

Impact of introduction of technology into election process on voter turnout and election result

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Keywords: Serj Sargsyan , Raffi Hovhannisyan ELQ, PPA, election, voter Turnout, regression analysis

Նոր տեխնոլոգիաների ներդրման արդյունավետությունը ընտրությունների արդյունքների և ընտրողների մասնակցության վրա

Միմոնյան Վ.Ա.
Հայաստանի Ամերիկյան Համալսարան /Հայաստան, Երևան/
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Ամփոփում: Մենք վերանայել ենք ընտրությունների Միջազգային Դիտորդական Առաքելության (ԸՄԴԱ) եւ ԵԱՀԿ / Ժողովրդավարական Հաստատությունների եւ Մարդու Իրավունքների Դիտորդական Առաքելության զեկույցները 2012 թ. խորհրդարանական 2013թ. նախագահական և 2017թ. նախագահական ընտրությունների նախնական վերլուծությունները: Այս զեկույցներում մենք կարեւորեցինք հայտնաբերված խոշոր մեղադրանքները եւ ընտրությունների անցկացման նոր ընտրական օրենսգրքի զարգացումները: Հայ ժողովրդի պատմության ընթացքում տեղի ունեցած խոշոր մեղադրանքը ընտրական ցուցակներն էին, որոնք միշտ քննադատվել են ընդդիմադիր կուսակցությունների, միջազգային առաքելությունների եւ քաղաքացիական հասարակության կողմից: Ունենալով իրավասու ընտրողների խոշոր ցուցակ բերում էր իր հետ բազմակի ընտրելու և լցնումների ռիսկեր: Մեկ այլ խնդիր որը տեղի ունեցավ 2012 և 2013 թվականներին թիկնապահների բացակայություններ բազմակի քվեարկությունների դեմ: Ավելին, կար ընտրությունների հաշվարկի թափանցիկության բացակայություն Երևանից դուրս գտնվող տարաքններում: Հետեւաբար 2017 ընտրությունների համար նախատեսված ընտրական բարեփոխումը նպատակաուղղված է այդ հարցերը լուծելու նոր տեխնոլոգիաների ներդրման միջոցով, ինչպես օրինակ, ընտրողների անձի հաստատման սարքերը եւ վեբ-տեսախցիկները: Այս բարեփոխումների ազդեցությունը գնահատելու համար արվել է էկոնոմետրիկ վերլուծություն և ՔՖԱ վերլուծությունները 2008թ. Նախագահական ընտրությունների համար: Այս ամենին ավելցրած տարվել են համեմատություններ հողվածուն քննարկվող ընտրությունների արդյունքների միջև օգտագործելով էկոնոմետրիկ մոդելներ:

Վճռորոշ բառեր՝ Սերժ Սարգսյան, Բաժնի Հովհաննիսյան, ԵԼԶ, ԲՀԿ, ընտրություն, ընտրողների մասնակցություն, ռեգրեսյուն վերլուծություն

Влияние внедрения технологии в избирательный процесс на явку избирателей и результаты выборов

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Резюме: Мы рассмотрели доклады Международной Миссии по Наблюдению за Выборами (ММНВ) и Миссии БДПЧ / Бюро по Демократическим Институтам и Правам Человека по наблюдению за парламентских выборах 2012 года в президентских выборах 2013 года и предварительных докладах парламентских выборов 2017 года. В этих отчетах были обнаружены основные утверждения и разработки новых кодексов избирательной системы для проведения выборов. Главным утверждением в ходе истории Армении были избирательные списки избирателей, имеющих право голоса, которые всегда подвергались критике со стороны оппозиционных партий, международных миссий и гражданского общества. Наличие чрезмерного списка избирателей, имеющих право голоса, имело риск предоставить возможности для многократного голосования и набивки голосов в боксах. Еще одной серьезной проблемой, имевшей место в 2012 и 2013 годах, было отсутствие гарантий против многократного голосования. Другой проблемой была непрозрачность подсчета голосов, особенно на станциях за пределами Еревана. Поэтому избирательная реформа, предназначенная для выборов в 2017 году была направлена на решение этих проблем путем внедрения новых технологий, таких как устройства авторизации

избирателей и веб-камеры. Эта ситуация мошенничеством с голосованием и новыми изменениями в кодексе было мотивом для проведения эконометрических исследований по выяснению того, как изменения в избирательном кодексе повлияли на предотвращение подобных утверждений, используя методологии и концепции, представленные в Политическом Форуме Армении доклады о президентских выборах 2008 года. Боле того было проведена сравнения между исследуемых выборах используя эконометрические модели.

