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Social media agenda setting of Environmental Policy Issues in Switzerland

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Abstract

This paper seeks to develop methodologies and testing methods for the agenda setting power of Swiss political organizational accounts on Twitter to determine who sets agenda about environmental topics. Previous research has examined social media's agenda setting power over traditional media but has been unable to draw conclusions on which political organizations set agenda on other organizations. Research has suggested that larger organizations might have an agenda setting role over smaller ones, and organizations perceived as experts may set agenda over others. Twitter data from official organizational accounts was collected, encoded as environmental or not, and then fitted to a Vector Autoregressive model to understand how environmental content published in the past by some organizations predicts environmental content published in the present by other organizations. There is little evidence that large organizations set environmental agenda on Twitter, and mixed results that perceived experts set agenda. These findings suggest that Swiss organizations believe voters will pick up cues from perceived experts, and thus are quick to jump on trends set by these experts such as green political parties. The methodologies outlined in this study will help provide framework for further analyses to understand which types of political organizations set agenda in the long run.

Key words. Political agenda setting, vector autoregression, Switzerland, supervised machine learning

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CONTENTS

Politics and policies affect every facet of our lives. Be it local mayoral elections that determine a city's annual budget, international negotiations of obtaining a common goal like reduced emissions, or ethical and moral debates on what is true social welfare, politics invariably shape the discourse of nearly every social and economic debate. For much of the western world, policy is introduced and agreed upon in some variation of a democratic process, a process heavily influenced by local politics and interactions from different groups with political interest and economic resources. But not every political topic has the same salience with one another. The political agenda, the political debates deemed to be important enough for discussion, are oftentimes set by actors known as "agenda-setters" such as the media, political units, or the constituency of voters themselves. One example of a highly salient political debate which continues to reappear on the political agenda is the well-being of the environment. The debate is often polarized by conservationists on one end and capitalistic business entrepreneurs on the other.

One of the greatest challenges of our world is to reconcile the seemingly paradoxical interests of conserving the environment and maintaining our systems of politics and business enterprise. With a steady increase of the world's global CO_2 levels, annual average temperatures, and sea levels, the necessity of promoting effective and immediate environmental policy has become even more self-evident. The environment's presence in the political agenda has been growing consistently, becoming highly pronounced during the Kyoto Protocol in 1997 and again at the Paris Agreement in 2016. Later in 2019, the environment rose back to the international political agenda during the climate strikes of September 2019. Novel international laws and movements are highly salient forces which have the capability to set global political agenda, but these have proved to not be sustainable in the long run. It is therefore a challenge of

environmentalists and green political groups alike to understand how to navigate the political agenda of a democracy to effectively promote public support for increased green policies.

Switzerland provides an excellent case study to examine such environmental geopolitics. The landlocked, alpine country is home to a wealth of natural beauty and environmental capital such as its pristine snow-capped mountains and picturesque lakes, tourism to such places providing small but substantial activity to the Swiss economy (Swiss Federal Council, 2017). The Swiss landscape is a profound aspect of their culture; skiing and hiking the Swiss Alps, swimming the lakes, relaxing in thermal baths, as well as having a simple picnics outdoors are activities enjoyed by many Swiss people, and the preservation of the landscape is generally very important to maintaining these practices. It is, thus, in Switzerland's best interest to maintain a high environmental quality for both the environment and for the health of Swiss industry. According to survey data after a 2016 referendum vote in Switzerland, about 68 percent of respondents said it is important to conserve the environment (FORS Research Center, 2016).

The strong presence of duty to conserve the environment is made even more interesting by the strong presence of businesses and business interest associations (BIAs) in Switzerland. The rapid growth of industry since the turn of the 19th century has driven the Swiss economy to substantially grow its tertiary service sector. For example, the Swiss banking industry experienced a boom during World War II, as Jews from neighboring countries rushed to hide their assets into Swiss bank accounts to utilize Swiss business secrecy law, known as the *Geheimsphäre* (Vincent, 1998:104). As the supply of banking reserves increased, interest rates on loans experienced a sharp decrease, giving birth to new industries and businesses. This influx of business in the country has given Switzerland a well-known corporate culture, as well as being

the catalyst for the creation of BIAs. BIAs fall into a broader group of Swiss interest groups who function with the Swiss federal government in arrangement known as 'liberal democratic corporatism' (Katzenstein, 1984:38). Business associations are situated between their members whose interest they serve and the public administration whose policies they try to influence in favor of their members (Kreisi and Treschel, 2010:100).

Switzerland provides a unique area of analysis for environmental policy due to its highly democratic federalist government and strong green policies. Switzerland is one of the most democratic countries in the world. Swiss political organizations have to be mindful of voters' specific wants since any new laws that are voted are effectively permanent changes to the Swiss constitution. Switzerland has held more referendums and popular votes regarding novel policy than every other country combined (Ladner & Brandle, 1999:283). Important to Swiss political framework is the use of the popular vote, a pre-parliamentary process that opens novel policy to a vote *before* it is signed into law, which in turn would then be signed into the Swiss constitution. The use of these democratic mechanisms has only increased in the past three decades (Kriesi & Trechsel, 2008:61). The increasing participation rates of Swiss voters suggests a trend of increasing democracy in Switzerland.

Switzerland is also one of the greenest countries in the world (Wendling et al., 2020). With one of the highest standards for air quality, water quality, and practices for sustainability, Switzerland is great example for how green policies can function in a democratic country with a strong corporate presence. Given the strong green political presence in Switzerland and the overwhelming support for environmentalism among Swiss respondents, analyzing the trends for how political information about the environment is discussed reveals how Swiss political groups

perceive voters will respond. Understanding who sets environmental agenda can provide valuable insight on how to set similar agendas in other high-income democracies. This paper outlines methodologies which can be replicated in other populations for understanding how political bodies engage with one another about environmental issues and provide environmental activists with additional tools to engage voters in less environmentally conscious populations. It is also important to understand evolving influence of social media in every level of politics, and its novel ability to disseminate political information function as a political forum for discussion (García-Orosa, 2021:2). Research about the growing influence of social media content on the political process has led to questions about which groups set agenda for online political discussions and who it is that follows.

One platform that continues to increase in popularity for its use of political news dissemination is Twitter. It is becoming increasingly common to see political parties and large political organizations to have official Twitter accounts for the purpose of press releases and audience engagement. Which accounts on Twitter, therefore, set and follow agenda? One possible explanation is that accounts of larger organizations with greater affluence have a better ability to set agenda for a wide range of topics, such as the environment. Research in this possibility has admittedly yielded mixed results. Another possibility is that a group's ability to set agenda is the audience's perception that the group is competent of the political subject. The research in this population is more supported in the literature, but it is often discussed outside the bounds of social media. Downloading Twitter publications from these official accounts and being able to classify them as environmental or not will create a dataset that can help address these questions. Tracking the environmental Twitter content of major Swiss political accounts as a function of content that other major accounts publish in the past provides a model for

predicting how much environmental content an agenda follower will post as an impulse response of the environmental content of an agenda setting account, known as *Vector Autoregression* (VAR). Tests for causality, cointegration, and comparing the magnitudes of VAR model coefficients against standard error provides evidence to test these hypotheses. The tests in aggregate will provide the basis for concluding which type of political group has agenda setting power for environmental political issues on the social media platform like Twitter which can be replicated for other social platforms.

LITERATURE REVIEW

Novel technologies, social platforms, and data have forever changed aspects of the democratic political process in ways that aren't fully understood. Research on these relationships and effects on politics at large has continued to grow since the 1990s when political actors first began creating online presences (García-Orosa, 2021:3). Digital media affects how political actors and organizations address needs, such as accessing and creating political information or coordinating with others (Gilardi, 2021:8). Moreover, digital technology provides an effective platform for political actors to introduce, amplify, and maintain topics, frames, and speakers that come to dominate political discourse (Junger et al, 2019:4).

Research suggests that political actors tend to follow the agenda of nonpolitical actors on social media (Barberá et al., 2019:885). However, political actors make use of their relative prestige and influence to amplify the opinions of their audience on social platforms (Gilardi, 2021:11). Political actors, in turn, disseminate information to potentially undecided voters who often take cues of endorsement to inform their voting decisions (Lupia, 1994:63). Political parties and interest groups are therefore able to disseminate information to a wide base of

potential voters, at a relatively low cost compared to ads in traditional newspapers or television ads (Junger and Shroeder, 2021:8).

Open access to and understanding of informational flow is essential to any democracy's ability to survive and thrive, since the role of technology in the political informational flow has only grown since the 1990s. García-Orosa (2019) identifies four distinct waves in new digital democracy that have shifted the paradigm of between political actors, voters, information, disinformation, and the role of big data. The current, fourth wave, began in 2016 with the vote of Brexit, giving rise to present developments such as the use of artificial intelligence and big data as well as audience engagement and co-production processes. Political actors are relying more on their social media presences than ever before to engage potential voters, as well as disseminate information to potential, undecided, voters. This is especially important in local elections and for first time voters in which social media has been observed to be an effective means of engagement (Ha et al., 2013:207).

Social media data and basic analytics can provide a valuable insight to who is setting a political agenda on social media and, therefore, whose biases are more likely to influence the dissemination of information. Swiss voter participation, while stagnant for decades, has begun to increase since the mid-2000s (Kriesi & Trechsel, 2010:55). Younger, first-time, and more technologically savvy voters are flocking to the polls on a variety of elections. These voters are both more likely to receive political information and engage in political discussion on forums like social media platforms. It is worthwhile to understand how political agenda on social platforms are set to understand which issues are likely to be more salient for this growing base of voters.

Political Agenda Setting and Social Media

Agenda setting, as it relates to political science, is the theory that certain actors "set" the political agenda, or determine which political topics receive attention in the political forum. Research into this field first began in 1972 when McCombs & Shaw conducted an initial investigation of news media's agenda-setting effects during the 1968 election (Luo et. al, 2019:152). They found a strong correlation of 0.97 between issues' according to voters, taken by telephone survey, and issues that appeared in news media that serviced the population of voters. Subsequent research into agenda setting has since followed, most pronounced in the traditional news media's power to set or follow the agenda. One important consideration of agenda-setting research is the time-lag or timeframe used in the study (Luo et. al, 2019:154). In general, time lag of agenda setting refers to the period of time that passes between a causal event and another event that demonstrates a political topic receiving increased attention. Researchers often disagree on the appropriate length of the lag—studies concerning traditional news media have implemented a lag from 6 days to 6 months or more.

Traditional news media, however, is not the only source that has the power to set agenda and mobilize a voter base. As the world continues to shift to digital technology, more and more information is dispersed through social media as opposed to traditional media. These new forms of digital news can be just as effective at setting agenda as traditional news media has been (Feezell, 2017:112). As social media content can be published far more quickly and cost-effectively than traditional media content, virtually any party has the ability to set an agenda, regardless of their platform size (Gilardi et. al, 2021:33). Furthermore, as information can be dispensed far more quickly than with traditional media, the time lag can dramatically shrink, down to just a few minutes. Research on this phenomenon is novel but growing.

As discussed, agenda setting describes the effect that some actors have the ability to set agenda, or importance, of issues in the political forum. However, traditional media has increasingly shifted to online social platforms which have the advantage of metrics such as likes, shares, and comments that increase political and cultural participation (European council). Looking on Twitter, for instance, it is easy to come across Tweets with hundreds of thousands of likes, retweets, and comments, metrics known as engagement, that are picked up by Twitter's algorithm to be pushed to a wider audience. Platforms, themselves, are passively setting agenda based on a particular topic's shareability and its potential to engage even more users. Twitter itself therefore can be seen as a political forum which acts as a microcosm to a country's political process and is highly responsive to agenda set by Twitter users.

What does it take to create trending content on a social platform like Twitter? While Twitter's algorithm for detecting trending events is proprietary, preliminary research suggests there are four classes of Tweets that are prone to becoming viral : news, ongoing events, memes, and commemoratives (Diakopoulos & Zubiaga, 2014:28). Generally speaking, these four classes of Tweets are more likely to spark engagement. Higher engagement on tweets further increases the odds that the tweet will spark a trend, albeit short-lived due to competing with other trending topics (Asur et al.:2011). While trending content on social media is often not sustainable in the long run, the trend can undoubtedly set an agenda of important topics offline which, in the face of an election, can be particularly important for voters. An example of this is the climate strikes of 2019 as a result of social media content from activists like Greta Thunberg (Jung et al., 2020:14).

As for agenda setting in Switzerland, the media holds a high level of agenda setting power over politicians (Sciarini & Tresch, 2019:18). This research is in accordance with polling data taken by the FORS research center which found that a random sample of Swiss voters gathered political information for an upcoming popular vote from traditional media. By contrast, only 34 percent of voters got information about a popular initiative from social media sources. However, as previously discussed, the role of traditional media is continuing to shift online. Thus, while agenda setting effects of organizations on individuals would likely not be significant at this point in time, this could change in a matter of a couple of years. Furthermore, due to the comparatively small number of Swiss voters looking online, actors such as political parties, BIAs, and ecological conservationist groups have more competition for attention in traditional sources and thus, use social media as a way to disseminate information with less cost and less competition. For Swiss voters, the ability to understand who sets agenda on social platforms—that is, who 'sets' political topics like the environment as important and who lags behind—can provide valuable knowledge as news and information becomes increasingly digitized.

