October 12, 2021

CSH Policy Brief

Election forensics of the Russia 2021 elections statistically indicate massive election fraud

Electoral fraud in Russia is not a particularly new phenomenon. The recent legislative election (450 seats of the State Duma (lower house)) held 17–19 September 2021 has been reported to be no exception, see [1–6]. The election resulted in a 49.82 % (324 seats) victory of United Russia (UR), the ruling party since 2007, whose de facto leader is Vladimir Putin.

Here we present an election forensic analysis of the recent Russian elections that clarifies to what extent voting irregularities are detectable in the outcomes of the election data on the level of voting stations and whether these irregularities were relevant for the election outcome. We use statistical forensics tests to quantify the extent to which the observed election results are compatible with specific types of electoral malpractices. In particular, we test if ballot-stuffing (multiple ballots per person during the voting process) and voter rigging (intimidation and coercion of voters) might have occurred and if yes, to what extent. We perform statistical tests to identify numerical anomalies in the election results.

For the 2021 Duma election, we find systematic and highly significant statistical support for the presence of both, ballot-stuffing and voter rigging. In about half of all voting districts different degrees of ballot-stuffing have to be assumed to explain the observed statistics. In 49 % of stations, we find signs for ballot-stuffing with a standard deviation (uncertainty of ballot-stuffing probability) of 1.6 % (30 sigma event). An inflated turnout in voting stations, in combination with an increased vote share for UR, does hint at a systematic practice of ballot-stuffing. In addition, we find that smaller voting stations contribute much stronger to statistical irregularities in the empirical vote–turnout distribution than larger stations, which strongly suggest the practice of voter rigging. Removing the ballot-stuffing- and voter rigging characteristic anomalies from the data would yield the overall outcome for UR at around 30 % instead of 50 %.

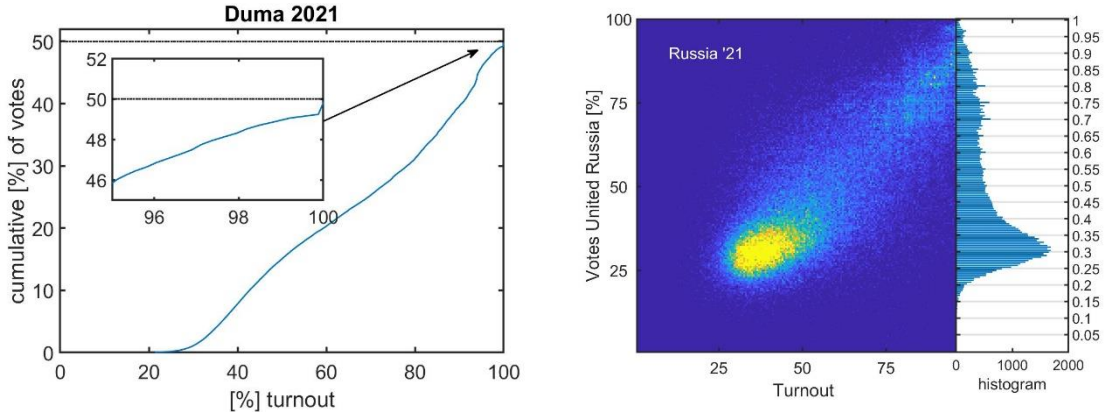
The 2021 legislative Duma election

The State Duma (lower house) election in Russia, held 17–19 September 2021, lead to a victory of the ruling party United Russia (49.82 %) This corresponds to 324 of the 450 seats in the Duma. The party Just Russia (SRZP) that also supports Vladimir Putin obtained 7.46 %, or 27 seats. The election has been reported to be fraudulent in various media [1, 2, 3]. Several episodes of ballot-stuffing were recorded [4]. The election was preceded by "managed democracy" practices of eliminating opposition leaders [5]. Here, we report on the extent of election fraud in the actual election process based on data on the level of individual voting stations [6]. Data was scraped by Sergey Shpilkin [7]. This was necessary because of obvious data obfuscations practices on the web page of the Russian Central Election Commission [8].

