

Fifteen Years of Internet Voting in Switzerland

History, Governance and Use

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Abstract—This paper reviews the piecemeal introduction of internet voting in a highly federalised political setting, Switzerland. We trace the processes leading to the implementation of internet voting and the network of actors involved in its governance. In the empirical analysis we report usage patterns and take stock of what we know about the individual and socio-demographic profiles of internet voters.

Keywords—internet voting; Switzerland; participation; e-governance; multi-level governance; socio-demographic profile

I. INTRODUCTION

Fifteen years after the first parliamentary motions asking for the introduction of a fourth voting channel in Switzerland there are currently two cantons (Geneva, Neuchâtel) that allow a selection of Swiss residents and, in addition, twelve cantons that provide internet voting for all of their citizens living abroad. A further expansion will occur in 2015 and 2016 when more cantons will have adopted internet voting. For the national elections in October 2015, for example, roughly 70 per cent of all Swiss citizens living abroad (if they have registered as voters) will have the option to vote via the internet. The roll-out of internet voting still seems to develop at a very slow pace. However, one has to be aware of the fact that in decentralised, federalist Switzerland it took thirty years to generalise postal voting which is nowadays by far the preferred voting channel. In the major cities more than 90 per cent of the voters opt for postal voting during the three weeks before the actual voting date. Voting at the ballot box became much less frequent. However, voting in an assembly taking place once or twice a year by a simple show of hands is still very much common for municipal matters (in 80 per cent of Swiss municipalities) as well as in the two cantons Appenzell Innerrhoden and Glarus.

Our aims in this overview article on Swiss internet voting are four-fold: First, to shed some light on the history of the introduction and piecemeal implementation of voting in the digital age. Second, to identify the governance networks in which policy-making and implementation of Swiss internet voting takes place. Third, to report the uptake rates for this new voting channel across the different Swiss internet voting systems and cantons. Fourth, to take stock of what we know about internet voters on the individual level and to observe what their socio-demographic characteristics are.

II. HISTORY

During the late 1990s the idea of modernizing elections by providing for remote forms of voting, such as internet voting, took root in many European countries. In this respect, Switzerland was no exception to the cyber enthusiasm of the period. However, unlike many other European countries, Switzerland already had accumulated a wealth of experience in generalising a remote form of voting: postal voting. Furthermore, it was already well established that the introduction of postal voting had a significant impact on turnout, 4 per cent on average according to econometric studies [1]. It was therefore unsurprising that promoters of internet voting hoped that this new form of remote voting would be quickly adopted by voters and might even provide an additional boost to Switzerland's low average turnout rates, which are especially problematic among the young. In terms of efficiency too, internet based voting also offered the benefit of streamlining the vote counting process as well as reducing the number of invalid votes – both of which are appealing in a context such as Switzerland where the frequency of voting is high. In addition to elections on all three state levels, there are three to four referendum vote dates per year, also on all three state levels [6].

In terms of the evolution of the Swiss case, a number of parliamentary motions related to matters of e-government (including internet voting) put forward at the beginning of the 2000s constituted the first steps towards the implementation of internet voting. The actual implementation process was rather piecemeal and rolled out at a slow pace, however. It involved numerous evaluations and testing of different models, which while enjoying a high degree of coordination were implemented in a decentralised fashion. This is largely the result of the way in which elections are organised in Switzerland in general where this specific competence is a cantonal, and sometimes communal, affair. The federal level can only establish some basic guidelines of a procedural nature even with regard to elections at the federal level. Given this context, it was evident that the role of the federal agencies would mostly be limited to facilitating experimenting with internet voting rather than implementing the trials. This, indeed, was the actual route taken when three cantons took up the internet voting challenge and the federal level initially provided financing of up to 80 per cent for the organisation

of internet voting trials. The latter would be conducted on national level referendums in the three pilot cantons. The result of this approach is that in Switzerland three distinct internet voting models have been developed, each of which correspond to a particular canton: the Geneva, Neuchâtel and Zurich models.

