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The Future of Voting in a Technological Era

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The Future of Voting in a Technological Era

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Around 137 million Americans voted in the 2016 presidential election; however, these voters only comprise 55.7% of the total eligible voting population, placing the U.S. 28th out of 35 countries that are a part of the *Organization for Economic Cooperation* (*OECD*).[1] For years, researchers have been searching for ways to increase low voter turnout. As daily and civic life continues to move online, some countries and localities have experimented with online voting platforms that would align with 21st century technology and capabilities.

The United States has never implemented an internet voting mechanism in a national election and many people argue that such a system will never be feasible because of vulnerabilities for election meddling. Given evidence found by special counsel Robert Mueller that Russia used cyberattacks to meddle in the 2016 election, the security threat of a remote internet voting mechanism seems higher than ever.[2] Pursuits to hack U.S. elections still remain a high threat as a Russian-owned firm attempted a cyberattack into the Ohio 2019 election.[3] Although this cyberattack was unsuccessful, there is a possibility that votes would not have been safe if the election machines were connected to the internet. Despite concern about an increased security threat with the implementation of an internet voting system, several U.S. jurisdictions such as West Virginia and a county in Utah have recently enacted laws allowing internet voting in the future for disabled citizens and military or overseas voters.[4] Most monumental in this regard is a plan for Seattle and neighboring cities to enable all registered voters to cast their

[1] Drew Desilver, "U.S Trails Most Developed Countries in Voter Turnout," Pew Research Center (2017). https://static1.squarespace.com/static/58706fbb29687f06dd219990/t/5b108a8d70a6ad1221aa63c1/1527810701921/U.S+voter+turnout+lower+than+most+countries+-+Pew+May+2017.pdf.
[2] Robert Mueller, *The Mueller Report,* 1st ed. (Brooklyn, NY: Melville House Publishing, 2019).
[3] Marty Johnson, "Russian Firm's Attempt to Hack Ohio Voting Systems Thwarted," The Hill (2019). https://thehill.com/homenews/state-watch/472496-russian-firms-attempt-to-hack-ohio-voting-systems-thwarted
[4] Jay Greene, "Voting by Smartphone in Seattle Area Pushes the Limits of Electronic Balloting," The Washington Post (2020). https://www.washingtonpost.com/technology/2020/02/11/seattle-smartphone-voting/

ballot from a mobile device or computer in the King County Conservation District election this year, the first ever online voting election for all eligible voters in a given district in the U.S.[5]

Aside from internet voting potentially increasing voter turnout, states are faced with the reality of how a worldwide pandemic will alter precinct ballot methods.[6] As fifteen states have postponed their primary elections due to Coronavirus (Severe Acute Respiratory Syndrome Coronavirus 2), the question of an internet voting mechanism as a voting alternative to in person precinct voting may be more relevant than ever. As the world continues to digitize, countries may be forced to develop a secure internet voting mechanism. The current debate about whether to adopt alternative voting methods in the 2020 general election raises the question of how such methods affect turnout. This paper contributes to that discussion and the larger political science literature by asking *to what extent would a remote electronic voting mechanism affect voter turnout?* Analysis of electronic voting in three different countries (Estonia, Australia, and Canada) and various election types finds that voter turnout on average does increase when electronic voting is available.

Literature Review

As the United States lags behind most developed democracies in voter turnout rates, researchers and activists of various stripes are eager to find a solution to boost voter turnout. The literature on, and potential answers to why voter turnout is low, and how to increase it, are virtually endless. Countries have implemented various convenience voting measures in hopes of

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[5] Ibid.

[6] Nick Corasaniti and Stephanie Saul, "15 States Have Postponed Their Primaries Because of Coronavirus. Here's a List," The New York Times (2020). https://www.nytimes.com/article/2020-campaign-primary-calendar-coronavirus.html

increasing voter turnout, including internet voting. Remote internet voting is the practice of voting via an internet enabled device like a computer or smartphone that is not under physical control of election officials.[7] A rising number of adults who own an internet enabled device and a societal advance in technology has left many curious about the possibility of an internet voting mechanism for local and national elections. While over twenty countries have piloted or implemented some form of internet voting in an election, Estonia is the only country to currently offer the option to its entire eligible voting population in its national election.[8] While it theoretically makes sense that an internet voting mechanism would increase voter turnout, the literature on whether internet voting increases turnout presents mixed results.

Convenience voting is any measure that allows citizens to cast their ballot other than by arriving in person at precinct-polling places on election day.[9] For example, some convenience voting measures include mail-in-ballots, early voting, call-in ballots, and remote internet voting. Studies have shown a positive increase in turnout when using convenience methods, ranging from a 5% to 10% increase when vote by mail was an option and approximately a 5% increase with early voting.[10] The main idea behind convenience voting is to increase political participation by making voting more convenient. To understand why convenience voting would theoretically increase voter turnout, it is imperative to understand the rational choice model of voting proposed by economist Anthony Downs. This model consists of a cost-benefit analysis on

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[7] Michael R. Alvarez and Thad E. Hall, *Point, Click, and Vote: The Future of Internet Voting,* 1st ed. (Washington, D.C.: The Brookings Institution, 2004) 4.
[8] Nicole Goodman and Rodney Smith, "Internet Voting in Sub-national Elections: Policy Learning in Canada and Australia," The International Conference on Electronic Voting (2016). https://www.researchgate.net/profile/Robert_Krimmer/publication/311101401_Proceedings_of_the_International_C onference_for_Electronic_Voting_E-Vote-ID_2016/links/583d933108ae61f75dc461de/Proceedings-of-the-International-Conference-for-Electronic-Voting-E-Vote-ID-2016.pdf#page=299
[9] Paul Gronke, Eva Galanes-Rosenbaum, Peter Miller, and Daniel Toffey, "Convenience Voting," *Annual Review of Political Science* (2008): 438. doi:10.1146/annurev.polisci.11.053006.190912
[10] Ibid.

behalf of the voter, in which an individual votes if the benefits outweigh the costs.[11] Here, the

marginal return is the benefit a voter receives from casting a vote and the marginal cost is all the

costs undergone by the actor in order to cast their vote.[12] These costs include factors like the cost

of collecting information about candidates, processing it in order to decide whom to vote for,

registering for the election, and physically going to the polls on election day.[13] Surely other

factors play into the calculation of these costs, such as the weather on election day, the cost of

missing work or school in order to cast a vote, or a person's distance from a polling station.[14]

Characteristically, these factors act as opportunity costs, where undertaking them limits time one

spends on other choice activities.[15] Ultimately, "the higher the cost of voting, the lower the

probability of voting," so that the "easier it is for a person to cast a ballot, the more likely he is to

vote."[16] This explanation sheds light on how an internet voting mechanism could make voting

more convenient, thereby increasing turnout.

 According to the rational choice model, implementing an internet voting system would

increase voter turnout by lowering the cost of voting. The cost of physically going to the polling

booth would be eliminated by the fact that people could vote via any remote device that is

connected to the internet. Factors that affect the magnitude of costs such as inclement weather,

distance from a polling station, and missing school or work would not play any role in

determining whether a person votes or not. According to *American Community Survey Reports,*

as of 2017, 86.8% of households in the U.S. own some form of a computer, whether that is a

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[11] Anthony Downs, *An Economic Theory of Democracy*, 1st ed. (New York, NY: HarperCollins, 1957),146-148.
[12] Ibid.
[13] John H. Aldrich, "Rational Choice and Turnout," *American Journal of Political Science* 37, no. 1 (1993): 248. doi:10.2307/2111531.
[14] Moshe Haspel and Gibbs Knotts, "Location, Location, Location: Precinct Placement and the Costs of Voting," *Journal of Politics* 67, no. 2 (2005): 560-73. doi:10.1111/j.1468-2508.2005.00329.x.
[15]Raymond E. Wolfinger and Steven Rosenstone, *Who Votes?,* 1st ed. (New Haven, CT: Yale University Press, 1980) 8.
[16] Wolfinger, 8.

laptop, desktop computer, or handheld device, like a smartphone.[17] This percentage has been

rising in recent years and is likely to continue to do so. Therefore, this data suggests that a

majority of Americans would have immediate access to an internet voting platform if the option

were available. However, elderly and poorer people account for less of this total.[18] If the system

of voting were set up to allow both an internet voting mechanism and the traditional polling

booth option, then the elderly and lower socioeconomic individuals who do not own an internet-

enabled device would not be disadvantaged. Consequently, internet voting would decrease the

costs of voting for some and leave the costs of voting unchanged for everyone else.

