

Data Observer

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The Social Sustainability Barometer 2017–2019: Survey Data on the *Energiewende*

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Abstract: A large majority of citizens supports the German transition toward clean energy production (*Energiewende*). Yet, the *Energiewende* involves a large suite of aspects that determine the support. The social sustainability barometer provides a comprehensive data base on a large variety of questions related to the *Energiewende* that was collected in three survey waves spanning from 2017 to 2019 among more than 6000 household heads.

Keywords: household panel, energy transition, acceptance, *energiewende*

JEL Classification: Q3, Q4

1 Introduction

In Germany, energy policy and the transition toward a more sustainable energy generation (the so-called *Energiewende*) have been highly topical issues for at least two decades. keystones of this transition are a rapid expansion of renewable energy sources, an increase in energy efficiency, and a withdrawal from nuclear power. More recently, the German government additionally stipulated a phase-out of coal-fired electricity generation (Oei et al. 2020) and the introduction of a carbon tax in the building and transport sectors (Edenhofer et al. 2020).

There is a large suite of estimations that show how effective these policies are in avoiding greenhouse gas emissions. For instance, Kittel et al. (2020) estimate that the German coal phase-out reduces carbon emissions in Europe by up to 85 Mt by 2030. Regarding a carbon tax, Andersson (2019) assesses that its introduction in Sweden has lowered emissions from transport by 11% relative to that in a group of

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comparable the Organisation for Economic Co-operation and Development (OECD) countries. However, it is less clear to which extent the policies are supported by people and how their attitudes can change over time. For instance, the cost of the promotion of renewable energy and their distribution has been a central point of discussion in the public sphere (Andor et al. 2018; Frondel and Sommer 2018).

In particular, the current debate about fairness concerns of the newly introduced carbon tax emphasizes that beside environmental effectiveness, social acceptance is required for a successful development of the Energiewende. So far, a solid base for the interplay of attitudes, fairness concerns, and related risks as well as challenges has been lacking despite a large literature on social acceptance of renewable energy sources (e.g., Hildebrand and Renn 2019; Sonnberger and Ruddat 2016; Wüstenhagen et al. 2007). In particular, the temporal evolution of attitudes is of major concern as these can quickly change according to public events. For instance, the Fridays-for-Future movement picked up momentum and had a major bearing on the public discussion that culminated in the stipulation of the climate package (Haunss and Sommer 2020).

To fill this void by creating a basis for energy policy tailored to the needs of the population, we, dynamis and RWI – Leibniz Institute for Economic Research, conducted three survey waves in 2017, 2018, and 2019. The dynamis consortium consists of the Institute of Advanced Sustainability Studies (IASS), the Innogy Foundation, and the 100% Erneuerbare Foundation. The data set generated from our surveys encompasses information on the attitudes and personal experiences of a representative sample of German household heads towards Energiewende and different energy sources. Forschungsdatenzentrum (FDZ) Ruhr provides the data free of charge for all interested scholars via data contracts that can be applied for at the website www.rwi-essen.de/fdz/.

While dynamis has focused on the participation in the transition toward a more sustainable energy system, RWI has used the data in the frame of the Kopernikus project “ENavi: Transformation und Vernetzung der Energieversorgung”, which was funded by the German Federal Ministry of Education and Research (BMBF).¹ The main purpose of the data collection within ENavi was to shed light on the acceptance of effects triggered by the Energiewende, such as higher energy costs (Andor et al. 2018) and potential power outages (Frondel et al. 2021). Thereby, the data enriches the research on the German Energiewende and enables policy makers to consider the preferences of the German population.

¹ For more information on the project see <https://www.iass-potsdam.de/de/forschung/kopernikus-projekt-energiewende-navigationssystem-enavi> and for the role of RWI within the project, see <https://www.rwi-essen.de/forschung-und-beratung/umwelt-und-ressourcen/projekte/376/>.

The three surveys were conducted on an annual basis between June 2017 and November 2019 and as the project is finished no further surveys will follow. All three waves gathered data on attitudes towards renewable energies and the implementation of the *Energiewende*. Furthermore, the extent to which panelists are involved in the *Energiewende* and their participation were queried. In addition, Wave 1 and Wave 3 included a section on inquiring about the electricity bill. Moreover, each wave included a stated-choice experiment on e.g., the willingness-to-pay (WTP) for green energy, the EU energy label, and the support of a carbon tax.²

The next section explains the process and methodology of data collection in more detail. Section 3 describes the socio-economic features of all three samples and Section 4 presents selected questions on energy policy. Section 5 gives examples of the application of the survey data. Information on how the data can be accessed and a codebook with details on all variables is annexed.