Swiss political parties, while having more measurable influence than other European countries, still remain quite low (Kriesi & Trechsel, 2010:92). There is great discourse on what exactly the role is upon voters and how the parties influence them. Voters on referendums have imperfect access of technical knowledge of policy and may therefore take cues from political parties and imitating an informed vote (Lupia, 1994:63). However, these cues are often missed or ambiguous, rendering the parties' influence null (de Vreese, 2006:593). Furthermore, Swiss political parties specifically are often underfunded, understaffed, and likewise wholly lacking in resources for effective campaign strategy (Kriesi & Trechsel, 2010:90). As a result of this

conflicting scholarship, it is unclear of what role, if any political parties have in popular votes, and thereby what stake they have to campaign their own interests.

It is important to be aware that while big data, algorithms, and technology may exert great influence over how information is disseminated to potential voters in a given democracy, this field of research is limited due to its novelty. Electoral forecasting, for example, shows promising results, but further research is needed on generalized models which can be applied across multiple elections (Schoen et al., 2013:538). For the purposes of my contribution, this research is not intended to provide a statistical model for election outcomes based on an input of Twitter data. Rather, it is a contribution to agenda setting theory for different actors on a given social media platform. While the voting decisions based off information and cues gathered from social platforms is debated, the role of social media is nonetheless growing more important in elections worldwide, from local or cantonal elections to international ones. Voters make choices by taking several different factors into consideration such as informational channels, personal biases, and culture. This paper seeks to contribute to the research on the former, but not address how voters make decisions based on information they are exposed to. I chose a period of time in which the environment was a hot topic of political discussion

Swiss Environmental Politics in 2019

The year 2019 was highly salient for environmental discussions in Switzerland. 2019 was a federal parliamentary election year in which the environment remained an important topic (Gilardi et al, 2021:11). Gilardi et al concluded that in the same year, social media of political parties set the agenda over traditional media news about environmental issues, and that advocacy campaigns may play an important role in enabling or constraining parties to set agendas. Also in

September of 2019 was the worldwide global climate strikes which called for international bodies to increase climate protection.

The year 2019 was also an important year for the Swiss popular vote about the environment. Switzerland's use of the referendum and popular initiative vote are an integral component to their political structure. It is common practice for the Swiss federal council to make negations with anyone who can credibly collect enough signatures for a popular vote (50,000 for a referendum, 100,000 for a popular initiative) when the council is in the process of writing a new bill into law. This process has coined Switzerland a *negotiation democracy*. It is common practice to have pre-parliamentary discussions on compromise to avoid the popular vote, as this can greatly slow down the political process (Kriesi & Trechsel, 2010:58). On 29th November, Swiss people voted on an initiative entitled "Popular Initiative 'For responsible businesses – protecting human rights and the environment'." The vote, should it had passed, would have greatly changed how Swiss businesses conduct affairs abroad. The results of popular votes have great consequences for Swiss policy, and assuming that political parties, business associations, and environmental groups are in a strategic position to campaign, their self-interest should dictate them to do so. This context is important to establish when theorizing potential forming research questions, assuming agenda setting follows a logical, self-interested approach.

The Players

The social democrats/socialists. The Social Democrats (Sozialdemokratische Partei der Schweiz in German, Partie Socialiste in French) is today one of Switzerland's two largest political parties (Kriesi & Trechsel, 2010:74). The groups was founded in 1888 as a result of a coalition between several smaller labor movements at the time such as the the Grütli Union and

the Swiss Federation of Trade Union. The party is defined as a center-left political group, supporting a pro-federal government stance on a variety of different political issues. Later in the 20th century, they involved themselves in a wide variety of heated political topics at the time such as women in government, environmental protection, and the question of Swiss integration with Europe. As of today, the Social Democrats are the largest political party in Switzerland that support joining the EU (Norwegian Centre for Research Data, 2015).

The research regarding agenda setting power of the Social Democrats on social media platforms is both novel and with mixed results. On the one hand, they were found to exhibit strong agenda-following behavior from news media articles during the 2019 federal elections (Gilardi et al, 2021:1). This suggests that for specific topics, Swiss political parties like the Socialists may be quick to follow on trends by third parties. On the other hand, there is little evidence that the official accounts of @PSSuisse or @spschweiz have a statistically significant agenda-setting effect on their politicians (Gilardi, 2021:16). This may indicate that the party's social media presence may be intentionally restrained as to not disinterest public voters who are not as politically extreme as the party's politicians (Leimgruber, 2010:504). However, when examining the effects of other party accounts setting agenda on social media, there may be a substantial effect to follow agenda as garnering as much party attention as possible on a topic so important to the party would have great strategic importance.

The Swiss people's party. The Swiss People's Party (Sweizerische Volkspartei in German, Union de Democratique Centre in French) is the second largest political party in Switzerland and represents a general political ideology of the center right. The group was founded in 1971 by the merger of the Farmer's, Artisans, and Citizen's parties with the

Democratic party. The SVP/UDC is mainly focused on classical right issues such as reduced taxes and welfare programs, as well as the protection of Swiss agriculture and industry. However, the group has continued a populist shift since the 1990s. Despite an incongruence between official party ideology and ideology of their specific politicians, the party has consistently seen great success at securing a large share of the parliament (Norwegian Centre for Research Data, 2015).

Research on the Swiss People's Party's abilities to set and follow agenda, like the Social Democrats, is both novel and mixed. Regarding the environment as a topic, the party was found to have a significant agenda setting effect on the Swiss newspapers—much to their own detriment (Gilardi, 2021:15). On political parties, the SVP/UDC were also found to carry significant agenda setting effect on smaller political parties such as the Free Democrats and the Greens when it came to the topic of European integration. It is unclear, however, how this relationship manifests. It is theorized that Swiss citizens will follow the agenda of specific topics that they believe parties are competent to discuss (Gilardi, 2021:12). The Swiss are well-known to have a strong sense of national identity, neutral and removed from European affairs; it is not clear who is setting the agenda and who is following. What is clear, however, is the agenda setting affect that the SVP/UDC has on other political parties, according to Gilardi et al., which is negligible. The party nonetheless remains a large political player. Researchers Gilardi et al in their analysis did not account for any potential agenda-setting or following effects from business interest associations or environmental advocacy groups, so the effects of agenda for the SVP/UDC have yet to be tested.

Other political parties. Switzerland is a multi-partisan country with a wide variety of political parties who each work to gain positions in the federal parliament. While the other political parties of Switzerland are substantially smaller than the Social Democrats and the Swiss People's Party, social media accounts of any size have the capacity to be agenda setters (Gilardi et al., 2021:16). This is especially true if the agenda follower believes the party to be credible on the given subject.

The Free Democrats (Freisinnig-Demokratische Partei in German and Partie Liberale Radicale in French) are also known as the Free-thinking Radical party. The party was formed in 1848 along with the formation of the Swiss Confederation and dominated Swiss politics throughout the latter 19th and much of the 20th centuries. The Center Party (die Mitte in German, le Centre in French) was formally formed in 2021 through a merger of the Christian Democrats and the Conservative Democratic Party of Switzerland. The party's main focus is decentralization of power and protection to the country's Roman Catholics. A handful of Swiss political parties focus their platforms on Green policy, specifically. The Green Party (die Gruene in German and Les Vertes in French) resulted from environmental movements in the 1970s which advocated against the construction of motorways and the promotion of human rights. While a small political party, they have steadily increased voters since the 1990s and today stand as the largest opposition party in Switzerland. Similar in ideology is the Green Liberal party which was founded in 2007 as a way to promote environmentalism with liberal economic policy.

The research of smaller political parties' powers of agenda setting and following has been surprisingly powerful. The Greens, in particular were found to be good predictors of agenda (Gilardi et al, 2021:16). The Greens had a statistically significant effect on the number of tweets

published by the Swiss People's Party, the Green Liberals, and the Radicals' official Twitter accounts. The Green Liberals, on the other hand, were found to be very poor predictors of agenda on other official accounts. This may be a result of low party participation and, thus, less affluence to set the agenda, especially if the Greens are seen to be the more competent party on environmental issues. They remain an interesting variable to study however, as the parent study did not account for potential effects of business interest associations or other environmental groups. The Radicals only exhibited a statistically significant agenda setting effect on the topic of immigration over the Green Liberals. There is little data as to the agenda setting or following effects of the center due to their relative infrequence of tweeting at the time the 2021 Gilardi et al study.

Business interest associations. There is strong evidence to the role of Business Interest Associations (BIAs) have a vested interest of information dissemination in the Swiss democratic system. According to Halbheer, Niggli, and Schmutzler, the factors that influence voters to vote more greenly include strong environmental preferences, favorable economic conditions, and endorsement from the largest business association (Halbheer, Niggli & Schmutzler, 2005:441). Furthermore, business associations have better funding, more membership, and are more centralized entities (Kriesi & Trechsel, 2010:99). Trust in political parties in Switzerland is relatively low when compared to business associations (Kriesi & Trechsel, 2010:99). Additionally, business associations have the strength in its high participation rate in contrast to political parties which are not much more than five percent (Kriesi & Trechsel, 2010:101).

By far the largest, and most influential, of these is Economiesuisse. The association was created following a large workers' demonstration in 1870. The association was born from a

merger between its predecessors, the Swiss union of commerce and industry (Vorort) and the Society for the development of the Swiss economy. Its membership is subdivided into two main types—sectoral associations (such as the Swiss machine industry) and regional associations (the chambers of commerce) (Kriesi and Treschel, 2010:101). According to the official website, it represents over 100,000 companies who employ over two million people—roughly a quarter of the Swiss population. Its primary objective is to represent the interests of its stakeholders which are Swiss business institutions. However, the association also advocates for other political, more tangential, objectives such as education, technology, and the environment. The organization takes an active role in the Swiss legislative process for each of these topics.

Two other influential business interest unions include the Swiss Farmer's Union and the Swiss Trade Association. The Swiss Farmer's Association (Scweizer Bauernverband) is an umbrella organization of 25 different cantonal farming associations. According to the association's official website, they have a membership of over 49,000 and serve 25 of 26 different Swiss cantons. Their mission is to protect the large number of Swiss farmer's as well as farming and agricultural interests. While there is little available research to suggest the organization's agenda setting or follow capabilities, it is possible that the group may exhibit a large agenda setting effect due to the group's large membership and relative affluence.

The Swiss Trade Association is, according to its official website, "the largest umbrella organization of the Swiss economy [and] is committed to optimal economic and political conditions as well as a business-friendly environment." The organization exists for the "accounting, and reporting of small and medium sized businesses" in Switzerland. The organization is one that is meant to protect Swiss' small business industry. Again, while research

about this specific organization's ability to set or follow political agenda is nil, they may follow the agenda set by other larger or greener accounts, in an attempt to shift environmental discussion to a way that is beneficial to industry.

Environmental organizations. In addition to political parties and business associations, interest groups also play a crucial role in involvement with the Swiss political process. Actors include environmentalist interest groups (VCS), environmentally conscious social movement organizations, and ecologist organizations (Kriesi & Trechsel, 2010:111). With varying degrees of influence over the Swiss political process, each possesses a veto power that can call for a pre-parliamentary popular vote that can drastically change the outcome of a novel policy's implementation. These groups also pursue political interests. For instance, ecologists' organizations have become important actors in transport, research, and energy policy—topics which are of great interest to the business community (Kriesi & Treschel, 2010:111). These groups are highly organized and often are able to push for legislation with great success. In 1994, ecologist groups such as the VCS were successful with the Alps initiative which prompted the government to change its transport sector to meet new environmental constraints. Ecological efforts have been greatly successful in promoting a green Switzerland.

On the other hand, the interests of ecological groups are often at odds with the powerful BIAs. In 2002 and 2003, major initiatives to reform the energy sector to move away from nuclear power were rejected at the polls after an intense campaign by the BIAs (Kriesi & Treschel, 2010:111). Later in 2019, the popular initiative for better business and environmental protection were similarly rejected. In other words, while the language of BIAs and their marketing materials

have undergone substantial greenwashing, their interests are still fundamentally different than ecological groups whose interests are environmental conservation.

ProNatura is a Basel-based environmental organization in Switzerland and is one of the oldest. According to the mission statement on its official website, it "love[s] nature, defend[s] its interests, and give[s] it a strong voice. The natural diversity of animals, plants, and habitats needs to be preserved and improved!" Information about its membership and relative affluence is not publicly available; however, I expect it may exhibit some agenda setting capabilities. Small efforts of smaller organizations may be consequential at an aggregate level (Margaretts et al., 2016:50). As the oldest environmental organization in all of Switzerland, it may have strong ties to the Swiss Green party which was formed in the 1970s. Being known for its environmental conscientiousness, political parties and BIAs may follow agenda cues of environmental organizations such as ProNatura in an attempt to mobilize their voters on other salient issues. A similar rationale was used to include the Swiss Association for Transport and the Environment.

Having reviewed the literature for several theories of agenda setting, I have built this study to test two separate hypotheses. **Hypothesis 1 : larger and more influential organizations set agenda on Twitter for smaller organizations to follow**. Follower count on Twitter is not an accurate predictor of influence (Romero et al, 2011:30). However, Gilardi et al (2021) hypothesized that a party's size could be a predictor of agenda setting power. Thus, I will define a "large" organization to consist of the two political parties in Switzerland with the most influence in the political process, The Socialists and the Swiss People's Party. I will also include EconomieSuisse, due to their own large influence in the Swiss political process. While influence in politics does not equate to influence on Twitter, I am making the assumption that the two

measures are comparable, given the organizations are competing for the attention of voters both on and off Twitter. Each account found for this study rarely receives the attention of non-Swiss people. **Hypothesis 2 : Green political parties and environmental organizations set agenda for environmental political discussion over other political accounts**. This hypothesis builds off the conclusion of Gilardi (2021) that Swiss political groups pick up cues from perceived experts.