Ключевые слова: Серж Саргсян, Раффи Оганесян, ЕЛК, ППА, явка избирателей, регрессивный анализ.

1. Data Of The Research Paper:

The data on election results for years 2012, 2013 and 2017 was obtained from the official website of the state central election committee-election.am. The number of voting stations in the year 2012 was 1982, in 2013 was 1988 and in 2017 was 2003 rows. After that we have calculated, analyzed and presented the voter turnout (VT) in each electoral station and the vote rates received by each party during 2012 and 2017 parliamentary elections and by each candidates in 2013 presidential elections. The participation rate/voter turnout in each station was calculated by taking into consideration the number of eligible voters and the number of voters who came to the election.

According to data presented by Central Electoral Commission in Armenia the number of eligible voters on 2017 parliamentary elections was 2,585,134, out of which 1,575,786 or 60.86% participated to elections. On 2012 parliamentary elections 2,522,962 people were eligible out of which 1,572,518 or 62.33% participated. On 2013 presidential elections 2,528,465 voters were eligible and 1,518,407 or 60.05% participated. The table below summarizes the parties that are considered in the paper.

Party	Short description
ELQ	ELQ political party participant of 2017 elections, English translation EXIT
ANC	Armenian National Congress Party, Participant of 2012 and 2017 elections
TA	Tsarukyan Alliance led by the founder of Prosperous Armenia Party, Participant of 2012 and 2017 elections
PPA	Prosperous Armenia Party led by the founder of Tsarukyan Alliance, Participant of 2012 and 2017 elections
ARP	Armenian Renaissance Party renamed version of OEK- Orinac Erkir Party, Participant of 2012 and 2017 elections
OEK	Orinac Erkir Party, currently named ARP- Armenian Renaissance Party, Participant of 2012 and 2017 elections
ORO	Ohanyan, Raffi, Oskanyan alliance affiliated with the Heritage Party and Raffi Hovhannisyan presidential candidate, Participant of 2012, 2013 and 2017 elections

HP	Heritage Party affiliated with ORO- Ohanyan, Raffi, Oskanyan alliance and Raffi Hovhannisyan presidential candidate, Participant of 2012, 2013 and 2017 elections
RPA	Republican Party of Armenia, affiliated with its party leader Serj Sargsyan also their presidential nominee, Participant of 2012, 2013 and 2017 elections. Also, this party is used to for better visual comparison of Serj Sargsyan’s candidacy
ARA	Armenian Revolutionary Alliance Party, participant of 2012 and 2017 election
ORO	Ohanyan, Raffi, Oskanyan alliance is used to for better visual comparison of Raffi Hovhannisyan’s candidacy

2. Voter Turnout Analysis

2.1. The testing of voter turnout distribution of the 2012 elections has shown following results:

- In Armenia (Figure 1), Yerevan (Figure 2) and outside of Yerevan (Figure 4) the distribution of voter turnout is close to normal with minor fast increases and slow decays, if we disregard some outliers on the right (100% voting turnout). This testing could indicate that the political commitment and new electoral code had possible positive influence on preventing fraud.
- If we compare the voting turnout and voting share of a party, we see that RPA (Figure 14) votes are close to the normal distribution, but have fast increase and slow decay while the voter turnout of Prosperous Armenia party (Figure 3) and Heritage Party (Figure 6) have even higher increase and slower decay with fatter left tale. This indicates that high frequency of voter participation could have minor negative effects mainly on other parties than the RPA and the faster increases and slower decays indicate possibility of falsification of the ballot counting process possibly in favor of RPA.

2.2. The testing of voter turnout distribution of the 2013 elections has shown following results:

- In Armenia (Figure 7) the distribution of voter turnout has a fast increase and a slow decay. This inconsistency with normal distribution

indicates that there is a probability of voter turnout fraud.