In the following analyses the data consists of 96,325 electoral units (also referred to as "districts" here) for which we consider electorate size (number of vote eligible population), number of valid votes, and the number of votes for *United Russia* (UR). When applying the election forensics tests, all electoral units with an electorate of less than hundred voters are excluded to rule out that results are driven by artefacts from small numbers bringing the number of electoral units down to 92,135. The number of valid votes divided by electorate size are referred to as the *voter turnout*, the number of votes divided by valid votes are called *vote shares*.

Voter turnout inflation

Figure 1A provides first evidence for a highly atypical voter turnout distribution, when compared to election results from mature democracies. The figure shows the percentage of the winning party (i.e., *United Russia*) on the y-axis as a function of the voter turnout on the x-axis. The figure considers all electoral units with less than a given percentage of turnout and gives the vote shares for UR when including only those units. By including more and more districts, with increasing cumulative turnout, the vote share for UR becomes inflated. This inflation even accelerates when approaching districts with almost a full turnout (100 %). The dashed line indicates the threshold for reaching the absolute majority (more than 50 % of all valid votes). Even though there is an additional boost when approaching 100 % (Inset in Figure 1A), the vote shares fall short of reaching 50 % by a small margin.



(A) (B)

Figure 1A: *We count the share of all votes that United Russia received when looking at all electoral units that have not more than a given level of turnout. The plot shows that UR typically less vote shares in low-turnout districts.*
Figure 1B: *Election fingerprint, a two-dimensional histogram of turnout and vote shares. The colour scale denotes the number of districts with a given turnout and percentage of votes, increasing from blue to yellow. We observe the bulk of districts with vote shares and turnout between 25 and 50 %. However, a substantial number of districts has an inflated turnout, and this inflation almost always coincides with an increased vote share for UR. Next to the y-axis we show the histogram of all vote shares for districts with more than hundred voters. The effect of round numbers is clearly visible, with a disproportionate number of districts with UR receiving, e.g., 70 %, 75 %, … 95 % of all votes.*

More details regarding the atypical vote–turnout distribution can be seen in Figure 1B, where a so-called election fingerprint is shown [12, 13, 14]. This is a two-dimensional histogram showing the voter turnout and the percentage of votes for UR. Every voting district has a turnout and a result (% for winning party) and adds to the histogram. The bulk of districts (yellow blob in the middle) has a turnout between 25 % and 50 % coinciding with vote shares for UR typically ranging between 25 % and 50 %. This is also shown by the vote share histogram revealing a clear peak in districts with vote shares around 32 %. The “blob” is smeared out toward the upper right corner, indicating a disproportionate number of districts with an inflated turnout that almost always coincides with an inflated vote share for UR. Typically, in elections in mature democracies, the smearing effect towards the upper righthand corner is absent.

In addition, percentages of exactly 70 %, 75 %, 80 %, etc. are visibly over-represented in the vote shares (right panel in Figure 1B). As can be seen in the histogram, there are clear spikes for districts that have vote shares of 70 %, 75 %, 80 %, etc. This effect has been observed in previous Russian elections and was interpreted as a sign of fraudulent vote counting [9, 10, 11].

Statistical evidence for ballot-stuffing

A possible explanation for the atypical vote–turnout distribution is ballot-stuffing and can be made quantitative through a statistical approach to election fraud [10, 11, 12, 13]. Ballot-stuffing refers to the electoral malpractice of stuffing multiple ballots into a box on top of the "normal" election results. Under the assumption that such malpractices occurred, one can formulate a statistical model that assesses how many districts have to be affected by ballot-stuffing in order to reproduce the observed statistics [12].