DATA AND METHODOLOGY

An archive of Tweets from the year 2019 were collected from the most influential Swiss political parties, interest groups, and environmental activist organizations. Table 1 shows the official accounts from which these tweets were taken. Several of the accounts of interest had separate accounts for both French and German content. The unit of analysis for this study is each account that posts general political content, and what proportion of this content is about the environment. I examined each account as an independent actor, capable of setting agenda (Gilardi et al, 2019:1). Accounts with both German and French versions are each taken into consideration as separate actors. While both language versions are affiliated with each other, the political parties and interest groups do not simply post translated copies of content. Furthermore, each account does not appeal to the exact same audience.

Table 1. Selected Twitter Political Actors and Their Official Twitter Accounts

Political Actors	Name (German/French)	Estimated Participant Number (Year)	Twitter Handles (German/French)
Political Parties	Free Democrats (FDP/PRD)	120,000 (2015)	(@PLR_Suisse)
	Center Party (CVP/PDC)	100,000 (2017)	@Mitte_Centre***
	Social Democrats (SP/PS)	30,000 (2015)	@spschweiz/ @pssuisse
	Swiss People's Party (SVP/UDC)	90,000 (2015)	@SVPch/ @UDCch
	Green Party (GPS/PES)	7,500 (2015)	@GrueneCH/ @LesVertsSuisses)
	Green Liberals (GLP/PLV)	3,800 (2015)	@grunliberale/ @vertliberaux
Business Associations	Economiesuisse	2,000,000	@economiesuisse/@economie_suisse
	Swiss Farmer's Union		@sbv/@usp
	Swiss Trade Association		@gewerbeverband***
Environmental Interest Groups	Pro Natura		@pronaturach/ @ProNaturaSuisse
	Swiss Association for Transport and the Environment		(@verkehrsclub***)

***indicates accounts where only one language version is available

Data Collection and Classification

Each account's timeline of tweets was downloaded programmatically. The tweets from each account in 2019 were pulled and saved using Twitter's open-source API, using the Python library Tweepy. Requests from Twitter's data were written in Python, the code of which is available in the Supplemental Sources. The Tweets from each account were saved as separate records into different CSV files. Each record in a file represented a single tweet which contained

the Tweet's unique Id, account publisher, publishing date, the textual content of the Tweet, as well as an object of Tweet metric data such as likes, reshares, and retweets. While metric data such as reshares was not used within this study, this data is freely available for further research.

Each tweet in this dataset needed to be classified according to its pertinence toward the environment. To classify the tweets reasonably and efficiently, I developed and utilized a system of machine learning algorithms which could classify a tweet's textual content. A machine learning model is an abstraction of programming to simplify complex tasks; instead of a programmer writing a complex algorithm to sort through the corpus, the programmer instead writes a script and a dataset which creates the algorithm that will sort the corpus. To accomplish this, the programmer feeds data to a model as annotated training data, a sample of various inputs with their corresponding outputs. For the purpose of this paper, the annotated training data was a collection of sample tweets that were manually encoded as being either pertinent to the environment or not pertinent to the environment. The neural network's function is to scan through the training data and attempt to look for patterns, creating hidden layers of information and complex calculations which are hidden to the programmer. The network then attempts to build a model through an activation function, a function which acts like a regression that calculates the most likely output, given unannotated user input. Errors from the activation function are calculated through a loss function or an aggregate of all error of each point of data from the model. This error is then processed with an optimizer that adjusts weights of calculations in attempt to create a better fitting model. The model can be thought of as a programmatic regression model; given sample data's inputs and outputs, a model is constructed that attempts to create a 'best-fit' prediction output for a new input.

A common issue for machine learning models is limited training data. That is, it can be very difficult for the neural network to create a robust model if the data does not provide enough cases or a wide enough variety of cases. One approach to help ameliorate this deficiency is to refeed the dataset into the model over multiple iterations which artificially inflates the dataset. The data gets refed to the model in batches, known as epochs, the number of which is defined by the programmer. A major issue that is common to neural network programmers is known as "overfitting". If the epochs are too high, the model tends to simply memorize the dataset and create a regression that is not generalizable for unannotated data. To evaluate for overfitting, it is common practice to implement a second dataset of annotated values which act as testing data. The accuracy of the model can be evaluated according to two probabilities: precision and recall. Precision refers to the number of true positive cases (correctly guessed outputs) divided by all predicted positive cases. Recall refers to the number of true positive cases divided by the sum of all true positive cases and all false negative cases.

The algorithms were designed in such a way to classify every collected Tweet as relevant to a politicized environmental issue or not. Before the supervised machine learning classifier could be built, suitable training data was needed to train the model. To get an adequate amount of training data, tweets were pulled from every Twitter account across six years (2015-2021). In line with the study by Gilardi et. al, I pulled the hashtags from this population of tweets and organized them by number of instances throughout the six-year period. I evaluated each hashtag to determine if it described a politicized environmental issue or not. To accomplish this, I evaluated each tag against a set of criteria. The criteria were as follows:

- Is the tag a common tag used in tweets pertaining to the environment in general? (Ex. #Klimaschutz, #Klimawandel, #climat, etc)
- Is the tag relating to a specific environmental movement, vote, or legislation in the context of Europe? (Ex. Es2050)
- Is the tag relating to a specific environmental movement, vote, or legislation in the context of Switzerland? (Ex. #Gothard)

Table 2. The Seventeen Most Common Hashtags Used about the Environment

Hashtag	Relative Translation	Frequency
#Klimashutz	#climateprotection	143
#ElectionsClimat2019	#climateelections2019	120
#Gothard	~	110
#Gotthard	~	102
#climat	#climate	94
#CO2Gesetz	#CO2law	72
#es2050	#energysystem2050	72
#Klima	#climate	71
#biodiversit	#biodiversity	66
#Klimapolitik	#climatepolicy	61
#SE2050	#energysystem2050	55
#Pestizide	#pesticide	53
#Klimastreik	#climatestrike	52
#Klimawandel	#climatechange	51
#CO2	~	48
#Umwelt	#environment	48
#Biodiversitt	#biodiversity	45

Table 2 lists the topmost-frequent hashtags that were used about Tweets that discussed the environment. Tweets that contained one or multiple tags were stored into a dataset. The tweets with these tags are assumed to be used on tweets about politicized environmental causes. In total, 1,752 tweets were tagged with a hashtag that was classified as relevant to the environment, about 6.8% of the total number of tweets in the six years. I stored these tweets into a dataset and encoded each of these tweets with a label ‘label_positive’ to indicate that the textual content of the tweet was pertinent to the environment. I then took a second sample of 2,000 tweets that did not include any of the environmental hashtags and analyzed them

individually according to the above criteria to determine its relevance to the environment. This was necessary as there was not a practical way to find hashtags that cannot necessarily be about the environment. For example, a Tweet tagged with "#Schweiz" could indicate a wide variety of topics about Switzerland. I encoded this 2,000-tweet sample with corresponding labels, 'label_negative', to indicate its non-relevance to the environment and added them to the dataset.

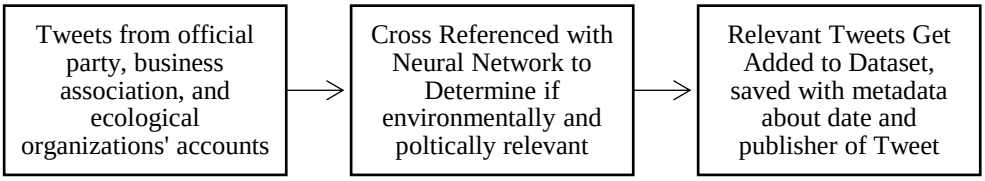
The tweets were first processed to remove any usernames from the tweets. These values have no semantic significance and would thus create an additional unnecessary noise for the neural network to disambiguate. The tweets were then preprocessed using the gensim preprocessing utility available with Python. This process removes non-alphanumeric characters from the text of the tweet, leaving behind raw words. Cleaning the tweets has the benefit of removing excessive noise from the network's hidden layer calculations.

I then began work to construct the neural network to classify a tweet through natural language processing. Natural language processing is a programmatic abstraction of words and language that can be understood by machines to be used programmatically. Before the sampled data could train the model, the corpus of words had to be encoded in such a way that is understandable to the machine. For this, researchers Gilardi et. al (2021) implemented a method known as Word2Vec. Word2Vec assigns each word in the corpus an integer key for every word, each key having a numeric vector value that captures the semantic meaning of every word in a corpus. Vectorization allows each word in a corpus to be semantically defined with only numeric data. For words that are closer in semantic meaning, values for each dimension of the vector will be closer together. Higher dimension vectors generally capture semantic meaning better than lower dimensional vectors. Word vectorization allows the linguistic context of words to be

maintained, providing a more robust numeric representation of words which can capture the meaning of a sentence as opposed to just the meaning of individual words, such as with a Bag of Words implementation. The authors Gilardi et al. furthered the complexity of their classifier by designing an ensemble algorithm for German and French tweets which maintained linguistic context of words across languages.

Neural networks require notorious amounts of fine tuning, adjustments of weights and values, and functional calculations to provide the most useful model. Natural Language Processing neural networks with incomplete data perform statistically very poorly: the researchers were only able to reach a maximum accuracy of 0.84 for German environmental tweets and 0.65 for French environmental tweets. My model, however, differs in a few significant ways. The study analyses the vector autoregressive relationship between the time of content published for a given time period, based upon previously published content by other groups, for other topics. Their model had to be able to classify an issue, with reasonable accuracy, the Tweet's relevance to issues such as gender, the environment, the European union, etc. However, my model reduces the complexity of vector autoregression. Only content published by different groups in the past is used as a predictor for a particular group's content published in the present. The model for how my neural network predicts a Tweet is shown below in Figure 1.

FIG 1. Flowchart Model of How Tweets are Classified as Pertinent to the Environment or Not



The researchers built a classifier themselves in R using Word2Vec. Fortunately, there are a wide range of pre-trained word vectorization models available in Python that are freely available online which do not require great back-end adjustments. For my study, I implemented Facebook's openly available FastText neural network Python library and word vectorization datasets to build my classification model (A. Joulin et al., n.d.). The models were able to use comprehensive corpora of 300-dimensional vector arrays which were available in over 100 different languages.

The FastText datasets encode words and their vector values on a plane which is unique to a given language. For example, the French words "reine" and "roi" (queen and king) would be relatively close in vector value on its respective French vectoral plane, given their semantic closeness. In contrast, the vectors assigned to the German word "Königin" (queen) are encoded in such a way that each dimension of the word that represents its semantic closeness to other German words. The numeric values between two words of two different languages in the FastText datasets, therefore, are functionally meaningless. Before the training data could be used to build the model, the words had to be normalized on the same vectoral plane in order that the vector values maintain semantic significance despite the language of the tweet.

Luckily, Google Translate provides its own Python-implementable API, and word-to-word translations from European languages to English. These translations perform with reasonably high semantic equivalence. Preliminary tests indicate a 0.88 semantic equivalence for French translated to English and a 0.77 equivalence for German to its English translations. English was chosen as the Google Translate packages are designed with an anglophone audience in mind. This approach had the additional benefit of correcting misspelled words which resulted

from downloading the Twitter data. Entire characters of words were omitted since non-UTF8 characters are not supported by the Twitter API. The Google Translate API is designed in such a way that misspelled words of any language are auto corrected before translation. This was necessary as words that were misspelled in the tweets could not be numerically vectorized; the algorithm would assume these words had no semantic value. This would be highly problematic for Twitter data, especially, due to Twitter's 280-character limit.

Understanding that semantics can greatly change from language to language, I determined the Google Translate API was still suitable. As the neural network need only classify a tweet based on its literal content, not all of the nuance of semantics or sentiment of the Tweet needs to be understood by the neural network. Unlike a sentiment analysis, positive or negative connotations of word are, more or less, irrelevant to the model. Thus, these tests are accurate enough to implement translated tweets into the model.

Training and evaluating the classification model yielded an astonishing precision and recall each of about 0.94, substantially higher than the researchers' accuracies. There could be a wide variety of reasons why this occurred. For one, both the Google Translate API and Fasttext library are funded by large corporations with large financial means to develop robust and flexible algorithms. Additionally, Fasttext models are trained upon English-language corpora, and a preliminary examination of available online datasets seems to indicate a higher vectorized vocabulary for English datasets. Fasttext is also coded in Python, which may have been unavailable to the researchers who coded in R. Fasttext has the advantage of being optimized with several different dense optimization layers, those of which could not feasibly replicated by

independent researchers. Nevertheless, the model performed exceedingly well, so it was implemented to classify the dataset of tweets.

Agenda Setting, Time-lagging, and Vector Autoregression

After the classification models were built, they were implemented to categorize the 7,968 number of Tweets published in the year 2019. All of these tweets were added to a dataset; tweets found to be relevant to the environment were encoded with a variable 'env_relev' as 1, while non-relevant tweets were encoded with env_relev = 0. An example of a Tweet that the model determined to be environmentally relevant can be found below in Figure 2. An example of a Tweet that the model determined to not be environmentally relevant can be found below in Figure 3.

FIG 2. Example Tweet Determined to be About the Environment

Roughly translated to English, Figure 2 says “If climate change continues unchecked, the largest glacier in the Alps, the Aletsch Glacier, will almost completely disappear by 2100”. Roughly translated to English, Figure 3 says “Many parties hesitate when it comes to implementing concrete, effective measures for more security. The SVP, on the other hand, works tirelessly to ensure the security of the people in our country.”