Internet voting may increase turnout among groups that traditionally turn out at lower

rates, namely younger voters.[19] Voters aged 18-34 have a much lower turnout rate compared to

older voters. However, they are more likely to prefer an online voting system, whereas older

people are more likely to prefer voting at the polling booth.[20] While 94.3% of people ages 18-34

own either a computer or handheld smartphone, only 70.9% of people ages 65 and up own

them.[21]

Providing an online voting method would possibly increase voter turnout of young voters

for a variety of reasons. First, because younger people are more likely to regularly use the

internet, the cost of casting a vote on election day via an already frequently used device would be

far less than making the trip to an unfamiliar polling station, especially for those without access

to a car or other transportation. Second, since younger voters frequently move, providing a

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[17]Camille Ryan and Jamie M. Lewis, "Computer and Internet Use in the United States: 2015," American Community Survey Reports, United States Census Bureau (2015). https://www.census.gov/content/dam/Census/library/publications/2017/acs/acs-37.pdf

[18] Ibid.,7.

[19] John M. Strate, Charles J. Parrish, Charles D. Elder, and Coit Ford, "Life Span Civic Development and Voting Participation," American Political Science Review 83, no. 2 (1989): 443–64. doi:10.2307/1962399.

[20] Jennifer Stromer-Galley, "Society Online," 1st ed. (Thousand Oaks, CA: Sage Publications, 2004). 97-98.

[21] Ryan and Lewis, 4.

remote voting system would reduce the cost associated with figuring out states' bureaucratic voting systems, assuming the system was universal across all states. Third, an internet voting system would limit the cost of missing school or other important obligations that make voting difficult for younger citizens. Additionally, people who are temporarily traveling out of the state or the country would also be able to vote remotely at the time of the election. Furthermore, encouraging young people to vote will likely pay dividends in the future since voting tends to be habitual; people who have voted a few times when they were young tend to be life-long voters.[22] However, it could be argued that there will be an increase in overall turnout when an internet voting option is first made available because of people's curiosity for new technologies, thereby increasing voter turnout in the first election where internet voting is made an option and decrease in subsequent elections.[23]

At the same time, internet voting may decrease turnout. Trust in the government is correlated with voter turnout, and a decline in trust leads to a decline in voter turnout.[24] Many people believe that an online voting system presents a high potential for cyber-attack from outside actors, or coercion outside the typical private voting booth from others that would force them to vote a particular way. As voter turnout decreases from a decline in trust in government, an online voting system might intensify people's distrust in the system, and as a result, voter turnout would also decrease.

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[22] Benny Geys, "'Rational' Theories of Voter Turnout: A Review," *Political Studies Review* 4, no. 1 (2006) 16-35.doi.org/10.1111/j.1478-9299.2006.00034.x.

[23] Anne-Marie Oostveen and Peter Van Den Besselaar, "Internet Voting Technologies and Civic Participation: The Users' Perspective," *Journal of the European Institute for Communications and Culture* 11, no.1 (2014): 71.doi.org/10.1080/13183222.2004.11008847

[24] Eric Belanger and Richard Nadeau, "Political Trust and the Vote in Multiparty Elections: The Canadian Case," *European Journal of Political Research* 44, no. 1 (2005): 136. doi.org/10.1111/j.1475-6765.2005.00221.x.

Estonia is the first and thus far the only country that allows remote internet voting in national and local elections for all citizens. The decision to incorporate internet voting in the civic participation process received broad based political support in an attempt to develop the information and communications sector of the economy and to include internet in intra-governmental activities.[25] In 2005, Estonia used an internet enabled voting mechanism in all of their local elections. In 2007, Estonia held the first ever Parliamentary election with the option for all citizens to vote via the internet.[26] Since then, twenty other countries have experimented with internet voting and fifteen have implemented it in a particular election; however, several have discontinued its use.[27] These programs were largely canceled because of marginal and unclear impacts on voter turnout, security concerns, and lack of budget resources to implement the mechanisms.[28]

Ten countries still use some form of remote internet voting including Australia, Armenia, France, India, Mexico, Panama, United States, Estonia, Switzerland and Canada.[29] Of these, Armenia, France, Mexico, Panama and the United States have restricted remote internet voting in national elections to citizens living abroad or active military personnel living abroad, instead of the entire voting population.[30] For example, in 2000 and 2008, the United States piloted remote internet voting for active military personnel overseas and other citizens living abroad.[31] In an effort to increase the participation of military and overseas voters, the MOVE (Military and

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[25] Michael Alvarez, Thad Hall, and Alexander Trechsel, "Internet Voting in Comparative Perspectives: The Case of Estonia," *Political Science and Politics* 42, no.3 (2009): 500. doi:10.1017/S1049096509090787

[26] Ibid.,498.

[27] Nicole Goodman and Leah C. Stokes, "Reducing the Costs of Voting: An Evaluation of Internet Voting's Effect on Turnout," *Cambridge University Press* (2018): 2. doi:10.1017/S0007123417000849.

[28] Goodman and Stokes, 2.

[29] Goodman and Smith.

[30] Ibid.

[31] Jordi Barrat Esteve, Ben Goldsmith, and John Turner, "International Experience with E-Voting," *International Foundation for Electoral Systems* (2012): 13.

Overseas Voter Empowerment) Act was passed in 2009, mandating that all states provide

military and overseas voters the opportunity to request and receive ballots online.[32] This act

provided a gateway for certain states to pilot and adopt mechanisms for these voters to return

their ballots electronically as well, serving as the only form of remote online voting in the United

States. It is possible that states can use these pilot programs for future local or national elections.

In 2008, Okaloosa County in Florida piloted a distance balloting voting mechanism via internet

enabled kiosks in several locations such as Germany, Japan and the United Kingdom.[33] Votes

were marked at the kiosk locations and sent via the internet back to Okaloosa County. In France,

electronic voting was available for electing representatives for the elections to the Assembly of

French Citizens Living Abroad.[34]

Australia, India, Switzerland, and Canada have implemented internet voting in

subnational, local, or national referenda elections, excluding national parliamentary elections. In

India, the state of Gujarat piloted and started offering the option of online voting in the 2015

municipal election; however data on voter turnout for these municipal elections and prior

elections without internet voting is unavailable.[35] Switzerland offers an advanced internet voting

system for municipal, cantonal, and federal referenda elections.[36] Because Swiss elections

include referenda, some elections may have greater turnout because salient policy proposals are

on the ballot, while other elections may not have salient proposals. Without knowing which

elections included referenda that would likely generate a boost in turnout, it is difficult to control

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[32] Charles Stewart III, "Voting Technologies," *Annual Review of Political Science* 14, (2011): 360. doi: 10.1146/annurev.polisci.12.053007.145205

[33] Michael Alvarez, Thad Hall, Kinsey Gimbel, and Brian Griepentrog, "The 2008 Okaloosa Distance Balloting Pilot Project," Fors Marsh Group (2012). https://www.fvap.gov/uploads/FVAP/OkaloosaPilotProject_20151228.pdf

[34] Esteve, Goldsmith, Turner, 13.

[35] Hiral Devrajbhai, "After Compulsory Voting, Gujarat Now Offers the Online Option," The Indian Express (2015). https://indianexpress.com/article/india/india-others/after-compulsory-voting-gujarat-now-offers-the-online-option/ and "Online Voting," Scytl. https://www.scytl.com/en/online-voting/

[36] Esteve, Goldsmith, Turner, 13.

for these effects and generate a valid estimate of the effects of electronic voting on turnout; therefore, I did not investigate Switzerland in this study.

