closest to the threshold exceeds the representation requirement. In contrast, the nationally dominant parties, i.e. the Social Democrats and the Civic Democrats, and also the local-level civic movements, either do not gain extra council seats or even lose some of their seats. Overall, the estimates suggest shifts in the political representation across political parties which occur simultaneously with the increase in the number of the represented parties.

TABLE 1.4

Exceeding the Electoral Threshold and Party Representation in Local Councils

	h=0.02		h=0.03		h=0.04	
	(1)	(2)	(3)	(4)	(5)	(6)
Council Seats For Christian Democrats	1.016***	1.077***	0.838***	1.010***	0.770***	0.881***
	[0.284]	[0.368]	[0.262]	[0.337]	[0.250]	[0.314]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Council Seats For Communist Party	0.910*	1.384**	0.289	0.974*	0.090	0.416
	[0.503]	[0.688]	[0.404]	[0.576]	[0.359]	[0.497]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Council Seats For Civic Democrats	0.086	-0.196	-0.074	-0.291	-0.068	-0.302
	[0.546]	[0.732]	[0.490]	[0.610]	[0.463]	[0.555]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Council Seats For Civic Movements	-1.146	-1.038	-0.495	-0.964	-0.198	-0.409
	[0.951]	[1.307]	[0.815]	[1.116]	[0.744]	[0.976]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Council Seats For Social Democrats	-0.866**	-1.227**	-0.558	-0.728*	-0.595*	-0.586
	[0.409]	[0.551]	[0.367]	[0.442]	[0.348]	[0.407]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Polynomial	linear	quadratic	linear	quadratic	linear	quadratic

Notes: All entries report the coefficient for the binary variable indicating that the party nearest the 5% electoral threshold exceeded the threshold estimated by local polynomial regressions as specified in Eq. (2). The bandwidth h (the width of the window of observations used in the regression) in Columns (1)-(2) is 2 percentage points, in Columns (3)-(4) is 3 percentage points, and in Columns (5)-(6) is 4 percentage points. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

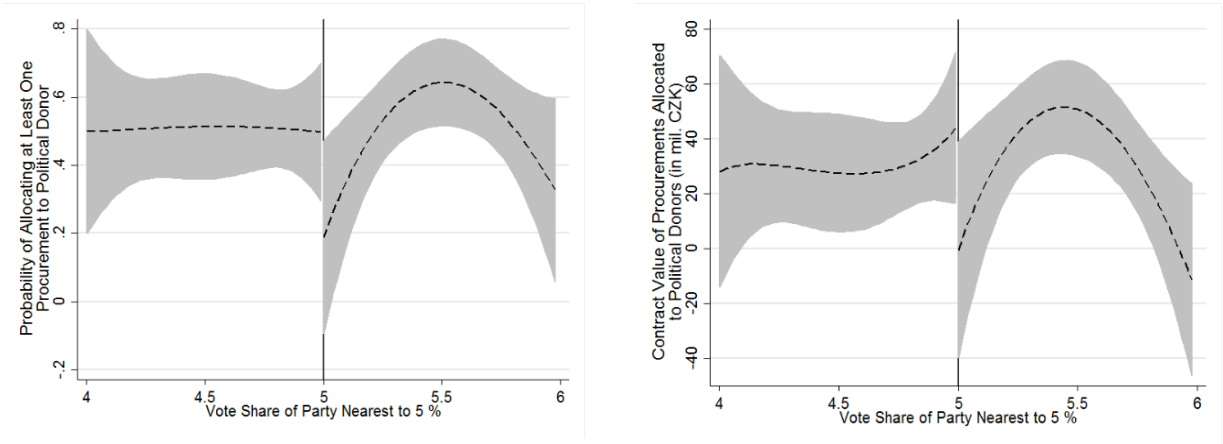
1.5.2 Public Procurement Outcomes

The empirical analysis proceeds by examining the impact of the broadness of party representation on procurement outcomes, including the allocation of procurements to donors of political parties, procurement prices, bidder competition, and the choice of contract-award procedures. Then I discuss the potential bias in OLS estimation.

Allocation of procurements to political donors Figure 1.7 illustrates the relationship between party representation and the allocation of procurements to corporate donors of political parties. The figure is plotted using kernel-weighted local quadratic smoothers with 0.5% bandwidth, estimated separately on either side of the threshold. The left subfigure suggests that municipalities are less likely to award procurements to political donors if the marginal party exceeds the representation threshold; the right subfigure shows that the value of procurements allocated to all corporate donors is lower in the councils in which the marginal party exceeds the threshold.

FIGURE 1.7

Number of Parties Represented in Council and Allocation of Procurements to Political Donors



Notes: The figure shows (a) the probability of allocating at least one procurement to a political donor in a municipality, and (b) the contract value of procurements allocated to political donors, both as functions of the vote share of the party that scored the nearest to the electoral representation threshold. The grey areas are 90% confidence intervals. The vertical line identifies the 5% representation threshold.

Table 1.5 provides more precise estimates from the fuzzy regression discontinuity design, when (i) the probability of allocating at least one procurement to some of the political donors, and (ii) the contract value of procurements allocated to political donors, respectively, serve as the outcome variables in Equation (1.1), and the number of the political parties represented in the councils is

the first-stage outcome in Equation (1.2). The table reports results in line with the evidence from Figure 1.7. The table finds that municipalities are less likely to allocate procurements to political donors when the number of parties in their councils is higher. The magnitude of the estimated effect ranges from -10.9 to -23.3 percentage points, which is a large effect given that 23.4% of procurements in the sample were allocated to political donors. The estimates are significant in all specifications, irrespective of the control function specification and the chosen bandwidth. The overall value of procurements allocated to political donors is estimated to decrease in a range between CZK 13.39 million to CZK 37.311 million. The estimates are again significant at the 1% level in the majority of specifications.

TABLE 1.5

Number of Parties Represented in Local Councils and Allocation of Procurements to Corporate Donors

	h=0.02		h=0.03		h=0.04	
	(1)	(2)	(3)	(4)	(5)	(6)
Probability of Allocating at Least One Procurement to Political Donor	-0.172**	-0.233***	-0.151**	-0.171**	-0.109*	-0.158**
	[0.068]	[0.069]	[0.060]	[0.075]	[0.058]	[0.068]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Contract Value of Procurements Allocated to Political Donors (mil. CZK)	-26.170***	-37.311***	-17.950***	-24.126***	-13.387**	-20.069***
	[8.079]	[8.908]	[6.921]	[8.503]	[6.658]	[7.621]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Polynomial	linear	quadratic	linear	quadratic	linear	quadratic

Notes: All entries report coefficient for the number of parties in a council estimated by local polynomial regressions as specified in Equations (1.1) and (1.2). The bandwidth h (the width of the window of observations used in the regression) in Columns (1)-(2) is 2 percentage points, in Columns (3)-(4) is 3 percentage points, and in Columns (5)-(6) is 4 percentage points. All regressions include administrative district effects and pre-treatment characteristics from Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Table 1.6 inspects the identity of the political parties whose donors are negatively affected by broader party representation. The largest drop in the value of procurements for party donors occurs for the Civic Democrats, i.e. for the most dominant national-level party in the municipal elections. A significant decline occurs even for the donors of other national-level parties, such as for the Christian Democrats and the Social Democrats, with the exception of the TOP09 party, which received most of its corporate donations in the last year of the sample period.

TABLE 1.6

Number of Parties Represented in Councils and Allocation of Procurements to Political Donors

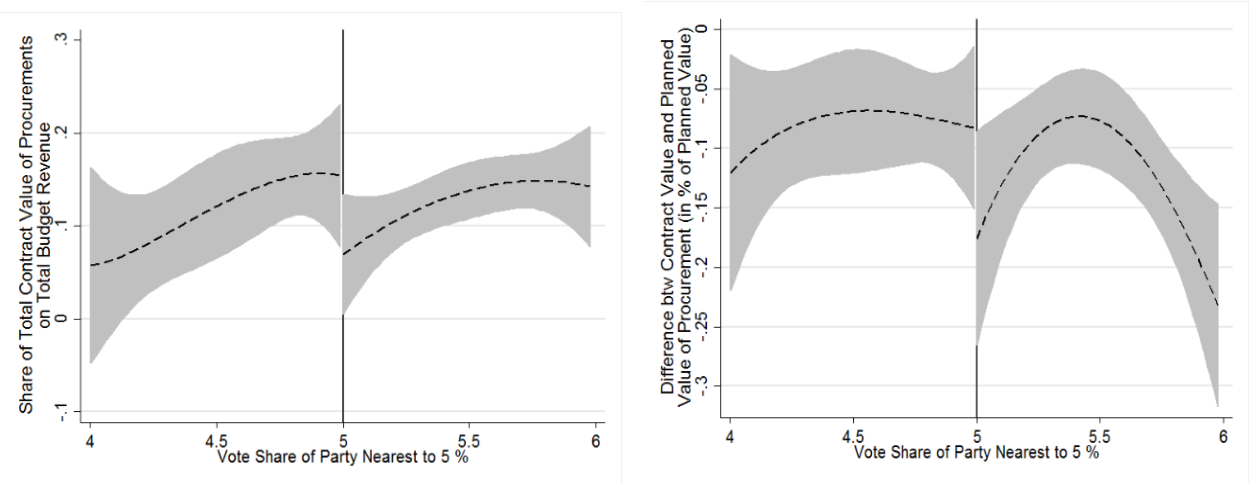
	h=0.02		h=0.03		h=0.04	
	(1)	(2)	(3)	(4)	(5)	(6)
Value of Procurements for Donors of Civic Democrats (mil. CZK)	-16.639**	-26.860***	-11.722*	-15.474*	-8.238	-12.405*
	[8.031]	[8.967]	[6.691]	[8.568]	[6.379]	[7.516]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Value of Procurements for Donors of Social Democrats (mil. CZK)	-4.413**	-5.343**	-2.280	-3.896*	-2.079	-3.109
	[2.131]	[2.157]	[2.156]	[2.066]	[2.117]	[2.117]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Value of Procurements for Donors of Christian Democrats (mil. CZK)	-4.792**	-5.130**	-4.467**	-4.541*	-3.847**	-4.795**
	[2.196]	[2.511]	[1.814]	[2.439]	[1.674]	[2.089]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Value of Procurements for Donors of Party TOP09 (mil. CZK)	-0.242	0.046	0.661	-0.202	0.925*	0.326
	[0.530]	[0.547]	[0.536]	[0.693]	[0.547]	[0.635]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Polynomial	linear	quadratic	linear	quadratic	linear	quadratic

Notes: All entries report the coefficient for the number of parties represented in a council estimated by local polynomial regressions as specified in Equations (1.1) and (1.2). The bandwidth h (the width of the window of observations used in the regression) in Columns (1)-(2) is 2 percentage points, in Columns (3)-(4) is 3 percentage points, and in Columns (5)-(6) is 4 percentage points. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Contract prices and procurement expenditure I proceed by illustrating the relationship between broader party representation, procurement prices and overall procurement expenditure. Panel (a) in Figure 1.8 shows that municipalities spend a lower share of their budgets on public procurement when a party barely crosses the representation threshold. Panel (b) shows that lower procurement expenditure is at least in part due to lower procurement prices.

FIGURE 1.8

Number of Parties Represented in Local Councils and Procurement Expenditure



Notes: The subfigures show (a) the share of the total value of procurements on total budget revenue, (b) the percentage difference between the contract value and planned value of procurements (in % of planned value), all as functions of vote share of the party that scored the nearest to the electoral threshold. The grey areas are 90% confidence intervals. The vertical lines identify the 5% electoral threshold.

Table 1.7 examines these results in greater detail by reporting estimates from fuzzy regression discontinuity design, where (i) the share of the total value of procurements on the total budget revenue, and (ii) the % difference between the contract price and the planned value of procurements, respectively, serve as the outcome variables in Equation (1.1). The estimates corroborate the results from Figure 1.8 as the number of parties represented in the local councils significantly decreases the procurement expenditure by reducing procurement prices relative to their planned value. The impact of the broader party representation on procurement expenditure is large as the estimated decline in the total value of procurements (as a share of the total budget revenue) range from -4.5 to -7.9 percentage points. The sample average share of the value of procurements on the total budget revenue is 30.7%. The percentage difference between the contract price and the planned value of procurements becomes sizably more negative. The estimates range

from -6.3 to -6.9 percentage points. The sample average difference between the contract price and the planned value of procurements is -8.45%. The estimated effects are statistically significant irrespective of the control function specification and the chosen bandwidth.

TABLE 1.7

Number of Parties Represented in Local Councils and Procurement Expenditures

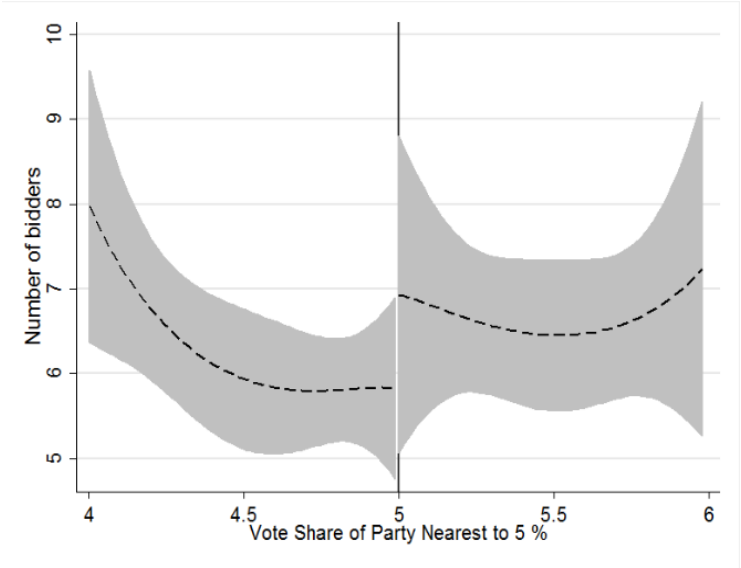
	h=0.02		h=0.03		h=0.04	
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Total Contract Value of Procurements on Total Budget Revenue	-0.079*** [0.029]	-0.067** [0.032]	-0.064*** [0.023]	-0.077** [0.031]	-0.045** [0.022]	-0.074*** [0.027]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Difference Between Contract Value and Planned Value of Procurement (in % of Planned Value)	-0.066** [0.029]	-0.066** [0.029]	-0.069** [0.030]	-0.063** [0.032]	-0.064** [0.028]	-0.065** [0.031]
Effective Obs.	245	245	311	311	368	368
Obs.	1,278	1,278	1,278	1,278	1,278	1,278
Polynomial	linear	quadratic	linear	quadratic	linear	quadratic

Notes: All columns report the coefficient for the number of political parties in a council estimated by local polynomial regressions as specified in Equations (1.1) and (1.2). The bandwidth h (the width of the window of observations around the threshold used in the regression) in Columns (1)-(2) is 2 percentage points, in Columns (3)-(4) is 3 percentage points, and in Columns (5)-(6) is 4 percentage points. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Bidder competition and choice of contract-award procedures Figures 1.9 and 1.10 inspect procurement characteristics that could drive the low procurement expenditure and less prevalent allocation of contracts to political donors in municipalities with broader representation of parties. According to Figure 1.9, the number of bidding suppliers is higher in municipalities with the marginal party barely above the representation threshold. Panels (a) and (c) in Figure 1.10 further show that the local councils with a party barely above the representation threshold more frequently use discretionary procurement procedures instead of open auctions. Panels (b) and (d) show that broader party representation has little impact on the prevalence of the restricted auctions and direct negotiations with specific bidders.

FIGURE 1.9

Number of Parties Represented in Local Council and Bidder Competition



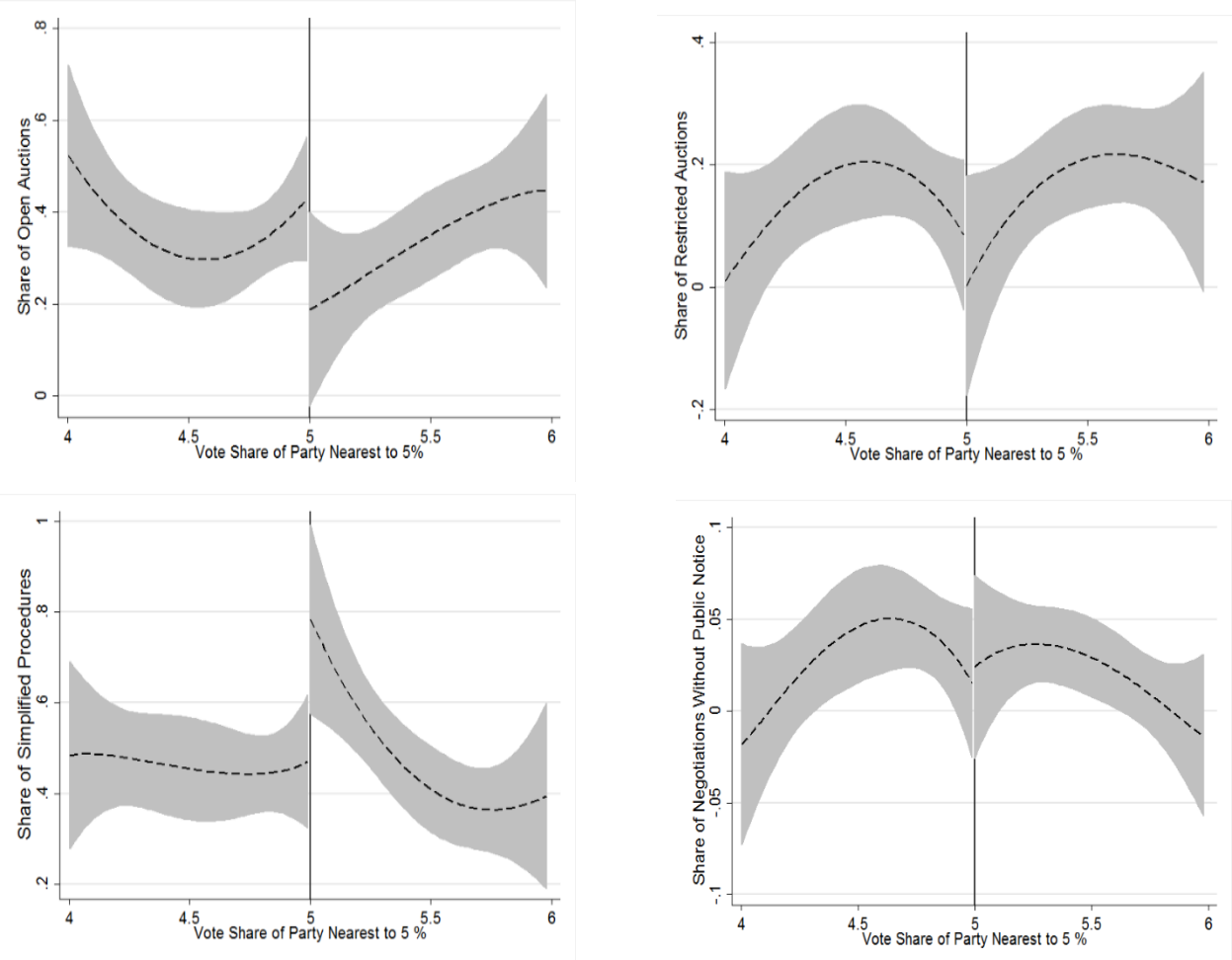
Notes: The figure shows the number of bidders in procurement tender as a function of the vote share of the party that scored the nearest to the electoral threshold. The grey areas are 90% confidence intervals. The vertical line identifies the 5% representation threshold.

Table 1.8 inspects the impact of broader party representation on bidder competition and the choice of contract-award procedures using more precise fuzzy regression discontinuity estimates. The table confirms that the participation of bidders in procurement increases due to broader party representation. The estimates range from 0.8 to 1.0 additional bids, while the sample average number of bidding suppliers is 6. The estimates are statistically significant at the conventional levels in all specifications. The table also supports the evidence that broader party representation

leads to less prevalent use of open auctions due to more prevalent use of discretionary procurement procedures. The share of open auction is estimated to drop by 8.3 to 17 percentage points, while the share of the discretionary procedure rises by 7.8 to 21 percent points. The estimates are significant at the 5% level in the majority of specifications. Restricted auctions and direct negotiations seem to be unaffected in all reported specifications.

FIGURE 1.10

Number of Parties in Local Council and Choice of Contract-Award Procedures



Notes: The figure shows (a) the share of open auctions, (b) the share of restricted auctions, (c) the share of simplified discretionary procedures, and (d) the share of negotiations without public notice, all as a function of the vote share of the party that scored the nearest to the electoral threshold. The grey areas are 90% confidence intervals. The vertical lines identify the 5% representation threshold.

TABLE 1.8

Number of Parties in Local Councils, Bidder Competition and Choice of Contract-Award Procedure

	h=0.02		h=0.03		h=0.04	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of Bidders	0.971**	0.960**	0.911***	0.852*	0.834**	0.988**
	[0.394]	[0.418]	[0.345]	[0.452]	[0.331]	[0.402]
Effective Obs.	245	245	311	311	368	368
Obs.	1,277	1,277	1,277	1,277	1,277	1,277
Share of Open Auctions	-0.142*	-0.170**	-0.116**	-0.164**	-0.083	-0.157**
	[0.076]	[0.086]	[0.058]	[0.083]	[0.052]	[0.066]
Effective Obs.	241	241	306	306	363	363
Obs.	1,234	1,234	1,234	1,234	1,234	1,234
Share of Restricted Auctions	-0.054	-0.026	-0.014	-0.027	-0.002	-0.008
	[0.043]	[0.040]	[0.040]	[0.044]	[0.038]	[0.041]
Effective Obs.	241	241	306	306	363	363
Obs.	1,234	1,234	1,234	1,234	1,234	1,234
Share of Simplified Discretionary Procedures	0.198**	0.210**	0.122*	0.211**	0.078	0.170**
	[0.082]	[0.092]	[0.066]	[0.089]	[0.059]	[0.074]
Effective Obs.	241	241	306	306	363	363
Obs.	1,234	1,234	1,234	1,234	1,234	1,234
Share of Negotiations without Public Notice	-0.002	-0.014	0.007	-0.021	0.006	-0.005
	[0.016]	[0.016]	[0.015]	[0.016]	[0.013]	[0.016]
Effective Obs.	241	241	306	306	363	363
Obs.	1,234	1,234	1,234	1,234	1,234	1,234
Polynomial	linear	quadratic	linear	quadratic	Linear	quadratic

Notes: All entries report the coefficient for the number of parties in a council estimated by local polynomial regressions as specified in Equations (1.1) and (1.2). The bandwidth h (the width of the window of observations around the threshold used in the regression) in Columns (1)-(2) is 2 percentage points, in Columns (3)-(4) is 3 percentage points, and in Columns (5)-(6) is 4 percentage points. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Direction of the OLS bias Finally, I inspect the potential bias underlying the OLS estimation, which may occur due to endogenous political representation formation. In particular, new parties may plausibly emerge and become represented primarily in municipalities where the performance of incumbent politicians is perceived by voters as unsatisfactory. One should thus expect to simultaneously observe a high number of the represented parties and adverse outcomes in public spending, which would negatively bias OLS underlying estimates of the party representation effects.