2 Data Collection

All surveys were conducted in collaboration with the research institute forsa that employed its omninet panel, which is a representative sample of the German population aged 14 and above. The participants are usually familiar with surveys. In our survey, we address household heads who are defined as persons responsible for the financial decisions within their household. We deliberately opt to ask household heads as the questionnaire also collects data on the electricity bill, which is usually more accessible to the household head. Moreover, we include the elicitation of energy efficiency investments, which are usually also made by the household heads. Most respondents participated via an online questionnaire, while respondents without an Internet connection received a device by forsa to take part via a mobile connection. By participating, the respondents could gain bonus points, which can be traded for rewards.

An advantage of this data set is that it can be connected to several other studies that were conducted by RWI in cooperation with forsa. Among others, RWI has established a panel on questions regarding the adaptation to and mitigation of climate change (Klick et al. 2021) that can be linked with this data set. Moreover, the

² IASS has issued yearly reports that contain the main results of each survey year. These reports can be found on <https://www.eon-stiftung.com/de/denken/barometer.html>. Moreover, IASS has set up a website that includes a data explorer with the most important results across the three waves: <https://www.iass-potsdam.de/de/barometer/data-explorer/>. The data set in German is already published at: <https://data.gesis.org/sharing/#!Detail/10.7802/2120>.

data of Wave 1 and Wave 3 allow the estimation of crucial determinants of private household energy demand, such as price and income elasticities through the connection to the energy consumption data of private households (RWI-GRECS), which was also collected by RWI (Frondel et al. 2015).

In the first wave, the survey link was sent to 12,941 households. Of those, 7843 took part in the study, yielding a response rate of 61% (Table 1). In total, 1332 of these households (17%) quit the survey at some point. The drop-out rates could be reduced to 6–7% in Wave 2 and Wave 3. Moreover, the response rates in Wave 2 and Wave 3 were higher relative to Wave 1 as the questionnaires were sent out to 9134 (76%) and 9842 (67%) households, respectively. The median participant in Wave 1 took about 32 min to complete the survey. This time was reduced to 27 min in Wave 2. In Wave 3, the median time needed to complete the questionnaire amounted to 35 min.

Table 1: Number of participants for each wave.

	Wave 1 (2017)	Wave 2 (2018)	Wave 3 (2019)
Total participants	7843	6923 ^a	6549
Participants who completed survey	6511	6497	6117
Participants who aborted	1332	426	432

^aThis number contains a special boost for the German region “Lausitz” of 329 participants.

Each wave contains nonrecurring sections that focus on specific aspects of the Energiewende, such as a stated-choice experiment on labeling according to the EU energy label (Section LA) and fairness concerns (Section F). Other sections occur in multiple waves, such as the electricity cost (Section K) and attitudes toward renewable energy (Section E). Additionally, general household information (Section A), information on the electricity provider (Section S), as well as detailed socio-economic data (Section SO./SOE) is collected. Table 2 provides an overview of the different sections contained in the questionnaires of the different waves. Even if a section occurs in several waves, the specific set of questions could still vary across the survey waves. A complete codebook is provided in the appendix and all questionnaires are available at the FDZ Ruhr website upon request.

3 Socioeconomic Features of Surveyed Households

In this section, we report several socioeconomic characteristics of the participants and compare them both across the three survey waves and with the population of

Table 2: Sections contained in different waves.

Section	Content	Wave 1 (2017)	Wave 2 (2018)	Wave 3 (2019)
A.	General	X	X	X
S.	Electricity provider	X	X	X
E.	Renewable energies	X	X	X
U.	Implementation of the energy transformation	X	X	X
LC.	Life chances and personal involvement	X	X	X
B.	Participation in the energy transition	X	X	X
LA.	Labeling	X		
K.	Cost burden on private households	X		X
SO./ SOE.	Socioeconomic data	X	X	X
KU.	Environmental awareness	X	X	X
C.	Cognitive reflection tests	X		
F.	Fairness experiment		X	
KP.	Experiment compensation charges			X
C.	CO ₂ tax experiment			X
PV.	Psychological control variables			X

German household heads. For the latter, we just contrast the statistics of the respondents from Wave 3 with the official projection based on the 2019 data from the Mikrozensus provided by the German Federal Statistical Office (Destatis 2021a, 2021b, 2021c, 2021d) because the overall pattern is qualitatively the same for all three waves. For starters, Table 3 documents that the share of participants is representative on the federal state level. Even small states, such as Bremen and Saarland, are covered according to the true distribution as reported by Destatis (2021a).

The distribution of household sizes is relatively constant over all waves (Figure 1). In all waves, almost half of the respondents live in two persons households and just about a quarter of the respondents live in single person households. The remaining quarter is composed of households with at least three members. About half of those are three-person households, while the remaining share comprises households with at least four members.

