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Impact of subsidies in a very fragmented situation: the case of Switzerland

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Executive Summary

In Switzerland subsidies for the purchase of electric cars and charging stations are granted at local level with very different approaches. This paper analyzes where and how the subsidies are implemented and their impact. They have been proved effective and their impact was highest in the first year of their introduction. They have stimulated the EV market both in areas with a higher-than-average and in areas with a lower-than-average market acceptance. As upfront cost of EVs and availability of charging infrastructure are the most relevant barrier to the EV purchase, it has been investigated whether the differences in socio-economic situations or dotation of charging infrastructure could have an impact on the results of the subsidies. They have been effective both in areas with socio-economic situation higher and lower than the average and in areas with an infrastructure dotation either aligned or even higher than the average.

1 The particular situation of Switzerland

Switzerland is experiencing a high market penetration of electric vehicles, even without national subsidies, which are granted only in few Cantons. Until 2021, electric vehicles for private mobility and their infrastructure have been subsidized only by local governments. This fact reflects both the national policy trends, which prefer to allocate resources for the public transportation, and the strongly federal structure of the country, where the local institutions have a lot of degrees of freedom. The consequence is that the Cantons, which have decided for subsidies targeting the electric cars, have implemented their own measures. On one hand this fragmentation is a straightforward consequence of a multi-cultural country, but on the other hand it makes it difficult for both national stakeholder and for the ones who wish to enter from abroad to the Swiss market, to implement nation-wide business models and plans.

Barriers and motivations for the purchase of an electric car in Switzerland are similar to those of other countries: upfront cost, range, availability of public charging stations are mentioned as the main barriers, while environmental concerns are the main trigger for the purchase (see for instance [14] for Switzerland, [15] and [16] for Germany, [17] for France and [18] for Italy, just to consider the largest neighbors of Switzerland). The high market penetration in Switzerland could be explained as a combination of wealth (see for instance [18] for the correlation between market penetration and GDP pro capita), environmental concerns and an offer of vehicles able to satisfy the demand.

Thus, given the high receptivity of Swiss market, some questions arise: are the subsidies, at least at local level, an effective way to push the electrification of vehicles? In Cantons where subsidies are granted, would the market penetration have been the same without them? The goal of this paper is to try to answer to these questions, doing an inventory of the subsidies, providing a qualitative and quantitative analysis, evaluating their effects, and finally providing some suggestions about a possible lowest common denominator for the subsidy policies and figuring-out possible lessons learned which can be applied also outside Switzerland.

2 Overview and Analysis of the subsidies

2.1 Limits of the analysis

This analysis covers the period 2019 – 2021, focusing on the subsidies at Canton level targeting:

- Electric cars and other vehicles for individual mobility
- Charging infrastructure

2.2 Overview

The 26 Cantons and semi-Cantons have been investigated, and subsidies have been found in 9 of them (Figure 1): Bern (BE) [3], Basle-City (BS) [4], Geneva (GE) [5], Schaffhausen (SH) [6], Schwyz (SZ) [7], Thurgau (TG) [8], Ticino (TI) [9], Vaud (VD) [10], Wallis/Valais (VS) [11].

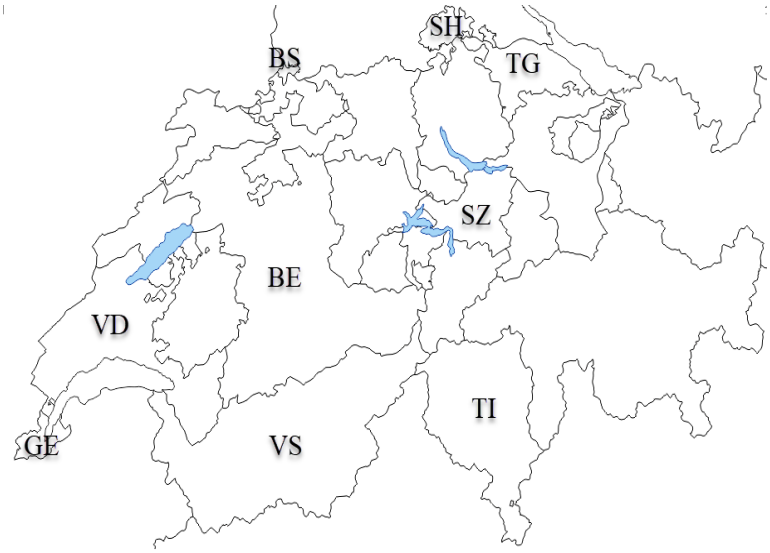

Figure 1: map of Switzerland with the Cantons adopting a subsidy policy

It is worth to mention that all the cultural regions of Switzerland are represented, but the German-speaking part of Switzerland is under-represented in the above map. Table 1 shows some data of the above Cantons in comparison with the whole Switzerland.

