Enabling flexibility through public acceptance in Switzerland

Christian Winzer (ZHAW) &
Morris Krainz (UNIGE)

sweet swiss energy research for the energy transition

PATHFNDR

ETH zürich Empa PSI zhaw HOCHSCHULE LUZERN UNIVERSITÉ DE GENÈVE EPFL TU Delft

Zurich University
of Applied Sciences

School of
Management and Law

Akzeptanz dynamischer Tarife.

Building Competence. Crossing Borders.

Christian Winzer
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Einleitung: Hintergrundarbeiten

- Die vorliegenden Arbeiten wurden im Rahmend der Projekte NETFLEX, PATHFNDR, NEDELA und ESIT mit Unterstützung des Bundesamts für Energie durchgeführt.

- Für Inhalt und Schlussfolgerungen sind ausschliesslich die Autoren verantwortlich.

Schweizerische Eidgenossenschaft
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Bundesamt für Energie

Übersicht

1. **Kunden mögen keine Preisrisiken.**
2. **Manche Kunden verzichten auf Komfort um Kosten zu sparen.**
3. **Verkauf von Absicherungsverträgen ist trotz Risikoaversion schwierig.**
4. **Opt-Out Rekrutierung ist wirksamer als Tarifgestaltung.**

Kunden wollen konstante Preise

Table 5
Utilities of the analyzed attributes.

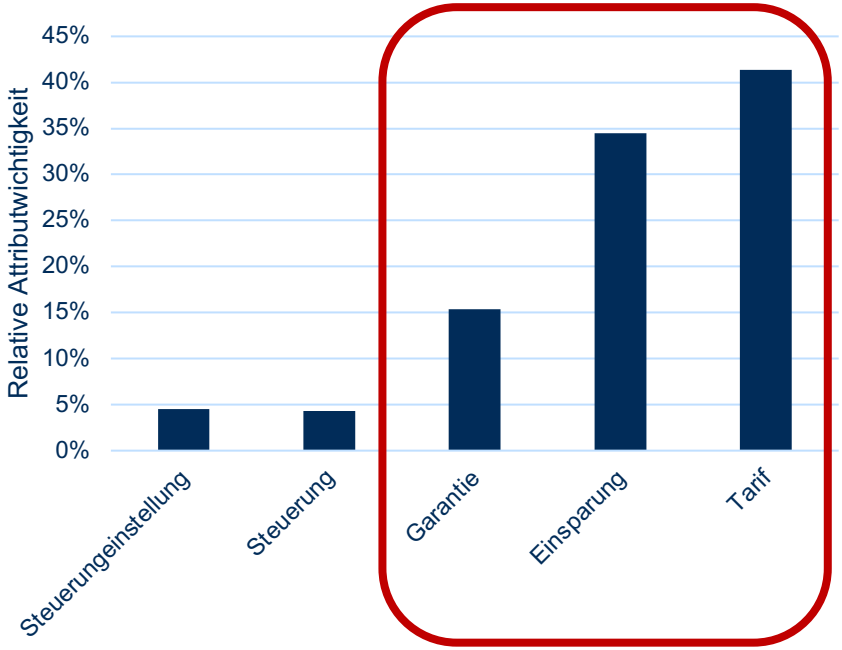
Attribute	Specification	Coeff.	S.D.	t	Sig.
Dynamics	Static	0	–	–	–
	Dynamic	−.383	.072	−5.300	< 0.01
	Variable	−.579	.088	−6.547	< 0.01
Rates: price spread	Low	0	–	–	–
	High	−.126	.057	−2.204	< 0.01
Demand response	Manual	0	–	–	–
	Automated	.565	.057	9.900	< 0.01

Abnehmender Nutzen bei Verträgen mit zunehmender Preisschwankung

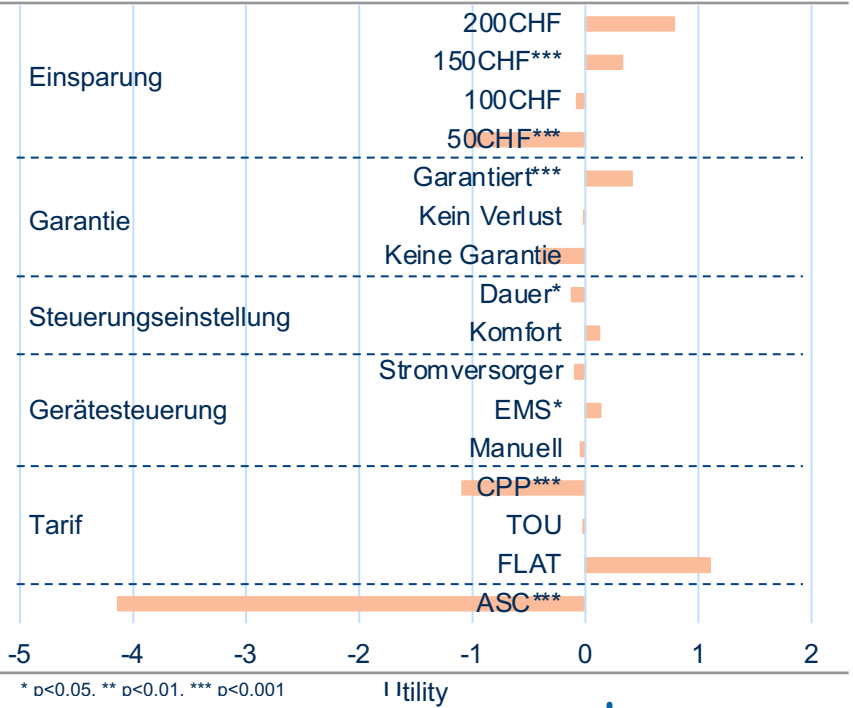
Quelle: Dütschke, Elisabeth, and Alexandra-Gwyn Paetz. 2013. “Dynamic Electricity Pricing—Which Programs Do Consumers Prefer?” Energy Policy 59 (August): 226–34. https://doi.org/10.1016/j.enpol.2013.03.025.