The shares of household sizes in Wave 3 are depicted in Table 4. We detect that single person households are underrepresented compared to the population of households in Germany, whereas two-persons households are overrepresented. Both differences to the population amount to about 15% points. In contrast, the

Table 3: Distribution of households across federal states Wave 3.

Federal state	Share in sample (Wave 3)	Share in Germany 2019
Baden-Württemberg	11.3%	12.9%
Bavaria	15.5%	15.6%
Berlin	4.4%	4.9%
Brandenburg	5.3%	3.0%
Bremen	0.8%	0.9%
Hamburg	2.2%	2.4%
Hesse	7.8%	7.4%
Lower Saxony	9.5%	9.6%
Mecklenburg-Vorpommern	2.0%	2.0%
North Rine-Westphalia	18.7%	21.1%
Rhineland-Palatinate	5.1%	4.7%
Saarland	1.1%	1.2%
Saxony	6.4%	5.2%
Saxony-Anhalt	2.5%	2.8%
Schleswig-Holstein	4.4%	3.5%
Thuringia	3.0%	2.7%

Source: Destatis (2021a).

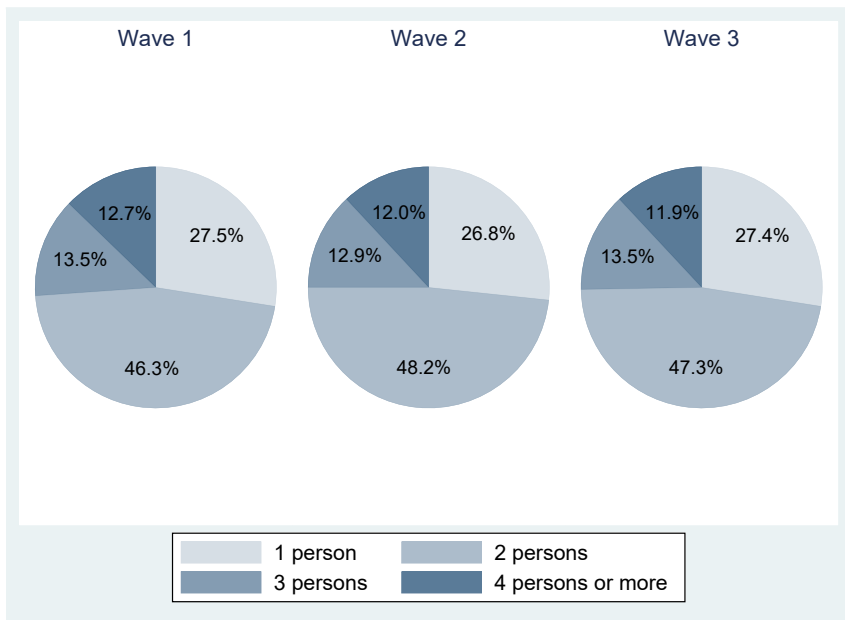
**Figure 1:** Household size of respondents over all waves.

Table 4: Household size in Wave 3.

Household size	Share in sample (Wave 3)	Share in Germany 2019
1. Person	27.4%	42.3%
2. Persons	47.3%	33.2%
3. Persons	13.5%	11.9%
4. Persons or more	11.9%	12.6%

Source: Destatis (2021b).

As the figures have been rounded, the total of the shares is more than 100%.

shares of 3- and 4-persons households in the sample resemble closely the actual share as reported by Destatis (2021b).

The mean age of respondents ranges between 53 years (Wave 1) and 57 years (Wave 3). The increase in mean age arises because we aim to follow the same sample over time. In all waves, with roughly 22%, a major part of the respondents is aged between 50 and 60 years (Figure 2). The second largest group consists of persons aged between 70 and 80 years (18.6–22.3%).

In Wave 3, the age of the participating household heads ranges from 18 to 94 years. In Table 5, the age of the survey respondents is juxtaposed with the Mikrozensus data Destatis (2021c). Here is a notable difference in the share of

