Signaling Games of Election Fraud

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Abstract

This paper introduces a novel theoretic approach towards understanding election fraud under autocracies, by suggesting a signaling model of election fraud and testing its basic implications on unique datasets from Russian and cross-national settings. According to the theory, the heads of subnational units can send their signals about loyalty to the leader by means of fraudulently augmented turnout or incumbent's vote percentages. These signaling patterns are related to an excess of 0s and 5s in the last digit of turnout and percentage of incumbent's voter support. In return, the local agents are rewarded by the leader with the larger amounts of postelectoral fiscal transfers. Basic implications from the formal model are supported by empirical data analysis: as the proportion of 0s and 5s increases the amount of postelectoral transfers also increases, both in Russia and worldwide.

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Introduction

In recent decades authoritarian and formerly authoritarian regimes held many elections, some truly competitive and some not (Levitsky and Way 2010; Wolchik and Bunce 2010; Bunce and Wolchik 2011; Hyde 2011; Hyde and Marinov 2012). Election fraud and its detection in those states have been a concern in a large body of literature (Lehoucq 2003; Bjornlund 2004; Schedler 2006; Alvarez, Hall, and Hyde 2008; Myagkov, Ordeshook, and Shaikin 2009; Cantu and Saiegh 2011; Fukumoto and Horiuchi 2011; Simpser 2013; Wintrobe 1998; Svolik 2012; Kalinin and Mebane 2013).

Elections are important for autocrats, because, if rightly controlled by them, elections periodically demonstrate the regime's popular support, thus reducing the likelihood of coup by disappointed regime notables. Elections solidify the legitimacy of the autocrat among the general public (Geddes 2006; Magaloni 2006). Elections can provide lots of information that allows assessment of the strength of the potential opposition in society, even if the signal is somewhat noisy due to attempts at manipulation and fraud (Gandhi 2008, 167). Moreover, elections can also elicit information about election fraud itself: specific patterns in electoral data can persist conditional on the strategies of officials and their success in signaling the loyalty to the leader. This information is especially valuable to the autocrat, who can use the electoral data to get a snapshot of the loyalty status of the local agents, and decide on each agent's success in mobilizing his regional "political machine" to provide necessary electoral support to the leader (Gel'man 2009).

While the previous research has shown that, in Russia and elsewhere, fraud can often be readily detected (Myagkov and Ordeshook 2008; Myagkov, Ordeshook, and Shaikin 2008; Myagkov et al. 2009; Mebane and Kalinin 2009b,c), it has rarely focused on the mechanisms by which election fraud can be conducted nationally. In this paper, I argue that local agents engage in a signaling strategy, wherein election fraud signals loyalty to the leader, who distributes post-election rewards and punishments based on electoral results and turnout. This approach allows us to explain the prevalence of anoma-

lous data patterns in turnout and voting percentage data, specifically the frequency with which a 0 or 5 appears as the last digit in a percentage. The Russian case exemplifies this phenomenon quite well: while in the mid-1990s Russian governors used strategies of bargaining, in which powerful regions provided the leader with favorable electoral outcomes in exchange for political, institutional and financial resources (Treisman 1997a,b), political recentralization in the 2000s has led to revision of bargaining agreements and the imposition of electoral signaling. In the Russian case this strategy is employed by regional governors to signal their loyalty to the leader by means of fraudulently augmented electoral results and to get certain rewards in exchange, such as political survival or postelectoral transfers.

Signaling strategies and signaling games in the authoritarian setting have been the subject of previous research. For instance, Simpser (2013) focuses on a ruling party signaling its "strength" by means of increasing the winner's election margin. By creating a public impression of his own political dominance, the autocrat is able to discourage the political opposition from its quest for power (Lohmann 1994; Simpser 2013). Rundlett and Svolik (2014) claim that to overcome the limited information problem, agents start relying on the autocrat's genuine nationwide popularity as a coordination mechanism. This, however, still leads to Pareto-inferior outcome expressed in an oversupply or undersupply of fraud, resulting from a herd dynamic among agents. Kalinin (2014) argues that the autocrat's genuine nationwide popularity can be polluted by preference falsification, which induces the agents to commit election fraud to cover up any discrepancies between polling estimates and election results. In other words, election fraud can be seen as a function of the preference falsification in the pre-electoral surveys, where the "signal of loyalty" is associated with a close match between the inflated polling estimates and incumbent's electoral returns, and *vice versa*, the "signal of disloyalty" is associated with a mismatch between both estimates.

To elucidate the institutional foundations of electoral signaling, in this paper I

introduce a game theoretic model—a signaling model (Cho and Kreps 1987)—which is used to motivate a set of empirical models that are estimated using the data from cross-national and Russian data. My approach utilizes the last digit of the turnout percentage and incumbent's vote percentage as the marker of fraud, reducing it to observation of 0s and 5s in the data (Beber and Scacco 2008). This approach has demonstrated its relative efficiency as a measure of fraud in our earlier works (Mebane and Kalinin 2009b,c).

The implications from the game-theoretic model are helpful in our understanding of the general mechanisms by which specific "signaling" markers such as 0s and 5s occur in percentages and vote counts across different political regimes. I confirm the predictions of the model via empirical analysis using data from Russia as well as cross-national data. The expansion of the "signaling game" to the cross-national realm is possible through classification of different emergent equilibria. Specifically, the presence of rigged elections and associated numerical anomalies either in democracies or autocracies can be explained by a combination of various institutional factors such as regime type (authoritarian or democratic), system of government (federal or unitary), form of government (presidential vs. parliamentary). In sum, all these factors preset a specific level of loyalty of local agents *via-a-vis* the leader, leading to the described strategic behavior expressed in signaling strategies.

The contribution of this paper to the existing literature is threefold. First, it offers a theoretical model of electoral signaling by bringing together electoral and financial data. Second, it uses implications from formal modeling to understand the mechanisms by which the evolution of federal relations in Russia can be connected to election fraud, and explores the spread of the "signaling" phenomenon worldwide. Finally, this paper engages two original datasets collected by the author: the Russian dataset and cross-national dataset, derived from both Adam Carr's Election Archive[1] — the largest and most comprehensive archive of electoral statistics from 182 countries, and *Government*

[1]http://psephos.adam-carr.net/

Finance Statistics(GFS) database managed by the *International Monetary Fund*.[2]

The structure is as follows. Section 1 discusses the idea of signaling and loyalty in connection to election fraud, while reviewing the literature on this topic. Section 2 examines the basic formal model and its extension to cross-national analysis. Section 3 is devoted to empirical analysis of the Russian and cross-national data for testing proposed hypotheses. In the final part I draw conclusions and discuss prospects for further research.

Signaling Strategies and Election Fraud

In authoritarian regimes, the leader and elites collaborate to preclude participation by the population, making it costly for citizens to coordinate and punishing those who criticize the regime. While most citizens cannot challenge the leader, elites with key positions in the regime can still oust leaders if they can solve their coordination problem. Therefore the question becomes to what extent the leader can monitor and punish the members of elites for expressing their disapproval. In authoritarian regimes, information uncertainty about the extent of the leader's real support among the elites prevents him from effectively controlling elites (Wintrobe 1998; Svolik 2012). The solution to this dilemma becomes possible on the one hand through control of the intelligence organs, allowing the Leader to monitor and punish the disloyal members, and on the other hand, through the use of positive incentives to encourage the elites to insure loyalty and compliance. For instance, Bueno de Mesquita and colleagues suggest that this is precisely why leaders of authoritarian regimes create small winning coalitions: the exchange between loyalty and private goods available with small winning coalitions strengthens ties between the leader and the elites (de Mesquita, Smith, Siverson, and Morrow 2004; Gehlbach 2013).

The distribution of rents in exchange for loyalty is undermined by the principal-agent problem between the autocrat and his local agents, where the agents are willing to engage in fraud only in situations where vested risks are compensated by certain

[2]http://elibrary-data.imf.org/

financial awards, such as rents and payments coming from the principal (Rundlett and Svolik 2014). This observation is supported by the general theory of agency, arguing that the principal benefits from giving the agent some rent to induce him to take a desired but unobservable action and to truthfully reveal his private information. This exchange, however, is costly in terms of the policymakers objective and decreases economic efficiency of the outcome compared to non-authoritarian states (Dixit 2010).

Even though the repression of various information channels helps an autocrat to efficiently deter any risks associated with the emergence of possible challengers (Wintrobe 1998; de Mesquita et al. 2004; Egorov, Guriev, and Sonin 2009), elections can still provide a wealth of useful information. Although manipulation and fraud may make the signal somewhat noisy, elections allow assessment of the strength of the potential opposition in a given society (Gandhi 2008, 167). The limited information problem, however, with regard to the leader's genuine popularity makes it quite difficult for him and the local agents to efficiently allocate election frauds throughout the system, as well as to differentiate the costly signals of agent's loyalty expressed in election frauds. In spite of this, some parts of the "signaling" information or the fingerprints of electoral fraud are well embedded in the electoral data and can be easily detected by a loyalty-seeking autocrat or by anomaly-seeking election forensics researchers. In fact, those agents with highest risks of exclusion from the winning coalition are most likely to radiate stronger signaling patterns (de Mesquita et al. 2004; Gehlbach 2013). In this sense elections serve an important purpose to the autocrats. If rightly controlled in their hands, elections periodically demonstrate the regimes popular support, thus reducing the likelihood of a coup by disappointed regime notables, and solidifying the legitimacy of the autocrat among the general public (Geddes 2006; Magaloni 2006). Also, electoral information enables the leader to get a snapshot of the loyalty status of the local agents and their success in mobilizing their regional "political machines" to provide necessary electoral support to the leader (Gel'man 2009).

Signaling strategies adopted by the local agents allow them to solve the limited information problem. For instance, Simpser (2013) focuses on a ruling party signaling its "strength" by means of increasing the winner's election margin. By creating a public impression of his own political dominance, the autocrat is thus able to discourage the political opposition (Lohmann 1994; Simpser 2013). Rundlett and Svolik (2014) claim that to overcome the limited information problem, agents start relying on the autocrat's genuine nationwide popularity as a coordination mechanism. This, however, still leads to Pareto-inferior outcome expressed in the oversupply or undersupply of fraud, resulting from a herd dynamic among the agents. Kalinin (2014) argues that election fraud can be seen as a function of the preference falsification in the pre-electoral surveys, where the "signal of loyalty" is associated with a close match between the inflated polling estimates and incumbent's electoral returns, and *vice versa* the "signal of disloyalty" is associated with mismatch between both estimates.

Signaling patterns serve as the markers of election fraud within the data, and can be detected using various kinds of the digit-based tests. For instance, irrational human biases can be explored by the last-digit vote counts test (Beber and Scacco 2008): if the turnout or vote counts reflected the natural complex of processes that cause people to vote or not to vote, we would expect the counts last digits to be uniformly distributed (i.e., each digit zero through nine would occur equally often). The rational strategic patterns of election fraud can be detected by the second-digit test: we might expect that if substantial vote switching or ballot stuffing is occurring, we should see significant departures from the Benford's expected mean for the second digit ($\bar{j}_B = 4.187$) (Mebane and Kalinin 2009a; Mebane 2010). The patterns in the data resulted from the use of signaling strategies are best explored by the "last digit of percentages" of turnout or voting percentages, which is a special case of the Beber and Scacco (2008) approach. According to Kalinin and Mebane (2013) the signaling strategies are explicitly present when the expected value for the mean of this indicator variable is significantly higher

$E(C05s) = 0.2$. In fact, the notion of signaling strategies has been especially acute during the Soviet period. During this time, governors would use "false accounting" (*pripiski*), designed to affect the measures of the level of regional output and help them to avoid punishment (Harrison 2009). Because of this "false accounting", it comes as no surprise that with the start of new Russian recentralization in 2000s, such Soviet practices were restored in relation to Russian contemporary elections. As a result, the presence of electoral fraud became a basic signaling mechanism of regional bosses' loyalty and of their ability to control administrative resources to the Kremlin's benefit. Electoral signaling can be readily detected by analyzing the percentages of electoral outcomes. If electoral signaling occurs, electoral "pripiski" are most likely to take place with rounded percentages of turnout or vote percentages, which is the easiest and most readily detected way to report basic information to superiors. In such cases, favorable percentages are first sent down from the Kremlin to the regional elections commissions, which passes this information further down to the territory-level commissions and, finally, precincts (Kalinin and Mebane 2013).

*** Figure A1 about here ***

One of the obvious ways to detect signaling patterns in to display kernel density estimates for precinct-level incumbent's vote shares and turnout for the Russian presidential elections. For most of the years, the figures in Figure A1 show the presence of non-normal distribution, exhibiting spikes at locations corresponding to the excess of vote shares and turnout values at values of 60%, 65%, 70%, 75%, 80%, 85% and 90% (Buzin and Lubarev 2008; Mebane and Kalinin 2009b,c). The authors argue that the only acceptable explanation for the spiked distributions is a wide-spread adjustment of those figures to specific "rounded" figures. Inspecting the last digits of the original precinct-level turnout counts adds to the impression that many of them are faked. If the turnout counts reflected the natural complex of processes that cause people to vote or not to vote, we would expect the counts last digits to be uniformly distributed, i.e.

each digit zero through nine would occur equally often (Beber and Scacco 2008). Table A1 shows for each digit the signed square root of the discrepancy between the observed frequency of the digit and the frequency of 0.1 expected if the distribution is uniform. The distribution of the last digits in the actual turnout counts from 2003-2012 is very often far from uniform for both presidential and parliamentary elections.

*** Table A1 about here ***

A value of 2.0 or greater in magnitude represents a significant discrepancy. The table shows that across all Russian elections there are always too many zeros and fives, with one exception too few nines.

The rise in political centralization leads to integration of local agents into the superstructure of the center with economic and political resources flowing from the leader to local units. From the cross-national perspective, unitary system of government, in which the center delegates authority to subnational units, should be prone to signaling strategies, as well as the federal system of government without gubernatorial elections, such as Russia's. The signaling game is built around the political loyalty, defined as the local agent's ability to control the political, social and economic spheres in the dependent region so as to provide the leader with the favorable electoral outcomes. In return for electoral outcomes, agents can be rewarded with financial inflows or appointments, or, in the event of a negative outcome, punished by the leader. Even when the political regime is stable and durable, the actual benefits from committing election frauds could far outweigh the actual costs, inducing the local agents to adopt their signaling strategies on a regular basis (Rundlett and Svolik 2014). The federal systems of government can be characterized by signaling strategies of subnational agents in the same way as the unitary. For instance, Filippov, Ordeshook, and Shvetsova (2004) observe in a federal system, regional executives' "aggressive programs of improving their units' position" may extend to elections: "If, for instance, the enforcement of antifraud election provisions is weak or nonexistent, and if regional chief executives can influence voting or the tabulation

of votes for national as well as regional offices, then those executives possess a powerful asset that can be used to short-circuit constitutional provisions written to direct federal bargaining elsewhere" (Filippov et al. 2004, 119).

The paper argues that the pattern of fraudulent electoral results can be explained by the presence of signaling games between the regions and the Leader/Center. Fraudulent electoral results show how favorable electoral results can be delivered by the regional elites to display their loyalty to the Leader/Center in exchange for administrative and financial rewards.

A Formal Model

Consider the signaling game (Cho and Kreps 1987) represented by the diagram in Figure. B1[3] $\mathcal{N}$ denotes a random move by Nature to produce a first player (the local agent or the governor, $\mathcal{G}$) who is either loyal (L) or not ($\neg L$). Then $\text{Prob}(L) = \lambda$ and $\text{Prob}(\neg L) = 1 - \lambda$. In the election the governor then either commits fraud (F) or not ($\neg F$). Player 2 (the Leader, $\mathcal{K}$) does not know whether $\mathcal{G}$ is loyal, but $\mathcal{K}$ does observe $\mathcal{G}$'s move. $\mathcal{K}$ then either punishes (P) or not ($\neg P$). The payoffs are given at the bottom of Figure B1. The interpretation of the symbols used in the payoff definitions is as follows.

