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Are Rural Residents the Real E-Mobility Pioneers?

Adoption and Willingness to Pay for E-Mobility in Switzerland's Urban and Rural Areas

This study investigates the differences in e-mobility between urban and rural areas in Switzerland. A survey of 1,037 residents in Switzerland shows that rural areas favor e-mobility more, despite urban areas being more environmentally conscious. Rural residents prefer e-bikes and cars, while urban residents rely on public transport. These differences suggest the need for tailored e-mobility strategies.

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The growing global awareness concerning environmental issues has brought the topic of sustainable mobility, and especially electric mobility (e-mobility), to the forefront of both academic research and public interest (Benevolo, 2016; Cellina et al., 2016). E-mobility, which encompasses electric vehicles (EVs), e-bikes, e-scooters and more, has emerged as a pivotal solution for the transition to more sustainable transport (Bretones & Marquet, 2022; Elmashhara et al., 2022; Stockkamp et al., 2021). Thus, the European Commission has banned the sale of new vehicles with internal combustion engines from 2035 onwards and is focusing on EVs (European Parliament, 2022). In China, more than one in three new cars is electric, while in Norway, the figure is over 90% (Ritchie, 2024).

In recent years, urban centers have been perceived as epicenters of environmental innovation and sustainable practices such as e-mobility, primarily due to high population density, strong public awareness, environmental consciousness, and rapid adoption (Bucher et al., 2019; Leal Filho et al., 2021). This suggests that companies and marketers should target urban residents when bringing new e-mobility solutions to market. One such example is Mobility, a Swiss car-sharing company that aims for a fully electrified car fleet by 2030, primarily targeting urban areas, similar to most car-sharing companies (Mobility.ch, 2024; Prieto et al., 2017).

Besides practitioners, many scholars also agree that urban areas are the ideal market for existing and new e-mobility solutions (Held & Gerrits, 2019; Nigro et al., 2021; Szymanska & Koloszko-Chomentowska, 2022). Consequently, there is less research on the effectiveness and use of e-mobility solutions in rural areas, especially in Switzerland (Szymanska & Koloszko-Chomentowska, 2022; Thimm, 2020). Furthermore, there is little knowledge of how rural areas compare to urban areas in terms of e-mobility adoption and use (Fornahl & Werner, 2015). There is also a lack of understanding of what drives potential differences in e-mobility adoption, purchase decisions, and use between rural and urban areas. Lastly, current literature on e-mobility focuses heavily on EVs while neglecting other e-mobility solutions such as e-bikes and e-scooters.

This paper contributes by shedding light on the under-researched phenomenon of e-mobility (including EVs, e-bikes, and e-scooters) in rural areas. Specifically, the authors compare the use and purchase decisions with regard to e-mobility in urban and rural areas in Switzerland. Furthermore, this paper provides additional insights for scholars and practitioners by investigating different forms of e-mobility separately: EVs, e-bikes, and e-scooters. The authors also explore the reasons for the differences in e-mobility use between urban and rural areas by investigating consumers' sustainability perceptions and lifestyles.

Counterintuitively, the authors propose that rural residents are the real e-mobility pioneers, even though urban areas are conventionally seen as the spearhead of new e-mobility solutions. The main objective of this paper is to investigate the differences in e-mobility use between urban and rural areas in Switzerland by addressing the following research question:

Do urban and rural areas require different e-mobility solutions?

To answer this question, a representative survey was conducted among Swiss residents (n = 1,037). The results show that urban residents, while more environmentally aware, use e-mobility less than rural residents. In the countryside, e-bikes are more popular than in the city, with a higher reported willingness to pay (WTP). For EVs, however, both urban and rural residents show similar WTP, with rural residents having a larger preference for fossil-fuel cars.

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Management Summary

This study compares e-mobility adoption between urban and rural areas in Switzerland, revealing that rural residents prefer e-mobility solutions such as e-bikes more than urban residents. Urban areas are more environmentally conscious, but they rely less on e-mobility and more on public transport, whereas rural areas show a higher willingness to pay for and use private e-mobility options. These findings highlight the need for tailored e-mobility solutions in Switzerland that take account of the different preferences and behaviors of urban and rural residents.