In terms of the three internet voting models, those of Zurich and Geneva are very similar. One significant difference between the two is that the Zurich model is operated by a private company whereas the one in Geneva is hosted and managed by the canton itself. The Neuchâtel model by contrast is quite different. Its internet voting solution is firmly integrated into an e-government portal that allows citizens to conduct other transactions with the administration, such as filing tax reports, in addition to internet voting. However, in order to do so citizens must first register at the municipality in order to use the e-government portal as a whole before they can use internet voting. In the cases of Geneva and Zurich no initial registration is required since all citizens are mailed the requisite information, such as log in details, that would enable them to make use of the internet voting channel prior to every election or referendum vote.

The first internet voting trials related to a binding referendum vote were conducted in 2003 in the small commune Anières that is part of the canton of Geneva. Within a two year period both Zurich and Neuchâtel had also conducted their first trials [2]. Since 2005 there have been numerous trials of internet voting in the three pilot cantons not only for national level votes but for communal and cantonal votes as well. It is important to note that these votes are principally related to referendums rather than elections -although there have been a number of the latter too. For the time being these trials have continued although in the case of Zurich the internet vote project has been temporarily halted for technical reasons since 2011 and is now being restarted in 2015. The technical problems were not related to the internet voting solution per se but to the interfaces with electoral management systems and the municipal vote registries.

In the early phase of internet voting trials Swiss voters abroad were not included. This soon changed when the Swiss government explicitly acknowledged its desire to make internet voting available to the large ex-patriot community of Swiss voters [4]. There are a number of reasons for this new strategy, which can be traced back to 2006. One of the most significant factors is the role of the Organization of the Swiss Abroad (OSA) -the main advocacy organisation for ex-patriot interests- which was firmly behind the internet voting initiative. The community of Swiss voters abroad were a natural target group for internet voting trials due to the well-known difficulties in providing for postal voting (i.e. because of problems related to postal delivery in some countries) [5]. In addition, facilitating the convenience of the vote for this group, it was hoped, would stimulate this segment of voters to turn out, thereby providing a further boost to participation rates. At 10 per cent, the Swiss abroad make up a considerable portion of the electorate. However, only a small proportion tends to

participate in elections and referendum votes. Their lower propensity to participate and the lack of media attention devoted to this group of voters ensured that the Swiss abroad provided an ideal test group. Furthermore, if the adoption rates were significantly higher this could have a positive spill over effect to the domestic debate where internet voting is much more contested politically [3].

The legal basis for the roll out of internet voting to Swiss ex-pats had been laid shortly after the federal government's 2006 report [5]. By June 2008 Neuchâtel had become the first canton to allow its Swiss abroad community to vote by internet. The two other pioneer cantons were quick to follow with Geneva in 2009 and Zurich in 2010. However, what is interesting about the ex-patriot roll out of internet voting is that it is not restricted to the three pioneer cantons. All Swiss cantons can make it available to their ex-patriot voters even if their own domestic residents are (not yet) allowed to make use of the new voting channel. By 2009 Basel-City had become the first of the non pilot cantons to take up the internet voting challenge for its voters abroad and within the timeframe of two years it was quickly followed by nine other cantons (Argovia, Berne, Fribourg, Grisons, Lucerne, Schaffhausen, Solothurn, St. Gallen, Thurgau). At the time of writing almost half of the Swiss cantons (12 out of 26) offer internet voting to their citizens abroad.

Although cantons introducing internet voting for Swiss abroad were free to adopt their own models, because of the financial costs involved in practice their strategy has been to collaborate with one of the pilot cantons and adopt their internet voting model. In particular, two models have emerged: the Zurich internet voting model has attracted seven cantons -all of which have formed a consortium. However, due to the interruption to the Zurich internet voting project -since 2011- the neighbouring canton of Argovia has taken the lead role in managing the consortium. The second model, the Geneva system, has been adopted by three new cantons. For the time being, no canton has adopted the third model, the Neuchâtel system. This is in large part due to its more idiosyncratic set up in which internet voting is a sub component of a broader e-governmental portal.