Preisrisiko eines der wichtigsten Vertragsmerkmale

Relative Attributwichtigkeit



Mixed-Logit-Model Output



Quelle: Ludwig, Patrick, and Christian Winzer. 2022. “Tariff Menus to Avoid Rebound Peaks–Results from a Discrete Choice Experiment with Swiss Customers.” *Energies* 15 (17): 6354. https://doi.org/10.3390/en15176354.

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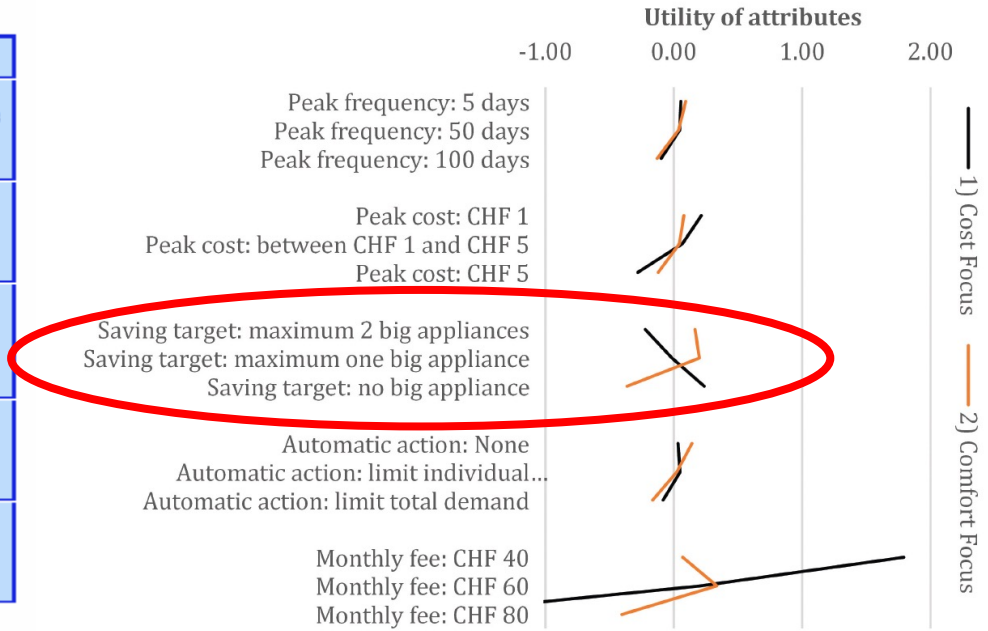
Kunden mit Kostenfokus wünschen Lasteinschränkung

Please consider the following three tariffs and choose one.

When you hover over the different aspects with your mouse you will receive additional information.

	Option 1	Option 2	Option 3
Peak frequency	5 peak periods per year	50 peak periods per year	100 peak periods per year
Additional costs during peak periods	CHF 5 per kWh	Between CHF 1 and 5 per kWh	CHF 1 per kWh
Saving target	No large appliances	Up to 1 large appliance	Up to 2 large appliances
Automatic action	Limit specific applicances	None	Limit total demand
Monthly base fee	CHF 60 per month	CHF 40 per month	CHF 80 per month

	Option 1	Option 2	Option 3
Which option do you	○	○	○



Quelle: Winzer, Christian, and Hongliang Zhang. 2024. "Cost Focus versus Comfort Focus: Evidence from a Discrete Choice Experiment with Swiss Residential Electricity Customers." *The Energy Journal* 45 (2): 209–35. https://doi.org/10.5547/01956574.45.2.cwin.

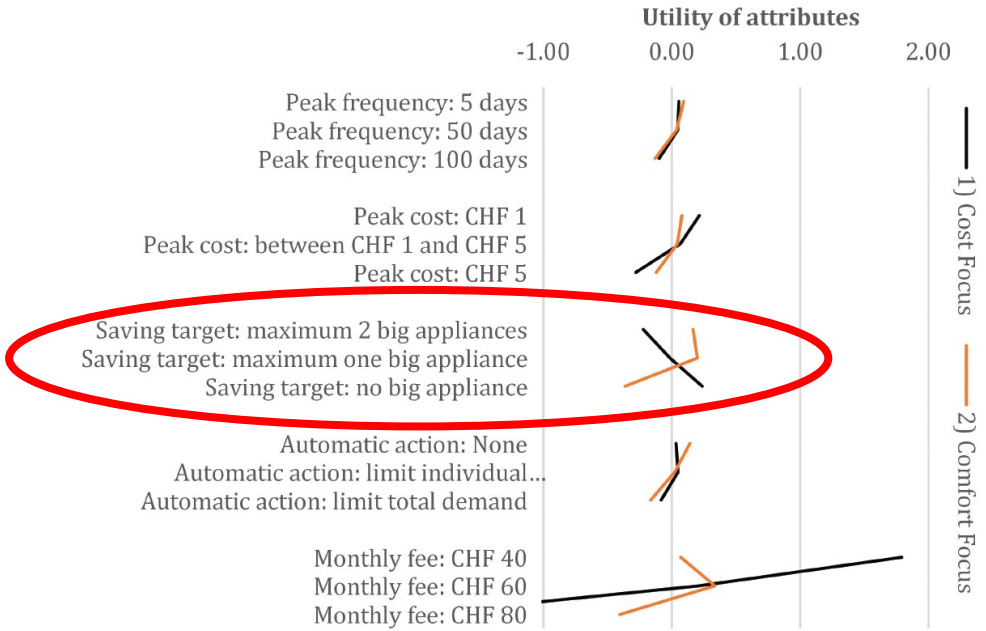
Kunden mit Kostenfokus wünschen Lastseinschränkung

30%

Kunden mit **Kostenfokus** wünschen automatische Laststeuerung um Preisspitzen zu vermeiden und Kosten zu senken.

70%

Kunden mit **Komfortfokus** bezahlen lieber mehr für ein überdimensioniertes Netz um Preisspitzen und automatische Laststeuerung zu vermeiden



Quelle: Winzer, Christian, and Hongliang Zhang. 2024. "Cost Focus versus Comfort Focus: Evidence from a Discrete Choice Experiment with Swiss Residential Electricity Customers." *The Energy Journal* 45 (2): 209–35. https://doi.org/10.5547/01956574.45.2.cwin.