In the following, the authors first examine the fundamental differences in attitudes towards mobility in the dataset in order to establish a baseline for the main analysis on e-mobility. Subsequently, the authors present their hypotheses and methodological approach before detailing the results and concluding with a discussion.

Mobility Behavior of Urban and Rural Residents

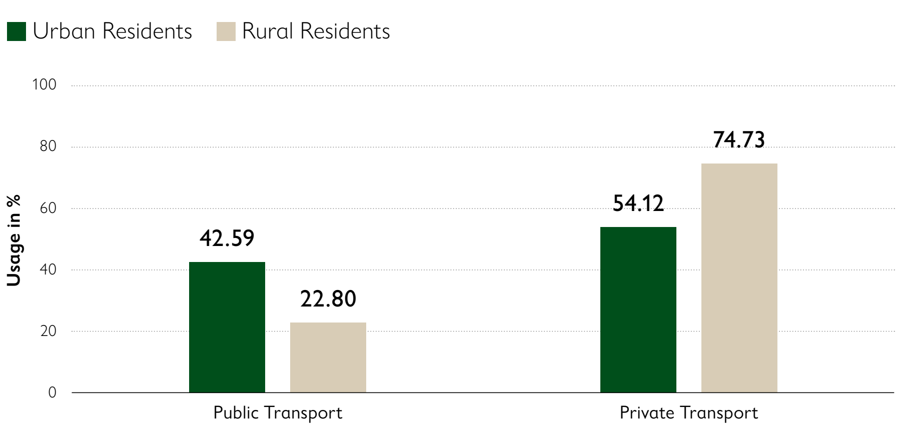
In line with the presented literature, we also find fundamental differences in the mobility behavior of urban and rural residents in our collected data. First, we find that rural residents have a significantly higher number of underage children in their households ($\text{Children}_{\text{Urban}} = 1.40$, $\text{Children}_{\text{Rural}} = 1.61$; $t(884) = -3.94$, $p < 0.001$). This is an important demographic fact that directly points to different mobility needs, as underage children do not have the same opportunities to use private mobility, and public transport is also less available in rural areas. Second, we find that rural residents have a significantly higher number of people in their households who need to be brought to their various destinations ($\text{People}_{\text{Urban}} = 1.80$, $\text{People}_{\text{Rural}} = 2.06$; $t(884) = -3.30$, $p < 0.01$). This is consistent with the higher number of underage children living in rural households. Third, we find that urban residents account for a higher proportion of public transport usage ($\text{Public Transport}_{\text{Urban}} = 42.59$, $\text{Public Transport}_{\text{Rural}} = 22.80$; $t(884) = 8.10$, $p < 0.001$), while rural residents have a larger share of private transportation usage ($\text{Private Transport}_{\text{Urban}} = 54.12$, $\text{Private Transport}_{\text{Rural}} = 74.73$; $t(884) = -8.19$, $p < 0.001$) (see figure 1). Fourth, we find that urban residents are significantly more environmentally responsible ($\text{Public Transport}_{\text{Urban}} = 5.45$, $\text{Public Transport}_{\text{Rural}} = 5.17$; $t(884) = 2.74$, $p < 0.01$) (see online Appendix A for construct reliability and items). Taken together, urban and rural residents in Switzerland show significantly different mobility behaviors. This raises the question of whether this difference in mobility behavior also affects the use of e-mobility.

Methodological Approach and Hypotheses

Data was collected via an empirical, representative survey in Switzerland (Swiss Mobility Monitor) from February 28 to March 11, 2024, with a total of 1,037 responses (50.7% male, 48.4% female, average age = 45.6 years; see online Appendix B for more demographic information). This paper draws on data from several parts of the Swiss Mobility Monitor 2024 (Schakols et al., 2024), specifically the chapters on e-mobility and willingness to pay. The survey was conducted in German, French, and Italian to represent Switzerland's heterogenous language landscape.