It would seem that after having successfully trialled internet voting in a number of cantons, this new and supplementary mode of remote voting would be well on its way to becoming generalised. If not in all Swiss cantons at least in the three pioneer cantons. However, this is not the case and nor was such a smooth transition actually envisaged by policy-makers. The introduction of postal voting had taken three decades and even today it is still subject to variation among the cantons. With regard to internet voting it seems that the federal government is following a similar piecemeal track. The roadmap for the first cantons to generalise internet voting set the year 2020 as a goal.

III. GOVERNANCE

In such a decentralized administrative setup the question arises of how to manage and coordinate the introduction of a

new and rather large-scale technological system such as internet voting. One of the typical features around the introduction of internet voting in Switzerland is precisely the multitude of political actors involved. Even national referendum votes and elections are, in general, executed by the cantons and municipalities. The Federal Chancellery as the main competent agency in all matters around elections and referendum votes fulfils the role of overseeing and coordinating. It is also the body overseeing the canton's laws on political rights making sure they conform to national norms. More specifically regarding internet voting the federal level can be considered to be a central coordinator and mentor of the whole project. To a certain degree the technical requirements lead to a transfer of competences from the municipal level to the cantonal and national level as far as the administration of referendums and elections is concerned. For example, vote registries had to be harmonised within cantons. Traditionally, the vote registries are administered by the municipalities where all inhabitants are formally registered by law.

On the other hand we can observe manifold intergovernmental relations in the realms of internet voting. The vertical and horizontal connections between all state levels and private actors can thus be described as a multi-level governance network. The reason for this rather intense collaboration lies in the complexity in providing a safe and trustworthy electronic voting channel, the institutional setup of the practice of political rights and the financial costs involved.

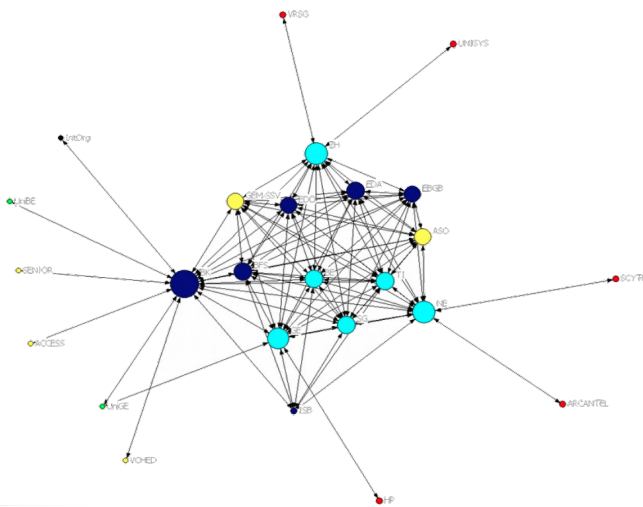


Figure 1: Internet voting governance network 2003-2007 (Source: Serdült and Wellig 2014).

Figures 1 and 2 capture these multi-level governance networks in the domain of internet voting in Switzerland. Actors were compiled on a first list by going through all official reports and literature on internet voting in Switzerland and were then verified by three senior experts working in public administrations. Relations are supposed to capture collaboration between the actors involved in the governance network and are defined as a composite of three dimensions given different weight in the calculation of the relational strength. First, actors

involved in strategic management with a seat in the respective bodies on the federal level (weighted by the factor 4). Second, actors providing internet voting (factor 4 for each internet voting instance per year of practice, factor 2 if only for Swiss expatriates). Third, simple information exchange in various consultative and coordinative bodies was weighted as 1. We calculated Bonacich centrality with the help of Ucinet 6 and used the Fruchtmann-Reingold layout algorithm in NetDraw for the graphical display of nodes and relations [15], [16]. The more central nodes in these networks have a larger radius proportional to their centrality values.