The literature on whether the implementation of internet voting increases voter turnout presents an array of possible positive and negative results. It is important to recognize that virtually all studies are solely based on a single country; therefore, the mixed results may be due to the variation in political factors in each country. My goal is to evaluate voter turnout in a variety of countries that have implemented internet voting to better understand its effect on turnout. Some studies show that internet voting has a small or null effect on voter turnout. Studies have shown that internet voting did not attract voters who would have otherwise not voted; instead the method merely acted as a substitute for votes at a traditional polling location.[37] In addition, some studies have found that implementing internet voting does not appeal to social groups that normally abstain from voting; rather it attracts the same politically motivated groups.[38] One study conducted in Switzerland for a referendum election found that where traditional precinct voting and mail-in-ballots were an option, internet voting did not increase turnout as people relied more heavily on mail-in-ballots and those who voted online would have voted anyway if the option was not available.[39] Similarly, in another study internet voting provided modest gains in turnout for the younger generation; however, a majority of the increase in turnout was a result of the mail-in-ballot option as it increased turnout for the elderly generation at a higher percentage than the percentage gain from younger generation internet voters.[40] Thus, numerous studies concluded that internet voting perhaps made voting more

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[37] Daniel Bochsler, "Can the Internet Increase Political Participation?," *Central European University* (2010). And Micha Germann and Uwe Serdült, "Internet Voting and Turnout: Evidence from Switzerland," *Electoral Studies* 47, no.1 (2017): doi.org/10.1016/j.electstud.2017.03.001.
[38] Bochsler.
[39] Germann and Serdült.
[40] Pippa Norris, "Will New Technology Boost Turnout?," *Electronic Voting and Democracy* (2004): 193-194.

convenient, but this convenience was overshadowed by mail-in-ballot measures and individuals who would have voted regardless of voting mode.

Other studies, by contrast, have found voter turnout to increase with the implementation of internet voting. Studies in Switzerland and Brazil for referenda elections have found an increase in voter turnout between 2 percentage points to as high as 9 percentage points in Switzerland[41] and an 8.2 percentage point increase in Brazil.[42] While other studies show a null impact of internet voting on voter turnout in Switzerland,[43] it is important to recognize that in cases like Switzerland and Brazil, any given referenda election can have dramatically higher or lower voter participation depending on what issue is on the ballot.

Other studies find internet voting brings modest increases in turnout in other types of elections. Those marginal increases were found in Ontario municipal elections with an increase of 3.5 percentage points when internet voting is an option; however, internet voting generates larger increases in turnout when mail-in-ballots are not adopted.[44] This suggests that convenience voting increases voter turnout; however, internet voting competes for turnout with other convenience voting methods. Thus, the amount of increase in turnout will presumably depend in large part on what voting options a country is currently using. A larger increase in turnout will likely be found in elections with little or no convenience voting options and smaller gains in elections that are more accommodating. A study in Estonia found that voter turnout increased in several elections when internet voting was an option.[45] Although many internet voters were

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[41] Jan Gerlach and Urs Gasser, "Three Case Studies from Switzerland: E-Voting," *Berkman Center Research Publication,* no. 2009-03.1 (2009).

[42] Paolo Spada, Jonathan Mellon, Tiago Peixoto, and Fredrik Sjoberg, "Effects of the Internet on Participation: Study of a Public Policy Referendum in Brazil," *Journal of Information Technology & Politics* 13, no.3 (2016): 187-207.

[43] Germann and Serdült.

[44] Goodman and Stokes, 1.

[45] Kristjan Vassil and Till Weber, "A Bottleneck Model of E-Voting: Why Technology Fails to Boost Turnout," *New Media and Society* 13, no. 8 (2011): 1336-54. DOI: 10.1177/1461444811405807

already politically engaged, a few 'peripheral citizens' or those that are not politically engaged, choose to vote via internet voting because of fascination with the technology.[46] Therefore, while few in number, disengaged citizens turnout increased with internet voting, potentially acting as a stepping stone for political participation among marginal groups.

Based on these studies, I hypothesize that implementing an online voting method will increase voter turnout by lowering the costs associated with in person voting on election day. Lowering the costs of voting will likely boost turnout for those who do not normally vote such as the younger generation, those who live far from polling centers, and physically impaired voters. My hypothesis assumes that traditional polling booth voting would still be an option for those who might be unable to vote on the internet such as lower-income Americans and senior citizens.

Methods

I examined turnout in Estonia, Canada, and Australia. I selected these countries because they offer multiple types of elections to examine, including national legislative, European Union, sub-national, and local elections and because data are available for time periods prior to and after the implementation of internet voting.

Estonia is an ideal case to study internet voting and voter turnout because it has offered the option in three different election types and over the course of several elections. Prior to internet voting, Estonia relied solely on paper-based precinct voting with early voting as well.[47] In order to vote online, a voter needs to authenticate themselves using an ID card which is a

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[46] Ibid.
[47] Alvarez, Hall, and Trechsel, 498.

standard identification mechanism in Estonia.[48] The voter then selects a candidate and the vote is

sent to the online server. The electronic ballots are kept in the signed and encrypted version until

the voting period is over, whereby signatures are dropped and anonymous ballots are tallied in

order to ensure voter anonymity.[49] It is also important to recognize that this system allows re-

voting measures where voters can recast their votes several times so that the last vote is counted

in order to prevent coercion.[50] For the purpose of my study, I collected data on voter turnout in

all three types of elections prior to and after internet voting was implemented.[51] From there, I

calculated the average turnout in each election prior to internet voting and after its

implementation in order to compare the effect on voter turnout across each election type

separately.

Australia has not implemented an internet voting mechanism for national elections;

however, New South Wales adopted remote online voting for state elections in 2011. There are

two interesting factors about New South Wales that make it useful for study. First, voting in New

South Wales is mandatory. Second, the online voting mechanism can only be used by disabled

citizens, those who live in remote rural areas away from a polling location, and citizens residing

out of state. These factors severely limit the capacity of internet voting to boost turnout. Prior to

internet voting in 2011, New South Wales offered traditional precinct-voting, early voting, and

vote-by-mail methods as options to vote.[52] As with the Estonia case, I conducted my analysis of

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[48] Sven Heiberg and Jan Willemson, "Verifiable Internet Voting in Estonia," Estonian Research Council.
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.691.7457&rep=rep1&type=pdf
[49] Ibid.
[50] Ibid.
[51] "Voter Turnout Database," International Institute for Democracy and Electoral Assistance.
https://www.idea.int/data-tools/country-view/99/40
[52] "Report on the 2007 State Election," New South Wales Electoral Commission.
https://www.elections.nsw.gov.au/NSWEC/media/NSWEC/Reports/Election%20reports/2007-State-election-report-(PDF-3.6MB).pdf

New South Wales by comparing average voter turnout in all of the elections prior to the implementation of an internet voting system with turnout averages after.[53]

Canada is similar to Australia in that remote internet voting has not been used in a national election; however, starting in 2003, some municipalities allowed internet voting and others did not. Over the subsequent elections, some municipalities adopted internet voting while some that had instituted internet voting later decided to discontinue its use. However, unlike New South Wales, remote internet voting is not limited to certain demographic groups, rather the entire eligible voting population can vote online in certain Ontario municipalities that have chosen to adopt the method. Data collection and analysis for Ontario municipal elections will take a slightly different approach.

First, using Stokes and Goodman's dataset of Ontario municipalities that have adopted internet voting on or before 2014, I calculated the average voter turnout of each municipality before it implemented internet voting compared to the years after internet voting was implemented.[54] Each municipality has voter turnout data starting in 2000, when no municipality had internet voting, and spans six elections to 2014, when all 98 municipalities in this dataset had internet voting. From there, I calculated the total number of municipalities where voter turnout increased with the implementation of internet voting compared to the number of municipalities where voter turnout decreased. In addition, I calculated the average voter turnout for all elections with internet voting compared to the average turnout in all elections without internet voting. Lastly, I evaluated voter turnout each year by comparing the average turnout for municipalities

[53] "Electoral Statistics," New South Wales Electoral Commission. https://www.elections.nsw.gov.au/About-us/Reports/Electoral-Statistics

[54] Stokes, Leah; Goodman, Nicole, 2018, "Replication Data for: Reducing the Cost of Voting: An Evaluation of Internet Voting's Effect on Turnout", https://doi.org/10.7910/DVN/KMMN1B, Harvard Dataverse, V1, UNF:6:T67aDIi2kGXbs0OuUOYW6Q== [fileUNF]

that had internet voting and those that did not for each year starting in 2000 and ending in 2014.

However, it is important to note that for 2000 there are no data on voter turnout with internet

voting as no municipalities had it in that year and similarly in 2014 there are no data on average

voter turnout without internet voting as the dataset only has values for municipalities that have

implemented online voting on or before 2014.