FIG 3. Example Tweet Determined to not be About the Environment

Descriptive statistics about the environmentally relevant tweets were found such as frequency per account and mean and median tweets across accounts from the three groups of interest: political parties, business interest associations, and environmental activist groups. A time series of the Tweets for each account was then generated using the statistics library Numpy and the graphing library Matplotlib in the Python scripting language. The graphs were constructed to represent proportion of total tweets in a day relating to the environment on the y-axis with the x-axis showing a given period of time. The provided labels show average tweeting activity about the environment every month in the year 2019.

To graph the data as a time series, the lag of time had to first be normalized. The lag of time refers to the length of time that passes before the quantity of a value in the present feels the effects to a shock in the quantity of the previous lag. For the purposes of this study, the time lag is the length of time that passes in each time series in which the proportion of tweets that discuss an environmental topic is a function of. Preliminary analysis of the data showed that the Twitter accounts were not consistently active on a daily basis. The idea of the time lag is that the proportion of time that a specific Twitter account will give on a topic such as the environment is a function of the proportion of time that other Twitter accounts give to the same topic in previous periods of time. The number of previous time lags that act as an independent variable to the proportion of time spent in the current time lag describes the time series' order. This variable is known as order p in a VAR(p, d, q) model. The order (p) refers to the all the proportions of time spent discussing the environment for each time lag in the past for each account that have a significant effect on the proportion of time in the present.

Gilardi et al found in their research that after three days, the impulse response of political party social media accounts did not significantly change in response to newspapers or social media accounts of politicians. Their study was an analysis of the responsiveness of political actors on social media were to topics in traditional media and vice versa. Due to the relative slowness of news organizations compared to social media publications, this choice was appropriate. However, my study only analyzes actors on social media which can jump on trends with far more quickness than can a newspaper. I simulated results from one hour up until ten days. The results of my lag simulation are found and discussed in the Results. To evaluate the order, each simulation's Bayesian information criterion was compared, the minimum of which will determine the of my autoregressive model.

$$Z_{i,t} = \alpha + \sum_i \sum_{\rho=0}^{1\ day} \beta_{i,p} Z_{i,t-p} + \varepsilon_{i,t} \quad (1)$$

Equation (1) shows the equation of the vector autoregressive model used within this study. Before the data could be analyzed for agenda setting effects, tests were performed to evaluate the data's candidacy for a vector autoregressive relationship. Again, autoregression refers to the idea that trends in the past can be predictors of present behavior. Coefficients $\beta_{i,p}$ were evaluated using Granger's Causality Test for Causality which allows for signficance causality testing of every time series against eachother, before the model is constructed (Granger, 1969). The results of these p-values are available below in the Results section. The p-values were used to make general conclusions about how the different time series may influence one another.

Next, a cointegration test was performed to evaluate the potential existence of a long-run linear relationship for all statistically significant coefficients $\beta_{i,p}$. For this, I implemented Johanssen's test for cointegration. The test provides a check if multiple series are cointegrating without the need to explicitly label dependent and independent variables (Johansen, 1991). According to the advice by researchers Granger and Newbold (1977), the series was then analyzed for stationarity. Stationarity refers to a time series whose mean and variance do not significantly change over time. To check for this, I implemented an Augmented Dickey-Fuller test. Any time series found to not exhibit stationarity, whose p-value of F statistic is greater than 0.05, would be differenced until the time series becomes stationary to build the model. The differenced time series would then be undifferenced before the full analysis.

To evaluate the agenda setting effects that accounts have on other accounts, I utilized a vector autoregressive model similar to that of Gilardi et al. The researchers' equation of regression is originally built from a study conducted by Barberá et al. (2019). The model

employs a set of stationary time series Y_i which represent the proportion of the daily attention each group of actors i paid to each topic j of interest on day t over the period of the years 2018 and 2019. Proportion of attention is defined as the percent of content published within one lag of time divided by the total quantity of content published in the same time period. For Gilardi et al, the distribution of the model is strongly skewed right as attention for both political parties and business groups must be spread across many topics, except for a few points in time.

The model that was employed diverges from both Barberá et al and Gilardi et al in a way that keeps the topic of agenda constant. While Gilardi et al are concerned with the proportion of posts spent on a given political topic, this study is only built upon the proportion each of these accounts spends creating posts about the environment as a percent of total posts per day. This approach, while more limited in scope, yields results that are more easily interpretable.

In regression (1), $\beta_{i,p}$ is the coefficient of attention for a given group at a particular time lag. That is, given the proportion of attention to the same political topic in the previous timelag ($Z_{i,t-p}$) which coefficient best fits as a predictor of the proportion of time given to the same topic in the next lag of time. $\varepsilon_{i,t}$ is the error term which accounts for noise in this equation. The model was fit using the Vector Autoregressive model package provided by the statsmodels API on Python. The model's residuals were then evaluated to check for serial correlation, using the Durbin Watson Statistic. Since the test statistic value of each regression equation was found to be close to 2, it was concluded that no serial correlation existed, and the models were a reasonable fit. Graphs of confidence intervals for the coefficients of $\beta_{i,p}$ were found for each autoregressive model. I determined any coefficient for independent variable accounts at time t-1 which is different than zero at 95% confidence would predict the proportion of Tweets published by

dependent accounts at time t. That is, the impulse response to an increase of environmental content published at time t-1 would increase the proportion of environmental content at time t by $\beta_{i,p}$ at 95% confidence.

To obtain the most interesting and most significant results possible, I have focused this study to examine environmental tweeting in the beginning of the year—January to March. Narrowing the time frame of this study, I will be able to examine trend-setting and trend-following behaviors in such a way that helps to circumvent the limitations of this data in two distinct ways. Firstly, none of the accounts publish tweets regularly or consistently, let alone tweet about pertinent environmental issues. Each account published tweets seemingly sporadicly, with multi-day periods of inactivity. Due to the amount of data available, testing for trend-setting and following behavior over a year or longer at lags t-n would yield coefficients so small that they are essentially meaningless. Trends on social media are influenced by a variety of factors other than following other accounts, so narrowing down a time window can help reduce excessive noise. Secondly, social media trends are notoriously short-lived and are not sustainable for long periods of time (Asur et al., 2011:436). The nature of trends on social media cannot generally be extrapolated for long periods of time. Shifting my analysis from a full year to three months will provide coefficients which are more meaningful. Again, I will be testing my hypotheses that 1.) larger accounts will tend to set trends for smaller accounts and 2.) green parties and environmental organisations will set environmental trends for other accounts.

RESULTS

Descriptive Statistics

The descriptive statistic results are summarized in Table 3 and Table 4. The highest number of environmental tweets that an account tweeted was 343 by @GrueneCH, the German

Green Liberals. The account with the smallest frequency was @usp at just 14 tweets for the entire year of 2019. The mean number of environmental tweets per account is about 97.2 tweets while the median is 64.5. The standard deviation was calculated to be about 95.9 tweets. The data has a high variation in comparison to its mean.

Table 3. Frequency of Environmental Tweets from Selected Accounts Published in 2019

Twitter Account	Environmental Tweets	Total Tweets	Proportion of Tweets about Environment
@PLR_Suisse	36	1694	0.0213
@Mitte_Centre	99	1004	0.0986
@spschweiz	86	1949	0.0441
@pssuisse	23	2406	0.0096
@GrueneCH	343	910	0.3769
@LesVertsSuisses	208	1541	0.1350
@grunliberale	261	1304	0.2002
@vertliberaux	63	927	0.0680
@economiesuisse	15	1200	0.0125
@economie_suisse	28	1043	0.0268
@sbv	66	1888	0.0350
@usp	14	1063	0.0132
@gewerbeverband	44	2444	0.0180
@pronaturach	67	553	0.1212
@ProNaturaSuisse	53	512	0.1035
@verkehrsclub	149	2829	0.0527

Table 4. Descriptive Statistics of Tweets per Account Group

Type	N Accounts	Average	Min	Max	N Tweets
Political Parties	8	139.9	23	343	1,119
BIAs	5	33.4	14	66	167
Environmental Groups	3	89.7	53	149	269

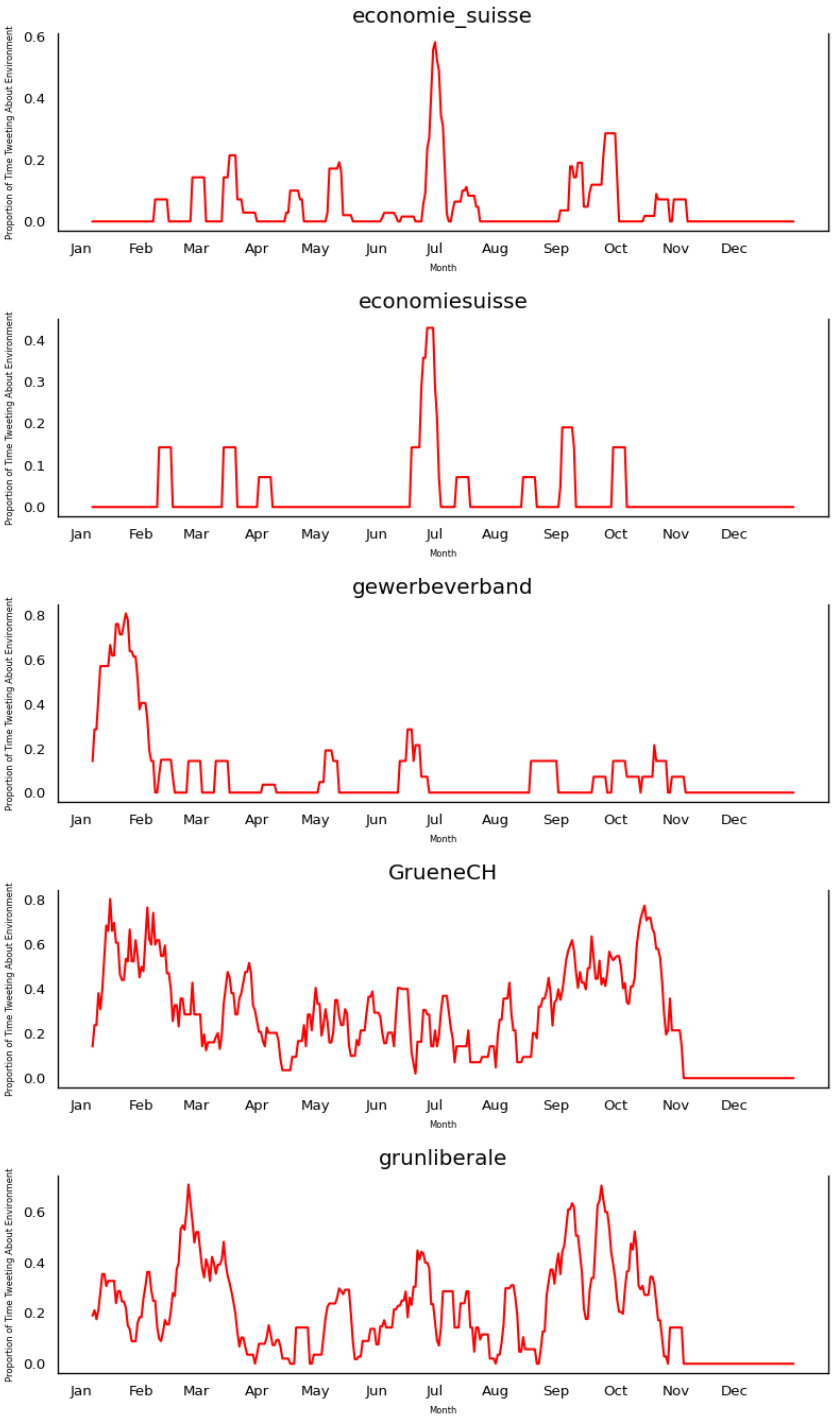
In general, political parties tweeted the most frequently about the environment, likely as a result of the 2019 federal election and, possibly, the November popular vote. The official accounts of the political parties tweeted more frequently than any other group tested. They also had the highest average volume of environmental tweets, compared to the BIAs and environmental advocacy groups, but this figure is greatly skewed by the Greens and the Green Liberals who tweeted far more frequently about the environment than other political parties. The BIAs had the lowest average number of tweets about the environment with an average frequency of 33.4 tweets across all accounts. The environmental advocacy groups tweeted somewhere in the middle, with an average number of tweets at 89.7 tweets across all three accounts tested. An interesting discovery is the trend that German accounts tweeted more frequently about the environment relative to their total number of tweets. Assuming an error in the classifier model, this is unlikely a result of incorrect “non environmental” guesses for the French tweets, since the Google Translate API had a higher accuracy of translating French to English than German to English. One possibility is a higher proportion of false “environmental” tweets predicted for German accounts. A more likely reason is that the German accounts simply discussed the environment more. More German speaking politicians were competing for parliamentary seats in the August federal elections than French speaking ones. It is likely that these parties were using

the environment in their social media content to mobilize their voters to the polls, as the environment was a large topic of discussion for this election.

Figure 4 shows the time series graphs of the tweeting activity for the accounts @economie_suisse, @economiesuisse, @gewerbeverband, @GrueneCH, and @grunliberale. Graphing the proportion of Tweets that are environmental across the year provides a general visual depiction of trends throughout a year. Time series graphs for the remaining accounts may be found in the Appendix. The graphs show the daily proportion of tweets that each account posted which were "environmental." To enhance the smoothness and show the general trends of the accounts' Twitter activity over the year, I transformed each graph by moving average. For every seven days in the year, I calculated the average proportion of environmental tweets and rendered new graphs accordingly.