For the first historical phase we identified 2003-2007 (see Fig. 1) we can detect the Federal Chancellery as the most central actor with many links to the cantons. The bigger the nodes in this network analysis the more important the actor is for the collaboration structure in the internet voting governance network as a whole. Further important actors on the federal level (dark blue) are the Justice Ministry and the ISB, a federal steering committee on all matters IT related. The cantons who participated in the development process of internet voting from the beginning (light blue) have a bit more weight in this network (Geneva, Neuchâtel, Zurich). Private service providers can rather be found at the periphery attached to the respective cantons they work with (red). Academic institutions (green) and NGOs (yellow) round the picture off but are of only marginal importance for the network as a whole.

The Swiss internet voting governance network during the second phase of implementation 2008-2014 is basically still structured the same way (see Fig. 1). However, we can observe an increased collaboration among the cantons and the Federal Chancellery. Academia, interest organisations and private service providers play complementary roles only. Although the number of actors has increased, the density value -in other words the intensity of collaboration- is with 31 per cent almost as high as it was in the first period. Network centralization -a network dispersion measure- is still low at 7 per cent meaning that the governance network is not dominated by one single actor (in which case network centralization would be at 100 per cent).

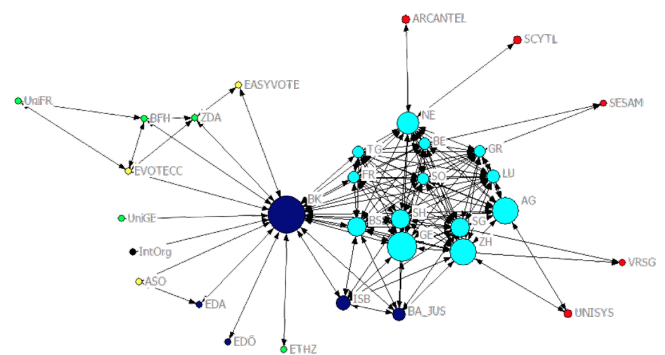


Figure 2: Internet voting governance network 2008-2014 (Source: Serdült and Wellig 2014).

IV. USAGE OF INTERNET VOTING

The percentage of users adopting the new voting channel is not only an interesting question in a sociological sense - especially in an environment with a convenient postal voting system in place in all the Swiss cantons, but also a political one. The argument that internet voting would help to boost voter turnout was frequently used in parliamentary debates by advocates of the new voting channel. In addition, high internet voting usage rates would help to justify the whole effort regarding financial costs and organisational resources involved. In order to keep track of internet voting usage rates we therefore maintain a database reporting all internet vote results in as much detail as possible since the first vote in 2003, eg. keeping the three voting channels apart for Swiss residents, Swiss living abroad and in some cantons also migrants with voting rights on the local or the cantonal level. The database stores this information on the municipal level and currently comprises 3'100 entries (see <http://www.ivotingproject.com> for a codebook). As internet voting is not generalised in any Swiss canton yet, availability for the general population is relatively limited and therefore also the inferences we can draw. However, we should also keep in mind that although generalisation is lacking the number of sequential binding internet votes is the highest in the world.

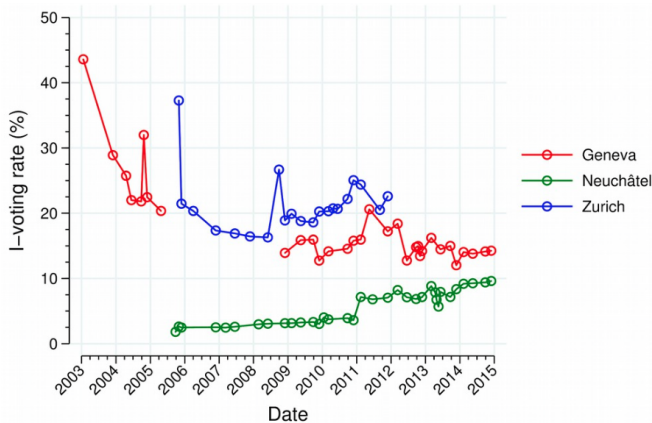


Figure 3: Popularity of the online channel among Swiss resident voters (Source: Germann and Serdült 20114).