Second, I gathered turnout data on all 444 Ontario municipalities for the 2018 municipal

elections.[55] Of the 444 municipalities, 175 of them allowed internet voting and 214 of them did

not. It is important to note that 55 municipalities either did not report information on the types of

voting mechanisms used or data on turnout for that given year.[56] I calculated the average voter

turnout in all the municipalities that had internet voting in the 2018 municipal elections

compared to the average of those that did not. This two-part study of Ontario municipal elections

is informative as it paints a picture of voter turnout from multiple angles within a given

providence.

I relied on the data from the Goodman and Stokes study of internet voting for my own

study.[57] Goodman and Stokes found a 3.5 percentage point increase with internet voting.

However, their data only included municipalities that had adopted internet voting on or sometime

before 2014 and excluded the hundreds of municipalities that did not have internet voting in

2014. I added to their study by calculating the total number of municipalities where voter

turnout increased or decreased with the implementation of internet voting. Additionally, I

calculated the effects of internet voting over time by calculating turnout with and without

internet voting for each year with an election up to 2014. My biggest addition to their study was

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[55] "List of Ontario Municipalities," Government of Ontario. https://www.ontario.ca/page/government-ontario
[56] "2018 Ontario Municipal Elections: Ontario Votes," Association of Municipalities Ontario.
https://elections.amo.on.ca/web/en/municipal/19411
[57] Goodman and Stokes.

that I found turnout data for almost all of Ontario's municipalities in 2018, not just the

municipalities that adopted internet voting, which allowed me to see the effect of internet voting

on turnout for an entire state. Ontario municipal elections are rather progressive in the types of

convenience voting methods offered ranging from early voting, vote-by-mail, braille ballots, vote

by phone call, and even rides to and from precinct polling locations. However, each of the 444

municipalities is different in terms of what voting options they offer and when they started

offering them.

Results

In this section I describe the results from Estonia's three election types first, followed by

results from New South Wales, Australia and Ontario, Canada.
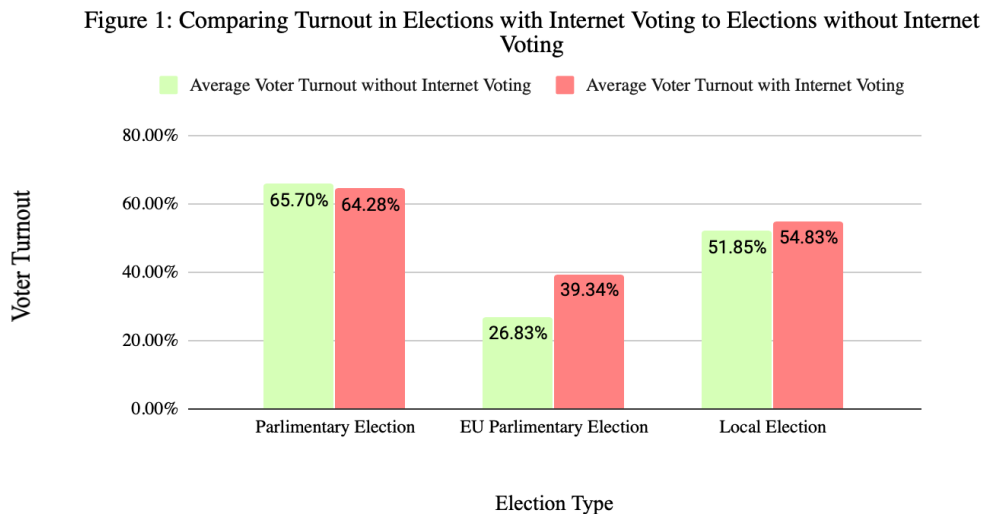
Estonia:

Estonia adopted internet voting in three types of elections: Parliamentary elections,

European Union (EU) Parliamentary elections, and local elections. The percentage of voters who

used internet voting in the Parliamentary election when it was first instituted in 2007 was 3.4%,

and has gradually increased to 27.9% by 2019.[58] For EU Parliamentary elections the percentage

of voters using internet voting grew from 6.5% in 2009 to 17.6% in 2019.[59] Finally, in local

Estonian elections the percentage of internet voting increased from .9% in 2009 to 16.9% in

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[58] "Statistics about Internet Voting in Estonia," Valimized (2019). https://www.valimised.ee/en/archive/statistics-about-internet-voting-estonia
[59] Ibid.

2017.[60] Thus, the percentage of voters utilizing internet voting is reasonably high and growing

rapidly, suggesting that an increasing amount of people are becoming familiar with online

technology.

An increasing percentage of voters opted to cast their ballot via the internet, but did more

citizens vote overall or did citizens who were already voting merely switch their voting method?

Overall, voter turnout increased on average after the introduction of internet voting for the EU

Parliamentary elections and the local elections but decreased slightly for the Parliamentary

elections in Estonia (see Figure 1).

Figure 1: Comparing Turnout in Elections with Internet Voting to Elections without Internet Voting
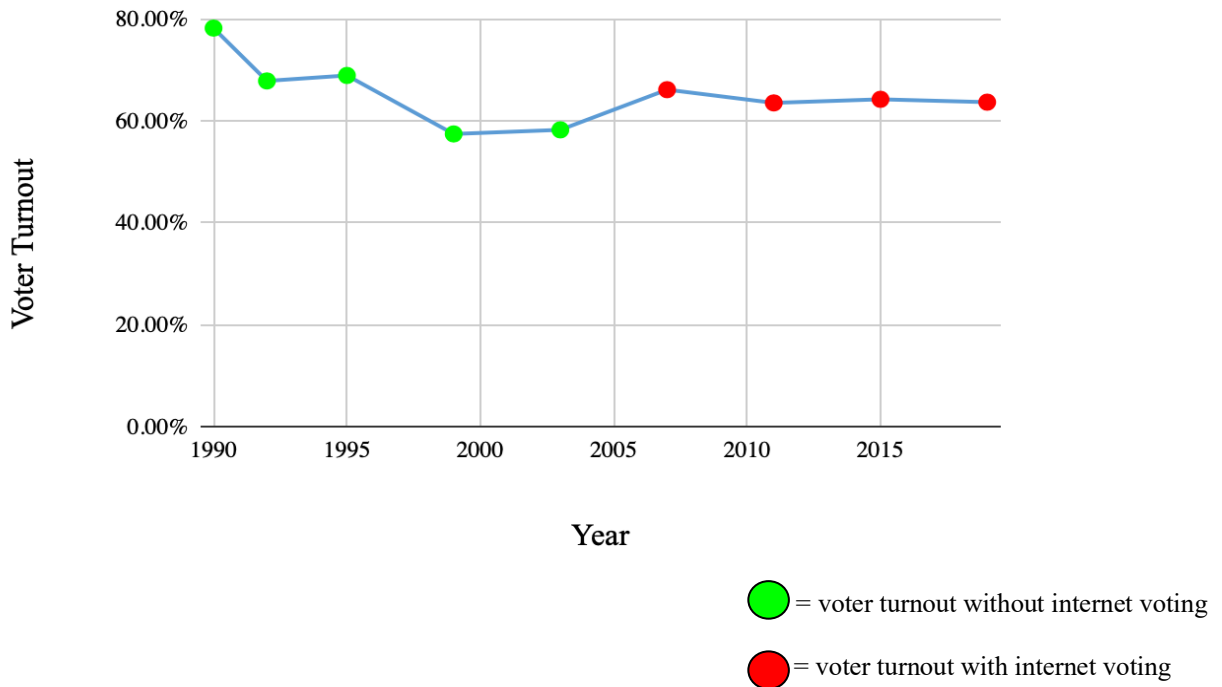

Parliamentary Elections:

The average voter turnout in the five parliamentary elections before Estonia implemented

internet voting was 65.7% (see Figure 2). When internet voting was introduced in 2007, the

average voter turnout for the subsequent years was 64.3% (see Figure 2). Voter turnout was

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[60] Ibid.

lower on average when internet voting was implemented by 1.4 percentage points. However,

these averages may mask an increase in turnout after the introduction of internet voting. The

highest turnout was 78.2% in 1990, which is roughly 10 percentage points higher than the next

highest year (see Figure 2). Estonia gained its independence in 1990. The high turnout in 1990

was presumably due to the excitement of being able to participate in a democratic election for the

first time. After the first election, turnout declined in the subsequent two elections to about 70%

(see Figure 2). The following two elections, the two elections before internet voting was adopted,

turnout fell to 57.8% (see Figure 2). If the two elections just prior to the adoption of internet

voting are taken as the baseline, turnout increased with the availability of internet voting. Thus,

viewed in the most positive light, voter turnout increased from about 58% to about 64% when

internet voting was made an option.