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Profilverträge: können effiziente Anreize für Laststeuerung erhalten… und Kosten für flexible Kunden senken.

Profile contracts for electricity retail customers

Christian Winzer [a], Héctor Ramírez-Molina [a], Lion Hirth [b c], Ingmar Schlecht [a b]

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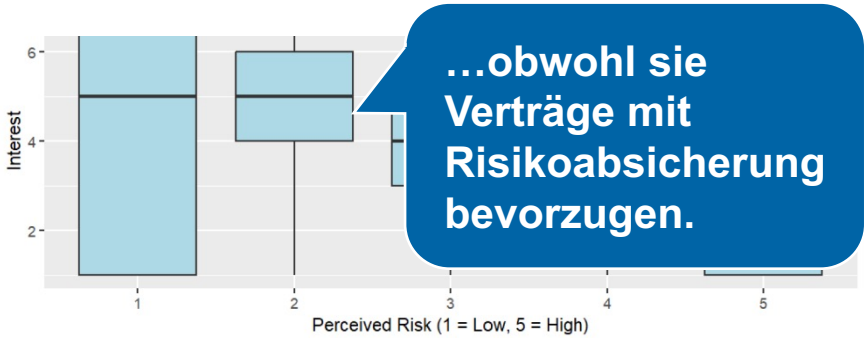
Highlights

- Profile contracts reduce bill volatility to similar levels as fixed price contracts.
- Profile contracts restore flexibility incentives suppressed by fixed price contracts.
- Profile contracts may reduce bill of flexible customers compared to fixed prices.
- Demand for profile contracts expected to increase as load flexibility increases.

	Dispatch Anreize	Preis Absicherung
Fixpreise	✗	✓
Spotpreise	✓	✗
Profilverträge	✓	✓

Quelle: Winzer, C., Ramírez-Molina, H., Hirth, L., & Schlecht, I. (2024). Profile contracts for electricity retail customers. *Energy Policy*, *195*, 114358. https://doi.org/10.1016/j.enpol.2024.114358

Marktintegration von Erneuerbaren: Anpassungsbedarf



Quelle: Luther (2026). "Designing realistic hedged dynamic electricity tariffs for utilities and households.

-Profilverträge verbreiten sich nur, wenn EVUs diese „promoten": da Kunden Erklärung benötigen
-EVUs werden Profilverträge nicht promoten: da unklarer Regeln, fehlende Erfahrung und andere Prioritäten

-Es braucht Förderung durch:
  -**Angebots*pflicht* von Wahltarifen**, die den Spotpreis (ggf. mit Aufschlag) durchreichen… so dass EMS-Anbieter oder Aggregatoren Preisabsicherung und Laststeuerung anbieten können.
  -**Angebots*möglichkeit* von Basistarifen**, welche den Spotpreis durch Profilvertrag absichern

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Opt-out Rekrutierung erhöht Teilnahme aber senkt Wirkung

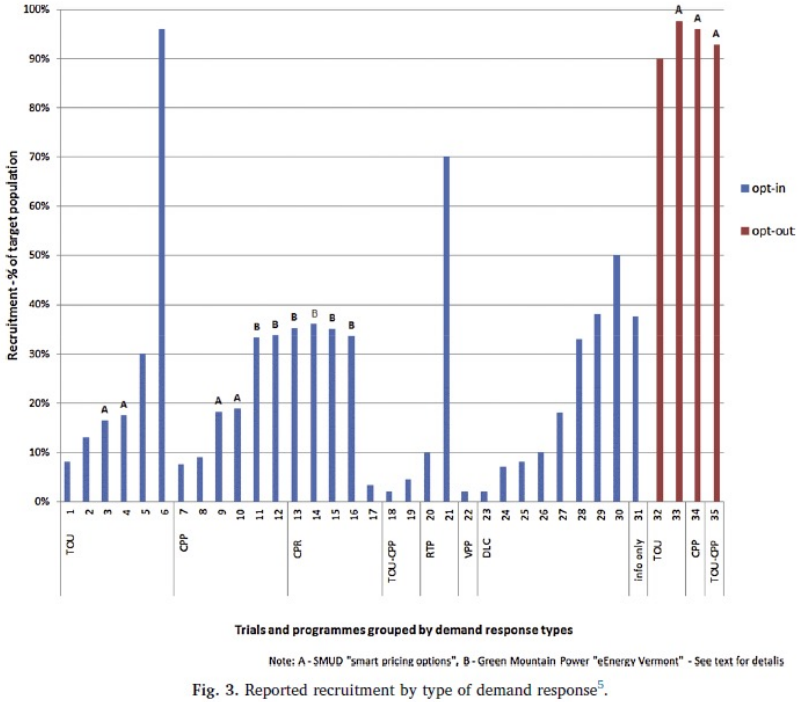

Fig. 3. Reported recruitment by type of demand response[5].

- Hohe Schwankung bei Rekrutierung für denselben Tarifansatz
- Unterschied zwischen Tarifansätzen kaum erkennbar
- Deutlich mehr Rekrutierung über Opt-out als über Opt-in Tarifwahl

Quelle: Parrish, B., Gross, R., & Heptonstall, P. (2019). On demand: Can demand response live up to expectations in managing electricity systems? *Energy Research & Social Science*, *51*, 107–118. https://doi.org/10.1016/j.erss.2018.11.018

Weiterführende Informationen

Fachtagung Dynamische Tarife

Wann: **22. Mai 2026, 10:00 bis 16:00**
Wo: ZHAW, St.-Georgen-Platz 2,
8400 Winterthur, Lageplan

Anmeldung: Link

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Danke für Ihr Interesse!