- In Yerevan (Figure 8) the distribution of voting turnout is close to normal, if we disregard some outliers on the right (100% voting turnout) and the very high frequency of some voting turnouts. On the other hand, voting distribution outside of Yerevan (Figure 10) shows fat right tale compared to the left one, which indicates the probability of voter turnout fraud is higher in the regions of Armenia.
- If we compare the voting turnout and voting share of a candidate, we see that Serj Sargsyan's votes are distributed more to the right having fatter right tale and a slow decay while Raffi's more to the left having fatter left tale and slow increase. This indicates that high frequency of voter participation could have been in favor of Serj Sargsyan. From this we can conclude that it could have been possible to fake ballot counting and voter turnout in favor of Serj Sargsyan.

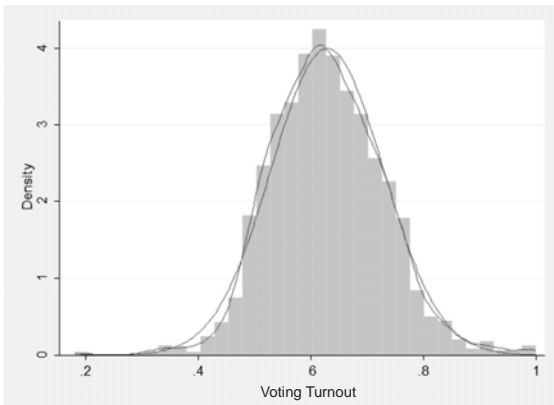