For a start, we propose that urban residents use e-mobility less than rural residents, even though they are more environmentally responsible in general. Thus, when it comes to e-mobility, one would expect urban residents to adopt

Figure 1: Use of Private and Public Transport in Swiss Urban and Rural Areas



Note: The error bars indicate the standard error of the mean. Source: Own illustration.

an innovative and environmentally friendly form of mobility earlier, as they are more environmentally responsible. One reason for our seemingly counter-intuitive hypothesis is the fact that rural residents use more private mobility than urban residents. Therefore, despite the possible affinity of urban residents for e-mobility, we expect them to lag behind rural residents in terms of e-mobility use:

H1: *Urban residents rely less on e-mobility than rural residents.*

Besides the overall use of e-mobility, different types of e-mobility can be distinguished, such as EVs, e-bikes, and e-scooters (Behrendt, 2018; Leal Filho et al., 2021). A detailed investigation is required to understand the use of e-mobility by Swiss residents. Therefore, the following hypotheses focus on electric vehicles and e-bikes, respectively. For reasons of space, the analysis on e-scooters, a niche phenomenon with little difference in use between urban and rural areas in Switzerland, can be found in online Appendix C. E-bikes are a growing market in Switzerland and have become increasingly popular in recent years (Velosuisse, 2024). Therefore, the following hypotheses look in more detail at how and why rural residents use e-mobility. Hypothesis 2 looks at EVs, while hypothesis 3 deals with e-bikes. H2a examines the perceived sustainability of different car engine types, as the higher sustainability of EVs is a major aspect for many consumers when switching to an EV (Wu et al., 2020; Gulzari et al., 2022). Furthermore, myths about the ecological advantages of EVs still persist, highlighting the need to investigate perceived sustainability. Hence, we propose:

H2a: *Urban residents have different perceptions of the sustainability of car engine types compared to rural residents.*

Beyond sustainability perceptions, prior research has shown that other factors can influence car choice and purchase decisions, such as cost and range (Graham-Rowe et al., 2012). As a result, we propose that due to urban residents' greater environmental responsibility, an EV would fit better with their personal lifestyle compared to rural residents. To put it formally:

H2b: *Lifestyle choices are a more important factor in switching to an EV for urban residents compared to rural residents.*

Beyond sustainability perceptions and lifestyle choices, concrete measurements of future consumer decisions provide managers with more direct and actionable insights. WTP data can provide such information by giving price-demand functions, where managers can observe the demand for any given price point

Main Propositions

1. In Switzerland, rural areas prefer e-mobility more than urban areas.
2. E-bikes are favored more in rural than in urban areas, while regular bikes are equally popular.
3. Differentiated regional e-mobility strategies are required to meet the diverse preferences and needs.

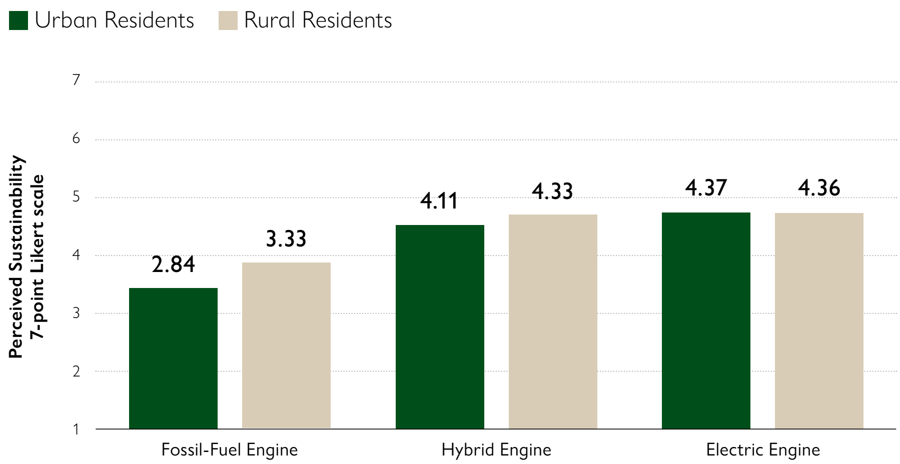
Source: © Adobe Stock.

