Information Acquisition and Projecting Invincibility in Authoritarian Elections*

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July 2018

What role do elections play in nondemocracies? We propose an empirical test that can distinguish between two major families of theories on authoritarian elections: that elections can be used to maintain an image of invincibility of the regime (Influence Theory), and that elections can be used to get information about the popularity of the regime (Information Theory). While these theories might not be mutually exclusive, we show that they generate different predictions about the spatial allocation of electoral manipulations. Under the Influence Theory, electoral manipulations happen in areas where the potential for a successful protest is high. Under the Information Theory, electoral manipulation should happen only in places where the potential for a successful protest is low. Using data from the 2011 parliamentary election in Russia and a regionally representative public opinion survey from one of the Kremlin's pollsters conducted before the election, we find that electoral manipulations were more likely to happen in regions where the level of protest potential is lower. When the protest potential goes up by 10 percentage points, the estimates of electoral manipulation in a subsequent election go down by a half of their standard deviation, thus corroborating the Information Theory.

*The authors are grateful to Pasha Andreyanov, Christian Dippel, Natalia Forrat, Barbara Geddes, Scott Gehlbach, Miriam Golden, Kirill Kalinin, Vasily Korovkin, Yegor Lazarev, Zsuzsanna Magyar, Paasha Mahdavi, Eric McGlinchey, Ben Noble, Imil Nurutdinov, Sergey V. Popov, John Reuter, Kirill Shilov, Anton Sobolev, Luke Sonnet, Zachary Steinert-Threlkeld, Yuan Tian, Daniel Treisman, Nico Voigtländer, Romain Wacziarg, seminar participants at UCLA, and conference participants at APSA, RES, and MPSA for excellent suggestions. Authors are grateful to Kirill Kalinin who generously provided region-level mixture estimates for electoral fraud in 2011, and Graeme Robertson who generously provided data on actual instances of protests. Correspondence to: Uris Hall, 126; 3022 Broadway; New York, NY; 10027.

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1. Introduction

What is the role of elections in nondemocracies? Today, many nondemocratic regimes maintain at least some of the institutions commonly associated with democracy: they allow for the existence of political parties, parliaments, and elected executive offices, and they regularly hold elections (Blaydes (2006), Gandhi (2008), Gehlbach and Keefer (2011), Levitsky and Way (2002), Lust-Okar (2006), Magaloni (2006), and Wright (2008)). Such institutions are not designed to pave the way for true political competition. On the contrary, the rules of the game are extremely unfair to the opposition: it is outspent (since the incumbent has an unvetted access to state budget), faces police intimidation, has trouble accessing the media, and, in many cases, its votes are stolen during the elections.

Electoral manipulation is commonplace in such elections. Simpser (2013) estimates that incidences of electoral manipulation was widespread in 19.5% of all election rounds around the world from 1990 to 2007; the highest levels were observed in countries of the former Soviet Union, followed by the Middle East and Northern Africa, Sub-Saharan Africa, and Asia. Calingaert (2006) documents multiple instances of fraud in Mexico, Serbia, Nigeria, and Ukraine.

Analysts have proposed several explanations for the existence of elections in authoritarian countries. According to one of the most prominent theories (hereafter, Influence Theory), elections are used to signal the strength of the incumbent to current and potential rivals. For example, Magaloni (2006) contends that the Institutional Revolutionary Party (PRI) in Mexico had to win elections to maintain an "invincibility image," thus deterring defections of members of the elite. In a related theory, Simpser (2013) argues that for authoritarian leaders to remain in office not only for the current term but also for future terms, they must convince potential opposition candidates that any challenge to the status quo is futile. A leader who wins by large margins eliminates the appearance of any chance that an opposition candidate could win.

Scholars of authoritarian politics offer cross-national statistical evidence that is consistent with these views: regimes that hold elections last longer on average (Geddes (2005), Simpser (2013)) than regimes that don't. However, as Brancati (2014) points out, causation in such studies can run both ways: maybe, indeed, authoritarian elections are able to convince potential opposition candidates of the regime's popularity. On the other hand, leaders who are initially stronger could choose to hold elections more frequently than weaker leaders.

To test the Influence Theory in a way that might come closer to overcoming the issue of reverse causality, one might look at some of its other predictions. For example, we argue, that one should expect more electoral manipulation in the areas where protest sentiments are high because an opposition is more likely to emerge in those regions. Thus, a positive and substantively meaningful subnational correlation between protest sentiments and the extent of electoral manipulation would be consistent with the Influence Theory, while negative correlation would be consistent with the Information Theory.

Also important is the theory of elections as devices of information acquisition (hereafter, Information Theory). According to this theory, elections are used to identify the level of support for the regime and for the opposition. Armed with information, the regime can implement policies that target different groups of population differently based on the level of their support. For example, the regime can punish opposition strongholds.[1] Information about opposition constituencies is important regardless of whether the regime chooses carrots or sticks as the instruments for survival. For example, Magaloni (2006) shows that the PRI in Mexico rewarded its supporters and punished some of its opponents, and Blaydes (2011) demonstrates, among other things, that in Mubarak's Egypt, regions that supported the Muslim Brotherhood were less likely to get sewage services. Whether a government is punishing the opposition, rewarding the supporters, or coopting of the opposition, it

[1] A vast literature on machine politics and patronage dispensation evinces this in various developing countries (see, for example, Golden and Min (2013) for an excellent review).

needs accurate information about the level of support for the regime. The Information Theory implies that holding elections is a straightforward way to get this knowledge.

This view is demonstrably more consistent with the different allocation of electoral manipulation than the Influence Theory. If elections are used to harvest information about public discontent, it follows that the higher the level of the regime's prior expectation of overall discontent, the more valuable the information is. This is why places where protest sentiments are high should stay relatively "clean," free of manipulation.

Since the theories of authoritarian elections offer conflicting predictions about the geographical allocation of electoral manipulation, one can distinguish between these theories by estimating a statistical relationship between electoral manipulation and protest sentiments. If this relationship is negative, then the Information Theory is more likely to be accurate, whereas a positive relationship would be more consistent with the Influence Theory.

In this paper, we offer such a test. We calculate a set of forensic measures of electoral manipulation in Russian regions during the 2011 parliamentary election, and we estimate a model that predicts the forensic evidence of electoral manipulation by the pre-election protest sentiments as measured by a regionally representative public opinion poll. The Influence Theory predicts that such a relationship will be positive, while the Information Theory predicts that this relationship will be negative. Because we find the actual relationship to be negative, we conclude that our data corroborates the Information Theory and is not consistent with the Influence Theory.

Because electoral manipulation is a covert activity, measuring it can be challenging. For our empirical evaluation, we rely on a set of statistical "fingerprints" of electoral manipulation calculated using precinct-level data. None of those indicators is conclusive by itself, but taken together, they elucidate the geographical distribution of electoral manipulation. We use indicators based on the prevalence of integer proportions in turnout and vote proportions for the main pro-regime party (Rozenas (2017)), a model-based approach that distinguishes between incremental fraud and extreme fraud (Klimek et al. (2012) and Mebane (2016)), and deviations of the distributions of digits per Benford's Law (Kalinin and Mebane (2011)). We also calculate a share of precinct when voter turnout is larger than 90% for an additional suggestive measure of electoral manipulation. For our main specification, we use the first principal component from the PCA decomposition of the indicators, but we also demonstrate that our result — the substantive and statistically significant negative correlation between the protest potential and indicators electoral manipulation — does not depend on which of the methods we use.

Our main contention is that our results corroborate the Information Theory. However, because several alternative explanations are possible, we make an effort to consider those and implement additional tests that can rule them out. One factor that might confound our analysis is the presence of electoral observers, and, in general, high levels of trust and social capital. In the regions where the population is more likely to be organized toward a certain goal, protest potential can be higher and, because of electoral monitoring, manipulations will be less pronounced. To control for this explanation, in a set of robustness checks, we add various region-level measures of the presence of electoral observers and levels of social capital.

Another alternative explanation concerns the incentives of field agents who implement manipulations.[2] First, as Rundlett and Svolik (2016) have demonstrated, strategic complementarity among the field agents can generate more manipulation in the areas where the regime is more popular, even if the regime does not want it. We consider this explanation by controlling for the regime's popularity. Second, because field agents come from the same population as people in a regionally representative survey, they might share the same grievances as the general population and thus be more reluctant to implement manipulation. Following Forrat (2018),

[2] In the Russian context, these agents are widely believed to be school teachers and administrative personnel (Forrat (2018)).

we control for the wages of those agents (teachers and administrative personnel). Inclusion of these controls, however, does not substantially change the estimates of the effect of protest potential. We also show that our results are not driven by local political competition and pre-election electoral manipulations.

We do not contend that the Influence and Information Theories are the only possible explanations for the role elections play in authoritarian countries. Several analysts have proposed other theories. According to Blaydes (2011), elections are used for managing conflict among members of the rent-seeking elite about who gets access to the spoils of government offices. Geddes (2009) suggests that autocrats create political parties to counterbalance a powerful military. Gandhi (2008) proposes a theory of authoritarian institutions as an arena for policy concessions. Malesky and Schuler (2010) contend that elections can be used to manage discontent. According to Boix and Svolik (2013), legislatures help reduce information asymmetry between an autocrat and his supporters. Truex (2017) suggests that legislatures serve to "collect preferences" of the subjects. In this paper, we are only able to formally derive the predictions that can distinguish Influence Theory from Information Theory. We believe that differentiating competing effects is necessary for understanding authoritarian institutions, but the theoretical content of this literature is too large and diverse for us to incorporate all possible explanations in a coherent set of tests in one paper. We confine this paper to just two popular theories, and we discuss possible avenues for further research in the Conclusion.

We see the main contribution of our paper in deriving and applying a theory-motivated statistical test that can distinguish between two competing theories of autocracy. Our paper is also relevant to the literature on the determinants and motivations of electoral fraud. In particular, Rundlett and Svolik (2016) offer a model, based on a global game, where field agents, implementing electoral fraud are more likely to engage in electoral manipulation if they know that the regime is more popular and that they are less likely to be punished. We complement this approach by showing that electoral fraud even in cases where the incumbent can win without manipulation can follow from a strategic calculation of the regime. Our findings are also consistent with Rozenas (2016), who shows that insecure incumbents are more likely to manipulate elections. Kalinin and Mebane (2011) look at electoral manipulation in the Russian context and argue that regional authorities use electoral manipulation to signal loyalty to the central government. Our results also pertain to the theory of "informational autocracy" (Guriev and Treisman (2015, 2018)), which postulates that modern authoritarian regimes survive not by mass repressions, but by controlling information flows and selective cooptation. Our results also contribute to the literature on the role of electoral fraud in autocracies. Gehlbach and Simpser (2015) offer a theory that incumbents manipulate elections to signal their strength to the bureaucracy, while Luo and Rozenas (2018) offer a theory of a trade-off between ex-ante and ex-post election rigging. While our theoretical framework can apply to a wide array of methods authoritarian governments use to slant the electoral process (including harassing the opposition dissemination propaganda through the media, our empirical test — because of data-availability issues — looks only at *election day manipulations*, such as ballot stuffing, vote stealing, and rewriting the election protocols.[3] We argue that it is informative nonetheless.[4]

This paper is organized as follows: Section 2 introduces theoretical expectations from the two theories. Section 3 provides an overview of the 2011 Russian parliamentary elections. Section 4 describes how we estimate the probability of electoral manipulation in different regions of Russia and describes the data. Section 5 presents the model specifications and empirical results. Section 6 details our tests for alternative explanations and provides robustness checks. Section 7 concludes.

[3]Scholars have documented that workplace mobilization through the patronage networks plays an important role in regime's survival (Frye et al. (2014, 2018), Hong and Park (2016)).