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Predictors of informed energy policy support across Europe

Morris Krainz (UNIGE)

sweet swiss energy research for the energy transition

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Overview

Theoretical Background & Key Research Question

Study 1 – Identifying the strongest predictors of energy policy support

Study 2 – Validating results in the context of a referendum on renewable energy

Study 3 – Validating results in the broader European context

Summary & Key messages

Theoretical background

Many options to decarbonize the energy sector (IPCC, 2022)

Normative expectation: implement options preferred by the informed general public (Dahl, 1998)

Public support key predictor of successful policy implementation (Yeganeh et al., 2020)

Theoretical background

Large number of predictors associated with policy support:

Sociodemographic factors (e.g. Bergquist et al., 2022)

Individual differences (Bergquist et al., 2022; Ding et al., 2011; Fairbrother et al., 2019; Goldberg et al., 2021, Syropoulous & Markowitz, 2022)

Policy-specific beliefs (Bergquist et al., 2022; Boon-Falleur et al., 2022; Goldberg et al., 2019; Ogunbode, et al., 2024; Swim & Geiger, 2021)

Affective responses (Jobin & Siegrist, 2018; Geiger et al., 2023; Gregersen et al., 2023; Myers et al., 2024; Smith & Leiserowitz, 2014; Spampatti et al., 2022)

Opinions often formed in low information environments (Kriesi, 2005; Lutz, 2006; Stadelmann-Steffen, 2011)

Informed citizens may be more capable of forming opinions in line with their values and concerns (Blastland et al., 2020; Fowler & Margolis, 2014; Wong-Parodi et al., 2016)

Overarching Research Question

What are the strongest predictors of informed energy policy support?

Evidence useful for:

Policy design

Policy communication

Study 1 - Methods

Focus: Policies to increase flexibility of the Swiss energy system

- DACCS to allow use of fossil fuel back up power plants
- Electricity trading
- National incentives for flexible EV charging infrastructure
- National incentives for flexible operation of heat pumps

N = 1056 Swiss citizens (randomly assigned to receive information on one policy)

- Impacts on environment, society, economy and energy sector
- Factsheets of about 900 words