(Simon & Fassnacht, 2019). Hence, we propose that urban residents have the same WTP for fossil-fuel cars and EVs, while rural residents do not. In formal terms:

H2c: *Rural residents have a higher average WTP for fossil-fuel cars compared to urban residents. For EVs, urban and rural residents have the same average WTP.*

Hypothesis 3 examines the use of e-bikes. We propose that rural residents are more willing to use e-bikes in the future, while regular bikes are equally favored by urban and rural areas. Recent research has shown that e-bikes are a form of micromobility that allows people to cover greater distances (Leal Filho et al., 2021), making e-bikes potentially more viable for many rural areas in Switzerland. Therefore, we propose:

Figure 2: Perceived Sustainability of Different Engine Types in Cars



Note: The error bars indicate the standard error of the mean. Source: Own illustration.

H3a: *Rural residents show a greater willingness to use e-bikes in the future compared to urban residents.*

Analogous to H2b, H3b provides actionable insights for managerial decision making by examining WTP data for e-bikes and regular bikes. We propose that urban residents have a lower WTP for e-bikes than rural residents. Formally stated:

H3b: *Urban residents have a lower average WTP for e-bikes than rural residents. Urban and rural residents have the same average WTP for regular bikes.*

Results

To test hypothesis H1, we conducted a chi-square test and found that urban residents use e-mobility, that is, EVs, e-bikes, or e-scooters, significantly less than rural residents (17.50% vs. 24.27%; $\chi^2 = 5.3724$, $p = 0.02$), providing evidence for hypothesis H1. (Note that participants were asked whether they already use e-mobility or not.) This finding is counterintuitive in view of urban residents' higher environmental responsibility. However, this result refers only to the total use of e-mobility without differentiating between EVs, e-bikes, and e-scooters. The following sections will present results for EVs (H2) and e-bikes (H3).

Lessons Learned

1 Improve charging infrastructure in rural areas to support the growing preference for electric mobility solutions and enhance overall accessibility.

2 Promote e-bikes in rural areas by developing bike highways and connecting cities to better meet the needs of long-distance travel and challenging terrain.

3 Develop targeted e-mobility campaigns that address the specific environmental consciousness and lifestyle preferences of both urban and rural residents.

To test hypothesis H2a, we conducted t-tests for three different types of car engines. Participants were asked to rate the sustainability of different car engine types from (1) highly unsustainable to (7) highly sustainable. Figure 2 shows the perceived sustainability of cars with fossil-fuel, hybrid, and electric engines. Note that gasoline and diesel engines were combined within the fossil-fuel category, and the hybrid engine category comprises both plug-in hybrid cars and full-hybrid cars.

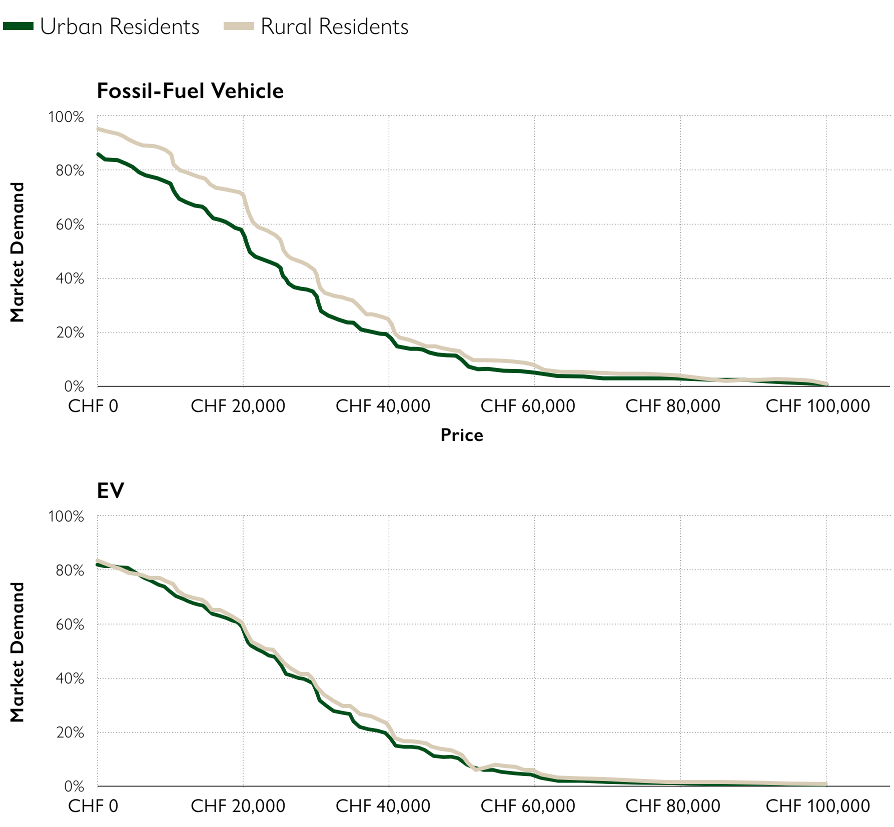
For fossil-fuel engines, we find that urban residents perceive them as significantly less sustainable than rural residents ($\text{Fossil}_{\text{Urban}} = 2.84$, $\text{Fossil}_{\text{Rural}} = 3.33$; $t(884) = -4.65$, $p < 0.001$). Similarly, for cars with hybrid engines, we find that urban residents perceive them as significantly less sustainable than rural residents ($\text{Hybrid}_{\text{Urban}} = 4.11$, $\text{Hybrid}_{\text{Rural}} = 4.33$; $t(884) = -2.41$, $p = 0.016$). For electric engines, however, we find no significant difference in perceived sustainability between urban and rural residents ($\text{Electric}_{\text{Urban}} = 4.37$, $\text{Electric}_{\text{Rural}} = 4.36$; $t(884) = 0.10$, $p = 0.922$). Therefore, we can accept hypothesis H2a, as residents have different perceptions of sustainability regarding engine types.