Figure 3 plots the annual internet voting user rates in the three pilot cantons, aggregated across all municipalities in the respective canton. We can easily depict the two main effects helping to explain the patterns of internet voting over time, namely the novelty and the convenience effect. Geneva (red) and Zurich (blue) are good exemplifications for the novelty effect, in the sense that some voters seem to test the new channel because it is new and then rather prefer to revert to their habitual voting channel. Whenever new municipalities are allowed to join the pilots we can observe another spike upwards. Geneva started with one, then four, and fourteen municipalities until they had to interrupt internet voting because of political opposition [3]. The Geneva case also illustrates the detrimental effect a long interruption can have for the user

rates which used to be in the 20 per cent range before the interruption and nowadays seemed to have stabilised in the 15 per cent range. Regarding the novelty effect we can find the same development in the Zurich case although the usage rates for internet voting were rather on an upward trend above 20 per cent. It will be interesting to observe on which level Zurich will settle after the interruption when they continue to use the electronic channel again for Swiss resident voters in 2016. In general, convenience of postal voting keeps the internet voting channel usage rates down. Eventually, they will grow with younger cohorts of voters much more attached to doing all kinds of transactions via the Internet. The fact that voters in Neuchâtel need to register for the e-government portal first is a clearly detectable effect of the lack of convenience. The small jump upwards in 2011 can be explained by the introduction of electronic tax filing capability within the e-government portal which seemed to have drawn some extra citizens to using internet voting as well. Overall, the level of internet usage is not surprising. Internet voting experiments in Estonia or Canada yielded quite similar usage rates [3], [7], [8].

We now turn to the second important group of internet voters in Switzerland, the Swiss living abroad. A first observation comparing the usage rates of the Swiss residents with the Swiss voters living abroad as shown in Fig. 4 can easily be detected on the spot. Generally, between 40 and 60 per cent of all expatriate voters used the online channel, and in some cases such as Aargau or Thurgau the rate is even higher heading towards 70 per cent. The trend is clearly upwards with a growth rate of roughly 2 per cent per year. With consistently less than ten per cent internet voters, Neuchâtel is again the deviation from the general pattern. For the Swiss living abroad the requirement to sign up in person for the whole e-government portal is an even higher burden resulting in lower usage rates. Geneva also scores lower than the rest, even though it is still much higher than in Neuchâtel. We attribute the relatively low figures for Geneva to the many 'fake' expatriates who tend to live just across the border in neighbouring France in order to avoid both the notorious lack of and the high prices of housing in Geneva. We should also note that until the end of 2013 the usage statistics for expatriate internet voters we are reporting are a bit lower than in reality because until then internet voting was only available in countries which had signed the Wassenaar treaty (under which encryption is considered a dual-use technology).

We can thus conclude this part with two main statements. First, the expatriates' naturally higher interest in internet voting is reflected in comparatively higher usage rates. Up to 7 out of 10 expatriate voters chose the internet voting channel in the trials so far and therefore clearly stand above the usage rates we can observe for the Swiss residents. The exception is internet voting in the canton of Neuchâtel, the one canton with an internet voting solution with a more onerous registration procedure, requiring citizens to sign up for the whole e-government portal in person. Internet voting usage rates in this canton are relatively low for both Swiss residents and expatriates, but they are slowly and constantly on the rise.

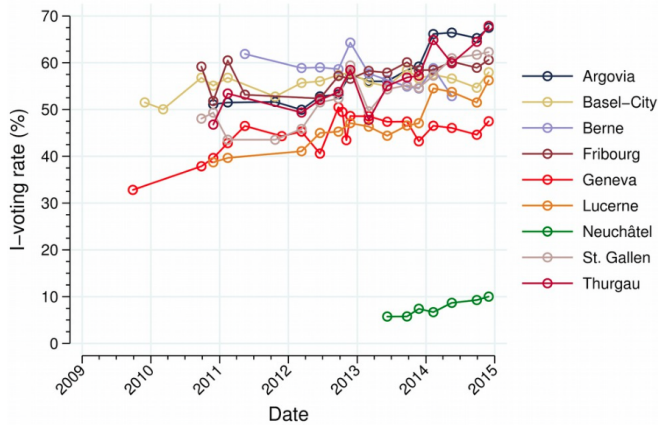


Figure 4: Popularity of the online channel among Swiss expatriate voters (Source Germann and Serdült 2014).