In order to evaluate the direction of the bias, I use OLS to estimate the impact of broader party representation on all previously inspected procurement outcomes. This means that I estimate Equation (1.1) within a close bandwidth around the representation threshold, where the number of parties represented in the council is the measure of the broadness of party representation and no first-stage estimation precedes.

Table 1.9 reports the results of this analysis and finds that OLS systematically attenuates estimates compared to the fuzzy discontinuity design. In particular, the OLS estimates are very close to zero for a number of procurement outcomes in the majority of specifications, with the exception of the narrowest 2 percent point bandwidth, where the representation by an additional party can be most plausibly considered as good as random. Here the (underestimated) effect goes in the same direction as suggested by the fuzzy RD estimates, particularlt for procurement prices and the restricted allocation of procurements to political donors. The negative bias associated with OLS is consistent with reverse causality, underscoring the importance of using quasi-experimental designs for obtaining unbiased estimates.

TABLE 1.9

Number of Parties Represented in the Local Councils and Procurement Outcomes - OLS results

Dependent variable:	Probability of Allocating at Least One Procurement to Political Donor	Contract Value of Procurements Allocated to Political Donors (mil. CZK)	Share of Total Contract Value of Procurements on Total Budget Revenue	Difference Between Contract Value and Planned Value of Procurement (in % of Planned Value)	Number of Bidders	Share of Open Auctions	Share of Restricted Auctions	Share of Simplified Discretionary Procedures	Share of Negotiations without Public Notice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bandwidth: 2 percentage points around the representation threshold									
	-0.047	-3.311	-0.007	-0.020**	0.007	0.277	0.026	-0.022	0.006
	[0.030]	[3.373]	[0.008]	[0.009]	[0.039]	[0.177]	[0.028]	[0.020]	[0.029]
Effective Obs.	245	245	245	245	245	245	241	241	241
R^2	0.526	0.676	0.442	0.470	0.247	0.466	0.336	0.449	0.259
Bandwidth: 3 percentage points around the representation threshold									
	-0.011	-3.199	-0.003	-0.009	0.008	0.173	0.025	-0.013	-0.011
	[0.026]	[2.732]	[0.008]	[0.009]	[0.033]	[0.138]	[0.023]	[0.016]	[0.025]
Effective Obs.	311	311	311	311	311	311	306	306	306
R2	0.456	0.613	0.386	0.415	0.200	0.331	0.281	0.437	0.263
Bandwidth: 4 percentage points around the representation threshold									
	0.001	-3.000	-0.004	-0.012	0.014	0.132	0.030	-0.018	-0.012
	[0.025]	[2.706]	[0.007]	[0.009]	[0.031]	[0.126]	[0.021]	[0.015]	[0.024]
Effective Obs.	368	368	368	368	368	368	363	363	363
R2	0.393	0.554	0.332	0.310	0.175	0.283	0.278	0.394	0.259

Notes: All entries report the coefficient for the number of political parties represented in the local councils estimated by Ordinary Least Squares. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

1.6 When Broader Party Representation Matters Most

The previously presented evidence of party representation effects can be rationalized in a number of ways. In this section, I examine three potential mechanisms that I believe to be most plausible: broadening the representation by non-incumbent parties, enhanced political competition, and lower bargaining power of the dominant parties.

1.6.1 Representation by Non-incumbent Parties

The first potential explanation is the representation by non-incumbent parties that can assume part of the responsibility for decision-making in municipalities and pursue policies that restrict the allocation of procurements to political donors and reduce procurement prices. Representation by non-incumbent parties can also enlarge the pool of firms with connections to politicians, which can trigger more active entry to bidding and more competitive tendering.

To examine this hypothesis, I classify the marginal parties, i.e. the parties that scored the closest to the representation threshold, according to the criterion whether they held council seats in the previous electoral term or not, i.e. I split the sample in the neighborhood of the representation threshold according to the incumbency of the marginal party. Then I use the fuzzy RD design outlined in Section 1.4 to estimate the impact of broadening the party representation on procurement outcomes for the two separate sub-samples. If the examined hypothesis is true and non-incumbent parties assume part of the responsibility which they did not previously hold, one should observe a pronounced effect of party representation in the local councils entered by non-incumbent parties compared to the councils re-entered by incumbent parties.

Table 1.10 reports the estimates of Equations (1.1) and (1.2), where I use quadratic control function and bandwidth of 4 percent points. Panel A uses observations where the marginal party is an incumbent party and Panel B uses observations where the marginal party is a non-incumbent party. The table reveals no difference between the two groups in terms of the impact of party representation on the allocation of procurements to corporate donors of political parties (columns 1 and 2). In both groups, the increase in the number of represented parties significantly restricts the allocation of procurements to political donors. Similarly, there is little difference between the

TABLE 1.10

Representation by (Non-) Incumbent Parties and Procurement Outcomes

Dependent variable:	Probability of Allocating at Least One Procurement to Political Donor	Contract Value of Procurements Allocated to Political Donors (mil. CZK)	Share of Total Contract Value of Procurements on Total Budget Revenue	Difference Between Contract Price and Planned Value of Procurement (in % of Planned Value)	Number of Bidders	Share of Open Auctions	Share of Restricted Auctions	Share of Simplified Discretionary Procedures	Share of Negotiations without Public Notice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Party closest to the threshold = previously represented (incumbent) party									
	-0.241***	-34.603***	-0.006	-0.048***	-0.087	0.021	0.069*	-0.092	0.002
	[0.074]	[10.478]	[0.011]	[0.017]	[0.314]	[0.048]	[0.037]	[0.060]	[0.012]
Effective Obs.	169	169	169	169	169	167	167	167	167
Bandwidth	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Polynomial	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic
Panel B: Party closest to the threshold = non-incumbent party									
	-0.303***	-17.043***	-0.044	-0.070*	1.763***	-0.159**	0.052	0.121	-0.014
	[0.097]	[6.433]	[0.034]	[0.039]	[0.683]	[0.080]	[0.047]	[0.085]	[0.022]
Effective Obs.	199	199	199	199	199	196	196	196	196
Bandwidth	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Polynomial	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic

Notes: All entries report the coefficient for the number of parties represented in a local council estimated by local polynomial regressions as specified in Equations (1.1) and (1.2). Panel A uses observations where party closest to the electoral representation threshold was previously represented in the local council. Panel B uses observations where the party closest to the representation threshold was not previously represented in the local council. The bandwidth h (the width of the window of observations used in the regression) is in all segments 4 percentage points. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

two groups in terms of the impact of broader representation on contract prices and overall procurement expenditure (column 3 and 4). However, the table suggests that representation by a non-incumbent party brings new suppliers into procurement competition (column 5), while broadening the representation by incumbent parties does not. Similarly, local councils entered by non-incumbent parties more frequently use discretionary procedures instead of open auctions.

Overall, the evidence does not provide strong support in favor of the examined hypothesis. Despite the relatively increased bidder participation and greater prevalence of discretionary procurement procedures, the changes in the procurement design do not translate into a pronounced impact of broader party representation on contract prices and restricted allocation of procurements to political donors. In the following subsections, I therefore explore alternative explanations.

1.6.2 Political Competition

An alternative explanation for the results presented in Section 1.5 is that representation by more political parties makes parties hold each other more tightly accountable via more intensive mutual monitoring and political competition. Since the electoral chances of each party increase as the chances of other parties decrease, parties may benefit from closely monitoring each other and revealing compromising information. Parties seeking re-election should respond to higher political competition by curbing the allocation of procurements to political donors and allowing for broader and more transparent competition in procurement (Aneja, Moszoro and Spiller 2015). Such competition should reduce procurement prices and overall procurement expenditure.

To evaluate the relevance of political competition for the estimated impact of broad party representation on procurement outcomes, I assume that political competition is on average higher in councils where the strongest party achieved a low electoral victory margin compared to the councils where the strongest party received a high victory margin. If the hypothesis of political competition is true, the impact of broader party representation on the allocation of procurements to political donors should be pronounced in the councils in which the strongest party wins with a low victory margin. To carry out this test, I split the sample around the representation threshold according to the median value of the victory margin of the strongest party in the council. Then I use the discontinuity design to estimate the impact of broader party representation on procurement outcomes for the two sub-samples.

TABLE 1.11

Political Competition and Procurement Outcomes

Dependent variable:	Probability of Allocating at Least One Procurement to Political Donor	Contract Value of Procurements Allocated to Political Donors (mil. CZK)	Share of Total Contract Value of Procurements on Total Budget Revenue	Difference Between Contract Price and Planned Value of Procurement (in % of Planned Value)	Number of Bidders	Share of Open Auctions	Share of Restricted Auctions	Share of Simplified Discretionary Procedures	Share of Negotiations without Public Notice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: High victory margin of the strongest party									
	-0.096	-10.571	-0.055**	-0.051	0.304	-0.413***	0.064	0.260***	0.089**
	[0.062]	[12.186]	[0.025]	[0.053]	[0.499]	[0.089]	[0.056]	[0.078]	[0.038]
Effective Obs.	184	184	184	184	184	183	183	183	183
Bandwidth	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Polynomial	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic
Panel B: Low victory margin of the strongest party									
	-0.253***	-27.420***	-0.028*	-0.066**	0.907***	-0.034	-0.156***	0.182**	0.008
	[0.074]	[6.608]	[0.016]	[0.027]	[0.341]	[0.080]	[0.048]	[0.078]	[0.009]
Effective Obs.	180	184	184	184	184	184	180	180	180
Bandwidth	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Polynomial	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic

Notes: All segments report the coefficient for the number of parties represented in a local council estimated by local polynomial regressions as specified in Equations (1.1) and (1.2). Panel A uses observations where the victory margin in the electoral vote share of the strongest party in the council (relatively to the second strongest party) is above its median value in the sample. Panel B uses observations where the victory margin is below its median value in the sample. The bandwidth h (the width of the window of observations used in the regression) is 4 percentage point in all regressions. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Table 1.11 reports the corresponding estimates of Equations (1.1) and (1.2) in which I use quadratic control function and a bandwidth of 4 percentage points around the representation threshold. The table finds that both the probability of allocating procurements to the corporate donors and the value of procurements allocated to the corporate donors drop due to broader party representation only in councils with relatively higher political competition (columns 1 and 2). The representation by an additional party simultaneously leads to significantly higher bidder competition only in politically competitive councils (column 5). At the same time, councils with higher political competition more frequently use transparent open auctions (column 6) instead of restricted auctions and direct negotiations with specific bidders (columns 7 and 9, respectively). The representation by more parties reduces procurement expenditure (column 3) and procurement prices (column 4) both in relatively less and more politically competitive councils. Overall, the presented evidence provides support for the hypothesis that political competition is an important channel of the impact of broader party representation on the selection of political donors as procurement suppliers.

1.6.3 Bargaining Power

Finally, I examine the explanation that the representation by additional parties affects procurement by changing the bargaining power of parties in municipal councils. As shown in Table 1.4, the representation by a marginal party reduces the seat share of the national-level parties. This seat share can be decisive for coalition formation and for the allocation of power within the coalitions. Low bargaining power of the dominant parties can constrain the extent to which the dominant parties can select their donors as procurement suppliers and how transparent the procurement competition will be.

In order to test the hypothesis of bargaining power, I calculate Shapley-Shubik (1954) power indices for all parties represented in the local councils. This indices express the probability that individual parties are pivotal in the formation of majority coalitions. Parties with a lower seat share have a lower probability of being pivotal, which makes it less likely for them to be a part of the majority coalition, and also leaves them with a worse bargaining power index. Once I calculate the Shapley-Shubik indices, I split the sample around the representation threshold according to the median value of the bargaining power index of the strongest party in the local council. Then I

estimate the impact of the broader party representation on the procurement outcomes separately for the two sub-samples. If the bargaining-power hypothesis is true, one would expect a pronounced effect of broader party representation in the councils where the strongest party has a relatively weaker bargaining position.

Table 1.12 reports the corresponding estimates of the broader party representation effects. Panel A uses observations in which the strongest party in the local council has a higher than median bargaining power index and Panel B uses the remainer of the observations. The table shows that the probability of allocating procurements to corporate donors drops particularly in councils in which the strongest party has a low bargaining power index (column 1). This evidence is not supported by the reduction in the value of procurements allocated to corporate donors (column 2). The procurement expenditures (column 3) and prices (column 4) seem to be reduced due to broader party representation only if the strongest party has low bargaining power, although the estimates are not significant in either of the groups of councils. The councils where the strongest party has relatively low bargaining power less frequently use less transparent restricted auctions (column 7) and direct negotiations with specific bidders (column 9) in favor of discretionary procurement procedures (column 8). However, bidder competition significantly increases due to additional party representation both in the councils where the strongest party had a relatively low and relatively high bargaining position (column 5). Overall, the results still appear to be consistent with the bargaining power hypothesis.

TABLE 1.12

Political Bargaining and Procurement Outcomes

Dependent variable:	Probability of Allocating at Least One Procurement to Political Donor	Contract Value of Procurements Allocated to Political Donors (mil. CZK)	Share of Total Contract Value of Procurements on Total Budget Revenue	Difference Between Contract Price and Planned Value of Procurement (in % of Planned Value)	Number of Bidders	Share of Open Auctions	Share of Restricted Auctions	Share of Simplified Discretionary Procedures	Share of Negotiations without Public Notice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Above-median bargaining power of the strongest party									
	-0.050	-22.275	-0.001	0.001	1.534***	-0.071	0.142**	-0.119	0.049
	[0.073]	[14.708]	[0.024]	[0.039]	[0.491]	[0.085]	[0.071]	[0.098]	[0.036]
Effective Obs.	169	169	169	169	169	168	168	168	168
Bandwidth	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Polynomial	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic
Panel B: Below-median bargaining power of the strongest party									
	-0.155*	-22.445***	-0.043	-0.042	0.887**	-0.127*	-0.048	0.182**	-0.006
	[0.088]	[7.013]	[0.026]	[0.026]	[0.357]	[0.070]	[0.047]	[0.072]	[0.010]
Effective Obs.	168	168	168	168	168	165	165	165	165
Bandwidth	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Polynomial	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic	quadratic

Notes: All entries report the coefficient for the number of parties represented in a local council estimated by local polynomial regressions as specified in Equations (1.1) and (1.2). Panel A uses observations where the Shapley-Shubik (1954) index of the bargaining power of the strongest party in the council is above the sample median. Panel B uses observations where the Shapley-Shubik (1954) bargaining power index of the strongest party is below its median value in the sample. The bandwidth h (the width of the window of observations used in the regression) is in all segments 4 percentge point. All regressions include administrative district effects and pre-treatment characteristics listed in Table 1.2. Robust standard errors are presented in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

1.7 Conclusions

This chapter examines the impact of increasing the number of parties in political representation on public spending and selection of politically-connected suppliers in public procurement. I exploit the discontinuous jump in the probability of receiving seats in the Czech municipal councils once political parties cross a 5% representation threshold. In this way, I identify the impact of having broader party representation on procurement outcomes separately from the effects of institutional factors and electoral selection.

The chapter finds that having more parties in local councils causally restricts the allocation of procurements to corporate donors of political parties. Local councils with more parties allocate procurements at lower prices, which reduces the share of procurement expenditure on the overall municipal budget. The likely drivers of these results are increased competition among suppliers and a higher prevalence of discretionary procurement procedures, which allow public officials to selectively invite suppliers to procurement tenders. The estimated effects are pronounced in councils with high political competition and low bargaining power of the dominant parties. On the other hand, the effects of broad party representation are not related to whether the marginally represented parties are incumbent or not.

Due to data limitations, the chapter cannot evaluate the overall welfare implications of broader party representation on public procurement. To calculate the total benefits of additional party representation, one would need to obtain information about the quality of the provided procurements and details about contract renegotiations. It is important to note that the estimates are local average treatment effects (Imbens and Angrist 1994). Despite these limitations, the presented evidence sheds new light on questions regarding the formation of political accountability and the role of political competition in shaping public policy. The study further opens the black-box of the returns to political connections created through corporate donations to political parties.

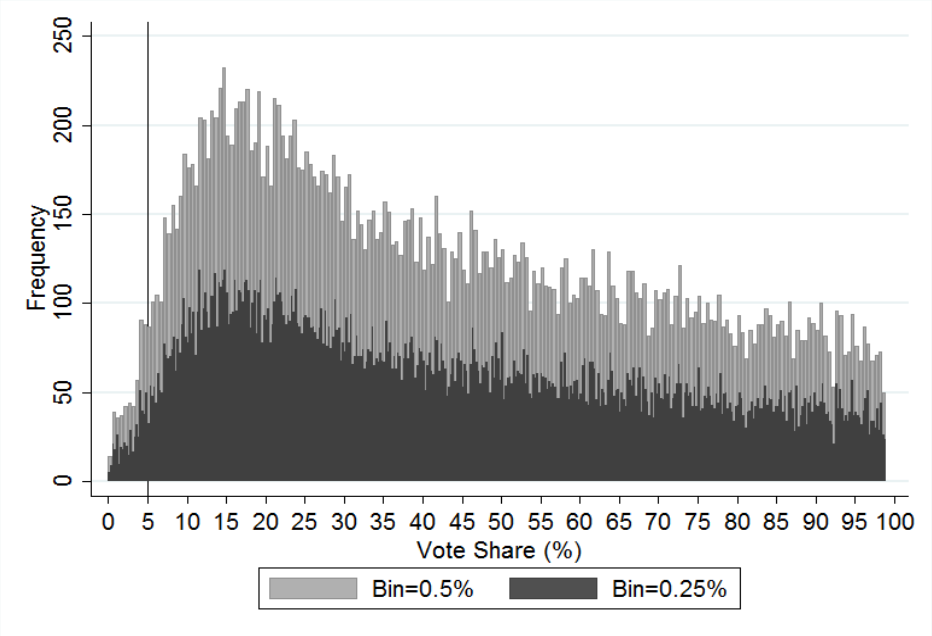
Given the evidence presented, it might seem natural to ask whether the representation thresholds should be reduced or entirely abolished. A more general question stands whether countries should try to reduce barriers to political representation. Although the findings in this study are consistent

with the literature showing that factors lowering the barriers to political entry are associated with less political corruption (Persson, Tabellini and Trebbi 2003), this chapter is unable to test whether a decrease in the representation thresholds would be overall desirable. My empirical strategy can compare the behavior of politicians in councils with and without additionally represented parties. The chapter thus cannot predict, for instance, how politicians would behave if thresholds were halved or entirely cancelled. Moreover, excessive fragmentation of political power and low clarity of governmental responsibility might become concerns if the representation threshold was to be reduced (Tavits 2007). To sum up, despite finding that broader party representation has important implications for the allocation of public funds, further research is needed to assess whether representation by a greater number of political parties also affects other aspects of governance and ultimately improves voters' welfare.

1.A Appendix 1

FIGURE 1.A.1

Vote Share Distribution – All Political Parties in All Municipalities, 2006 local elections



Notes: The figure shows the frequency of the vote share of all political parties in all municipalities in the 2006 local elections. The vertical line identifies the 5% electoral threshold that determines whether parties enter seat-allocation procedure and therefore qualify for representation in local council.

TABLE 1.A.1

Procurement Procedures

Open auctions

In an open auction, a local council starts the procurement process by publishing a complete project specification, including a set of pre-qualification criteria for potential suppliers, anticipated project value and a set of bid-evaluation criteria. A deadline for bid-submission is scheduled, by which any firm may submit a bid. Upon the deadline, the council reviews whether the firms fulfilled the pre-qualification criteria. From among the qualified firms, the council selects the most favorable bid according to the pre-defined evaluation criteria.

This procedure is the default procurement procedure. The requirement to prepare a complete project specification before the start of the procurement process and the rule that all firms can participate in procurement limit the flexibility of the procurement process and the discretion of the local councils to eliminate undesired firms from procurement competition.

Restricted auctions

In a restricted auction, a local council starts the procurement process by publishing a complete project specification, including a set of pre-qualification criteria for potential suppliers, an anticipated project value and a set of bid-evaluation criteria. A deadline for bid-submission is scheduled, by which any firm may submit a bid. Upon the deadline, the council reviews whether the firms fulfilled the pre-qualification criteria. From among the qualified firms, the council randomly selects a subset of firms (not smaller than five, if applicable), and selects the most favorable bid from the subset of firms according to the pre-defined evaluation criteria.

This procedure restricts competition and transparency in procurement and the mode of selecting the subset of considered firms is often questioned. The benefit of this procedure is that it can save administrative and time costs associated with evaluating all incoming bids.

Simplified discretionary procedures

In a simplified discretionary procedure, a local council prepares a complete project specification, including an anticipated project value and a set of bid-evaluation criteria. The council selects autonomously no less than five potential suppliers, sends them the project specification and calls them to submit their bids. The firm with the best offered bid is selected as the procurement supplier.