To test H2b, we conducted a t-test and found that urban residents reported being more likely to switch to an EV because it better fits their lifestyle compared to rural residents ($Lifestyle_{Urban} = 3.58$, $Lifestyle_{Rural} = 3.25$; $t(695) = 2.21$, $p = 0.027$), providing evidence for H2b. Note that participants were asked what would motivate them to switch from their current fossil-fuel vehicle to an EV. Participants could respond to multiple options by answering on a 7-point Likert scale from (1) strongly disagree to (7) strongly agree.

To test H2c, we asked participants about their WTP for fossil-fuel vehicles and EVs. Based on their answers, we calculated two price-response functions for both types of vehicles (see figure 3), one for urban residents and one for rural residents. We conducted two t-tests to analyze the differences in means between the WTP of urban and rural residents. For fossil-fuel vehicles, we find that urban residents have a lower WTP compared to rural residents ($WTP\ Fossil\text{-}Fuel\ Vehicle_{Urban} = 23'751$, $WTP\ Fossil\text{-}Fuel\ Vehicle_{Rural} = 28'544$; $t(884) = -3.43$, $p < 0.001$). For EVs, we find that there is no statistically significant difference in WTP between urban and rural residents ($WTP\ EV_{Urban} = 23'760$, $WTP\ EV_{Rural} = 25'262$; $t(884) = -1.13$, $p = 0.257$), providing evidence for H2c.

The core finding of this paper is that, counterintuitively, rural residents in Switzerland use e-mobility more than urban residents, which contradicts previous findings that cities are the epicenters of e-mobility.

Figure 3: Price-Response Functions for Fossil-Fuel and Electric Vehicles



Source: Own illustration.