Second, the online channel has over the years gained in popularity among Swiss expatriates. We are expecting the growth curve to continue some more at the current pace and then to stabilise at a relatively high level. Swiss expatriates seem to be quite loyal to the online voting channel. In contrast, the trials with Swiss residents show a pattern of dropping usage rates after the novelty effect wears out. Users rather seem to revert back to their traditional mode of voting, especially postal voting. Eventually, usage patterns for the internet channel will become clearer once more cantons join the effort and start to generalise this channel for all municipalities on their territory and not only allow it for a few pilot municipalities only.

V. SOCIO-DEMOGRAPHIC PROFILE OF INTERNET VOTERS

Who are the users of internet voting in Switzerland? What are their socio-demographic characteristics? Seven studies have been conducted so far on Swiss internet voters' socio-demographic profile. Table ?? gives a condensed overview of these studies. In this section, we focus on four basic socio-demographics: age, gender, education and income. We report results based on within-voter comparisons, that is, differences between internet voters and the other voters (postal or ballot box voters). Some studies also investigated differences between internet voters and the general population; these results are not reported here to maintain comparability.

A. Age

Concerning age, the seven studies reveal a relatively uniform picture: younger voters tend to use the internet voting channel disproportionately more often compared to older voters. The age bias emerges both in trials involving residents and in trials involving expatriates. The only studies finding no age biases are [14], [17], but these studies' results should be taken with care as they base on a self-selected sample and thus are potentially marred by selection bias. Interestingly, it is not the youngest voters (18-29 years) who use internet voting most often but rather voters in the 30-39 years cohort [9]–[13]. In turn, older cohorts (50+) are under-represented among users of

the internet voting channel. Crucially, age loses its statistical significance when controlling for ICT variables, such as IT skills, the frequency of internet usage and trust in internet transactions [11], [12]. This indicates that younger voters tend to use the internet voting channel more frequently not because they are young but because younger people have a higher internet affinity and more IT skills.

B. Gender

Without exception, all seven studies found that men are over-represented among internet voters [9]–[14], [17]. However, the size of the gender bias varies significantly between the studies. For example, [13] show that 35.7 per cent of male voters used internet voting but only 16.4 per cent of female voters, whereas [10] reports that 36.7 per cent of male voters used the online channel compared to 30.2 per cent of female voters. Gender loses statistical significance in multivariate models including other socio-demographics in [12] though not in [11]. In contrast, gender loses statistical significance in both [11], [12] when ICT variables are included, suggesting that it is gender differences with regard to variables like IT skills that drive internet voting rather than gender per se.

C. Income

No study has yet looked at income differences in the expatriate context. The three studies that considered income differences in the trials for Swiss residents invariably showed that voters living in high-income households use the internet channel disproportionately more often [11]–[13]. Income loses significance when controlling for other socio-demographic variables in [12] but not in [11]. Critically, income loses its predictive power when ICT variables are accounted for in both [11], [12].

D. Education

Five of the seven studies researched education differences. Similarly to age and income, education tends to be positively related to internet voting in bivariate comparisons. Those with the highest educational attainment tend to be the most overrepresented. [13], for instance, found that more than a third of voters with a university degree voted online but only 2.8 per cent of voters with compulsory education. The only studies finding no differences with regard to education are [14], [17], but again it has to be highlighted that these studies are problematic due to self-selection into the sample. Moreover, while finding no differences regarding education, both studies found that politically knowledgeable expatriate voters are overrepresented among expatriate internet voters, which goes into a similar direction. Thus voters with high education are most likely overrepresented among internet voters in both residents and expatriate trials. Finally, multivariate analyses controlling for ICT variables result in a familiar pattern: education loses statistical significance as soon as ICT variables are introduced [11], [12].