- $w \geq 0$ is the value of electoral punishment by voters for fraud committed in the election; $w > 0$ — the value of electoral punishment when elections take place, and $w = 0$ — the value of electoral punishment when elections are absent.
- $p > 0$ is the value of punishment imposed by $\mathcal{K}$
- $v > 0$ is the value of excess votes produced by fraud
- $t > 0$ is the value of transfers from $\mathcal{K}$ to $\mathcal{G}$

[3] A more detailed description of the formal model can be found in Kalinin and Mebane (2013)

- b is a coefficient that when multiplied by t gives the present discounted value of the future expected to be produced by a transfer; this may be positive or negative
- $d > 0$ is the value to $\mathcal{K}$ of replacing a disloyal $\mathcal{G}$

*** Figure B1 about here ***

Given equivalent actions by $\mathcal{K}$, fraud is always worse for $\mathcal{G}$ due to the sanction from voters. That is, if $\mathcal{G}$ is loyal and $\mathcal{K}$ always punishes, then playing F gives $\mathcal{G}$ a payoff of $-w - p$ while playing $\neg F$ gives $-p$. If there is no sanction from voters, $w = 0$, then F and $\neg F$ give $\mathcal{G}$ the same payoff given an identical response from $\mathcal{K}$. The payoffs to $\mathcal{G}$ from F are always w subtracted from the corresponding payoff from $\neg F$.

If fraud happens, $\mathcal{K}$ always gains excess votes v. If $\mathcal{K}$ doesn't punish, then $\mathcal{G}$ always gains a transfer from $\mathcal{K}$, t, which costs $-t$ to $\mathcal{K}$. If $\mathcal{K}$ punishes, then $\mathcal{G}$ always loses $-p$ which also costs $-p$ to $\mathcal{K}$. But if a disloyal $\mathcal{G}$ is punished (e.g., fired), then $\mathcal{K}$ gains d.

One key difference between a loyal $\mathcal{G}$ and a disloyal one is who retains any future surplus generated by a transfer from $\mathcal{K}$. Compare the payoffs when a loyal $\mathcal{G}$ commits fraud and is not punished to the payoffs when a disloyal $\mathcal{G}$ commits fraud and is not punished: the difference is that the term bt is added to $\mathcal{K}$'s payoff in the former case but is added to $\mathcal{G}$'s payoff in the latter case. A similar situation holds when $\mathcal{G}$ does not commit fraud and is not punished: the disloyal $\mathcal{G}$ retains the surplus while with a loyal $\mathcal{G}$ $\mathcal{K}$ retains the surplus.

The game is presented in multiagent normal form (Myerson 1991). The strategies of the loyal $\mathcal{G}$ are now denoted F_1 and $\neg F_1$ while the disloyal $\mathcal{G}$'s strategies are F_2 and $\neg F_2$. $\mathcal{K}$'s strategies are now P_1 and $\neg P_1$ if acting after fraud and are P_2 and $\neg P_2$ if acting after no fraud. The multiagent strategic normal form of the game appears in Table B1.

***Tables B1, B2, B3 about here ***

The necessary conditions for a perfect Nash equilibrium are tested for the set of possible pure strategy equilibria. The strategy profiles along with the payoffs that go

to $\mathcal{G}$ and $\mathcal{K}$ are listed in Table B2. The strategy profiles, the results of testing whether the profile can be a Nash equilibrium and a brief description of the requirements for the profile to be an equilibrium appear in Table B3. The tests are done by comparing payoffs produced with each profile to the payoffs produced with the profiles produced by changing each agent's strategy while holding the other strategies constant.

According to the signaling model, four parameters are central to our understanding of why specific equilibria hold and why, in particular, the "electoral signaling" equilibrium arises. These parameters are d, the value to the Leader of replacing a disloyal governor, λ, the probability that a governor is loyal, which is presumably increased by having the governor be appointed instead of elected, b, the future returns expected to be produced by a transfer, and w, the value of electoral punishment by voters for fraud committed in the election. Here loyalty is regarded as a choice each governor makes and not an immutable personality trait, $\lambda \in (0, 1)$: $\lambda = 0$ indicates no chance of loyal governor at all, and $\lambda = 1$, a good chance of loyalty.

Several profiles that can be equilibria have conditions that require either $\lambda = 0$ or $\lambda = 1$. These are the profiles labeled I*, II*, V*, VI*, XI* and XVI*.[4]

While some of these equilibria have potentially interesting features, the condition $\lambda = 0$—no chance of loyalty at all—is too extreme. Once elections are abolished or all governors are appointed, the circumstance of $\mathcal{K}$ being certain of $\mathcal{G}$'s loyalty ($\lambda = 1$) becomes at least thinkable, but first we will consider equilibria that admit uncertainty: $\lambda \in (0, 1)$. The profiles that can be equilibria and admit uncertainty about $\mathcal{G}$'s loyalty are the ones labeled III*, IX*, XII* and XV*.[5]

The signaling theory implies that over all the country, regions are diverse, so a single configuration of the parameter values of the game model does not characterize the whole

[4]Explicitly, these profiles are I*, $(F_1, F_2, \neg P_1, \neg P_2)$; II*, $(F_1, \neg F_2, \neg P_1, P_2)$; V*, $(F_1, \neg F_2, P_1, \neg P_2)$; VI*, $(F_1, \neg F_2, \neg P_1, \neg P_2)$; XI*, $(\neg F_1, F_2, \neg P_1, P_2)$ and XVI*, $(\neg F_1, F_2, \neg P_1, \neg P_2)$.

[5]Explicitly, these profiles are III*, $(F_1, F_2, \neg P_1, P_2)$; IX*, (F_1, F_2, P_1, P_2); XII*, $(\neg F_1, \neg F_2, \neg P_1, P_2)$ and XV*, $(\neg F_1, \neg F_2, P_1, \neg P_2)$.

country.[6] The future returns expected from a transfer, b, may be positive or negative. Negative b values are associated with corruption and political opportunism: as far as the Leader is concerned, economic resources transferred to a corrupt region are expected to produce no significant value in the future, and if the resources facilitate regions' gaining further autonomy and even independence, the return on transfers to a region may even be evaluated as strictly negative. Alternatively, b may be positive. Indeed, if b is like a normal investment, we should have $b \geq 1$: the transfer is at least expected to pay for itself. Different regions may at any one time have different values of b. For instance, during the 1990s, the threat of regions leaving the Russian Federation was very real, so b was negative. For this period, the game model does not explain the relationship that may exist between election fraud and postelection transfers as well, but when the model is applied it suggests that when $b < 0$, the relationship between election fraud and transfers is such that governors who commit fraud are likely worse off than governors who do not.

In the case of greater centralization, the clearest change is that the value of d becomes high and increasing over time. The increase in d reflects how local "political machines" were coopted into the power vertical. As long as the loyalty of governors is not certain—$0 < \lambda < 1$—and $b < 0$, there may be an alternation between III*, in which both types of governors commit fraud, and XV*, in which neither type of governors commits fraud—an alternation that is related to transfers and punishments and depends on loyalty. As a result, this will induce an association between transfers and punishments, on the one hand, and election fraud, on the other. With regards to Russia, for instance, recentralization greatly reduced separatist concerns, so that perhaps $b > 0$. A positive value of b would rule out XV* as an equilibrium. Recentralization likely raised the typical value of λ, so that b may more often exceed the lower bound. In the period

[6]Note that we have modeled the relationship between the Leader and one governor. It is assumed that the Leader plays such a game independently in each region, and that regional actors learn nothing from one another's experience. Reality undoubtedly involves more interaction between regions than this, but it is intractable to extend the game to one in which the Leader simultaneously interacts with all other regions.

before gubernatorial elections were abolished—in particular 2004—this may imply an alternation between III* and XII*. Now a payoff of $-w + t[1 + b(1 - \lambda)]$ to the governor who commits fraud, under III*, is likely positive, while the payoff to a governor who does not commit fraud, under XII*, is $-p < 0$.

Once regional election take place or all governors are appointed, as in Russia in 2008, $w = 0$ rules out XII*. If $b > 0$ and having governors be appointed means that often $\lambda = 1$, then VI*, or $(F_1, \neg F_2, \neg P_1, \neg P_2)$, comes into play as a possible equilibrium alternative to III*, with the alternation between the two depending on the balance between transfers and punishments. If transfers are high enough, VI* may come into play so that only truly loyal governors commit fraud. The occurrence of both III* and VI* would complicate assessing the relationship between transfers, punishments and fraud, because in III* governors commit fraud and are not punished while in VI* governors commit fraud and are punished. Nonetheless, III* and VI* give identical payoffs if $\lambda = 1$. If often $b < 0$ notwithstanding recentralization, then II* can explain why high λ goes with fraud and higher transfers, and low λ goes with no fraud and lower transfers, if the value of b is associated with λ.

To summarize, for Russia in the 1990s the game model does not explain the relationship that may exist between election fraud and postelection transfers very well. In the 2000s the clearest change is that the value of d becomes high and increasing over time: recentralization signals such a change, and the abolition of gubernatorial elections in 2004 decisively indicates it. The increase in d reflects how local "political machines" were coopted into the power vertical. This will induce an association between transfers and punishments, on the one hand, and election fraud, on the other.

Hypothesis 1: *In Russia of the 90s, elements of bargaining prevent the observation of signaling model, whereas in 2000, fraud-signal-transfers-reward regime seems to be fully in place.*

The signaling model can be extended to the cross-national setting as well. This

game is characterized by multiple equilibria, which can be successfully mapped using the parameters from equilibria conditions, onto different typologies of political regimes (autocracy vs. democracy), political systems (federal system vs. unitary system), the presence or absence of regional elections. Table 1 presents all the equilibria profiles with conditions containing both *institutional loyalty* λ, being a function of political regime, political system, and electoral punishment w denoting the presence of regional elections. The table depicts the results of matching regime type with the system of government. Intuitively the magnitude of λ has been divided into three broad categories with high, medium and low values of λ. Depending on the degree of the *institutional loyalty* and the presence of electoral punishment of the governors *ceteris paribus*, the probability of electoral signaling with voter fraud and subsequent rewards/punishments is expected to differ. The table shows that in highly centralized authoritarian regimes with the absence of possibility of electoral punishment on behalf of the voters, i.e. with high levels of *institutional loyalty* λ, the local agents will be more prone to signaling strategies directed to the Leader by means of fraudulently augmented turnout or inflated voting support for the ruling party/candidate.

For the purpose of my analysis, only those equilibria have been classified which contain both the value of λ, reflecting the local agent's loyalty at the country-level, and w, entailing the presence or the absence of the regional elections with which the electoral punishment for the voter fraud takes place.

High level of loyalty ($\lambda = 1$) corresponds to hard authoritarian regimes. According to the Table 1, the federal system of government in those regimes implies modest levels of electoral punishment with only loyal type of the governor committing fraud; in contrast, the unitary system of government with absent elections of the regional heads suggests two separate equilibria outcomes: the one in which both types of the governors commit fraud, and the one in which only the loyal type commits fraud (it holds when the amount of transfers exceed the amount of punishment and the future cash flows are positive). As far

Table 1: Matching regime type and system of government

Regime type and system of government	Institutional loyalty, λ^a	Electoral punishment (by voters), w	Equilibrium	Conditions	Frauds	Punishment (by Leader)
Hard authoritarian regime, federal system of government	High λ	Yes	$(F_1, \neg F_2, P_1, \neg P_2)$	$\lambda = 1 \cap b \leq 0 \cap (1 - b)t \geq p \geq t \cap 2p \geq w$	Loyal commits fraud	Fraud punished
Hard authoritarian regime, unitary system of government		No	$(F_1, F_2, \neg P_1, \neg P_2)$	$\lambda = 1 \cap w = 0$	Both commit fraud	Fraud unpunished
		No	$(F_1, \neg F_2, \neg P_1, \neg P_2)$	$\lambda = 1 \cap w = 0 \cap t \geq p \cap b \geq 0$	Loyal commits fraud	Fraud unpunished
Soft authoritarian regime, federal system of government	Medium λ	Yes	$(\neg F_1, \neg F_2, P_1, \neg P_2)$	$\frac{t+p}{w+t+p} \leq \lambda < 1 \cap \frac{-(p+t)}{(1-\lambda)t} \geq b \geq \frac{v+t-p}{t}$	No fraud	Fraud punished
Soft authoritarian regime, unitary system of government		No	$(F_1, F_2, \neg P_1, P_2)$ [b]	Complicated	Both commit fraud	Fraud unpunished
		No	(F_1, F_2, P_1, P_2)	$\lambda < 1 \cap w = 0 \cap \frac{-(p+t)}{(1-\lambda)t} \geq b$	Both commit fraud	Fraud punished
Democratic regime, federal system of government	Low λ	Yes	$(\neg F_1, \neg F_2, \neg P_1, P_2)$	$w \geq p + t \cap t + d \geq p + v$, loyalty is undefined	No fraud	Fraud unpunished
Democratic regime, unitary system of government		No	$(\neg F_1, F_2, \neg P_1, P_2)$	$\lambda = 0 \cap w = 0 \cap b \geq \frac{w-p-t}{t}$	Non-loyal commits fraud	Fraud unpunished
		No	$(\neg F_1, F_2, \neg P_1, \neg P_2)$	$\lambda = 0 \cap w = 0 \cap b \geq 0 \cap p \geq d + t$	Non-loyal commits fraud	Fraud unpunished

Notes: Based on the Table "Some Equilibrium Tests" in Kalinin and Mebane (2013). Only those equilibria were selected in which w, and λ are defined, except $(\neg F_1, \neg F_2, \neg P_1, P_2)$.

[a] $\lambda = f(Regime, System, w)$,

[b] This equilibrium is defined for $\lambda \in [0, 1]$.

as the Leader's punishment is concerned, both types of local agents tend to be punished for their actions in the case of the federal system of government. One of the feasible reasons for this is that those regional heads who are engaged in committing election fraud are likely to be ousted by the voters at the regional elections. This incentivizes the Leader to outpace the unhappy voters and financially punish such a governor after the signaling has been spotted. In contrast, in the unitary systems of government election fraud is never punished by the Leader.

A similar logic of mapping equilibria outcomes has been applied to soft authoritarian regimes, where the value of λ is found in the range between 0 and 1. Table 1 demonstrates that within the federal regimes, election fraud is never conducted by any of the agents and none of them is punished for the rigged election outcomes. In contrast, the model predicts that in soft authoritarian regimes with the unitary system of government ($w = 0$) always experience election fraud which is strategically exercised by both types of the agents, but the Leader's punishment strategy is quite ambiguous. The observation of both types of local agents tending to resort to election fraud, can be understood from costless signaling ($w = 0$) , inducing the nonloyal type of local agents to imitate its loyalty towards the Leader. Hence,

Hypothesis 2: *in autocracies one would observe electoral signaling in both the federal and the unitary systems of government higher than in democracies.*

The democratic regime is characterized with a low level of institutional loyalty to the Leader ($\lambda = 0$) for the unitary system of government, and undefined λ for the federal system of government. In the case of the federal system of government, none of the agents commits actual election fraud and none of them is punished, the situation in the unitary states is much more sophisticated. $(\neg F_1, \neg F_2, \neg P_1, P_2)$ is the only equilibrium with undefined λ. This equilibrium fits democracies with the federal system of government quite well. In the unitary system of government election fraud conducted by nonloyal agent, only happens in the situation, where $w = 0$. Moreover, the nonloyal agent can always

avoid punishment for conducting election fraud. The same is true for the loyal agent who never commits election fraud and is never punished. Hence,

Hypothesis 3: *In democracies one would observe greater electoral signaling in the case of the federal system of government, and only nonloyal type of the local agent committing fraud in the unitary system.*

The efficiency of signaling in determining the agents' loyalty status by the Leader is one of the most important implications of the equilibria analysis. It is determined by the type of the equilibria outcome, facilitating the Leader's ability to learn about agent's type: in a pooling equilibrium with two different types choosing the same message and in a separating equilibrium different types selecting different messages. In the hard authoritarian regimes both systems of federal government imply separating equilibria, making it easier for the Leader to learn about the agent's type, with the loyal type always resorting to election fraud and nonloyal type always abstaining from it. Conversely in a soft authoritarian regime with the unitary system of government both types will commit election fraud, making it impossible for the Leader to disentangle them. The latter situation, resulting in the Leader being unable to determine if the present discounted value of the future expected to be produced by a transfer would belong to him or to the nonloyal agents. If we turn our attention to equilibria profiles of the soft authoritarian regimes, we would find the constellation of pooling equilibria, in which the nonloyal type of the agent fully imitates the strategic behavior of the loyal types. In the case of the federal system of government none of the agent types implements election fraud, fearing retaliation from the voters, whereas in the unitary system of government both types do.[7] In contrast to conventional wisdom, the observation of multiple pooling equilibria with widely spread imitational strategies of nonloyal agents would be in place under the soft authoritarianism. Finally, democratic regimes are characterized by one pooling equilibria,

[7]Of course, the local agent in order to avoid punishment by the electorate, can attempt to falsify the regional elections as well. However, my basic assumption implies that in the federal states the regime will be hosting free and fair elections $w = 1$.

in which none of the types conducts election fraud (federal system of government), and two separating equilibria with the loyal type abstaining from election fraud and nonloyal type conducting it (unitary system of government).