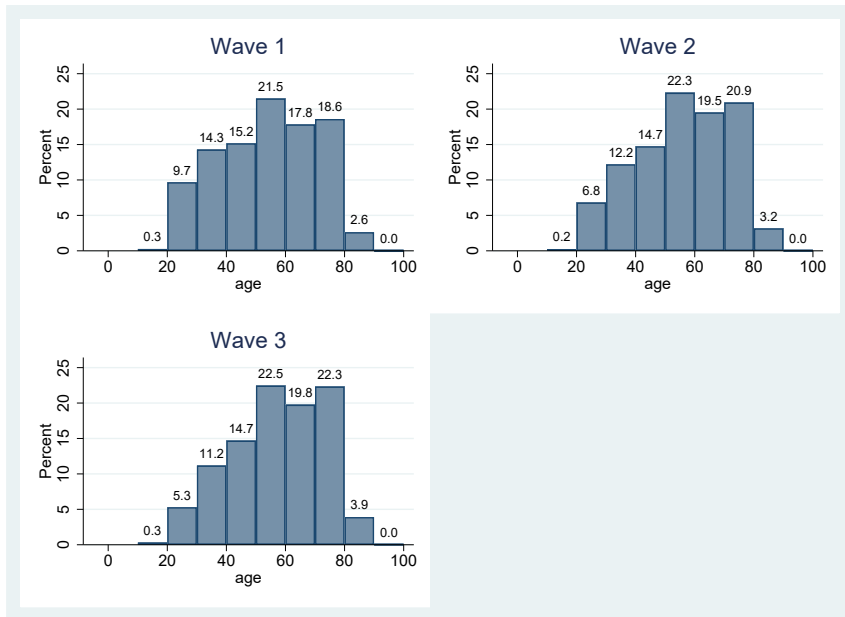


Figure 2: Age of respondents over all waves.

Table 5: Age of respondents in Wave 3.

Age	Share in sample (Wave 3)	Share in “Mikrozensus” 2019
Below 25	1.9%	4.7%
25 to below 45	20.1%	30.2%
45 to below 65	38.4%	37.1%
65 and above	39.7%	28.0%

Source: Destatis (2021c).

respondents in the sample aged between 25 and 44 years (20.1%) and the share in the Mikrozensus data (30.2%). In addition, the share of respondents aged 65 years and above is almost 12% points higher in the survey than in the Mikrozensus data. Those differences in the distribution of age might stem from the different definitions of household heads. In our sample, the surveyed household member is the person in the household who decides – alone or together with the partner – when it comes to financial matters. In the Mikrozensus, the household head is defined as the main income earner of the household.

The share of female household heads is relatively constant across all survey waves and amounts to roughly 42% (Figure 3). This imbalance across gender is

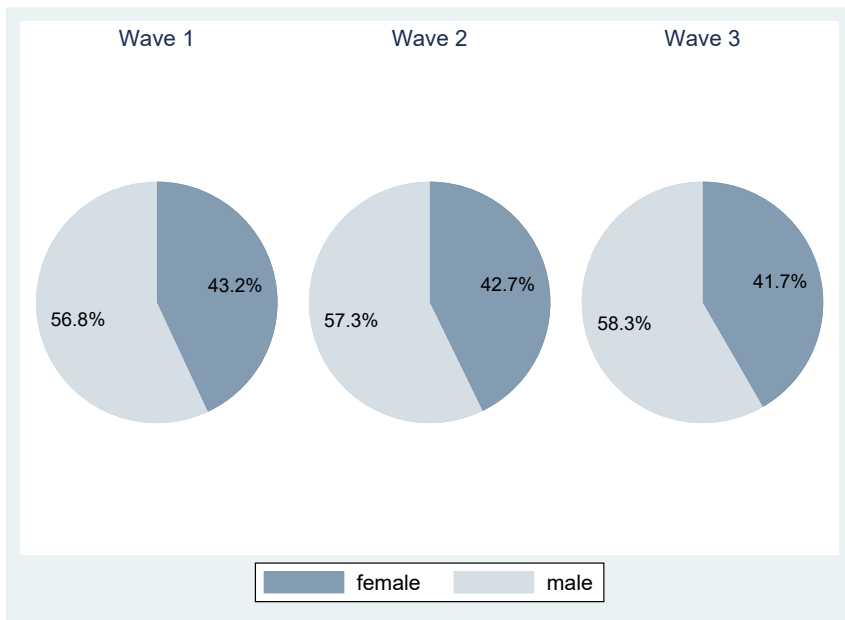
**Figure 3:** Gender of respondents over all waves.

Table 6: Gender of respondents in Wave 3.

Gender	Share in sample (Wave 3)	Share in Germany 2019
Female	41.7%	35.9%
Male	58.3%	64.1%

Source: Destatis (2021d).

likely caused by the fact that the survey targeted the household members who are mainly responsible for financial decisions in the household. In our sample, the household heads are predominately male. However, we detect that our sample slightly overrepresents women. In Wave 3 almost 42% of household heads were female compared to the Destatis (2021d) where women only account for 36% of the respondents (Table 6).