[4]Our argument is about how authoritarian regimes *use* elections but not why they choose to create or abolish political systems that involve elections. For example, Fearon (2011) argues that the regime that has already imposed elections cannot abolish them because the fact of not conducting elections at the pre-specified date can serve as a coordination device for the opponents of the regime to revolt.

2. Theoretical Expectations

This section derives the predictions about the amount of electoral manipulation under different theories of authoritarian elections. We argue that under the Influence Theory, a regime's ex-ante expectations of protest potential are positively related to the probability of electoral manipulation. Under the Information Theory, the opposite is true: a regime's ex-ante expectations of protest potential are inversely related to the probability of electoral manipulation.

The intuition behind these predictions is straightforward: if the Influence Theory is accurate and the regime tries to deter potential opposition candidates from organizing a successful protest, electoral manipulation is more meaningful when public support for the regime is low, and the probability of a rebellion is high.[5] If the Information Theory is accurate, it is critical that the regime learns where its support is low. In this case, a regime's manipulation of elections (which adds more noise to the electoral results, since it is impossible to control the exact number of manufactured votes) in areas where the regime suspects it has little support might contaminate the much-needed signal about the regime's true level of support.[6]

One might wonder what the point of election fraud is in Information Theory, given both that the regime's goal is to gather information and that electoral fraud

[5] Our argument is related to the predictions from several formal models of electoral autocracies. Gehlbach and Simpser (2015) argue that the relationship between the manipulation and the ruler's popularity is positive if the goal of the ruler is to induce bureaucratic effort and the ruler can choose the effectiveness of manipulation. The key difference with our setup and the setup of Gehlbach and Simpser (2015) is that the manipulation is observable by the bureaucrats in Gehlbach and Simpser (2015). In our computational setup, we assume that the audience understand the capacities of the regime and the incentives of the regime, but the number of manipulated votes in unobserved. Another model related to ours is Egorov and Sonin (2014) that shows that the relationship between manipulation and the popularity of the regime is non-monotonic if the act of holding elections itself is endogenous. In our setup, the ruler is not given an option to abolish the elections at will but is allowed to implement manipulations, which is consistent with the stylized facts about competitive autocracies. Another important argument that derives a non-monotonic relationship between the regime's popularity and election rigging is Rozenas (2012). Our difference from Rozenas's setup is that we assume that the rigging influences post-election stability through calculation of the dissidents (in the Influence theory) or through the regime's information accumulation (in the Information theory).

[6] Alternative argument would be that clean elections help the regime to acquire information not about the preference of the underlying population but capacity of local power-brokers to control their population. However, model implications would be similar.

just adds noise to the signal. As we noted previously, first and foremost, the ruling elite (a party or an individual leader) needs to win an election to remain in power.[7] This goal is the same in both theories, and electoral fraud is one of the tools a regime may use to achieve this goal.[8]

Table 1 summarizes the expectations under both theories. Influence Theory posits that the goal of the regime is to deter the dissidents from staging a protest. Because protests are ex-ante more likely to happen when the prior knowledge is that the protest potential is high, then the most effective spatial allocation of the electoral manipulation is to the places with high ex-ante protest potential. If the election correctly reveals that the regime is not popular, and the dissidents decide to revolt, it is the worst outcome for the regime. We call this outcome *true negative*: dissidents decide that the regime is not popular, and they are correct. So, under the Influence Theory, the goal of the regime would be to minimize true negatives.[9]

Information Theory posits that the goal of the region is to learn where the protest potential is high and to dispense patronage or repression in those areas. Because we assume that the uncertainty about the protest is the highest where ex-ante protest potential is high, the improvement of the precision of the regime's knowledge would be achieved when those areas stay relatively clean of manipulation. The worst outcome of the regime is that the protest potential is high, but the regime decides that the protest potential is low and thus does not perform any policies (patronage or repression) that would insulate him from the potential revolt. We call this outcome

[7] It is also impossible to get rid of the electoral fraud even if the regime wishes so (Rundlett and Svolik (2016)). The central government also uses the percentage for the ruling party as a tool to evaluate sub-national power-brokers (Zhuravskaya (2010)). This creates additional incentives to conduct electoral manipulations.

[8] Scholars of authoritarian regimes list some other instruments ruling parties use for winning the authoritarian elections: unfair access to media, police intimidation of the opposition, and use of the state budget to finance an electoral campaign of an incumbent. See, for example, Levitsky and Way (2002).

[9] Another way to think about the Influence Theory is that government only need to win, and show high support of the regime overall. However we assume that dissidents can see the local support for Putin, and the government doesn't want them to know it. It is reasonable to assume this as most of protests and protest movements in Russia (and other countries) are grounded on the local agenda (e.g., Saint Isaac's Cathedral in Saint Petersburg, dump in Volokolamsk, or fire in the mall in Kemerovo. See more in Greene (2014).

Table 1: Comparison of Theories

Theory	Danger for the Regime	Goal of the Regime
Information	Regime decides that protest potential is low, but it is high	Minimize false positives
Influence	Dissidents decide that protest potential is high and they are right	Minimize true negatives

Note: Comparison of the theories and their predictions. We call *positive* a situation when the protest potential is low (it is a positive piece of news for the regime). *False positive* happens when the region is classified (by the regime) as having a low protest potential (classified as *positive*) after observing all signals, but, in fact, has high protest potential. Analogously, we call *negative* a situation when the protest potential is high (it is a negative piece of news for the regime). *True negative* happens when a region is classified (by the dissidents) as having high protest potential (classified as *negative*), and this classification is correct.

false positive. Under the Information Theory, the goal of the regime is to minimize false positives.[10]

We offer a simple Monte Carlo simulation to help illustrate the expectations that come from different theories, a stylized scenario of an authoritarian election with a possibility of fraud most relevant for our Russian case: the regime observes an initial signal about the distribution of preferences, then decides where to implement fraud, and then observes the results of the elections.

Here is a more detailed description:

- Step 0: Each of the N regions (i) has a true level of protest sentiment s_i. It is unobserved by either the regime of the local dissidents, and their prior is uninformative.

- Step 1: A noisy signal is received by the regime about the regime popularity in each region: $A_i^r \sim \mathcal{N}(s_i, \sigma_1^r)$. One can think of this signal as a regionally representative public opinion poll, of which σ_1^r is a total survey error. Dissidents in every region observe a potentially different signal from the same underlying

[10]We also assume that if protest potential is low, there will be no protests. However, in the places where protest potential is high, protests will happen only if the capacity to organize collective action is high enough. Thus, automatically, the Information Theory suggests that information would be most useful where there is not only the highest protest potential but also the most uncertainty about discontent.

distribution of preferences: $A_i^d \sim \mathcal{N}(s_i, \sigma_1^d)$.

- Step 2: As elections are coming, the regime decides how intensely it will manipulate the election in each region. Following the literature on formal models of autocracy (Gehlbach et al. (2016)), we assume that the public understands the incentives of the regime and discounts manipulated results. But as field agents implement electoral fraud in a noisy way, it follows that the higher the level of fraud, the noisier the signal resulting from the elections — both for the public and for the regime.[11] In our simulation, we offer two scenarios: positive correlation between protest potential and fraud, and negative correlation.

- Step 3: The electoral results are observed. For computational convenience, we assume that the results are: $R_i \sim \mathcal{N}(s_i, \sigma_2^i)$. In other words, the election provides another signal of the underlying popularity of the regime, but the precision is different for every region and depends on the decisions the regime made in the previous step. The regime doesn't know the mean (the true level of protest potential which is unobserved), but it knows the variance, because it is an increasing or decreasing function of the signal the regime got on the previous step.

- Step 4: After observing the electoral results, the regime and the dissidents update their expectations about the popularity of the regime according to Bayes Rule. The regime combines A_i^r and R_i, while the dissidents combine A_i^d and R_i.

- Step 5: After the election, the Information Theory implies that the regime identifies the opposition stronghold and tries to either punish or pacify them. The Influence Theory implies that dissidents in every region solve the same problem: they rebel if they decide that they live in an opposition stronghold, and if they are right about it, their rebellion becomes problematic for the regime. In the simulations, we assume that a region i is an opposition stronghold if $s_i > 1$ (that is, if the level of true opposition sentiment is among approximately the top 15% of all the

[11] Informally, this mechanism is described in Magaloni (2006), while Egorov and Sonin (2014) offer a rigorous formal theory of how a rational public reacts to potentially fraudulent elections.

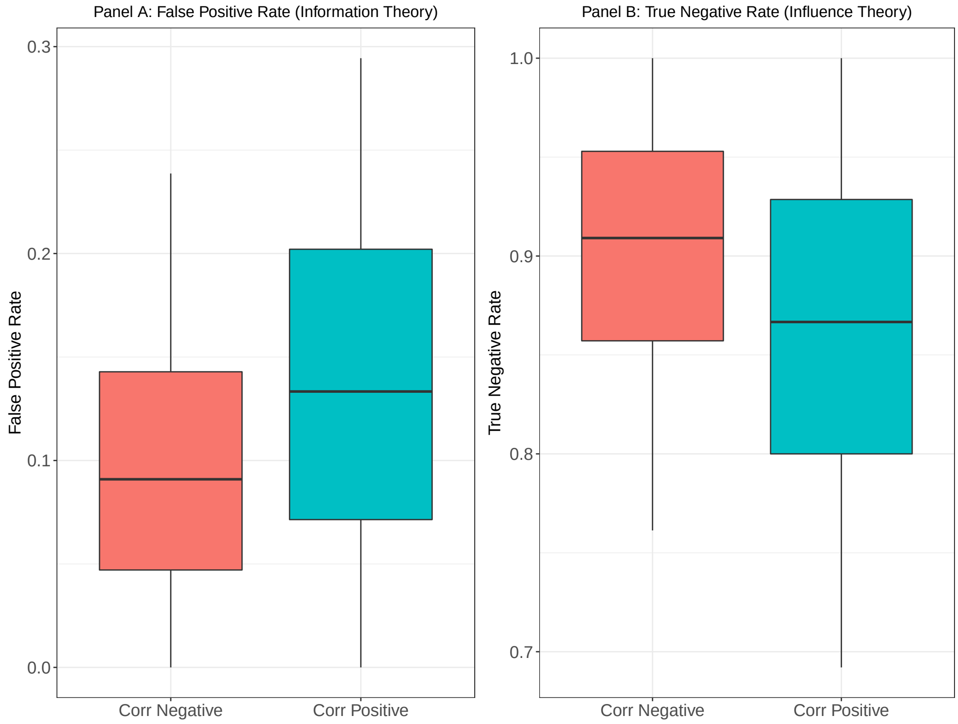
regions). All the regions are classified as either safe for the regime ("positives") if they are in the bottom 85% of the posterior expectation of protest potential (posterior estimate of $s_i < 1$) or unsafe for the regime ("negatives") if they are in the top 15% of the posterior expectation of protest potential (posterior estimate of $s_i > 1$).

As a result of this simulation, we get conflicting predictions from the different theories. Under the Information Theory, the regime's goal is **to minimize the false positive rate** of the classification of the regions, because the worst that can happen (from the regime's point of view) is that a region it considers safe and thus overlooks when doling out punishment/patronage in reality turns out to be unsafe.

Under the Influence Theory, the regime's goal should be different: **to minimize the true negative rate.** If the goal is to dissuade dissidents from rebelling in a region where the regime is truly unpopular, then the worst that can happen (again, from the regime's point of view) is that the dissidents, after observing the election results, correctly identify unsafe regions and rebel there.

Figure 1 shows the estimated false positive rates and true negative rates under different regimes of electoral fraud: when the correlation between the first signal of protest potential and fraud is positive and when the correlation is negative. By comparing the bars within the panels, we demonstrate that the two theories have mutually exclusive implications.