Figure 2: Comparing Voter Turnout with and without Internet Voting in Estonia's Parliamentary Election

European Union Parliamentary Elections:

Voter turnout prior to the implementation of an internet voting system for the EU parliamentary election was 26.8% in 2004 (see Figure 3). This was the first and only year Estonia had an EU election without an internet voting mechanism. In the subsequent years when internet voting was made an option, average voter turnout was 39.3%, 12.5 percentage points higher than before internet voting was allowed (see Figure 3). However, this jump in turnout may not be exclusively due to the implementation of internet voting. It is possible that turnout in this type of election would increase over time as people learn more about the EU and consequently think it is important to vote in this election.

Figure 3: Comparing Voter Turnout with and without Internet Voting in Estonia's EU Parliamentary Elections

= voter turnout without internet voting

= voter turnout with internet voting
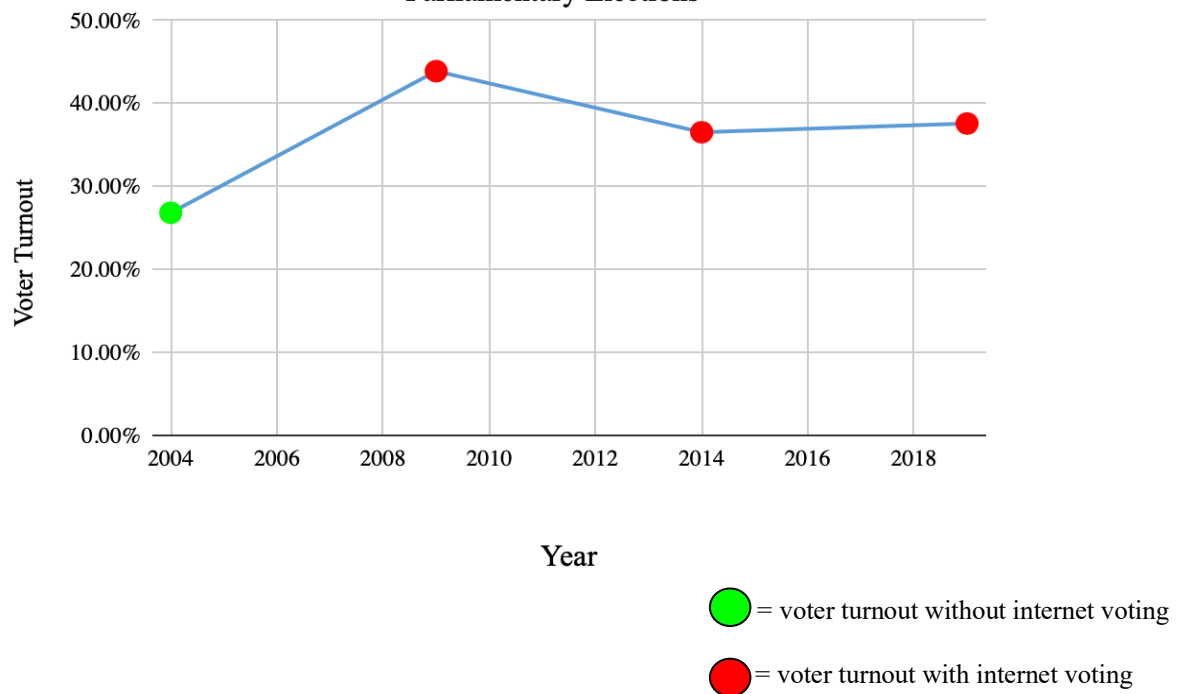
Local Elections:

The first four free and fair elections in Estonia (1993-2004) did not have internet voting. In the elections without internet voting, the average turnout was 51.9% (see Figure 4). In 2005, internet voting was used with an average voter turnout of 54.8% over the next subsequent elections, a 2.98 percentage point increase in average turnout in the year's internet voting was an option. The highest turnout was 60.6% in 2009 with internet voting and the lowest was 47.4% in 2005, the first-year internet voting was made an option. However, after the first election with internet voting, voter turnout sharply increased.

Figure 4: Comparing Voter Turnout with and without Internet Voting in Estonia's Local Elections

= voter turnout without internet voting

= voter turnout with internet voting
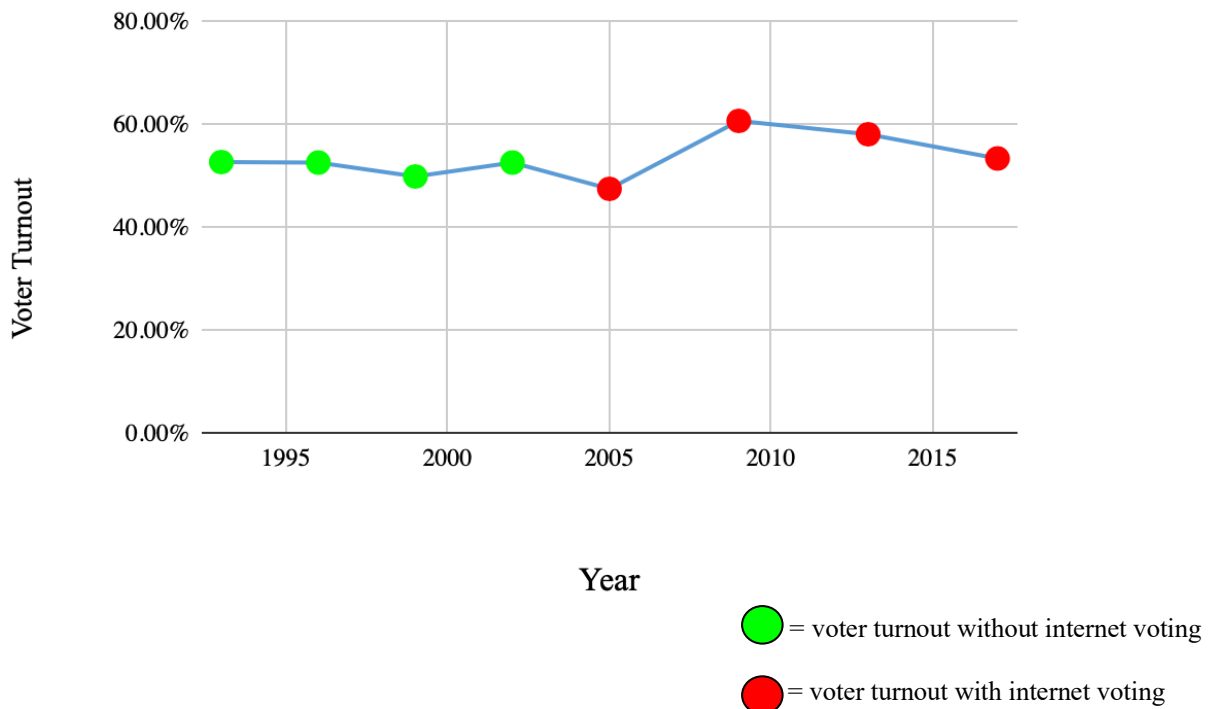
New South Wales State Elections:

New South Wales did not have internet voting from 1995 to 2007, and in those years the average voter turnout was 91.5%. Figure 5 presents turnout in New South Wales elections over time (see Figure 5 —note that the scale in the graph below starts at 80% voter turnout in order to see the difference between turnout in subsequent years easier).[61] Since voting is mandatory in New South Wales, the turnout rate was already high. Beginning in 2011, New South Wales implemented remote internet voting for citizens who are blind or visually impaired, have a disability, live in remote rural areas, or for residents currently outside of the state.[62] In 2011, 51,103 eligible citizens registered to vote using this method, and of this group 46,864 (92%) eligible citizens voted via internet voting on election day.[63] In the years that internet voting was made an option for this group, overall voter turnout on average was 92.9%. Therefore, voter turnout increased on average by 1.5 percentage points. This is a notable increase due to the fact that New South Wales elections are mandatory, meaning that there is little room to grow an already high voter turnout rate. In addition, only specific groups could vote by internet, not the entire eligible voting population. New South Wales is unique in its attempt to increase voter turnout from marginalized groups that are at a disadvantage from in person voting on election day, while not offering this method to the entire population. While this reduces their costs of implementing a new system for their entire eligible voting population, it is possible that voter turnout would further increase if they made the option available for their entire electorate. In

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[61] "Electoral Statistics," New South Wales Electoral Commission. https://www.elections.nsw.gov.au/About-us/Reports/Electoral-Statistics

[62] "Evaluation of Technology Assisted Voting Provided at the New South Wales State General Election March 2011," The Allen Consulting Group (2011). https://www.elections.nsw.gov.au/NSWEC/media/NSWEC/Reports/iVote%20reports/Evaluation-of-technology-assisted-voting-provided-at-the-New-South-Wales-State-general-election-March-2011-(PDF-1005kB).pdf

[63] Ibid.