The results of the statistical model are shown in Figure 2. Figure 2A shows the vote–turnout distribution as it is expected to look like in the absence of ballot-stuffing, as it is typically observed in mature democracies. In the statistical model one has to assume that 49 % (+/– 1.6 %) of all electoral districts show an inflated turnout in combination with inflated vote shares for UR (see Figure 1B) in order to reproduce the shape of the vote–turnout distribution that was empirically observed in Figure 2. This means that in half of all voting districts different degrees of ballot-stuffing need to be assumed to explain what was observed in the statistics. The probability to observe such an election outcome in the model without ballot-stuffing can computationally not be distinguished from zero.

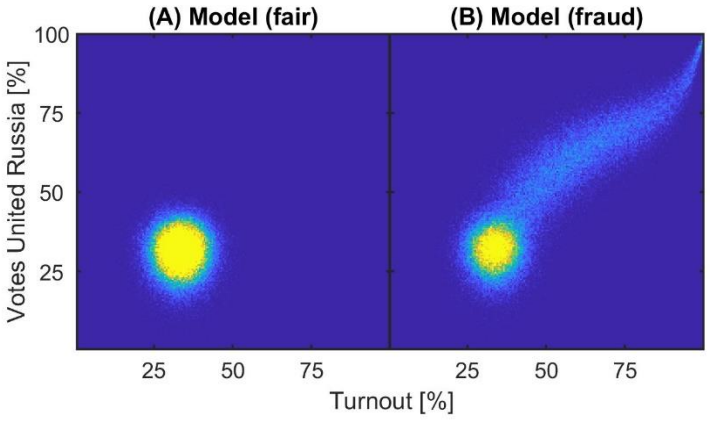


Figure 2: *Results from the ballot-stuffing model. In the model, a "fair" election would lead to a symmetrical vote–turnout distribution* **(A)**, *as it is typically observed in mature democracies. In order to approximate the shape observed in the 2021 Russian Duma election* **(B)**, *one has to assume that about 50 % of all electoral districts show an inflated turnout that coincides with increased vote shares for UR, as is characteristic for ballot-stuffing.*

Previous works on election fraud detection have shown that geographic factors play a role in how susceptible various regions, in particular rural areas, are for electoral malpractices [14]. In brief, the smaller and the more remote a district is, the less likely it is to be visited by observers (international or from multiple political parties) and the easier it is to deny specific (groups of) people their right to cast their votes in a fair way. The practice of intimidation and coercion of voters has been termed voter rigging.

To capture the extent of voter rigging a different statistical test of electoral fraud has been developed, the so-called *voter rigging test* [15]. This test compares vote shares and turnout of a given electoral unit belonging to the same administrative division (making it likely that the voting station is visited by people with similar distributions of political preferences) and then evaluates whether small voting stations are more likely to show inflated vote and turnout than comparable large ones.

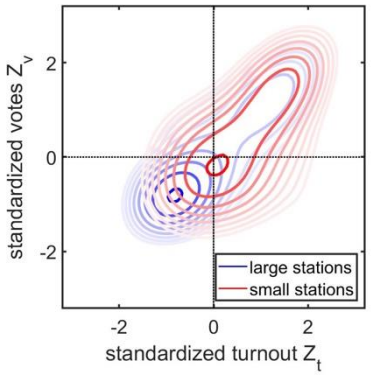


Figure 3: *Results for the voter rigging test. Small (red) and Large (blue) voting stations are compared in terms of their vote and turnout distributions to other, geographically nearby stations that are assumed to be visited by people with similar distributions of political preferences. The vote–turnout distributions for small and large stations are shown as "equi-density" contour lines; the more intense the colour, the larger the number of districts with the given vote–turnout shares. The peak for small stations is clearly displaced from the peak of larger stations, revealing that smaller stations are much more likely to show inflated vote shares and turnout.*

Results of the voter rigging test are shown in Figure 3, where small stations are defined as those with an electorate size being in the lowest ten percentiles. To adjust for geographic heterogeneities, for each electoral district we subtract the average vote shares/turnout of all stations and the same administrative region and divide by the corresponding standard deviation to obtain *standardized* votes and turnouts. For small stations, the peak in the standardized vote–turnout distribution is clearly displaced from the larger stations in the direction of inflated turnout, coinciding with inflated vote shares for UR. This means that smaller stations contribute much stronger to the statistical irregularities observed in the empirical vote–turnout distribution than larger stations, indicating the presence of voter rigging.