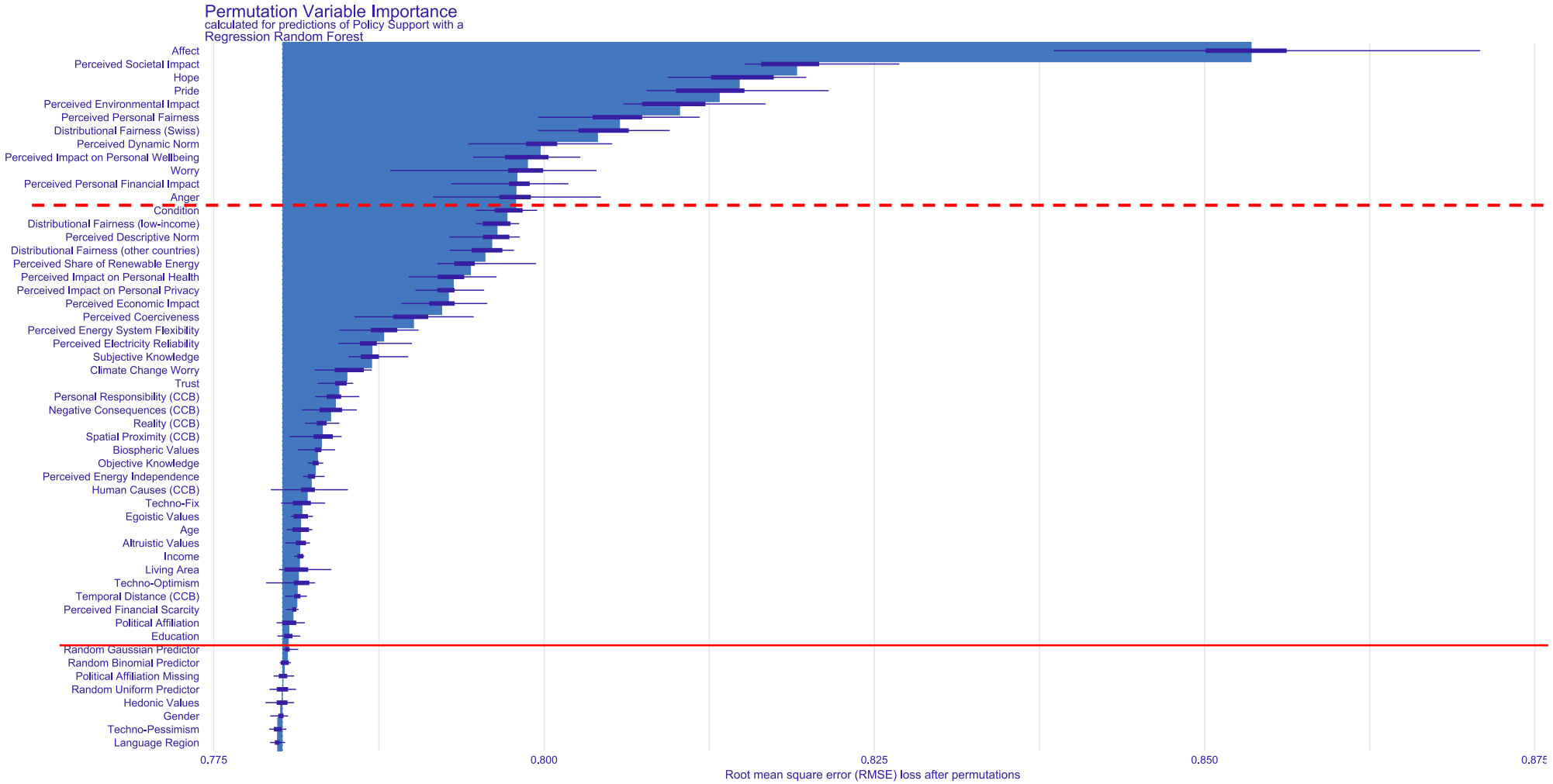
Study 1 - Methods

Collected data on ~50 predictors of policy support

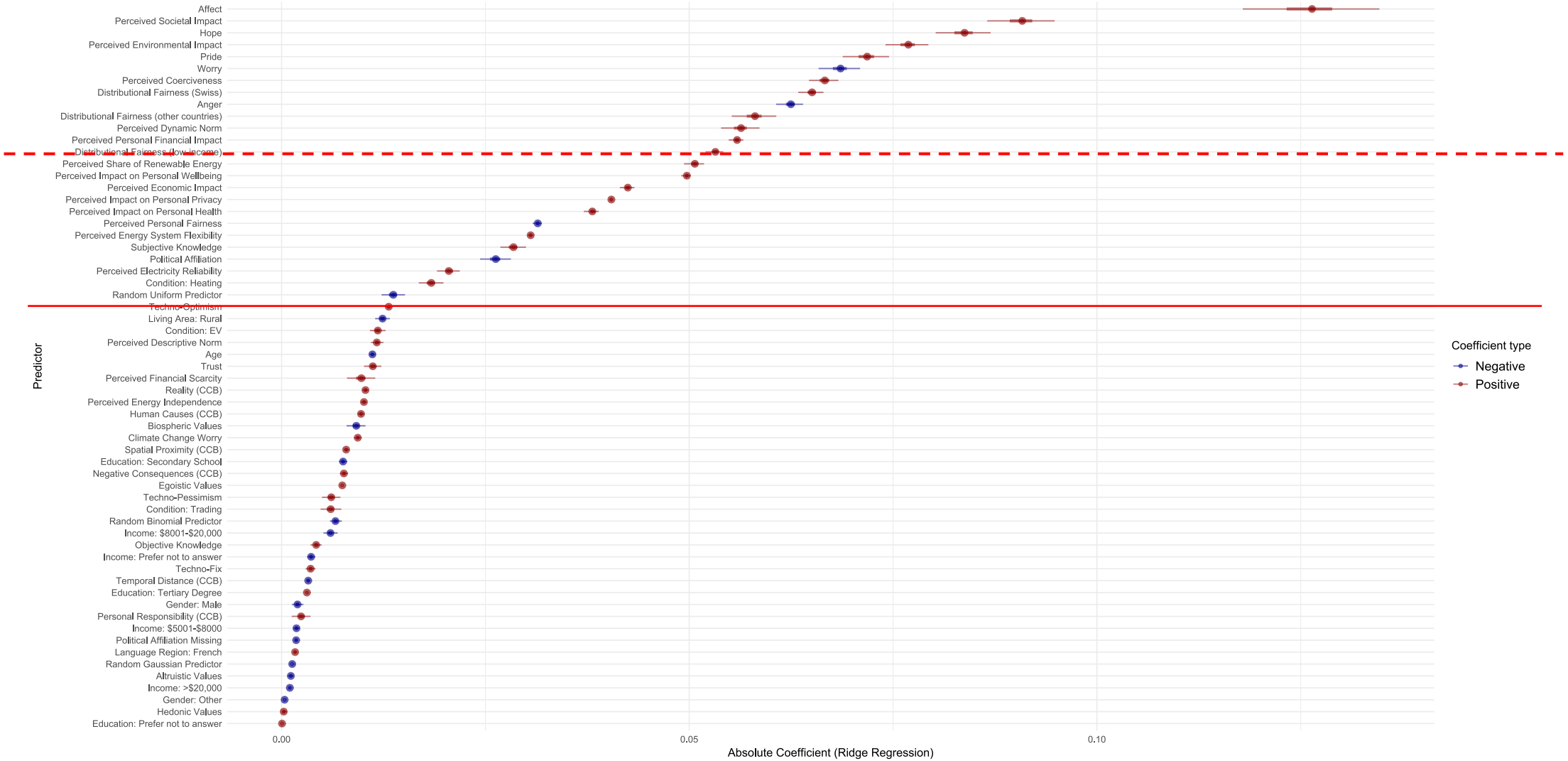
- Sociodemographics (age, gender, education, living area)
- Individual differences (personal values, trust, attitudes towards technology, political orientation, climate change beliefs)
- Policy-specific beliefs (fairness, impacts on environment, society & economy, personal impacts, social norms)
- Affect and emotions (anger, worry, hope, pride)

Analysis: Non-linear (Random forests) and linear (Ridge regression) machine-learning models

Study 1 - Results



Study 1 - Results



Study 1 – Combined Model Results

High overlap between models

- 10/12 predictors in both models
- Order of predictors similar (e.g. Top 3 predictors in the same order)

Combined strongest predictors of energy policy support:

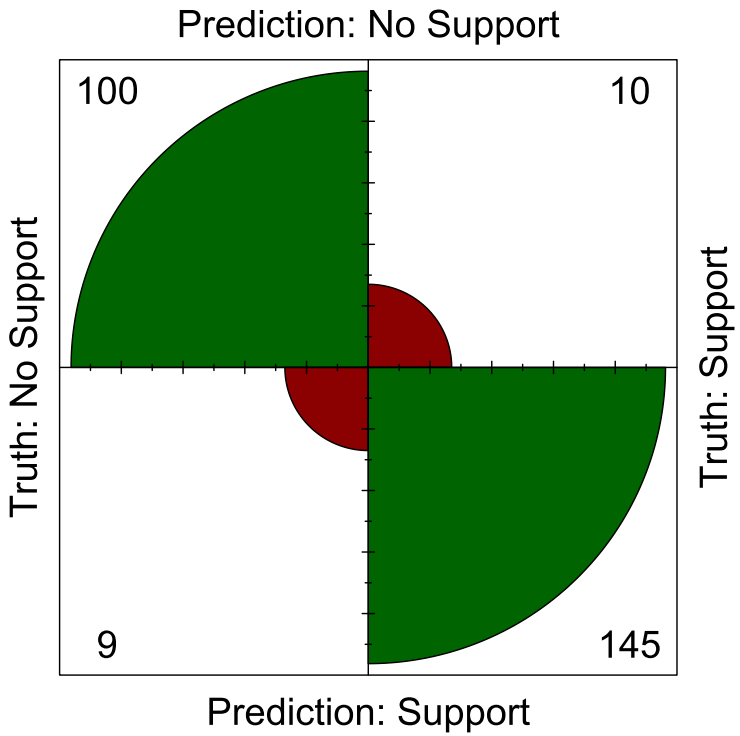
- Affective responses (Affect, Hope, Pride, Worry, Anger)
- Policy impact beliefs (Societal, Environmental, Personal)
- Fairness perceptions (Distributional fairness)
- Perceived trends in policy support in the general public

Study 1 – Model Classification accuracy

How accurately do these variables predict policy support?