In sum, the existing evidence of Swiss internet voters' socio-demographic profile points to the conclusion that internet

Table I: Overview of studies examining socio-demographic characteristics of internet voters in Swiss internet voting trials

Study	Target group and results
Christin and Trechsel [9]	Target group: residents in Geneva. Bivariate analyses show that younger (under 40, although not the youngest) and male voters are overrepresented among internet voters.
Christin and Trechsel [12]	Target group: residents in Geneva. Bivariate analyses suggest that the online channel was used more by younger (30-39 followed by 40-49 and 18-29), male voters with a high education level and a relatively high household income. In a multivariate model including all above-mentioned variables, only age and education retain statistical significance. Differences fade completely if ICT variables are added: only the ICT variables remain as significant predictors of internet voting.
Serdült and Trechsel [13]	Target group: residents in Zurich. Bivariate analyses suggest that voters between 40-49 are the most frequent users of internet voting, followed by voters between 18-39. Male voters, voters with high education and voters living in high-income households are also overrepresented among internet voters.
Serdült [10]	Target group: expatriates registered in Geneva. Based on bivariate analysis the 30-39 year old voters most often choose the internet voting channel, followed by the 40-49 and the 18-29 year old cohort. Men are also slightly overrepresented among internet voters.
Sciarini et al. [11]	Target group: residents in Geneva. Bivariate analyses show that voters between 25 and 34 are the most frequent users of the i-voting channel. Males are again overrepresented. Voters with high education and voters living in high-income households vote disproportionately often via the internet. In a multivariate model including all these variables, all retain statistical significance (note: income could not be included in these models). However, as soon as ICT variables are added, the socio-demographic variables are no longer statistically significant.
Germann et al. [14] & Germann and Serdült [17]	Target group: expatriates registered in Argovia, Basel-City, Grisons and St. Gallen. Both studies focus on the 2011 federal elections and use the same data source. Bivariate analyses show that males are overrepresented among internet voters. No differences are found with regard to age and education. However, it has to be noted that the studies' empirical basis (a self-selected sample of expatriates) is rather weak.

voting has, at least to date, primarily been a service to the young and privileged: compared to 'traditional' voters, internet voters tend to live in comparatively rich households, have a comparatively high education, be male and between 18 and 49 years old. However, multivariate models show that it is not these variables per se that make voters more likely to vote online, but rather their relationship with ICT variables, such as the frequency of internet usage and trust in internet transactions. The explanation for this is simple. On the one hand, it is the resource-rich that are more likely to have the necessary resources to buy computers and link them to the internet. On the other hand, it is the young and higher educated who are more likely to be engaged with computers and the

internet, develop IT skills and trust in internet transactions. In terms of a positive conclusion, the finding that it is ICT variables rather than socio-demographics that drive the use of internet voting at least suggests that internet voting's digital divide should become smaller over time as computers become cheaper, younger cohorts grow older and IT skills and trust in the internet and internet voting solutions therefore become more widespread.

VI. OUTLOOK

Over the past fifteen years Switzerland has undertaken a piecemeal implementation of internet voting. The policy model pursued has, in many respects, dovetailed the way in which another form of remote voting was introduced in the past - postal voting. Evidently, there are case characteristics that are quite specific to Switzerland, such as the high frequency of referendums. Nonetheless, the dynamics of laboratory federalism in the domain of internet voting, whereby diversified experimentation takes place across distinct political units, could provide comparative insights that are relevant to other federal countries such as Australia and Canada where elections are very decentralised affairs as well.

In the year 2015 the Swiss internet voting systems currently in operation are going to be upgraded and include verification mechanisms for the voters (so called individual verification, in contrast to even more advanced systems allowing for universal verification). The first use of these so called second generation internet voting systems is scheduled for March 2015. Furthermore, for the national elections in October 2015 roughly 70 per cent of the Swiss living abroad will be allowed and have the option to use internet voting. In addition, more cantons will offer the electronic channel to their citizens living in Switzerland starting in 2016. Internet voting is thus here to stay and will most likely establish itself as a further voting channel. Full generalisation will take some more time. Whether internet voting effects the voting behavior of Swiss citizens is still to be seen but should of course continuously be monitored.

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