Figure 1: Simulated Classifications of Regions



Note: Winsorized distributions of false positive and true negative rates under different regimes of electoral fraud: a negative correlation between the regime's ex-ante expectations about protest potential and electoral fraud (labeled *Corr Negative*) and a positive correlation between the regime's ex-ante expectations about protest potential and electoral fraud (labeled *Corr Negative*).

We see that if a correlation between the initial knowledge about protest potential and electoral fraud is negative, the false positive rate is lower (the red bar is lower than blue bar in Panel A) – this is what the regime wants under the Information Theory. But the true negative rate is higher (the red bar is higher than the blue bar in Panel B) — the opposite of what regime wants under the Influence Theory). If the correlation is positive, then the opposite is true: the false positive rate is higher (the blue bar is higher than the red bar in Panel A) — an undesirable outcome under Information Theory — but the true negative rate is lower (blue bar is lower than red bar in Panel A) — a desirable outcome under Influence Theory. Thus, under this logic, by observing an empirical correlation between electoral manipulation and protest potential in a different regime, we might discern the goals of the regime: a negative correlation would be consistent with the Information Theory, while a positive correlation would be consistent with the Influence Theory.

3. Background: 2011 Russian Parliamentary Elections

The 2011 parliamentary election was widely criticized by international observers for being heavily manipulated.[12] Many cases of ballot stuffing were caught on video and posted on YouTube. In one such video, posted on-line by Yegor Duda (a volunteer observer), the chairman of a polling station was caught filling a stack of ballots.[13] In another video, a cameraman demonstrates that voters' pens in a polling station were filled with erasable ink.[14] Observers from the Organization for Security and Cooperation in Europe (OSCE) also found multiple "indications of possible fraud."[15]

To quantify the extent of fraud in 2011, Enikolopov et al. (2013) use the random assignment of independent election observers to the polling stations in Moscow and found that the presence of observers reduced United Russia's (hereafter, UR) vote tally by 11 percentage points. Many more papers either demonstrate electoral fraud in Russian parliamentary elections or try to quantify it.[16]

In this paper, we use the presence of multiple instances of fraud in parliamentary elections to distinguish between the theories of electoral institutions. The Information Theory and the Influence Theory both imply heterogeneity of the allocation of manipulation across subnational units. The Influence Theory implies that regions where the regime is unpopular will be targeted with manipulation, whereas the Information theory implies that regions where the regime is ex-ante popular should stay relatively clean.

It is not our contention that the size of the manipulation in every region is determined inside the Kremlin. In fact, scholars have analyzed the role of local politics in

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[12] We provide additional background information on Russian Parliament in Appendix B.

[13] www.youtube.com/watch?v=P_wWJnRclE8. The story has been reported by The *New York Times*: www.nytimes.com/2011/12/06/world/europe/russian-parliamentary-elections-criticized-by-west.html?_r=0.

[14] www.youtube.com/watch?v=ezEFUGcdShE

[15] www.osce.org/odihr/elections/86981

[16] See Myagkov et al. (2005), Bailey (2008), Buzin and Lyubarev (2008), Myagkov and Ordeshook (2008); Kalinin and Mebane (2009, 2011), Shpilkin (2009), and Vorobyev (2011).

electoral fraud (Kalinin and Mebane (2011), Rundlett and Svolik (2016)). Nevertheless, the role of the central government is not absent. In particular, the central government is known to provide governors with informal expectations of how many votes it expects from their regions. According to the anonymous sources of the leading Russian business daily "*Vedomosti*," before the Parliamentary election of 2011, the operatives of Russian presidential administration have divided all the regions into three groups ("weak," "average," and "strong") and communicated to local bureaucrats the vote share they needed to achieve.[17] Of course, since the Kremlin had the access to the polling data, demanding those pre-specified vote shares is equivalent to demanding election rigging.

4. DATA

This section briefly describes the data we use to test the empirical predictions of the competing theories. The main dependent variable in our analysis is the region-level statistical forensic evidence for the electoral manipulations. The main explanatory variable is the region-level propensity to protest. We describe our sources and construction of other variables used as covariates in Appendix C.

4.1. Measuring Protest Potential

In Russia, the government takes the monitoring of protest potential seriously. The Russian presidential administration regularly commissions public-opinion surveys, with special attention given to presidential approval ratings toward, popularity of various policies pursued by the government, and the attitude to the leaders of the opposition movement. Major pollsters regularly brief Kremlin operatives on the latest changes in public opinion (Baker and Glasser (2005), Ananyev and Rogov (2018)).

In this study, we rely on one of the large-scale surveys conducted by FOM (*Fond*

[17] www.vedomosti.ru/politics/articles/2011/10/13/skolko_nuzhno_edinoj_rossii

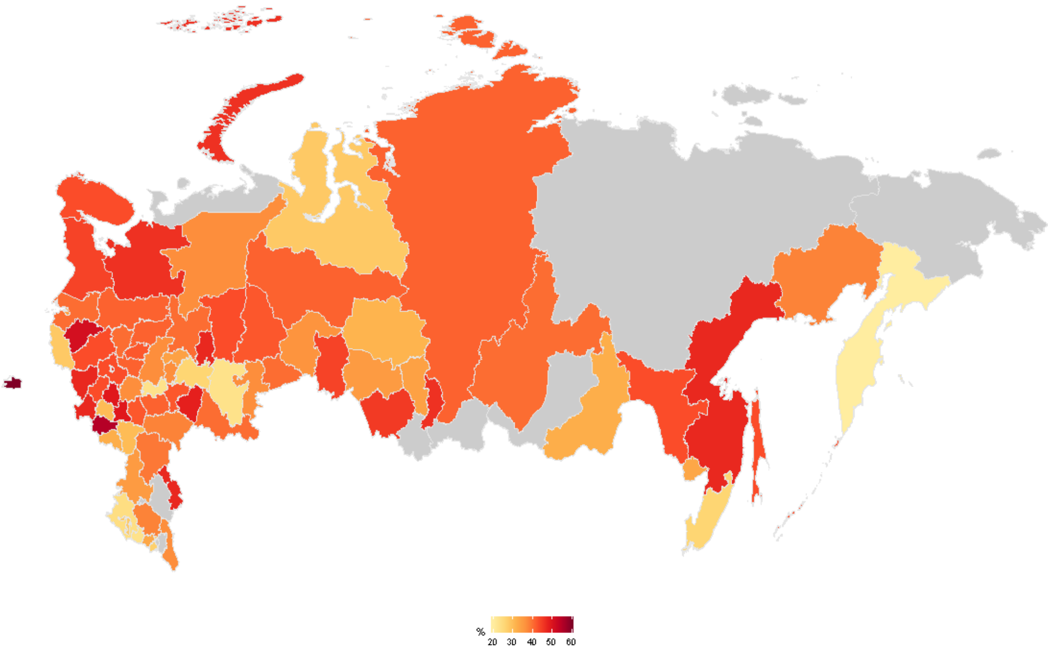
Obschestvennoe Mnenie, literally "The Public Opinion Foundation"), one of the most reputable polling firms in Russia and a regular contractor for the Russian presidential administration. FOM conducts a type of regionally representative survey called a "georating": a representative sample of respondents in almost all of Russia's regions is asked a comprehensive array of questions designed to elicit attitudes toward the federal and regional governments, economic expectations, and so on.[18]

For this study, we are using a georating survey conducted in February 2011 — the election took place that year on December 4. The question about protest potential was as follows: "Tell us please, do you notice people's discontent around you with the government authorities, the leadership of our region (the province, the republic), the protest sentiments? And if you notice, is this discontent growing or weakening lately?" There are five proposed answers: "Don't notice," "Increases," "Remains the same," "Decreases," and "Don't know." We compute the proxy for protest potential as the number of respondents who say that discontent and protest sentiments are increasing divided by the total number of respondents in a region (see Figure 2).[19]

[18]The survey is conducted in 74 out of 83 regions in Russia. The missing regions are sparsely populated, so FOM decided that it would be prohibitively expensive to conduct a representative survey there. The non-missing regions cover more than 95% of Russian population.

[19]In Section E.1 we show robustness of our results to alternative measures of protest potential from Robertson (2013).

Figure 2: Map of Protest Potential in 2011



Note: This map depicts the level of protest potential by Russian regions in February 2011, according to FOM. The protest potential varies from about 20% to 60% of respondents who answered "Increases." The darker colors represent higher protest potential.

4.2. Measuring Electoral Manipulation

To measure electoral fraud, we use official polling-station-level voting data from the Central Election Commission (CEC) for the Russian parliamentary elections in 2011.[20]

Electoral manipulation is a covert activity that in most cases cannot be measured directly, so one needs to rely on indirect measures. Statisticians and social scientists have proposed several methods of detecting fraud. Most of these methods rely on statistical artifacts that are unlikely to emerge under plausible models of voting. For example, one of the simplest possible statistics is the share of polling of stations where a particular party won nearly 100% of the votes. Even if one party is genuinely popular, such results might suggest electoral manipulation. While the mea-

[20]Data are available at `www.cik.bg/`. To ensure that the data are not corrupted, we use the data collected by the nonprofit organization "Golos" ("Voice," `www.golosinfo.org/`), which scraped all the data after they were published online by the CEC.

sure on its own is certainly not sufficient to prove electoral manipulation beyond the shadow of a doubt, it may prove it if corroborated by other sorts of evidence.

Forensic methods that explore statistical irregularities to find evidence of covert activities are widely applied in different areas of social science. They are used to detect tax and accounting fraud (Heron and Lie (2007)), racial discrimination (Price and Wolfers (2010)), corruption in auctions (Porter and Zona (1993), Andreyanov et al. (2018)), and electoral fraud (Kalinin and Mebane (2011), Voigtländer and Voth (2014)).[21]

In this paper, we use several forensic techniques to quantify the extent of electoral manipulation.

Spikes Estimates of electoral fraud based on spikes are intuitive: field agents in the polling stations who add votes for the favored candidate often try to match certain arbitrary "round" numbers (e.g., 50%, 55%, or 60%). This results in a situation when in a distribution of the polling stations by the votes in favor of UR there are density spikes at round numbers.

We follow Rozenas (2017), who developed a statistical algorithm to compute electoral manipulations based on the difference between the abnormal share of votes on round numbers and predicted share of votes based on the distribution around them. We use Rozenas's *spikes* package[22] to estimate region-level percentages of fraudelent precincts.

Mixture Estimator An estimate of fraud based on the mixture estimator is developed in Klimek et al. (2012). The method has three assumptions. First, votes come from a normal distribution. Second, there is incremental fraud, when all candidates receive additional votes through ballot stuffing (but maybe one more than other). And third, there is extreme fraud, when one candidate receives all the fraudulent votes. Overall, the empirical distribution of votes is a mixture of three normal distri-

[21] For many other examples as well as a discussion of basic approaches, see Zitzewitz (2012).

[22] `https://cran.r-project.org/web/packages/spikes/index.html`.

butions with three different humps: one for polling stations without fraud, one for polling stations with incremental fraud, and one for polling stations with extreme fraud.

Klimek et al. (2012) choose the parameters of these three distributions to compute the amount of incremental and extreme electoral manipulations. Mebane (2016) proposes an alternative, more robust method of estimating fraud based on the finite-mixture-likelihood method, in which the model's parameters are estimated before the fraud is estimated. Kalinin and Mebane (2017) deployed these estimates to evaluate the integrity of Russian elections. Here, we use their estimates for the 2011 elections.

Benford's Law One of our electoral-manipulation estimates is based on the generalized Benford's Law (hereafter, BL) which postulates a certain probability distribution that digits in a number follow (Benford (1938)). Kalinin and Mebane (2011) demonstrates, using simulations under a plausible data-generating process of voting, that the second digit in a vote count should follow a BL distribution.