Classification Random Forest:

Predictors achieve 92.8% accuracy in predicting policy support



Study 2

Key limitation of Study 1: Hypothetical policies and only related to flexibility

Study 2 RQ: Does model accurately predict support for an actual policy decision?

Study 2 - Methods

Model validation in the context of the Swiss Federal Act on Renewable Energy

Proposed funding instruments and regulations for rapid expansion of renewable energy production (hydropower, solar, wind, biomass)

Referendum on the 9th of June 2024

Data collection from 30th May – 7th June 2024

Online survey with N = 765 Swiss citizens

Measured 14 model-identified predictors and policy support

Study 2 - Methods

Classification random forest predicting support / no-support for referendum

- Study 1 sample (N = 1056) as training data
- Study 2 sample (N = 765) as test data

Pre-registered model performance interpretation:

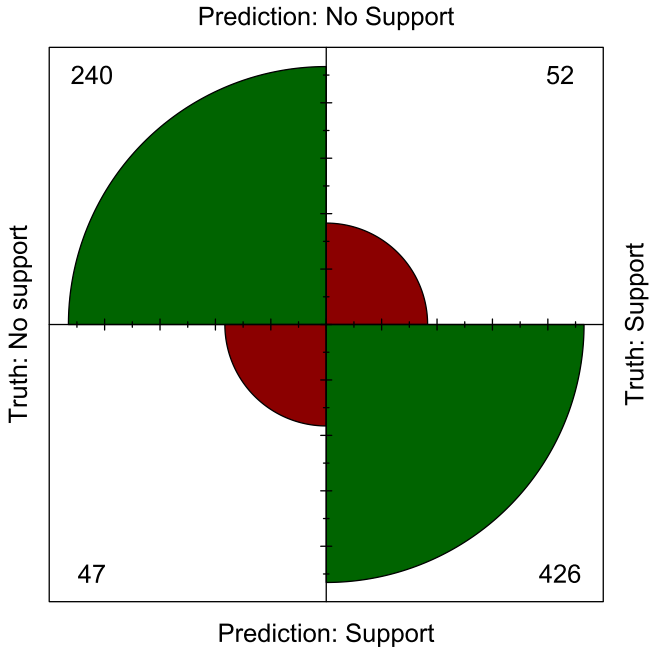
- Calculated lower bound of confidence interval (CI) for model prediction accuracy (=88.2%); if:
  - Prediction accuracy at least as high as lower bound CI → model generalizes
  - Lower than CI but does not drop by more than 10% → performance reasonably well
  - Accuracy drops by more than 10% → does not generalize

Study 2 - Results

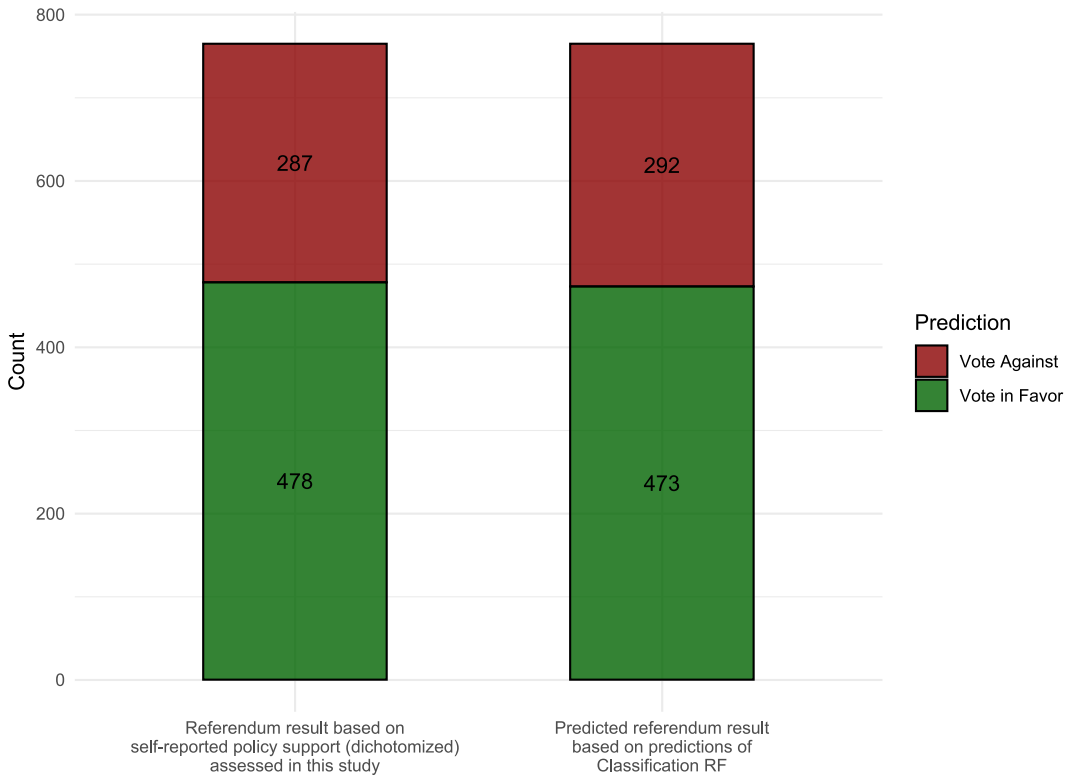
Classification random forest predicting support / no-support for referendum

- Study 1 sample (N = 1056) as training data
- Study 2 sample (N = 765) as test data