This procurement procedure may be used only if the anticipated value of a procurement does not exceed CZK 20 million. The selection of firms to be invited to submit bids is at the full discretion of local councils. This procedure gives much more flexibility and discretion to councils compared to the open and restricted auctions; however, at the cost of unequal treatment of suppliers and low transparency of their selection.

Negotiations with suppliers approached directly.

In a negotiating procedure, a local council negotiates project specification and contractual terms with only one firm approached directly. If both the council and the firm agree on contractual terms, then the contract between them is signed.

This procedure can be used only after previous unsuccessful attempts to procure the contract in a different type of contract-allocation procedure or if specific technical reasons, the need for proprietorship protection or other legal circumstances preclude contracting with other than one specific firm. The procedure may be also used in cases of emergency which the local council did not cause and could not anticipate. This procedure gives substantial discretion to the local council; however, at the cost of very low transparency and no competition in procurement.

TABLE 1.A.2

Pre-treatment Characteristics

	3 percentage points spread in vote share				
	obs.	mean	st .dev.	RD estimate	SE on estimate
	(1)	(2)	(3)	(4)	(5)
Fiscal outcomes (pre-election term)					
Log tax revenue per capita	311	9.02	0.20	0.001	[0.021]
Log capital revenue per capita	311	6.78	1.16	-0.035	[0.160]
Log subsidies per capita	311	8.85	0.56	0.008	[0.043]
Log spending per capita	311	9.87	0.33	0.008	[0.020]
Total deficit per capita (in ths. CZK)	311	-0.10	2.77	-0.280	[0.254]
Electoral outcomes (prior to seat-allocation)					
Voter turnout	312	0.35	0.08	-0.003	[0.011]
Number of parties in race	312	7.19	2.21	-0.510	[0.732]
Number of seats in council	312	19.42	7.50	0.233	[0.637]
Demographic characteristics					
Population size (in ths.)	312	12.59	19.26	0.130	[1.862]
Average resident age	312	39.42	1.61	0.131	[0.291]
Average resident male ratio	312	0.49	0.01	0.002	[0.002]

Notes: Data on municipal public finance are from the Ministry of Finance of the Czech Republic. Electoral data and demographic characteristics are from the Statistical Office of the Czech Republic. Column (4) reports the coefficient for the number of parties represented in a local council estimated by local polynomial regressions as specified in Eq. (2) when the respective characteristic is used as the dependent variable, for quadratic polynomial, and a bandwidth h (the width of the window of observations used in the regression) of 3 percentage points. Column (5) reports the RD robust standard errors.

TABLE 1.A.3

Pre-treatment Characteristics

	2.5 percentage points spread in vote share				
	obs.	mean	st .dev.	RD estimate	SE on estimate
	(1)	(2)	(3)	(4)	(5)
Fiscal outcomes (pre-election term)					
Log tax revenue per capita	273	9.02	0.20	-0.005	[0.021]
Log capital revenue per capita	273	6.76	1.17	-0.133	[0.152]
Log subsidies per capita	273	8.88	0.56	-0.001	[0.042]
Log spending per capita	273	9.88	0.33	0.015	[0.020]
Total deficit per capita (in ths. CZK)	273	0.05	1.47	-0.352	[0.279]
Electoral outcomes (prior to seat-allocation)					
Voter turnout	274	0.34	0.08	-0.002	[0.012]
Number of parties in race	274	7.41	2.18	-0.535	[0.757]
Number of seats in council	274	20.02	7.62	0.143	[0.618]
Demographic characteristics					
Population size (in ths.)	274	13.83	20.19	0.535	[1.807]
Average resident age	274	39.42	1.63	-0.021	[0.290]
Average resident male ratio	274	0.49	0.01	0.002	[0.002]

Notes: Data on municipal public finance are from the Ministry of Finance of the Czech Republic. Electoral data and demographic characteristics are from the Statistical Office of the Czech Republic. Column (4) reports the coefficient for the number of parties represented in a local council estimated by local polynomial regressions as specified in Eq. (2) when the respective characteristic is used as the dependent variable, for quadratic polynomial, and a bandwidth h (the width of the window of observations used in the regression) of 2.5 percentage points. Column (5) reports the RD robust standard errors.

2 Chapter

Manipulation of Procurement Contracts: Evidence from the Introduction of Discretionary Thresholds[1]

Co-authored by Filip Pertold

2.1 Introduction

Administrative law has long recognized that giving greater discretion to public officials can adversely affect public service provision. Public servants can abuse discretionary power to pursue their private rather than social interests. However, a potential benefit of the discretion is that competent bureaucrats can use valuable information they hold privately about the provision of public services.

In the spirit of administrative law, many European countries, as well as the United States, use open auctions in public procurement. Open auctions are supposed to increase transparency, boost competition and promote equal access among potential contractors, but they also reduce public officials' flexibility and generate additional administrative and time costs (Banfield 1975; Kelman 1990; Bulow and Klemperer 1996; Europe Economics

[1] This chapter is forthcoming in the *American Economic Journal: Economic Policy*.

2006; Calzolari and Spagnolo 2009; Helper and Henderson 2014). If the anticipated value of a procurement does not exceed a certain legislative threshold, public officials can decide to allocate procurements using flexible contract-allocation procedures in which firms selected by the officials submit bids.[2] This discretion enables knowledgeable public officials to exclude suppliers with potentially low performance, but it also increases the risk that dishonest officials will collude with some suppliers and ultimately misallocate public resources.

In this chapter we ask whether and how legislative thresholds allowing for such flexible procedures affect public officials' decisions regarding the value of a given procurement and the selection of contractors. Understanding the effects of these thresholds on public officials' behavior is important, since OECD countries alone redistribute 13 % of their GDP through public procurement systems (OECD 2013). At the same time, 40 % of the total value in European construction works procurement is below the threshold level (European Commission 2011). Expenditures under the US simplified acquisition threshold (excluding micro-purchases) totaled about USD 19 billion in 2014, which is about 4% of federal acquisition spending (GovConChannel 2015).

Previous literature used legislative thresholds in regression-discontinuity designs in order to analyze whether contract-allocation procedures with different levels of discretion affect procurement outcomes, such as contract prices or renegotiation costs (Spagnolo 2012; Coviello and Mariniello 2014; Coviello et al., forthcoming). Discontinuity in discretion at thresholds helped to address the identification problem that public officials may choose the type of allocation procedure based on unobserved characteristics of procurements, such as their complexity. In order to properly apply such discontinuity designs, these studies had to analyze only procurements that are not subject to sorting by public officials below the thresholds. However, little attention has been paid to procurement sectors where legislative thresholds may lead to strategic considerations of public officials - for example, in setting the anticipated value of procurement or using discretion to select

[2] The US Federal Acquisition Regulation (FAR), for example, has a "simplified acquisition threshold" set at a contract value of $150,000. Several reporting requirements do not apply below this value; e.g., the Miller Act (requiring payment and performance bonds), etc. (Coviello, Guglielmo and Spagnolo, forthcoming). The threshold is especially significant for small businesses, because transactions below the threshold are reserved for small businesses.

specific contractors. Understanding the strategic behavior of public officials is critical for setting such thresholds in legislation as well as in discussion about optimal levels of discretion in public sector.

We contribute to the literature by showing how the introduction of thresholds that allow the option to avoid open procurement competition leads to distortions by public officials. Distortions are revealed by bunching of procurement values just below the thresholds, and are more likely to be present in certain procurement sectors where setting the anticipated value is less transparent, such as in construction and services. We thus show that the contract-allocation procedure and the anticipated value of a procurement can be simultaneously subject to the choices of public officials. This implies that the discretion of public officials can endogenize the relationship between characteristics of procured goods, format of procurement (e.g. transparency, flexibility) and procurement outcomes (e.g. contract price).

We further show that manipulation of procurement values is associated with an increased probability that procurements are awarded to firms hiding their owners. We also observe that the contract prices (relative to the anticipated value of procurements) just below the thresholds are higher if procurements are awarded to anonymously-owned firms rather than to firms with traceable owners.

We view our results as a concrete illustration of how endogenous sorting below discretionary thresholds may invalidate regression discontinuity designs, because characteristics of procurement winners and related procurement outcomes around the discretionary thresholds can be subject to the choices of public officials. Further, the observed association between the manipulation of procurement values and the revealed preferences for anonymous firm owners suggest that in a regime with higher flexibility, public officials are more likely to select firms whose legal form allows for hiding rent-seeking behavior.[3] This evidence is more in line with a traditional view of administrative

[3] In countries with weak institutions, anonymously-owned firms may hide the identity of agents who are procurement officials and at the same time stakeholders in anonymously-owned companies (Gordon 2009; Sharman 2010; United Nations 1998). Previous evidence from Russia, for example, shows that similar fly-by-night firms are used to extract resources from public procurement (Mironov and Zhuravskaya 2016). In Table 2.A.2 in the Appendix we present anecdotal evidence of many corruption scandals that are associated with anonymously-owned firms in public procurement in the Czech Republic.

law that emphasizes the costs of administrative discretion over its benefits, which may be relevant mainly for countries with low accountability of public officials and weak institutions, represented here by the case of the Czech Republic (Shleifer and Vishny 1993, 1994).

In our empirical strategy, we employ a policy change that introduced new discretionary thresholds into the system of public procurements. Before the change, public procurements had to be conducted through transparent auctions with open access for any potential contractor. After the change, public bodies were given the autonomy to preselect at least five potential contractors for simplified negotiations if the anticipated value of procurement was set below the legislative threshold. For example, construction procurements could be awarded using the new simplified procedure only if they were valued at less than CZK 20 million (approx. USD 1 million) (see Table 2.A.1). By comparing the empirical distributions of procurement values before and after the reform, we can isolate the effect of the thresholds from other factors that may cause bunching in procurement and which are constant over time.

This approach has rarely been used in the economic literature, which usually analyzes the effect of thresholds on sorting in environments with already existing thresholds. For example, Urquiola and Verhoogen (2009) show that class size caps lead to endogenous sorting of students with specific parental backgrounds into schools near the cap. This illustrates how estimating the impact of class size on student output may lead to bias even in a regression discontinuity design. Another example is Saez (2010), which, in line with a simple tax evasion model, shows that tax brackets lead to sorting of the self-employed just below the bracket. In both cases, the distribution of the studied outcomes is not observable for environments without the thresholds, and the shape of the counterfactual needs to be assumed; for example, as smooth at the threshold. In many cases, such assumptions may be questioned, as in our case due to the rounding of procurement values by public officials. We thus incorporate the pre-reform distribution of procurement values into our empirical strategy. This approach ultimately leads to lower estimates of sorting.

In our analysis, we use data that contain information about more than 45,000 procurements worth over USD 52 billion, and include details about procurement contracts, winning contractors and procurement authorities. This data originates from the

Czech Republic, where the procurement market corresponds to approximately 16 % of GDP and where cross-country comparisons indicate high levels of favoritism in public contracting (Transparency International 2012; World Economic Forum 2011). The shortcoming of these data is that they do not include information about the delivered quality of procurements, renegotiations and administrative costs, which precludes an overall welfare analysis of the impact of manipulation. Our dataset, however, does carry information about the characteristics of the winning firms, including information about the traceability of their owners.

Our research is in line with literature that discusses optimal delegation in the public sector. This literature (e.g. Alonso and Matouschek 2008) advises the use of stricter rules and external controls whenever there is a misalignment between the preferences of public officials and those of the society. This is supported by the empirical evidence presented in Di Tella and Schargrodsky (2003), which shows that external controls and reduced discretion of public officials led to less corruption in the procurement of medical goods in Argentina. In contrast, Bandiera, Prat and Valletti (2009) argue that high external controls and reduced discretion can have detrimental effects when wasteful behavior is unintentional and public officials do not earn private benefits from public waste. Similarly, Spagnolo (2012) and Coviello, Guglielmo and Spagnolo (forthcoming) use a regression discontinuity design to document that greater use of flexible procedures below thresholds does not adversely affect outcomes in procurement, but allows public officials to speed up the procurement process by selecting incumbent suppliers. On the other hand, Coviello and Mariniello (2014) analyze the impact of reduced transparency requirements below procurement thresholds and show that reduced transparency has a negative impact.

In our case, we find that the introduction of regimes giving greater discretion to procurement officials in a high corruption country leads to the manipulation of procurement values and simultaneously to a more likely allocation of procurements just below the thresholds to firms with anonymous ownership structure. Although we cannot quantify the impact of the manipulation on quality of the provided goods, administrative and renegotiation costs, our results are more in line with the stream of literature suggesting likely negative effects of the reduced transparency, greater discretion and low accountability of public officials.

The rest of the chapter is organized as follows. Section 2.2 discusses the institutional framework of Czech public procurement and the policy reform that introduced new procurement thresholds. Section 2.3 describes the data from procurement contracts. Section 2.4 presents our empirical strategies for detecting manipulation in procurement. Section 2.5 shows the results and the empirical analysis of manipulation, along with robustness checks. Section 2.6 presents evidence that the thresholds distort associations between the characteristics of contract-allocation procedures and procurement outcomes. Finally, section 2.7 summarizes our findings and discusses policy implications.

2.2 Institutional Background

Public Procurement and Thresholds in the Anticipated Value

Public procurement constitutes one of the largest public spending processes in the Czech Republic. Annually, about 13-16% of GDP (USD 31 billion in 2010) is spent on procurement of goods, construction works, and services, making this one of the largest procurement markets among OECD countries (OECD 2013).

Several characteristics of planned procurements determine the level of autonomy of procurement agencies in the Czech institutional setting. In this study, we focus on the *anticipated value* of procurements, as this defines the level of discretion available to procurement officials.

Different legislative thresholds in the anticipated contract value divide procurements into separate groups that differ in their mandatory requirements on transparency and open access to the procurement process. The rule is that the anticipated value should be set so as to approximate the anticipated financial obligations ensuing from the contract, so that the agency can plan its future expenditures. Engineers employed by the agencies estimate the value of projects prior to the start of the contract-awarding process based on a menu of standardized costs for each type of works. However, these standards vary across agencies and are neither strictly binding nor enforced. The anticipated value does not serve as a reserve price in procurement auctions. The firms can bid even a higher price than the anticipated value of a project. As shown later, procuring agencies can thus adjust

the anticipated value of projects quite freely, so that lighter legislative restrictions apply to their targeted procurements.

The reform of the Czech procurement code of July 2006 introduced a new type of procurement procedure into the legislation and thereby introduced several new thresholds in procurement (see Table 2.A.1 in the Appendix). This reform followed the accession of the Czech Republic into the European Union and replaced the older regulation which did not comply with the European Directives on public procurement (Pavel 2013). The introduction of the new thresholds is the key factor for our empirical strategy, because the new procedure is not applicable above these thresholds.

The new thresholds offered procurement officials the opportunity to free themselves from the rigid rules which otherwise regulate the transparent contract-awarding process. In particular, if the anticipated value of a procurement contract is set below the threshold, the officials are allowed to autonomously approach potential contractors themselves instead of being required to provide open access to any company that might want to participate in the procurement competition. Agencies therefore did not need to set lengthy deadlines for bid-submission or to evaluate all incoming bids, but could rather directly invite pre-selected companies to submit bids. In a trade-off, the law demanded that agencies must invite at least five potential suppliers so as to guarantee some degree of competition (see Table 2.A.3 for further details on procurement procedures).

A major novelty of the reform arose from the fact that the decision as to which bidders would be invited was left at the full discretion of the procurement agencies. This practice is considered common in private-sector procurement (Kelman 1990). The discretion to pre-select sub-contractors enables firms to procure contracts based on long-term relationships and reputation, which can partly remedy the common aspect of non-contractible quality in procurement (Bannerjee and Duflo 2000; Calzolari and Spagnolo 2009). The cost of this discretion is, however, less equal treatment of suppliers and a lower accountability of officials in less transparent procurement. In private sector procurement these issues are nonetheless considered secondary, because private procurement officials do not redistribute public money and are accountable to company owners.

Anonymous Firms in the Czech Republic

Czech public procurement has been criticized for favoritism, corruption and lack of effective institutional oversight. The World Economic Forum (2011) ranked the Czech Republic as low as 123rd among 142 countries in terms of the extent to which government officials show favoritism toward well-connected firms. Even though two public institutions oversee Czech public procurement, one of them, the Supreme Audit Office, does not have the authority to impose sanctions, but merely issues recommendations, while the other, the Czech Antitrust Office, has been known for its rather passive and formalistic approach (Transparency International 2009).

The Czech institutional setting has also been characterized by a high number of anonymously-owned firms competing for procurements. The Czech legal code specifically enables joint-stock companies to issue two types of shares: either they are nominated to concrete holders with shareholders' names declared directly on the shares (or in the list of shareholders), or a joint-stock company can issue bearer shares, which entitle any current bearer of the shares to property rights. The share bearers are not registered anywhere and are unknown to the joint-stock company or to any controlling bodies (Šedová 2014). A change in ownership can be performed instantly without producing any traceable records. The owners of bearer shares usually cash in benefits from their ownership by sending legal representatives to general meetings of joint-stock companies. The loose regulation of bearer shares thereby helps to conceal connections between businesses and procurement officials.

Many firms with anonymous owners have played an important role in various corruption scandals in both the public and private sector (Economist 2013), which is also documented in Table 2.A.2 in the Appendix. These scandals have led to pressure from many anticorruption organizations, including Transparency International, demanding that anonymous ownership be banned in order to reduce corruption and other types of waste of public resources. The Czech government has incorporated these recommendations into legislation.

2.3 Data from Public Procurement Contracts

The available data on public procurement contracts include the characteristics of all procurements awarded in the Czech Republic from 2005 to 2010, conditional on their procurement process being governed by the Czech Public Procurement Act. The database therefore mandatorily contains information on contracts that are expected to cost more than minimum anticipated value and does not contain data on contracts procured through legislative exemptions.[4] Altogether, this amounts to over 45, 000 procurement contracts worth more than CZK 1,038 billion (approximately USD 52 billion).

The unit of observation in this study is a procurement project, although several contracts (with different contractors) may be procured within one project, for example, due to geographically dispersed branches of some procurement agencies or due to procurement through framework agreements. The focus is however placed on projects because the anticipated value of procurements must be estimated at the level of an entire project, rather than for each contract separately.

For each project the database includes information on the subject of the procured goods/ services/ construction works (represented by a detailed CPV code[5]), the type of contract-awarding procedure, characteristics of the procuring agencies and winning contractors, and the anticipated value and contractual price of procurements.

Table 2.1 provides the summary statistics of all the contracts in two observation periods: before the legislative reform of the Public Procurement Act in 2006 and afterwards. The table shows very little changes in the overall structure of demand for procurements. One can see that the share of the overall financial volume spent on goods, services, and construction remains stable over time. Also, there is only a small change in the share of procurements allocated by national versus regional agencies.

---

[4] The minimum anticipated value for collecting data on procurements was CZK 2 million for goods, services and construction works before the 2006 reform. This was far below the new discretionary thresholds. The limit for construction works changed in 2006 from CZK 2 million to CZK 6 million. We take this change into account in our analysis.

[5] CPV code (Common procurement vocabulary) is a classification of the main subject of procurements unified across the European Union. For more information, visit http://simap.europa.eu/codes-and-nomenclatures/codes-cpv/codes-cpv_en.htm

TABLE 2.1

Descriptive Statistics

Characterization:	January 2005 - June 2006		July 2006 – Dec 2010	
	Volume (CZK billion)	(%)	Volume (CZK billion)	(%)
By main object:				
- Goods	21.56	12.45	102.71	11.87
- Services	37.87	21.87	192.17	22.21
- Construction works	113.71	65.68	570.33	65.92
By procurement procedure:				
- Open	146.52	84.58	580.45	68.00
- Restricted	26.69	15.42	82.23	9.63
- Simplified Negotiations or Negotiations with Prior Public Notice	N/A*	N/A*	98.56	11.55
- Negotiations without Prior Public Notice	N/A*	N/A*	92.36	10.82
By procuring agency type:				
- National Procurers	117.89	68.09	560.63	64.80
- Regional Public Bodies	55.25	31.91	304.57	35.20
By Anonymity of Suppliers:				
- Anonymous Owner	3.26	1.88	18.78	2.17

Notes: Descriptive statistics are provided both by the number of procurement projects and by procurement volume (in billion CZK; 20 CZK ≈ 1 USD). * The N/A mark indicates the non-applicability of a statistic for a given observation period.

The table, however, shows evident changes in the use of procurement procedures after the reform. More than 16.5% of the total procurement value shifted from open auctions to other, less transparent, procedures. This demonstrates the preference of procurement agencies for the new procedures.

We further merge the procurement dataset with additional information about contractors from the official register of economic subjects using unique contractor identifiers. The register includes information about the size of their capital stock, legal form, year of incorporation, number of employees, and – most importantly – about the traceability of their owners.

TABLE 2.2

Contractor Characteristics, by Type of Ownership

	All companies	Traceable companies	Anonymous companies	Difference
Capital stock (mill. CZK) [a]	334	396	78.2	- 317.8**
Median year of incorporation [b]	1997	1996	1999	***
Number of employees [C]				
- *0 – 24 employees*	28.77	25.04	44.04	+19.0***
- *25 – 99 employees*	32.46	34.48	24.19	-10.3***
- *100 – 249 employees*	17.36	18.96	10.83	-8.13***
- *250 – 999 employees*	12.83	13.49	10.11	-3.38*
- *1000 and more*	4.61	5.20	2.17	-3.04**
- *not specified*	3.97	2.82	8.66	+5.84***

Notes: The differences between joint-stock companies with anonymous and traceable owners are tested using: a) one-sample two-group t-test in case of the "capital stock"; b) k-sample test of the equality of medians in case of the "median year of incorporation" and c) one-sample two-group z-tests of the equality of proportions in case of the "Number of employees" categories, *** p<0.01, ** p<0.05, * p<0.1

In total, procurements transferred to anonymously-owned firms were worth CZK 22 billion (approx. USD 1 billion), based on almost 1,200 contracts, which represents 2.6% of the total number of contracts. These contracts were awarded to a total of 277 unique anonymously-owned firms. The share of these firms is not negligible, as they represent about 20 percent of all joint stock companies obtaining public procurements.