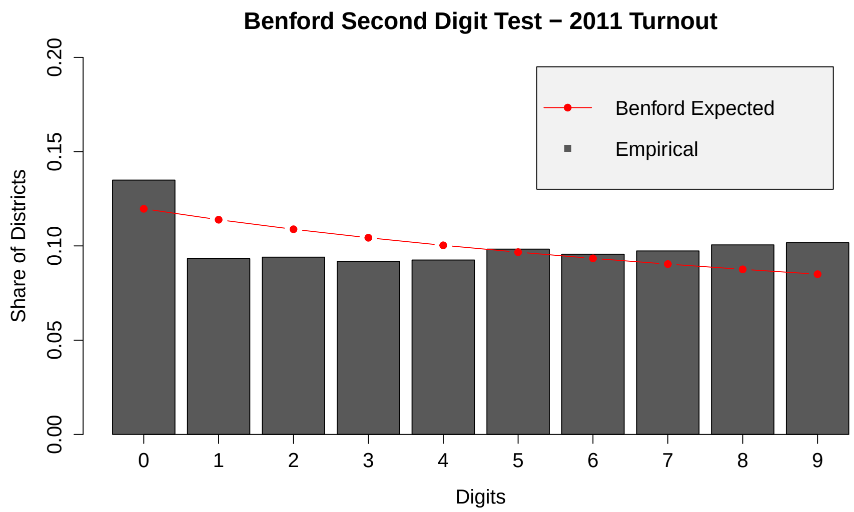
Its intuition is straightforward: if a number represents a naturally occurring phenomenon, the distribution of its second digit should follow certain empirically established distribution. See Appendix D for details.

In this paper, for every Russian region, we calculate a mean absolute deviation (MAD) of actual digits' frequencies from the frequencies expected by BL. The higher the deviation is in a region; the more electoral manipulation should be plausibly expected there.

Figure 3 shows the difference between the actual frequencies of second digits and the frequencies that are predicted by the theory. According to BL, the frequencies of digits should gradually go down as numbers represented by the digits increase from 0 to 9. The empirical distribution is different: there is a bump at digit "0," while all other digits have very similar frequencies.

Using BL for election forensics has been criticized in other literature. In some contexts, tests based on BL have been shown to "detect electoral manipulation where it most likely did not happen and miss electoral manipulation where it most likely did happen.[23] We take these concerns seriously: we computed eight types of electoral fraud estimates based on BL and compute the first principal component of all measures. In particular, we use four "Second Digit" and four "Last Digit" tests based on UR's count, UR's share, turnout count, and turnout share.

Figure 3: Actual and Predicted Frequencies of Digits in 2011 Turnout Numbers



Note: On the horizontal axis: every digit that can appear in a turnout number. On the vertical axis: share of polling stations with a particular digit in a second place in a turnout number. Source: Central Election Commission of the Russian Federation.

Extreme Turnout Extreme turnout is plausibly the simplest and most intuitive proxy for electoral manipulations. Many observers of Russia's elections agree that the precincts where more than 90% of voting population showed up to vote are likely to be manipulated (Shen (2012)). We construct a variable that represents the share of polling stations where turnout was over 90% of the total registered voters.[24]

Comparison of Electoral Fraud Measures All measures described above are efficient in detecting electoral manipulations. Moreover, spikes and mixture estimator

[23]For example, Deckert et al. (2011) document departures from BL distribution in the elections in developed democracies where no other evidence of electoral manipulation exists.

[24]All results hold if we construct this measure as the share of polling stations where UR won over 90% of the votes.

measures are currently considered the state-of-the-art ways of measuring electoral fraud (Hicken and Mebane (2015)). Nevertheless, each measure can be criticized for its assumptions.

As Rozenas (2017) points out, spikes can be vulnerable to a confounding "feedback loop"; if the regime learns of this method fraud of detection, it can direct polling-stations field agents not to create round numbers for the UR's turnout or vote count.

The mixture estimator does not work if the regime's goal is not to make one candidate win but to increase turnout by adding votes to all candidates. Alternatively, the mixture estimator will fail if assumptions of the model do not hold. For example, if a country's voting behavior is bimodal, as among anglophone vs. francophone parts of Canada (Klimek et al. (2012)). However, in our case, we use regional measures of electoral manipulations, and the regional population is likely to be relatively homogeneous in their political preferences even within the ethnic republics.

As we noted above, BL test is not free from Type I and Type II errors. At the same time, extreme turnout is a crude measure of electoral manipulation in that it does not detect relatively small manipulations.

Table 2: Correlations of the Measures of Electoral Manipulations

	Spikes	Mixture Est.	Digit Est.	Extr. Turnout	PCA
Spikes	1				
Mixture Est.	0.71	1			
Digit Est.	0.41	0.49	1		
Extr. Turnout	0.66	0.87	0.61	1	
PCA	0.82	0.92	0.71	0.94	1

Thought all these measures can be criticized for some drawbacks, they do complement each other. In Table 2, we demonstrate that all of them exhibit very strong correlation, suggesting that if all of them yield consistent results in our empirical specification, the result is not likely caused by a statistical artifact in the data. We also construct a first principal component of the four measures (that draws equally from all four variables) and use it as our baseline estimate for electoral fraud.

5. Main Empirical Specifications and Results

In this section, we build a set of statistical linear models that control for a set of potential confounders: variables that might influence electoral manipulation as well as regional propensity to protest. Here, we still try to keep our parsimonious, controlling only for the most relevant covariates.[25]

We estimate the following specification:

$$MANIP_i = \alpha + \beta PROTEST_i + \mathbb{X}_i'\Gamma + \epsilon_i.$$

Here $MANIP_i$ is a measure of electoral fraud in region i. To make sure that our results are not driven by a specific choice of measure, we use all the measures mentioned previously: Kalinin and Mebane's mixture model estimates, Rozenas's spikes, proportion of precincts with extreme turnout, and an index based on digit tests. Because these measures produce results on different scales, we demean them and divide by the standard deviation.

The main explanatory variable $PROTEST_i$ is a measure of protest potential of region i: the share of the georating's respondents who say that protest inclinations are increasing. As we discussed, if electoral fraud is used to deter protests and prevent opposition mobilization, then it should be more prevalent in the regions where such mobilization is ex-ante most likely. Thus, the Influence Theory would imply a positive effect of protest propensity on electoral fraud. Alternatively, negative β implies that our results support the Information Theory.

The vector $\mathbb{X}_i$ represents a series of region-level control variables described below. First, we control for the level of gross regional product (GRP) per capita —

[25] We use only cross-sectional data in our analysis. While polling-level data also exist for the 2003 and 2007 parliamentary elections, reliable survey-based data on the regional variation of protest sentiment for the majority of Russian regions are available only for 2011.

the most basic way to capture the level of economic development. Scholars have shown that the level of economic development is a powerful determinant of many social, economic, and political characteristics of a polity.

Second, we control for characteristics that might facilitate collective action and information dissemination: level of education, access to the Internet, and population density. Previous studies have demonstrated these variables can impact both the level of electoral fraud and the level of protest potential (Enikolopov et al. (2016, 2017), Skovoroda and Lankina (2017)). Third, we control for distance from Moscow to capture parsimoniously the geographical heterogeneity of Russia. (We consider other ways to capture this heterogeneity in Section 6.)

Finally, to capture some of the political and geographical heterogeneity among the regions, we include an indicator variable for the existence of a "subnational autonomy" treaty between the central government and the region. Such treaties were signed in the 1990s, when Russia's first president, Boris Yeltsin, tried to win the acquiescence of regional power brokers. The first treaty was signed in 1994 by Boris Yeltsin and Mentimer Shaimiev, Tatarstan's leader. Soon this example was followed by treaties with Bashkorstostan, Buryatia, some of other "ethnic republics," and regions with strong subnational patron-client networks. As a result, those regions have been able to enjoy some autonomy for many years and build strong subnational authoritarian regimes.

Those are the controls that we include in the main specification. However, some other variables might also be relevant: e.g., characteristics of the economy, poverty, social spending, and reliance on resource extraction. We consider an extended set of controls and other robustness checks in Section 6.

Table 3 presents the regression results. Each column corresponds to a different measure of electoral manipulation. We use Rozenas's spikes as the dependent variable in column 1, Kalinin and Mebane's mixture model estimates in column 2, digit-test index in column 3, and the proportion of precincts with extreme turnout in column 4. We see that the effect of protest potential is statistically significant and substantively large for all measures of electoral fraud.[26]

The magnitude differs across specifications. We see the largest magnitude for the Kalinin and Mebanes's mixture model estimates (column 2), and the smallest magnitude for Rozenas's spikes estimates (column 1). Even the smallest estimates are quantitatively large: a 10 percentage points increase in protest potential is associated with a 0.27 standard deviation of spikes.[27] Coefficients for the protest variable in columns 1 and 3 are not statistically different from each other. The same is true for coefficients in columns 2 and 4.

Because protest potential varies from around 20 percent to around 60 percent, our model implies that the largest possible in-sample change in protest potential reduces electoral fraud by a magnitude from 1.2 standard deviation (for Rozenas's spikes and digit-test estimates) to 2.8 standard deviations (for Kalinin and Mebane's mixture model estimates and proportion of precincts with extreme turnout).

In column 5, we use the first principal component of the four measures of electoral fraud as a dependent variable. Similarly to previous columns, the results are significant: a 10 percentage point increase in protest potential is associated with a 0.46 standard deviation lower instance of electoral fraud.

We see that, across specifications, GRP per capita is negatively associated with the observable fingerprints of electoral fraud (though the estimate is statistically significant only for spikes). Somewhat surprisingly, in three of the specifications, the level of education (share of people with college degrees among the employed) is positively correlated with the measures of fraud.[28] Other control variables appear to be insignificant.

Figure 4 presents a set of the added-variable plots with the linear fit for all four

[26]Our results also hold for the specification without any covariates: we present scatter plots in Figure A.1.

[27]The difference between two regions, one on 25th and one on 75th percentile, of protest sentiment is 0.095. For simplicity, hereafter we will use 10 percent as the interquartile range.

[28]The goal of these specifications is to control for potential confounders of the relationship between protest potential and electoral manipulation, not the variables that confound a relationship between protest potential and education. Thus, this particular estimate must not be interpreted causally.