Many of the graphs show increased activity spikes in similar periods of the year. Figure 4, for example, shows that accounts for EconomieSuisse and the Green Liberals have three distinct spikes in environmental tweeting activity: one in the begininnig of the year (approx Jan-March), one in the middle of the year (Jun and July), and another one at the end of the year (approx Sept to end of Nov). Graphs across all accounts produced similar patterns with varying degrees of distinctiveness.

FIG 4. Proportion of Tweets per Day About the Environment – Taken from Selected Accounts



Hypothesis 1 : Larger Accounts as Agenda-Setters for Smaller Accounts

For the first of my hypotheses, I tested to see if the accounts of larger, more-powerful, and more-financially-backed organizations set the agenda of the accounts for smaller organizations. That is, do large, affluent political organizations set the agenda of other organizations suggested by Gilardi et al (2021). Based upon preliminary research, I am defining a large organization to be the two most prominent Swiss political parties of both German and French account versions. I am also including both language versions of Switzerland's most prominent business organization Economiesuisse. The official Twitter accounts I hypothesize will have high power of prediction will be @PSSuisse, @spschweiz, @UDCch, @SVPch, @economie_suisse, and @ecnonomiesuisse.

Table 5. Granger Causality Test for Most Affluent Political Groups

	@PSSuisse	@spschweiz	@UDCch	@SVPch	@economie_suisse	@economiesuisse
@Economie_suisse	0.8862	0.7991	***0.0000	0.8625	1.0000	0.9497
@Economiesuisse	0.9247	***0.0000	0.9579	***0.0000	***0.0000	1.0000
@Gewerbeverband	**0.0195	0.3160	***0.0002	0.3115	0.8152	0.8772
@GrueneCH	0.1120	*0.0858	***0.0000	***0.0000	**0.0446	***0.0001
@grunliberale	*0.0805	***0.0023	***0.0065	***0.0000	0.2843	***0.0030
@LesVertesSuisses	***0.0000	0.4566	0.8352	***0.0020	***0.0000	***0.0000
@MitteCentre	**0.0318	*0.040	***0.0000	***0.0017	***0.0001	0.7262
@PLR_Suisse	0.1087	0.2249	***0.0012	**0.0112	***0.0002	***0.0000
@pronaturach	0.8517	0.1659	0.9168	0.8210	***0.0000	0.9320
@ProNaturaSuisse	0.8403	0.7201	0.9103	0.8073	***0.0000	0.9268

@PSSuisse	1.0000	***0.0000	0.9082	0.7080	0.8868	***0.0000
@sbv	0.8935	***0.0007	0.9404	**0.0335	***0.0000	0.9513
@spschweiz	***0.0070	1.0000	***0.0000	0.2633	***0.0003	0.0000
@SVPch	0.7566	**0.0450	***0.0000	1.0000	***0.0000	***0.0000
@UDCch	0.9077	**0.0217	1.0000	***0.0000	0.1397	0.9579
@usp	0.9467	0.9055	0.9702	0.9356	0.9632	0.9757
@verkehrsclub	**0.0483	***0.0062	0.7978	***0.0000	***0.0006	***0.0000
@vertliberaux	***0.0003	***0.0083	0.8628	0.1366	0.8311	0.8878

* 0.10 significance level ** 0.05 significance level *** 0.01 significance level for all causality tests.

The Granger causality test provided some interesting results for the political parties' abilities to both set and follow agenda. Table 5 lists the results of the tests for the accounts of the affluent groups. Columns indicate the time series for each account as a predictor of the time series of each account in the rows. The values given are p-values which describe the probability that the column account is a predictor of the row account. At a 0.05 significance, there is strong evidence to suggest a relationship of the time series of @spschweiz, @SVPch, and @UDCch are predictors of the time series for all other accounts. For example, the time series @spschweiz was found to have a strong potential relationship for the time series of @Economiesuisse, @grunliberale, @PSSuisse, @sbv, @verkehrsclub, and @vertliberaux at 0.01 significance and @SVPch and @UDCch at the 0.05 significance level. For @PSSuisse, accounts with p-values less than 0.01 include @LesVertesSuisses, @spschweiz, and @vertliberaux. Expanding significance to 0.05 also includes @Gewerbeverband, @MitteCentre, and @verkehrsclub.

The Granger causality test results in Table 7 further provided interesting results for the accounts @economie_suisse and @economiesuisse. As mentioned above, the p-values were

calculated to test the alternate hypothesis that one time series account could be a potential predictor of the series for another account. The time series for @economie_suisse tested as a potentially significant predictor at 0.01 significance for @economiesuisse, @LesVertesSuisses, @MitteCentre, @PLRSuisse, @pronaturach, @ProNaturaSuisse, @sbv, @spschweiz, @SVPch, and @verkehrsclub while @GrueneCH was significant at 0.05. This suggests that the proportion of environmental content that @economie_suisse posted in time lag t-1 in the months of January, February, and March of 2019 could be predictive of the proportion of environmental content of these other accounts.

The test also indicates that accounts @economiesuisse and @PSSuisse may also be good predictors. For @economiesuisse, accounts with p-values less than 0.01 included @GrueneCH, @grunliberale, @LesVertesSuisses, @PLR_Suisse, @PSSuisse, @SVPch, and @verkehrsclub. No other accounts were found to be significant at a level of 0.05. According to the results of the Granger test for causality, I conclude that the results I have detailed indicate potential linear relationships.

The Johansen cointegration test was then performed to test for potential cointegrating relationships between the time series as a whole. Table 6 provides the results of this test. At a confidence level of 95%, the calculated test statistics were found to be significant for @Mitte_Centre, @PLR_Suisse, @pronaturach, @ProNaturaSuisse, @PSSuisse, @sbv, @spschweiz, @SVPch, @UDCch, @usp, and @verkehrsclub. The results from this test indicate the potential existence of a long-run linear relationship between these accounts. It is important to mention that the tests did not provide results for the remaining accounts, but instead encountered errors. This is later explained in the Discussion.

Table 6. Results of Johansen's Cointegration Test

Account	Test Statistic	C(95%)	Significance
@economie_suisse	6049.58	~	False
@economiesuisse	5567.95	~	False
@gewerbeverband	5100.53	~	False
@GrueneCH	4653.28	~	False
@grunliberale	4235.36	~	False
@LesVertesSuisses	3833.07	~	False
@Mitte_Centre	3450.03	311.1288	True
@PLR_Suisse	3076.65	263.206	True
@pronaturach	2728.67	219.405	True
@ProNaturaSuisse	2398.53	179.5199	True
@PSSuisse	143.6691	143.6691	True
@sbv	1776.59	111.7797	True
@spschweiz	1470.44	83.9383	True
@SVPch	1188.44	60.0627	True
@UDCch	914.49	40.1479	True
@usp	650.22	24.2761	True
@verkehrsclub	395.89	12.3212	True
@vertliberaux	155.52	4.1296	True

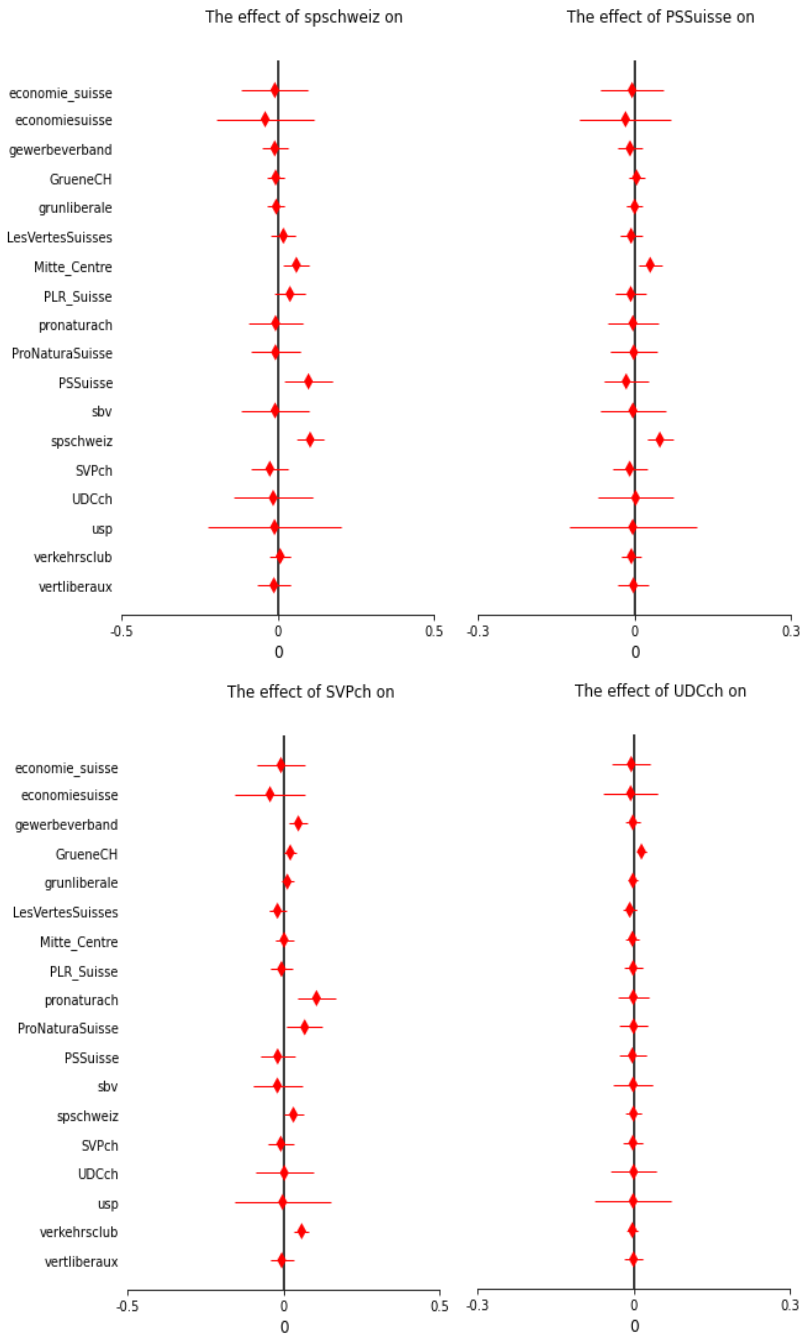
The results of Johannsen's test for co-integration were promising. At 95% significance, the time series for the accounts of @SVPch, @UDCch, @SPSchweiz, and @PSSuisse were tested to have a relationship that is co-integrated. That is, I determined that these accounts have a relationship with one another that in the long-term is linear. Interestingly, this was not found for @economie_suisse and @economiesuisse. The program found test statistic values that were NaN

(not a number). This suggests that the dataset may not have enough complete data to calculate a valid statistic.

Next, an Augmented Dickey Fuller Test was run on the time series to determine their stationarity. Testing against the null hypothesis that each series has a unit root produced p-values that were statistically significant in all accounts. I concluded that each time series was therefore stationary.

To determine the lag order of the VAR models, I simulated different model results from between 1 hour at a minimum to ten days at a maximum. Each model's Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were compared with one another. Since both AIC and BIC were minimized at a lag order of one hour, I adopted the model to fit a VAR($p = 1$). In the context of the autoregression, the proportion of environmental tweets in one hour are regressed to predict the proportion of environmental tweets in the next hour. In other words, any impulse response that occurs in lag t-1 will have a measurable effect on the proportion of tweets at time lag t. Lags of time beyond this one-hour predictor were not adopted to the models.

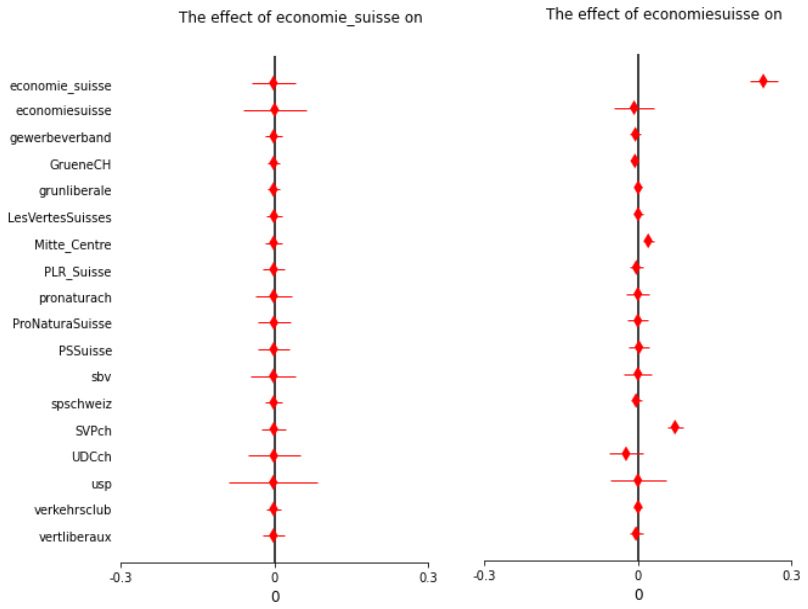
FIG 5. Confidence Interval Forest Plots of the Socialists and Swiss People's Party



Confidence intervals for the predictor coefficients were far less impressive than I anticipated. Figure 5 shows the results of this graphed as Forest plots with a 95% confidence. For every account's prediction, predictor accounts had coefficients of prediction that were indistinguishable from zero in almost all cases. However, there are notable exceptions to this

trend. The account which was the best at predicting other accounts' content was @SVPch which, as a predictor coefficient, was found to be non-zero at a confidence of 0.95 for @gewerbeverband, @pronaturach, @ProNaturaSuisse, @spschweiz, and @verkehrsclub. @spschweiz was found to be a reasonable predictor for @MitteCentre, @PSSuisse, and @spschweiz. The least impressive results of for a large party's account was @UDCch, only predicting @GrueneCH.