The monthly household net income is measured on a scale with intervals of 500 Euro, where the lowest interval denotes incomes below 700 Euro. The scale is top coded at an income of 5700 Euro. For the sake of an easier illustration, we group income into four categories, as displayed in Figure 4. In all three waves, the mode is the group comprising incomes between 1700 and 3200 Euro, representing about 40% in all waves. The share of incomes from 3200 Euro to 4700 Euro

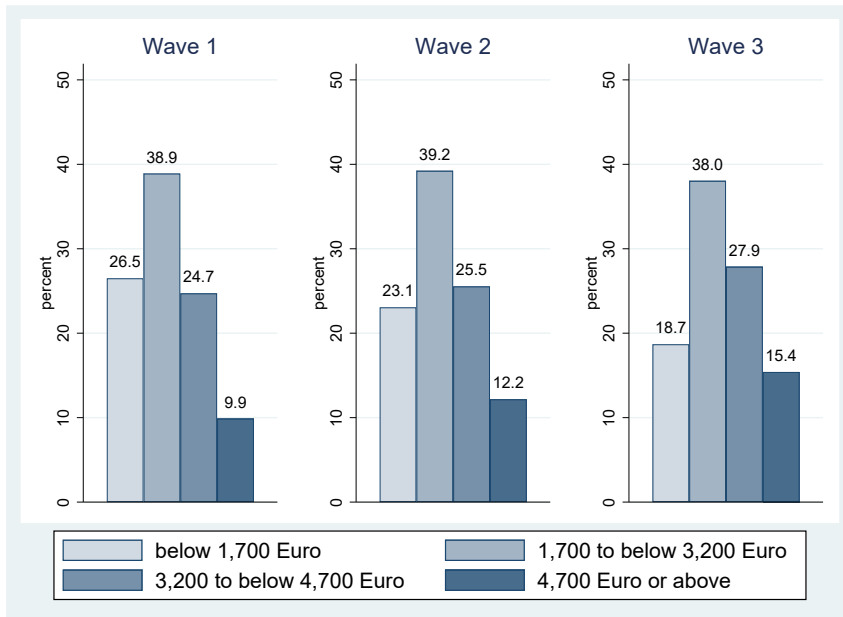


Figure 4: Income distribution across respondents over all waves.

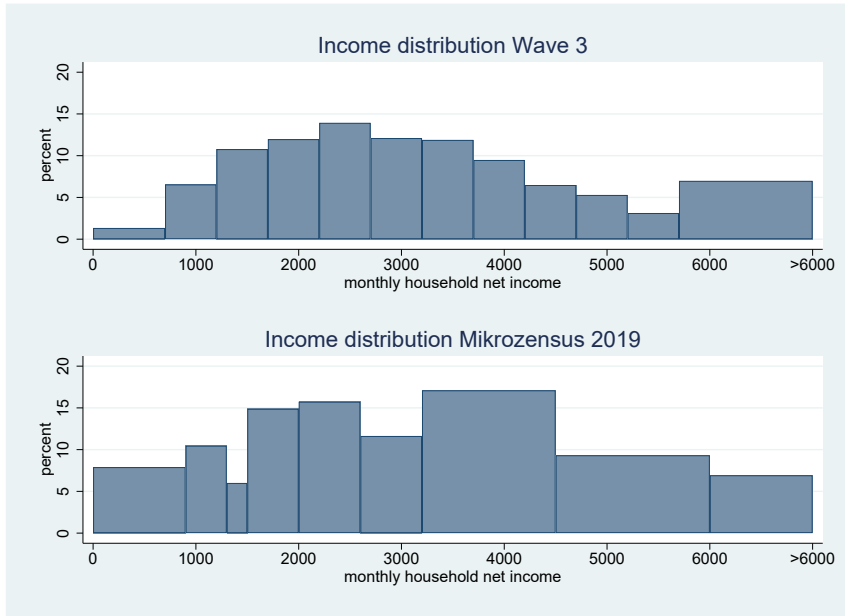


Figure 5: Income distribution in Wave 3 and in Mikrozensus 2019.

Source: Destatis (2021d).

increases throughout the waves from almost 25% in Wave 1 to almost 28% in Wave 3. The same applies for the share of household incomes of 4700 Euro or above: its share rises from almost 10% to over 15%. The share of monthly household net incomes below 1700 Euro decreases from 26% in Wave 1 to 19% in Wave 3. A similar movement of the distribution of income groups can be detected in the Mikrozensus data (see Figure 10 in the appendix for further information).

A direct comparison to the Mikrozensus data reported by Destatis (2021d) is not possible as the income categories differ. Figure 5 displays the shares of the different income categories in Wave 3 and of the Mikrozensus data. Overall, our data set survey reflects the true income distribution fairly well. For instance, around 7% of our sample are grouped in the highest income category with incomes of at least 5700 Euro. The highest category in the Mikrozensus data comprises incomes of at least 6000 Euro and roughly 7% of the respondents fall into this category.

4 Selected Questions on Energy Policy

The core of this data set concerns a plethora of attitudes towards the energy transition. This section presents descriptive results for a small subset of questions.