Table 3: Measures of Electoral Manipulation and Protest Potential

	Dependent variable: Electoral fraud				
	Spikes	Mixture Est.	Digit Est.	Extr. Turnout	PCA
	(1)	(2)	(3)	(4)	(5)
Protest	-2.748^{**}	-5.173^{***}	-2.747^{**}	-4.837^{***}	-4.651^{***}
	(1.238)	(1.531)	(1.349)	(1.508)	(1.387)
GRP	-0.340^{**}	-0.097	-0.141	-0.021	-0.168
	(0.150)	(0.186)	(0.164)	(0.183)	(0.168)
Education	0.051^{**}	0.039	0.054^{**}	0.033	0.051^{**}
	(0.021)	(0.026)	(0.023)	(0.026)	(0.024)
Internet	0.003	1.961	-2.342	2.295	0.783
	(1.617)	(1.999)	(1.761)	(1.970)	(1.811)
Pop. Density	-0.119	-0.143	-0.140	-0.132	-0.156
	(0.092)	(0.114)	(0.101)	(0.113)	(0.104)
Distance to Moscow, km	-0.052	-0.187	0.164	-0.001	-0.034
	(0.093)	(0.115)	(0.101)	(0.113)	(0.104)
Treaty	0.129	0.062	-0.238	0.091	0.027
	(0.152)	(0.188)	(0.166)	(0.186)	(0.171)
Constant	-0.972	-0.803	1.083	-0.908	-0.555
	(1.411)	(1.744)	(1.537)	(1.718)	(1.580)
Observations	74	74	74	74	74
R^2	0.281	0.376	0.256	0.352	0.358

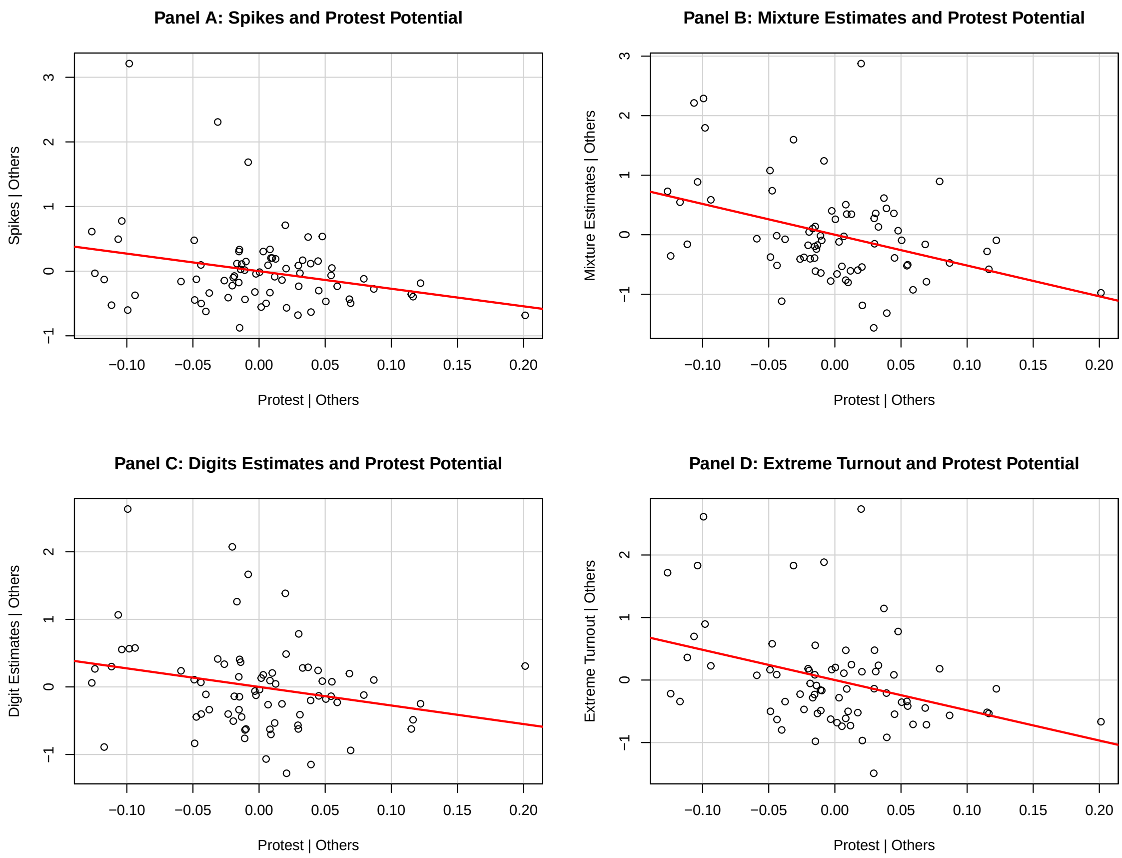
Note: Robust standard errors are in parentheses. *p<0.1; **p<0.05; ***p<0.01

fraud measures. The plots demonstrate that the results in Table 3 are likely to be driven by broad patterns in the data, not by the set of specific distinct observations.

Overall, we have demonstrated that there is a negative correlation between the level of electoral manipulation and the protest potential of a region. The correlation remains negative and substantively nontrivial when we adjust for a set of potential confounders. One of the potential explanations that we explicitly consider in

Section 2 is Information Theory: the idea that authoritarian elections are used to gather information. This theory would imply that the information about potentially high-protest regions is more valuable. This information is conveyed by the electoral results, and the regime would avoid contaminating this information with electoral manipulation. Thus, our results can be interpreted as evidence against the Influence Theory in favor of the Information Theory.

Figure 4: Electoral Fraud and Protest Potential: Added Variable Plots



Note: Panels A through D above correspond to columns (1) through (4) of Table 3. The plots were created using *AvPlot* command from *car* package in R.

6. Alternative Explanations and Robustness

In the previous sections, we find strong evidence in favor of the Information Theory against the Influence Theory. Nevertheless, there are other potential ways to explain of our main results. In this section, we consider a set of such alternative explanations.

6.1. *Alternative Explanation I: Election Monitoring*

One of the specific mechanisms through which protest potential might be linked to electoral manipulation is election monitoring. In 2011, the opposition parties campaigned to recruit more activists to volunteer to monitor the elections. The campaign to "crowdsource" election monitoring had some success (Bader (2013)), and Enikolopov et al. (2013) show that polling stations monitored by independent activists had fewer episodes of electoral vote manipulations.

We address concerns regarding electoral monitoring and social capital in Table A1. First, in column 1 we replicate the baseline specification from column 5 of Table 3. We add a control for political activism in column 2. The data come from the non-for-profit organization Voice ("*Golos*"), which created a system, SMS-TSIK, where observes could text the results of the elections in their polling stations. The variable that Voice measures is the share of polling stations in each region where observers were present during the March 2012 presidential election.[29] Though it was a different election, it took place only three months after the parliamentary elections of 2011, and the same networks of activists were used. Thus, we assume it is a reasonable proxy for political activism during the 2011 elections. The resulting coefficient of interest remained significant and even increased in magnitude. At the same time, Voice's estimate is negative and significant and is consistent with the predictions by Enikolopov et al. (2013), suggesting that the presence of observers decreases electoral manipulation.

In column 3, we use alternative measure of electoral monitoring from Buzin et al. (2016). In particular, we use a dummy if the region had independent observers during the 2011 parliamentary elections. The results are similar to those in column 2: the proxy for observers is negative and significant (regions with observers had

[29] For more information about the construction of variables introduced in this section, see the Appendix C.

0.55 standard deviation less fraud); point-estimate for the effect of protest becomes larger in magnitude.[30]

In columns 4–6, we test whether social capital is an important source of omitted variable bias. We use various measures such as the number of blood donors, trust, and the number of people who say in the survey that they would turn to their community in time of need. In column 4, we add a region-level control for the number of blood donors. The magnitude of the resulting coefficient becomes smaller but remains highly significant, thus supporting our main finding. Similarly, we add controls for level of trust and participation in community services in columns 5 and 6, respectively. The estimate for protests remains significant and does not differ from the one in column 4.

6.2. *Alternative Explanation II: Past Electoral Fraud and Manipulation Skills of Field Agents*

Another important possible alternative explanation concerns the possibility that electoral manipulation in the past influences the protest potential today.[31]

Thus if field agents that conducted more electoral fraud in previous Parliamentary elections of 2007 became more skillful and can make more (or costs of making fraud are lower) electoral manipulations in 2011. At the same time protests may correlate with the electoral fraud in 2007, thus biasing our estimate of interest.

However, the literature suggests that electoral fraud has a strong positive effect on protests, as people become unsatisfied with electoral manipulations (Tucker (2007), Way (2008), Beissinger (2011), Wellman et al. (2017)). However, in this case the bias will be against us finding negative effect of protest on electoral fraud. And as our coefficient is negative and significant, without bias it should be even larger in magnitude and even strengthening our results.

[30] The results also hold if we use share of polling stations that had observers.

[31] Electoral manipulation in 2011 should not affect protest potential in 2011, as the election took place *after* the survey.

6.3. *Alternative Explanation III: Strategic Complementarities among Field Agents*

In a recent article, Rundlett and Svolik (2016) presented a model based on a global games framework, where they demonstrate that if agents expect to be rewarded if the incumbent wins, and they know that other field agents have the same expectation, then they will be more likely to collectively overshoot the targeted level of manipulation. Thus, in areas where the regime is more popular, we expect to see more manipulation.

We address this concern in Table A2. The first column contains the baseline regression for the comparison. In column 2, we first control for the regime's popularity measured as the share of respondents supporting Putin. Putin's support is positive and significant: a 10 percentage point increase in the regime's popularity increases electoral fraud by 0.26 of its standard deviation. This result is consistent with the argument made by Rundlett and Svolik (2016). The point estimates for protests decrease in magnitude (from 4.7 to 3.7) while remaining significant and nontrivial in size.

We also include as controls alternative measures of regime popularity. In column 3, we use Dmitry Medvedev's support instead. The results remain significant. We also use approval for UR and for a regional governor in columns 4 and 5 respectively. While the coefficient for UR's approval remains significant, the one for the governor does not. Nevertheless, the estimate for protests remains stably negative and significant.

6.4. *Alternative Explanation IV: Unreliable Field Agents*

In Russia, field agents implementing electoral fraud do not come from the elite; they come from the masses. So, if the masses are disgruntled and want to protest, then the field agents might share the same sentiment and be reluctant to manipulate. Thus, if protests are positively correlated with dissatisfaction of the field agents, our estimates would be biased. To deal with this source of omitted-variable bias, we add controls for average wage of school teachers in that region. As most of the polling stations in Russia are located in schools, teachers are allegedly the main source of electoral manipulation. By coincidence, school teachers have dismally low salaries even compared to public-sector employees. Thus, controlling their salary we gauge their dissatisfaction and effort of committing electoral fraud.

The results are presented in Table A3. Similarly, the first column contains the baseline regression for the comparison. We add controls for price levels and average monthly wages in the region. These variables may be confounding and correlate with electoral fraud and protest level. To address the threat of unreliable field agents, we add a control for wages of public employees (working in regional administration) in column 2. They are the primary field agents, so their low wages may positively correlate with protest level, and negatively correlate with electoral fraud, thus confounding the results. The point-estimate for protests remains negative and significant, while decreasing slightly in magnitude. In column 3, we use expenditures for public goods provision as a control; however, the results hold. Following Forrat (2017) and Forrat (2018), we control for expenditures directly related to school teachers — the agents responsible for supervising polling stations. We add share of regional expenditures on education in column 4, and wages of school teachers in column 5. Wages of school teachers are positively correlated with electoral fraud, supporting the findings of Forrat (2017). In column 5, we also add control for the size of public sector; however, it does not affect our results. Nevertheless, while unreliable field agents indeed may affect efficiency of electoral manipulation, this factor does not contradict our main findings.

6.5. *Alternative Explanation V: Institutional Explanations*

In this section we address additional institutional concerns regarding institutional factors that may distort our results. Results of this section are presented in Table A4 where the first column contains the baseline results.

Bader and van Ham (2015) and Reisinger and Moraski (2017) argue that electoral manipulation is more likely to happen in regions that have both a larger non-Russian population and also some autonomy from the so-called "ethnic republics."[32] To address possible bias caused by ethnic republics with traditionally low levels of protests and high levels of electoral fraud, we add an indicator variable for ethnic republics in the baseline specification in column 2. This anomaly is consistent with our measure of electoral manipulation: deviations from the baseline measure of electoral fraud are 107% of standard deviation larger in the ethnic republics. The coefficient for protests remains significant, though its magnitudes decreases by 39%.

In case protest potential and electoral fraud are correlated with political culture (e.g., Hale (2007)) in column 3, we introduce control for "political competition." This variable is measure in an expert survey by the Carnegie Center (Petrov and Titkov (2013)) and is, probably, the best available proxy for the political culture. It is negatively (but insignificant) correlated with electoral fraud suggesting, that regions with higher political competition may indeed experience less manipulations; however, the coefficient of interest does not change. In case Carnegie Center's measure do not fully grasps regional democratic proclivities we control for the urbanization in column 4. The coefficient for urbanization is negative and significant; however, and our results hold.