Table 2.2 compares anonymously-owned joint-stock firms with traceable joint-stock firms. Anonymously-owned firms are, on average, smaller, 3 years newer, and have much smaller capitalization.

2.4 Empirical Strategy for Detecting the Manipulation of Procurement Values

We use two empirical methods for detecting manipulation of procurement contracts. The first is based on the methodology of Chetty, Friedman, Olsen and Pistaferri (2011) and focuses on repeated cross-sectional density distributions of the anticipated value of procurements. The assumption, which underlies the statistical inference, is that the density distributions of the anticipated value would be smooth if more restrictive tendering procedures were not prohibited above the thresholds. The smoothness assumption might be rather strong in our application, for example in case rounding of the inspected variable were an issue.

Therefore, we offer an alternative strategy, which relaxes the assumption of the smooth counterfactual density distribution by exploiting the timing of the introduction of new thresholds into the procurement system. We assume that the density distribution after the reform would look the same as before the reform, if the reform had not established procurement thresholds. The assumptions behind our strategy are a stable demand for procurements over time, and no intentional delays in procurements until after the reform.[6] Our empirical strategy is technically only an extension of that in Chetty el al., thus we start with cross-sectional analysis.

In the first step, we plot the empirical distribution of the anticipated value of procurements in a histogram with D re-centered to zero. In the second step, a polynomial is fitted to the histogram excluding the data in a narrow window below the threshold. This means that a polynomial regression of the following form is estimated:

$$C_j = \sum_{i=0}^{q} \beta_i . (Z_j)^i + \sum_{i=-R}^{0} \gamma_i . \mathbf{1}[Z_j = i] + \varepsilon_j \quad (2.1)$$

where C_j is the number of procurement contracts in a histogram bin j, Z_j is the anticipated value of contracts grouped in histogram bin j, q is the order of the polynomial, and R

[6] Supportive evidence for the first assumption is presented in Table 2.1, which shows that the structure of the overall financial volume spent on construction, goods and services appears to be stable over time. Evidence for the second assumption is discussed in section 2.5, in which we show that the extent of manipulation remains stable over time after the reform. Moreover, our evidence rather suggests that there was a slight delay in the impact of the reform, mainly in the construction sector.

denotes the width of the excluded region below the threshold measured in the number of excluded bins below D.[7]

The estimate of the counterfactual distribution is defined as predicted values from (1) omitting the contribution of the dummy variables below the threshold:

$$\hat{C}_j = \sum_{i=0}^{q} \hat{\beta}_i \cdot (Z_j)^i \tag{2.2}$$

The excess number of contracts that are located below the threshold is[8]:

$$\hat{B}_N = \sum_{j=-R}^{0} C_j - \hat{C}_j = \sum_{i=-R}^{0} \hat{\gamma}_i \tag{2.3}$$

Finally, we define the empirical estimate of the excess mass below the threshold relative to the average density of the counterfactual anticipated contract value distribution between –R and 0 as:

$$\hat{b} = \frac{\hat{B}_N}{\sum_{j=-R}^{0} \hat{C}_j / R} \tag{2.4}$$

We calculate the standard error for $\hat{b}$ using a parametric bootstrap procedure. We draw from the estimated vector of errors ξ_j in (1) with replacement to generate a new set of counts and apply the above technique to calculate a new estimate $\hat{b}^k$. We define the standard error of $\hat{b}$ as the standard deviation of the distribution of $\hat{b}^k$s.

The second empirical method incorporates a time dimension into the econometric model. This method relaxes the assumption of a smooth density distribution of the anticipated contract value and assumes that the shape of the density distribution after the 2006 reform would look the same as prior to it.

The estimation again proceeds in two steps. We first plot all the annual histograms of the anticipated value with thresholds re-centered to zero. In the second step, we regress the

[7] We conduct the analysis for different parametric choices of q and R. We also estimate the specification where the excluded region is symmetric around the threshold D. We comment on the results of this analysis in section 2.5.

[8] This calculation would overestimate B_N because it does not satisfy the constraint that the area under the counterfactual distribution must equal the area under the empirical distribution. To take this aspect into account, we follow Chetty et al. (2011) and correct the counterfactual distribution above the threshold so that the integration constraint is satisfied.

number of contracts in bin j and time t, denoted as C_{jt}, on an interaction term between an indicator for contracts located in the excluded region below the threshold and indicator for the validity of the 2006 reform (that occurred in time denoted as T). We include in our model a set of fixed effects for histogram bins in which contracts would be located, and annual fixed effects, which are intended to capture the time trend. The econometric model can be formally expressed as follows:

$$C_{jt} = \alpha_j + \alpha_t + \sum_{i=-R}^{0} \gamma_i \,.\, \mathbf{1}[Z_j = i].\, \mathbf{1}[t > T] + \varepsilon_{jt} \tag{2.5}$$

The coefficients of interest $\hat{\gamma}_i,\ i \in [1,\ R]$, represent our estimates of the excess mass of contracts in particular bins of the excluded region below the threshold. We estimate the regressions using Poisson conditional fixed-effects quasi-maximum likelihood (QML). This estimator has several desirable properties, including 1) consistency of the coefficient estimates independently of any assumption on the conditional variance as long as the mean is correctly specified (Wooldridge 1997) and 2) consistency of the standard errors even if the data generating process is not Poisson. [9]

2.5 Empirical Analysis of Manipulation Detection

We divide our analysis into three types of procurements – construction, goods, and services. This is because the difficulty of manipulating the value of a procurement may depend on the product type. For example, monitoring an appropriate price for consulting services can be more difficult compared to procurement of IT hardware for which comparison prices are readily available.

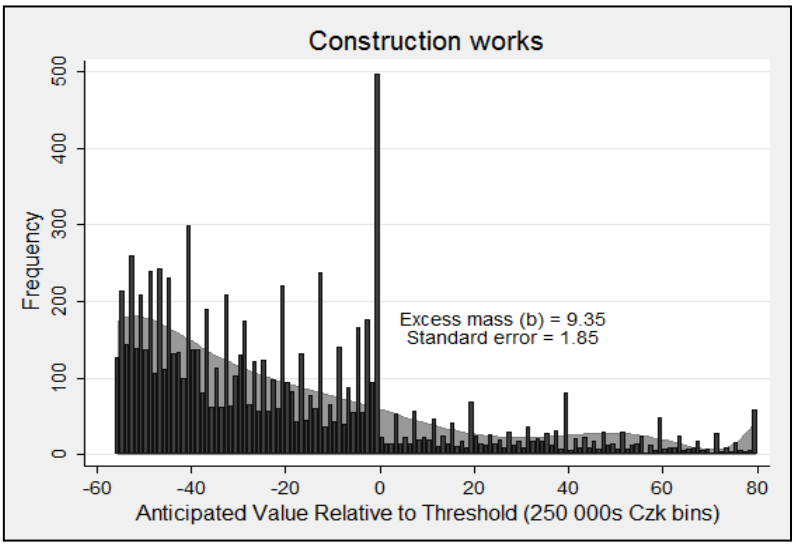
We start with cross-sectional analysis and plot the empirical distribution of the anticipated value of procurements for all construction contracts procured in the Czech Republic after the 2006 procurement reform up to the end of our observation period in 2010 (Figure 2.1). The contracts are grouped into CZK 250,000 bins (-14,000,000 to -13,750,000, -

[9]The estimation is implemented in STATA with the xtpqml procedure written by T. Simcoe and is available at http://people.bu.edu/tsimcoe/code/xtpqml.txt

13,750,000 to -13,500,000, etc.) on the re-centered anticipated value variable (the threshold is re-centered to zero).

FIGURE 2.1

Anticipated Value Density Distribution around the Procurement Threshold



Notes: The series shown in bars is a histogram of the anticipated value of construction works, relative to the threshold. The solid distribution beneath the empirical distribution is a seventh-degree polynomial fitted to the empirical distribution, excluding points CZK 750,000 or less below the threshold.

Figure 2.1 shows that there is a spike below the simplified negotiations threshold in the (otherwise declining) anticipated value distribution. The solid area beneath the empirical distribution shows the counterfactual density $\{\hat{C}_j\}$ predicted using (1) with a seventh-degree polynomial (q=7) and a window of CZK 750,000 located just below the threshold (R=3). With these parameters, we estimate $b = 9.35$ – the excess mass below the threshold is 935 % of the average height of the counterfactual distribution within CZK 750,000 below the threshold.[10, 11]

[10] The results are not qualitatively sensitive to changes in bin size, parametric choice of q or R, as demonstrated in Table 2.A.4, Table 2.A.5, and Table 2.A.6, respectively. The results are also not sensitive to specifications accounting for specific focal points located within the anticipated value distribution (for example, located at substantial round figures within the distribution).

[11] We also estimate the specification where the excluded region is symmetric around the threshold. This exercise increases the estimated magnitude of bunching for goods and services contracts and reduces the estimated bunching for construction contracts. The estimates remain highly statistically significant.

The first column of Table 2.3 presents these results. The standard error associated with our estimate of *b* is 1.85. The null hypothesis that there is no excess mass at the threshold relative to the counterfactual distribution is rejected with a t-statistic of 5.055.

TABLE 2.3

Polynomial Regression Estimates of Excess Mass below the Threshold

	Construction Works	**Goods**	**Services**
$\hat{b}$	9.352***	1.996***	3.027***
	[1.850]	[0.236]	[0.275]
$\hat{B}_N$	581	282	501
N	8,830	5,228	6,357

Notes: $\hat{B}_N$ denotes the estimated excess number of contracts below the threshold, and $\hat{b}$ denotes the excess mass of contracts relative to the average density at the threshold. Standard errors are presented in brackets. ***Estimates significant at the 1% level.

Using the same methodology, we also find statistically significant evidence of manipulations of the anticipated values of goods and services contracts. The second and third columns of Table 2.3 summarize these results.[12] The estimated excess mass at threshold for goods contracts is 200% of the average height of the counterfactual distribution. The estimated excess mass at the threshold for services is 303% of the average counterfactual distribution height. The estimated extent of manipulation is thus smaller than for construction. [13]

Using a back-of-the-envelope calculation, we calculate the share of manipulated contracts procured through the simplified negotiations below threshold. According to our results, the manipulations affect 11% of all contracts procured using this non-transparent procedure after July 2006.[14]

[12] Due to space constraints, we omit figures showing the distributions for goods and services contracts.
[13] We test for the presence of bunching in the five largest sub-categories of construction works, including building construction works, engineering works, and construction works for water projects (see Table 2.A.7 in the Appendix). We find evidence of bunching in all of these categories, except for the relatively small category of water projects, for which the estimates are not statistically significant. This finding is different to Coviello et al. (forthcoming), who find no evidence of bunching in the Italian building construction sector.
[14] We count 1,364 contracts excessively massed below thresholds, while altogether 12,372 procurements were allocated using the simplified negotiations after July 2006.

The assumption of the smooth counterfactual density distribution can be relaxed by exploiting the timing of the introduction of new thresholds into the procurement legislation. Figure 2.2 displays the distribution of the anticipated value in each year from 2005-2010 for all construction works. In the subfigures it is clear that the first appearance of bunching appears just a few months after the introduction of the simplified negotiating threshold. In the subfigures, the excess mass of contracts persistently clings very closely to the legislative threshold after the reform and its size remains quantitatively similar. This implies that possible short run effects, for example, intentional delays of procurements until the reform, are not relevant for the estimated extent of manipulation just below the limit.

TABLE 2.4

Estimated Excess Mass below the Threshold by Year and Main Object

	Construction Works		**Goods**		**Services**	
Year	Excess Mass Estimates	SE	Excess Mass Estimates	SE	Excess Mass Estimates	SE
2005	2.861	[1.902]	0.410	[0.552]	- 0.025	[0.577]
2006	2.628	[1.891]	1.635***	[0.257]	0.800***	[0.294]
2007	12.100***	[2.697]	1.389***	[0.427]	3.162***	[0.460]
2008	8.965***	[1.651]	1.799***	[0.494]	2.121***	[0.478]
2009	11.190***	[2.504]	1.901***	[0.522]	2.503***	[0.561]
2010	8.954***	[1.990]	2.362***	[0.360]	2.852***	[0.371]

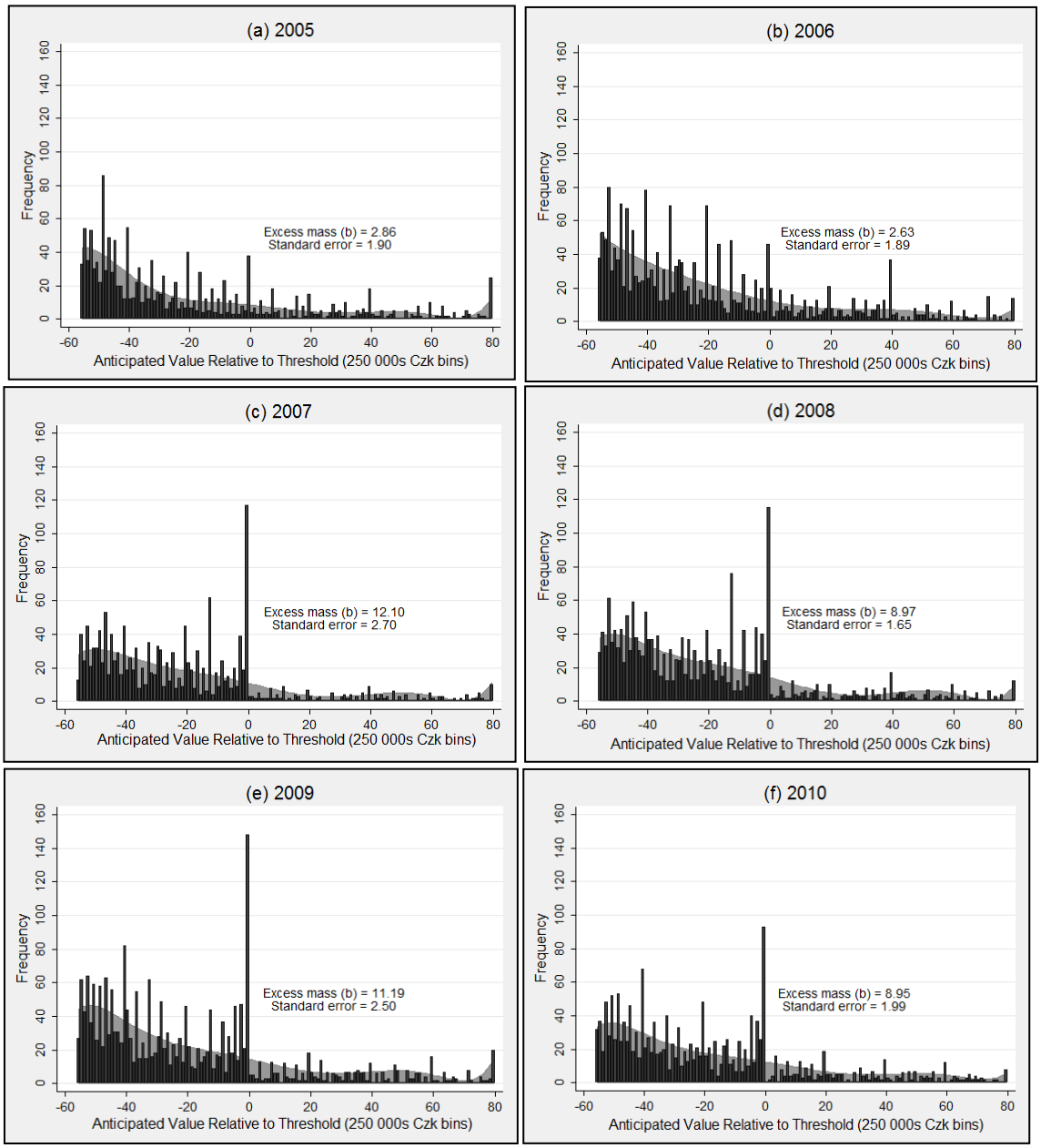
Notes: The table estimates the excess mass of contracts relative to the average density at thresholds. Standard errors are in brackets. ***Estimates significant at the 1% level.

The annual estimates of discontinuities for all types of the main subject are shown in Table 2.4. The procurement reform and the first emergence of discontinuities coincide perfectly for goods and services contracts. For construction works, the discontinuity can be statistically detected after a six month period, which is evidence against the hypothesis of intentional waiting for the reform.

The delay in construction can be contrarily explained by the fact the procurement process requires a relatively considerable amount of time, which varies for different types of contracts. Because the new law was passed in July 2006, the authorities may not have procured enough new construction contracts (as opposed to smaller and simpler goods and services contracts) in the last two quarters of 2006 for manipulations to become statistically significant before 2007.

FIGURE 2.2

Anticipated Value Distributions around Procurement Thresholds, by Year



Notes: Series shown in bars are histograms of the anticipated value of construction procurements relative to the threshold. Each bar shows the number of observations in CZK 250,000 bins. The solid distributions beneath empirical distributions are seventh-degree polynomials fitted to empirical distributions, excluding points CZK 750,000 or less below the threshold.

We further continue by quantifying the excess mass using Poisson conditional fixed effects. Table 2.5 shows the results of estimating (5), which incorporates time into our model, with CZK 250,000 wide histogram bins and CZK 750,000 wide excluded region

below the threshold (R=3). Using these parameters, we estimate that the number of contracts in the last bin below the threshold increased after the 2006 reform by 156%, 113%, and 182% for construction works, goods, and services contracts, respectively. The null hypotheses of no manipulation of procurement in these bins were rejected with z-statistics of 24.79, 13.30, and 16.20. The estimated excess bunching is of a smaller but still significant magnitude relatively to the cross-sectional analysis.

The results presented in Table 2.5 are our preferred estimates of bunching, as they take into account the pre-reform distribution of procurement values, which can be influenced, for example, by rounding of procurement values. This can be confirmed by a visual inspection of Figure 2.2, which shows that the distribution before the reform exhibits some accumulation of contracts at approximately every 1 million CZK.

TABLE 2.5

Estimates of Excess Mass below the Threshold Using a Fixed-Effects Strategy

	Construction	**Goods**	**Services**
$\hat{\gamma}_{-1}$	0.942***	0.758***	1.037***
	[0.038]	[0.057]	[0.064]
$\hat{\gamma}_{-2}$	1.478***	0.295***	0.006
	[0.038]	[0.057]	[0.064]
$\hat{\gamma}_{-3}$	1.205***	0.571***	0.188***
	[0.038]	[0.057]	[0.064]
Histogram Bin FE	YES	YES	YES
Year FE	YES	YES	YES
N	816	990	996

Notes: Coefficient estimates are interpreted as (exp ($\hat{\gamma}_i$)-1)*100 percentage change. Robust standard errors, clustered at the histogram bin level, are presented in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Results from both cross-sectional and policy change empirical strategies suggest that manipulation is more pronounced for construction and services, while it is less pronounced, but still significant for goods. Our explanation is that the subject of contracts is much more difficult to specify in procurements on construction and services and the scope for manipulation is much broader. As a result, procurements on construction and services are generally more difficult to control and provide more opportunities for manipulation relative to procurements of goods.

Robustness Checks

We provide alternative approaches to detection of manipulation and analysis of robustness. In particular, we test whether procurements cluster at inflationary adjusted thresholds and use the alternative density test described by McCrary (2008) to test for procurements bunching.

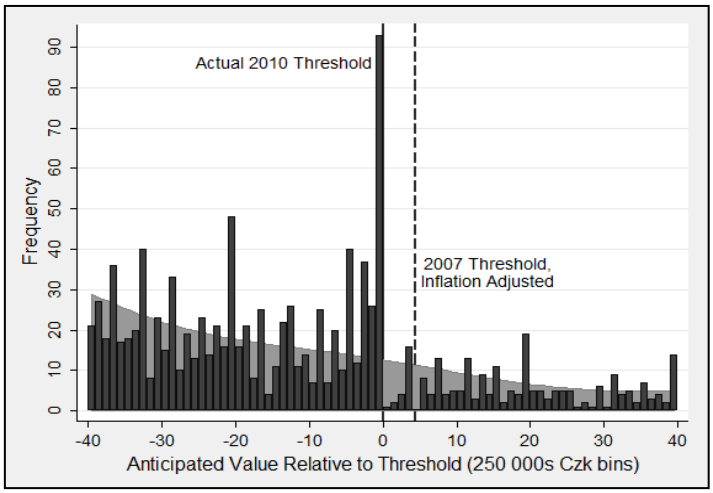
Does Contract Bunching Follow Inflation or Does it Cling to Thresholds?

One could still conjecture that at the time of the procurement reform a change occurred in government orders for projects that were worth approximately the same value as the procurement threshold. Such a change in government needs would have brought about a disproportionate representation of projects beneath the threshold even in the absence of any manipulation. However, one would then expect that the spike in the anticipated value density distribution would shift with inflation over time.

In Figure 2.3 we consider the period from 2007 to 2010, during which the simplified negotiations threshold for construction works declined in real terms. Noting that the excess mass was located at the negotiations threshold in 2007, the figure shows two possibilities for its location in 2010: the 2010 threshold and the 2007 threshold adjusted for inflation in the construction industry.

FIGURE 2.3

Distinguishing Thresholds in Public Procurement from Inflation



Notes: The location of the threshold in 2010 is marked with a solid line. The dashed line shows the level of the 2007 threshold adjusted for inflation in the Czech construction industry.

Figure 2.3 shows that the excess mass clearly clings to the 2010 threshold rather than following inflation. The procurement threshold is therefore more important for contract bunching than specific government needs.

Alternative Density Discontinuity Test

We apply McCrary's (2008) density test in order to provide an alternative test of contract bunching. The test consists of an extension of the local linear density estimator from Cheng, Fan and Marron (1997) and is particularly useful in applications where a discontinuous density is itself the object of interest. In a practical sense, the test is implemented as a Wald test of the null hypothesis that there is no discontinuity at threshold D.