Table 1: population and car fleet in the selected Cantons in 2020

	Population	Car fleet
BE	1’043’132	541’507
BS	196’735	64’504
GE	506’343	218’952
SH	83’107	46’634
SZ	162’157	104’485
TG	282’909	176’961
TI	350’986	222’391
VD	814’762	420’332
VS	348’503	223’780
Total	3’788’634	2’019’546
Switzerland	8'670’300	4'658’335

Nevertheless, even if the number of Cantons is limited, they represent 44% of the population [1] and 43% of the whole car fleet of Switzerland [2]. It is worth to mention that in 2022 three other Cantons are granting subsidies (Lucerne, St Gallen and Neuchatel, for charging stations).

Table 2 summarizes the validity of the subsidies and who grants them.

Table 2: Subsidies for electric vehicles and charging infrastructure

	Subsidy given by	Validity
BE	Canton	From 2019
BS	Canton	Apr 17 - Feb 21
GE	Canton	From Jan 2019
SH	Canton	from 01.01.21 on annual basis
SZ	EBS	N/A
TG	Canton	from 01.01.19 on annual basis
TI	Canton	June 19-June 21. Pending funding request from Jan 22
VD	Canton	Jan 21 up to 26
VS	Canton	Nov 20 – Dec 22

As expected, the subsidies are paid by the Cantons, with one notable exception: Canton Schwyz (SZ) entrusted the payment of the subsidies to the local power utility (EBS).

Table 3 summarizes the subsidies for vehicles and Table 4 for the charging infrastructure. In the column "Description" there are the details of the subsidy (per vehicle, per charging station or charging point). The constraints to the eligibility of the subsidy are listed in the row "Limitations". The column "Budget" shows the allocated financial resources.

Only pure electric vehicles are eligible for the subsidies, apart from VS, which also subsidizes the plug-in-hybrids, but recently they withdraw the sustain to PHEVs (from January 1st 2022).

Table 3: Subsidies for electric vehicles

	Subsidized vehicle	Description	Limitations	Total budget [CHF]
BS	Taxi (passenger cars, vans)	max. 5 -10 kCHF	For business	900 kCHF
SH	passenger cars, vans, small motor vehicles, quadricycles, motorcycles	2 kCHF, 0.5 kCHF for motorcycles	Vehicle owner has to use 100% renewable energy in his property Power of the motorcycles <= 11 kW	No limit defined
SZ	Passenger cars	0,3 – 2 kCHF	EBS clients only	-
TG	passenger cars, light motor vehicles, vans, small motor vehicles, light motor vehicles	2 kCHF + 2 kCHF Bonus solar power system in connection with vehicle	Vehicle owner has to use 100% renewable energy in his property and has to scrap a car belonging to the same market segment	-
TI	passenger cars	2 kCHF (Canton) + 2 kCHF (dealer)	1 car per any physical or legal person	3 MCHF
VS	passenger cars, quadricycles, motorcycles	3,5 – 5 kCHF (cars), 0.75 kCHF (motorcycles)	-	6.85 MCHF (3.35 MCHF in 2021, but topped up with 3.5 MCHF in sept.21)