New South Wales, turnout increased among populations that traditionally had lower turnout.

Perhaps internet voting would do the same for other relatively low turnout groups like young

voters.

Figure 5: Comparing Voter Turnout with and without Internet Voting in New South Wales State Election
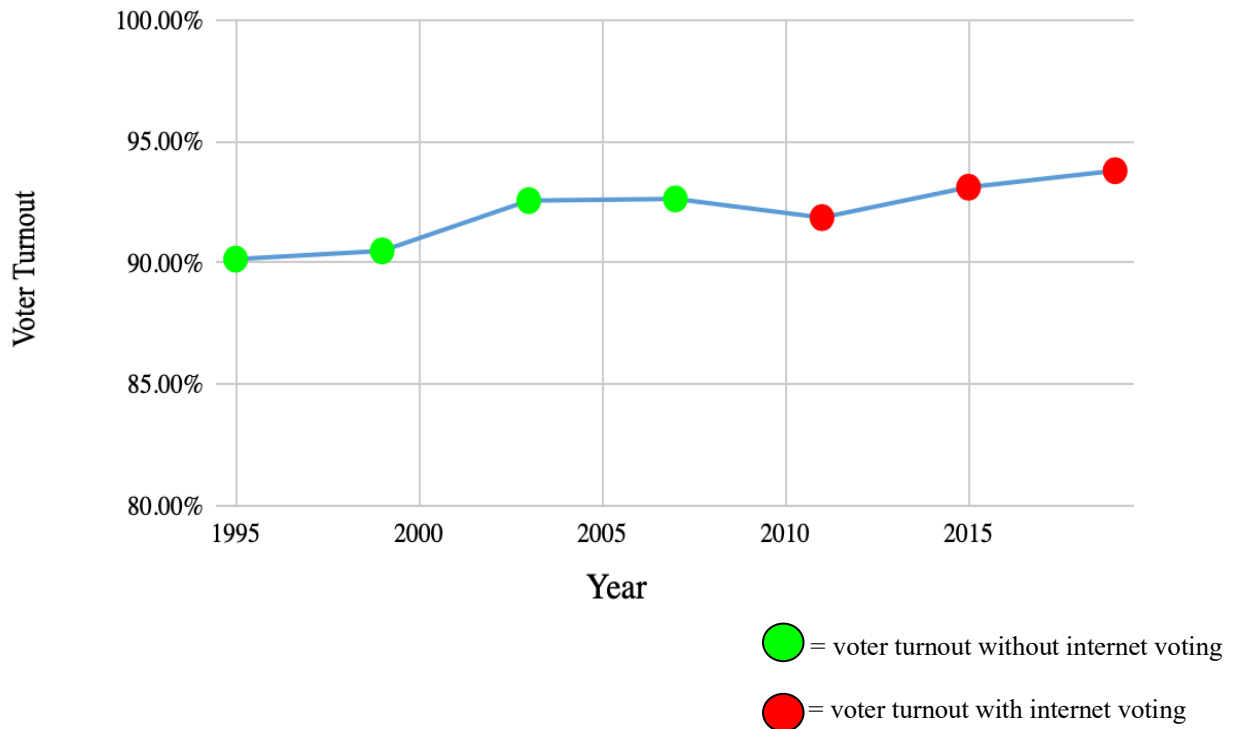

Ontario Municipal Elections:

Certain municipalities in Ontario offered internet voting starting as early as 2003. In

2003, 12 municipalities enabled internet voting, increasing every year until 2018 when 178

municipalities had internet voting. For each municipality that adopted internet voting sometime

between 2003 and 2014, I compared average turnout in elections prior to the implementation of

internet voting and after the implementation. In certain cases, a municipality had implemented

internet voting and then went back to other voting methods in subsequent years. In these cases, I

took the average voter turnout in the years that internet voting was made an option in a specific

municipality and compared that to the average turnout in the same municipality in years without

internet voting. Turnout was higher on average after internet voting was adopted in 53 of the 98

(54%) municipalities that adopted it. However, turnout was lower on average in 45 of the 98

municipalities when internet voting was an option. Across all 98 municipalities, average turnout

when internet voting was an option was 44.2% compared to 42.6% when internet voting was not

an option, a difference of 1.57 percentage points. Figure 6 portrays the vast variation in voter

turnout rates across all municipalities with a high of 34.4 percentage point increase and low of

23.4 percentage point decrease in turnout when an internet voting mechanism was used (see
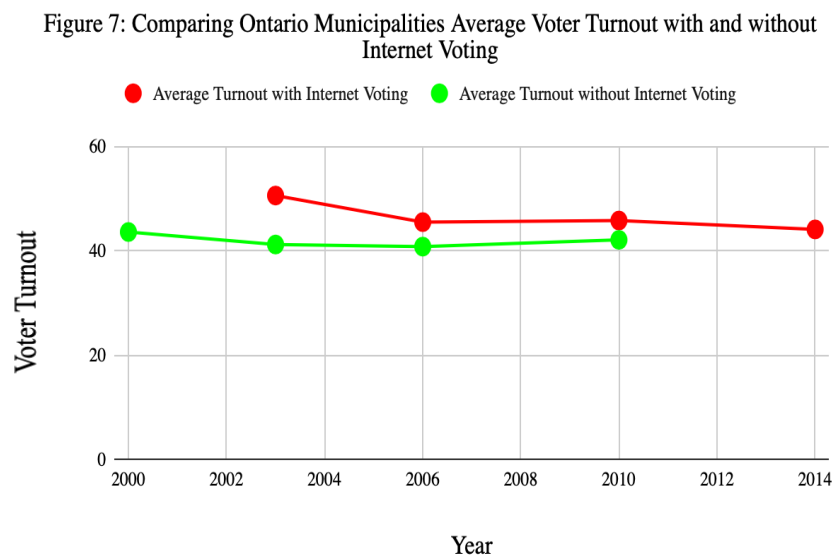
Figure 6).

Figure 6: Difference in Voter Turnout with the Implementation of Internet Voting in Ontario Municipalities on or before 2014
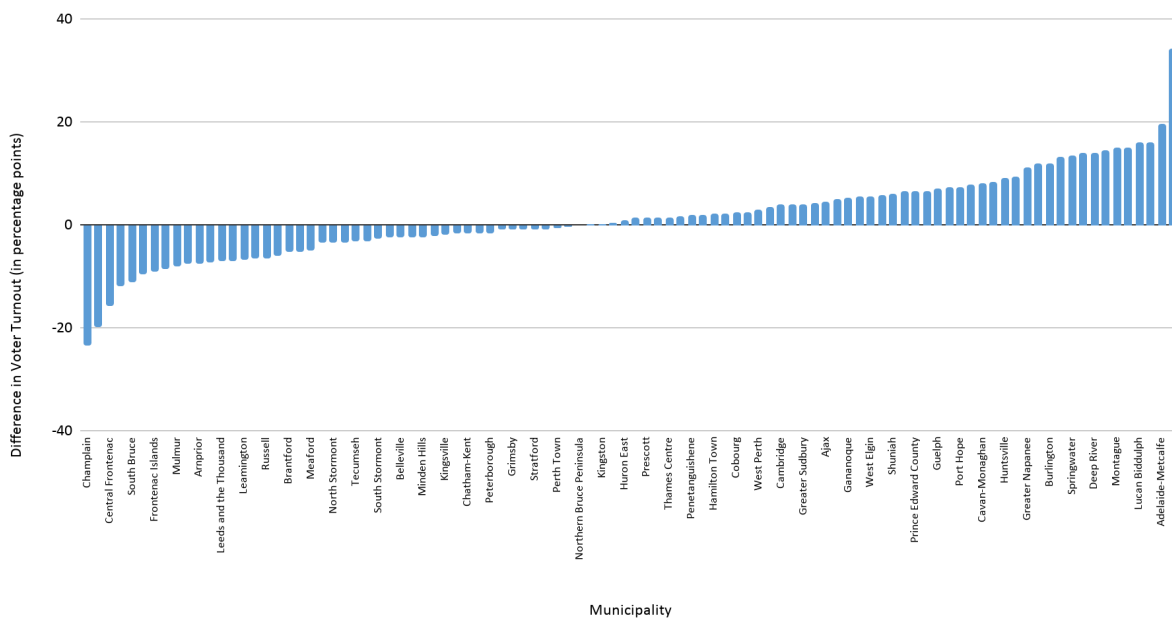
The line graph below represents the average voter turnout per year in all the