Figure 1: Density function of Voting Turnout (VT1) in Armenia

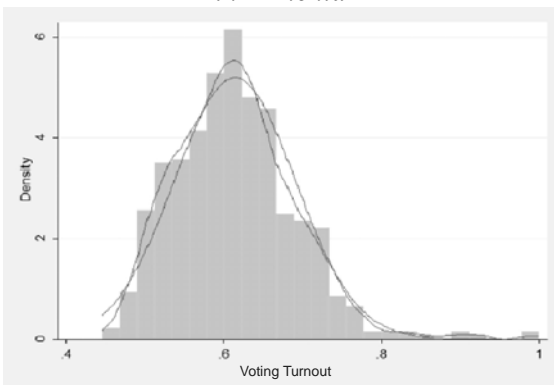


Figure 2: Density function of Voting Turnout in Yerevan

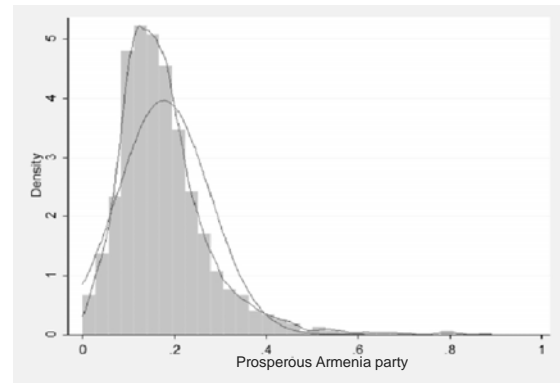


Figure 3: Density function of voting share of Bargavach Armenia Party

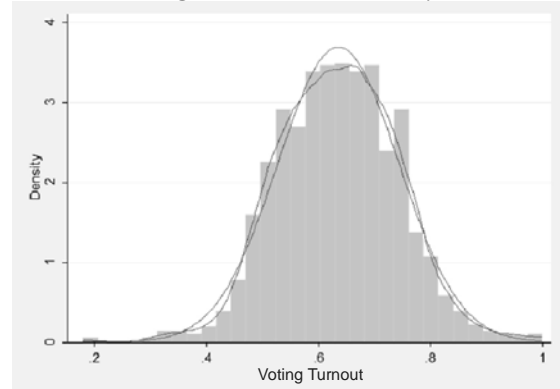


Figure 4: Density function of Voting Turnout out of Yerevan

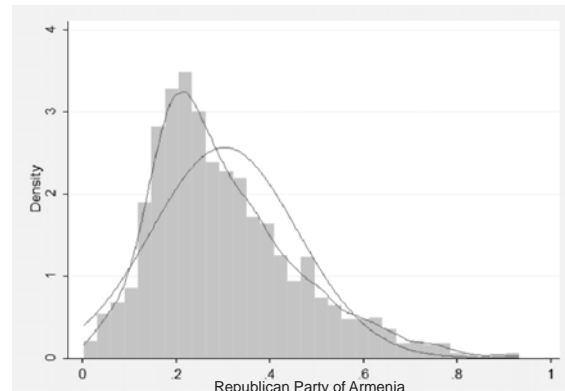


Figure 5: Density function of voting share of Republican Party of Armenia

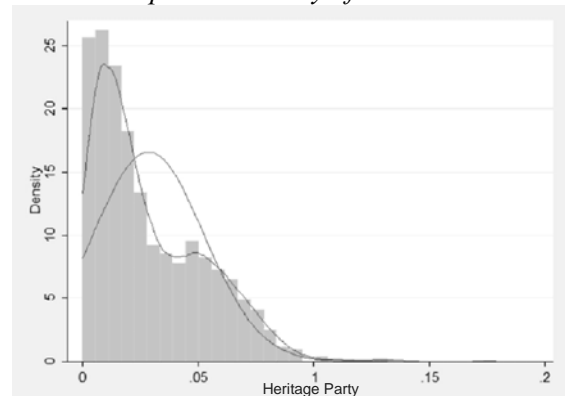


Figure 6: Density function of voting share of Heritage Party

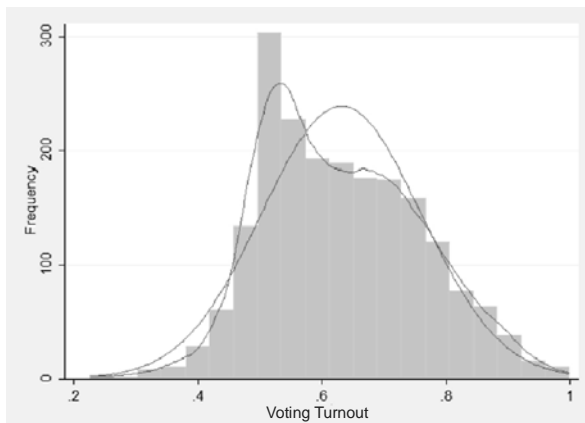


Figure 7: Density function of Voting Turnout (VT1) in Armenia

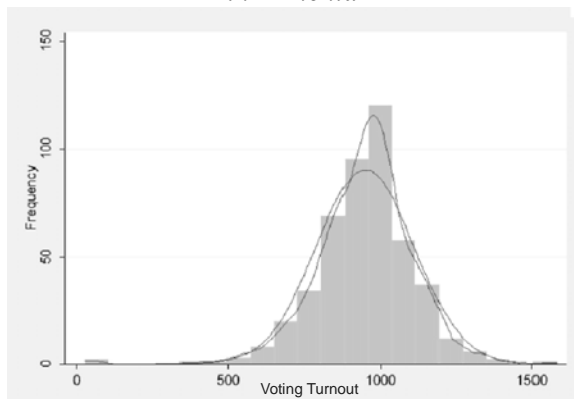


Figure 8: Density function of Voting Turnout in Yerevan

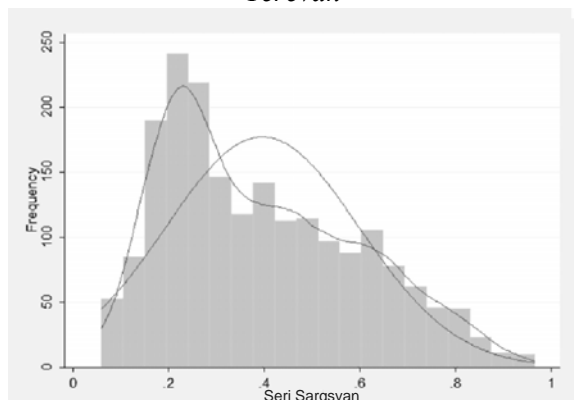


Figure 9: Density function of voting share for Serj Sargsyan (SS2)