FIG 6. Confidence Interval Forest Plots of EconomieSuisse



Slightly less impressive results were found for the two official accounts of EconomieSuisse. Figure 6 graphs these results. For example, the French account @economiesuisse yielded non-zero coefficients for predicting @economie_suisse, @MitteCentre, and @SVPch. The worst performing account was this group was the German account @economie_suisse which had no coefficients of prediction different than zero at 95%

confidence. Overall, the accounts which were the best predictors for posting environmental content, from one hour to another, were @SVPch, @economiesuisse, and @spchweiz.

Hypothesis 2 : Green Parties and Green Organizations as Agenda-setters for Others

For my second hypothesis, I tested to see if the accounts for Green political parties and environmental organizations set the agenda for non-environmentally focused groups. The Granger's Test for causality produced the most interesting results for the German Greens. Table 7 shows the results of this test. P-values were calculated for each time series as a predictor of each other. At the 0.05 significance level, the content @GrueneCH published at time t-1 had a statistically significant effect on the content published at time t by @gewerbeverband, @LesVertesSuisses, @MitteCentre, @PLR_Suisse, @UDCch, and @verkehrsclub at the 0.01 significance level. The accounts @economie_suisse, @grunliberale, @SVPch, and @vertliberaux tested similarly at the 0.05 significance level. The French Greens, as a predicted, also yielded a high number of accounts with statistically significant p-values : @GrueneCH, @MitteCentre, @PLR_Suisse, @PSSuisse, @spschweiz, @UDCch, @verkehrsclub, and @vertliberaux all tested at 0.01 significance while @gewerbeverband and @grunliberale) tested at the 0.05 significance level.

Table 7. Granger Causality Test for Environmental Parties and Advocacy Groups

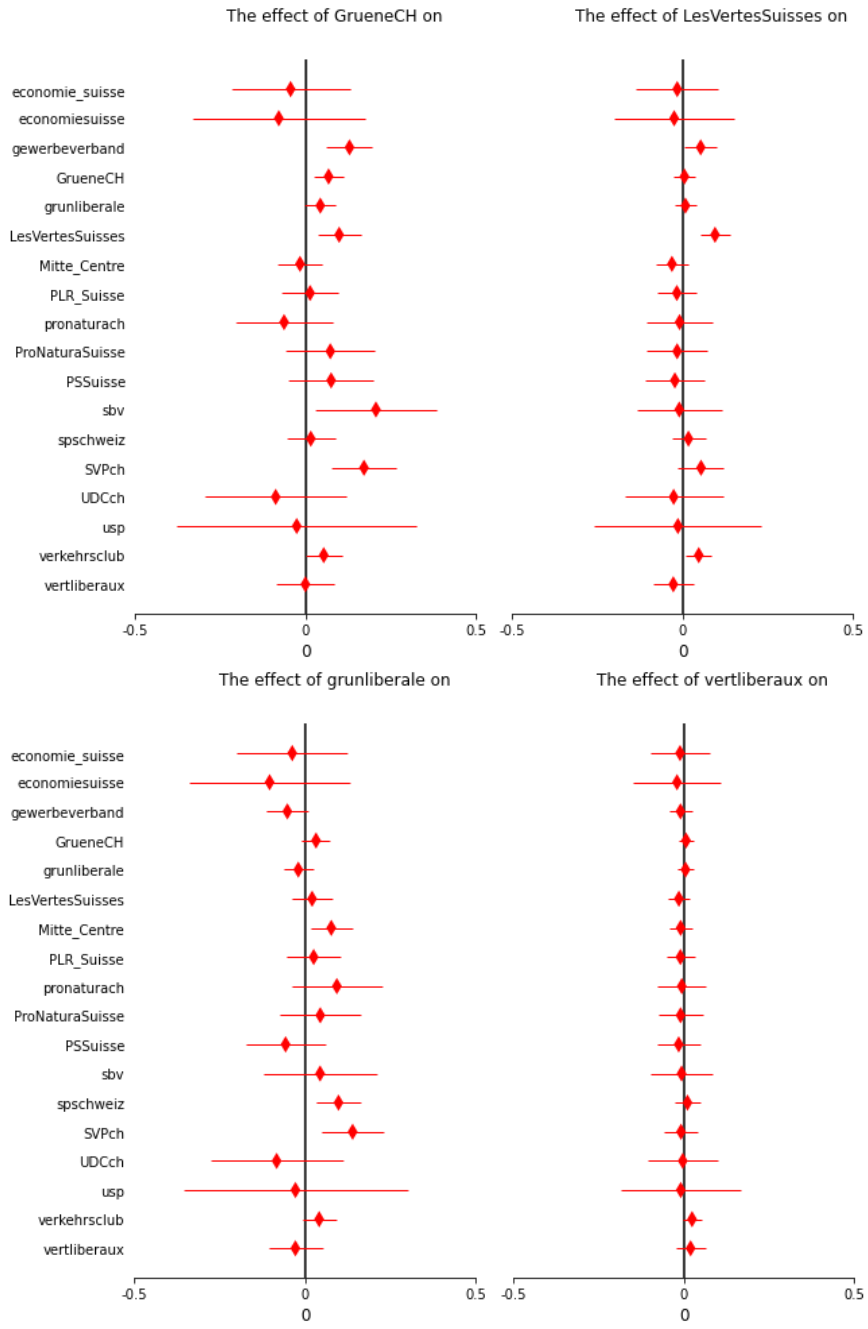
	@GrueneCH	@LesVertesSuisses	@grunliberale	@vertliberaux	@pronaturach	@ProNaturaSuisse	@verkehrsclub
@economie_suisse	**0.0140	0.7756	0.1895	0.1946	0.8975	0.8897	0.5318
@economiesuisse	0.2357	0.8506	0.6370	0.8857	0.9322	0.9270	0.4109
@gewerbeverband	***0.0070	**0.0152	0.2794	0.8225	**0.0048	0.7426	***0.0000
@GrueneCH	1.0000	***0.0001	**0.0353	0.5229	0.6176	0.1903	**0.0470
@grunliberale	**0.0381	**0.0104	1.0000	***0.0026	*0.0881	0.1518	*0.0673
@LesVertesSuisses	***0.0000	1.0000	*0.0796	***0.0046	0.2607	*0.0630	***0.0000
@MitteCentre	***0.0000	***0.0002	*0.0943	***0.0010	0.7209	0.7003	***0.0000
@PLR_Suisse	***0.0000	***0.0018	0.3900	**0.0221	0.7977	0.4928	*0.0766
@pronaturach	0.5809	0.7096	0.5163	0.7536	1.0000	0.8984	0.6719
@ProNaturaSuisse	0.5518	0.6881	0.5689	0.7592	***0.0027	1.0000	0.1457
@PSSuisse	0.5761	***0.0003	***0.0000	***0.0004	0.8527	0.8414	0.1375
@sbv	0.6926	0.5016	0.3591	0.8386	***0.0000	***0.0000	0.7617
@spschweiz	0.2439	**0.0027	***0.0056	***0.0047	0.7686	0.3125	0.5713
@SVPch	**0.0261	0.6250	*0.0946	*0.0674	***0.0000	***0.0001	***0.0000
@UDCch	***0.0045	***0.0002	***0.0000	*0.0000	0.9170	0.9106	***0.0002
@usp	0.8436	0.8942	***0.0000	0.9191	0.9521	***0.0000	0.8797
@verkehrsclub	***0.0004	***0.0000	0.6796	**0.0215	**0.0429	**0.0082	1.0000
@vertliberaux	**0.0434	***0.0000	***0.0036	1.0000	0.7808	0.7643	*0.0704

The Granger's Causality Test for the Green Liberals produced interesting, albeit less-impressive, results. Again, p-values were calculated for each time series as a predictor of each other. At the 0.01 significance level, the content @grunliberale—the German Green Liberals—

published at time t-1 had a statistically significant effect on the content published at time t by @PSSuisse, @spschweiz, @UDCch, @usp, and @vertliberaux while shifting to a significance of 0.05 also includes @GrueneCH. For the French Green Liberals, statistically significant p-values were found at 0.01 significance for @grunliberale, @LesVertesSuisses, @MitteCentre, @PLR_Suisse, @PSSuisse, @spschweiz, and @UDCch. @verkehrsclub was also found to be statistically significant at 0.05.

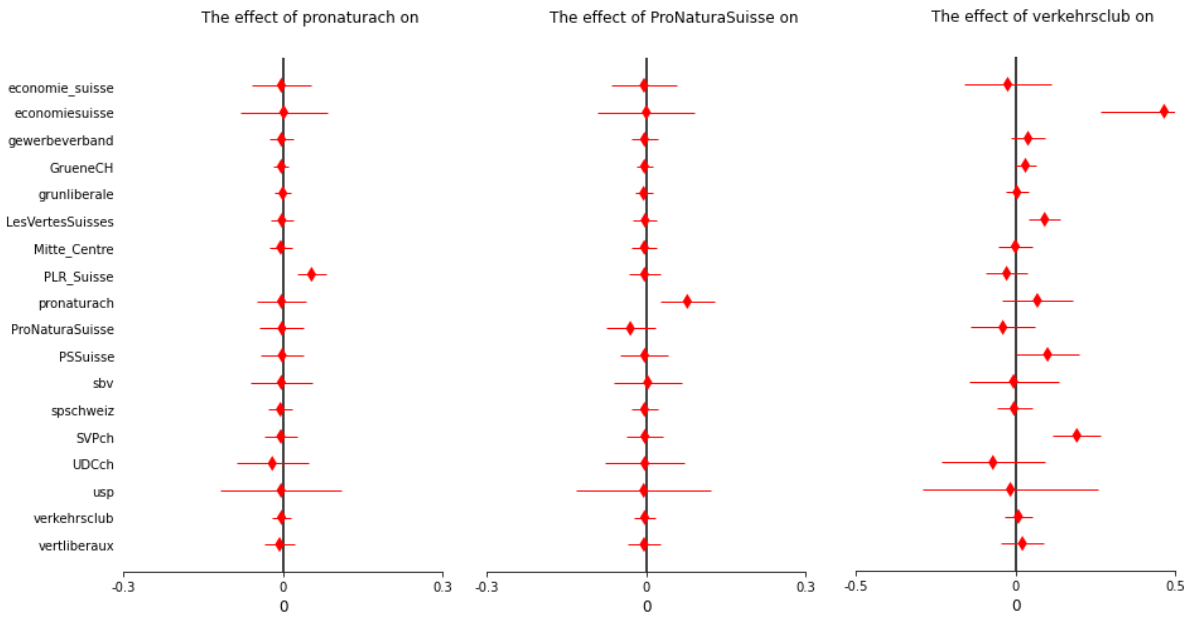
The account @verkehrsclub yielded p-values which indicate a potential relationship as a predictor for @gewerbeverband, @GrueneCH, @LesVertesSuisses, @MitteCentre, @SVPch, and @UDCch. ProNatura for both their German and French accounts gave the worst p-values of predicting proportion of environmental content for other accounts. The German account was found to be a potential predictor for @gewerbeverband, @ProNaturaSuisse, @sbv, @SVPch, and @verkehrsclub. The French account likewise predicted possible relationships for @sbv, @SVPch, @usp, and @verkehrsclub. Overall, the results from the Granger's causality test suggested potential relationships between several of these accounts.

FIG 7. Confidence Interval Forest Plots of Green Political Parties



I calculated 95% confidence intervals for each coefficient of prediction, just as I did for my first hypothesis. Figure 7 shows the results of this for green political parties and Figure 8 shows this for the environmental advocacy organizations. For the German Greens as a predictor, coefficients of prediction at 95% confidence were found for predicting @gewerbeverband, @GrueneCH, @LesVertesSuisses, @sbv, @SVPch, and @verkehrsclub. Important to note is the magnitude of predictive power that @sbv and @SVPch were found to respond to a shock response of content posted by the German Greens. The French account had less impressive results, only giving significant confidence intervals for @gewerbeverband, @LesVertesSuisses, and @verkehrsclub. The German Green liberals produced a significant interval for predicting @MitteCentre, @spschweiz, and @SVPch. The French Green liberals did not produce any evidence as being predictive of the environmental content for other accounts.

FIG 8. Confidence Interval Forest Plots of Environmental Advocacy Groups



The environmental organizations produced less impressive results, as displayed in Figure 8. At 95% confidence, the coefficient of prediction of @verkehrsclub was found to be statistically different than zero for predicting @economiesuisse, @LesVertesSuisses, and @SVPch. The environmental group ProNatura performed the worst predictor of all groups of accounts tested. The German account was only found to be a statistical predictor of @PLR_Suisse while the French account was found to predict only the content of its German sister account. Overall, the accounts that were the best predictors were @GrueneCH, @grunliberale, and @verkehrsclub. That is, the proportion of content each of these accounts published in a particular hour had the highest coefficients for the different vector autoregressive models that were found.

DISCUSSION

Despite relatively high Twitter activity, between 512 tweets by @ProNaturaSuisse and 2829 tweets by @verkehrs club, the proportion of time that every account spent discussing the environment in any context is relatively small. The account with the highest proportion of environmental tweets is the German account for the Greens, followed by the German Green Liberals (@GrueneCH and @grunliberale, respectively). Only the French Greens accounts of ProNatura surpassed ten percent of total tweets as relevant to the environment. For the remaining accounts, the environment hovered at an average of 5 percent of total tweets, with the lowest percentages coming from the French socialists, the French account (usp) for the Swiss farmer's union and the French account of Economiesuisse.