In column 5, we employ these three institutional controls together. The coefficient for protests remains significant, while decreasing slightly in magnitude: a 10 percentage point increase in protest sentiments decreases electoral manipulations by 0.26 of its standard deviation.

To conclude, in this Section we addressed main alternative explanations. In Appendix E.2 we address the possibility of the pre-election day fraud. In case the government is afraid of the protests that can be caused by the electoral manipulations during the election day, they may substitute it with pre-election day manipulations.

[32] Table A10 shows that national republics are much more likely to have polling stations with near 100% turnout.

We find to correlation between protest potential and pre-election fraud, and demonstrate that its inclusion as a control variable does not affect our results. In Appendix E.3 we also address some additional concerns regarding possible omitted-variable bias. In Table A7 we show that our results are robust to inclusion of controls on geographical coordinates, number of regional newspapers, share of oil and gas sector of regional economies, and share of unemployment. Following Oster (2017) we also explore the sensitivity of our results to the potential omitted variables and show that the effect of unobservables should be very large to nullify our findings. We also show that our results are robust to outliers.

7. Discussion of External Validity and Conclusion

Questions about the role of institutions in non democracies are important for understanding politics around the world. In this paper, we offer a theory-guided statistical test that can help distinguish between two families of conjectures about the role of institutions: the Influence Theory and the Information Theory.

The Influence Theory implies that the government uses elections to project strength and deter potential opposition, while the Information Theory implies that government uses elections to identify the true level of support for the regime.

We have argued that the Information Theory implies that electoral manipulation will be used in places where protest potential is low, so this activity does not interfere much with the goal of getting accurate information. The Influence Theory implies that electoral manipulation is used in places where the regime is less popular, as a way to deter potential opposition. Therefore, a negative association between electoral manipulation and protest sentiment is consistent with the Information Theory and not consistent with the Influence Theory.

We tested the association between regime popularity and protest potential using data from the 2011 parliamentary elections in Russia and a regionally representative public-opinion poll. We found that the association between the digital fingerprints of electoral fraud and region-level protest sentiment is negative and substantial, thus corroborating the Information Theory.

To reiterate an earlier point, this empirical exercise does not suggest that these two theories exhaust the list of possible roles for authoritarian institutions. We focus on these theories because they produce different empirical predictions about the spatial distribution of electoral manipulation. Other theories, while being plausible, might not have empirical predictions related to electoral manipulation. We leave differentiating the effects suggested by those theories for further research.

Our results hold for a political regime with strong surveillance capacities (Soldatov and Borogan (2015)). Even though the current Russian regime does rely on pollsters and security agencies to deliver information about potential protest activity, it also seems to rely on electoral results to improve its understanding of public preferences.

There are many different political regimes whose institutions vary in the degrees of repressiveness. Our findings may not fit every political regime. However, a set of regimes exists, defined by Levitsky and Way (2002), as competitive autocracies e.g., Iran, Egypt (under Mubarak), Mexico (under PRI), Russia, Turkey, Ukraine (under Yanukovich). In such regimes, an incumbent has an unfair advantage over the opposition in elections. But the opposition exists, and often it can participate in the elections in some form and run campaigns. It is reasonable to expect that our results will hold in such political regimes, but further research is needed to make predictions regarding other authoritarian regimes.

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Online Appendix

to

"Information Acquisition and Projecting Invincibility in Authoritarian Elections"

A. Tables

Online Appendix Table A1: Alternative Explanation I: Observers and Social Capital

	Dependent variable: Electoral fraud (PCA)					
	Baseline					
	(1)	(2)	(3)	(4)	(5)	(6)
Protest	-4.65^{***}	-4.82^{***}	-5.03^{***}	-3.21^{***}	-3.29^{***}	-3.28^{***}
	(1.39)	(1.37)	(1.32)	(0.94)	(0.95)	(0.95)
Voice		-7.43^{*}				
		(4.35)				
Observers			-0.55^{***}			
			(0.19)			
Donors				0.03^{**}		
				(0.01)		
Trust					-0.78	
					(1.11)	
Community						-2.95
						(6.49)
Controls	✓	✓	✓	✓	✓	✓
Observations	74	74	74	66	68	68
R^2	0.358	0.386	0.435	0.350	0.285	0.281

Note: All regressions contain constants. The following variables are used as controls: log of GRP, education, Internet penetration, population density, distance to Moscow (km), and an indicator variable for the autonomy treaty. The main dependent variable is a first principal component of the four measures of electoral fraud: spikes, mixture estimator, BL, and extreme turnout. Robust standard errors are in parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Online Appendix Table A2: Alternative Explanation III: Strategic Complemetarities among Field Agents

	Dependent variable: Electoral fraud (PCA)				
	Baseline	Putin	Medvedev	UR	Governor
	(1)	(2)	(3)	(4)	(5)
Protest	-4.651^{***}	-3.725^{***}	-3.991^{***}	-3.859^{***}	-4.403^{***}
	(1.387)	(1.387)	(1.407)	(1.393)	(1.415)
Approval of Putin		2.611^{**}			
		(1.052)			
Approval of Medvedev			2.163^{*}		
			(1.160)		
Approval of UR				2.813^{**}	
				(1.263)	
Approval of Governor					0.706
					(0.773)
Controls	✓	✓	✓	✓	✓
Observations	74	74	74	74	74
R^2	0.358	0.414	0.391	0.404	0.366

Note: All regressions contain constants. The following variables are used as controls: log of GRP, education, Internet penetration, population density, distance to Moscow (km), and an indicator variable for the autonomy treaty. The main dependent variable is a first principal component of the four measures of electoral fraud: spikes, mixture estimator, BL, and extreme turnout. Robust standard errors are in parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Online Appendix Table A3: Alternative Explanation IV: Unreliable Field Agents

	Dependent variable: Electoral fraud (PCA)					
	Baseline					
	(1)	(2)	(3)	(4)	(5)	(6)
Protest	-4.651^{***}	-3.510^{**}	-3.920^{**}	-4.213^{***}	-4.594^{***}	-4.295^{***}
	(1.387)	(1.323)	(1.541)	(1.442)	(1.401)	(1.350)
Prices		−0.034	−0.013	−0.059	−0.088	−0.089
		(0.092)	(0.108)	(0.102)	(0.100)	(0.926)
Avg. Wages		-0.175^{***}	−0.008	0.009	-0.175^{*}	0.001
		(0.059)	(0.048)	(0.034)	(0.101)	(0.030)
Admin. Wages		0.153^{***}				
		(0.041)				
Expenditure			0.091			
			(0.233)			
Educ. GRP				0.156		
				(0.163)		
Educ. Wages					0.153^{**}	
					(0.075)	
Share Pub. Sect.						1.476
						(1.550)
Controls	✓	✓	✓	✓	✓	✓
Observations	74	74	72	74	74	74
R^2	0.358	0.483	0.357	0.376	0.406	0.375

Note: All regressions contain constants. The following variables are used as controls: log of GRP, education, Internet penetration, population density, distance to Moscow (km), and an indicator variable for the autonomy treaty. The main dependent variable is a first principal component of the four measures of electoral fraud: spikes, mixture estimator, BL, and extreme turnout. Robust standard errors are in parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Online Appendix Table A4: Alternative Explanation V: Additional Institutional Explanations

	Dependent variable: Electoral fraud (PCA)				
	(1)	(2)	(3)	(4)	(5)
Protest	-4.651***	-2.836**	-4.403***	-3.873***	-2.559**
	(1.311)	(1.105)	(1.259)	(1.287)	(1.087)
Ethnic Republic		1.069***			0.949***
		(0.287)			(0.265)
Political Competition			-0.209		-0.115
			(0.143)		(0.124)
Urbanization				-0.0281**	-0.0125
				(0.0118)	(0.0100)
Controls	✓	✓	✓	✓	✓
Observations	74	74	74	74	74
R^2	0.358	0.555	0.388	0.428	0.580

Note: All regressions contain constants. The following variables are used as controls: log of GRP, education, Internet penetration, population density, distance to Moscow (km), and an indicator variable for the autonomy treaty. The main dependent variable is a first principal component of the four measures of electoral fraud: spikes, mixture estimator, BL, and extreme turnout. Robust standard errors are in parentheses. *p<0.1; **p<0.05; ***p<0.01

B. Background: Russian Parliament

The lower house of the Russian Parliament ("Russian State Duma," or "*Gosudarstvennaya Duma*") is the major legislative body in Russia. According to the Constitution, it is responsible for lawmaking, major foreign policy decisions, no-confidence votes, and impeaching the president.

During the period that we focus on, the Duma was elected every four years through a closed-list proportional representation system. Every ballot had a list of parties, and a voter was allowed to vote for any one party. The 450 seats in the Duma are distributed among the parties that pass the 7% threshold proportional to their election results. Parties that win less than 7% of the votes receive no seats. Those seats that they could have received are redistributed among the winning parties thus increasing their presence in the Duma, in proportion to the votes they received.

Here we offer a brief description of the major parties in Russia. The biggest party in terms of parliamentary representation is United Russia ("*Edinaya Rossiya*"). It won 49% in 2011 and is closely aligned with Vladimir Putin.[33] UR is expected to be a major beneficiary of electoral manipulation (see Reuter (2017) on the origins of UR as a dominant party). Next, with 19% of the 2011 vote, is the CPRF ("Communist Party of the Russian Federation"). The main legal opposition party, CPRF considers itself the successor of the Communist Party of the Soviet Union. Two other parties passed the threshold in 2011: the nationalist Liberal Democratic Party of Russia (LDPR), 11.6%, and a socialist party, Just Russia (JR), 13.2%.

C. Data Appendix

In this section, we discuss sources and data construction for the control variables used in baseline regressions and robustness checks. Most of the data come from two sources: the International Center for the Study of Institutions and Development (ICSID) databases collected by the National Research University Higher School of Economics; "georating" survey by FOM ("The Public Opinion Foundation"). All variables are from the 2011 calendar year, unless stated otherwise.

- GRP: Gross regional product (a subnational equivalent of GDP), log of millions of rubles, basic prices.[34] Source: ICSID.
- Education: Share of people with higher education: BA/BS or above, ("*vysshee obrazovanie*"). Source: ICSID.
- Internet: Internet penetration. Source: ICSID.
- Pop. Density: population density. Source: ICSID.

[33]He was number one on the party list in 2007, and his hand-picked successor, Dmitry Medvedev, led the party into the 2011 elections.

[34]In Russia, GRP is measured in basic prices, i.e., net of taxes, including subsidies on products. GRP is determined by using the production approach, i.e., as the difference between the region's gross output and intermediate consumption, or as the sum total of all the values added by all the economic activities in the region.