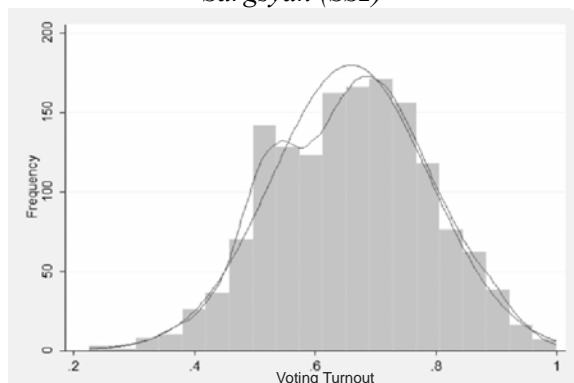


Figure 10: Density function of Voting Turnout out of Yerevan

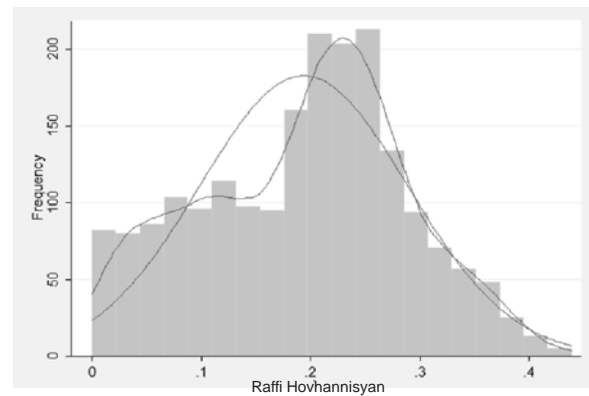


Figure 11: Density function of voting share for Raffi Hovhannisyian (RH2)

2.3. The testing of voter turnout distribution of the 2017 elections has shown following results:

- In Armenia (Figure 12), Yerevan (Figure 13) and outside of Yerevan (Figure 15) the distribution of voter turnout is close to normal, if we disregard some outliers on the right (100% voting turnout). This testing could indicate that investing new technologies had possibly positive influence on preventing voter turnout fraud.
- If we compare the voting turnout and voting share of a party, we see that RPA (Figure 14) votes are close to the normal distribution, but has fast increase and normal decay while the voter turnout of ELQ party (Figure 17) and Tsarukyan alliance (Figure 16) have fast increase and slow decay with fatter left tail. This indicates that high frequency of voter participation could not have an affect on the voting distributions. However, fast increase of all candidates and slow decay of only ELQ party and Tsarukyan alliance could indicate possibility of minor falsification in the ballot counting processes.

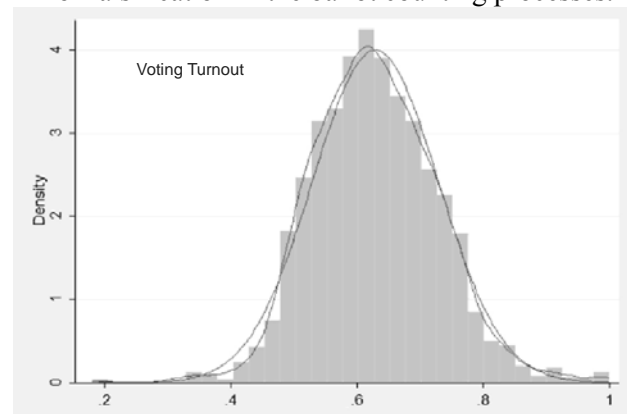


Figure 12: Density function of Voting Turnout (VT1) in Armenia

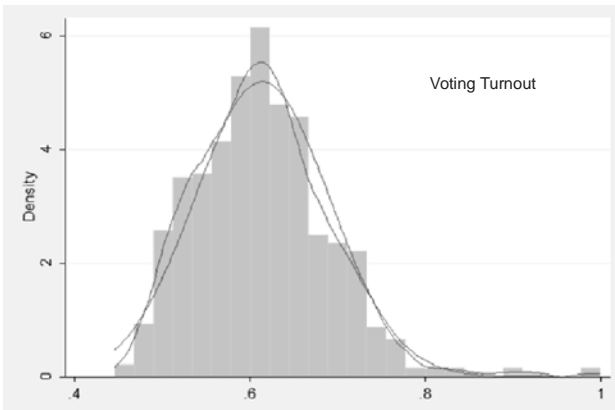


Figure 13: Density function of Voting Turnout in Yerevan

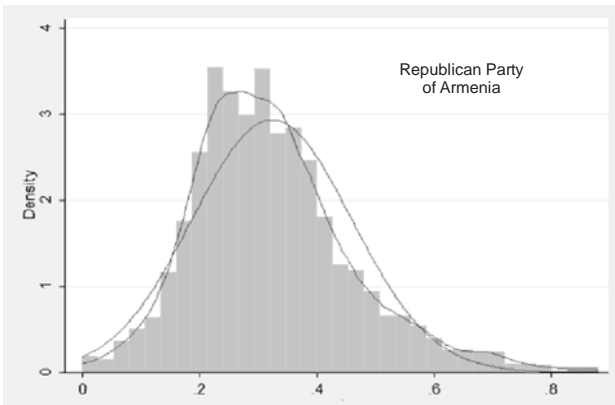


Figure 14: Density function of voting share Republican Party of Armenia (HHK2)