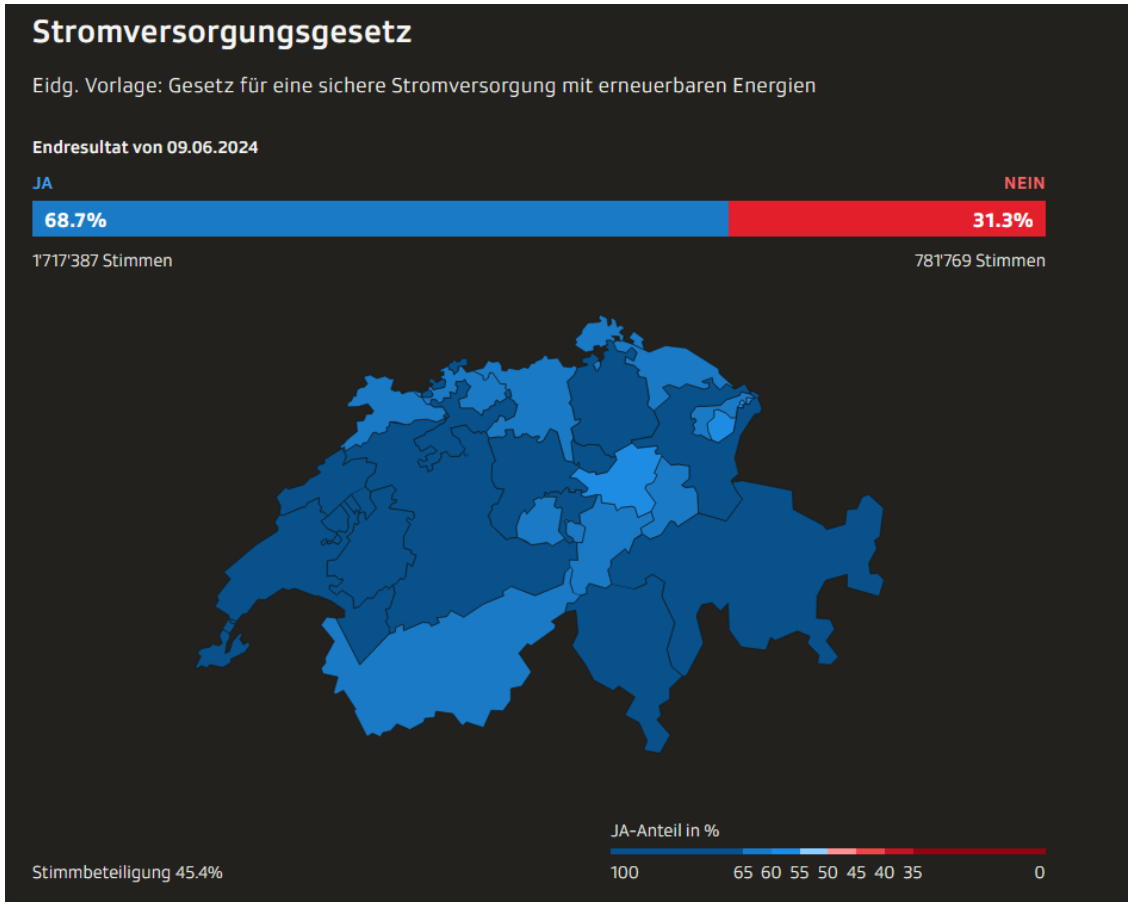
87.1 % accuracy in predicting referendum support



Study 2 - Results



Random forest predicts 61.83% votes in favor and 38.17% votes against the Federal Act on renewable energy



Eidgenössische Abstimmungen—Stromversorgungsgesetz ist angenommen. (2024, June 9). Schweizer Radio und Fernsehen (SRF). https://www.srf.ch/news/schweiz/stromversorgungsgesetz/eidgenoessische-abstimmungen-stromversorgungsgesetz-ist-angenommen

Study 3 - Methods

Does model extend to predict support for climate mitigation measures across Europe?

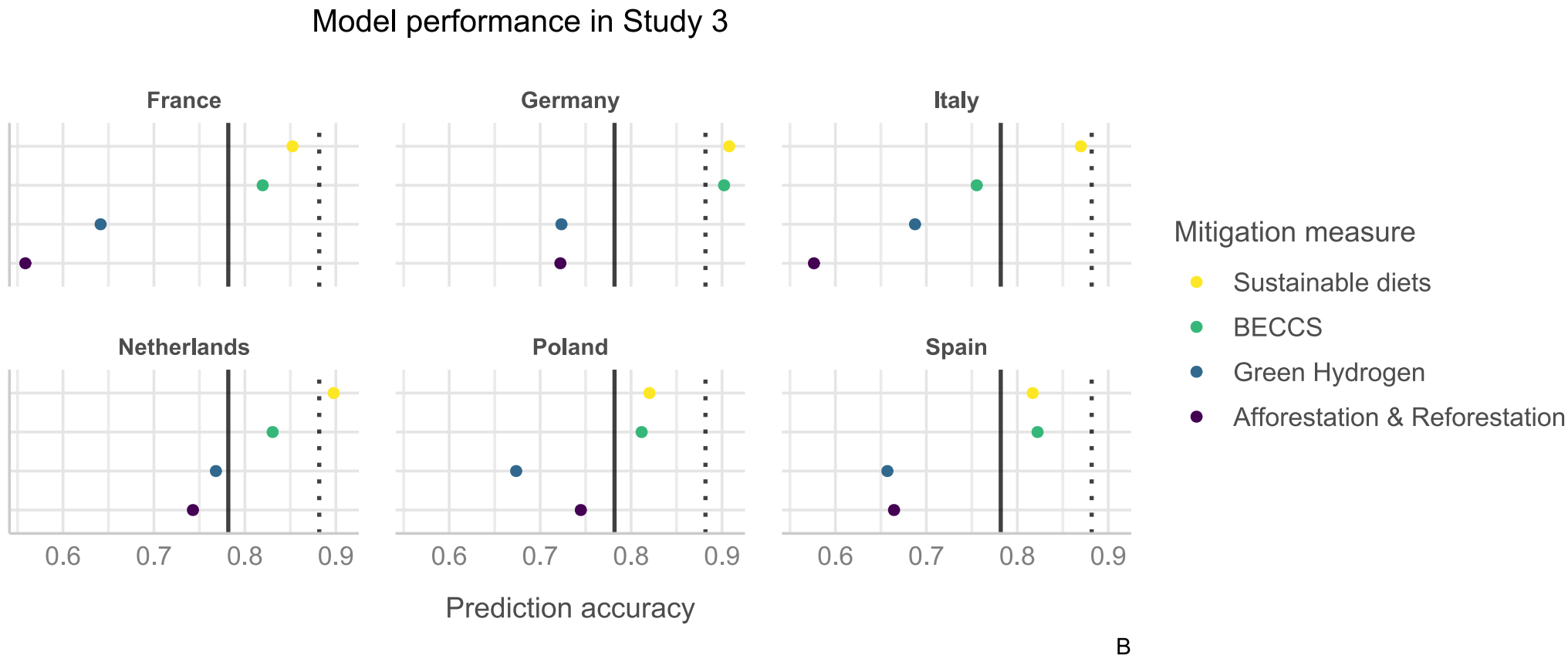
Data collection in France (N = 572), Germany (N = 559), Italy (N = 573), the Netherlands (N = 523), Poland (N = 562) and Spain (N = 566)