- Distance to Moscow: Distance from a regional capital to Moscow, in kilometers. Source: ICSID.
- Treaty: Indicator variable for the existence of a treaty between the central government and the region. Source: `www.politika.su/reg/dogovory.html`.
- Ethnic Republic: Indicator variable for the region to be an ethnic republic.
- Educ. Wage: Average monthly wage of a school teacher in a province in 2013, in rubles. Source: Rosstat — Central Statistical Database, Incomes and Standard of Living.
- Educ. GRP: Educational expenditures as a share of GRP. Source: ICSID.
- Expenditure: Indicator of efficiency of public spending. Source: ICSID.
- Admin. Wage: Average monthly wage of public service employee in a province, in rubles. Source: ICSID.
- Avg. Wage: Average monthly wage in a province, in rubles. Source: ICSID.
- Prices: Consumer price index, December-to-December, expressed as a percentage. Source: ICSID.
- Approval of the Putin: Share of respondents who strongly or somewhat strongly approve of the actions of Prime Minister Putin. Source: FOM georating.
- Approval of Medvedev: Share of respondents who strongly or somewhat strongly approve of the actions of President Medvedev. Source: FOM georating.
- Approval of UR: Share of respondents who strongly or somewhat strongly approve of the actions of the Parliament party "United Russia." Source: FOM georating.
- Approval of Governor: Share of respondents who strongly or somewhat strongly approve of the actions of the local governor in each region. Source: FOM georating.
- Voice: Share of total number polling stations in each region that had observers during the presidential elections of 2012. Source: `www.sms-cik.org/`.
- Observers: Indicator variable for regions with observers during the parliamentary elections of 2011. Source: Buzin et al. (2016).
- Donors: Number of blood donors per capita in each region. Source: Collected from `www.yadonor.ru` by the "Blood Service" program.
- Trust: Share of people that responded that generally people should be trusted out of the total number of respondents in each region. Source: FOM georating.
- Community: Share of respondents in each region who participate in community services. Source: FOM georating.

D. Methods of Electoral Manipulation Estimation: Benford's Law

One of the measures of fraudulent elections employs Benford's Law. Traditionally, Benford's Law postulates nonuniform distribution of leading digits in large data sets. Here we apply Benford's Law to the second digit of two sets of data: turnout percentages and percentage of the total vote won by UR. We cannot use first digit, because turnout is capped by construction with digit three: there is no polling station in Russia with at least 4,000 people. Thus, following the existing literature we use second digit.

Benford's Law has been demonstrated to describe the distribution of the heights of buildings around the world (regardless of the unit of measurement), the length of rivers, voting results, economic performance, the urban population, the size of the human genome, and many other phenomena.[35] As most distributions appear to be smooth and symmetric due to the Central Limit Theorem (according to Hill (1995)), data tend to follow Benford's Law; if they do not, then most probably certain types of errors have to be introduced to the data.

The method based on Benford's Law has been borrowed from fraud detection in statistics (e.g., Leemis et al. (2000); Diekmann (2007); Corazza et al. (2018)), forensic financial accounting (e.g., Drake and Nigrini (2000); Durtschi et al. (2004); Nigrini (2012); Amiram et al. (2015)), and finance (e.g., De Ceuster et al. (1998); Tam Cho and Gaines (2007); Pimbley (2014)). For electoral fraud detection, it was first used in Pericchi and Torres (2004). This method operates under the following assumption: if a person writes fictional figures in a report, they instinctively try to distribute them evenly; that is, all figures will meet in the first place with the same probability.

Benford's Law distribution is widely used in papers employing forensic methods to study electoral fraud (Mebane (2006a), Mebane (2006b), Mebane (2007a), Mebane (2007b), Mebane (2008a), Kalinin (2008), Kalinin and Mebane (2009) and Kalinin and Mebane (2011). For example, Mebane (2007a) studies parliamentary elections in Mexico in 2006, by comparing differences between the means of the second digits with the means expected according to the 2BL distribution. In addition Kalinin (2008) and Mebane (2008a) used the same data as we do, counting second-digit conditional means to compare them with other fraud-detection methods.

Benford's Law (Raimi (1976), Hill (1995)) stipulates that the probability of a number that begins with a set of digits is $\log_{10}\left(1+\frac{1}{n}\right)$. Therefore, we can sum over the probabilities that $11, 21, ..., 91$ each existing to get the probability of the second digit being a 1. If we do this for all digits, we reach the following table of probabilities for second digits:

2nd Digit	0	1	2	3	4	5	6	7	8	9
Prob. , %	11.97	11.39	10.88	10.43	10.03	9.67	9.34	9.04	8.76	8.50

In general, the joint distribution of any combination of digits is as follows (Hill (1995)):

[35] The site http://testingbenfordslaw.com/ can find a large number of such examples. An overview of the 2011 Russian parliamentary elections by Mellnik et al. (2015) can be found here: http://testingbenfordslaw.com/2011-russian-parlimentary-elections-united-russia.

$$Pr\left(D_1 = d_1, ..., D_n = d_n\right) = \log_{10}\left(1 + \frac{1}{\sum d_i \cdot 10^{k-i}}\right). \quad (1)$$

And in our case, we define the marginal distribution for the second digit $d_2 = 0, 1, ..., 9$ as follows:

$$Pr\left(d_2\right) = \sum_{k=1}^{9} \log_{10}\left(1 + \frac{1}{10k + d_2}\right). \quad (2)$$

Mebane (2006a) proves that Benford's Law can be applicable to the second digits of votes. He provides Pearson chi-squared statistics for two kinds of tests. The first is whether the distributions of the second digits of vote counts for various US elections match the distribution specified by Benford's Law. Second is whether the second digits occur equally often (uniform distribution). He computes two statistics,

$$X^2_{B_2} = \sum_{i=0}^{9} \frac{(d_{2i} - d_2 q_{B_2 i})^2}{d_2 q_{B_2 i}} \text{ and } X^2_{U_2} = \sum_{i=0}^{9} \frac{(d_{2i} - d_2/10)^2}{d_2/10},$$

where $q_{B_2 i}$ denotes the expected relative frequency with which the second significant digit is i (shown above), d_{i2} the number of times the second digit is i among the J precincts being considered, and set $d_2 = \sum_{i=1}^{9} d_{2i}$. By comparing these two statistics with $\chi^2(9)$ - distribution, which has a critical value of 16.9 at the 5% confidence level, and conducting a similar test with the first digit Mebane (2006a) concludes that usage of the second-digit test is more appropriate.

The measures constructed for this paper are the mean absolute deviations (MAD) from this distribution.[36] We take this Benford's Law distribution and compare it to the distribution of second digits in the data. Then we use shares to describe both distributions (e.g., 0.1135). Then,we calculate the absolute difference between the expected Benford's Law distribution and the empirical distribution at each digit. Finally, we sum all of these deviations, then we take the mean of the deviations, producing the mean absolute deviation.

The MAD is constructed as follows:

$$MAD = \frac{\sum_{i=1}^{10} |AD - ED|}{10}, \quad (3)$$

where AD is an actual distribution — the empirical frequency of the number and ED is an expected distribution — the theoretical frequency expected by Benfords distribution. The scale invariance of the MAD statistic makes it useful when examining large pools of digits, since the number of polling stations in each region and (sometimes) year is different.

Implementing this in R Development Core Team (2008) is simple thanks to the 'benford.analysis' package. This package creates the Benford's Law distribution for

[36] We do not use the Kolmogorov-Smirnov statistic; it becomes less useful as total number of digits used increases (Nigrini (2012)). As a result, the Kolmogorov-Smirnov statistic tends toward over-rejection as the pool of digits increases. On the other hand, MAD does not take the total number of digits into account.

the first two digits and the empirical distribution. We followed the procedure above (summing over $11, 21, ..., 91$) to get the second-digit distribution for both Benford's Law and empirical distribution. We then constructed the MAD from these two distributions.

Our results also hold if we use the "Digit Deviation" (Turnout) test from Mebane (2008b) and Kalinin and Mebane (2011). It represents the sum of absolute deviations from a uniform distribution of the trailing digit in turnout percentages.

To calculate this, we first constructed the expected distribution of trailing digits $0, 1, ..., 9$ as if all were equally probable (each occur with probability 0.1). Then, we rounded all of the turnout data to the nearest 1 and observed in the data the frequency of trailing digits in turnout data. For example, if the turnout is 69.3%, we round to 69 and the trailing digit is 9. We then calculate the share of data that ends in each digit. Therefore, if fraud exists, we should expect anomalies in this data (especially deviations at 0 and 5, given tendencies of past Russian elections). We then summed the deviations from the expected distribution across all digits 0 to 9.

E. Additional Robustness and Sensitivity Checks

E.1. Robustness to Alternative Measures of Protest Potential

In this Section, we check sensibility of our results to alternative measures of the explanatory variable.

One possible concern is related to the fact that the FOM's survey took place nine months before the election. It would create a measurement error. In case of a classical measurement error we would have attenuation of the coefficient of interest what would be against us finding negative effect of protest potential on electoral fraud. However, if the measurement error is not classical, the direction of bias may be ambiguous.

To address this concern we use the data from Robertson (2013) who counted actual number of protests in Russian regions in 2011. While the theory suggest that we need to use protest potential rather then actual protests, number of protests in November 2011 provide us a good snapshot of protest activity just before the December's election.

We present our results in Table A5. In column 1, we report the baseline results with the protest potential computed on FOM's data. In column 2, we use number of protest in November 2011 as the main explanatory variable. The coefficient of interest remains significant, suggesting that we indeed measure protest potential. Column 3, where we use total number of protests during September, October, and November yield similar results.

Online Appendix Table A5: Regressions with Protest Data from Robertson (2013)

	Baseline	One Month	Three Months
Protest Sentiments	-4.65^{***}		
	(1.31)		
Nov. Protests.		-0.21^{*}	
		(0.92)	
Sep., Oct., Nov. Protests			-0.32^{**}
			(0.12)
Controls	✓	✓	✓
R^2	0.36	0.30	0.33
Observations	74	74	74

Note: All regressions contain constants. The following variables are used as controls: log of GRP, education, Internet penetration, population density, distance to Moscow (km), and an indicator variable for the autonomy treaty. The main dependent variable is a first principal component of the four measures of electoral fraud: spikes, mixture estimator, BL, and extreme turnout. Robust standard are errors in parentheses. *p$<$0.1; **p$<$0.05; ***p$<$0.01

E.2. Alternative Explanation VI: Pre-election Day Fraud

Another possible alternative explanation is related to the possibility of the pre-election day fraud. For example, if the government is afraid of the protests that can be caused by the electoral manipulations during the election day, they may substitute it with pre-election day manipulations. In this case we would make us see less fraud in regions with high protest potential (thus supporting the Information theory against the Influence theory.

Pre-election day fraud is not unusual in authoritarian regimes (Simpser and Donno (2012)). For example, Frye et al. (2014, 2018) document the most widespread type of such manipulations in Russia: voter intimidation through work-place mobilization. They estimate the measure of work-place mobilization in Russian regions as a share of the total number workers who were intimidated to vote divided by the total number of workers in employed in companies with ties to the government during Russian elections of 2011-2012. We use this data to address this important alternative explanation in Table A6.

We present our baseline results in column 1 for comparison. In column 2, we add measure of pre-election day fraud as control variable. The coefficient of interest did not change much suggesting that channel between pre-election and election day manipulations goes not through the protest potential. Moreover, the size of the point-estimate for the pre-election day fraud is insignificant. In column 3, we use protest potential as the dependent variable, and pre-election day fraud as the main explanatory variable and omit the measure of electoral day fraud. Absence of the correlation between the work-place mobilization and the protest potential means that protests do not depend on pre-electoral fraud.

Online Appendix Table A6: Alternative Explanation VI: Pre-Electoral Fraud

	Baseline	Fraud	Protest
Protest	-4.65^{*}	-4.43^{*}	
	(1.31)	(1.50)	
Pre-Elec. Fraud		0.10	0.02
		(0.20)	(0.01)
Controls	✓	✓	✓
R^2	0.36	0.36	0.46
Observations	74	73	73

Note: First column shows the baseline result. The second column controls for pre-electoral fraud. The third column uses protest sentiment as dependent variable and shows that it does not depend on pre-electoral fraud All regressions contain constants. The following variables are used as controls: log of GRP, education, Internet penetration, population density, distance to Moscow (km), and an indicator variable for the autonomy treaty. The main dependent variable is a first principal component of the four measures of electoral fraud: spikes, mixture estimator, BL, and extreme turnout. Robust standard errors are in parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

E.3. Additional Robustness Checks

In this section, we address some additional concerns regarding possible omitted-variable bias. The results are presented in Table A7, where column 1 contains the baseline specification for a comparison.