Table 4: Subsidies for charging infrastructure

	Description	Limitations	Total budget [CHF]
BE	Charging station 11-22kW: 1,5 – 3 kCHF >22kW: 0.15 kCHF/kW, +2kCHF for bidirectional charging station, Installation costs: 35% of investments (max 20 kCHF, max 60kCHF per site).	Only SME with 5-249 employees with an operating site in the Canton are eligible. Charging station must be supplied by renewable electricity only.	380 kCHF (2021), additional funds decided year by year
GE	Charging station for one single user: 1kCHF, for multiple users: 2kCHF	For condominiums only	400 kCHF
SH	Electricity connection costs	For condominiums with construction permit before 2019	N/A
SZ	Charging station for cars: 0,5 kCHF, Charging station for bike: Infr. Bike: 3 kCHF	EBS clients only	N/A
TG	Installation costs	For condominiums with construction permit before 2019	No limit
TI	Charging station: 0.5 kCHF	Only for private and business for their employees.	Cumulative with car subsidies
VD	Private charging stations: 0.5 – 2 kCHF, public charging stations: 0.5 – 3 kCHF, cost of installation: 50% of the investment cost (max 100 kCHF per building/parking lot)	Charging station must be supplied by renewable electricity only. Charging stations must be equipped with a load control system. Only existing condominiums and office buildings are eligible Min 3 charging stations Site configured according to the equipment level C1 and C2 of SIA2060	2.2 MCHF/year for charging stations, 0.75 MCHF/year for installation
VS	Charging station <22kW: 0.7 – 3 kCHF, > 22kW 2 kCHFper charging point		Cumulative with car subsidies

2.3 Analysis of the subsidies

Table 3 and Table 4 show that it is not possible to outline common trends: 3 Cantons subsidize only the charging infrastructure, 1 only the car and 5 both car and infrastructure. It means that it is possible to get a subsidy for an electric car in 6 Cantons.

Subsidies for charging infrastructure are addressed to both the purchase of charging stations and the installation costs.

Concerning the vehicles, some Cantons have limited the subsidies to specific owners (e.g. only private owners, only business owners), others to specific vehicles.

The subsidies for charging infrastructure are sometimes limited either to specific owners or to specific uses, e.g. only in condominiums. The subsidies for charging stations are usually based on a fixed amount, according to the charging power or even on the type of parking site (for a single vehicle / for multiple vehicles). The installation costs are usually subsidized with a percentage of the total costs with a cap. In other words, all the possible methods, limits and constraints have been implemented by these 8 Cantons. This is not surprising knowing the political complexity of Switzerland.

It is worth to mention the efforts by some Cantons:

- To push specific technology solutions, introducing additional rewards and/or constraints (e.g. a bonus for bi-directional charging stations or charging stations combined with photovoltaic, the constraints to use 100% electricity from renewables or to allow a remote control by the power utility and so on).
- To push the deployment of charging infrastructure in the existing condominiums, which is one of the most critical points for the introduction of plug-in vehicles in Switzerland. In most of these buildings, the parking places are in common areas, therefore the permit for the installation has to be agreed by the majority of the owners. The fact that the supply of a charging station has typically to be done from the common energy meter, adds difficulties, despite the availability of charging solutions allowing an automatic billing of the charged energy to the EV users.

Focusing on the numbers, Figure 1 and Figure 2 show the range of eligible subsidies for cars and for charging stations.

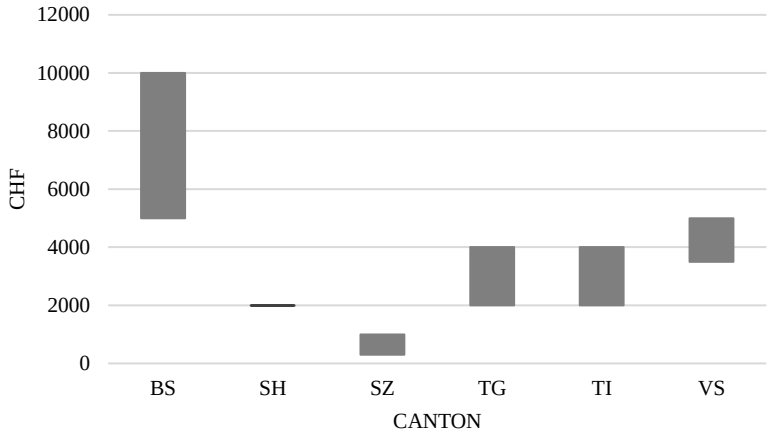

Figure 1: range of the subsidies for electric cars

The subsidies for cars are quite aligned, except for Basle (BS), where the target are taxis (and vans) and Schwyz (SZ), where the subsidies are granted by the local power utility.