The equilibrium analysis across multiple regime types provides us with an important insight on the sources of election fraud: in the hard authoritarian regime we would predict mostly loyal types of local agents conducting election fraud and getting away with it. In the soft authoritarian regimes both types act more synchronically in delivering fraudulent results with the ambiguous punishment patterns. Finally, in democratic regimes loyal types never conduct election fraud, but nonloyal types of the governors do, which partially undermines the notion that the opposition interested in playing by democratic rules (Przeworski 1991).

Basic Empirical Model and Its Variants

To interpret the empirical model, transfers t are not defined by the totality of actual transfers from the Leader to regional governments, but rather as a deviation from the plain relationship between successive years' transfers. That is, if the regression of total transfers T in region i in the year immediately following the election, s, on the level of transfers in the year preceding the election, $s-$, is written $T_{it} = c_0 + c_1 T_{it-} + u_{it}$, for disturbance u_{it} and coefficients c_0 and c_1, then the amount of transfers subject to manipulation may be represented by a term t_{it} in the form

$$T_{it} = b_0 + b_1 T_{it-} + t_{it} + e_{it}\,. \tag{1}$$

The coefficients c_1 and b_1 should be close to 1.0, capturing the relative stability of the social and economic needs and resources that affect the total amount of transfers going to an area, t_{it} can be thought as a short-run distortion. In particular t_{it} exists in the year following a presidential election. The game model motivates a special form for t_{it}

that is discussed further below. The point to make now is that for the game model's b to be interpreted in terms of the future returns associated with the component t_{it} of T_{it} and not with the entirety of T_{it}.

My empirical data analysis is divided into two parts: (1) the analysis of authoritarian regime, such as Russia, and (2) cross-national analysis using the aggregated electoral results.

Empirical model for Russia

The empirical model motivated by the associations suggested by the game model, focusing on the form of the short-run distortion term t_{it}. The empirical model does not follow in any direct way from the game model, but rather picks up on its core idea that the signaling structure induces a short-run distortion in transfer payments that depends on election fraud and loyalty. I analyze data measuring T_{it}, transfer payments to region i for postelection year s: T_{it} measures the amount of transfers per 10,000 people allocated to the region.[8] T_{it} is a function of preelection transfer payments (T_{it-}) and other variables in models of the form

$$T_{it} = b_0 + \mathbf{z}'_{it}\mathbf{c} + \lambda_i + \mathbf{f}'_{it}\mathbf{d} + \lambda_{it}\mathbf{f}'_{it}\mathbf{g} + e_{it}\,^{9}, \tag{2}$$

where b_0 is a constant term and $\mathbf{c}$ and $\mathbf{d}$ are vectors of coefficients, $\mathbf{z}_{it}$ is a vector of covariates, $\mathbf{f}_{it}$ is a vector of fraud measures, λ_i is a function to be defined that represents the probability the governor is loyal and e_{it} is a normally distributed disturbance. $\mathbf{z}_{it}$ contains variables that plausibly affect the level of transfer payments from Leader to each region. The term $\lambda_{it}\mathbf{f}'_{it}\mathbf{g}$ corresponds to the idea expressed by t_{it} in (1), for particular fraud measures $\mathbf{f}_{it}$ and particular functional forms for λ_{it}: postelection transfer payments are a function of readily observable fraud signals, depending on the probability of loyalty.

[8] Data source information is in the Appendix.

[9] Because of the convergence issues T_{it-} enters the model only as a part of λ_i component, which is a substantial departure from the original model.

For some years (1996, 2000) there is territory-level election data. For other years (2004, 2008) I have both territory- and precinct-level (UIK-level) election data.

To measure election fraud, I use Frauds Indices, defined as follows. First compute voter turnout and incumbent's percentage in the presidential election for each precinct or territory as a percentage rounded to the nearest digit. Define two variables `turnoutlast0` and `incumbentlast0` that is equal to 1 if the last digit of turnout and incumbent's variable is a zero and equal to 0 for other digits, and define another pair of variables `turnoutlast5` and `incumbentlast5` that is equal to 1 if the last digit is a five and equal to 0 for other digits. The variables $\texttt{Turnout}_{fraud}\texttt{f}_0$ and $\texttt{Incumbent}_{fraud}\texttt{f}_0$ are the means of `turnoutlast0` and `incumbentlast0` for each region, and $\texttt{Turnout}_{fraud}\texttt{f}_5$, $\texttt{Incumbent}_{fraud}\texttt{f}_5$ are the means of `turnoutlast5` and `incumbentlast5`. The Frauds Indices are $\texttt{fraudT0}_{it}, \texttt{fraudI0}_{it}, \texttt{fraudT5}_{it}, \texttt{fraudI5}_{it}$.

Vector $\mathbf{z}_{it}$ contains other variables that may relate to transfer payments: $\texttt{Republics}_{it}$ is a dummy variable measuring whether a region belongs to a Republic[10]; $\texttt{Incumbent}_{it}$ is the percent of the incumbent party's electoral support in the region (in 1996 the incumbent is Yeltsin, in 2000 and 2004 it is Putin, and in 2008 it is Medvedev); and $\texttt{turnout}_{it}$ is the turnout percentage defined above.

The term λ_{it} represents a notion of loyalty slightly different from that in the game model. The game has the governor moving before Leader, with Nature first selecting the type of the governor. In reality the governor makes a decision whether to be loyal, in response to anticipations of what Leader will do and in light of preelection conditions. Among those conditions are preelection actions by the Leader. A simple way to connect preelection actions to the game model is to imagine that they influence the value of λ: preelection actions affect the likelihood that the governor is loyal. Here the λ_{it} is defined as a logistic function of preelection transfers (T_{it-} or $\texttt{Transfers}_{it}$) and possibly several other preelection variables: $\texttt{Appointed}_{it}$, a dummy variable measuring whether the gover-

[10]Republics are Russian regions with predominantly the non-Russian ethnicity.

nor was appointed a year before the elections; $\texttt{Bilateral}_{it}$, a dummy variable measuring whether the regions signed a bilateral treaty by the year of elections; and $\texttt{GovernorUR}_{it}$, a dummy variable measuring whether a governor openly supported Unity/United Russia after 1999 parliamentary elections. The formulation is

$$\lambda_{it} = \frac{1}{1 + \exp(-a_0 - \mathbf{x}'_{it}\mathbf{a})} \tag{3}$$

where a_0 is a constant, $\mathbf{x}_{it}$ is a vector containing $\texttt{Transfers}_{it}$ and possibly some of the other preelection covariates, and $\mathbf{a}$ is a vector of coefficients. Variables $\texttt{Appointed}_{it}$ and $\texttt{GovernorUR}_{it}$ measure actions affecting or taken by the governor that would suggest the governor is loyal, and $\texttt{Bilateral}_{it}$ indicates disloyalty. Higher preelection transfers may indicate either the presence or purchase of loyalty (Hyde and O'Mahony 2010).

The rationale behind selection of the nonlinear functional form is explained by estimation of loyalty. Since we are dealing with probabilities of loyalty, we need to have a function that naturally varies between 0 and 1. Moreover, logistic function has a good theoretical underpinning. Both lower and higher levels of loyalty are associated with the weaker effect of loyalty on dependent variable (election fraud or transfers), which can be especially the case if the Leader is indifferent between too small or too large levels of loyalty.

The model (2) represents a very simple implementation of a mixture model. Fraud measures and transfers are related when the governor is loyal and not otherwise. The probability that the governor is loyal is measured by λ_{it}. All parameters are assumed to be identical for the various types of governors, so the interaction term involving λ_{it} is sufficient to represent the mixture. Conceptually, the fraud variables play a role only when the governor is loyal. Regression relationships based on linear predictors are not specifically implied by suggested theoretical model, but they represent the easiest way to get at possible relationships, taking into account the likelihood that multiple, correlated and conceptually distinct variables are associated with the occurrence of fraud.

The theoretical model supports different predictions about the relationships among fraud, transfers and other variables in different time periods. The game model suggests that transfers will be negatively associated with measures of fraud, where loyalty is relatively high, during the 1990s. During the 2000s, once the Kremlin commences recentralization and Putin comes to power, and particularly after 2004 when gubernatorial elections are abolished, the game model predicts that when loyalty is high the incidence of fraud will be positively associated with transfers.

To guide the choice of what to include in $\mathbf{x}_{it}$, I include the vector of variables that relate directly to the probability that the governor is loyal: substantive judgments about what factors matter. This principle draws on the judgment that different institutional arrangements existed at different times, so that actions to incentivize or reflect loyalty are different at different times. It is always assumed that $\mathbf{x}_{it}$ includes $\texttt{Transfers}_{it}$, preelection transfers. The $\texttt{Appointed}_{it}$ variable enters the equation in 1996 and 2008, because when these three elections occurred, some governors were appointed while others were elected.[11] Variable $\texttt{GovernorUR}_{it}$, used in years 2000, 2004 and 2008 to indicate whether the governor was nominated on the United Russia ballot in the previous parliamentary elections (1999, 2003 and 2007), measures how closely affiliated a governor is to the party of power Unity/United Russia and the governor's predisposition to use necessary economic and administrative resources of the region to support the Kremlin's candidate at the presidential elections. Variable $\texttt{bilateral}_{it}$, used in years 1996, 2000 and 2004 to indicate whether the region has signed a bilateral treaty with the Leader, measures the political autonomy of the governor from the Leader.[12] Because most bilateral treaties were abolished after 2004, $\texttt{bilateral}_{it}$ is excluded in 2008.

[11] The 2004 presidential election held on March 14, 2004, before gubernatorial elections were abolished at the end of 2004.

[12] In Russia bilateral treaties have been negotiated between the Center and forty-seven regions during the 90s. These assumed the provision of additional economic resources in exchange of political support for the Kremlin's policies.

Empirical Model for Cross-National Analysis

For the purpose of cross-national analysis I resort to nonlinear least squares model specifications with postelectoral transfers serving as a response variable. The proposed mixture model implies that the future short-run distortions in the levels of financial centralization are resulted from the interaction effects between the election fraud measures and the *institutional loyalty* λ_{it}, which also encompasses the measure of financial centralization in a given electoral year. Here I propose a slightly revised variant of the model estimated for the Russian case, and adopted it to cross-national analysis:

$$T_{it} = b_0 + \mathbf{z}'_{it}\mathbf{c} + \mathbf{y}'_{it}\mathbf{t} + \lambda_{it} + \lambda_{it}\mathbf{f}'_{it}\mathbf{d} + e_{it}\,^{13}, \tag{4}$$

where b_0 is a coefficient and $\mathbf{c}$ and $\mathbf{d}$ are vectors of coefficients, $\mathbf{z}_{it}$ is a vector of covariates, $\mathbf{y}_{it}$ is a vector of time covariates, $\mathbf{f}_{it}$ is a vector of fraud measures, λ_{it} is a function to be defined that represents the probability of institutional loyalty. In this case loyalty is represented by λ_{it}, which can be defined as a logistic function of key institutional variables: $\texttt{Appointed}_{it}$ — a dummy variable denoting whether the regional executives are appointed by the central authorities or not; $\texttt{Polity}_{it}$ an interval variable defining regime's level of democracy; $\texttt{Presidential}_{it}$ a dummy variable specifying the form of government (presidential vs. parliamentary); $\texttt{Federal}_{it}$ a dummy variable denoting the system of government (federal vs. unitary). I also added two additional controls: $\texttt{Rallies}_{it}$, which is a total sum of three components: strikes, rallies and demonstrations from the "Cross-National Time-Series Data Archive" and lagged annual $\texttt{GDPgrowth}_{it}$ rate taken from the World Bank data. The vector $\mathbf{z}_{it}$ contains variables that plausibly affect the level of transfer payments to subnational units. The term $\lambda_{it}\mathbf{f}'_{it}\mathbf{d}$ corresponds to the idea expressed by t_{it} in model (1), for particular fraud measures $\mathbf{f}_{it}$ and particular functional forms for λ_{it}: postelection transfer payments are a function of readily observable fraud

[13] Because of convergence issues T_{it-} enters the model only as a λ_i component, which is a substantial departure from the original model.

signals, depending on the probability of loyalty.

All the nonlinear least squares models for the Russian and cross-national data were estimated using `nls2()` function in **R**.

Empirical Analysis of the Russian Case

Electoral signaling can be readily detected by analyzing the percentages of electoral outcomes. If electoral signaling occurs, electoral manipulations with figures are most likely to take place with rounded percentages of turnout or incumbent's vote percentages, which is the easiest and most readily detected way to report basic information to superiors. In such case, favorable percentages are first sent down from Kremlin to the regional elections commissions, which pass this information further down to the territory-level commissions and, finally, precincts. Of course there is no direct evidence that this "passing down" is the precise procedure used to commit the fraud I allege exist, nor is reliable information available about exactly how the fraud is implemented. Ballot box stuffing and simply writing down false numbers are likely mechanisms (e.g. Boldyrev 2012), but also likely is fraud using phony voter registrations (Arbatskaya 2004) or perhaps other methods (Lehoucq 2003). Since the territory-level commissions serve as an intermediate body between regional and precinct level commissions, I suppose that these have the highest leverage to produce faked numbers in the system and report them to the upper level in percentages. Thus I expect numeric anomalies with percentages to be detected at both tiers of the system, i.e. at both precinct and territory levels.

The results from the multivariate regression analysis are presented in Tables C1 and C2. Since the sample size used in this analysis is small and there is no substantive justification for which outliers should be excluded, I keep all of the observations in multivariate regression analysis and account for any possible outliers by reporting White's robust standard errors. To estimate the model (3) here I apply to nonlinear least squares using transfer payments, T_{it}, measured in postelection years 1997, 2001,

2005 and 2009.[14] Each model is estimated for each year separately. Moreover, two different indicators of transfers designed to check robustness of my findings are included as dependent variables: transfers per capita and the proportion of transfers in the regional revenues. For 1996 the model is estimated separately for the first and the second round elections using fraud measures derived respectively from each election (see models M(01) and M(02) in Table C1). In 1996 λ_i is a function of several loyalty indicators including $\texttt{Transfers}_{it}$, $\texttt{Bilateral}_{it}$, and $\texttt{Appointed}_{it}$, where only $\texttt{Transfers}_{it}$ yields statistically significant positive coefficient for $\hat{a}_1$ in the first model. My initial expectation that none of the coefficient estimates $\hat{f}_0$ and $\hat{f}_5$ of the Frauds Index yield statistically significant results is supported by the findings: the effect of anomalies in incumbent's vote shares $\hat{f}_5$ is positive and significantly different from zero. In both rounds of elections fraud, as measured by the Frauds Index measures, seems to play only limited role in signaling, while preelection transfers show statistically significant effects on postelection transfers.

*** Table C1 about here ***

The model M(03) in Table C1 reports results for 2000. As one would expect, the coefficient estimate $\hat{a}_1$ for $\texttt{Transfers}_{it}$ in λ_{it} is significantly positive. Besides, the coefficient estimates for Putin's vote percentages $\hat{f}_0$ and $\hat{f}_5$ and for anomalies in turnout $\hat{f}_5$ are also characterized by positive and statistically significant effects. This finding bears the evidence about election forensics measures being indicative of the relatively larger signaling phenomena taking place in 2000 compared to 1996.