municipalities that had implemented internet voting for that year and all the municipalities that

did not for that year, among the 98 municipalities that had adopted internet voting by 2014 (see

Figure 7). Every year, voter turnout is higher on average in the municipalities that implemented

voter turnout versus those who did not. However, voter turnout decreased in a linear fashion on

average for municipalities that implemented internet voting after it was first adopted in 2003. On

the other hand, voter turnout slightly increased for municipalities that did not implement internet

voting. Note that in 2000, no municipalities had implemented internet voting yet and all of these

municipalities had adopted internet voting by 2014.

The data from Ontario only represents the municipalities that had some form of internet

voting on or before 2014. The limitation of this set of data is that it only consists of

municipalities that adopted internet voting at some point on or before 2014. There is a possibility

that this set of municipalities is systematically different from the remaining municipalities that

did not implement internet voting some time before 2014. For example, it is possible that

municipalities that implemented internet voting had a history of low voter turnout; therefore,

implementing such technology was an attempt to increase voter turnout. On the other hand, it is

possible that municipalities that did not implement internet voting had other ways to make voting

easier like mail in or telephone ballots.

Figure 7: Comparing Ontario Municipalities Average Voter Turnout with and without
Internet Voting

● Average Turnout with Internet Voting   ● Average Turnout without Internet Voting

Although turnout data for the municipalities that had not adopted internet voting through 2014 were not readily available for earlier elections, I collected turnout data for all 444 of Ontario's municipalities for the 2018 election, some of which allowed internet voting, and some did not. The official returns for Ontario did not report turnout for the methods of voting for 55 municipalities, leaving 389 municipalities for analysis. Overall, the average voter turnout in municipalities without internet voting in 2018 was 40.9%. Where internet voting was made an option, voter turnout was 42.2%. Therefore, average turnout was higher by 1.3 percentage points where internet voting was made an option in the 2018 municipal elections, a difference statistically significant at the .10 level (p=.09).

To sum up the Canadian cases, voter turnout was marginally higher when internet voting was an option.

Summary of Results

What do these results across three different countries and various types of elections tell us? These results can be read in a range of ways. One conclusion is that turnout increased in all the countries and all the election types examined except one (Estonia's parliamentary elections— see table 2) that adopted internet voting. Even in that one instance if we use the two elections prior to the adoption of internet voting as the benchmark instead of all pre-internet voting elections, turnout increased by about 6 percentage points. Turnout even increased where it was least likely to—in Australia, where turnout was already high and only a small group of people could take advantage of internet voting.

However, one might argue that the results show internet voting offers a minimal turnout boost of between 1 to 3 points, a boost that varies so much that in many instances, such as almost half of Ontario's municipal districts, turnout actually declines. While average voter turnout was

1.3 percentage points higher for municipalities that offered internet voting in the 2018 Ontario election, each municipality differed in terms of various voting methods offered to make voting easier which could have had a bigger effect on turnout rather than just internet voting. The highest increase in voter turnout after the implementation of internet voting was in the Estonia EU election (12.5 percent). The smallest increase in voter turnout was in the 2018 Ontario Municipal election (1.4 percent). This large variance in voter turnout increase can likely be attributed to a multitude of factors, such as each country having very different political institutions and climates, which can affect voter turnout in any given year with and without internet voting as an option. Additionally, larger gains in turnout can be seen in places like Estonia where the convenience voting options prior to internet voting were non-existent compared to smaller gains in turnout in places like certain Ontario municipalities that offer much more progressive voting options.

Table 2: Voter Turnout with and without Internet Voting in Estonia, New South Wales, and Ontario

Elections:	Average Turnout in Elections with Internet Voting	Average Turnout in Elections without Internet Voting	Difference (in percentage points)
Estonia Parliamentary Election	64.3%	65.7%	-1.4
Estonia EU Parliamentary Election	39.3%	26.8%	+12.5
Estonia Local Election	54.8%	51.9%	+2.9
New South Wales State Election	92.9%	91.5%	+1.4
Ontario Municipal Elections (2018)	42.2%	40.9%	+1.3

Note: - equates to a lower percentage when internet voting is made an option and + equates to a positive difference when internet voting is an option.

Conclusion

Based on my analysis of voter turnout from three different countries and four different election types, I found that voter turnout does generally increase when an internet voting mechanism is adopted (the Estonia Parliamentary election is the one exception). Voter turnout increased anywhere between 1.3 and 12.5 percentage points; however, in most cases the average increase was around 1.5 to 6 percentage points. These estimates are similar to earlier studies of internet voting and other methods of making voting more convenient (e.g. mail in ballots, early voting). For example, Goodman and Stokes[64] found internet voting increased voter turnout by about 3.5 percentage points, while other studies of convenience voting typically find a 2-4 percentage point increase in voter turnout.[65]

Some may see this as an important effect on voter turnout, while others could see these gains in turnout rather trivial. I argue that such an increase in voter turnout is worth the cost of implementing an internet voting system. In elections where the margin of votes between two candidates is between 1.5 and 6 percentage points, a turnout boost of this magnitude that skewed towards one party could change the outcome of that election. For example, in the 2016 presidential election, the national popular vote margin between Clinton and Trump was 2.1 percentage points. The vote difference in swing states was 1.2 percentage points in Florida, .7 percentage points in Pennsylvania , .8 percentage points Wisconsin, and .2 percentage points in Michigan.[66] That said, while it is difficult to know what the partisan implications of a boost in turnout would be, a potential boost in turnout from implementing an internet voting system could

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[64] Goodman and Stokes.
[65] Gronke, Galanes-Rosenbaum, Miller, and Toffey, 437-55.
[66] Rob Griffin, Ruy Teixeira, and John Halpin, "Voter Trends in 2016," Center for American Progress (2017). https://www.americanprogress.org/issues/democracy/reports/2017/11/01/441926/voter-trends-in-2016/

nonetheless affect a close election. However, internet voting as a matter of policy does not need to be outcome determinative, rather the goal is to increase voter engagement in the political process. If a particular country wants to make voting easier for younger citizens, citizens with busy lives who would otherwise not be able to miss work or other obligations to vote, or citizens temporarily residing or vacationing in locations away from their voting district, then implementing an internet voting system could help achieve this goal. Here, we can turn to the case in New South Wales where the state made internet voting an option for groups of people with historically low voter turnout, such as people with disabilities or those residing out of state during a particular election. When these groups could vote via the internet, overall turnout went up, suggesting that an internet voting system can increase voter turnout of those people that are least likely to vote.

Furthermore, countries may implement an internet voting system not simply to increase voter turnout; rather voters might come to expect this mechanism since technology is so much a part of our lives. And that in turn might boost civic participation. While the argument could be made that certain demographic groups would be limited to vote by the implementation of online voting, such as the elderly or those who do not have an internet enabled device, offering internet voting as an additional option to civic participation would not deter voters who prefer traditional voting methods rather than implementing an internet voting system as the only option to vote. Additionally, the fact that the number of Americans that own an internet enabled device is already presumably high and growing, suggests that a majority of adults will be comfortable using this technology.