TABLE 2.6

Log Density Discontinuity Estimates

	Construction Works	**Goods**	**Services**
$\hat{\theta}$	- 3.291***	- 0.457***	- 0.801***
	[0.243]	[0.104]	[0.079]
N	9,067	6,869	8,518

Notes: The table presents the log estimates of discontinuity in the density of the anticipated value. Estimates were obtained using a local linear density estimator proposed by McCrary (2008). Simulated standard errors are presented in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 2.6 presents the log discontinuities estimated using McCrary's (2008) local linear regressions along with the simulated standard errors. [15, 16]

The results in the table strongly suggest that the density function of anticipated value of procurements is discontinuous at the threshold for simplified negotiations. The estimates

[15] To apply the local linear density estimator, we select the bandwidth of h=2,000,000 and the bin size of w=250,000 subjectively after using an automatic procedure. Pagan and Ullah (1999) and Deaton (1997) point out the effectiveness of subjective bandwidth choice. The automatic procedure would select a bin size of w=191,313 and a bandwidth of h = 4,749,168.

[16] We follow Horowitz (2001), Hall (1992) and McCrary (2008) and, when estimating the standard error, we under-smooth the local linear estimator by choosing a half bandwidth with respect to the reference bandwidth. The cited authors recommend this procedure in order to reduce the bias associated with a bandwidth which minimizes the asymptotic mean square error.

indicate that contracts within hundreds of thousands of CZK of the threshold are much more likely to be procured below the threshold than above it. These results affirm the robustness of our prior analysis of contract bunching.

2.6 Manipulations and Sorting of Firms below Thresholds

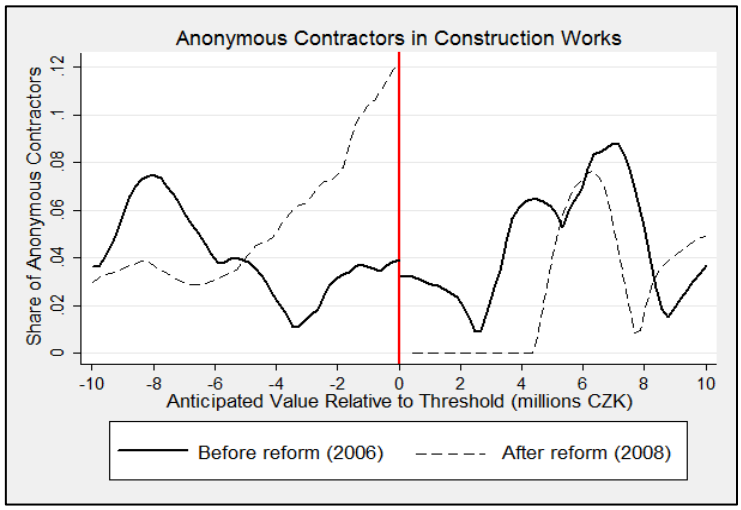
The results presented so far provide robust evidence of manipulations of anticipated value, especially for construction works and services. In this section, we illustrate how the introduction of procurement thresholds affects sorting of specific contractors below thresholds and how procurement characteristics change in their proximity.

In particular, we focus on the allocation of procurements to firms which allow hidden owners. According to the previous literature, firms similar to those with anonymous owners can serve as a means of transferring rent from procurement (Mironov and Zhuravskaya 2016).

Figure 2.4 illustrates the access of anonymously-owned firms to procurements in the proximity of the threshold for construction works. The figure shows the share of procurements awarded to anonymously-owned joint-stock companies (out of all joint-stock companies) in two periods: before and after the 2006 reform that established the thresholds. We use kernel-weighted local polynomial smoothers and 1 million CZK bandwidths on either side of the threshold to plot the figure.

FIGURE 2.4

Share of Construction Contracts Awarded to Anonymous Firms, by Year



The figure clearly indicates that after the reform, contracts just below the threshold were three times more likely to be allocated to firms with anonymous owners than prior to the reform.

We also inspect the access of firms with anonymous owners to contracts in a regression framework for all types of procurements – construction works, goods, and services. We apply a similar methodology to that leading to equation (2.5). For that purpose, we create a binary variable for whether the contract was awarded to a company with anonymous owners or not. We regress this measure of access to contracts on a variable that captures the interaction between contracts located just below thresholds and the legal force of the 2006 reform. Our specification also includes annual fixed effects, fixed effects for histogram bins in which contracts are located, and dummies for all types of procurement procedures. Finally, the specification controls for the content of procurements as it contains dummies for procurement CPV codes that systematically characterize the detailed procurement subject.[17]

This regression is a statistical model to detect sorting of anonymously-owned firms below the discretionary thresholds where we estimate a significant bunching of procurement values. The model is based on the comparison of empirical distributions of anonymously-owned firms before and after the introduction of the thresholds, similarly as in the case of procurement values. We therefore formally test whether the sorting of anonymously-owned firms appears just below the threshold simultaneously with the bunching of procurement values. The regressions are estimated using the linear probability model (LPM), with standard errors clustered at the histogram bin level.

Table 2.7 presents the results of this estimation and supports the findings presented in Figure 2.4 for the construction sector.

[17] Technically, we control for the content of procurement at the level of the first three digits of the detailed CPV code. Our specification includes dummies for the most prevalent CPV code groups within each type of procurement – this materializes in 6 CPV code dummies for construction contracts, 16 dummies for services and 15 dummies for goods.

TABLE 2.7

Sorting of Contractors below Threshold

Outcome Variable: Indicator that Contractor is Anonymously Owned						
	Construction works		**Services**		**Goods**	
Contracts in Bins Just below D x 2006 Reform	.027** [.012]	.029** [.012]	.011* [.006]	.013* [.008]	-.006 [.015]	-.004 [.015]
Histogram Bin FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Procurement Procedure Dummies	NO	YES	NO	YES	NO	YES
Procurement Subject (CPV code) Dummies	NO	YES	NO	YES	NO	YES
R^2	0.01	0.01	0.06	0.11	0.02	0.04
N	11,863	11,585	7,118	7,017	7,494	7,398

Notes: Estimates multiplied by 100 can be interpreted as percentage point change. Robust standard errors, clustered at the histogram bin level, are presented in brackets, *** p<0.01, ** p<0.05, * p<0.1.

In particular, Table 2.7 suggests that after the 2006 reform, the conditional probability that a contractor just below the threshold is anonymously-owned increased by approximately 3 percentage points in construction. This corresponds to an approximate threefold increase in the probability of officials awarding a contract to an anonymously-owned firm. The size of the increase is comparable to Figure 2.4, even though the regression sample now includes all contractors, not only joint-stock companies. This result is significant at the 5% level. For services, we find over one percentage point increase in the prevalence of anonymously-owned firms below the threshold, which is significant at the 10% level. In the case of goods, we estimate a non-significant change in the prevalence of anonymously-owned firms just below thresholds.

Putting our evidence together, we observe greater sorting of anonymously-owned firms in construction and services, where, simultaneously, the bunching of procurement values is also more prevalent. The introduction of thresholds therefore drives both the bunching of procurements and, at the same time, the sorting of anonymously-owned firms. It should be noted that the detected manipulations may have also led to other changes in the

characteristics of procurements after the introduction of thresholds. These results therefore provide a concrete illustration of how economic behavior may violate assumptions behind regression discontinuity designs in settings with high incentives to manipulate anticipated values.

Nevertheless, we consider the emergence of sorting of anonymously-owned firms below thresholds after the reform as the revealed preference of procurement agencies for hidden owners. The selection of an anonymously-owned contractor may or may not be associated with other procurement characteristics; but in either case, we consider it as a threat to the transparency and fairness of the procurement process.

We further ask whether sorting of anonymously-owned firms below the thresholds is associated with changes in procurement prices. Table 2.8 documents that procurements of anonymously-owned firms have higher contract prices compared to procurements with the same anticipated value below the thresholds, but awarded to firms with traceable owners. This illustrates that procurements awarded to firms with anonymous owners can be more costly compared to procurements allocated to firms with traceable owners. However, as previously mentioned, procurements allocated to anonymously-owned firms may have different underlying value compared to procurements granted to firms with traceable owners. One reason may be that reputable traceable firms may not be willing to participate in competitions together with anonymously-owned firms, which may generate differences in the content of procurements. To mitigate this bias, the regressions include CPV code dummies, which to some extent control for the procurement subject. Furthermore, the regressions include histogram bin fixed effects to account for changes in the relative difference between the contract price and anticipated value of procurements across the whole distribution of the anticipated values. Nevertheless, if contracts awarded just below the thresholds to anonymously-owned firms still have on average higher underlying value and are properly delivered, then the estimated higher contract price may not be interpreted as an increased cost in the procurement.

TABLE 2.8

Anonymous Contractors and Procurement Prices

Outcome variable: Difference Between the Contractual Price and Anticipated Value of Procurement (in % of Anticipated Value)						
	Construction works		**Services**		**Goods**	
Contracts in Bins Just below D x Anonymous Firm	.082**	.089***	.084***	.063**	-.066	-.051
	[.034]	[.029]	[.026]	[.029]	[.045]	[.053]
Anonymous Firm	-.016	-.014	-.000	.019	.045	.033
	[.018]	[.015]	[.026]	[.024]	[.035]	[.041]
Histogram Bin FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Procurement Procedure Dummies	NO	YES	NO	YES	NO	YES
Procurement Subject (CPV code) Dummies	NO	YES	NO	YES	NO	YES
R^2	0.01	0.06	0.04	0.05	0.01	0.01
N	8,241	7,976	6,069	5,971	6,051	5,958

Notes: The estimates multiplied by 100 can be interpreted as percentage point changes. Robust standard errors, clustered at the bin level, are presented in brackets, *** p<0.01, ** p<0.05, * p<0.1.

The coefficient of interest in Table 2.8 is the interaction of the indicators for anonymously-owned firms and contracts located just below the threshold (CZK 750,000 below or less). Using the post-2006 sample, we estimate an 8.9 percentage point higher price of construction contracts awarded to anonymously-owned firms just below the thresholds. The estimate is significant at the 1% level. Similarly, we find significant association between anonymously-owned firms and procurement prices among manipulated service contracts. The estimated effect is 6.3 percentage points. For goods where the sorting of anonymously-owned contractors is not present, there is no association between price and allocation of procurements to firms with untraceable owners.

2.7 Conclusions

In this chapter, we detect and quantify manipulation of procurement contracts using the example of the Czech public procurement system. An incentive for officials to manipulate the anticipated value of procurements was created by a policy reform that introduced new discretionary thresholds, below which the procurement agencies were given autonomy to preselect any five contractors for the bidding process.

We quantify the extent of manipulation using two empirical strategies. In the first, we use the methodology presented in Chetty et al. (2011) to estimate the cross-sectional counterfactual distributions of procurement value. The second strategy is our extension, which employs the distributions of procurement value before the reform as counterfactual.

Using both methods, we find a substantial impact of the policy reform on the extent of manipulation, even though our method yields lower estimates of bunching. We further find that manipulation is simultaneously related to a threefold increase in the probability that construction procurements are awarded to firms with anonymous owners. We consider this finding as worrying, because the anonymity of company owners allows for hiding rent-seeking behavior as it can conceal the identity of agents who are procurement officials and at the same time stakeholders in anonymously-owned companies. Although we estimate that procurements just below the threshold are associated with higher contract prices if they are allocated to anonymously-owned firms rather than to firms with traceable owners, we cannot provide evidence of overall losses in welfare due to data limitations.

To calculate the total costs of manipulation, one would need to obtain information about the quality of the provided procurements, details about contract renegotiations and information about the administrative costs of contract-allocation procedures. Although anonymously-owned suppliers are most often selected using a simplified procedure, which may save some administrative costs, at the same time, anonymous ownership restricts the transparency of the procurement process. This may not only hide conflicts of interest, but can also distort competition in procurement markets and discourage other potential suppliers from participation. Such effects may be difficult to quantify and may

not become evident immediately. On the positive side, greater discretion on the part of procurement officials can also serve to speed up the procurement process by allowing pre-selection of incumbent suppliers (Coviello et al., forthcoming; Bobilev et al. 2015). Elimination of firms with poor past performance can help officials to ensure the quality of procurements and limit contract renegotiations (Bannerjee and Duflo 2000; Calzolari and Spagnolo 2009). Although some procurements may have thus been manipulated with the intention to improve welfare, the total effect is difficult to quantify.

Should thus procurement officials be allowed to preselect potential contractors below thresholds with a high degree of autonomy? In general, if there is misalignment between the preferences of officials and those of society, the optimal delegation literature (e.g. Alonso and Matouschek 2008) advises calling for stricter rules and external controls. In the spirit of Holmstrom and Milgrom (1991), it might also be optimal to strip procurement officials of the discretion to preselect potential contractors autonomously, and rather leave them with the option of including past performance indicators among bid-evaluation criteria. This policy may be specifically relevant for countries with weak institutions and low accountability of public officials.

Finally, our research provides controlling bodies with a new tool for analyzing manipulation in procurement competition. We illustrate the scope of manipulation using the case of the Czech Republic, but many other countries regulate their procurements using similar thresholds, although with different changes in discretion at thresholds. This includes, for example, public administrations in the European Union, as EU directives on public procurement cover only tenders expected to be worth more than a given threshold. Each country in the EU can create its own procurement thresholds, provided that the thresholds are located below those determined by EU directives. Similarly, the Federal Acquisition Regulations in the United States permit simplified acquisition procedures only for supplies and services, the aggregate amount of which does not exceed the simplified acquisition threshold. Given the often limited resources of controlling bodies, we suggest that it may be cost-efficient to use our methodology to find the extent of manipulation and further test the extent to which it has consequences on the price of procurements, undesirable selection of winners and further procurement outcomes.

2.A Appendix 2

TABLE 2.A.1

Procurement Thresholds for Simplified Negotiating Procedure (in thousands of CZK)

		2005	2006	2007	2008	2009	2010
Goods, Services	- National Bodies	N/A	4,290*	4,290	3,782	3,782	3,236
	- Regional Bodies	N/A	6,607*	6,607	5,857	5,857	4,997
Construction Works		N/A	20,000*	20,000	20,000	20,000	20,000

The table shows the annual procurement thresholds for simplified negotiations by the main object of procurements and the type of contract-awarding agency (in thousands of CZK). Thresholds for simplified negotiations determine the scope of discretion of public officials in inviting suppliers of their choice. Thresholds also restrict entry of bidders and determine the overall transparency of the contract-awarding process. *Simplified negotiation thresholds were introduced on July 1st, 2006. Source: Consolidated text of act no. 137/2006 Coll. on Public Contracts.

TABLE 2.A.2

Description of scandals in procurement related to anonymous joint-stock firms

Scandal	Time period	Institutions involved	Name of anonymous firms	Type of procurement	Subject of the contract	Involvement of the anonymous joint-stock firm	Potential loss	Charges, sentences
Opencard	2006-present	Capital city of Prague	Haguess	services	IT system for chip cards used in public transport	The Capital City's public transport company, owned exclusively by the City of Prague, approved a number of contracts awarded to companies with anonymous owners, including company Haguess (now eMoneyServices), which was very closely linked to people in the Prague City public transport company.	25 mil. CZK	A few people have been accused, including the former and current Mayor of Prague and former officers of Prague City Hall who reported the suspicious contracts to the police. The investigation is still in progress.
Kardio Port	2010-2014	The Institute of Clinical and Experimental Medicine in Prague	Kardio Port	supplies	medical supplies	The Cardio Port won a procurement contract worth 1.8 billion CZK on medical supplies to a Prague hospital as the only bidder. Even four years later, it is still not possible to determine who profits from the contract.	1.8 billion CZK	No people accused. EU closely watched the case.
EDS Holding	2012	Town of Kolin, The Waterways Directorate of the Czech Republic	EDS Holding	construction	highway bridge	EDS Holding is an anonymous firm linked to the former Minister of Transport Ales Rebicek. The largest contract from June 2009 was worth almost 1.2 billion.	400 mil. CZK	Auditors of the European Court of Justice had already been investigating the tender. In 2011, the auditors questioned the meaningfulness of the bridge and the unprecedented increase in the cost by CZK 400 million. No people accused.

Scandal	Time period	Institutions involved	Name of anonymous firms	Type of procurement	Subject of the contract	Involvement of anonymous joint-stock firm	Potential loss	Charges, sentences
Neocity Ron	2012	Public Hospital in Mladá Boleslav	Neocity Ron	construction	hospital	Tender for building a new pavilion of a hospital. The winner did not have any experience, had only one employee and did not have any relevant financial history. Its owners were hiding behind Cyprus offshore companies.	500 mil. CZK	n.a.
IZIP	2002-2012	General Insurance Company: Vseobecna zdravotni pojistovna	MD Access	services	IT system designed for processing personal health care data	MD Access, the winning company, was personally connected with the procuring official. It cannot be proven whether the official has shares in the company at the moment due to the anonymous structure of MD Access.	2 billion CZK	n.a.
Montegar	2009-present	The Road and Motorway Directorate (RSD)	Montegar	services	Rentals of the highway rest stops	The Road and Motorway Directorate (RSD) rents highway rest stops to Montegar. This is a company with anonymous owners linked to Monster International, which had anonymous owners in Cyprus.	n.a.	Former RSD managers who signed the contracts are under police investigation.

TABLE 2.A.3

Procurement Procedures

Open procedure	In an open procedure, a procurement agency starts the procurement process by publishing a complete project specification, including a set of pre-qualification criteria for potential suppliers, an anticipated project value and a set of bid-evaluation criteria. A deadline for bid-submission is scheduled, where any firm may submit a bid. Upon the deadline, the procuring agency reviews whether the firms have fulfilled the pre-qualification criteria. From among the qualified firms, the agency selects the most favorable bid according to the pre-defined evaluation criteria. This procedure is the default procurement procedure and can be used both below and above the procurement thresholds. The requirement to prepare a complete project specification before the start of the procurement process and the rule that all firms can participate in procurement limit the flexibility of the procurement process and the discretion of procurement agency to eliminate undesired firms from procurement competition.
S**implified negotiating procedure**	In a simplified negotiating procedure, a procurement agency prepares a complete project specification, including an anticipated project value and a set of bid-evaluation criteria, and sends it to no less than five potential suppliers with a call to submit their bids. The firm with the best bid is selected as the supplier. This procurement procedure may be used only if the anticipated value of a procurement does not exceed the procurement threshold. The selection of firms to be invited is at the full discretion of a procurement agency. This procedure gives much more flexibility and discretion to the agencies compared to the open procedure; however, at the cost of less equal treatment of potential suppliers and lower transparency of procurement.
Other procurement procedures	There are several other procurement procedures that can be used irrespective of the procurement thresholds: for example, a restricted procedure or a negotiating procedure without a prior public notice. As shown in Figure 2.A.1 in the Appendix, these procedures are not affected by the procurement thresholds, as we do not observe any bunching of procurements at the thresholds in these procedures.

TABLE 2.A.4

Polynomial Regression Specification Checks – Choice of the Bin Size

	Construction Works	Goods	Services
	Bin size: CZK 200,000		
$\hat{b}$	11.600***	2.210***	3.598***
	[2.041]	[0.257]	[0.279]
$\hat{B}_N$	574	252	482
	Bin size: CZK 250,000		
$\hat{b}$	9.352***	1.996***	3.027***
	[1.850]	[0.236]	[0.275]
$\hat{B}_N$	581	282	501
	Bin size: CZK 500,000		
$\hat{b}$	5.533***	1.901***	2.466***
	[0.868]	[0.227]	[0.284]
$\hat{B}_N$	677	498	757
N	8,830	5,228	6,357

Notes: $\hat{B}_N$ denotes the estimated excess number of contracts below the threshold, and $\hat{b}$ denotes the excess mass of contracts relative to the average density at the threshold. Standard errors are presented in brackets. The excluded area below the threshold always corresponds to 3 bins and the order of the polynomial fitted to the empirical distribution of the anticipated project value is seven. ***Estimates significant at the 1% level.

TABLE 2.A.5

Polynomial Regression Specification Checks – Choice of the Order of the Polynomial

	Construction Works	Goods	Services
	Order of the Polynomial: 7th		
$\hat{b}$	9.352***	1.996***	3.027***
	[1.850]	[0.236]	[0.275]
$\hat{B}_N$	581	282	501
	Order of the Polynomial: 6th		
$\hat{b}$	10.74***	2.196***	3.261***
	[2.179]	[0.245]	[0.284]
$\hat{B}_N$	600	298	520
	Order of the Polynomial: 5th		
$\hat{b}$	10.63***	3.057***	4.295***
	[1.955]	[0.321]	[0.341]
$\hat{B}_N$	598	356	588
N	8,830	5,228	6,357

Notes: $\hat{B}_N$ denotes the estimated excess number of contracts below the threshold, and $\hat{b}$ denotes the excess mass of contracts relative to the average density at the threshold. Standard errors are presented in brackets. The bin size always corresponds to CZK 250,000 and the excluded area below the threshold always equals 3 bins. ***Estimates significant at the 1% level.

TABLE 2.A.6

Polynomial Regression Specification Checks – Excluded Area below the Threshold

	Construction Works	Goods	Services
Excluded area below the threshold: 3 bins			
$\hat{b}$	9.352***	1.996***	3.027***
	[1.850]	[0.236]	[0.275]
$\hat{B}_N$	581	282	501
Excluded Area below the threshold: 4 bins			
$\hat{b}$	9.038***	2.767***	4.067***
	[2.051]	[0.295]	[0.329]
$\hat{B}_N$	570	383	656
Excluded area below the threshold: 5 bins			
$\hat{b}$	11.23***	2.731***	4.133***
	[2.739]	[0.349]	[0.412]
$\hat{B}_N$	684	378	663
N	8,830	5,228	6,357

Notes: $\hat{B}_N$ denotes the estimated excess number of contracts below the threshold, and $\hat{b}$ denotes the excess mass of contracts relative to the average density at the threshold. Standard errors are presented in brackets. The bin size always corresponds to CZK 250,000 and the order of the polynomial fitted to the empirical distribution of anticipated procurement value is always seven. ***Estimates significant at the 1% level.