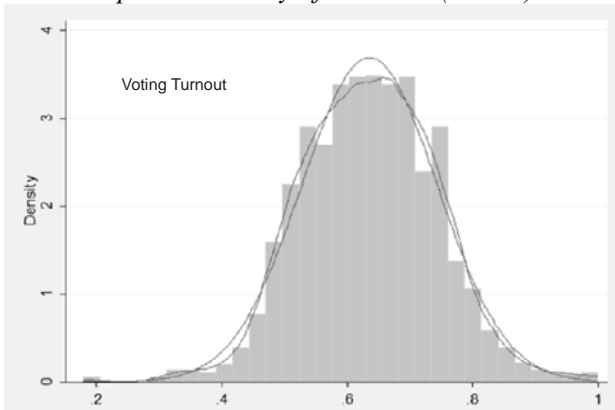


Figure 15: Density function of Voting Turnout out of Yerevan

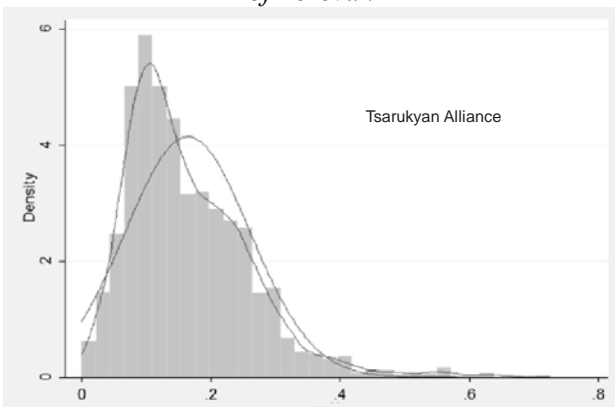


Figure 16: Density function of voting share for Tsarukyan Alliance (TSD2)

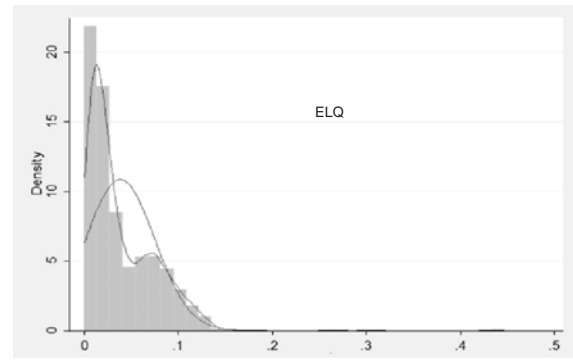


Figure 16: Density function of voting share for ELQ party

3. Econometric Model And Estimation Results:

Due to new technological and legislative advancements were implemented in 2017 parliamentary elections, we take that year as a benchmark for making comparisons between elections. In this analysis we will use a test proposed by Sobianin and Sukhovolskiy which considers the relationship between the share of party/individual candidate and voter turnout. According to them, the slope coefficient of Ordinary Least Square (OLS) regression of party's/candidates share of total eligible voters on turnout should be positive and less than one. In addition, the authors argue that if the coefficient is higher than one it would indicate a possibility of ballot stuffing to support the party/candidate with that coefficient. Moreover, the coefficient more than one also indicates that there may have been voting counting fraud: votes were subtracted from other candidates and added to the party/candidate in question.

Also, we constructed two datasets where the first one contains data for 2012, 2017 elections and the second one for 2013, 2017 elections. To be able to make comparisons we kept those parties/candidates which appear both in 2012 and 2017 for first dataset and in 2013 and 2017 first second dataset. It should be noted that even though ELQ party does not appear in 2012 elections we kept it because of interesting results.