Models M(04) and M(05) report the results for 2004 based on territory-level and precinct-level election returns. Again, the coefficient estimates for pre-electoral $\texttt{Transfers}_{it}$ yield a positive statistically significant effect. $\texttt{GovernorUR}_{it}$ in both models yield negative effects that are statistically significant at $\alpha = 0.1$. While the original intuition suggests that the governors aligned with the party of power are expected to be recipients of larger

[14] For estimation we use the `nls()` function of **R** (R Development Core Team 2011).

transfers, the coefficient's negative sign is indicative of the leader's parsimonious policies with regard to the governors affiliated with United Russia. In both models built for 2004, the presence of statistically significant positive coefficient estimates $\hat{f}_0$ and $\hat{f}_5$ for anomalies in turnout and Putin's vote percentages at $\alpha = 0.05$ and $\alpha = 0.1$ levels, respectively, demonstrate the presence of a strong relationship between anomalies and transfers as predicted by the theory. Specifically, when the probability of loyalty is high, readily observable fraud is associated with higher levels of postelection transfers directed to each region. This is a kind of result the game model suggests should happen when either game model parameter b is positive and there is alternation between the equilibria, as described by III* and XII*, or when b is negative and there is alternation between fraud and no fraud, as allowed by II* when there is suitable association between b and λ. Notably, the figures for incumbent's vote share ($\hat{c}_2$) and the turnout proportion itself ($\hat{c}_3$) are not significantly associated with transfers for either levels of analysis. The fact that λ_i is a function of different covariates when territory-level versus precinct-level returns are considered may reflect the reality that different kinds of officials are involved in fraud committed in the respective election commissions. Perhaps, in reality, election fraud in Russia in 2004 involved multiple levels of signaling, not merely signaling between each governor and the Leader.

Both models M(06) and M(07) in Table C1 show the results for 2008 for both territory-level and precinct-level election returns. For both levels of electoral data aggregation, the coefficient estimates $\texttt{Transfers}_{it}$ are positive and significantly different from zero. If precinct-level model demonstrates that loyalty expressed in United Russia's affiliation and appointments can be associated with lower transfers, the territory-level model provides us with the opposite finding: party affiliation with the United Russia can be related to higher amounts of transfers. Interestingly, the coefficient estimates $\hat{f}_0$ and $\hat{f}_5$ for turnout measured at the precinct-level data model are significantly positive and substantively comparable in the magnitude to the values estimated for 2004. Thus, when

the probability of loyalty is high, readily observable fraud with turnout committed at the precinct level is associated with higher levels of postelection transfers directed to the regions. Overall, the demonstrated models yield broad variation of signaling strategies throughout the studied period: relatively weak signaling patterns in the 90s; relatively strong signaling is associated with turnout and vote shares in the 2000 elections; strong signaling is associated with turnout and weak signaling associated with incumbent's support in 2004; finally, very strong signaling is associated with turnout and the absence of any signaling whatsoever with regards to Medvedev's vote percentages back in 2008.

*** Table C2 about here ***

Table C2 exhibits a different set of models designed to check the robustness of my previous findings by using the proportion of transfers in the regional revenues as a dependent variable. In general, the results are compatible with my previous findings from Table C1: signaling patterns seem to persist across all the years. The coefficient estimate $\texttt{Transfers}_{it}$ $\hat{a}_1$ is significantly positive across all my models. The signaling patterns are prevalent for the second round of 1996 where $\hat{f}_0$ shows its statistical significance, and also 2000 elections with both anomaly measures for turnout being statistically significant. It is worth mentioning that while the credibility of my findings for the 1990s can be undermined by the issues of data quality, especially for the shares of transfers in the regional revenues, the models M(04)-M(07) built for 2004 and 2008 are more trustworthy. If in 2004, the territory-level models show the presence of apparent signaling patterns in incumbent's percentages $\hat{f}_0$, in 2008 precinct-level models yield quite comparable levels of signaling positively associated with postelectoral transfers. Unlike the 2004 models though, both 2008 models display signaling patterns associated with turnout in both precinct and territory levels. Thus, alternative measure of transfers provides us with a solid empirical proof of the signaling concept: anomalies associated with election fraud are closely related to transfers per capita as well as the share of transfers in the regional revenues.

*** Table C3 about here ***

Next, for additional robustness check I perform to panel data analysis, which enables me to estimate both temporal effects of election fraud associated with loyalty in the 1990s and 2000s, and also addresses the problem of region-specific heterogeneity that can potentially bias my estimates of interest. In particular, I obtain two separate territory-level datasets for 1996-2000 and 2004-2008, and then I compute the first-difference estimators using the ordinary least squares regression, which is an unfortunate departure from the original nonlinear model. Since data for the 1990s and 2000s come from different data sources, to avoid the measurement error, I exclude first-difference estimator between 2000 and 2004. The proposed linear model includes direct and indirect effects of election fraud, enabling me to estimate the conditional effects of anomalies on postelectoral transfers. Moreover, in order to insure comparability of results across different elections I resort to curtailing the "loyalty" component by reducing it to only one variable — preelectoral $\texttt{Transfers}_{it}$. My findings from the panel data analysis are shown in Table C3. According to the Table, while in the 90s incumbent's vote share is positively related to transfers per capita, in the 2000s the sign of this effect has been reversed to a negative. One of the most feasible explanations of this counterintuitive finding can be originated from the difference between electoral contexts and varying mobilization mechanisms of the regional "political machines," used to provide necessary electoral support to the national ruling elites. The 1996-2000s period was more crucial for regime's own stability, as these were years of transition, as compared to 2004-2008, which was a period of consolidation. In addition, the Table also provides us with the limited evidence that $\texttt{Turnout}_{it}$ coefficient yields its negative effect on the proportion of transfers in the regional revenues in the 90s, while in 2000s its effect is positive, thus displaying regime's greater attention to the level of turnout in the 2000s rather than in the 90s.

*** Figures C1 and C2 about here ***

Since the inclusion of interaction effects between pre-electoral transfers and anomalies associated with turnout and incumbent's support makes their interpretation quite complicated, here I build graphs depicting the marginal effects of electoral anomalies on transfers. All figures are sorted in such a way as to simplify the comparative analysis between the 1990s and 2000s. According to Figure C1(a), while for the 1990s, as the margin of pre-electoral transfers increases, the marginal effect of election fraud $\hat{f}_0$ on post-electoral transfers decreases. In the 2000s, however, the marginal effect of election fraud $\hat{f}_0$ on post-electoral transfers takes the opposite sign. The remaining pairs of figures agree with each other in terms of direction of the marginal effects: the graph for $\hat{f}_5$ yields a negative statistically significant linear trend for 1996-2000(c) and 2004-2008(d), and yields a positive statistically significant effect for 1996-2000(e) and 2004-2008(f). In a similar vein, Figure C2 depicts the marginal effect of anomalies associated with turnout on post-electoral $\texttt{Transfers}_{it}$: while in the 90s the increase in preelectoral transfers contributed to noticeable drop in the marginal effect of turnout's fraud $\hat{f}_0$ on post-electoral transfers, in the 2000s the observed effect is statistically significant and positive (See Figure C2(a,b)). Finally, the marginal effects of $\hat{f}_5$ on postelectoral transfers are negative for both studied periods (See Figure C2 (c,d)).

In sum, while the 2000s have a number of instances in which the marginal effects are negative, thus contradicting my theoretical expectations, this period is also characterized by mainly positive marginal effects, while the 1990s are characterized by mainly negative ones. Interestingly, the drastic differences between both periods has been well-observed for $\hat{f}_0$ in incumbent's percentages and turnout. While in the 1990s $\hat{f}_0$ would result in the drastic decline in the amount of transfers directed from the Leader, in the 2000s this association has been reversed: the presence of excessive 0s has been always compensated with additional postelectoral transfers. Thus, the presented modified panel data analysis is in agreement with my by-year regression analysis, supporting theoretical implications

from the model.[15]

The results from estimating model (3) using data from the various elections strongly confirm the theoretical argument that refers to the game model and also validates using the fraud measures that focus on particular digits occurring in turnout figures. Thus, my **Hypothesis 1** has been confirmed. All examined Russian presidential elections show evidence of fraud that is described more or less well by the game model. For elections from 2000 on, and very clearly for the elections of 2004 and 2008, evidence indicates that there was widespread fraud motivated by governors' desire to signal their individual loyalties to the Center. The fact that signaling in 2004 is apparent in both territory-level and precinct-level turnout data suggests, of course, that many officials besides merely the governors are involved in the fraud. The signaling in 2008 is apparently connected to postelection turnout rewards at the precinct-level. These both observations say something about election fraud activities having become even more completely federalized in ways that go beyond the scope of our game model. Likely hierarchies of signals are involved.

The specific institutional change that began as Putin came to power in 2000 severely impacted the structure incentives of local agents. In terms of the game model, the value of the parameter d greatly increased. As recentralizaton gained hold, the threat associated with transfers to regions often decreased—the threat of regional secession disappeared—so that the long-run returns associated with transfers likely often increased: b was less often negative or at least often less negative. These changes led to revision of the strategies governors and the Kremlin found optimal, leading to the situations seen in 2004 and 2008, where election frauds are easy to detect because governors are using them to send signals to the Kremlin. Of course, the methods used by Myagkov et al.

[15]In addition to OLS analysis, after computing first differences for the data I also apply to nonlinear least squares estimation (See Table C4). Although key model parameters such $\texttt{Incumbent}_{it}$, $\texttt{Turnout}_{it}$ and $\texttt{Transfers}_{it}$ demonstrate almost similar in sign statistically significant coefficients, the change in specification has led disappearance of statistically significant positive signs of coefficient estimates for anomalies.

(2009) that focus on turnout also diagnose fraud in all of these Russian elections, but their methods do not focus specifically on turnout and vote figures' last digits. As it has been shown, in Russia, the occurrence of zeros or fives in the last digit is connected to an extensive signaling structure wherein election frauds are closely interlinked with postelection rewards and punishments.

Overall, our theoretical propositions are supported by my data. The results sometimes display a complex picture. The presidential election of 1996 seems to contain elements of bargaining that the signaling model is not optimally designed to represent. In the first round of the 1996 election we see empirical results that match what the game model suggests should happen—governors who commit election fraud are worse off. The presidential election of 2000 reflects political uncertainty and institutions under transition: governors who signal by committing fraud seem to be rewarded in an incipient way. By 2004 and continuing into 2008, the fraud-signal-transfers-reward regime seems to be fully in place. If anything the rewards in terms of postelection transfers from committing fraud in order to signal seem to be comparable in 2004 and 2008.

The prevalent "signaling" mechanism raises a fundamental problem for the political regime: regional elites after being coopted by the Center are inclined to exploit the existing asymmetry in distribution of information between the Center and themselves for their own benefit, by systematically distorting information in their best interests, including electoral information. Is it "folly" to rest "the stability of a federation on the shoulders of some electoral scheme" (Filippov et al. 2004, 175)? Taylor (2011) suggests perhaps yes. The scope of this analysis is too narrow to support an evaluation of whether what Bednar (2009) calls the "safeguards" of federalism have been improved or worsened by the highlighted changes. But in Russia, the signals of political loyalty, in exchange for reduced interference by the Center highlighted here occur in the context of great informational asymmetry between the regions and the Center. The true level of support for the ruling party is difficult to discern. Both III* and XII*, which, among the equilibria,

best describe what happens in 2004 and 2008, are pooling equilibria: both loyal and disloyal governors take the same actions. This makes the Center unable to separate the types of the heads of the regions—who is really supportive of the regime and who is not but is successfully faking their support.

Empirical Model for Cross-National Analysis

The data on electoral anomalies comes from Adam Carr's Election Archive, which is the largest and most comprehensive archive of electoral statistics from 182 countries.[16] All the country-year data from 1997 to 2010 available at the regional level in different formats has been extracted and processed to derive several measures of interest: the last digit of the percentage and the last digit of vote counts for the candidate or party who has received the most popular votes, as well as the last digit of the total vote counts and turnout. Additionally, the auxiliary data, containing the last digit in the percentage and in the last digit in vote counts across all the candidates, has been utilized. As a result, I have an electoral data sample that includes 567 country-year observations. An additional measure of election fraud, capturing the extra-constitutional irregularities reported by international observers or mentioned in the text of the sources, also has been used from the Database of Political Institutions. The only potential drawback of this measure, which needs to be accounted for, is that there may have been instances of fraud/violence that were not reported, thus resulting in false negatives. Since application of alternative better indicators, such as Judith Kelley's data on electoral observation, has been limited due to a poor overlap with my electoral data, I have decided to remove it from my the present analysis. For a similar reason, the empirical measure of loyalty norm based on the the CNTS dataset has been eliminated from my analysis (de Mesquita et al. 2004).

Unfortunately, the data scarcity on the regional grants and transfers at the *Government Finance Statistics(GFS)* database managed by the *International Monetary Fund*

[16] http://psephos.adam-carr.net/

prevented me from using these most appropriate indicators. As a substitute for the relevant dependent variable, in this paper I apply to two measures of fiscal decentralization rigorously described in Dziobek, Mangas, and Kufa (2011), both of which supposedly must be sensitive to any inflows and outflows in the regional revenues. These two out four most appropriate financial decentralization indicators picked for the purpose of my analysis are *revenues* and *tax effort*. The financial decentralization involving the *revenues* is computed as a $GL2/GL3$ ratio, i.e. the ratio between the noncash revenues of the central government and the noncash revenues of the general government both measured as a percentage of GDP.[17] The alternative measure is the *tax effort*, which is the fiscal indicator defined as the sum of tax revenue and compulsory social security contributions also computed as a $GL2/GL3$ ratio. According to the manual, the notion of "tax burden" actually duplicates the notion of "fiscal burden", which is understood as the "amount of compulsory transfers by units of the general government sector on the rest of the economy", which can be approximated by the sum of tax revenue and social security contributions (Int 2001, 48). Both measures reflect the simple notion, by which the increase in the values of indicators is tied to the increase in the level of financial centralization. As a result of merging financial centralization data with my electoral data, the size of the original data sample has dropped to 375 country-year observations. I also use two additional control variables: collective action and economic development. The collective action variable implies, on the one hand, opposition's capability to mobilize support against election fraud, on the other hand, the Leader's capability to organize election fraud given the observed collection action events. Economic development can be regarded as a key contributor to the occurrence of election fraud or financial redistribution, which impacts the Leader's popular support (Treisman 2011); as well as the

[17] According to Int (2001, 13-15), "[t]he political authority of a countrys central government extends over the entire territory of the country. The central government can impose taxes on all resident institutional units and on nonresident units engaged in economic activities within the country" and "The total economy of a country consists of the set of all resident institutional units, and the general government sector consists of all resident general government units".

demand for allocation of additional resources by the local agents .

The set of institutional covariates comprising *institutional loyalty* are obtained from the Database of Political Institutions coming from the World Bank. The included measures are as follows: political system (parliamentary or presidential), presence of regional elections (in other words, whether the regional government are directly/indirectly elected or appointed). A measure of federalism has been obtained from Daniel Treisman's dataset assembled for this paper (Treisman 2000). A measure reflecting the country-year level of democracy has been taken from the Polity IV project.

My cross-national analysis starts with the construction of the boxplots with 90% confidence intervals for the winners, all the participants on the ballot, and total vote counts and turnout. It is worth noting that before starting my analysis all the percentages for parties and candidates less than 1%, raising the issue of skewness in the distribution of percentages due to excessive number of 0s, were removed from my data. Figure D1(a) illustrates the differences in 0s and 5s in the winners' electoral results between the countries with appointed and elected regional authorities: these anomalies in the percentages are characterized by a well-expected small excess for the states with unelected local agents over the elected ones, however, this difference is not statistically significant. Figure D1(b) depicting the comparison between the states with unitary and federal systems, shows excess of 0s and 5s in the unitary states over the federal. Unfortunately, overlapping confidence intervals between the box-plots prevent us from making any stronger conclusions. A similar pattern is observed in Figure D1(c): the quantities of interest in authoritarian compared to democratic regimes are characterized with a slightly greater excess of 0s and 5s though such a difference lacks statistical significance.

*** Figures D1(a-c) about here ***

To better understand the baseline for comparison, it's also critical to construct the barplots for all the participants across the country-year electoral races. Figure D2(a) shows an excessive appearance of 0s in the percentages compared to other anomalies.

Specifically, in authoritarian regimes compared to democratic ones, the number of 0s in the percentages is not only greater, but also statistically significant, which is also supportive of my theoretical expectations (Figure D2(c)). In Figure D3 yielding the comparison of the last digits in turnout across different systems the bars look quite complicated: while in the states with unelected local agents the proportion of 0s in the percentages is smaller than with elected, the systematic excess of 0s in the unitary states over the federal ones is observed.