TABLE 2.A.7

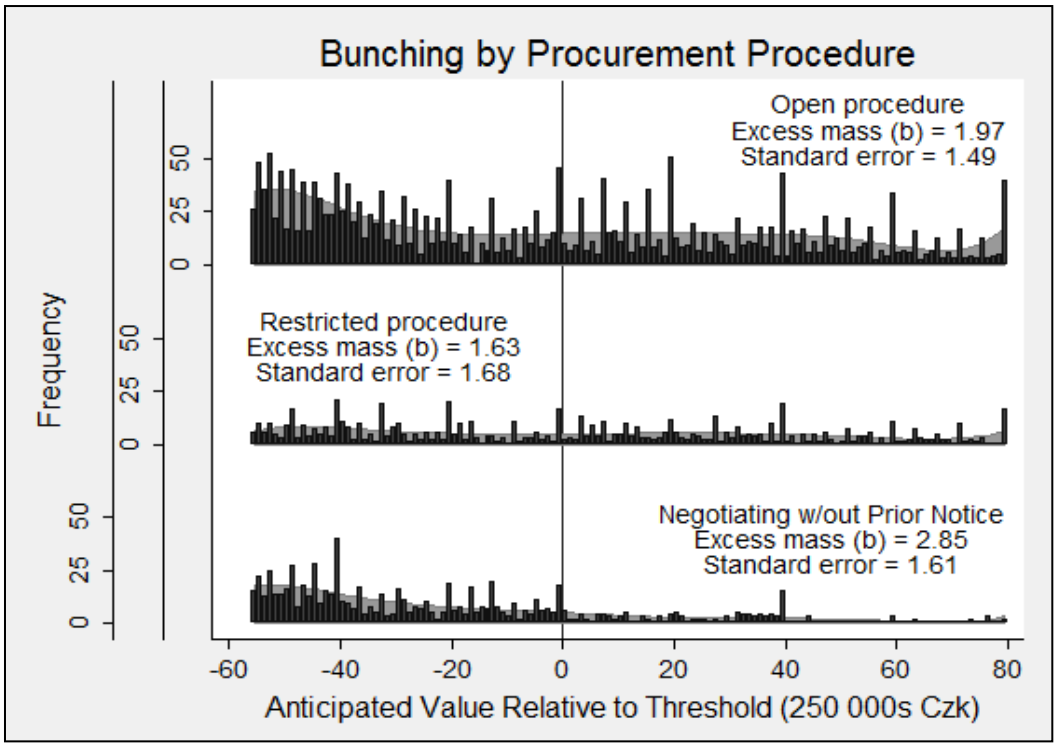
Polynomial Regression Estimates of Excess Mass below the Threshold by CPV code

	Building construction work	**Engineering works and construction works**	**Construction work for pipelines, communication and power lines, for highways, roads, airfields and railways; flatwork**	**Construction work for water projects**	**Other building completion work**
CPV code –4 digits	4521	4522	4523	4524	4545
$\hat{b}$	4.276***	5.854***	6.265***	3.064	3.783***
	[0.962]	[2.254]	[0.985]	[1.926]	[1.178]
$\hat{B}_N$	108	48	286	14	36
N	1,939	589	2,974	469	608

Notes: $\hat{B}_N$ denotes the estimated excess number of contracts below the threshold, and $\hat{b}$ denotes the excess mass of contracts relative to the average density at the threshold. Standard errors are presented in brackets. The excluded area below the threshold always corresponds to 3 bins. The bin size always corresponds to CZK 500,000. ***Estimates significant at the 1% level.

FIGURE 2.A.1

Anticipated Value Distributions by Procurement Procedure



Notes: The figure shows distributions of the anticipated value of procurements around "placebo" thresholds (demarcated by the vertical line at 0) in three contract-awarding procedures, which are not restricted by a procurement threshold. Only construction contracts from 2006 –2010 are considered in the figure. "Placebo" threshold is located at the point, where simplified negotiation threshold would apply. The series shown in bars are histograms of the anticipated value of procurements relative to the threshold. Each bar shows the number of observations in CZK 250,000 bins. The solid distributions beneath empirical distributions are seventh-degree polynomials fitted to empirical distributions, excluding the points CZK 750,000 or fewer below the threshold. The top subfigure shows the series for contracts procured in an open procedure. The middle subfigure depicts the series for procurements in a restricted procedure. The bottom subfigure considers procurements from a negotiating procedure without a prior public notice.

3 Chapter

Voting Experiments: Measuring Vulnerability of Voting Procedures to Manipulation[1]

3.1 Introduction

Strategic voting disturbs collective decision-making and social choice. Under strategic voting, voters willfully vote for alternatives which would be abandoned if voters could choose the voting outcome on their own (Alvarez and Nagler 2000; Blais, Nadeau, Gidengil, and Nevitte 2001; Fisher 2001, 2004; Schmitt 2001). For example, voters often do not vote for their favorite party in proportional elections if the party is not expected to exceed the electoral entry threshold. At other times, voters support coalitional partners of their preferred parties in order to strenghten the overall potential of the coalition. Alternatively, voters in multiple-round elections often support weak candidates in the earlier rounds so that their preferred candidate can win in the final round.

Despite the rationality of strategic voting at the individual level (Myerson and Weber 1993; Feldman and Serrano 2006; Edlin, Gelman, and Kaplan 2007), strategic voting considerations can lead to suboptimal voting outcomes in terms of overall social welfare. Preference misrepresentation can lead to handing power to illegitimate or controversial candidates and choosing publicly inferior projects or undesirable investments. Yet, the prediction of the theory of

[1] This chapter was published in Palguta, Ján, "Voting Experiments: Measuring Vulnerability of Voting Procedures to Manipulation," *Czech Economic Review*, 5 (2011), 324-345.

social choice is dismally clear: all non-dictatorial and universal voting rules can be subject to strategic voting manipulation (Gibbard 1973; Satterhwaithe 1975).

This chapter contributes to the previous literature as it provides new simulation evidence suggesting that the ability of strategic voters to swing the voting outcome depends crucially upon the amount of information that the strategic voters have. In particular, I study the impact of relaxing the assumption of the strategic voter's full information about all other voters' preferences that is implicit in the dismal Gibbard-Satterthwaite theorem. According to my results, a minimal reduction in strategic voter's information severely inhibits her ability to swing the voting outcome through strategic voting manipulation.

I arrive at my findings using a series of computation-based simulations of the ten most common voting rules. I simulate these voting rules to find out which are most-to-least vulnerable to strategic voting. Then I ask how beneficial it is for the strategic voter to misrepresent her voting preference when the number of voters or the number of alternatives change. Finally, I simulate the frequency of strategic voting when the strategic voter loses full knowledge of other voters' preferences.

My main findings are that Condorcet-consistent procedures are the most strategy-resistant rules, followed by elimination procedures and the simplest voting rules. The voting outcome can be more easily swayed when the number of voters is smaller, and the more alternatives are considered. I find that the incidence of strategic voting decreases both with the absolute and relative drop in the amount of information that the strategic voter has about other voters' preferences. It is sufficient to take away the information about just one other voter to severely inhibit the strategic voter's ability to vote strategically.

The rest of the chapter is organized as follows. Section 3.2 reviews previous approaches to modelling voting strategy-proofness. Section 3.3 describes the methodology of voting simulations and strategic voter's behavior under full and limited information. Sections 3.4 and 3.5 presents the results of the simulations under the full and limited informational settings, respectively. The last section 3.6 summarizes the main findings and concludes.

3.2 The Formal Concept of Strategy-Proofness

In a broad sense, any voting rule can be considered strategy-proof if no voter can achieve a more favorable social outcome by misrepresenting her voting preferences than by voting sincerely.

The previous literature distinguishes several formal approaches to modelling strategy-proofness. These approaches differ mainly in the way they determine the utility from the social outcome. Umezawa (2009), for example, provides an overview of the literature that defines strategy-proofness in a probabilistic framework where expected utilities are derived from probabilities over particular alternatives (Feldman 1980; Barbera, Dutta, and Sen 2001; Rodriguez-Alvarez 2007). Another approach defines strategy-proofness in a non-probabilistic framework, where individuals evaluate sets of alternatives by focusing on the best and/or the worst alternative in a set (Bandyopadhyay 1983; Barbera 1977; Pattanaik 1973). A compromise between the two approaches consists of defining strategy-proofness probabilistically over the orderings of the alternatives considered. For example, Bossert and Storcken (1992) use Kemeny distance to evaluate voting distances between individual and social preference orderings. Duddy, Perote-Peña and Piggins (2010) investigate the problem of constructing a social welfare function that is strategy-proof in a context of manipulating a social ordering as opposed to a social choice.

In this chapter, I take this last approach to formally model strategy-proofness, with an important distinction - using Euclidian rather than Kemeny's metric to evaluate the expected utilities from manipulating social preference orderings.

Formally, I consider a set of m alternatives $X = (x_1, x_2, ..., x_m)$ and a group of n voters with strict preference orderings $\pi = (x_{j_1}, x_{j_2}, ..., x_{j_m})$. Each ordering π can be represented by its indices $x(\pi) = (x_1(\pi), x_2(\pi), ..., x_m(\pi))$, where $x_k(\pi) = j_k$ (order number of the alternative x_k in ordering π). Let f(t) be a non-negative decreasing function of t. Then a weight $r_k(\pi)$ of alternative k in the strict ordering π can be defined as $r_k(\pi) = f(x_k(\pi))$. The distance between the ordering π_1 and the social ordering π_2 can be expressed as the distance $d(\pi_1, \pi_2)$ between two vectors $r(x(\pi_1))$ and $r(x(\pi_2))$. Generally, any distance function based on vector norms would suffice, although I use the Euclidian metric in this study.

The weights that I attach to alternatives in the preference orderings correspond to scores by which the individual would evaluate alternatives in Borda's voting. An individual's best preferred alternative is therefore associated with a weight of (m-1) points. The weights attached to other options consecutively drop by 1 point, with the last option being weighted by 0. Consider, for example, two individuals, each one with a strict preference ordering of 4 alternatives. Individual 1 prefers alternative a to alternative b to alternative c to alternative d. Individual 2 prefers c to d to a to b. By the considered specification and assumed weights, I can represent the two orderings by vectors $r(x(\pi_1)) = (3, 2, 1, 0)$ and $r(x(\pi_2)) = (1, 0, 3, 2)$. The resulting Euclidian distance between the two vectors is equal to $d(\pi_1, \pi_2) = \sqrt[2]{(3-1)^2 + (2-0)^2 + (1-3)^2 + (0-2)^2 = 4}$.

The minimization of the voting distance between the individual preference ordering and the social preference ordering will therefore correspond in this study to a strategic voter's utility maximization. If any strategic voter cannot, by misrepresentation of her preferences, achieve a lower voting distance between her individual preference ordering and the social ordering, then the voting rule is considered strategy-proof in this study.[2]

3.3 Methodology of Voting Simulations

I use computation-based simulations to randomly generate a collective preference profile of a set of voters. Because I aim to treat all voting alternatives and preference orderings symmetrically, I use an '*impartial preference generating culture*', which distributes preference orderings to individual voters according to a uniform distribution over m! logical strict preference orderings. Therefore, learning some feature about the voting preferences of some voters yields no information about the preferences of others. [3]

I simulate the collective preference profile for (n-1) voters and m alternatives using 100,000 simulations of the ten most common voting rules. The description of the voting rules considered is provided in Appendix 3. I simulate the voting process for small groups of voters in committees

[2] Practically, the social outcome may sometimes involve tie(s) between alternatives. I resolve this issue by calculating the average distance between the individual ordering and all possible social orderings that could arise given a random breaking of the tie(s)

[3] An overview of other preference generating cultures has been provided by Laslier (2010).

deciding among a small number of alternatives, where the assumption that a particular voter might know all or at least a majority of other voters' preferences is feasible. Therefore, I consider n = {2, 3, 5, 7 and 11} and m = {3 and 4}.

I consider two informational settings: one where the strategic voter has full information about other voters' preferences and one where she does not have full information. In the first scenario, all but one voter cast their votes sincerely in order to arrive at the collective decision. The last voter attempts to manipulate the voting outcome through her strategic vote. Her role as a fully informed voter is straightforward, because she simply calculates all possible distances that could arise between her own preference ordering and the social outcome. Then she selects the voting pattern which minimizes the voting distance. This task is simple as the strategic voter finalizes the aggregation of preferences. She is the only strategic voter and thus she faces no uncertainty about the voting patterns of other voters.

To evaluate how successful the strategic voting manipulation is, I calculate the fraction of cases when the strategic voter succeeded in decreasing the targeted voting distance between her own preference ordering and the social outcome. In the full information setting, I use this statistic to compare the voting rules considered in terms of their strategy-proofness.

I continue with the second informational setting when the strategic voter lacks full knowledge about other voters' voting patterns. I consider the situation when the strategic voter knows the full collective preference profile except for a preference ordering of one of the sincere voters. This is a very minor restriction on the information available to the strategic voter, yet as our results will show, it can have a significant impact on the strategic voter's ability to manipulate the outcome.

With the limited information, the strategic voter can determine only partial scores of the alternatives evaluated. Instead of the certainty she used to have, the strategic voter can only expect other voters to vote according to the uniform distribution. We can think of some simple heuristic rules that the strategic voter might use given her limited information. For instance, we can imagine her attempting to manipulate the partially aggregated social ordering as if it were the fully aggregated social ordering. Nevertheless, such heuristic rule could often lead to situations, in which the strategic voter would end up with even worse payoffs than she would have achieved by voting sincerely. Alternatively, the strategic voter could stick to a minimalistic approach to

strategic voting, when she would choose to vote strategically only if all possible payoffs from voting strategically would be higher than the payoffs from voting sincerely. Nonetheless, to be consistent with the previous specifications, I make the strategic voter decide on a specific voting pattern based on the minimization of the weighted distance between her individual preference ordering and all plausibly aggregated social orderings that might arise as a result of her voting pattern. The weights will be the probabilities of the particular social preference orderings to arise.

I use the outcomes of my simulations to estimate the change in the success rate of the strategic voter to manipulate the voting outcome in her favor. This success rate is calculated as the number of cases when the strategic voter decides to manipulate the outcome and then acquires the same voting distance she would achieve if she had full information. This measure of strategic voting manipulation is captured in the variable 'Maintained best manipulation'. This variable also reflects how vulnerable strategic voting is to reduction in the amount of information the strategic voter has. The variable does not include cases when it was individually optimal for the strategic voter to vote sincerely and she has correctly chosen to do so.

For the restrained informational setting, I evaluate two further statistics. First, I simulate the probability that the strategic voter attempts strategic manipulation at all. Because the strategic voter does not have full information, she must decide on the basis of the weighted distances. The number of attempts to manipulate the voting can therefore be both higher and lower than the number of cases when strategic voting was individually optimal for the strategic voter.

Finally, I calculate the number of cases when the strategic voter attempted manipulation, and this led to a worse outcome than sincere voting would have produced. Even this variable can be considered as an alternative measure of manipulation, because the residual number of cases, i.e. (100 000 simulations – 'Worse than sincere') captures the situation when the resulting voting distance was not strictly worse than the distance from voting sincerely.

3.4 Simulation Results under Full Information

Table 3.A.1 in Appendix 3 provides the complete tabulated overview of the successful strategic voting manipulations of the single strategic voter under full information. Table 3.1 and Table 3.2 present summary statistics on the probability of strategic manipulation by the number of voters and the number of alternatives considered. Figures 3.1 and 3.2 graphically outline the success of manipulations for all ten voting procedures considered.

I observe three main results. The opportunities for strategic voting manipulation vary substantially across the voting rules. Strategic manipulation is always more probable if four alternatives are considered compared three. Finally, the opportunities for strategic voting manipulation weakly decrease with the number of sincere voters.

Consider Figures 3.1 and 3.2 with regard to the first result. Both figures show that the strategic voter has the fewest opportunities for strategic voting in Copeland's, Condorcet's and Black's voting procedures. This comes as no surprise, as these procedures are Condorcet-consistent procedures, meaning that they always select Condorcet's winner if it exists. The second group of slightly less strategy-proof procedures involves three elimination procedures: Coombs', Hare's, and the Plurality rule with runoff. Although these procedures are not Condorcet-consistent, they involve several consecutive rounds of eliminations of the dominated alternatives, where it is not only necessary for the strategic voter to find a situation where her vote is pivotal, she also has to find a voting pattern which does not harm her in the later rounds of the eliminations. The last and least strategy-proof group of voting rules involves approval voting, max-min voting and Borda's count. The common feature of all these rules is that they allow allocation of a wide range of points to the alternatives. This gives the strategic voter the opportunity to swing the voting outcome more flexibly.

It is important to note that some degree of strategic manipulation must be attributed to the use of the impartial preference-generating culture. Because this culture attributes preference orderings to voters according to a uniform distribution, the culture generates numerous voting ties. This gives the strategic voter many opportunities to be the pivotal voter and to manipulate the voting outcome in her favor. Had I used some other preference-generating culture, where fewer ties occur during the preference aggregation process, the strategic voter would face fewer opportunities for gainful

strategic manipulation. This property most apparently affects those voting procedures where the range of points that determine the social ordering is the narrowest, for example the max-min procedure.

TABLE 3.1

The Probability of Strategic Voting Manipulation, Full Information, Three Alternatives

Full information, m=3	n = 2	n = 3	n = 5	n = 7	n = 11
Average	0.142	0.144	0.156	0.127	0.129
Min	0	0	0	0	0
Max	0.333	0.361	0.432	0.325	0.289
Std. Dev	0.019	0.016	0.019	0.010	0.010

TABLE 3.2

The Probability of Strategic Voting Manipulation, Full Information, Four Alternatives

Full information, m=4	n = 2	n = 3	n = 5	n = 7	n = 11
Average	0.404	0.361	0.358	0.365	0.346
Min	0.167	0.147	0.124	0.107	0.082
Max	0.794	0.684	0.704	0.592	0.562
Std. Dev.	0.052	0.032	0.036	0.032	0.031

I also compare the voting procedures in terms of their strategy-proofness in the regression framework. In the first column of the Table 3.A.5 in Appendix 3, I use ordinary least squares (OLS) to explain the variation in the probability of strategic voting. This probability is captured in the variable "$prob_i$", where index i stands for each particular entry in Table 3.A.1. The explanatory variables include the number of voters n_i and the indicator variable $m4_i$ which equals one when voters consider four rather than three voting alternatives. The rest of the explanatory variables are the indicator variables for all the voting rules considered. They are included in the (10x1) vector "$proced_i$".

FIGURE 3.1

The Probability of Strategic Voting Manipulation, Full Information, Three Alternatives

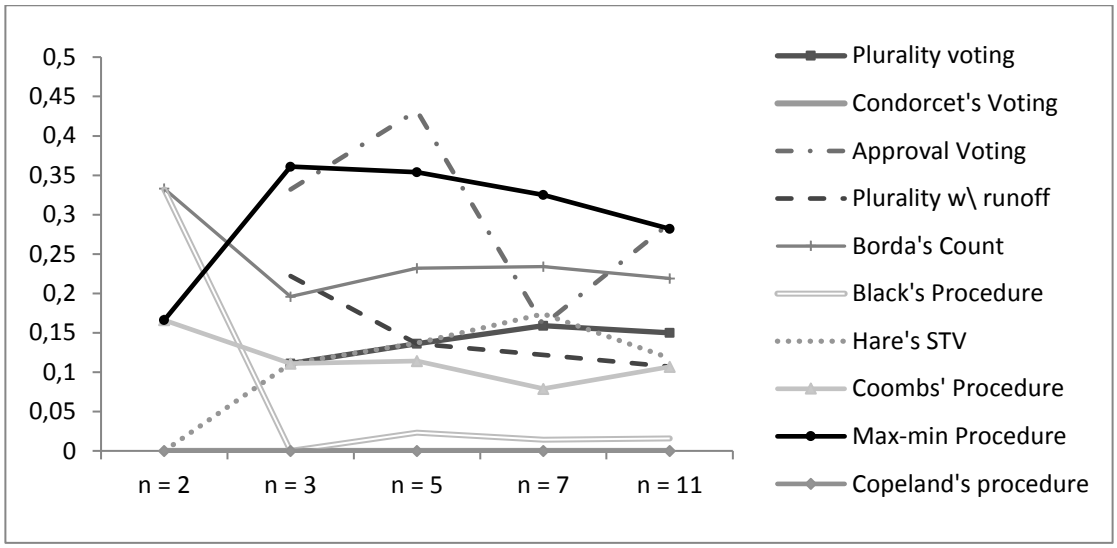
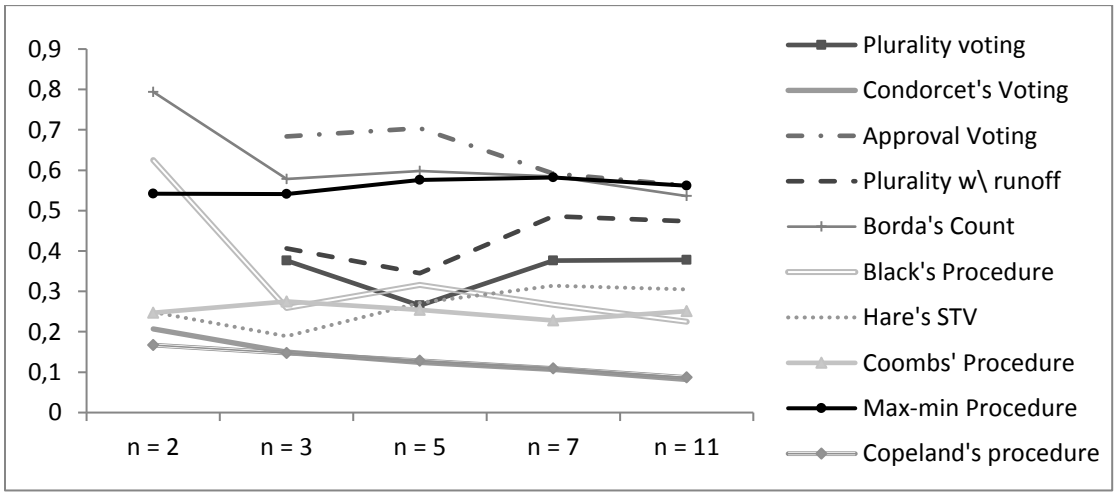


FIGURE 3.2

The Probability of Strategic Voting Manipulation, Full information, Four Alternatives



The formal model can be expressed as follows:

(3.1) $$\text{prob}_i = \beta\, \text{n}_i + \gamma\, \text{m4}_i + \delta\, '\text{proced}_i + \varepsilon_i$$

The estimated regression coefficients allow ranking of the particular voting procedures according to their strategy-proofness, consistent with the previous discussion.