As an addition to the model suggested by Sobianin and Sukholskiy we added a dummy variable for an election and we created an interaction variable between that variable and voting turnout. The final model is

$$\frac{V_{ij}}{E_j} = \beta_0 + \beta_0 D + \beta_1 VT + \beta_1 DVT$$

where: V_{ij} is the number of votes for the i party/candidate and j election year,

E_j – total eligible voters for j election year,

D – Dummy variable, VT – Voting Turnout,

DVT – interaction variable between D and VT .

3.1. Regression results analyzing 2012 and 2017 elections:

The above described model is used for describing the data. At first multi-collinearity was checked for the independent variables using VIF test. In particular, it was checked for the case of Republican Party of Armenia and the results indicated an issue of multi-collinearity. However, as the multi-collinearity was on dummy variable and the interaction term between DVT it was omitted. Secondly, heteroscedasticity tests were done (using hettest) on all regressions and strangely, in all cases heteroscedasticity was present. To solve for heteroscedasticity robust errors were taken in all cases. All these results are the same for comparative analyzes between elections in 2013 and 2017.

Table 1: Regression analysis results summary Parliamentary 2017*

Party	Intercept	Coefficient	t stat
ELQ	0.112143	-0.117676	-14.58
TA	0.073339	0.1447139	6.22
ARP	0.005186	0.0289024	3.51
ORO	0.005535	0.0121636	1.11
RPA	-0.20424	0.8388489	27.8
ARA	-0.02399	0.1098188	8.11

Parliamentary 2012			
Party	Intercept	Coefficient	t stat
ANC	0.076062	-0.0609176	-10.79
PPA	0.0900352	0.1328413	5.3
OEK	0.0129095	0.0320969	3.73
HP	0.0887767	-0.0928965	-19.53
RPA	-0.3155339	0.9541082	32.5
ARA	0.0025603	0.05145	5.18

*Significances for 2017 were calculated using the same do file and the same dataset but the dummy variable was reversed: 2017 data was given 0 value and 2012, 1.

First it should be noted that the coefficient of ORO (2017) is not significant, therefore we will not implement analyzes on that data. Overall, the results go along with the expectations for Sobianin and Sukholskiy. However, for the cases of ELQ (2017), ANC (2012) and ZHK (2012) the value is negative. That suggests a possibility that votes were taken from those parties and given to other ones. The coefficient of RPA decreased by 0.11 which indicates that for an additional 100 votes the party

received 11 votes less in 2017. That can be considered as an indicator of fairer elections.

Table 2: Summary of coefficients of the parties for certain levels of voting shares

	Voting Turnout < 90%	Voting Turnout < 80%	Voting Turnout < 70%	Voting Turnout < 60%
TA (2012)	0.173	0.202	0.185	0.131
RPA (2012)	0.911	0.868	0.742	0.449
ORO (2012)	-0.0997	-0.102	-0.0671	0.0565
TA (2017)	0.193	0.232	0.258	0.133
RPA (2017)	0.786	0.739	0.71	0.62
ELQ (2017)	-0.125	-0.125	-0.0758	0.15

From the Table 2 it can be noticed that the lower is the level of voting turnout the lower is the coefficient of RPA for both elections while TA does not have any obvious pattern. The result for RPA indicates that the party was generally favored in stations where voting turnout was high in both election years. Alternative possible explanation is that in high voting turnout stations there was ballot stuffing in favor of RPA. Moreover, the results for ORO (2012) and ELQ (2017) indicate that there is possibility of stealing their votes in stations with above 60% voting turnout rates. So, even though 2012 and 2017 elections are assumed to be more or less fair especially in terms of voter turnout fraud prevention but the possible risk of ballot stealing still remained actual for both elections. However, 2017 has lower indications of possible ballot stealing compared to 2012.

3.2. Regression results analyzing 2013 and 2017 elections:

The same data analyzes as for the previous case was done and results are identical: there is multi-collinearity because of dummy variables and robust errors were taken. Though 2013 elections are of a president and 2017 is for parliament, the comparable analysis is valid due to constitutional changes making this new parliament the strongest power holder in the country from 2018. As Raffi Hovhannisyanyan is one of the co-founders of ORO alliance, we have considered the alliance comparable to him. The same applies to Serj Sargsyan, who is the president RPA which has endorsed his candidacy for the president.