*** Figures D2(a-c) and D3(a-c) about here ***

The results from my multivariate analysis are reported in Table D1. A set of findings shown in the table are supportive of my hypothesis that financial rewards can be connected to the signaling strategies of the regional authorities. For instance, in Model *M(P05)* the effect of f_5 yields statistically significant negative effect on financial centralization -0.099% (significant at the 0.05 level). These findings elucidate the fact that signaling strategies conditional on $\hat{\lambda}$ seem to affect the successive allocation of financial resources in the regions: 1% increase in 5s contributes to almost 0.10% increase in reallocation of revenues to the regions, holding all other variables constant.

*** Table D1 about here ***

Additional empirical support for my findings is provided by my auxiliary model *M(F)*, utilizing the observer-based measure of fraud: it yields statistically significant negative effect of election fraud on financial centralization. According to model *M(F)*, if a governor moves from a clean election to a fraudulent election, the country average of regional revenues increases by 0.084 points, holding all other variables constant. Across all the computed models in Table D1 the regime's lower democracy score seem to be predictive of higher levels of financial decentralization.

*** Table D2 about here ***

Table D2 reporting the effects of election fraud on financial centralization expressed in tax effort also shows the presence of statistically significant effects of 0s and 5s in the direction predicted by my theory. Specifically, in Model *M(P05)* a 1% increase in the winner's vote percentage of 5s contributes to 0.29% increase in financial allocation of tax effort favoring the regions; in Model *M(T05)* 1% increase in 0s of turnout results in 0.21% rise in financial allocation of tax effort favoring the regions. Finally, the direction and significance of explored effect also holds for the alternative measure of fraud in *M(F)*.

The overall results of analysis are reported in Table D3. Unfortunately, because of the data limitations I was unable to estimate the mean effect of loyalty on punishment in the federal setting.

*** Table D3 about here ***

The Table displays the means and standard errors of the measures of interest across the different political regimes and systems of government. For each of the country groups I computed the mean predicted probability of loyalty on financial punishment. As one moves from the democracy to autocracy, the mean effect of institutional loyalty on financial punishment increases. Thus, autocracies are characterized with greater signaling patterns, compared to democracies, confirming **Hypothesis 2**.

The comparison of mean effects between the federal and unitary states in democracies shows a distinctive effect of loyalty on financial punishment in the federal states than in the unitary states: counter to my theoretic my expectations the signaling patterns seem to be prevalent in the unitary states compared to the federal ones. Thus, **Hypothesis 3** has not been confirmed by my empirical analysis: unitary states demonstrate stronger signaling patterns compared to federal ones.

Conclusion

My basic empirical findings suggest that theoretical implications from the formal signaling model are supported by the data.

The data analysis from the Russian presidential elections shows strong evidence of election fraud associated with the interbudgetary transfers. For elections from 2000 and on, and very clearly for the elections of 2004 and 2008, I am confident that there is widespread fraud motivated by governors' desire to signal their individual loyalties to Kremlin. The fact that the signaling in 2004 is apparent in both territory-level and precinct-level turnout data suggests that many officials besides merely governors or local agents are involved in the frauds. Likely hierarchies of signals are involved. The signaling patterns with turnout and incumbent's vote percentage in 2008 are apparently well-connected to postelection rewards. This tells us something about how election fraud activities by 2008 have become even more completely federalized in ways that go beyond the scope of the game model.

In a broader perspective my analysis suggests that institutional change over time associated with Putin's recentralization policies in the 2000s also impacted the structure of election frauds in Russia. In terms of the game model, the value of the parameter d, the value to the Leader of replacing a disloyal governor, greatly increased. As recentralization gained hold, the threat associated with transfers to regions often decreased—the threat of regional secession disappeared—so that the long-run returns associated with transfers likely often increased: b was less often negative or at least often less negative. These changes changed the strategies governors and the Kremlin found optimal, leading to the situations seen in 2004 and 2008, where election frauds are easy to detect because governors use them to send signals to the Kremlin. As has been shown, in Russia, the occurrence of zeros or fives as the last digit in turnout and vote percentages is connected to an extensive signaling structure wherein election frauds are connected to postelection rewards and punishments, confirming my Hypothesis 1.

My game-theoretical propositions has been also adjusted to cross-national data analysis by classifying equilibria profiles from the signaling game across multiple political regimes. The empirical analysis based on unique original datasets helps us to draw two important conclusions. First, specific signaling patterns seem to be prevalent in cross-national data as well as in the Russian data: abundance of zeros and fives contributes to growing financial recentralization, i.e. leading to more resources concentrated in the regions. Second, in accordance with my theoretical expectations, autocracies are characterized by greater signaling patterns than democracies, confirming Hypothesis 2. Moreover, counter to my theoretic expectations, the signaling patterns seem to be prevalent in the unitary states compared to the federal ones, rejecting Hypothesis 3. Although the implications from the formal model are suggestive of Hypothesis 3, intuitively it seems plausible that the unitary states are expected to show greater signaling patterns compared to the federal ones, because of the stronger hierarchies and larger consolidation of resources in the center. The observed complexity in interpretation of results may be also due to classification errors and subsequent misattribution of equilibria profiles to specific regimes.

Although this research employs multiple robustness checks for both the Russian and cross-national data, it has several important limitations. First, analysis of the cross-national data has been performed using regional level data, however, data scarcity with respect to the proxy of transfers has led to the aggregation of all data to the national level. Second, convergence issues related to nonlinear models prevented me from utilizing the model including short-run distortion linearly, and led to substituting it with its nonlinear equivalent. In the future more fine-grained data will mostly likely resolve these issues. Even though all these limitations are substantial, my empirical analysis demonstrates strong applicability of the signaling games of election fraud to the Russian case, and to a broad range of political regimes, in particular, to autocracies and unitary democracies.

Appendix: Data Sources

The data used in this research were taken from multiple sources. The data on financial transfers for different periods were kindly provided by Daniel Treisman and Andrei Starodubtsev. The data on governor's affiliation with United Russia in 2003 and 2008 were kindly given by Olesya Tkacheva. The electoral data for 1996 and 2000 presidential elections were provided by Alexei Sidorenko. The data for 1996 and 2000 include only territory-level election reports. The electoral data for 2004 and 2008 were obtained from the website of Russian Central Elections Commission (`http://www.cikrf.ru`). The data for 2004 and 2008 include both precinct-level (UIK-level) and territory-level election reports. Other data were collected by the author from the databases of Federal State Statistics Service and the websites of regional administrations. The cross-national electoral data on comes from Adam Carr's Election Archive. An additional measure of election fraud capturing the extra-constitutional irregularities was been drawn from the Database of Political Institutions. The financial data on fiscal decentralization was been taken from the *Government Finance Statistics(GFS)* database managed by the *International Monetary Fund*.

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A Appendix. Russian Electoral Data

Figure A1: Turnout and Vote Support Across Precincts

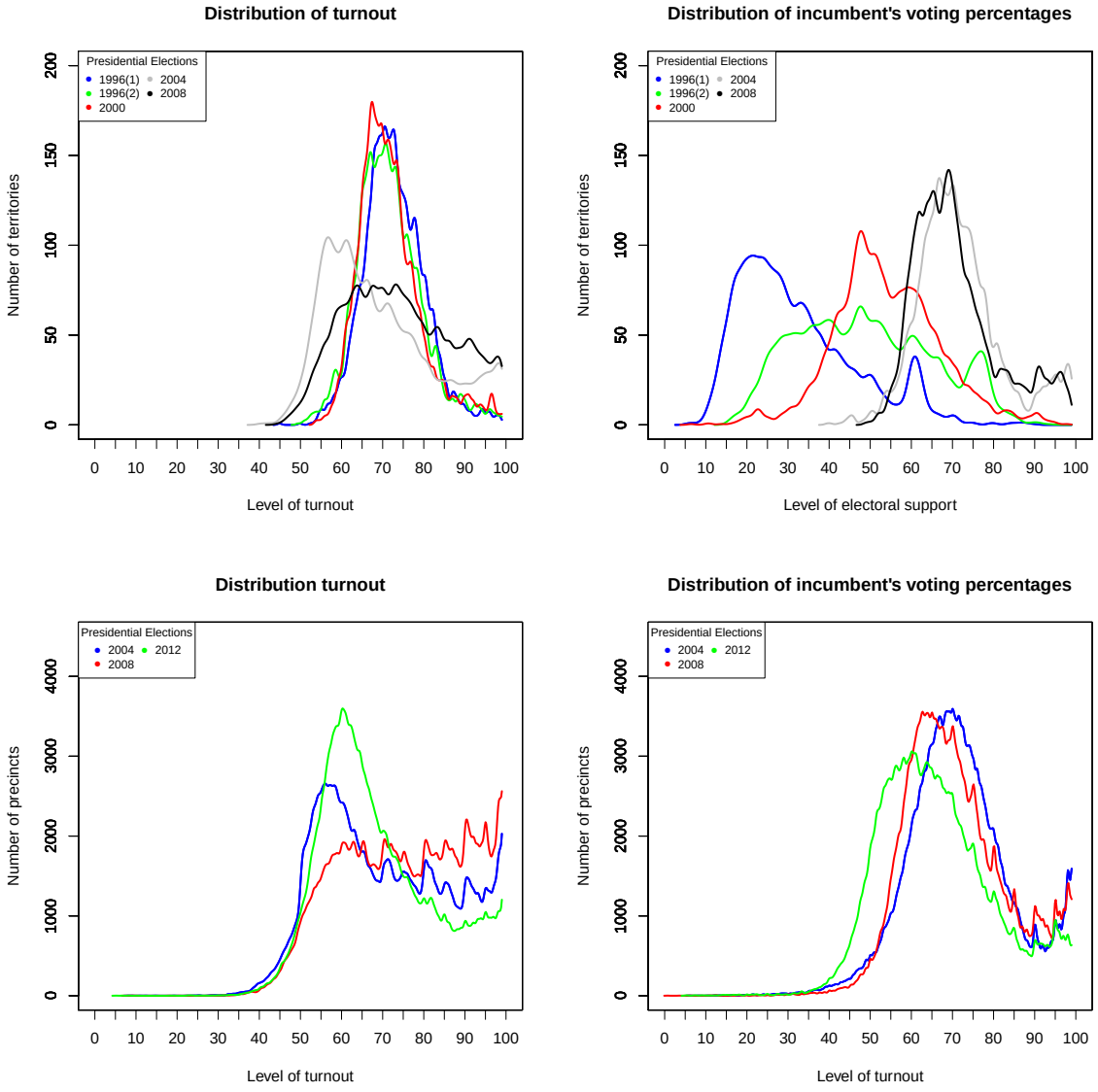


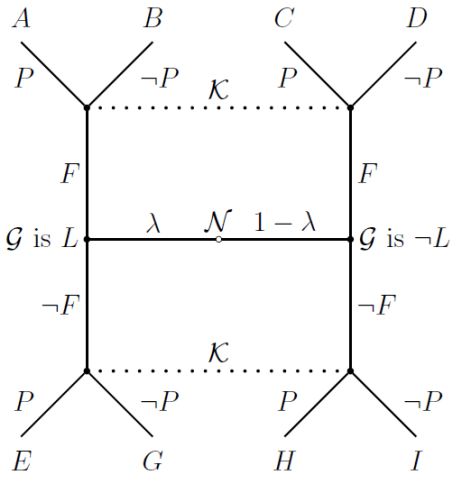
Table A1: Distribution of last Digits for precinct Vote Totals in Russian Elections 2003–2012

	Year											
	2003		2004		2007		2008		2011		2012	
Digit	Repub.	Oblast	Repub.	Oblast	Repub.	Oblast	Repub.	Oblast	Repub.	Oblast	Repub.	Oblast
0	**6.2**	**3.0**	**9.9**	**4.7**	**10.5**	**7.7**	**15.4**	**10.5**	**11.4**	**5.6**	**8.0**	**2.9**
1	−2.0	0.1	−1.8	1.3	−0.8	0.1	−1.4	−0.7	−2.9	−1.0	−2.3	1.0
2	−0.6	−0.4	1.1	0.5	−1.3	1.7	−2.1	−0.2	0.9	−2.7	0.2	−1.1
3	−1.2	−1.0	−1.8	−0.7	−0.6	−1.4	−1.9	−2.1	−0.5	−1.3	−2.6	−2.2
4	0.7	−0.3	−3.3	−0.8	−3.4	−1.0	−3.7	−1.3	−3.8	1.2	−0.1	−0.8
5	**3.1**	**0.9**	**2.1**	**3.3**	**2.1**	**−0.2**	**2.7**	**0.8**	**1.3**	**0.4**	**1.3**	**1.4**
6	−1.8	−0.9	−0.1	0.0	−2.8	−1.8	−1.3	−1.1	−2.9	0.6	−1.8	0.1
7	−0.2	0.9	−2.0	−2.2	−1.1	−0.9	−3.1	0.0	−1.6	0.2	−0.9	1.2
8	−0.7	−1.5	−0.7	−2.1	−0.3	−0.8	−1.4	−1.0	−0.3	−1.1	−1.5	−1.0
9	−3.5	−0.8	−3.4	−4.0	−2.3	−3.5	−3.2	−4.9	−1.5	−1.8	−0.3	−1.4
χ^2_L	69.9	15.4	137.2	60.9	144.2	82.0	292.2	143.0	169.9	47.33	84.1	22.3
n	17,008	77,305	17,600	77,824	17,875	77,928	17,865	78,383	17,732	77,435	17,729	77,685

Notes: Entries for each digit show signed square roots of chi-squared statistics implied by the null hypothesis that the total number of votes cast at each UIK (polling station) have uniformly distributed last digits. The χ^2_L statistics show the overall Pearson chi-squared statistic (9 degrees of freedom). n shows the number of UIKs.