Conclusion

An election forensic analysis of the recent Russian Duma elections shows significant signs for systematic electoral fraud of different type. It is shown that about 20 % out of the almost 50 % of vote shares would not have been obtained without ballot-stuffing that is apparent in a massive voter inflation (much higher than (statistically) normal voter turnout) in a huge number of voting stations in combination with a much higher than (statistically) normal fraction of votes for *United Russia*, i.e. Putin's party. We find substantial signs for systematic voter rigging in small and peripheral regions. In conclusion it must be stated that the outcome of the Russian Duma election 2021 is from a statistical point of view highly unlikely to represent an outcome of a free and fair democratic election.

CSH scientists: Stefan Thurner, Peter Klimek (CSH & Medical University of Vienna)

References

[1] Troianovski A, In Russia Election Results, Online Votes Sweep Putin Opponents Aside, New York Times, Sept 20, 2021.

[2] Troianovski A, Nechepurenko I, Russian Election Shows Declining Support for Putin's Party, New York Times, Sept 19, 2021.

[3] "Russian parliament remains in hands of Putin's party after elections". Courthouse News Service. Retrieved 27 Sept 2021.

[4] Litvinova D (20 September 2021). "Mop up: Ballot-stuffing videos taint Russian election". Associated Press.

[5] Kramer A E (17 September 2021). "Fake Parties and Cloned Candidates: How the Kremlin 'Manages' Democracy". The New York Times. Retrieved 27 September2021.

[6] https://github.com/dkobak/elections/tree/master/data

[7] https://gistcdn.githack.com/alexshpilkin/bf25962064e570d10aca9a8a4b325b78/raw/a153d79965e74dab532f38d7eddff8db82b0d064/unfuck.py.html

[8] https://twitter.com/hippopedoid/status/1439897585783803914 and https://twitter.com/hippopedoid/status/1443594428963336199

[9] https://www.themoscowtimes.com/2016/09/19/statistical-evidence-suggests-russias-ruling-party-cheated-its-way-to-a-supermajority-a55396

[10] Kobak D, Shpilkin S, Pshenichnikov M S. "Integer percentages as electoral falsification fingerprints", Annals of Applied Statistics 10, 54-73 2016

[11] Kobak D, Shpilkin S, Pshenichnikov M S. "Statistical fingerprints of electoral fraud?" Significance (Royal Society) 13, 20-23 2016.

[12] Klimek P, Yegorov Y, Hanel R, Thurner S. Statistical detection of systematic election irregularities. PNAS 106(41), 16469-16473 2012.

[13] Klimek P, Jiménez R, Hidalgo M, Hinteregger A, Thurner S. Forensic analysis of Turkish elections in 2017-2018. PLoS one 13(10), e0204975 2018.

[14] Jiménez R, Thurner S, Pericchi LR, Klimek P. Fraud Detection, Electoral. Wiley Stats Ref (John Wiley & Sons, 2018), https://doi.org/10.1002/9781118445112.stat08006.

[15] Jiménez R, Hidalgo M, Klimek P. Testing for voter rigging in small polling stations. Science Advances 3(6), e1602363 2017.

About the CSH

The Complexity Science Hub Vienna was founded with the aim of using Big Data for the benefit of society.

Among other things, the CSH systematically and strategically prepares large data sets so that they can be used in agent-based models. These simulations allow the effects of decisions in complex situations to be tested in advance and systematically assessed. Thus, the CSH provides fact-based foundations for an evidence-based governance.

***CSH Policy Briefs** present socially relevant statements that can be derived from CSH research results.*