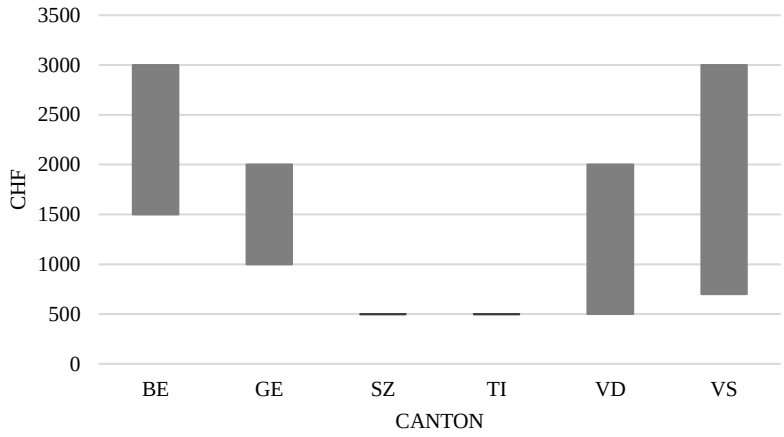

Figure 2:range of the subsidies for charging stations

The range reflects the fact that some Cantons have applied methods depending on technical characteristics of the charging stations (see Table 4), while others have applied a fixed value, independent from the charging station specifications.

2.4 Analysis of the boundary conditions

The subsidies have been introduced in Cantons with different socio-economic conditions and level of deployment of public charging infrastructure. The number of public charging stations (48% of the answers), the upfront cost (46%) and the range (45%) are the main barriers to the purchase of EVs, according to the yearly survey about the EV market acceptance and people's awareness [14]. The barrier concerning the upfront cost is evaluated taking the GDP pro capita as an indicator for a possible correlation to the market penetration (Figure 3, see also [18]), while the barrier concerning the number of charging stations is evaluated taking the density of stations per 100'000 inhabitants as an indicator (Figure 4).

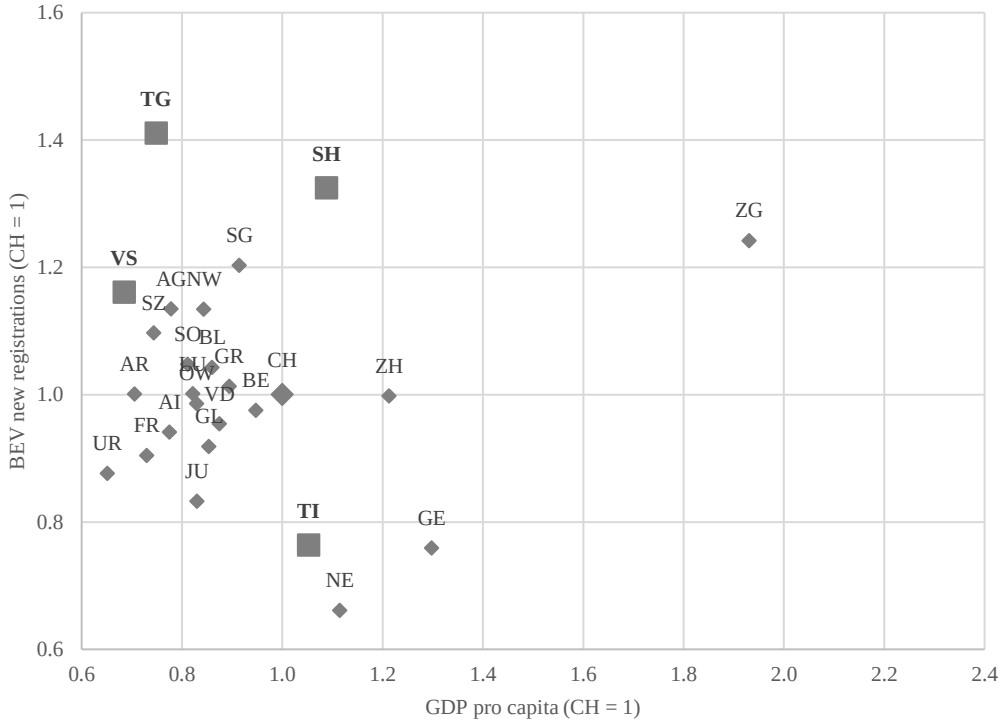

Figure 3: relative market penetration of BEVs vs relative GDP pro capita. Squares: analyzed Cantons with BEV subsidies. Protoscar elaboration from [19]