These results are as I expected with environmental parties and environmental interest groups leading the total proportion of content about the environment. Interestingly, the proportion of environmental tweets for every environmental organization remained below the

proportion of environmental tweets by the German Greens and the German Green Liberals. One possible explanation of this is the average higher tweeting activity for the political parties as opposed to environmental organizations. Both Twitter of the accounts for ProNatura tweeted about a quarter and a half, respectively, as frequently as any political party. Another explanation is that the ProNatura accounts may not tweet as frequently words which explicitly refer to the environment. Twitter allows any user account to "quote tweet" or respond to Tweets directly and share the response publicly; these quote tweets are useful for creating interactions between users, but this feature may also be causing an underrepresentation of environmental tweets. If the advocacy groups were to quote a tweet about the environment and reply a simple 'yes' or 'no', the Tweet may be, in fact, environmental in nature but lack the key words in which the neural network relies.

The time series graphs revealed interesting information about the behavior of environmental tweeting in the year 2019. Many of the time series graphs reveal that the proportion of tweets relevant to the environment had several peaks throughout a year, but many graphs indicate three clusters of increased environmental tweeting. One such cluster was between the months of January and March. All of the accounts show a drop of tweeting activity in December. It is likely that the organizations who run the accounts take off the last month of the year for the holidays, either by law or according to expectations of business. The spike in the beginning of the year might be a result of the upcoming Swiss federal elections in August for which the environment was a highly discussed topic. As organizations likely took a break from work for the holidays, there might be additional pressures to cover as much as possible the upcoming environmental debates. The second spike occurs about the months of June and July. This spike is almost assuredly a result of the federal elections in August. The last spike occurs

anywhere between September and November, likely a result of the Swiss Popular Vote in November or the global climate strikes that began in September. These trends are more visible in some graphs than in others. For example, @ecnomiesuisse is an excellent example since the account does not frequently tweet about the environment. This trend is not as visible in other accounts like @GrueneCH which discusses the environment in more tweets on average throughout the year.

Hypothesis 1 : Small Accounts Follow Agenda of Larger Accounts

Results from the Granger's causality test were used to determine the general, potential interrelationships between each account's time series in the activity spike from January to March. For each causality test, p-values greater than 0.05 fail the test and p-values equal to or less than 0.05 pass. Of the six accounts classified as a "Large account", there is mixed evidence to suggest that these time series are related. The German and French accounts for the two largest political parties—the Swiss People's Party and the Socialists—were found to be statistically significant predictors of between six time series (the French socialists) and nine time series (the German Swiss People's Party). The results for the French EconomieSuisse found six potential linear predictive relationships and the German one tested eleven. The results suggest that there is an imperfect causal relationship between the time series. That is, the proportion of tweets that some accounts produces will have some effect on the proportion of tweets that other accounts produce.

The Granger's causality test is useful as it provides a means of testing every possible combination of time series as dependent and independent variables without the need to calculate eighteen different test statistics or equation models. The test, however, only provides potential linear relationships between causal variables and potential reactive variables. It should be noted

that the results from Granger's causality test are only pieces of evidence that a researcher must decide to accept or deny with discretion. According to Granger (1988):

> Possible causation is not considered for any arbitrarily selected group of variables, but only for variables for which the researcher has some prior belief that causation is, in some sense, likely. (p. 208)

Thus, the results of the relationships found as a result of Granger's Causality test may be susceptible to researcher bias, since it is the researcher who determines the independent and dependent variables.

Results from the co-integration test were promising for those accounts that did not throw an error. For every account that tested as expected, the number of cointegration vectors was equal to the number of time series tested for cointegration. There is significant evidence that suggests the time series have a linear relationship with one another in the long run. In other words, there is additional evidence that each of these time series have high interactivity with one another. The information relevant to the models' AIC and BIC are also expected as social media trends are often short-lived and occur with a relatively quick pace.

For each modified VAR model, originally defined by researchers Barbera et al (2019), regression models for each account were constructed and intervals for 95% confidence were constructed. Again, the results are only indicative of environmental content published to twitter between the months of January and March—similar conclusions cannot be necessarily extrapolated for other periods of time. For @spschweiz, intervals at 95% significance different than 0 include @MitteCentre, @PSSuisse, and @spschweiz. However, the Granger test for @spschweiz effect on @MitteCentre has a null hypothesis probability of 0.0940; thus, I do not

reject it. The only accounts, therefore, to experience a significant effect from environmental content published an hour previously is itself and the French equivalent account @PSSuisse. There is no evidence to conclude that @spschweiz sets environmental content agenda over "small" accounts. Similarly for the French account @PSSuisse, only a statistically different agenda setting effect was found on its @MitteCentre and its German sister account. There is not enough evidence to suggest that @PSSuisse has a significant agenda-setting effect on Twitter.

Similarly, results for the German People's Party (@SVPch) did not yield interesting results. Both accounts for ProNatura and verkehrs club were tested to be statistically different than 0. However, only @verkehrsclub provided a causal test at the 0.05 significance level. The French account (@UDCch) did not test any coefficient statistically different than 0 at 95% confidence. Neither account was concluded to have great agenda-setting power of the environment on Twitter. Results from the official German account for EconomieSuisse did not test any coefficient statistically different than 0 at 95% confidence. The French version, the only account in the dataset whose French version is larger than the German one, was found to be causal for its German sister account, @Mitte_Centre, and @SVPch but only significant over @SVPch at the 0.05 significance level. While not displaying great agenda-setting behavior over a variety of accounts, it is interesting to note that the evidence suggests Switzerland's largest right-winged political party (The Swiss People's Party) takes cues from Switzerland's largest business association about content it publishes on the environment.

Overall, these six accounts provided weak evidence for the hypothesis that larger accounts with more followers and financial resources sets agenda for smaller accounts. However, this trend could be different depending on the time period studied, refining the definition of "large" and "small" accounts, etc. Only researching the trends in the three-month period of 2019,

more research is needed to understand any potential long term causal relationships that large accounts have over smaller accounts about environmental content.

Hypothesis 2 : Green Groups and Green Parties set Agenda Over other Accounts

Again, results from the Granger's causality test were used to determine the general, potential interrelationships between each account's time series in the activity spike from January to March. "Green" accounts refers to the accounts whose platforms are built upon promotion of environmental causes. Of the seven accounts classified as a "Green", there is once again mixed evidence to suggest that these time series are related. The German and French accounts of the Greens were found to be predictors of nine other accounts for each at a significance of 0.05. The accounts for the German and French Green Liberals were similarly found to be predictors of five and seven accounts, respectively. The results from the environmental groups were less impressive with @pronaturach, @ProNaturaSuisse, and @verkehrsclub each predicting five, four, and six accounts, respectively.

I once again constructed intervals of 95% confidence for the coefficient predictors of these seven accounts. The results were mixed. @GrueneCH had the most non-zero coefficients in each VAR model. Significant coefficients that tested a Granger causality at a significance at 0.05 include @Gewerbeverband, @grunliberale, @lesvertessuisses, @mitte, @svpch, and @verkehrsclub. The French version was less impressive, only testing significant predictive ability for themselves and @verkehrsclub. Overall, however, the Greens seem to have great agenda setting power over the environment on Twitter, both over other green groups and non-green groups.

The Green Liberals also produced significant coefficient predictors for @Mitte_Centre, @spschweiz, and @SVPch, the former of the two were found to be statistically significant

according to Granger at the level 0.05 while @SVPch fell just outside at a p-value of 0.0674. Even though the German People's Party fell just outside the level of significance, it is likely that this value may be different in the long term, with more testing across longer periods of time or a different period of the time in the same year. Nevertheless, I will not reject the null correlation for this specific account. The French greens proved to be far less effective at setting agenda; its VAR model only yielded one coefficient that was 95% confident different than 0, @verkehrsclub. However, this coefficient is relatively small at about 0.025 on average. I cannot conclude that this account, therefore, had a statistically significant agenda setting effect on any account about the months January to March of 2019.

Overall, the accounts for the two Green political parties had the most significant test results for the predictive power they had over the environmental content that other accounts tweeted. One reason might be the relative size of the German accounts compared to the French accounts. The German accounts across all political parties had a higher number of followers than the French equivalents. A likely reason is that these accounts receive more follower engagement which, in turn, triggers other accounts to discuss the environment, thus inciting the social media trend. More research is needed to determine the causes of what drives a social media trend about the environment in Switzerland.

The environmental groups were not as predictive over the tweeting content of other accounts. The account @verkehrsclub was the best predictor, with both @LesVertesSuisses and @SVPch having nonzero coefficients at 95% confidence, each with p-values significant at 0.05. The coefficient for @SVPch was particularly interesting; an impulse shock to the environmental content from 0 to 1 increases, on average, the proportion of environmental content that the German Swiss People's Party publishes by about 20%. This suggests that about the months from

January to March of 2019, the account @SVPch likely followed agenda set by @verkehrsclub. No evidence was found to suggest that either account for ProNatura had any measurable effect on the accounts of any political party, business interest association, or other environmental group as each coefficient statistically different than 0 fails Granger's Causality Test. While more testing is needed to determine ProNatura's role on other accounts, there is not enough evidence for the purposes of this study to conclude that they have any agenda setting power. More tests are also needed to determine if other environmental groups like @verkehrsclub have agenda setting power in the long run.

CONCLUSION

This study was designed with the intent to conclude who sets political agenda of environmental topics on Twitter as a political forum. Based on the suggestions and conclusions of Gilardi et. al (2021), I tested two separate hypotheses for who sets the political agenda. The first, accounts of larger political parties and interest groups have agenda setting power over other, smaller groups. The second, environmentally focused accounts set agenda of environmental topics for similar political actors and organizations who are not environmentally focused. The study was designed to be a case study between January and March of 2019 and should not be extrapolated for other time periods, or even to be indicative of long-term trends. This study should, however, provide a framework of methodologies which should be retested or modified to find the long-term agenda setting relationship. I conclude that there is insufficient evidence to demonstrate that accounts of large organizations set environmental agenda over accounts of smaller organizations. I further conclude that official accounts of Green political parties have some agenda setting power over the content that other accounts publish on Twitter as it relates to the environment, especially for other political parties. This effect is most pronounced, however, in the German version of the accounts, likely due to the increased pressure

of German political parties to campaign in an election year. There is insufficient evidence to conclude that environmental activist organizations have any agenda setting power over other political organizational accounts on Twitter.

It is important to recognize the limitations inherent in this study, and there is ample room for researcher bias. One example is the neural network classifier built to classify tweets as environmental or not. It is highly important in neural network design to include a wide range of annotated training data so that the neural network can be as robust as possible. It is important to have a list of well-defined criteria that separates one category from another, in a way that removes as much room for bias as possible. This concern may not be particularly pertinent for the purpose of this study, but it is important to understand the implications if the methods of this study are replicated in other contexts. For the purposes of this study, there is a chance that the true proportion of environmental tweets may be underrepresented by the algorithm, due to the methodology of determining cases. Since the training tweets' content were determined based on specific hashtags, some tweets in the dataset may not give enough information for the neural network to interpret any meaningful information from each tweet's vectorized text content. As with all neural network problems, more robust training data is always more helpful. Another limitation of the study is its lack of generalizability in different time periods than the one chosen. Additional testing is required to determine how these accounts interact in the long run.

I performed this study to get a better understanding of how the official social media accounts of significant political players to the Swiss democratic system interact with one another about environmental topics. As social media continues to be a growing influence upon democracy worldwide, it is more important than ever to get a general understanding of how these players interact with one another and who sets the trends for topics that a potential base of voters is

exposed. Additionally, as the world's global levels of CO_2 continue to rise and countries around the world must address how to combat these issues. Understanding the political process and the flow of information in the face of elections becomes essential for any democratic country in the world. It is quintessential to understand who sets agenda for certain political topics, what information they want disseminated, and what intentions they have for its dissemination.

Overall, this study provides a basis of methodology and mathematical models for researching similar case studies in the future. As the political dissemination of information transitions increasingly to be tailored to a younger, more technologically savvy audience, previous research of agenda setting theory must be continuously evaluated to keep up with the technological renaissance of news media and political organizations. As globally minded environmental advocates around the world scramble to come up with solutions to address the increasing need to make large systemic changes toward environmental policy, we can look to examples like Switzerland, simultaneously one of the most democratic and most green countries in the world. Understanding that Swiss political groups respond to cues based on the perceived expertise and not organizational affluence, we can now look into ways to promote this behavior in other countries around the world. As a suggestion for a further study, a comparative analysis of agenda setters and followers of other countries might provide a great theoretical framework for how to "play the game" of social media marketing and bring the environment to the political agenda to mobilize voters in democracies around the world.