B Appendix. Formal Model

Figure B1: Game Diagram



symbol	$\mathcal{G}$	$\mathcal{C}$
A	$-w-p$	$v-p$
B	$-w+t$	$(b-1)t+v$
C	$-w-p$	$v-p+d$
D	$-w+(b+1)t$	$v-t$
E	$-p$	$-p$
G	t	$(b-1)t$
H	$-p$	$-p+d$
I	$(b+1)t$	$-t$

Table B1: Game in Multiagent Strategic Normal Form

		P_2	
		P_1	$\neg P_1$
F_1	F_2	$-w-p,$ $v-p+(1-\lambda)d$	$-w+t[1+b(1-\lambda)],$ $v+t(\lambda b-1)$
F_1	$\neg F_2$	$-\lambda w-p,$ $\lambda w-p+(1-\lambda)d$	$-p(1-\lambda)-\lambda(w-t),$ $\lambda[(b-1)t+v]+(1-\lambda)(d-p)$
$\neg F_1$	F_2	$-(1-\lambda)w-p,$ $-p+(1-\lambda)(v+d)$	$-\lambda p+(1-\lambda)[(b+1)t-w],$ $-\lambda p+(1-\lambda)(v-t)$
$\neg F_1$	$\neg F_2$	$-p,\ -p+(1-\lambda)d$	$-p,\ -p+(1-\lambda)d$

		$\neg P_2$	
		P_1	$\neg P_1$
F_1	F_2	$-w-p,$ $v-p+(1-\lambda)d$	$-w+t[1+b(1-\lambda)],$ $v-t(\lambda b-1)$
F_1	$\neg F_2$	$-\lambda(w+p)+(1-\lambda)(b+1)t,$ $\lambda(v-p)-(1-\lambda)t$	$-\lambda w+t[1+(1-\lambda)b],$ $\lambda v+(\lambda b-1)t$
$\neg F_1$	F_2	$-\lambda(w+p)+(1-\lambda)t,$ $\lambda(b-1)t+(1-\lambda)(v-p+d)$	$t[1+(1-\lambda)b]-(1-\lambda)w,$ $(1-\lambda)v+(\lambda b-1)t$
$\neg F_1$	$\neg F_2$	$-p,\ \lambda(b-1)t-(1-\lambda)t$	$t[1+(1-\lambda)b],\ (\lambda b-1)t$

Table B2: Payoffs for Strategy Profiles

label	profile	governor's payoff	Leader's payoff
I*	$(F_1, F_2, \neg P_1, \neg P_2)$	$-w + t[1 + (1-\lambda)b]$	$v + (\lambda b - 1)t$
II*	$(F_1, \neg F_2, \neg P_1, P_2)$	$-p(1-\lambda) - \lambda(w-t)$	$\lambda[(b-1)t + v] + (1-\lambda)(d-p)$
III*	$(F_1, F_2, \neg P_1, P_2)$	$-w + t[1 + b(1-\lambda)]$	$v + t(\lambda b - 1)$
IV*	$(F_1, \neg F_2, P_1, P_2)$	$-\lambda w - p$	$\lambda v - p + (1-\lambda)d$
V*	$(F_1, \neg F_2, P_1, \neg P_2)$	$-\lambda(w-p) + (1-\lambda)(b+1)t$	$\lambda(v-p) + (1-\lambda)(-t)$
VI*	$(F_1, \neg F_2, \neg P_1, \neg P_2)$	$-\lambda w + t[1 + (1-\lambda)b]$	$\lambda v + (\lambda b - 1)t$
VII*	$(\neg F_1, \neg F_2, \neg P_1, \neg P_2)$	$t[1 + (1-\lambda)b]$	$(\lambda b - 1)t$
VIII*	$(\neg F_1, \neg F_2, P_1, P_2)$	$-p$	$-p + (1-\lambda)d$
IX*	(F_1, F_2, P_1, P_2)	$-w - p$	$v - p + (1-\lambda)d$
X*	$(\neg F_1, F_2, P_1, P_2)$	$-(1-\lambda)w - p$	$-p + (1-\lambda)(v+d)$
XI*	$(\neg F_1, F_2, \neg P_1, P_2)$	$-\lambda p + (1-\lambda)[(b+1)t - w]$	$-\lambda p + (1-\lambda)(v-t)$
XII*	$(\neg F_1, \neg F_2, \neg P_1, P_2)$	$-p$	$-p + (1-\lambda)d$
XIII*	$(F_1, F_2, P_1, \neg P_2)$	$-w - p$	$v - p + (1-\lambda)d$
XIV*	$(\neg F_1, F_2, P_1, \neg P_2)$	$-\lambda(w+p) + (1-\lambda)t$	$\lambda(b-1)t + (1-\lambda)(v-p+d)$
XV*	$(\neg F_1, \neg F_2, P_1, \neg P_2)$	$-p$	$\lambda(b-1)t + (1-\lambda)(-t)$
XVI*	$(\neg F_1, F_2, \neg P_1, \neg P_2)$	$t[1 + (1-\lambda)b] - (1-\lambda)w$	$(1-\lambda)v + (\lambda b - 1)t$

Table B3: Some Equilibrium Tests

label	profile	equilibrium conditions
I*	$(F_1, F_2, \neg P_1, \neg P_2)$:	$\lambda = 1 \cap w = 0$
II*	$(F_1, \neg F_2, \neg P_1, P_2)$:	$\lambda = 0 \cap \frac{-p-t}{t} \geq b$, $\lambda = 1 \cap \frac{t+p}{t} \geq b \geq \frac{t-p-v}{t}$
III*	$(F_1, F_2, \neg P_1, P_2)$:	complicated (see Table B4)
IV*	$(F_1, \neg F_2, P_1, P_2)$:	never
V*	$(F_1, \neg F_2, P_1, \neg P_2)$:	$\lambda = 0 \cap p \geq -(1+b)t$, $\lambda = 1 \cap b \leq 0 \cap (1-b)t \geq p \geq t \cap 2p \geq w$
VI*	$(F_1, \neg F_2, \neg P_1, \neg P_2)$:	$\lambda = 1 \cap w = 0 \cap t \geq p \cap b \geq 0$
VII*	$(\neg F_1, \neg F_2, \neg P_1, \neg P_2)$:	never
VIII*	$(\neg F_1, \neg F_2, P_1, P_2)$:	never
IX*	(F_1, F_2, P_1, P_2) :	$\lambda < 1 \cap w = 0 \cap \frac{-(p+t)}{(1-\lambda)t} \geq b$
X*	$(\neg F_1, F_2, P_1, P_2)$:	never
XI*	$(\neg F_1, F_2, \neg P_1, P_2)$:	$\lambda = 0 \cap w = 0 \cap b \geq \frac{w-p-t}{t}$
XII*	$(\neg F_1, \neg F_2, \neg P_1, P_2)$:	$w \geq p + t \cap t + d \geq p + v$
XIII*	$(F_1, F_2, P_1, \neg P_2)$:	never
XIV*	$(\neg F_1, F_2, P_1, \neg P_2)$:	never
XV*	$(\neg F_1, \neg F_2, P_1, \neg P_2)$:	$\frac{t+p}{w+t+p} \leq \lambda < 1 \cap \frac{-(p+t)}{(1-\lambda)t} \geq b \geq \frac{v+t-p}{t}$
XVI*	$(\neg F_1, F_2, \neg P_1, \neg P_2)$:	$\lambda = 0 \cap w = 0 \cap b \geq 0 \cap p \geq d + t$

Table B4: Equilibrium Tests for Profile III*

	profile	governor's payoff	Leader's payoff
III*	$(F_1, F_2, \neg P_1, P_2)$	$-w + t[1 + b(1-\lambda)]$	$v + t(\lambda b - 1)$

conditions:

$$\lambda = 0 \Rrightarrow t(b+1) \geq w - p \cap v + d \geq t - p \cap p - t \geq d$$

$$\lambda = 1 \Rrightarrow t \geq w - p \cap t(b-1) \geq -p$$

$$0 < \lambda < 1 \Rrightarrow t + p \geq w \cap t(b+1) + p \geq w \cap v + t(b-1) + p \geq 0 \cap v + d + p \geq t$$
$$\cap\, t(b+1) + p \geq \lambda bt \geq (1-\lambda)d + t - p$$
$$\Rightarrow \begin{cases} 1 + \dfrac{t+p}{bt} \leq \lambda \leq 1 - \dfrac{t(b-1)+p}{bt+d}, & \text{if } b < 0 \\ \lambda \geq 1 + (t-p)/d, & \text{if } b = 0, \text{ requires } p \geq t \\ 1 + \dfrac{t+p}{bt} \geq \lambda \geq 1 - \dfrac{t(b-1)+p}{bt+d}, & \text{if } b > 0 \end{cases}$$

$$b < 0: \quad 1 + \frac{t+p}{bt} = 0 \text{ if } b = -\frac{t+p}{t}, \quad 1 - \frac{t(b-1)+p}{bt+d} = 1 \text{ if } b = \frac{t-p}{t}$$

$$b > 0: \quad \lim_{t\to\infty}\left(1 + \frac{t+p}{bt}\right) = 1 + \frac{1}{b}, \quad \lim_{t\to\infty}\left(1 - \frac{t(b-1)+p}{bt+d}\right) = \frac{1}{b}$$

C Appendix. Russian Analysis

Table C1: Postelectoral Model: Effect of Election Fraud on Logged Transfers Per Capita:

	M(01)	M(02)	M(03)	M(04)	M(05)	M(06)	M(07)
Constant b_0	-1.68	-0.812	-0.758	0.189	0.297	-3.367***	3.637***
	(1.802)	(1.278)	(1.008)	(0.761)	(0.657)	(0.287)	(0.331)
Republics c_1	0.085	0.185	0.277	0.084	0.13		0.045
	(0.225)	(0.215)	(0.194)	(0.207)	(0.148)		(0.066)
Incumbent c_2	-0.507	0.082	0.428	1.264	-0.353	1.53*	-0.993
	(0.875)	(0.662)	(0.879)	(1.021)	(0.867)	(0.618)	(0.659)
Turnout c_3	-0.451	-1.467	1.44	0.928	0.303	0.304	0.156
	(2.438)	(1.674)	(1.557)	(0.793)	(0.649)	(0.552)	(0.502)
Constant a_0	6.131*	12.328*	1.967*	-7.995***	-5.118***	-1.68	-11.477***
	(2.985)	(6.586)	(0.951)	(2.029)	(1.315)	(5.919)	(2.308)
Transfers a_1	3.967*	8.454	2.969***	3.025***	1.717***	-2.848	2.861***
	(1.975)	(4.518)	(0.923)	(0.756)	(0.419)	(2.232)	(0.596)
Bilateral a_2	0.294	0.5	-0.476				
	(0.775)	(1.229)	(0.572)				
GovernorUR a_3			0.527	-1.492*	-0.444	0.612*	-0.533*
			(0.53)	(0.59)	(0.252)	(0.239)	(0.235)
Appointed a_4	0.036	1.015				-0.215*	-0.413
	(0.606)	(0.956)				(0.086)	(0.222)
fraudT0 f_0	1.592	0.28	-0.135	2.408***	1.41**	0.77**	2.02***
	(0.867)	(0.986)	(0.711)	(0.653)	(0.519)	(0.281)	(0.559)
fraudT5 f_5	0.142	-0.713	2.492*	0.202	6.19***	1.114***	4.671*
	(0.845)	(0.827)	(1.053)	(0.642)	(1.985)	(0.302)	(1.9)
fraudI0 f_0	1.019	-0.145	0.747***	1.576*	4.049	0.044	0.39
	(0.907)	(0.737)	(0.215)	(0.624)	(2.096)	(0.293)	(1.205)
fraudI5 f_5	1.063	1.643*	1.821*	0.656	3.193	-0.243	-0.27
	(0.799)	(0.765)	(0.84)	(0.613)	(2.205)	(0.273)	(1.443)
$\hat{\sigma}$	0.753	0.723	0.631	0.514	0.421	0.341	0.259
N	81	80	79	82	80	77	78

Notes: Robust standard errors in parentheses. Significance levels: *p $\leq$ 0.05, **p $\leq$ 0.01, ***p $\leq$ 0.001. Listed models: M(01) – regression model for 1996 (first round); M(02) – regression model for 1996 (second round); M(03) – regression model for 2000; M(04)-M(05) – regression models for 2004 territory and precinct-level elections; M(06)-M(07) – regression models for 2008 territory and precinct-level elections.

Nonlinear least squares estimates for all the models:

[a] $\texttt{Transfers}_{it} = b_0 + c_1\texttt{Republics}_{it} + c_2\texttt{Incumbent}_{it} + c_3\texttt{Turnout}_{it} + f_0\texttt{fraudT0}_{it} + f_5\texttt{fraudT5}_{it} + f_0\texttt{fraudI0}_{it} + f_5\texttt{fraudI5}_{it} + \lambda_{it} + \lambda_{it} \cdot (f_0\texttt{fraudT0}_{it} + f_5\texttt{fraudT5}_{it} + f_0\texttt{fraudI0}_{it} + f_5\texttt{fraudI5}_{it}) + e_{it}, \lambda_{it} = \frac{1}{1 + \exp\{-(a_0 + a_1\texttt{Transfers}_{it-} + a_2\texttt{Bilateral}_{it} + a_3\texttt{GovernorUR}_{it} + a_4\texttt{Appointed}_{it})\}}.$

Table C2: Postelectoral Model: Effect of Election Fraud on the Log Share of Transfers in the Regional Revenues

	M(01)	M(02)	M(03)	M(04)	M(05)	M(06)	M(07)
Constant	-0.052	-0.338	-3.37***	-1.905***	-3.227*	-2.11***	-2.203***
	(0.557)	(0.496)	(0.787)	(0.246)	(1.287)	(0.4)	(0.397)
Republics c_1	0.091	0.127*	0.297	0.171	0.078	0.229*	0.235*
	(0.057)	(0.059)	(0.159)	(0.094)	(0.07)	(0.091)	(0.089)
Incumbent c_2	-0.504	-0.172	-0.597	0.152	0.283	1.082	0.157
	(0.402)	(0.146)	(0.797)	(0.355)	(0.408)	(0.718)	(0.775)
Turnout c_3	-0.533	-0.237	2.02	0.215	0.023	-0.917	-0.546
	(0.607)	(0.613)	(1.396)	(0.247)	(0.311)	(0.559)	(0.486)
Constant a_0	1.148*	1.055***	8.829*	3.72***	3.041***	4.827***	4.013***
	(0.523)	(0.317)	(4.06)	(1.107)	(0.738)	(1.137)	(1.094)
Transfers a_1	1.845***	1.656***	4.052*	3.907***	2.559***	3.112***	2.473***
	(0.337)	(0.276)	(1.92)	(0.582)	(0.536)	(0.623)	(0.669)
Bilateral a_2	-0.297	-0.455					
	(0.429)	(0.302)					
GovernorUR a_3			0.368	-0.747*	-0.097	0.321	0.142
			(0.824)	(0.327)	(0.127)	(0.381)	(0.201)
Appointed a_4	-0.336	-0.325				0.232	0.011
	(0.33)	(0.254)				(0.416)	(0.234)
fraudT0 f_0	-0.177	0.638*	1.004*	0.095	0.186	0.694*	0.327
	(0.399)	(0.276)	(0.505)	(0.222)	(0.322)	(0.293)	(0.218)
fraudT5 f_5	-0.155	0.025	1.25*	0.577	3.129	0.758**	2.329*
	(0.602)	(0.294)	(0.534)	(0.361)	(2.186)	(0.271)	(0.964)
fraudI0 f_0	0.35	-0.781	-0.272	1.057***	3.181	0.157	1.695*
	(0.282)	(0.538)	(0.315)	(0.311)	(2.317)	(0.316)	(0.838)
fraudI5 f_0	0.059	0.072	0.659	-0.212	2.328	-0.02	0.057
	(0.221)	(0.188)	(0.535)	(0.29)	(1.499)	(0.215)	(1.434)
$\hat{\sigma}$	0.204	0.184	0.626	0.368	0.324	0.285	0.276
N	81	81	80	82	82	79	79

Notes: Robust standard errors in parentheses. Significance levels: *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001. Listed models: M(01) – regression model for 1996 (first round); M(02) – regression model for 1996 (second round); M(03) – regression model for 2000; M(04)-M(05) – regression models for 2004 territory and precinct-level elections; M(06)-M(07) – regression models for 2008 territory and precinct-level elections.

Nonlinear least squares estimates for all the models:

[a] $\texttt{Transfers}_{it} = b_0 + c_1\texttt{Republics}_{it} + c_2\texttt{Incumbent}_{it} + c_3\texttt{Turnout}_{it} + f_0\texttt{fraudT0}_{it} + f_5\texttt{fraudT5}_{it} + f_0\texttt{fraudI0}_{it} + f_5\texttt{fraudI5}_{it} + \lambda_{it} + \lambda_{it} \cdot (f_0\texttt{fraudT0}_{it} + f_5\texttt{fraudT5}_{it} + f_0\texttt{fraudI0}_{it} + f_5\texttt{fraudI5}_{it}) + e_{it}$, $\lambda_{it} = \frac{1}{1 + \exp\{-(a_0 + a_1\texttt{Transfers}_{it-} + a_2\texttt{Bilateral}_{it} + a_3\texttt{GovernorUR}_{it} + a_4\texttt{Appointed}_{it})\}}$.