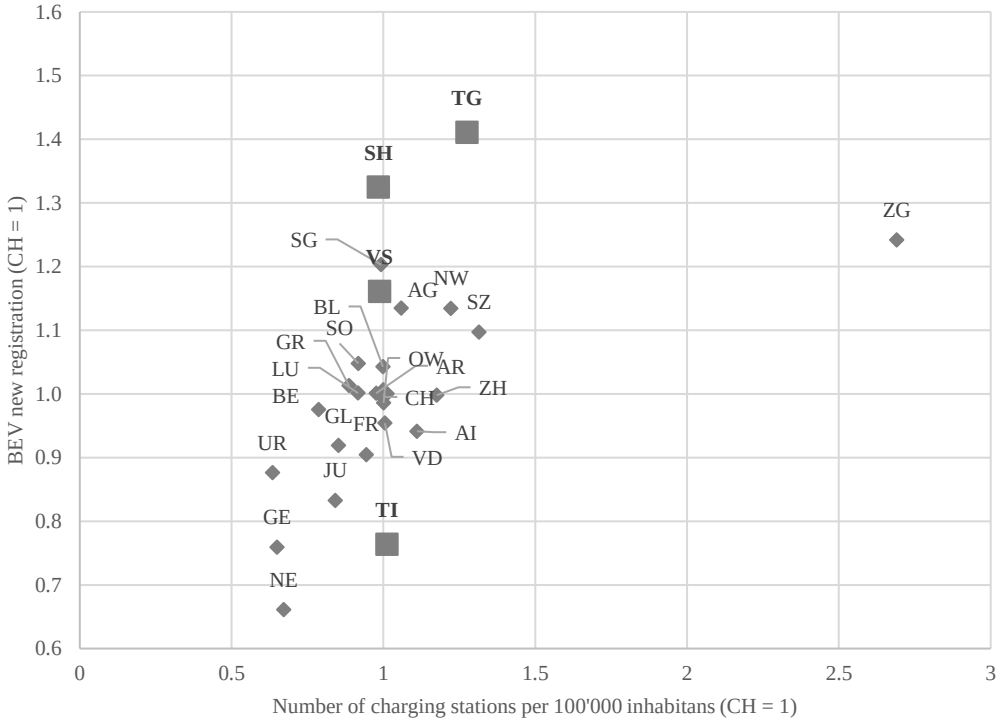

Figure 4: relative market penetration of BEVs vs relative number of charging stations per 100’000 inhabitants. Blue squares: analyzed Cantons with BEV subsidies. Our elaboration from [1] and [20]

Thus, the analysis of the impact of subsidies covers quite different contexts with higher GDP pro capita than the national average but with both a higher and lower market penetration of BEVs, higher public charging station density with a higher market penetration, charging station market density aligned with the national average with both higher and lower market penetration.

3 Evaluation of the impact of subsidies

The analysis is done on the Cantons which have implemented subsidies for electric cars targeting the private owners but excluding SZ, because the subsidies are granted by a power utility only for their clients.

The impact of the subsidies is evaluated comparing the evolution of the market penetration. The two Cantons granting subsidies for charging stations to private users are added to the following tables as well.

Table 5 gives the new registrations of BEVs [12] and Table 6 the market penetration. The market evolution is analyzed starting from 2015, because before that year it is difficult to outline the trends, due to the fact that the vehicle offer was too poor and there were strong fluctuations year over year.

Table 5: yearly new registrations of BEVs in Switzerland and in the Cantons with subsidies for BEVs and/or for charging infrastructure purchase

	2015	2016	2017	2018	2019	2020	2021
CH	3882	3525	4929	5411	13197	19765	32033
Cantons with subsidies for BEV purchase							
SH	23	31	49	59	112	149	306
TG	100	107	141	181	614	785	1252
TI	135	125	141	176	496	868	1453
VS	98	93	189	132	375	621	1408
Cantons with subsidies for charging infrastructure							
GE	144	162	214	217	526	820	1114
VD	240	253	408	343	1396	1955	3055

Table 6: market penetration of BEVs in % of the new registrations in Switzerland and in the Cantons with subsidies for BEVs and/or charging infrastructure purchase. Grey cells indicate the years covered by subsidies.