More detailed information and visualizations of temporal differences can be found on <https://www.iass-potsdam.de/de/barometer/data-explorer/>. All variables are measured on a 5-point Likert scale that ranges from “I strictly reject” to “I strongly support”. Respondents who did not answer a question or answered with “Do not know” are excluded from the following illustrations.

One of the key energy policies in Germany is the nuclear phase-out (Rehner and McCauley 2016). Attitudes toward this policy were elicited in all three survey waves. In all waves, a majority supports or strongly supports this measure (Figure 6). The support for this energy policy objective diminishes over the years and its rejection increases. In the first wave more than half of the respondents strongly support the exit from nuclear energy, in Wave 3 only a little more than 40% answered this way. Reversely, the share of respondents who strictly reject this measure increased from less than 6% to almost 12%.

Another key policy is the expansion of renewable energy sources. The participants demonstrate great support for this measure (Figure 7). In all waves, more than 55% of the participants strongly support this policy objective and more than 25% support it. The share of respondents who reject or strongly reject the expansion of renewable energy sources equals roughly 5%. Across the temporal dimension, the distribution of answers remains roughly the same.

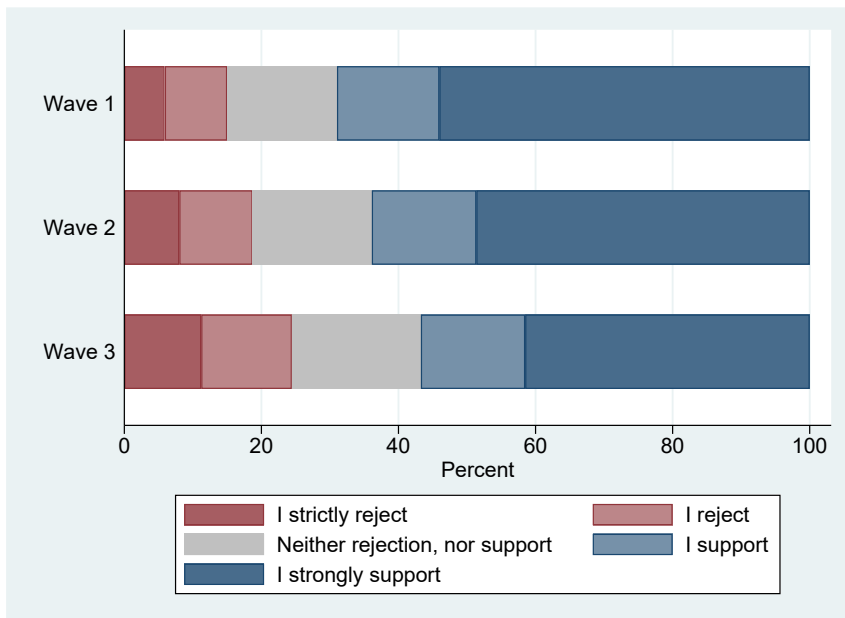


Figure 6: Respondents' attitude towards the exit from nuclear energy.

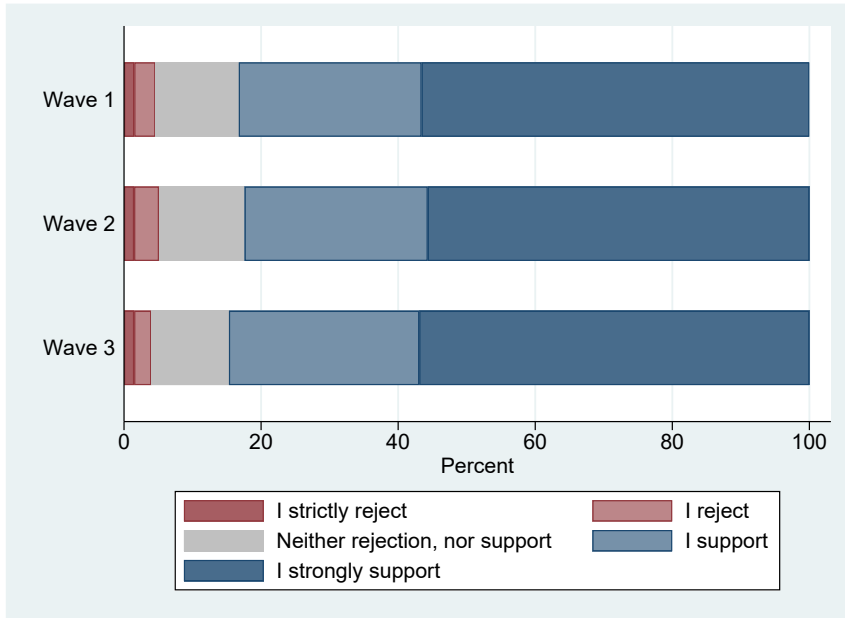


Figure 7: Respondents' attitude towards the expansion of renewable energy sources.