The second result is that strategic manipulation is always more probable if four alternatives are considered as compared to three. Column 1 in Table 3.A.5 shows that if voters choose from 4 alternatives rather than 3, there is 25 percentage points higher chance that the strategic voter will reach a situation where it is beneficial for her to vote strategically. Nonetheless, one should not generalize this result with respect to higher numbers of competing alternatives. A sound expectation would be that this pattern is non-linear, and that it rather depends on the difference (n-m) if not on the ratio of the number of voters and the number of competing alternatives (n/m).

The last result from the full informational setting is that the opportunities for strategic manipulation weakly decrease with the number of sincere voters. From the first column in Table 3.A.5 we observe a very slight decline in the probability of strategic voting manipulation due to the increase in the number of voters. We cannot reject the null hypothesis of no impact of this variable at the 5% significance level and we have to allow for wider confidence intervals to be able to reject it. The logic of our expectations for the coefficient to be negative is nevertheless straightforward: the more voters involved, the smaller the relative weight of one vote in the sense that the strategic voter becomes less often pivotal. The higher the number of voters, the lesser the chance that the strategic voter can gain by voting insincerely.

3.5 Simulation Results under Incomplete Information

This section presents evidence from voting simulations when the strategic voter loses information about the voting preferences of one sincere voter. Because we are mainly interested in how much the loss of information hampers the strategic voter's ability to vote strategically, I focus on the variable 'Maintained best manipulation', which counts the cases when the strategic voter decides to manipulate the outcome and achieves the same outcome as if she had full information. In the later part of the section, I analyze two alternative measures of strategic voting described in the methodology of voting simulations. These measures reflect how often the strategic voter misrepresents her preferences and how often she ends up with a worse outcome than sincere voting would yield. The simulation results for the variable 'Maintained best manipulation' are provided in the Appendix in Table 3.A.2. Figures 3.3 and 3.4 show the probability of strategic voting

manipulation by the number of voters and the voting rule for three and four alternatives, respectively.

The analysis of strategic voting under restricted information yields the following five results. The opportunities for strategic voting vary less substantially across the voting rules under the limited informational setting. We observe a rapid drop in the strategic voter's ability to successfully manipulate outcomes in all the voting rules. The ranking of the most-to-least strategy-proof rules remains unchanged. The opportunities for strategic manipulation grow with the number of voters. The levels of strategic voting are higher when the number of alternatives is higher. I describe these results now in greater detail and then proceed with the alternative measures of strategic voting manipulation.

The first result is that the opportunities for strategic voting vary less substantially across the voting rules considered under the limited information. This is can be seen from comparison of Figures 3.1 and 3.3 and Figures 3.2 and 3.4, respectively, which compare the strategic voter's opportunities for voting manipulation in settings with and without full information, respectively. The same result follows from the second column in Table 3.A.5 in Appendix 3, which estimates Equation (3.1) using the data from the restricted informational setting. The estimated effects of the particular voting procedures have a lower dispersion under the restricted information compared to the full informational setting. Numerous coefficients are not, in fact, significantly different from zero.

The rapid drop in opportunities for strategic voting can be seen from the regression output in the third column in Table 3.A.5 in Appendix 3. Here the data from the full and restricted informational settings were merged and the additional explanatory dummy variable $(\text{Incomplete info})_i$ controls for the difference in the information available to the strategic voter.

A formal notation of the regression model follows in (3.2):

$$prob_i = \beta\, \mathrm{n}_i + \gamma\, \mathrm{m4}_i + \delta'\, \mathrm{proced}_i + \lambda\, (\mathrm{Incomplete\ info})_i + \varepsilon_i \tag{3.2}$$

The regression results suggest that the reduction in a strategic voter's information about the preference profile of one sincere voter reduces the strategic voter's ability to achieve the optimal voting manipulation by 18 percentage points.

FIGURE 3.3

The Probability of Strategic Voting Manipulation, Incomplete Information, Three Alternatives

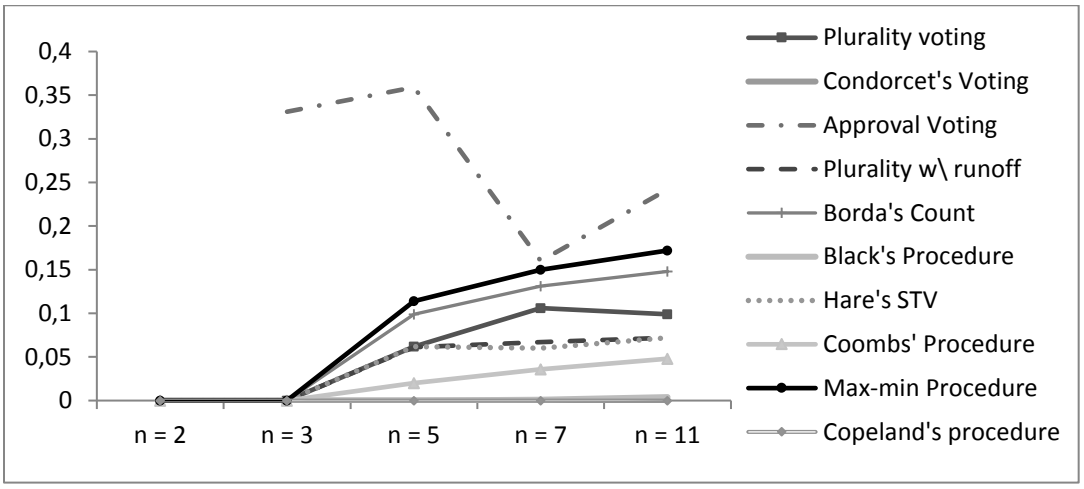
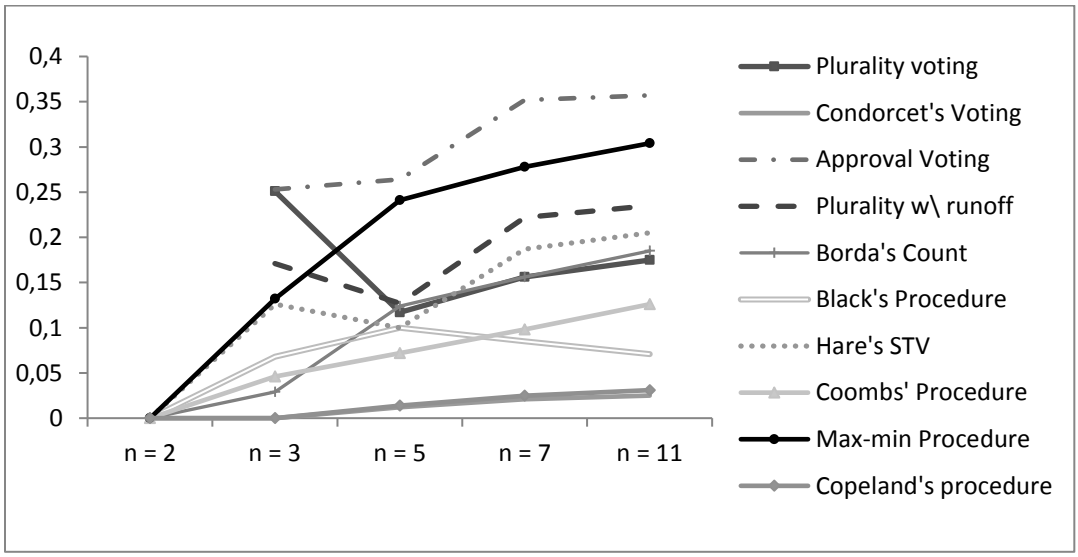


FIGURE 3.4

The Probability of Strategic Voting Manipulation, Incomplete Information, Four Alternatives



Interestingly, the ranking of the most-to-least strategy-proof voting procedures remained unchanged under the limited information**.** I again find the Condorcet-consistent procedures to be most strategy-proof, followed by the elimination-based procedures, placing the approval, Borda's and max-min procedures in the top ranks in their vulnerability to strategic voting under the restricted information.

Table 3.3 compares voting procedures in terms of how vulnerable to strategic voting they remained after strategic voter lost complete information about the preferences of one sincere voter. In particular, I construct the ratio of variables 'Maintained best manipulation' from the restricted informational setting and 'Probability of strategic manipulation' from the full informational setting. The higher the ratio of the two variables, the more vulnerable remained the voting procedure to strategic voting after the strategic voter lost the information.

TABLE 3.3

The Drop in the Probability of Strategic Voting Manipulation due to Incomplete Information

Procedure	Obs.	Mean (a)	Min	Max
Plurality	8	.471	0	.66
Condorcet	4	.149	0	0.30
Approval	8	.705	0.36	1
Runoff	8	.426	0	0.67
Borda	8	.316	0	0.67
Black	7	.219	0	0.31
Hare's STV	8	.463	0	0.67
Coombs	8	.307	0	0.50
Max-min	8	.384	0	0.60
Copeland	4	.173	0	0.35

Notes: (a) Maintained best manipulation / the probability of manipulation under full information

The table shows that the ability of the strategic voter to swing the outcome remained the strongest in the least strategy-proof procedures, i.e. in approval, plurality and Hare's procedures and in plurality voting with runoff. The most strategy-proof procedures, i.e. Condorcet's, Copeland's and Black's procedures, became even less susceptible to strategic manipulation.

Importantly, the results show that the ability of the strategic voter to gainfully swing the outcome is declines not only with the absolute amount of information withheld from the strategic voter, but also in the relative amount of withheld information. In particular, from the third column in Table 3.A.5 in Appendix 3, it is clear that the probability of successful strategic voting manipulation grows with the number of voters. This means that the lower the relative amount of the withheld information from the strategic voter is, the more frequently she can succeed in strategically swinging the voting outcome.

The last result from the analysis of the main measure of strategic voting manipulation is that the levels of strategy-proofness are lower for voting situations with four alternatives as compared to situations with three. The discussion is analogous to that in the section discussing a strategic voter with full information. The more alternatives considered, the more opportunities the strategic voter has to swing the voting patterns. This result, however, needs to be carefully considered before generalizing it with respect to the higher number of alternatives.

The rest of this section considers two alternative measures of voting manipulation, the number of attempts at strategic voting and the number of cases when the strategic voter ended up with a worse outcome than sincere voting would have yielded. The simulation results for the former measure are provided in Table 3.A.3 in Appendix 3 and for the latter measure in Table 3.A.4.

Here it is important to note that the number of attempts to manipulate voting coincides perfectly with the number of successful manipulations of voting in the full informational setting. Similarly, there are no situations in which the strategic voter can end up with a worse outcome under full information as compared to restricted information. The reason is exactly the strategic voter's full knowledge of all other voters' preferences. Therefore, it makes sense to examine the two considered measures of strategic voting under restricted information with respect to the outcomes under full information.

The formal model for the number of attempts at strategic voting therefore considers the ratio of the variables 'the number of attempts' and the 'probability of strategic voting under full information'. This ratio is captured in the left-hand side variable $(\text{Rel. Attempts})_i$. The formal model (3.3) follows:

$$(3.3) \qquad (\text{Rel. Atempts})_i = \frac{attempts_i}{prob_i} = \beta\, \text{n}_i + \gamma\, \text{m4}_i + \delta'\, \text{proced}_i + \varepsilon_i$$

Table 3.A.5 in Appendix 3 shows the estimates from this regression in the fourth column. The table shows that the strategic voter attempts strategic manipulation in the majority of procedures to a comparable extent. Only Black's and Borda's rules significantly differ from other procedures, and their relative numbers of manipulation attempts are higher. Nevertheless, as we will see in the case of Black's procedure, this increased number of manipulation attempts eventually leads to an increased number of adverse voting outcomes for the strategic voter.

The estimates further suggest that the number of attempts at strategic voting (relative to the number of cases when strategic voting was individually optimal) does not depend on the number of alternatives considered. On the contrary, an increase in the number of voters decreases the number of attempts at strategic voting. This can be interpreted as the strategic voter becoming more exact in attempting for strategic voting as she has relatively more information about the collective preference profile.

The last considered measure of strategic voting is the number of cases when the strategic voter ended up with a worse outcome than sincere voting would have produced. Speaking in absolute figures, the voting outcome is worse than that produced by sincere voting in at most 5% of simulated voting scenarios if the committee has 3 alternatives. The outcome is worse than that produced by sincere voting in at most 15% of cases when 4 alternatives are considered. These percentages appear to be a relatively small price to be paid for attempting strategic manipulation, given how many times the strategic agent gains from misrepresentation of her preferences. Moreover, the adverse outcome is not probably much worse than from voting sincerely.

Speaking in relative figures, I relate the number of 'Worse than sincere outcomes' to the number of cases when strategic voting manipulation was individually optimal. I capture the ratio of these two variables in a left-hand side variable $(\text{Rel. Worse})_i$. The formal model (3.4) follows:

$$(\text{Rel. Worse})_i = \frac{worse_i}{prob_i} = \beta\, \text{n}_i + \gamma\, \text{m4}_i + \delta'\, \text{proced}_i + \varepsilon_i \tag{3.4}$$

The last column in Table 3.A.5 in Appendix 3 shows the results of estimation of this regression equation. The main findings are that the voting rules are not statistically different from each other in terms of how many 'Relatively worse than sincere outcomes' they deliver. The strategic voter selects the unsatisfactory voting pattern in a similar number of cases across all procedures.

Furthermore, the number of relatively worse outcomes is diminishing with the number of voters. This means that the relative increase in the strategic voter's amount of information does not only translate to a higher exactness when attempting strategic voting manipulation, but also to her ability of choosing voting patterns which do not harm the strategic voter relative to her sincere voting. The selection of unsatisfactory voting patterns is nevertheless higher when she selects from among four competing alternatives.

3.6 Conclusions

This chapter has computationally simulated the ten most common voting rules to study their vulnerability to manipulation by a voter who can strategically misrepresent her voting preference. This was followed by a study of the vulnerability of strategic manipulation to variations in the amount of information that the strategic voter possessed about the preferences of sincere voters.

I have shown that susceptibility of voting rules to strategic voting manipulation is a decreasing function in the number of voters and an increasing function in the number of alternatives considered. All voting rules could be characterized by a specific extent to which they are susceptible to strategic manipulation. The least susceptible voting procedures are the Condorcet-consistent procedures: Black's, Copeland's and Condorcet's procedure itself. The second group of relatively more susceptible procedures involve three elimination procedures: Coombs', Hare's and Plurality with runoff. The most manipulable procedures are the simplest rules: the plurality procedure, approval procedure, max-min voting and Borda's count. The procedure-specific degree of susceptibility to manipulation was dependent on the amount of information that the procedure typically requires a participating voter to disclose, and on the strictness of the voting rule, i.e on the amount of points that the procedure allows the strategic voter to allocate.

Once the strategic voter lost the full knowledge of other voters' preferences, strategic voting became much less feasible. I found that strategic voting was least vulnerable to a reduction of information in approval, plurality, Hare's and plurality with runoff procedures, and most vulnerable in Condorcet's, Copeland's and Black's procedures. The precision of selection of the best manipulating voting pattern was decreasing in the relative amount of information withheld from the strategic voter. Consistently, the strategic voter has more often ended up with a worse payoff than sincere voting would yield when a relatively larger share of information was withheld from her.

The chapter contributed to the discussion of importance of communication rules between board members and project evaluation committees. The variables through which the potential institutional optimization of voting schemes could be performed include the size of committees, voting rules employed, and information available to committee members.

3.A Appendix 3

3.A.1 List of Simulated Voting Procedures

This appendix describes ten voting rules, which I use in my voting simulations. For more detail, see, for example, Nurmi (1987).

1. **Simple plurality voting**

Each voter needs to decide, to which single alternative to assign a score of 1, while assigning 0 to all other alternatives. The plurality winner is the candidate that collects the highest number of votes.

2. **Condorcet's voting procedure**

A winning candidate is chosen by Condorcet's rule if and only if the alternative is not defeated by a strict majority by any other candidate in a pair-wise vote.

3. **Plurality voting with runoff**

Plurality voting with runoff involves two rounds. The first round exactly just like simple plurality voting. The second round involves a vote between the two candidates with the highest scores in the first round. The purpose of the first round, so-called runoff, is to eliminate the least preferred candidates.

4. **Borda's voting procedure**

Given m candidates, each voter's first ranked candidate obtains (m-1) points, the second ranked obtains (m-2) points, the third (m-3) points, and so forth, down to a minimum of 0 points for the last candidate. The scores are added up and the candidate with the highest score wins.

5. **Approval voting**

An individual voter may assign a score of 1 to as many candidates as she wishes and assign nothing to all other candidates. The candidate with the highest score wins.

6. **Black's voting procedure**

Black's procedure simply chooses the Condorcet's winner if one exists. Otherwise it ranks the candidates according to Borda's voting.

7. Hare's single transferable vote system

If some candidate in Hare's voting procedure is ranked first by more than 50% of voters, it wins the election. If no such candidate exists, the candidate with fewest first ranks is eliminated from the count and the rest of candidate are being pushed upwards in the preference lists of the voters. Again, one needs to determine if any candidate ranks first by more than 50% of the voters. If so, it wins. If not, another round of eliminations proceeds. Eventually, after a number of rounds of eliminations, one candidate must become Hare's winner or a tie is established in the final round.

8. Coombs' technique

Coombs suggested a slight modification to Hare's voting procedure, and that is to eliminate such candidate that is ranked last by the largest number of voters during elimination rounds. The qualification criterion for victory remains the absolute majority of the first ranks in voters' preference profiles.

9. Max-min voting technique

Max-min procedure counts how many voters rank every candidate above each alternative. For every candidate, the procedure finds the lowest of these numbers. The procedure then ranks the candidates according to the retrieved minima.

10. Copeland's voting procedure

The procedure calculates a number of wins and a number of losses for each candidate. The candidate wins over other candidate if it gains a majority of votes in a pair-wise vote. Otherwise it loses. The voting outcome is the ordered list of candidates ranked according to the difference between the sum of wins and the sum of losses of each candidate.