	2015	2016	2017	2018	2019	2020	2021
CH	1.2%	1.1%	1.6%	1.8%	4.2%	8.3%	13.2%
Cantons with subsidies for BEV purchase							
SH	1.0%	1.3%	2.2%	2.8%	4.9%	9.1%	17.5%
TG	1.1%	1.2%	1.7%	2.2%	6.7%	12.0%	18.7%
TI	0.7%	0.6%	0.7%	1.0%	2.7%	6.0%	10.1%
VS	0.8%	0.8%	1.7%	1.3%	3.4%	7.3%	15.4%
Cantons with subsidies for charging infrastructure							
GE	0.9%	1.0%	1.4%	1.5%	3.8%	7.4%	10.0%
VD	0.7%	0.8%	1.3%	1.1%	4.4%	8.2%	12.6%

The possible impact of the subsidies can be evaluated analyzing the growth trends, i.e. the increase of the market penetration in a year, compared with the one of the past years (Table 7).

Table 7: YoY growth of BEVs new registrations in Switzerland and in the Cantons with subsidies for BEVs and/or charging infrastructure purchase. Grey cells indicate the years covered by subsidies.

	2016	2017	2018	2019	2020	2021
CH	-9.2%	39.8%	9.8%	143.9%	49.8%	62.1%
Cantons with subsidies for BEV purchase						
SH	34.8%	58.1%	20.4%	89.8%	33.0%	105.4%
TG	7.0%	31.8%	28.4%	239.2%	27.9%	59.5%
TI	-7.4%	12.8%	24.8%	181.8%	75.0%	67.4%
VS	-5.1%	103.2%	30.2%	184.1%	65.6%	126.7%
Cantons with subsidies for charging infrastructure						
GE	12.5%	32.1%	1.4%	142.4%	55.9%	35.9%
VD	5.4%	61.3%	15.9%	307.0%	40.0%	56.3%

The national trend [13] shows a growth peak in 2019, a strong decrease of the growth rate in 2020 and a partial recovery in 2021. In the Cantons with subsidies for cars there is a similar trend but, the first year the subsidies are introduced, the market growth is much higher than the national one (approx. 1.3 to 2 times higher). Looking at the 2 Cantons where the subsidies for BEVs cover more than one year, it is observed that in TI the market growth was higher than the national average both in 2020 and 2021, but in TG the growth was lower both in 2020 (56% of the national growth) and in 2021 (96%). An explanation could be that the subsidies have impressed a huge acceleration to the decision to purchase a BEV, concentrating most of the purchases in one year. Concerning the impact of the subsidies for charging infrastructure only, there is no correlation: when the subsidies were introduced, both in GE and VD, the market growth did not show any variation, compared to the national one. As the first year of introduction of subsidies for BEVs has the higher effect, Figure 5 and Figure 6 show the YoY growth in all the Cantons in 2019 and 2021.

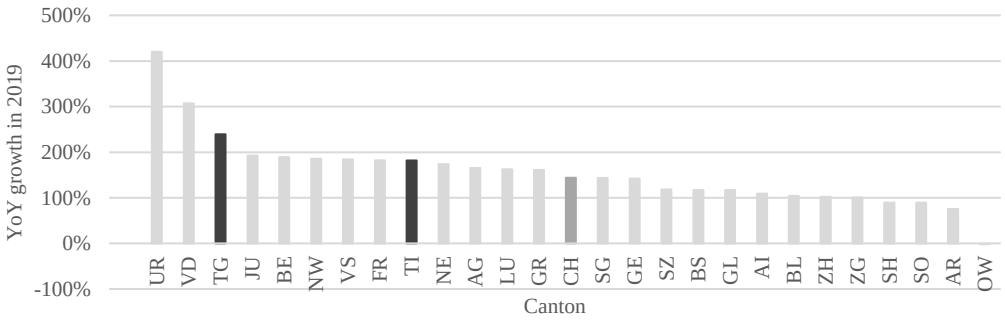

Figure 5: YoY growth of BEVs new registrations in Switzerland and in each Canton in 2019. In dark grey the Cantons with subsidies which started in 2019.