Table C3: Panel Data Analysis with the First-Difference Estimator, OLS

	M(01)	M(02)	M(03)	M(04)	M(05)	M(06)
Incumbent	13.972***	-1.347***	11.331**	-0.476	-131.145*	-0.524*
	(2.841)	(0.13)	(4.186)	(0.543)	(51.428)	(0.229)
Turnout	-6.979	-4.827***	13.518	-6.73***	70.383	0.692***
	(14.686)	(1.037)	(17.552)	(1.551)	(44.38)	(0.121)
Transfers	6.877***	0.058	7.613***	0.031	2.043	-0.023
	(1.438)	(0.147)	(1.524)	(0.224)	(0.133)	(0.111)
fraudT0	-5.297	-0.208	-16.946	1.234*	-103.029	0.129
	(6.079)	(0.339)	(9.591)	(0.533)	(88.227)	(0.19)
fraudT5	-2.888	-0.454	2.089	0.014	130.244*	0.05
	(6.378)	(0.358)	(5.985)	(0.563)	(49.825)	(0.172)
fraudI0	6.052	-0.022	-4.805	-0.283	42.783	0.015
	(5.354)	(0.159)	(10.362)	(0.21)	(50.237)	(0.178)
fraudI5	3.816	-0.17	18.824*	0.888	69.677	0.114
	(10.706)	(0.36)	(8.909)	(0.554)	(46.776)	(0.172)
Transfers $\times$ $fraudT0$	-15.109*	-0.099	0.023	-4.416**	-0.382	2.422**
	(6.908)	(1.206)	(18.67)	(1.775)	(2.497)	(0.733)
Transfers $\times$ $fraudT5$	4.477	-0.89	-21.725*	-1.453	-5.27***	1.165
	(10.564)	(0.847)	(9.49)	(1.857)	(1.641)	(0.834)
Transfers $\times$ $fraudI0$	-4.577*	2.266	-0.637	-0.838	3.006*	0.212
	(1.961)	(1.173)	(3.536)	(1.411)	(1.442)	(1.712)
Transfers $\times$ $fraudI5$	2.538	3.582**	-38.701**	-1.692	-3.685*	3.042***
	(8.813)	(1.212)	(14.596)	(2.532)	(1.572)	(0.758)
$\hat{\sigma}$	5.219	0.289	5.872	0.404	27.062	0.113
N	80	80	80	80	80	80

Notes: Robust standard errors in parentheses. Significance levels: *p $\leq$ 0.05, **p $\leq$ 0.01, ***p $\leq$ 0.001. Listed OLS models: a) the first-difference estimator for 1996(first round) and 2000 with transfers per capita M(01) and M(02) with the share of central transfers in the regional budget as dependent variables; b) the first-difference estimator for 1996(second round) and 2000 with transfers per capita M(03) and share of central transfers in the regional budget M(04) as dependent variables; c) the first-difference estimator for 2004 and 2008 with transfers per capita M(05) and the share of central transfers in the regional budget M(06) as dependent variables.

Ordinary least squares estimates for all the models:

[a] $\Delta\texttt{Transfers}_{it} =$
$b_0 + b_1\Delta\texttt{Incumbent}_{it} + b_2\Delta\texttt{Turnout}_{it} + b_3\Delta\texttt{Transfers}_{it-} + b_4\Delta\texttt{fraudT0}_{it} + b_5\Delta\texttt{fraudT5}_{it} +$
$b_6\Delta\texttt{fraudI0}_{it} + b_7\Delta\texttt{fraudI5}_{it} + b_8\Delta\texttt{Transfers}_{it-} \times \Delta\texttt{fraudT0}_{it} + b_9\Delta\texttt{Transfers}_{it-} \times$
$\Delta\texttt{fraudT5}_{it} + b_{10}\Delta\texttt{Transfers}_{it-} \times \Delta\texttt{fraudI0}_{it} + b_{11}\Delta\texttt{Transfers}_{it-} \times \Delta\texttt{fraudI5}_{it}$.

Table C4: Panel Data Analysis with the First-Difference Estimator, NLS

	M(01)	M(02)	M(03)	M(04)	M(05)	M(06)
Constant b_0	1.166***	-0.242	1.006***	-0.319*	4.149***	-0.086
	(0.113)	(0.16)	(0.227)	(0.135)	(0.048)	(0.08)
Incumbent c_2	0.98	0.322**	0.635	0.361*	-0.298	0.109
	(0.763)	(0.112)	(0.892)	(0.158)	(0.483)	(0.16)
Turnout c_3	-2.634	-1.207***	-2.002	-1.611***	-0.203	-0.016
	(2.258)	(0.278)	(2.344)	(0.285)	(0.42)	(0.117)
Constant a_0	5.504	0.61	4.116	0.547	-51.7***	-1.301*
	(4.142)	(0.771)	(2.662)	(0.574)	(14.67)	(0.512)
Transfers a_1	14.797	0.448*	11.589	0.532*	11.599***	3.209***
	(10.427)	(0.201)	(7.303)	(0.226)	(3.303)	(0.865)
fraudT0 f_0	-0.787	0.041	-1.294**	-0.059	-0.696**	-0.06
	(0.526)	(0.085)	(0.438)	(0.095)	(0.248)	(0.081)
fraudT5 f_5	1.158	-0.203	0.576	-0.172	0.3	-0.179
	(0.765)	(0.087)	(0.891)	(0.109)	(0.354)	(0.086)
fraudI0 f_0	0.36	-0.04	0.431	-0.005	0.049	0.035
	(0.197)	(0.046)	(0.229)	(0.068)	(0.228)	(0.069)
fraudI5 f_5	-0.396	0.018	0.085	0.028	0.101	-0.027
	(0.705)	(0.096)	(0.928)	(0.107)	(0.4)	(0.094)
$\hat{\sigma}$	0.761	0.118	0.758	0.114	0.253	0.07
N	83	83	83	83	80	80

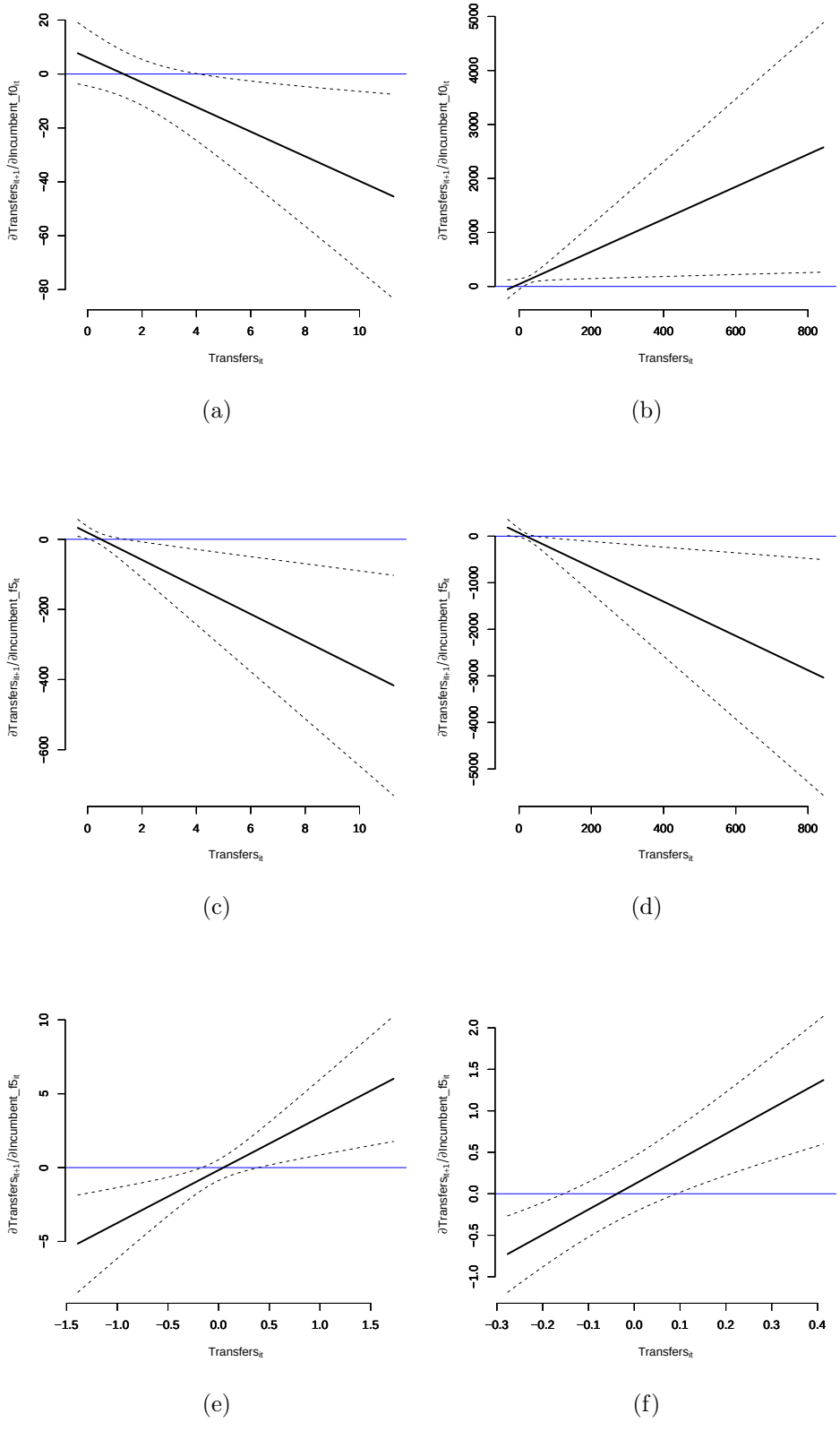
Notes: Robust standard errors in parentheses. Significance levels: *p $\leq$ 0.05, **p $\leq$ 0.01, ***p $\leq$ 0.001. Listed models: a) the first-difference estimator for 1996(first round) and 2000 with logged transfers per capita M(01) and M(02) with the share of central transfers in the regional budget as dependent variables; b) the first-difference estimator for 1996(second round) and 2000 with the logged transfers per capita M(03) and share of central transfers in the regional budget M(04) as dependent variables; c) the first-difference estimator for 2004 and 2008 with logged transfers per capita M(05) and the share of central transfers in the regional budget M(06) as dependent variables.

Nonlinear least squares estimates for all the models:

[a]

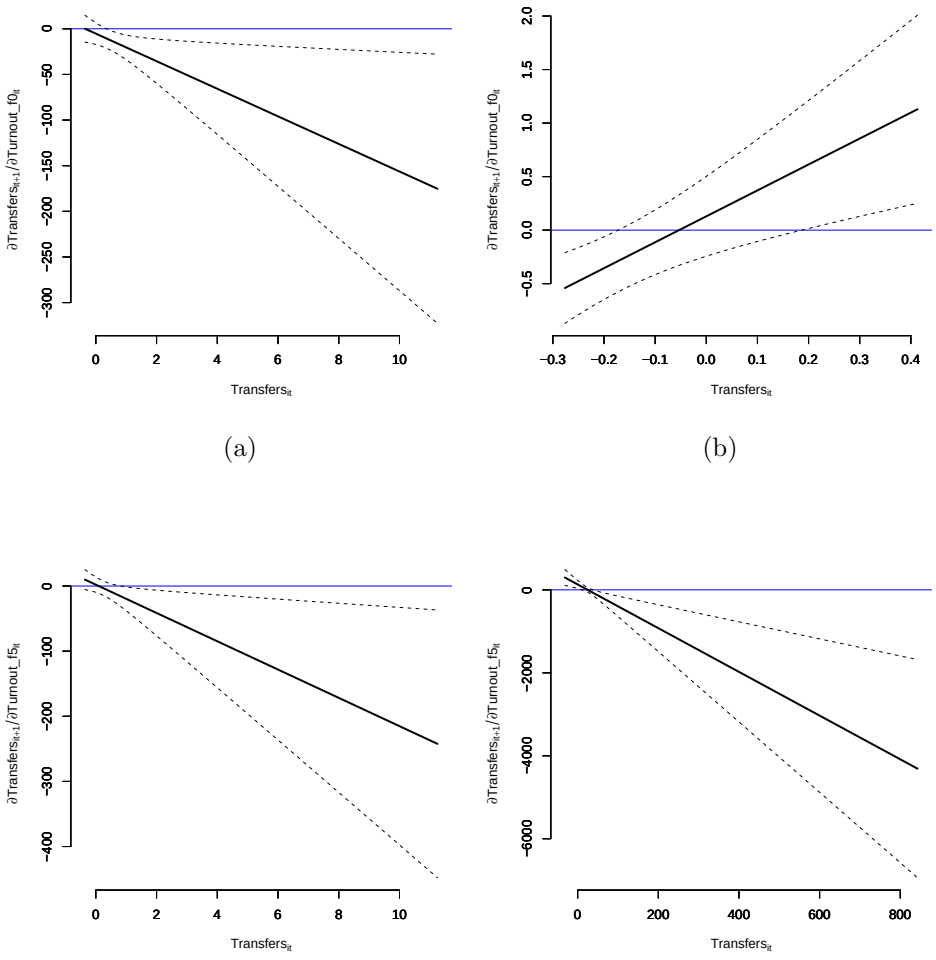
$$\Delta\texttt{Transfers}_{it} = b_0 + c_1\Delta\texttt{Incumbent}_{it} + c_2\Delta\texttt{Turnout}_{it} + f_0\Delta\texttt{fraudT0}_{it} + f_5\Delta\texttt{fraudT5}_{it} + f_0\Delta\texttt{fraudI0}_{it} + f_5\Delta\texttt{fraudI5}_{it} + \lambda_{it} + \lambda_{it}\cdot(f_0\Delta\texttt{fraudT0}_{it} + f_5\Delta\texttt{fraudT5}_{it} + f_0\Delta\texttt{fraudI0}_{it} + f_5\Delta\texttt{fraudI5}_{it}), \lambda_{it} = \frac{1}{1+\exp\{-(a_0 + a_1\Delta\texttt{Transfers}_{it-})\}}\ .$$

Figure C1: The Marginal Effects of Election Fraud in Incumbent's Percentage on Post-electoral Transfers)



Notes: Estimated marginal effects for the models in Table C4: (a)M(01), (b)M(05), (c)M(03), (d)M(05), (e)M(02), (f)M(06).

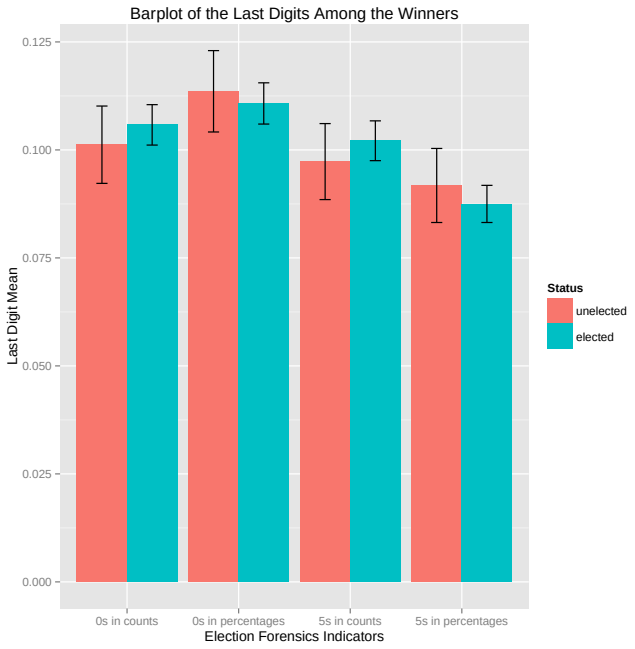
Figure C2: The Marginal Effects of Election Fraud in Incumbent's Percentage on Post-electoral Transfers)



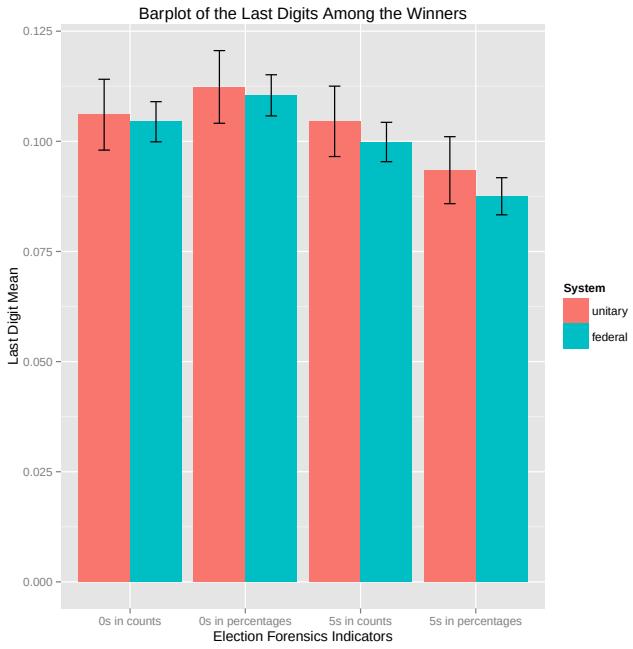
Notes: Estimated marginal effects for the models in Table C4: (a)M(01), (b)M(06), (c)M(03), (d)M(05).