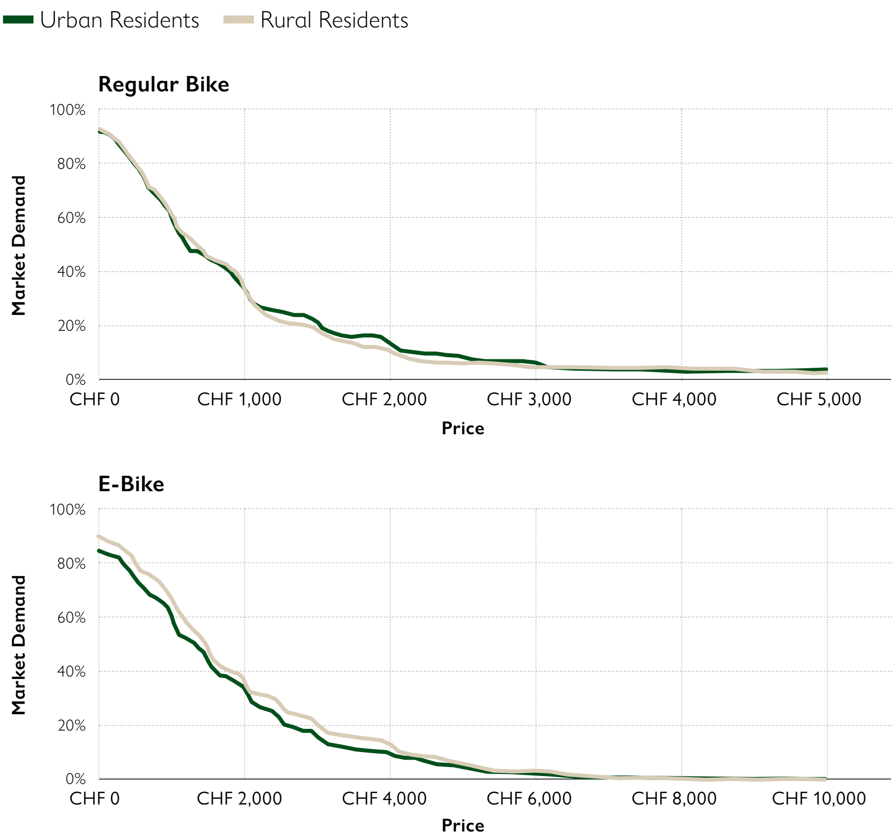
To test H3a, we conducted two chi-square tests. Participants were asked whether they would like to use an e-bike for commuting and leisure in the future, allowing us to examine the usage intention for commuting and leisure separately. For commuting, we find that rural residents (26.86%) intend to use an e-bike significantly more compared to urban residents (19.76%) ($\chi^2 = 5.4689$, $p = 0.019$). For leisure use, we find that rural residents (48.87%) also intend to use an e-bike significantly more than urban residents (38.3%) ($\chi^2 = 8.7941$, $p < 0.01$). Therefore, H3a can be accepted.

To test H3b, we followed the same approach as for H2c. For regular bikes, we find no statistically significant difference in WTP between urban and rural residents ($WTP\ Regular\ bike_{Urban} = 1'047$, $WTP\ Regular\ bike_{Rural} = 967$; $t(884) = 0.91$, $p = 0.364$). For e-bikes, we find that rural residents have a marginally significant higher WTP compared to urban residents ($WTP\ e\text{-}bike_{Rural} = 1'893$, $WTP\ e\text{-}bike_{Urban} = 1'699$; $t(884) = -1.696$, $p = 0.09$), providing evidence for H3b.

Discussion and Limitations

The core finding of this paper is that, counterintuitively, rural residents in Switzerland use e-mobility more than urban residents, which contradicts previous findings that cities are the epicenters of e-mobility (Aultman-Hall et al., 2012;

Figure 4: Price-Response Functions for Regular Bikes and E-Bikes



Source: Own illustration.

Bakker & Trip, 2013). One potential explanation for this is the higher share of private mobility used by rural residents, as public transportation is less available in the countryside (Cellina et al., 2016). This might explain their greater inclination to adopt new e-mobility solutions as viable alternatives, making them e-mobility pioneers by default (Sierzchula et al., 2012).

With regard to EVs, we find that urban and rural residents perceive them as equally sustainable and have similar WTP. This is interesting as prior research often claimed that EVs would be preferred in cities (Buhmann & Criado, 2023). We find the opposite and provide evidence that EVs can be marketed to rural residents as well. At the same time, urban and rural residents disagree on both perceived sustainability and WTP for fossil-fuel cars, with rural residents having higher sustainability perceptions and WTP. At the same time, we provide initial evidence that EVs are favored in cities because they fit better with personal sustainable lifestyles. While a car might be seen as a mere mobility necessity or commodity in rural areas, it may be seen as more of a luxury item to express one's identity by urban residents. Furthermore, skepticism towards EVs in the countryside might reduce rural residents' WTP for EVs compared to urban residents (Zaino et al., 2024).

The equal demand for expensive fossil-fuel cars with prices over CHF 60'000 in urban and rural areas is also worth noting. Even though urban residents have a significantly lower WTP for fossil-fuel cars overall and for fossil-fuel cars up to CHF 60'000, this gap narrows for expensive fossil-fuel cars. This may indicate that a small subgroup of urban residents prefers expensive fossil-fuel cars.