In unlikely case that there is an improvisational dynamic built into how the Kremlin and its regional clients react to information about the extent of regime support available from regions that have already returned their first voting results we add latitude and longitude as controls. Nevertheless, inclusion of these variables in column 2 does not affect our results.

The literature also suggests (Lipman et al. (2018)) that regional media less affected by the federal propaganda machine may induce protest sentiments while negatively affecting electoral fraud. Thus, in column 3, we add a control for the number of regional newspapers published in 2011. As expected, the coefficient for regional media is negative and significant. Moreover, the estimate for electoral manipulation also moved in the expected direction, in line with the existing literature.

Some analysts have suggested that dependence on oil sector may affect subnational regime dynamics (Mahdavi (2015)). We add a control in column 4 for the share of oil and gas in the regional GRP; however, find that it does not correlate with electoral fraud and did not affect the coefficient of interest. In column 5, we control for regional unemployment rates, which may potentially it can positively affect protest sentiments and be correlated with electoral fraud. However, adding unemployment rates as a control does not change our results.

Finally, in column 6, we employ all our controls together. The coefficient for protests remains significant, while decreasing slightly in magnitude: a 10 percentage point increase in protest sentiments decreases electoral manipulations by 0.44 of its standard deviation.

Online Appendix Table A7: Additional Robustness Checks

	Dependent variable: Electoral fraud (PCA)					
	Baseline					
	(1)	(2)	(3)	(4)	(5)	(6)
Protest	-4.65^{***}	$--4.69^{***}$	-5.07^{***}	-4.25^{***}	-4.83^{***}	-4.45^{***}
	(1.39)	(1.38)	(1.35)	(1.19)	(1.35)	(1.43)
Latitude		-0.041				-0.03
		(0.03)				(0.24)
Longitude		-.006				0.001
		(0.010)		0		(0.007)
Newspapers			-0.24^{**}			-0.10
			(0.10)			(0.08)
Oil				0.002		0.0002
				(0.002)		(0.002)
Unemployment					0.12^{**}	0.08
					(0.06)	(0.076)
Controls	✓	✓	✓	✓	✓	✓
Observations	74	74	74	64	74	64
R^2	0.358	0.399	0.411	0.297	0.400	0.388

Note: All regressions contain constants. The following variables are used as controls: log of GRP, education, Internet penetration, population density, distance to Moscow (km), and an indicator variable for the autonomy treaty. The main dependent variable is a first principal component of the four measures of electoral fraud: spikes, mixture estimator, BL, and extreme turnout. Robust standard are errors in parentheses. *p<0.1; **p<0.05; ***p<0.01

E.4. *Exploring Selection on Unobservables*

Despite the rich set of control variables, some unobserved heterogeneity may still bias the estimate of interest if an omitted variable is correlated with both anti-government protests and electoral fraud. To address the concern about the effect of unobservables, we follow Oster (2017) by evaluating the likelihood that the coefficient estimate is biased by omitted variables. This procedure suggests adopting the conservative bounding value for the R-squared (R_{max}) from the hypothetical regression with all observable and unobservable controls all together, and then finding the value of the coefficient of proportionality (δ) for which the estimator would produce a treatment effect of zero. Thus, intuitively, the coefficient of interest can be expressed as a function of δ and R-squared movements ($\beta = \beta(\delta, R_{max})$), and by setting $\beta = 0$ we can calculate how big the effect of unobservables δ given R_{max} should be.

The results of the robustness test are shown in Table A8. In Columns 1–5, we present results for all five measures of electoral fraud. Each column reports δ for different values of $\overline{R_{max}}$. Following Oster (2017), we use the value of $\overline{R_{max}} = 1.3R^{UR}$. For the baseline specification in Column 5, $R^{UR} = 0.36$, thus $\overline{R_{max}} = 0.47$. The value of δ for the baseline measure of electoral manipulation suggests that the unobservables would need to be 1.16 times as important as the observables to completely explain away the effect of protest sentiments. Similarly, all other values of δ are above 1, suggesting that our results are robust to potential confounding by unobservables.

Online Appendix Table A8: Selection on Unobservables

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable:				
	Spikes	Mixture Est.	Digit Est.	Extr. Turnout	PCA
Delta	1.26	1.17	1.27	1.12	1.16
$\overline{R_{max}}$	0.369	0.488	0.332	0.457	0.467

Note: The first row reports the coefficient of proportionality δ computed by using the psacalc STATA code (Oster (2017)). The $\overline{R_{max}}$ is computed as $1.3R^{UR}$, where R^{UR} is an R-squared of the regression with the full set of controls. See Table 3 for the list of controls.

E.5. Robustness to Outliers

Table A9 presents the results of our efforts to ensure that our results are not driven by a handful of outliers. We start by reporting the baseline specification in column 1. In column 2, we omit two largest Russian cities, Moscow and Saint Petersburg. The coefficient of interest remains significant and does not change. In column 3, we similarly omit three observations with the strongest protest sentiments (Kaliningradskaya Oblast, Kurskaya Oblast, and Novgorodskaya Oblast). The protest sentiment coefficient remains significant and even increases in magnitude. Then, in column 4, we drop three observations with the largest share of electoral manipulation (Republic of Kabardino-Balkaria, Republic of Karachayevo-Cherkessia, and Republic of Mordovia). While the point-estimate for protest sentiment decreases in magnitude, it remains negative and significant. Finally, in column 5, we omit the three ethnic republics with the largest population (Bashkortostan, Daghestan, and Tatarstan). The estimate for protest sentiment decreases slightly but remains significant. Overall, this table suggests that our results are not caused by statistical artifacts in the data. We also use robust regression with the automated deletion of observations that have a Cook's distance (a statistic that combines leverage and residual) larger than one. However, this method chooses to drop only Moscow from the sample, yielding results similar to the specification in column 2 of Table A9.

Online Appendix Table A9: Robustness to Outliers

	Dependent variable: Electoral fraud (PCA)				
	(1)	(2)	(3)	(4)	(5)
Protest	-4.651^{***}	-4.841^{***}	-5.299^{***}	-3.798^{***}	-4.032^{***}
	(1.387)	(1.387)	(1.607)	(1.084)	(1.403)
w/o Capitals		✓			
w/o Largest Protests			✓		
w/o Largest Fraud				✓	
w/o Largest Rep					✓
Observations	74	72	71	71	71
R^2	0.358	0.379	0.363	0.270	0.339

Note: All regressions contain constants. The following variables are used as controls: log of GRP, education, Internet penetration, population density, distance to Moscow (km), and an indicator variable for the autonomy treaty. The main dependent variable is a first principal component of the four measures of electoral fraud: spikes, mixture estimator, Benford's Law, and extreme turnout. Robust standard errors are in parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

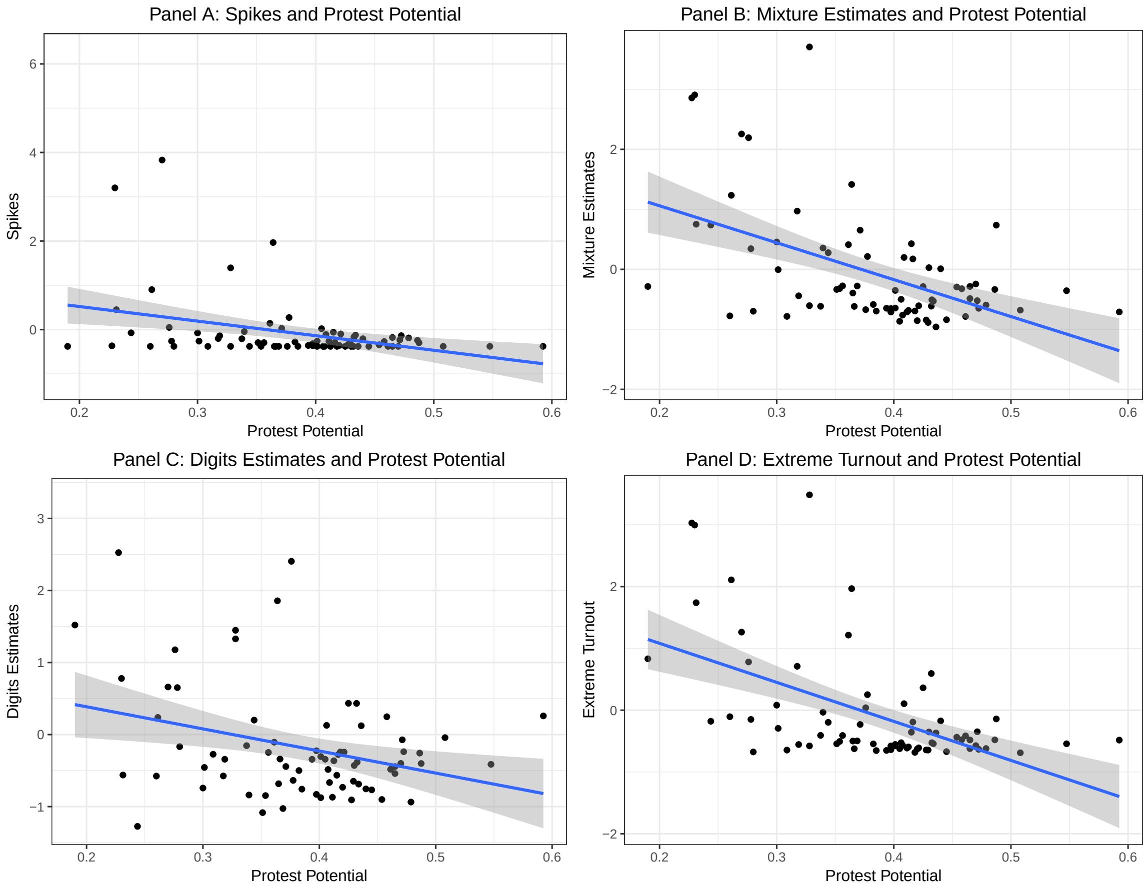
F. Additional Tables and Figures

Online Appendix Table A10: Ethnic Republics vs. Other Regions

	2003		2007		2011	
Total Turnout (%)	54.7		59.0		60.2	
Share of UR (%)	37.6		64.3		49.3	
	Ethnic Republics	Oblasts	Ethnic Republics	Oblasts	Ethnic Republics	Oblasts
Turnout (%)	68.8	53.4	79.3	61.0	76.1	57.3
Share of UR (%)	35.2	18.4	62.6	37.1	54.2	25.1
Number of polling stations	17,360	77,622	17,897	78,349	17,734	77,423
100% turnout	1,695	2,538	2,383	2,549	1,532	2,229
of than 100% for UR	72	37	310	92	124	68
90-100 % turnout	3,627	2,561	6,729	6,015	6,311	4,305
> 90% for UR	714	22	3,367	431	2,500	437
80-90 % turnout	2,555	5,087	2,666	9,101	2,614	6,293
> 80% for UR	71	7	239	145	389	85

Note: Turnout is a share of voters who reportedly voted in a parliamentary elections in a given year. *Share of UR* is a share of ballots cast in support of the major pro-government political party UR. Source: Central Election Commission of the Russian Federation.

Online Appendix Figure A.1: Electoral Fraud and Protest Potential: Scatter Plots



Note: Panels A through D above correspond to columns (1) through (4) of Table 3. All four measures of electoral fraud exhibit very strong negative correlation with protest sentiments, even without controls. Measures of spikes (A) and extreme turnout (D) capture mostly extreme fraud, thus many observations have many near-zero values of electoral fraud. Meanwhile, mixture (B) and digit-test (C) estimators can catch more subtle electoral manipulations and have more regional variation.