Climate mitigation measures:

- Bioenergy with carbon capture and storage (BECCS)
- Green Hydrogen
- Afforestation & Reforestation
- Transition to sustainable diets

Same measures and same performance interpretation as in Study 2

Study 3 - Results



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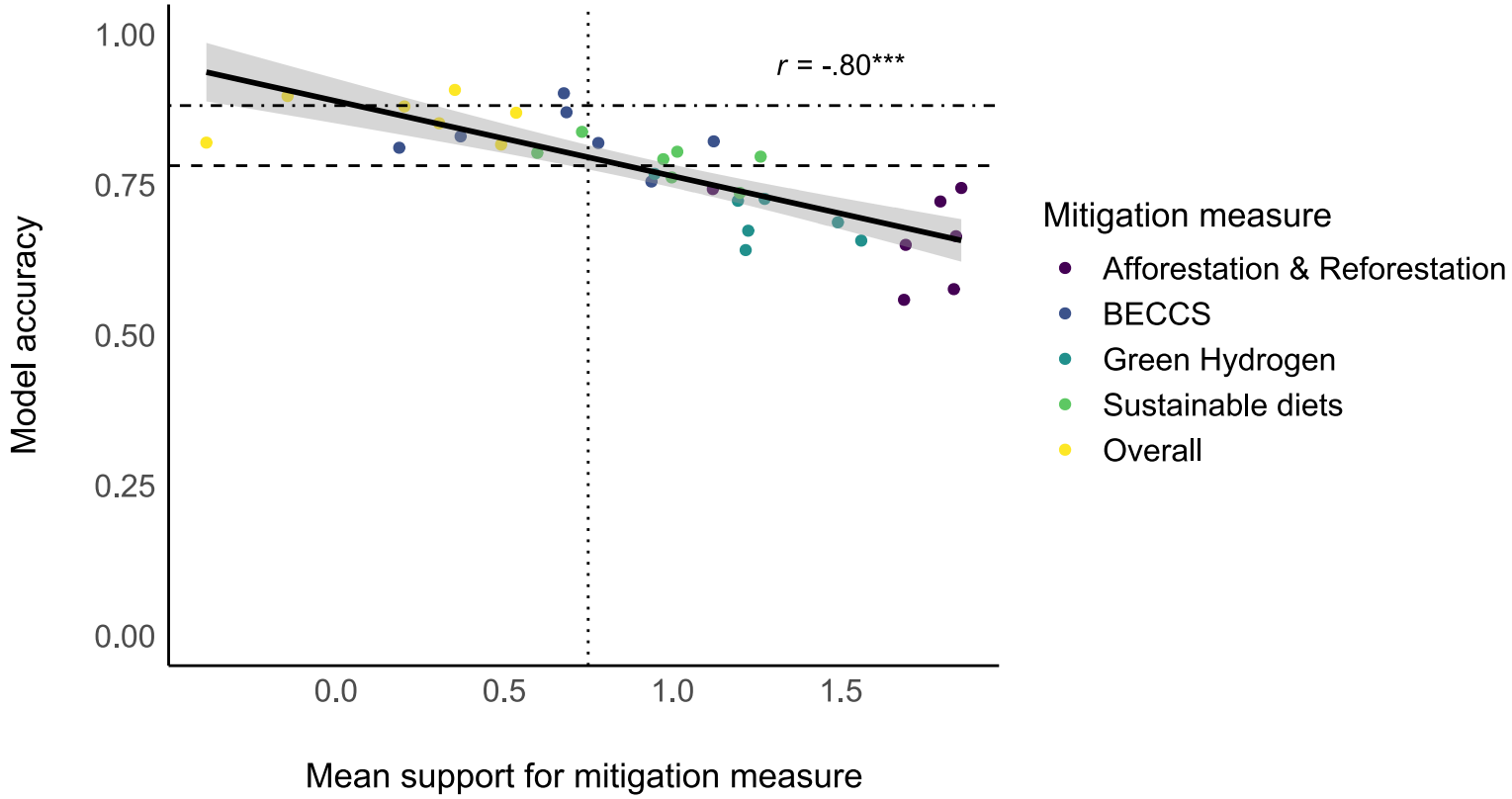
Study 3 - Results



Summary & Key Messages

- Beliefs about societal and environmental impacts, along with beliefs about fairness and affective responses drive energy policy support in informed participants

- Predictors generally also allow high accuracy in predicting support for
  - Actual policy decisions (Referendum on Swiss Federal Act on Renewable Energy)
  - Climate mitigation measures (BECCS, Sustainable Diets)

Recommendations

Policy-makers

To design policies that receive broad public support it is recommended that policy-makers develop energy policies especially taking into account policy impacts on the society, the environment and how impacts are distributed in the public (fairness concerns)

Communicators

To help the public build stable opinions on energy policies it is advisable that communicators prioritize informing the public about impacts on the society and the environment and how impacts are distributed (fairness concerns)

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PATHFNDR

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CDSB: https://www.unige.ch/fapse/decisionlab/

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