Interestingly, e-bikes are viewed more favorably in rural areas, despite being a form of micromobility that is traditionally first implemented in cities (Mina et al., 2024). That is, rural residents show a higher intention to use e-bikes and a higher WTP for them. This may be explained by their ability to better overcome physical barriers such as long distances and challenging terrain in rural areas, making them an effective and flexible alternative to regular bicycles (Plazier et al., 2023), especially where public transport services are limited (Plazier et al., 2023). This argument is also supported by our finding that urban and rural residents have a similar WTP for regular bicycles, as they cannot be used as effectively for longer distances or for difficult terrain.

In terms of practical implications, it is important to recognize the potential of e-mobility in rural areas. Better charging infrastructure and extended ranges could make EVs even more popular in the countryside (Bakker & Trip, 2013). Rural areas should not be dismissed when it comes to EVs, as rural residents view them as favorably as urban residents and are the ones who drive longer distances. The greater preference for e-bikes in rural areas shows that micromobility is not a phenomenon reserved for cities. Therefore, policy makers should extend micromobility to rural areas by building bike highways between cities (e.g., Darmstadt to Frankfurt, connecting two large cities and making it easier for rural residents to commute to these cities; Region Frankfurt RheinMain, 2024) and to the countryside to encourage e-bike adoption.

This paper analyzes e-mobility usage between urban and rural areas using a

Swiss dataset. This descriptive approach is a clear limitation when it comes to causal inferences. Furthermore, the findings in Switzerland may not be generalizable to other countries, as Switzerland is a small country characterized by both good public transport and difficult alpine terrain. Future research could try to replicate our findings in other countries and use more causal empirical approaches. Additionally, more in-depth research on charging infrastructure is needed, as limited access to charging stations often poses a significant barrier to EV adoption.

This paper contributes to current knowledge by shedding light on the under-researched phenomenon of e-mobility in rural areas. It provides additional insights for scholars and practitioners by investigating different forms of e-mobility separately: electric vehicles, e-bikes, and e-scooters. The authors also explore the reasons behind the differences in e-mobility usage and WTP between urban and rural areas by examining consumers' sustainability perceptions and lifestyles.

For further supplementary tables to the article, visit: https://unisg.link/MRSG-Schakols-et-al-Appendix

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Online Appendix

Are Rural Residents the Real E-Mobility Pioneers?

Adoption and Willingness to Pay for E-Mobility in Switzerland's Urban and Rural Areas

Appendix A: Environmental Responsibility Construct

Category	Content
Items	• Ich bin mir darüber bewusst, dass mein Verkehrsverhalten einen Einfluss auf die Klimaveränderungen durch den Treibhauseffekt hat. – *Translation:* I am aware that my mobility behavior has an influence on climate change due to the greenhouse effect. • Ich kann durch eine umweltschonende Verkehrsmittelwahl einen Beitrag zum Umweltschutz leisten. – *Translation:* I can help protect the environment by choosing an environmentally friendly mode of transport.
Answer Options	7-point Likert scale from "Strongly disagree" to "Strongly agree"
Reliability	Cronbachs Alpha = 0.82