In July 2020, the German government eventually agreed on phasing-out coal by 2038 after a few years of intensive public debates (Vögele et al. 2020). The coal phase-out receives strong support from more than 40% of the respondents in all survey waves (Figure 8). Another 20% indicate that they support it. Only less than 5% express a strong rejection of this policy objective, and less than 10% rather reject it.

Moreover, the Energiewende encompasses an extension of interregional power grids. These are necessary to transport the electricity from the generation-intensive north to the consumption-intensive south of Germany (BMW 2020). The respondents' opinion on the expansion of interregional power grids is mostly positive (Figure 9). Across all waves more than 35% of the participants strongly support this objective, while more than 30% support it. Less than 10% have a negative attitude towards the expansion of interregional power grids, of which 2% strongly reject it.

5 Application Examples

The survey has a special focus on the personal perception of and attitudes towards the Energiewende. Moreover, it captures a variety of aspects, such as energy efficiency, green electricity, and a carbon tax. Four publications presented below,

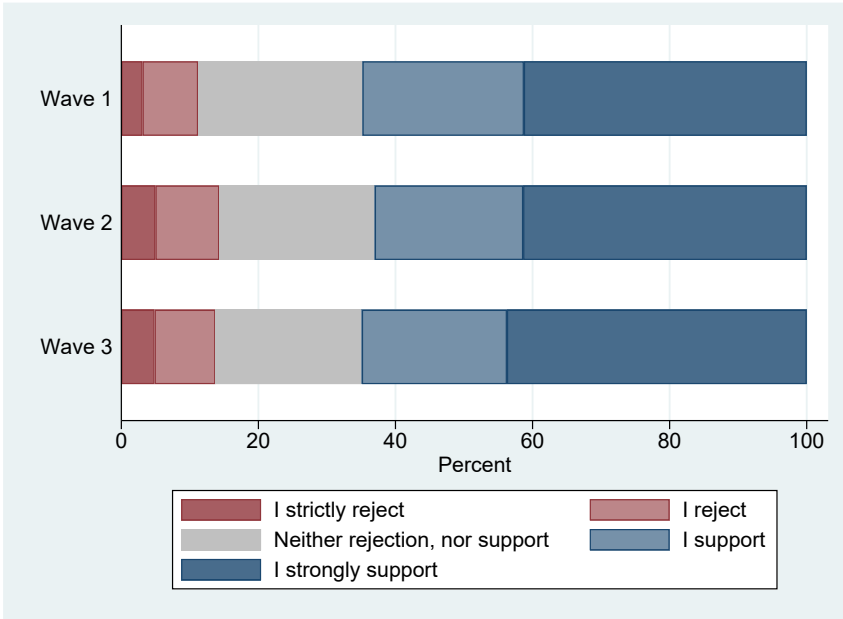


Figure 8: Respondents' attitude towards the exit from coal.

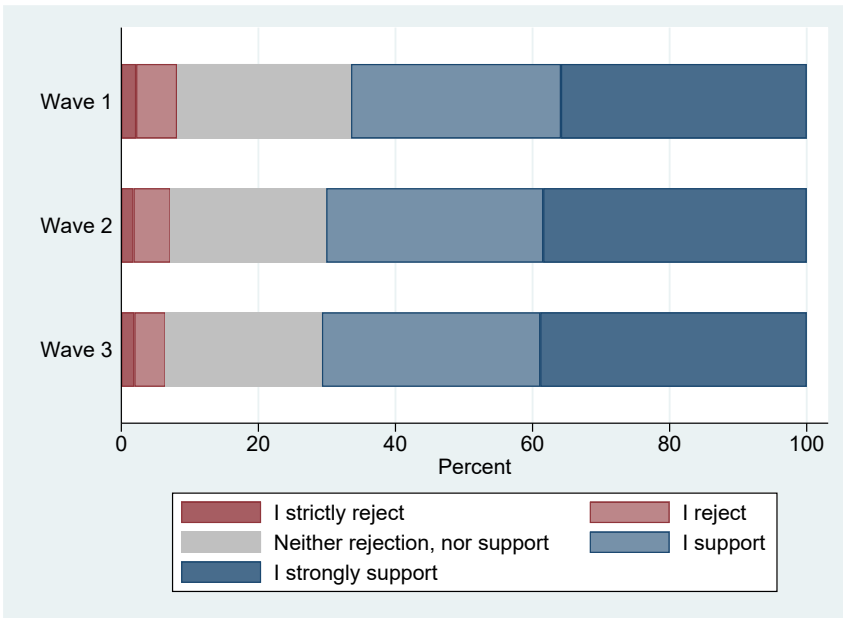


Figure 9: Respondents' attitude toward the expansion of interregional power grids.

illustrate the variety of possibilities working with the social sustainability barometer and how they enhance the political and scientific dialog on the energy transition in Germany.