It is possible that implementing an internet voting system does not significantly boost turnout, rather voters are merely switching their voting methods from traditional means to

internet voting. This situation was highlighted in the Estonia case, where each year significantly more people voted via the internet, but overall turnout only increased by a few percentage points subsequently. The argument could be made that although implementing internet voting does not significantly gain voters who would have otherwise not voted, the mechanism makes voting easier and therefore is preferred by voters who do vote in elections.

A multiple of variables can affect voter turnout, from the weather on election day to the political climate around an election. I am unable to hold all factors constant, meaning that any deviation in an election's circumstance could affect voter turnout, instead of just the factor of internet voting. However, having found voter turnout to increase in three different countries across several election types, the variety of circumstances suggests a consistent effect that voter turnout does increase when internet voting is made an option.

There are several potential limitations in my analysis, such as not being able to hold account for other factors that could have made voting easier in a given election. For example, Ontario's municipalities vary in terms of the voting methods available, with some municipalities offering mail in ballots, phone ballots, braille ballots, magnified text, and rides to and from a polling station, or any mix of these options. This could affect the estimated impact of internet voting on turnout in a variety of ways. First, in elections where there are a multitude of options for voting, a higher voter turnout could be attributed to another voting method instead of just internet voting. Second, in areas where internet voting was not made an option, but other options were, voter turnout could be higher due to these alternative modes of voting compared to areas where only paper only ballots were an option. One study that tested the effects of internet voting in all 98 municipalities that have adopted it since 2014 controlled for some of the factors such as eliminating paper ballots, whether vote by mail was an option, and whether there were additional

registration costs associated with internet voting.[67] They found internet voting still increases

turnout where municipalities offer other convenience voting options, though the increase is

significantly smaller than municipalities that do not offer other types of convenience voting.[68]

This evidence suggests that in any given municipality, the implementation of internet voting is

affected by multiple factors. Furthermore, there is a possibility that some regions that have

implemented internet voting are systematically different from other regions that did not, which

could affect overall turnout and therefore the estimated impact of internet voting on turnout.

Further Discussion: Security Analysis and Blockchain

Some might conclude that seemingly marginal increases in voter turnout are not worth

the costs of implementing a new voting system. Aside from the monetary costs of implementing

a system, there is an even greater cost that the security of elections might be compromised. It is

vitally important to consider the security implications of internet voting. There is a risk that

domestic political groups, foreign state actors, or cyberterrorists could hack the election to steal

or change votes, altering the results of an election. Attacks may be especially attractive to

cyberterrorist groups because such attacks would be recognizable, promoting motivation as it

would cause chaos in the electoral system.[69] There are several major potential threats with

implementing an internet voting system. First, there is a potential for a hacker to gain access to

an individual's computer via their software which would allow hackers to alter many individuals'

votes.[70] Second, a hacker could hack into someone's computer or an entire network revealing

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[67] Goodman and Stokes, 9-10.

[68] Ibid.

[69] Aviel Rubin, "Security Considerations for Remote Electronic Voting," *Communications of the ACM* 45, no. 12 (2002): 44.

[70] Michael R. Alvarez and Thad E. Hall, *Point,* "Security and Internet Voting." In *Click, and Vote: The Future of Internet Voting,* 1st ed. (Washington, D.C.: The Brookings Institution, 2004) 83.

voters' preferences. This would present a huge privacy risk for voters. Third, a virus could be downloaded on many computers so that large scale amounts of computers shut down prior to an election, restricting individuals' ability to vote or raising their costs to do so.[71] Fourth, is the threat of a denial-of-service attack, which would occur from an individual sending mass amounts of information to the government website that the internet voting platform is on so that it would be flooded and shut down.[72] In this case, internet voters would lose their ability to cast a ballot. Next, is the threat of spoofing, which would occur if a hacker encouraged individuals to vote via a fake website, thinking that they were legitimately casting their ballot. Not only is this a security implication because people would think they have cast a ballot when they haven't, but also because these fake websites would allow hackers to gain individuals' voter information so they could cast real ballots.[73] Lastly, there is a threat that since voters are not at a precinct location, individuals could be coerced or bribed to vote a certain way. This is a larger threat for groups such as the elderly or handicapped who can more easily be coerced into voting a certain way or convinced that someone who is helping them vote with the new technology is voting according to their preferences when they really are not.

While these security risks seem hypothetical, there is evidence that they have happened before. In 2010, Washington D.C. created a pilot internet voting system which invited anyone to not only cast ballots, but also to attempt to hack the system.[74] Within two days of the launch of the system, individuals were able to gain control over the server allowing them to change and reveal past and future votes.

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[71] Ibid.
[72] Ibid.
[73] Ibid, 84.
[74] Scott Wolchok, Eric Wustrow, Dawn Isabel, and Alex Halderman, "Attacking the Washington, D.C. Internet Voting System," The University of Michigan. http://www.ifca.ai/fc12/pre-proceedings/paper_79.pdf

In light of the security implications of internet voting, one way to make an internet voting system more secure would be to implement a blockchain style internet voting mechanism. Blockchain is a technology first used in Bitcoin which is a peer-to-peer payment system for cash transactions via the internet without the need for a financial institution.[75] This technology is essentially a public chain of linked data that carries information. Blockchain can be used in internet voting by creating a chain of blocks that contain a foundation block, which will be each candidate's name linked together with blocks of each voter who has voted for the candidate. Each block in the chain will be composed of a hash which is a voter's identification or social security number which will be linked with the hash of the previous block, as well as the individuals' vote.[76] Each hash will be made using an advanced algorithm. For purpose of presentation, see figure 8 below: the foundation of the block is each candidate who is running for office, each block that makes up the chain contains a voter's information and their vote which is titled "hash", which is connected to all the previous voter's information titled "previous hash", ultimately making a chain that cannot be broken. This system is more secure because if anyone hacks the system and makes changes to votes along the way, the hash will change. This change can easily be identified because all the proceeding hashes will not line up and it would be impossible for a hacker to change all the hashes in all the blocks in the time between when people vote and when voting closes.

Figure 8:
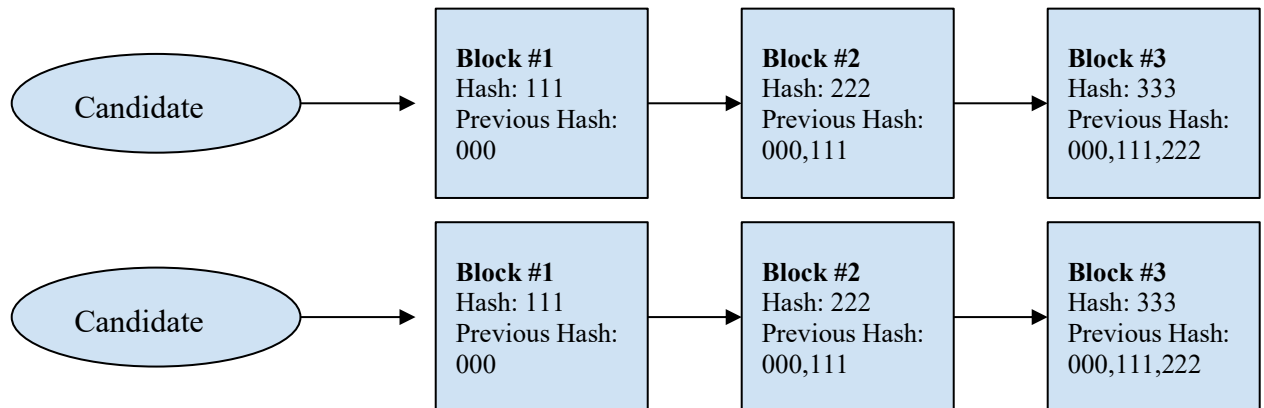
My research has found that in almost all cases tested, internet voting has increased voter turnout. In deciding whether or not to implement an internet voting system, states need to understand the tradeoffs between increases in voter turnout and the security implications with such a mechanism. As we continue further into the technological revolution and more daily and civic life moves online, states may be forced to adapt to internet voting. In this case, it is important for states to research and implement voting mechanisms such as blockchain which will reduce the security threat of internet voting. In the future, we will have to ask ourselves whether internet voting enhances democratic participation or erodes it due to potential threats to the system.