The coefficient of ORO is negative in 2013 which indicates that there is a possibility of ballot counting fraud. In addition, the 1.41 coefficient of RPA reaffirms the possibility of fraud because it

means that for every additional 100 votes RPA received 141. To check whether RPA coefficient is significantly 1 or not a one tailed t test was done, with $H_0: \text{coefficient} \leq 1$ and $H_1: \text{coefficient} > 1$. $t = \frac{1.41-1}{0.03} = 13.7$. Thus H_0 is rejected in favor of H_1 at 1% significance. Therefore, with 99% of significance we can state that the coefficient of RPA is more than 1.

Table 3: Regression analysis results summary
Presidential 2013

Party	Intercept	Coefficient	t statistic
ORO	0.408	-0.34	-21.2
RPA	-0.493	1.41	76.8

Parliament 2017

Party	Intercept	Coefficient	t statistic
ORO	0.0055351	0.0121636	1.11
RPA	-0.204239	0.8388489	27.8

In contrast, in 2017 elections are fair from the perspective of RPA. The difference between fairness can be quantified by taking the difference between coefficients of RPA which 0.572. That indicates that in comparison to 2013 RPA received 57 less votes for every additional 100 voters.

Table 4: Summary of coefficients of the parties for certain levels of voting shares

	Voting Turnout < 90%	Voting Turnout < 80%	Voting Turnout < 70%	Voting Turnout < 60%
ORO (2013)	-0.326	-0.263	-0.123	0.166
RPA (2013)	1.39	1.323	1.17	0.76
RPA (2017)	0.786	0.739	0.71	0.62

To recheck the possibility of voter turnout fraud, the coefficients of candidates were calculated for certain voting turnout levels. As can be seen OROs coefficient increases in 2013 as stations with high voting turnouts are taken out. On the other hand, the coefficient of RPA decreases in 2013. This implies a possibility that in stations where voting turnout was high, votes were taken from ORO and to RPA. In some sense, it can also be considered that as we take out high voting turnout stations elections become fairer. In comparison we do not observe such pattern for 2017. One reason that could have resulted in such difference between fairness is the effect of technological and legislative advancements.

4. Conclusion Of The Research Paper:

To sum up, in this research paper we have reviewed 2012 parliamentary, 2013 presidential and 2017 parliamentary election results by conducting econometric analysis of the major highlighted allegations discovered by the observation and the influence of the technological and legislative advancements. In specifically, we have conducted density testing for all the three electoral data in order to understand how the real image of voter turnout distribution compared to the normal is. Moreover, we have also tested the density of voting shared with the voter turnout distribution for understanding graphically how the voter turnout affected on the voting share of a candidate or a party. Even visually, we could see that in 2017, we had the closest normal distribution, which can be justified with the investment of new technologies and electoral code, which had possibly decreased the likelihood of voter turnout and ballot counting frauds. 2012 parliamentary was also more or less close to normal distribution, which was justified by higher level political commitments, but 2013 elections in this case were the most abnormal.

We have gone further analyzing the reported major allegation effect on the electoral data by using multiple regression analysis model developed by the Policy Forum Armenia, which has also shown 2017 as the most fair elections and 2013 the least. This regression model has shown that in 2013 President Serj Sargsyan has received about 141 votes per each 100 voters, which can present the effect of the likelihood of voter turnout and ballot counting frauds. On the other hand ELQ was the only party in the 2017, which had negative number for each additional 100 voters, which shows that though there was technological and legislative advancements still ballot counting frauds could have possibly happen.

In order to have better comparative analysis of these elections, we have developed our own model using the knowledge gained from the econometrics course, using the Introductory Econometrics textbook of Jeffrey M. Wooldridge. As the major advancements were implemented in 2017, we have chosen this year, as a benchmark to compare with 2012 parliamentary and 2013 presidential elections. Here is important to mention that though 2013 elections are of a president and 2017 is for parliament is anyways comparable due to constitutional changes that makes this new parliament the strongest power holder in the country from 2018. From the comparative analysis we have seen improvements of the data for both elections indicating less possibility of voter turnout and ballot counting fraud in 2017. As the main conclusion of

this paper, we can say that the technological and legislative advancements have played positive influence on preventing two of major voting irregularities in the electoral stations leaving the Armenian public to fight against other type of election frauds of voter-buying and abuse of power.

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