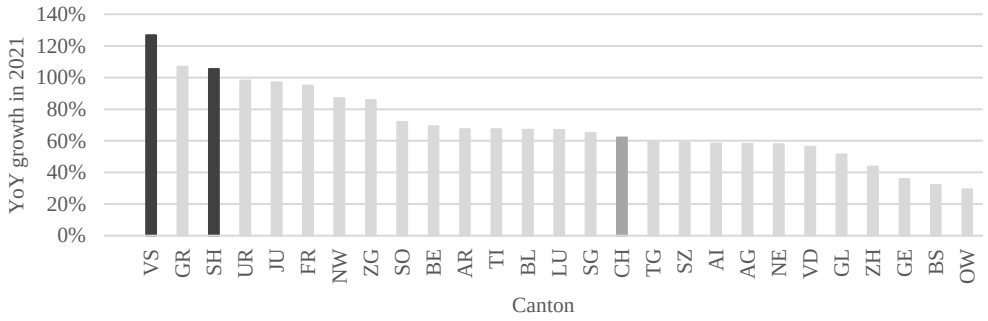

Figure 6: YoY growth of BEVs new registrations in Switzerland and in each Canton in 2021. In dark grey the Cantons with subsidies which started in 2021.

In 2019 subsidies were introduced in TG and TI and they ranked 3rd and 9th in the YoY growth. It must be observed that 3 Cantons doing better than TI, (UR, JU and NW), represent small markets where an increase of the new registrations by only 19, 39 and 52 units caused a huge growth, confirming the positive impact of the subsidies in TI.

In 2021 subsidies were introduced in VS and SH, which ranked 1st and 3rd in the YoY growth.

The impact of subsidies for the charging infrastructure (GE and VD) is not measurable with the above criteria, another method should be adopted to investigate it (e.g. an interview to people who purchased an EV in GE and VD to understand if their decision was influenced by the subsidy).

4 Conclusions

The subsidies for the purchase of electric cars are an effective tool even in a country characterized by a high level of wealth. Even if Switzerland is already a receptive market for BEVs, subsidies for the purchase of vehicles stimulate the market growth in the Cantons where they have been applied. It has been observed that in Cantons already highly receptive to BEVs, the subsidies have had a strong impact. This analysis provides suggestions which can be generalized outside the Swiss context:

- Subsidies to the purchase seem to be a very effective way to stimulate the market even in those contexts where the boundary conditions, like the economic situation of the inhabitants and/or their acceptance of the technology is already high.
- In the countries where local subsidies are applied on top of national ones, local authorities may decide not to add local subsidies, assessing boundary conditions in their region already favorable to EV market penetration: the above analysis shows that the application of additional subsidies can effectively stimulate the market.
- The barriers to e-mobility should be constantly monitored and subsidies or any other active measure for e-mobility should address the most critical points. In the last 3 years the number of public charging stations and the upfront cost are the main barriers in Switzerland. They are following different trends: an increase of the importance of the former and a decrease of the importance of the latter. Today the subsidies for vehicle purchase are effective, but if the above mentioned trends will be confirmed, subsidies for the BEV purchase should be reviewed, allocating them to the charging stations or other measures.
- The fact that the charging of the cars is not possible at home and/or at the working place is mentioned among the minor barriers in Switzerland [14], but its importance has increased in the last 3 years. The impact of subsidies to charging stations was not measurable with the criteria used in this paper, but it may become very important in the next few years, once the potential market coming from people who can easily charge will be fully exploited. The authors of this paper recommend that the subsidies include the deployment of charging infrastructure in condominiums. The costs for the installation of just one charging station, if the single owner was able to convince the others to allow the installation, could be too high. It would be very rational to do investments allowing a future installation of charging points for each parking place, but today the owners who are not interested in purchasing electric vehicles or that simple rent the apartments, do not invest. So, whatever can help the installation of charging stations in condominiums has to be considered a tool to further increase the market penetration, at least in Switzerland.

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Presenter Biography

Giorgio Gabba obtained a master's degree in Aeronautical Engineering from Politecnico di Milano. He has always worked in the e-mobility field. On 1999 he joined Protoscar SA as project manager and senior researcher/analyst. Current activities focus on charging infrastructure analysis (quantification of charging infrastructure, definition of the sites, planning, deployment plans and recommendations), WTW assessment, fleet analysis.

Maud Rasmussen studied Literature (Lic. Phil. I, Modern Languages D, F, E) in Neuchâtel (French speaking part of Switzerland). Captured by climate-related topics she joined Protoscar SA in 2017, where she develops and executes communication projects and in the specific projects contributing to the divulgation of e-Mobility, more particularly of charging infrastructure or in relation to e-Mobility support measures.