Frondel and Sommer (2018) use the data set and analyze a variety of attitudes and their temporal evolution. They show that the support for renewable energy technologies has remained very high, but the willingness to pay for green electricity decreased between 2013 and 2017. Potential reasons for this decline are that the *Energiewende* is perceived as expensive as well as unfair, and many respondents are dissatisfied with its implementation.

The other publications presented here illustrate the analysis of the stated-choice experiments incorporated in the surveys. First, Andor et al. (2019) explore the impact of cognitive reflection on the valuation of energy efficiency employing the EU energy label. The results indicate that consumers with low cognitive reflection attach a lower value to energy efficiency than consumers with higher scores. Furthermore, they show that consumers with a low level of cognitive reflection respond strongly to grade-like energy efficiency classes and tend to disregard detailed information on annual energy use, while the opposite holds true for consumers with a high level of cognitive reflection.

Second, Andor et al. (2021) use a stated-choice experiment to test how exemptions for low-income households and energy-intensive companies influence the support for additional cost for renewable energy. They detect that the willingness to pay for renewable energy increases substantially when low-income households rather than the industry are exempt. Moreover, the support for exemptions is associated with individual behavioral measures like inequality aversion and fairness perceptions.

Third, Sommer et al. (2020) examine how fairness preferences influence the support for carbon taxation and revenue-recycling options. It shows that green spending is the most popular use of revenues but is notably more popular among those who are proenvironment and trust the government. Moreover, when restricted to options for direct revenue redistribution, lump-sum payments are preferred over directing payments to the poorest or the most affected. Principally, choices over these options depend both on genuinely different conceptions of fairness and respondents' economic circumstances. The findings have implications for building support for effective climate change mitigation policies with those who are not yet convinced.

6 Data Access

The data set is available as a Scientific Use File at the FDZ Ruhr, the research data center at RWI – Leibniz Institute for Economic Research. The data access is only

granted for scientific, noncommercial studies and to affiliated researchers of scientific institutions. It requires a signed data usage agreement which can be applied for on the FDZ website. The data can be obtained as a Stata® dataset (.dta) csv file. The users are requested to cite the source correctly and to inform FDZ Ruhr about publications with the data. The dataset consists of all waves described here. When using the dataset, please cite it as:

Matejko, Leonie; Sommer, Stephan; (2021): the social sustainability barometer. Version: 1, RWI – Leibniz-Institut für Wirtschaftsforschung, Data Set, <https://doi.org/10.7807/ss:baro:v1>.

Furthermore, we recommend citing this data description.

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Appendix

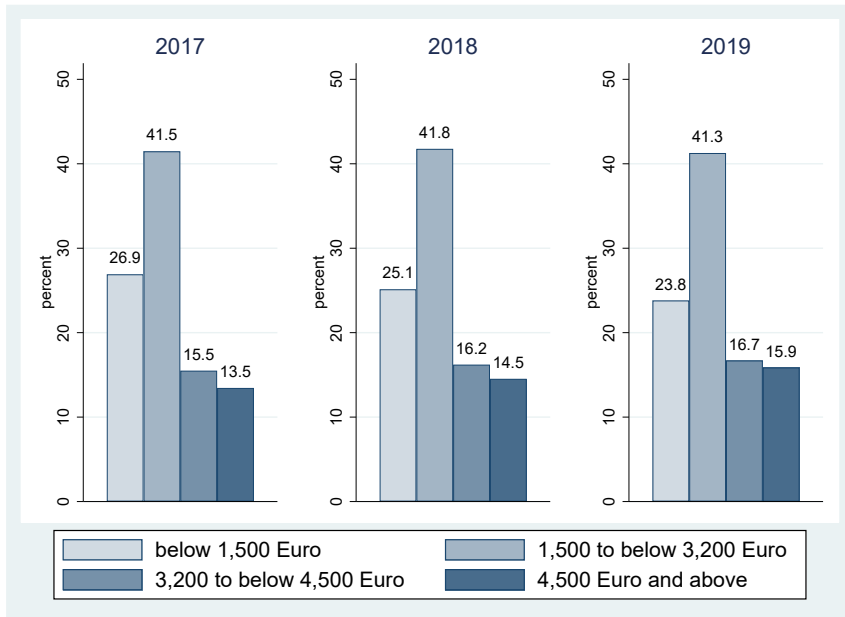


Figure 10: Income distribution according to Mirkozensus data.

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Supplementary Material: The online version of this article offers supplementary material (<https://doi.org/10.1515/jbnst-2021-0049>).