Appendix B: Demographics of the Sample

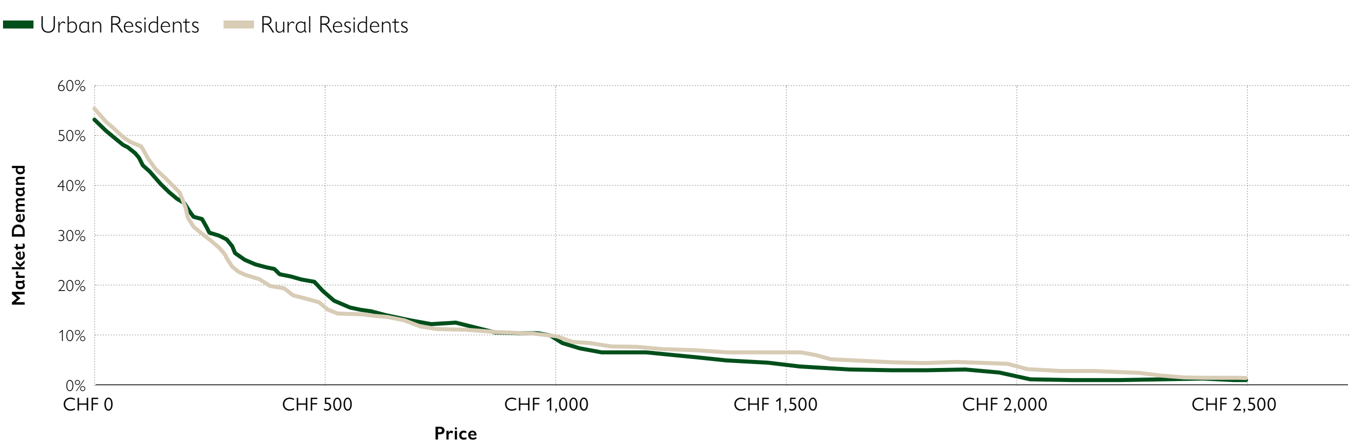
Variable	Level	Sample	Swiss Population
Gender	Male	50.72%	49.64%[1]
	Female	48.41%	50.36%[1]
Language	German	70.3%	61.8%[2]
	French	23.8%	22.8%[2]
	Italian	5.9%	7.8%[2]
Household Size	1	21.22%	36.82%[3]
	2	37.90%	32.70%[3]
	3+	40.88%	30.48%[3]
Educational Level	Primary school / middle school / (obligatory school)	3.38%	–
	Vocational school / apprenticeship	28.93%	
	Secondary school / high school	15.43%	
	Higher schools like universities, technical universities, universities of applied sciences and higher vocational schools	50.63%	
	Other	1.64%	
Profession	Employed	61.72%	50.70%[4]
	Self-employed	8.39%	8.80%[4]
	Students	7.71%	10.6%[4]
	Unemployed / seeking work	2.31%	2.90%[4]
	Others	19.86%	–
Household Income	4000 CHF or less	13.31%	–
	4001 – 8000 CHF	32.30%	
	8001 – 12000 CHF	24.69%	
	12001 – 16000 CHF	9.84%	
	More than 16000 CHF	5.30%	
	n/a	14.56%	
Geographic Segmentation	Urban[5]	65.12%	–
	Rural[5]	34.88%	

(n = 1,037)
1: https://www.bfs.admin.ch/bfs/de/home/statistiken/bevoelkerung/stand-entwicklung.assetdetail.23064702.html
2: https://www.bfs.admin.ch/bfs/de/home/statistiken/bevoelkerung/sprachen-religionen/sprachen.html
3: https://www.bfs.admin.ch/bfs/de/home/statistiken/bevoelkerung/stand-entwicklung.html
4: https://www.bfs.admin.ch/bfs/de/home/statistiken/arbeit-erwerb.html
5: The federal statistics office categorizes every Swiss ZIP code as (1) Urban, (2) Intermediate, and (3) Rural (see https://www.bfs.admin.ch/bfs/en/home/statistics/cross-sectional-topics/spatial-analyses/spatial-divisions/spatial-typologies.as- setdetail.23304437.html). For this manuscript, we combined (2) Intermediate and (3) Rural into our Rural category, as intermediate regions primarily refer to rural areas that are in closer proximity to cities (https://www.ekm.admin.ch/ekm/de/home/projekte/abgeschlossen/periurban/programm-periurban.html). Resultingly, respondents ZIP codes were allocated to the urban or rural categories.

Appendix C: E-Scooter Analysis

Future Usage Intention E-Scooter	
Commuting	• Future Usage Intention Urban Residents: 5.03% • Future Usage Intention Rural Residents: 2.91% • $\chi^2 = 1.7049$, $p = 0.192$
Leisure	• Future Usage Intention Urban Residents: 10.40% • Future Usage Intention Rural Residents: 8.09% • $\chi^2 = 0.98413$, $p = 0.321$
WTP E-Scooter	
T-Test of Means	• Mean WTP of urban residents: CHF 273 • Mean WTP of rural residents: CHF 295 • $t(884) = -0.61$, $p = 0.541$

Appendix D: Price- Response Functions for E-Scooters



Source: Own illustration.