D Appendix. Cross-National Analysis

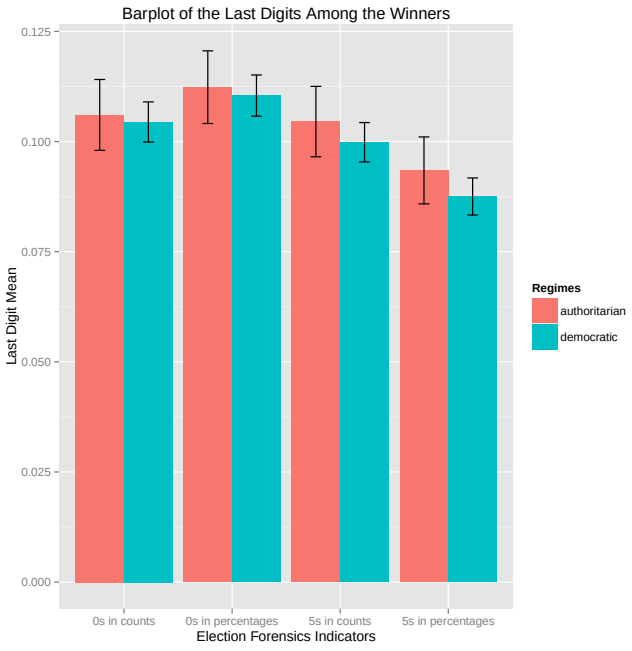
Figure D1: Barplots for the Winners



(a)

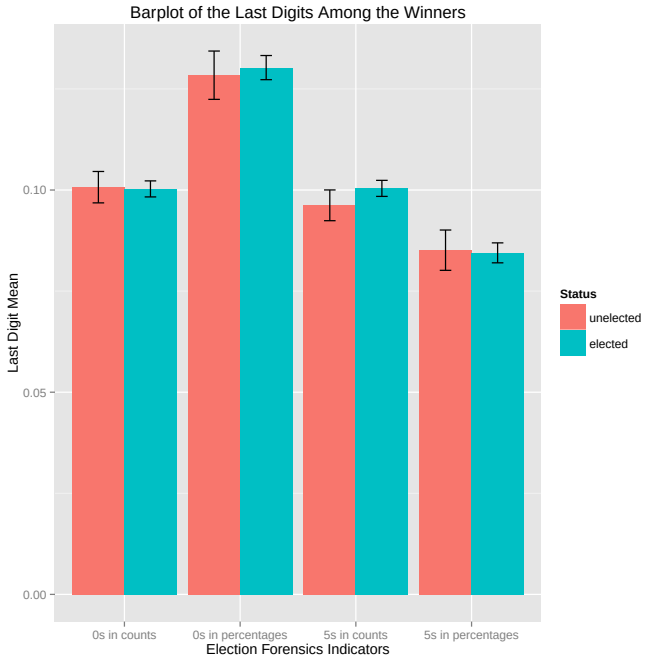


(b)

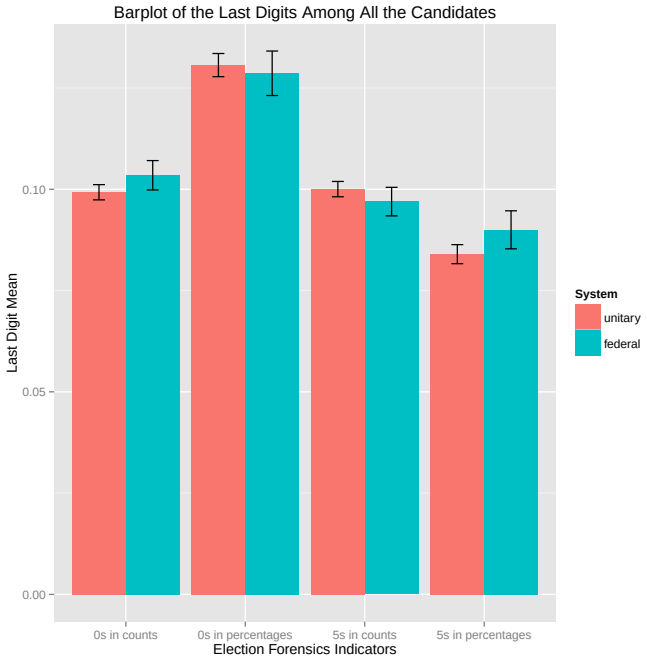


(c)

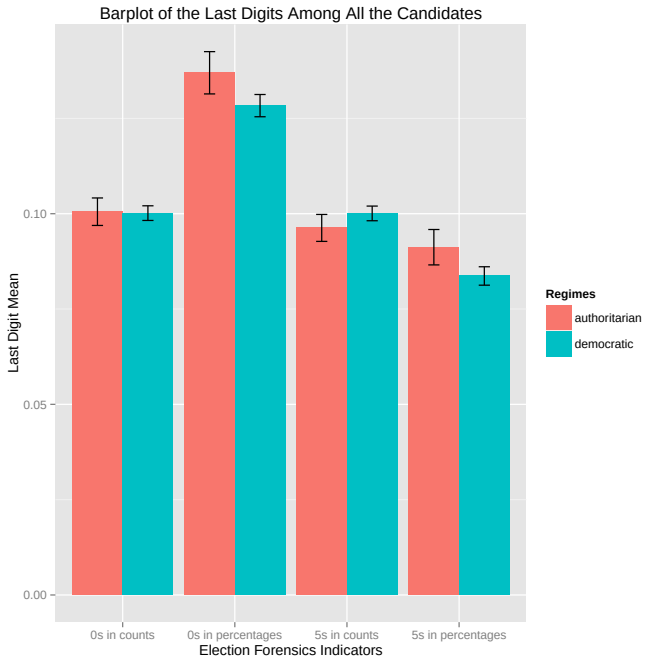
Figure D2: Barplots for All Candidates



(a)

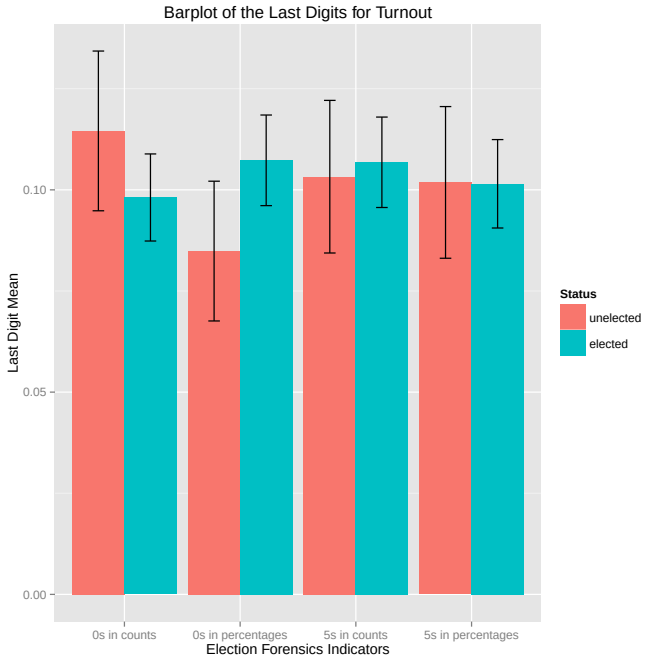


(b)

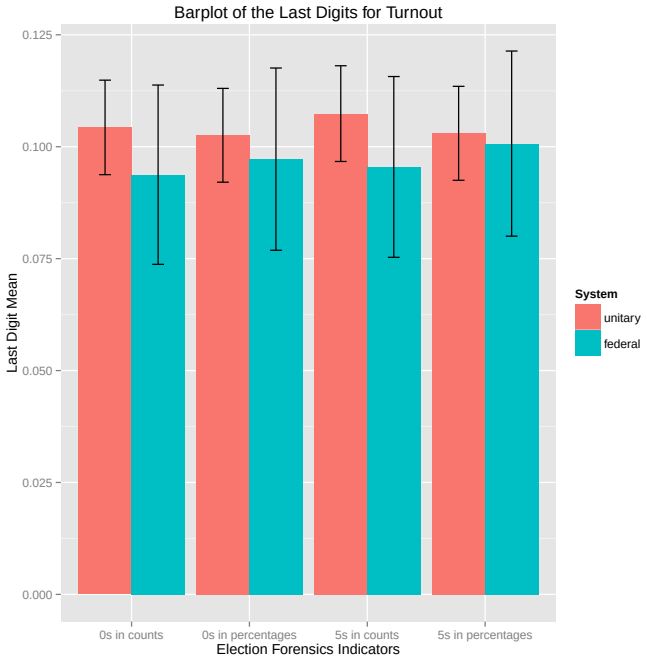


(c)

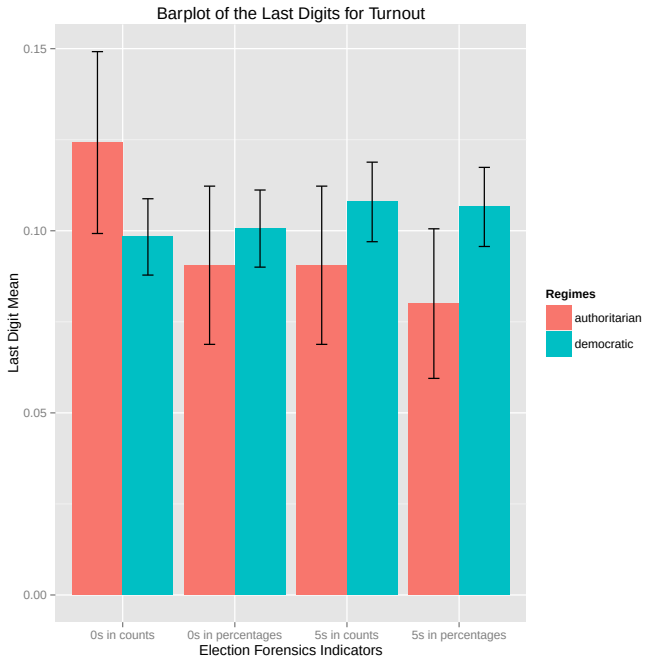
Figure D3: Barplots for Turnout



(a)



(b)



(c)

Table D1: Effects of *Institutional Loyalty* and Election Frauds on Financial Centralization ($Revenues_{t+1}$) [a]

	M(P05)	M(C05)	M(T05)	M(F)
Const b_0	0.042*	0.019	0.034	0.04
	(0.022)	(0.024)	(0.045)	(0.025)
Rallies b_1	-0.004**	-0.004**	-0.004***	-0.005**
	(0.002)	(0.002)	(0.001)	(0.002)
GDP growth b_3	0.001	0.000	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.001)
Year2005 b_4	-0.005	-0.006	0.003	-0.005
	(0.008)	(0.008)	(0.011)	(0.007)
Year2011 b_5	-0.002	-0.003	0.003	-0.002
	(0.008)	(0.008)	(0.009)	(0.008)
Appointed a_1	0.007	0.003	0.088	0.006
	(0.097)	(0.097)	(0.109)	(0.09)
Revenues(Electoral) a_2	4.668***	4.553***	4.811***	4.563***
	(0.212)	(0.222)	(0.579)	(0.202)
Polity a_3	-0.241***	-0.231***	-0.262***	-0.239***
	(0.014)	(0.013)	(0.03)	(0.012)
Presidential a_4	-0.108	-0.126	-0.245**	-0.121
	(0.106)	(0.1)	(0.105)	(0.103)
Federalism a_5	-0.098	-0.095	-0.012	-0.085
	(0.079)	(0.074)	(0.094)	(0.071)
Fraud 0s f_0	-0.081	0.1	-0.05	
	(0.08)	(0.066)	(0.072)	
Fraud 5s f_5	-0.099	0.045	-0.042	
	(0.04)	(0.062)	(0.079)	
Fraud f				-0.094***
				(0.025)
$\hat{\sigma}$	0.03	0.031	0.031	0.03
N	107	107	64	107

Notes: Cluster robust standard errors in parentheses. Significance levels: *p ≤ 0.1, **p ≤ 0.05, ***p ≤ 0.01. The models include the measure of fraud: M(P05) – the proportion of 0 or 5s in the vote shares of the winners; M(C05) – proportion of 0 or 5s in the vote counts of winners; M(T05) – proportion of 0 or 5s in the percentages of turnout; M(F) – the binary indicator of election fraud from *Database of Political Institutions*. Nonlinear least squares estimates for all the models:

[a] $\texttt{Revenues}_{it+1} = b_0 + b_1\texttt{Yr2005}_{it} + b_2\texttt{Yr2011}_{it} + b_3\texttt{Rallies}_{it} + b_4\texttt{GDP Growth}_{it} + \lambda_{it} + \lambda_{it}(f_0\texttt{fraud0s}_{it} + f_5\texttt{fraud5s}_{it}) + e_{it}$,$\lambda_{it} = \frac{1}{1+\exp\{-(a_1\texttt{Appointed}_{it} + a_2\texttt{Revenues}_{it} + a_3\texttt{Polity}_{it} + a_4\texttt{Presidential}_{it} + a_5\texttt{Federal}_{it})\}}$.

Table D2: Effects of *Institutional Loyalty* and Election Frauds on Financial Centralization (*Tax Effort*$_{t+1}$) [a]

	M(P05)	M(C05)	M(T05)	M(F)
Const b_0	0.057	-0.015	0.001	0.033
	(0.054)	(0.037)	(0.054)	(0.027)
Rallies b_1	0.002	0.002		-0.004
	(0.004)	(0.004)		(0.004)
GDP growth b_2	-0.004	-0.004		-0.003
	(0.003)	(0.003)		(0.003)
Year2005 b_3	-0.002	0.015	-0.008	-0.005
	(0.029)	(0.014)	(0.029)	(0.016)
Year2011 b_4	-0.035	-0.023	-0.019	-0.011
	(0.035)	(0.029)	(0.033)	(0.022)
Appointed a_1	-0.303	-0.3	0.204	0.008
	(0.195)	(0.205)	(0.102)	(0.138)
Revenues(Electoral) a_2	6.125***	6.454***	5.766***	4.871***
	(1.108)	(1.2)	(0.693)	(0.454)
Polity a_3	-0.311***	-0.318***	-0.322***	-0.258***
	(0.052)	(0.057)	(0.033)	(0.02)
Presidential a_4	0.035	-0.047	0.139	0.047
	(0.188)	(0.169)	(0.4)	(0.098)
Federalism a_5	-0.223	-0.184	0.374***	0.001
	(0.189)	(0.172)	(0.091)	(0.091)
Fraud 0s f_0	-0.316	0.191	-0.211**	
	(0.228)	(0.137)	(0.098)	
Fraud 5s	-0.157	-0.21	-0.039	
	(0.147)	(0.208)	(0.135)	
Fraud f				-0.064**
				(0.031)
$\hat{\sigma}$	0.448	0.45	0.056	0.045
N	74	74	37	74

Notes: Robust standard errors in parentheses. Significance levels: *p ≤ 0.1, **p ≤ 0.05, ***p ≤ 0.01. The models include the measure of fraud: M(P05) – the proportion of 0 or 5s in the vote shares of the winners; M(C05) – proportion of 0 or 5s in the vote counts of winners; M(T05) – proportion of 0 or 5s in the percentages of turnout; M(F) – the binary indicator of election fraud from *Database of Political Institutions*. Nonlinear least squares estimates for all the models:

[a] $\texttt{Tax Effort}_{i+1t} = b_0 + b_1\texttt{Yr2005}_{it} + b_2\texttt{Yr2011}_{it} + b_3\texttt{Rallies}_{it} + b_4\texttt{GDP Growth}_{it} + \lambda_{it} + \lambda_{it}(f_0\texttt{fraud0s}_{it} + f_5\texttt{fraud5s}_{it}) + e_{it}$,$\lambda_{it} = \frac{1}{1+\exp\{-(a_1\texttt{Appointed}_{it} + a_2\texttt{Effort}_{it} + a_3\texttt{Polity}_{it} + a_4\texttt{Presid}_{it} + a_5\texttt{Federal}_{it})\}}$.

Table D3: Summary of Results: Effect of $\hat{\lambda}$ on Financial Punishment

		P5	$T5$	F
Democracies	Federal	0.673	0.655	0.666
		(0.154)	(0.16)	(0.152)
	Unitary	0.802	0.816	0.793
		(0.149)	(0.083)	(0.148)
Autocracies	Federal	−−	−−	−−
		−−	−−	−−
	Unitary	0.994	0.997	0.993
		(0.004)	(0.001)	(0.004)

Notes: Standard errors in parentheses.