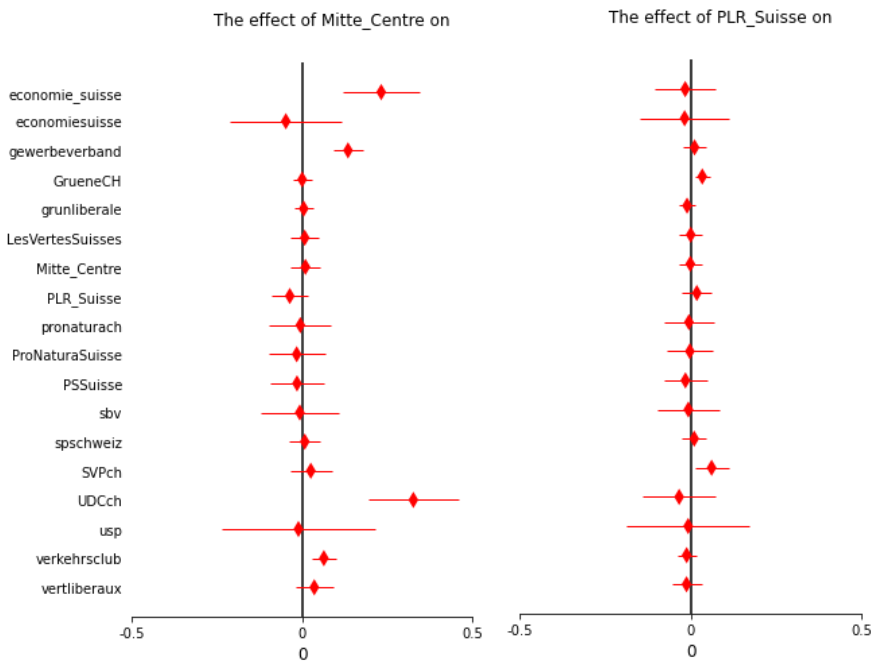
APPENDIX

A1. Environmental Tweeting by Non-Discussed Twitter Accounts

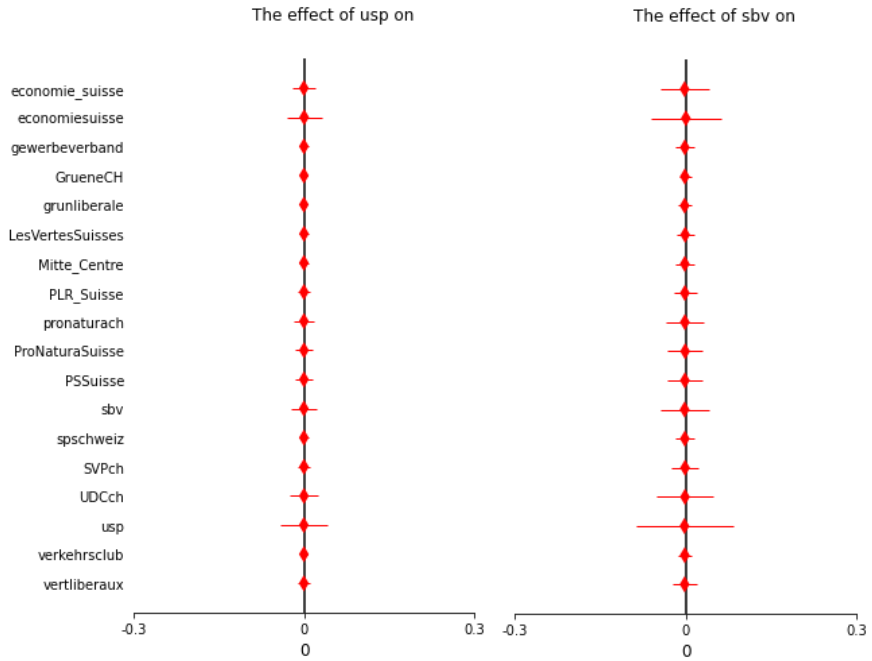
A2. Granger Causality Test for Smaller Parties and Business Interest Associations

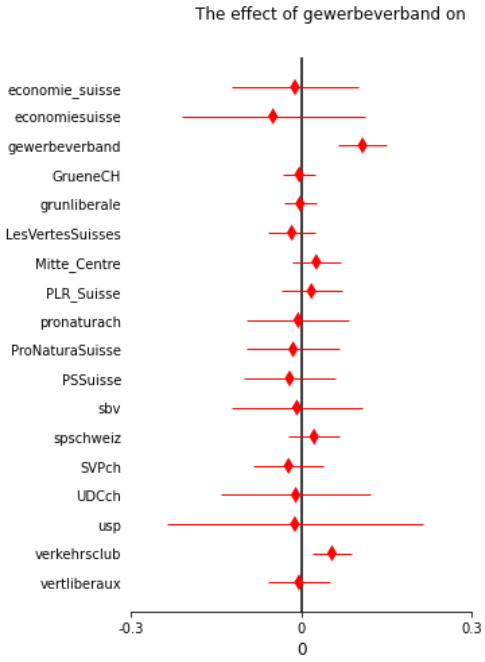
	@gewerbeverband	@sbv	@usp	@PLR_Suisse	@Mitte_Centre
@economie_suisse	0.7935	0.9264	0.9632	0.8409	0.7778
@economiesuisse	***0.0000	0.9513	0.9757	***0.0000	***0.0001
@gewerbeverband	1.0000	***0.0000	0.9130	0.5305	***0.0006
@GrueneCH	***0.0000	**0.0159	*0.0933	**0.0499	***0.0008
@grunliberale	*0.0915	0.4280	0.8461	0.1020	***0.0081
@LesVertesSuisses	***0.0000	0.8101	0.9044	***0.0082	***0.0001
@MitteCentre	***0.0000	0.7977	0.6932	0.5402	1.0000
@PLR_Suisse	0.4049	***0.0000	0.9268	1.0000	0.5469
@pronaturach	0.7324	***0.0000	0.9519	***0.0001	0.7124
@ProNaturaSuisse	0.5609	***0.0000	0.9482	0.7775	0.6911
@PSSuisse	0.7057	0.8940	0.9469	0.1445	**0.0108
@sbv	0.4418	1.0000	0.9656	0.8511	**0.0189
@spschweiz	0.8277	0.6755	0.9160	0.1502	***0.0057
@SVPch	***0.0000	**0.0253	0.9352	***0.0034	**0.0297
@UDCch	*0.0985	0.9404	0.9702	0.8768	***0.0000
@usp	0.9027	0.9656	1.0000	0.9254	0.8952
@verkehrsclub	***0.0000		0.8825	**0.0354	***0.0000
@vertliberaux	**0.0381		0.9206	**0.0480	***0.0028

A3. Confidence Interval Forest Plots of Smaller Political Parties



A4. Confidence Interval Forest Plots of Smaller Business Associations





REFERENCES

A. Joulin, E. Grave, P. Bojanowski, T. Mikolov, Bag of Tricks for Efficient Text Classification

Asur, S., Huberman, B. A., Szabo, G., & Wang, C. 2011. "Trends in Social Media: Persistence and Decay." Proceedings of the International AAAI Conference on Web and Social Media, 5(1), 434–437.

Balasubramanian, M. 2018. "Climate change, famine, and low-income communities challenge Sustainable Development Goals." The Lancet Planetary Health, 2(10), e421–e422. https://doi.org/10.1016/S2542-5196(18)30212-2

Barberá, P., Casas, A., Nagler, J., Egan, P. J., Bonneau, R., Jost, J. T., & Tucker, J. A. 2019. "Who Leads? Who Follows? Measuring Issue Attention and Agenda Setting by Legislators and the Mass Public Using Social Media Data." American Political Science Review, 113(4), 883–901. https://doi.org/10.1017/S0003055419000352

de Vreese, C. H. (2006). "Political Parties in Dire Straits ? Consequences of National Referendums for Political Parties." Party Politics, 12(5), 581–598. https://doi.org/10.1177/1354068806066787

Diakopoulos, Nicholas & Zubiaga, Arkaitz. 2014. "Newsworthiness and Network Gatekeeping on Twitter: The Role of Social Deviance." Proceedings of the 8th International Conference on Weblogs and Social Media, ICWSM 2014.

Federal Council of Switzerland, The. 2017, November 27. "Tourism. Eidgenössisches Departement für auswärtige Angelegenheiten EDA." Retrieved April 7, 2022, from https://www.eda.admin.ch/aboutswitzerland/en/home/wirtschaft/taetigkeitsgebiete/tourismus.html

Feezell, J. T. 2018. “Agenda Setting through Social Media: The Importance of Incidental News Exposure and Social Filtering in the Digital Era.” Political Research Quarterly, 71(2), 482–494. https://doi.org/10.1177/1065912917744895

FORS Research Center (University of Lausanne) and ZDA Center for Democracy in Aarau (University of Zurich). 2016-20. VOTO Studies. [Survey data collected from a random sampling of Swiss referendum voters]. Retrieved from https://www.voto.swiss/francais-information-pour-les-repondants/.

García-Orosa, B. 2021. “Disinformation, social media, bots, and astroturfing: The fourth wave of digital democracy”. El Profesional de La Información, 30(6), 1–9. https://doi.org/10.3145/epi.2021.nov.03

Gilardi, F., Gessler, T., Kubli, M., & Müller, S. 2021. “Issue Ownership and Agenda Setting in the 2019 Swiss National Elections.” Swiss Political Science Review, 00, 1– 19. https://doi.org/10.1111/spsr.12496

Gilardi, F., Gessler, T., Kubli, M., & Müller, S. 2021. “Social Media and Political Agenda Setting.” Political Communication, 1–22. https://doi.org/10.1080/10584609.2021.1910390

Granger, C. W. J. 1969. “Investigating Causal Relations by Econometric Models and Cross-Spectral Methods.” Econometrica 37(3):424–38. doi: 10.2307/1912791.

Granger, C. W. J. 1988. “Some recent development in a concept of causality.” Journal of Econometrics, 39(1-2), 199–211. https://doi.org/10.1016/0304-4076(88)90045-0

Ha, L. S., Wang, F., Fang, L., Yang, C., Hu, X., Yang, L., Yang, F., Xu, Y., & Morin, D. 2013. "Political Efficacy and the Use of Local and National News Media Among Undecided Voters in a Swing State: A Study of General Population Voters and First-Time College Student Voters." Electronic News, 7(4), 204–222. https://doi.org/10.1177/1931243113515678

Halbheer, D., Niggli, S., & Schmutzler, A. 2006. "What Does it Take to Sell Environmental Policy? An Empirical Analysis of Referendum Data." Environmental & Resource Economics, 33(4), 441–462. https://doi.org/10.1007/s10640-005-4993-y

Johansen, S. 1991. "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models." Econometrica, 59(6), 1551–1580. https://doi.org/10.2307/2938278

Jung, Jieun, Peter Petkanic, Dongyan Nan, and Jang Hyun Kim. 2020. "When a Girl Awakened the World: A User and Social Message Analysis of Greta Thunberg." Sustainability 12(7):2707. doi: 10.3390/su12072707.

Jungherr, A., & Schroeder, R. 2021. "Disinformation and the Structural Transformations of the Public Arena: Addressing the Actual Challenges to Democracy." Social Media + Society, 7(1), 2056305121988928. https://doi.org/10.1177/2056305121988928

Katzenstein, Peter J. 1984. *Corporatism and Change: Austria, Switzerland, and the Politics of Industry.* Ithaca: Cornell University Press. 1985. *Small States in World Markets: Industrial Policy in Europe.* Ithaca: Cornell University Press.

Kriesi, H., & Trechsel, A. H. 2010. *The politics of Switzerland: Continuity and change in a consensus democracy*. Cambridge, MA: Cambridge University Press.

Ladner, A., & Brändle, M. 1999. “Does Direct Democracy Matter for Political Parties? An Empirical Test in the Swiss Cantons.” Party Politics, 5(3), 283–302. https://doi.org/10.1177/1354068899005003002.

Leimgruber, P., Hangartner, D., & Leemann, L. 2010. “Comparing Candidates and Citizens in the Ideological Space.” Swiss Political Science Review, 16(3), 499–531. https://doi.org/10.1002/j.1662-6370.2010.tb00439.x

Luo, Y., Burley, H., Moe, A., & Sui, M. 2019. “A Meta-Analysis of News Media’s Public Agenda-Setting Effects, 1972-2015.” Journalism & Mass Communication Quarterly, 96(1), 150–172. https://doi.org/10.1177/1077699018804500

Lupia, A. 1994. “Shortcuts Versus Encyclopedias: Information and Voting Behavior in California Insurance Reform Elections.” American Political Science Review, 88(1), 63–76. https://doi.org/10.2307/294488

Margetts, H., P. John, S. Hale, and T. Yasseri. 2016. “Political turbulence: How social media shape collective action.” Princeton: Princeton University Press.

Norwegian Centre for Research Data. 2015. *Switzerland - Political parties. European Election Database (EED)*. Retrieved March 11, 2022, from https://o.nsd.no/european_election_database/country/switzerland/parties.html

Romero, D. M., Galuba, W., Asur, S., & Huberman, B. A. n.d. “Influence and Passivity in Social Media.” 16.

Schoen, H., Gayo-Avello, D., Takis Metaxas, P., Mustafaraj, E., Strohmaier, M., & Gloor, P. 2013. “The power of prediction with social media.” Internet Research, 23(5), 528–543. https://doi.org/10.1108/IntR-06-2013-0115.

Sciarini, P., & Tresch, A. 2019. “The political agenda-setting power of the media: The Europeanization nexus.” Journal of European Public Policy, 26(5), 734–751. https://doi.org/10.1080/13501763.2018.1458890

Vincent, I. 1998. *Hitler's Silent Partners: Swiss banks, Nazi gold, and the pursuit of Justice*. Vintage Canada.

Wendling, Z.A., Emerson, J.W., de Sherbinin, A., Esty, D.C., et al. 2020. *2020 Environmental Performance Index*. New Haven, CT: Yale Center for Environmental Law & Policy. epi.yale.edu

SUPPLEMENTAL RESOURCES

Supplemental materials, datasets, models, and graphs may be found in the following Github repository. https://github.com/cjvaugha/swiss_tweet_agenda_setting