3.A.2 Simulation Tables

TABLE 3.A.1

Successful Voting Manipulations, Full Information

Probability of manipulation		n = 2	n = 3	n = 5	n = 7	n = 11
Plurality	m = 3	*	0.111	0.136	0.159	0.150
Voting	m= 4	*	0.376	0.265	0.376	0.378
Condorcet's	m = 3	0	0	0	0	0
voting	m = 4	0.207	0.150	0.124	0.107	0.082
Approval	m = 3	*	0.332	0.432	0.160	0.289
Voting	m = 4	*	0.684	0.704	0.592	0.562
Plurality	m = 3	*	0.222	0.136	0.122	0.107
w\ runoff	m = 4	*	0.406	0.345	0.486	0.474
Borda' s Count	m = 3	0.333	0.196	0.232	0.234	0.219
	m = 4	0.794	0.578	0.598	0.585	0.536
Black' s	m = 3	0.332	0	0.023	0.014	0.016
Procedure	m = 4	0.625	0.259	0.316	0.267	0.225
Hare' s STV	m = 3	0	0.111	0.137	0.174	0.118
	m = 4	0.249	0.189	0.272	0.314	0.305
Coombs'	m = 3	0.166	0.111	0.114	0.079	0.107
Procedure	m = 4	0.247	0.275	0.254	0.228	0.251
Max - min	m = 3	0.166	0.361	0.354	0.325	0.282
Procedure	m = 4	0.542	0.541	0.576	0.582	0.562
Copeland’s	m = 3	0	0	0	0	0
Procedure	m = 4	0.167	0.147	0.128	0.109	0.087

* For plurality, Condorcet’s and Approval voting procedures, the results are trivial for n=2

TABLE 3.A.2

Manipulations under Incomplete Information That Have the Same Outcome as Manipulations under Full Information

Maintained		n = 2	n = 3	n = 5	n = 7	n = 11
Plurality	m = 3	*	0	0.062	0.106	0.099
Voting	m = 4	*	0.251	0.117	0.156	0.175
Condorcet's	m = 3	0	0	0	0	0
voting	m = 4	0	0	0.012	0.021	0.025
Approval	m = 3	*	0.331	0.359	0.160	0.242
Voting	m = 4	*	0.253	0.264	0.352	0.357
Plurality	m = 3	*	0	0.061	0.067	0.072
w\ runoff	m = 4	*	0.171	0.127	0.222	0.235
Borda' s	m = 3	0	0	0.099	0.131	0.148
Count	m = 4	0	0.029	0.124	0.156	0.185
Black' s	m = 3	0	0	0	0.001	0.004
Procedure	m = 4	0	0.068	0.100	0.085	0.071
Hare' s	m = 3	0	0	0.062	0.060	0.072
STV	m = 4	0	0.126	0.100	0.187	0.205
Coombs'	m = 3	0	0	0.020	0.036	0.048
Procedure	m = 4	0	0.046	0.072	0.098	0.126
Max – min	m = 3	0	0	0.114	0.150	0.172
Procedure	m = 4	0	0.132	0.241	0.278	0.304
Copeland’s	m = 3	0	0	0	0	0
Procedure	m = 4	0	0	0.014	0.025	0.031

* For plurality, Condorcet’s and Approval voting procedures, the results are trivial for n=2

TABLE 3.A.3

Attempts at Manipulation, Incomplete Information

Attempts for manipulation		n = 2	n = 3	n = 5	n = 7	n = 11
Plurality	m = 3	*	0	0.149	0.209	0.205
Voting	m = 4	*	0.498	0.203	0.251	0.290
Condorcet's	m = 3	0	0	0	0	0
voting	m = 4	0	0	0.032	0.052	0.065
Approval Voting	m = 3	*	0.667	0.592	0.374	0.419
	m = 4	*	0.749	0.542	0.729	0.707
Plurality	m = 3	*	0	0.109	0.132	0.146
w\ runoff	m = 4	*	0.248	0.185	0.338	0.397
Borda' s	m = 3	0	0	0.291	0.375	0.422
Count	m = 4	0	0.120	0.429	0.527	0.616
Black' s	m = 3	0	0	0	0.007	0.019
Procedure	m = 4	0	0.449	0.530	0.470	0.410
Hare' s	m = 3	0	0	0.111	0.134	0.151
STV	m = 4	0	0.257	0.130	0.265	0.338
Coombs'	m = 3	0	0	0.057	0.083	0.110
Procedure	m = 4	0	0.088	0.194	0.234	0.239
Max - min	m = 3	0	0	0.184	0.277	0.347
Procedure	m = 4	0	0.505	0.627	0.666	0.671
Copeland’s	m = 3	0	0	0	0	0
Procedure	m = 4	0	0	0.049	0.066	0.080

* For plurality, Condorcet’s and Approval voting procedures, the results are trivial for n=2

TABLE 3.A.4

Manipulations with a Worse Outcome than from Sincere Voting, Incomplete Information

Worse than sincere		n = 2	n = 3	n = 5	n = 7	n = 11
Plurality	m = 3	*	0	0.037	0.040	0.022
Voting	m = 4	*	0.247	0.058	0.085	0.069
Condorcet's	m = 3	0	0	0	0	0
voting	m = 4	0	0	0.0006	0.001	0.008
Approval	m = 3	*	0.336	0.111	0	0.047
Voting	m = 4	*	0.061	0.050	0.066	0.067
Plurality	m = 3	*	0	0	0.007	0.002
w\ runoff	m = 4	*	0.077	0.043	0.079	0.076
Borda' s	m = 3	0	0	0.041	0.042	0.033
Count	m = 4	0	0.027	0.063	0.072	0.058
Black' s	m = 3	0	0	0	0	0.001
Procedure	m = 4	0	0.156	0.108	0.080	0.057
Hare' s STV	m = 3	0	0	0	0	0
	m = 4	0	0.130	0.017	0.034	0.028
Coombs'	m = 3	0	0	0.018	0.002	0.016
Procedure	m = 4	0	0.021	0.052	0.030	0.041
Max - min	m = 3	0	0	0.009	0.011	0.011
Procedure	m = 4	0	0.133	0.122	0.108	0.082
Copeland’s	m = 3	0	0	0	0	0
Procedure	m = 4	0	0	0.011	0.010	0.009

* For plurality, Condorcet’s and Approval voting procedures, the results are trivial for n=2

3.A.3 Regression Results

TABLE 3.A.5

Regression Results

VARIABLES	(1) Prob full info	(2) Prob reduced info	(3) Prob merged groups	(4) Attempts reduced info	(5) Worse outcome reduced info
n	-0.00567*	0.00773***	0.00310	-0.0589**	-0.0179***
	[0.00285]	[0.00183]	[0.00234]	[0.0229]	[0.00432]
m=4	0.250***	0.0855***	0.162***	-0.00896	0.0846***
	[0.0190]	[0.0115]	[0.0154]	[0.139]	[0.0263]
Reduced info			-0.186***		
			[0.0146]		
Plurality	0.156***	0.0278	0.174***	2.336***	0.349***
	[0.0357]	[0.0210]	[0.0296]	[0.270]	[0.0510]
Condoret	-0.0845*	-0.121***	-0.0212	3.042***	0.106
	[0.0443]	[0.0283]	[0.0396]	[0.379]	[0.0716]
Approval	0.381***	0.197***	0.371***	2.487***	0.219***
	[0.0357]	[0.0210]	[0.0296]	[0.250]	[0.0472]
Runoff	0.199***	0.0264	0.195***	2.118***	0.225***
	[0.0357]	[0.0210]	[0.0296]	[0.270]	[0.0510]
Borda	0.337***	0.0160	0.253***	3.697***	0.210***
	[0.0319]	[0.0210]	[0.0267]	[0.270]	[0.0510]
Black	0.114***	-0.0519**	0.115***	6.264***	0.227***
	[0.0319]	[0.0210]	[0.0267]	[0.291]	[0.0550]
Hare STV	0.0935***	0.00850	0.129***	2.207***	0.198***
	[0.0319]	[0.0210]	[0.0267]	[0.270]	[0.0510]
Coombs	0.0898***	-0.0372*	0.108***	2.752***	0.261***
	[0.0319]	[0.0210]	[0.0267]	[0.270]	[0.0510]
Max-min	0.336***	0.0809***	0.279***	2.776***	0.200***
	[0.0319]	[0.0210]	[0.0267]	[0.270]	[0.0510]
Copeland	-0.0909**	-0.118***	-0.000472	2.940***	0.189***
	[0.0443]	[0.0283]	[0.0399]	[0.361]	[0.0683]
Observations	84	72	164	63	63

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Bibliography

Aghion, Phillipe, Alberto Alesina, and Franseco Trebbi (2004), "Endogenous Political Institutions," *Quarterly Journal of Economics*, 119, 565–612.

Alonso, Roberto and Niko Matouschek (2008), "Optimal Delegation," *Review of Economic Studies*, 75, 259-293.

Alvarez, Michael, and Jonathan Nagler (2000), "A New Approach for Modelling Strategic Voting in Multiparty Elections," *British Journal of Political Science*, 30, 57-75.

Aneja, Abhay, Marian Moszoro, and Pablo Spiller (2015), "Political Bonds: Political Hazards and the Choice of Municipal Financing Instruments," *NBER Working Papers 21188*, available at: http://www.nber.org/papers/w21188

Ashworth, Scott (2012), "Electoral Accountability: Recent Theoretical and Empirical Work," *Annual Review of Political Science*, 15, 183-201.

Austen-Smith, David and Jeffrey Banks (1988), "Elections, Coalitions, and Legislative Outcomes," *American Political Science Review*, 82, 405–422.

Baltrunaite, Audinga (2016), "Political Finance Reform and Public Procurement: Evidence from Lithuania," *mimeo,* avilable at: https://www.dropbox.com/s/al950vwrjohky0c/Procurement_JMP.pdf?dl=0

Bandiera, Oriana, Andrea Prat and Tommaso Valletti (2009), "Active and Passive Waste in Government Spending: Evidence from a Policy Experiment," *American Economic Review*, 99, 1278-1308.

Banerjee, Abhijit and Esther Duflo (2000), "Reputation Effects and the Limits of Contracting: A Study of the Indian Software Industry," *Quarterly Journal of Economics*, 115, 989-1017.

Banfield, Eric (1975), "Corruption as a Feature of Governmental Organization," *Journal of Law and Economics*, 18, 587-605.

Banks, Jeffrey, and Rangarajan Sundaram, "Moral Hazard and Adverse Selection in a Model of Repeated Elections." In *Political Economy: Institutions, Competition, and Representation*, ed. W. A. Barnett, M. J. Hinich, and N. J. Schoefield. (Cambridge: Cambridge University Press, 1993).

Barberà, Salvador, Bhaskar Dutta, and Arunava Sen (2001), "Strategy-proof Social Choice Correspondences," *Journal of Economic Theory*, 101, 374–394.

Barro, Robert (1973), "The Control of Politicians: An Economic Model," *Public Choice*, 14, 19-42.

Blais, André, Richard Nadeau, Elisabeth Gidengil, and Neil Nevitte (2001), "Measuring Strategic Voting in Multiparty Plurality Elections," *Electoral Studies*, 20, 343-352.

Bobilev, Roman, Andrea Guglielmo, Elena Paltseva and Giancarlo Spagnolo (2015), "Public Procurement Thresholds and Data in Sweden," KKV Report 2015:3, available at: http://www.kkv.se/globalassets/publikationer/uppdragsforskning/forsk_rap_2015_3.pdf

Bossert, Walter, and Ton Storcken (1992), "Strategy-proofness of Social Welfare Functions: The Use of the Kemeny Distance between Preference Orderings," *Social Choice and Welfare*, 9, 345-360.

Bulow, Jeremy and Paul Klemperer (1996), "Auctions versus Negotiations," *American Economic Review*, 86, 180-194.

Calonico, Sebastian, Matias Cattaneo, and Rocio Titiunik (2014), "Robust Data-driven Inference in the Regression-discontinuity Design," *Stata Journal*, 14, 909-946.

Calonico, Sebastian, Matias Cattaneo, and Rocio Titiunik (2014), "Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs," *Econometrica*, 82, 2295-2326.

Calzolari, Giacomo and Giancarlo Spagnolo (2009), "Relational Contracts and Competitive Screening," *CEPR Discussion Paper 7434*, available at: http://ssrn.com/abstract=1484466

Campbell, Donald (1969), "Reforms as Experiments," *American Psychologist*, 24, 409-429.

Caughey, Devin and Jasjeet Sekhon (2011), "Elections and the Regression Discontinuity Design: Lessons from Close US House Races, 1942–2008," *Political Analysis*, 19, 385–408.

Coviello, Decio, and Mario Mariniello (2014), "Publicity requirements in public procurement: Evidence from a regression discontinuity design," *Journal of Public Economics*, 109, 76-100.

Coviello, Decio, Andrea Guglielmo and Giancarlo Spagnolo. "The Effect of Discretion on Procurement Performance." *Management Science*, forthcoming.

Deaton, Angus (1997). *The Analysis of Household Surveys: A Microeconomic Approach to Development Policy* (Washington, D.C.: World Bank).

Di Tella, Rafael and Ernesto Schargrodsky (2003), "The Role of Wages and Auditing during a Crackdown on Corruption in the City of Buenos Aires," *Journal of Law and Economics*, 46, 269-92.

Duddy, Conal, Juan Perote-Pena, and Ashley Piggins (2010), "Manipulating an Aggregation Rule under Ordinally Fuzzy Preferences," *Social Choice and Welfare*, 34, 411-428.

The Economist, "Bearer Beware," May 19th, 2013.

The Economist, "State Capture," Nov 2nd, 2011.

Edlin, Aaron, Andrew Gelman, and Noah Kaplan (2007), "Voting as a Rational Choice. Why and How People Vote to Improve the Well-being of Others," *Rationality and Society*, 19, 293-314.

Europe Economics (2006). *Evaluation of Public Procurement Directives* (European Commission, DG Internal Market).

European Commission (2011). *Public Procurement in Europe: Cost and Effectiveness (*European Commission, PwC, London Economics and Ecorys).

Feldman, Allan (1980), "Strongly Nonmanipulable Multi-valued Collective Choice Rules," *Public Choice*, 35, 503–509.

Feldman, Allan, and Roberto Serrano (2006), *Welfare Economics and Social Choice Theory*. (New York: Springer).

Ferejohn, John (1986), "Incumbent Performance and Electoral Control," *Public Choice*, 50, 5-25.

Ferraz, Claudio, and Frederico Finan (2008), "Exposing Corrupt Politicians: The Effect of Brazil's Publicly Released Audits on Electoral Outcomes," *Quarterly Journal of Economics*, 123, 703-745.

Ferraz, Claudio, and Frederico Finan (2011), "Electoral Accountability and Corruption: Evidence from the Audits of Local Governments," *American Economic Review*, 101, 1274-1311.

Ferreira, Fernando, and Joseph Gyourko (2009), "Do Political Parties Matter? Evidence from U.S. Cities," *Quarterly Journal of Economics*, 124, 399-422.

Fisher, Stephen (2001), "Extending the Rational Voter Theory of Tactical Voting," *CREST Working Paper No. 94,* available at: http://www.nuff.ox.ac.uk/users/fisher/fishermw.pdf

Fisher, Stephen (2004), "Definition and Measurement of Tactical Voting: the Role of Rational Choice," *British Journal of Political Science, 34,152-166.*

Folke, Olle (2014), "Shades of Brown and Green: Party Effects in Proportional Election Systems," *Journal of the European Economic Association*, 12, 1361-1395.

Gelman, Andrew, and Guido Imbens (2014), "Why High-order Polynomials Should Not be Used in Regression Discontinuity Designs," *NBER Working Papers 20405,* available at: http://www.nber.org/papers/w20405

Gibbard, Allan (1973), "Manipulation of Voting Schemes: A General Result," *Econometrica*, 41, 587-601.

Goldman, Eitan, Jörg Rocholl, and Jongil So (2013), "Political Connections and the Allocation of Procurement Contracts," *Review of Finance*, 17, 1617–1648.

Gordon, Richard (2009). *Laundering the Proceeds of Public Sector Corruption* (Washington, DC: World Bank).

Gordon, Sanford, and Gregory Huber (2007), "The Effect of Electoral Competitiveness on Incumbent Behavior," *Quarterly Journal of Political Science*, 2, 107–138.

Gordon, Sanford, Gregory Huber, and Dimitri Landa (2007), "Challenger Entry and Voter Learning," *Americal Political Science Review*, 101, 303–20.

GovConChannel, "Got Your Fingers Crossed Small Federal Contractors?," July 25th, 2015.

Hahn, Jinyong, Petra Todd, and Wilbert van der Klaauw (2001), "Identification and Estimation of Treatment Effects with a Regression Discontinuity Design," *Econometrica*, 69, 201-209.

Hall, Peter (1992), "Effect of Bias Estimation on Coverage Accuracy of Bootstrap Confidence Intervals for a Probability Density," *The Annals of Statistics*, 20, 675–694.

Helper, Susan, and Rebecca Henderson (2014), "Management Practices, Relational Contracts, and the Decline of General Motors," *Journal of Economic Perspectives*, 28, 49-72.

Holmstrom, Bengt and Paul Milgrom (1991), "Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design," *Journal of Law, Economics and Organization*, 7, 24–52.

Horowitz, Joel (2001). "The Bootstrap." in *The Handbook of Econometrics*, James J. Heckman and Edward Leamer, eds. (Amsterdam, The Netherlands: Elsevier Science B.V.), 3463–3568.

Chang, Eric, and Miriam Golden (2007), "Electoral Systems, District Magnitude and Corruption," *British Journal of Political Science*, 37, 15-137.

Cheng, Ming-Yen, Jianqing Fan and James Marron (1997), "On Automatic Boundary Corrections," *Annals of Statistics*, 25, 1691–1708.

Chetty, Raj, John N. Friedman, Tore Olsen and Luigi Pistaferri (2011), "Adjustment Costs, Firm Responses, and Micro vs. Macro Labor Supply Elasticities: Evidence from Danish Tax Records," *Quarterly Journal of Economics*, 126, 749-804.

Imbens, Guido, and Joshua Angrist (1994), "Identification and Estimation of Local Average Treatment Effects," *Econometrica*, 62, 467-475.

Imbens, Guido, and Thomas Lemieux (2008), "Regression Discontinuity Designs: A Guide to Practice," *Journal of Econometrics*, 142, 615-635.

Jurajda, Štěpán, and Daniel Münich (2014), "Candidate Ballot Information and Election Outcomes: the Czech Case," *Post-Soviet Affairs*.

Kelman, Steven (1990). *Procurement and Public Management: The Fear of Discretion and the Quality of Government Performance* (Washington, DC: AEI Press).

Kunicova, Jana, and Susan Rose-Ackerman (2005), "Electoral Rules and Constitutional Structures as Constraints on Corruption," *British Journal of Political Science*, 35, 573-606.

Laslier, Jean-Francois (2010). In Silico Voting Experiments. In *Handbook on Approval Voting, Studies in Choice and Welfare*, ed. Jean-François Laslier and Remzi Sanver (Berlin, Germany: Springer Verlag).

Lee, David (2008), "Randomized Experiments from Non-Random Selection in U.S. House Elections," *Journal of Econometrics*, 142, 675-697.

Lee, David, and Thomas Lemieux (2010), "Regression Discontinuity Designs in Economics," *Journal of Economic Literature*, 48, 281-355.

Lee, David, Enrico Moretti, and Matthew Butler (2004), "Do Voters Affect or Elect Policies? Evidence from the U.S. House," *Quarterly Journal of Economics*, 119, 807-860.

Manin, Bernard, Adam Przeworski, and Susan Stokes (1999). Elections and Representation. In *Democracy, Accountability, and Representation*, ed. Adam Przeworski, Susan Stokes and Bernard Manin. (New York: Cambridge University Press).

McCrary, Justin (2008), "Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test," *Journal of Econometrics*, 142, 698-714.

Mironov, Maxim and Ekaterina Zhuravskaya (2016). "Corruption in Procurement and the Political Cycle in Tunneling: Evidence from Financial Transactions Data," *American Economic Journal: Economic Policy*, 8, 287-321.

Myerson, Roger, and Robert Weber (1993), "A Theory of Voting Equilibria," *American Political Science Review*, 87, 102-114.

Nurmi, Hannu (1987). *Comparing Voting Systems* (Dordrecht, Holland: D. Reidel Publishing Company).

OECD (2013). *Government at a Glance 2013* (Paris, France: OECD).

Pagan, Adrian and Aman Ullah (1999). *Nonparametric Econometrics* (New York: Cambridge University Press).

Pattanaik, Prasanta (1973), "On the Stability of Sincere Voting Situations," *Journal of Economic Theory*, 6, 558–574.

Pavel, Ján (2013). *Veřejné zakázky a efektivnost*. (Praha, Czech Republic: Ekopress).

Persson, Torsten, and Guido Tabellini (2000). *Political Economics: Explaining Economic Policy* (Cambridge, Massachusetts: MIT Press).

Persson, Torsten, Guido Tabellini, and Francesco Trebbi (2003), "Electoral Rules and Corruption," *Journal of the European Economic Association*, 4, 958-989.

Pettersson-Lidbom, Per (2008), "Do Parties Matter for Economic Outcomes? A Regression-Discontinuity Approach," *Journal of European Economic Association*, 6, 1037-1056.

Rodriguez-Álvarez, Carmelo (2007), "On the Manipulation of Social Choice Correspondences," *Social Choice and Welfare*, 29, 175–199.

Saez, Emmanuel (2010), "Do Taxpayers Bunch at Kink Points?" *American Economic Journal: Economic Policy*, 2, 180–212.

Satterthwaite, Mark Allen (1975), "Strategy-proofness and Arrow's Conditions: Existence and Correspondence Theorems for Voting Procedures and Social Welfare Functions," *Journal of Economic Theory*, 10, 187-217.

Shapley, L. S. and Martin Shubik (1954), "A Method for Evaluating the Distribution of Power in a Committee System," *American Political Science Review*, 48, 787–792.

Sharman, Jason (2010), "Shopping for Anonymous Shell Companies: An Audit Study of Anonymity and Crime in the International Financial System," *Journal of Economic Perspectives*, 24, 127-140.

Shleifer, Andrei and Robert Vishny (1993), "Corruption," *Quarterly Journal of Economics*, 108, 599–617.

Shleifer, Andrei and Robert Vishny (1994), "Politicians and Firms," *Quarterly Journal of Economics*, 109, 995–1025.

Schmitt, Hermann, and Cees van der Eijk (2007). Non-voting in European Parliament Elections and Support for European Integration. In: *European Elections and Domestic Politics: Lessons from the Past and Scenarios for the Future*, ed. van der Brug, Wouter and Cees van der Eijk, (Notre Dame: University of Notre Dame Press).

Snyder, James, Michael Ting, and Stephen Ansolabehere (2005), "Legislative Bargaining under Weighted Voting," *American Economic Review*, 95, 981–1004.

Snyder, Jason (2005), "Detecting Manipulation in U.S. House Elections," *mimeo*, available at: http://graphics8.nytimes.com/images/blogs/freakonomics/pdf/SnyderCloseVotes.pdf

Spagnolo, Giancarlo (2012), "Reputation, Competition, and Entry in Procurement," *International Journal of Industrial Organization*, 30, 291-296.

Šedová, Jindřiška (2014), "Transparency of Shareholders in the Czech Republic," *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 62, 415–426.

Tavits, Margit (2007), "Clarity of Responsibility and Corruption," *American Journal of Political Science*, 51, 218-229.

Titl, Vítězslav, Miroslav Palanský, and Jiří Skuhrovec (2014), "Analýza Darů Právnických Osob Politickým Stranám," *mimeo*, available at: http://www.zindex.cz/data/polfin/2014-09-04-studie_dary_politickym_stranam_po.pdf

Transparency International (2009). *Efektivnost Fungování Kontrolních Systemů Veřejných Zakázek v České Republice* (Prague, Czech Republic: Transparency International).

Transparency International (2012). *Corruption Perceptions Index 2012* (Berlin, Germany: Transparency International).

Trebbi, Francesco, Phillipe Aghion, and Alberto Alesina (2008), "Choosing Electoral Rules: Theory and Evidence from US Cities," *Quarterly Journal of Economics*, 123, 325–357.

Umezawa, Masashi (2009), "Coalitionally Strategy-proof Social Choice Correspondences and the Pareto Rule," *Social Choice and Welfare*, 33, 151-158.

Urquiola, Miguel, and Eric Verhoogen (2009), "Class-Size Caps, Sorting, and the Regression-Discontinuity Design," *American Economic Review*, 99, 179-215.

van der Klaauw, Wilbert (2002), "Estimating the Effect of Financial Aid Offers on College Enrollment: A Regression-Discontinuity Approach," *International Economic Review*, *43*, 1249-1287.

Wooldridge, Jeffrey (1997), "Multiplicative Panel Data Models without the Strict Exogeneity Assumption," *Econometric Theory*, 13, 667-678.

World Economic Forum (2011). *The Global Competitiveness Report 2011-2012* (Geneva, Switzerland: World Economic Forum).