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Self-consumption rises due to energy crises? An evaluation of prosumers' consumption behavior in 2022

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***Abstract*— Prosumers with photovoltaic systems can reduce their electricity expenses by increasing their consumption of self-generated electricity. This makes them more resilient to price shocks, like the 2022 European energy crisis. We evaluate how prosumers adapt their consumption behavior in response to such political uncertainty and increasing electricity prices. The collected survey and smart meter data allow us to evaluate the perceived self-reported and measured impact on self-consumption.**

Saving intentions due to the energy crisis are more clearly displayed by the survey than by the measured self-consumption. While solar radiation predominantly explains self-consumption changes, Google searches on electricity-related topics have limited explanatory power. However, considering time lags and the interaction with solar radiation leads to more nuanced insights on the effect of Google searches. Depending on the level of solar radiation, the effect of Google searches ranges from decreasing the daily self-consumption by 26.45 Wh to increasing it by 69.45 Wh.

***Index* - Energy Crisis, Smart Meter Data, Prosumer, Energy Savings, Google Trends**

I. Introduction

Increasing energy prices in 2022 exerted pressure on households to save energy on an unprecedented scale. Prosumer households with photovoltaic (PV) rooftop systems and energy management systems set an interesting case for monitoring energy savings. These households can reduce the electricity consumed from the grid by shifting their consumption towards midday-generation peaks, thereby increasing self-consumption. In the German field experiment of the EU-funded project NUDGE [1], such consumption shifts are aimed to be triggered by small, subtle interventions in the energy management system. This paper examines how Europe's energy crisis in 2022, which led to increasing energy prices and political uncertainty, impacted prosumers' self-consumption.

Data collected in the German field experiment of the NUDGE project during 2022 allow the evaluation of the crisis's *actual* impact and its *perceived* impact. The latter is assessed by data from two surveys which can reveal whether participants' self-reported intention to save electricity is impacted by changes in their electricity prices. The continuously measured smart meter data reflect actual changes in their self-consumed electricity. Whether potential changes in electricity consumption are affected by public awareness of electricity-related topics is tested based on daily collected search requests from Google Trends.

In the following, we present the relevant literature on consumption behavior during Europe's energy crisis in 2022 and methods to evaluate consumption changes (Section 2). In Section 3, we introduce the data of the field experiment and the analytical strategy (Section 3). Section 4 presents the results of the statistical evaluation. Sections 5 and 6 discuss our findings and conclude, respectively.

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II. Literature Review

A. Impact of Europe's energy crisis on consumption behavior

A comparison of the first half of 2021 and the first half of 2022 by Eurostat shows that the electricity prices for EU households increased by 14 percent on average. Due to the prevalence of fixed-price electricity contracts, most German households experienced only a minor increase in electricity prices [2]. In 2022, Germany's overall energy and electricity consumption decreased by 4.7 percent and 4.1 percent, respectively [3]. While gas savings were mainly realized by the industry and not by households [4], the reasons for the electricity savings remain mainly open.

The scientific literature presents little evidence of the impact of the energy crisis on consumption behavior. Guan et al. (2023) described the worldwide increase [5], and Saligkaras and Papageorgiou (2022) outline the European increase in household electricity prices [6]. Szymańska et al. (2023) found that Polish prosumers are less concerned about the energy crisis and its price increase than non-prosumers [7].

This attitude of prosumers coincides with their enhanced ability to adapt their consumption [8]. In particular, independent of the energy crisis, households with PV rooftop systems are more willing to shift their consumption to hours of self-generation than households with other or no generation technology [9]. In line with the intention-behavior gap, field experiments using consumption data show that self-reported intentions for self-consumption tend to be pronounced more strongly than their actual, measured consumption data [10]. Hence, the rise of smart meter infrastructure allows more in-depth monitoring of consumption behavior in field experiments.

B. Google Trends as a predictor for consumption changes

Search requests provided by Google Trends are frequently used as a proxy for societal trends [11], revealing public interests and concerns and can predict interrelated developments. In the energy domain, for instance, Google Trends showed that electricity consumption decreases with increased search requests of the term "renewable" [12] and that gasoline consumption decreases with increased public transport requests [13].

Including results from Google Trends partly outperforms the prediction of self-reported surveys (e.g., [14]) or provides information that can hardly be measured by alternative means (e.g., daily occupation of public and commercial buildings by Fu and Miller (2022) [15]). These advantages outperform discussed limitations of Google Trends, such as the noise of minor changes in search requests, the missing context, and deteriorated data quality when selecting smaller regions [15].

III. Materials & Methods

A. Data

We analyze the self-consumption of 111 prosumer households living in, or close to, the German city of Mannheim. The average installed PV capacity per participating household is 8.16 kWp [16]. Most households are equipped with flexible technologies, which allow them to increase their self-consumption. In particular, battery storage systems (88%), electric vehicles (59%) and heat pumps (17%).The majority are families with children (57%) living in a single- or semi-detached house (69%) [16].

For the present paper, two types of data were collected during the field experiment. On the one hand, survey data were collected twice to analyze the perceived impact of electricity prices on self-reported consumption – the first survey ran from June to August 2022 (answered by 90 participants) and the second one in November and December 2022 (answered by 97 participants).

On the other hand, we continuously collected smart meter data that reflect the *actual* changes in the self-consumption of the prosumer households. For the analysis, the hourly self-consumption values, calculated as the difference between locally produced electricity and electricity fed into the grid, are aggregated to daily values. The average daily self-consumption per participant is 8,911 Wh, corresponding to 55% of the overall consumption. Data gaps in the smart meter data reduced the sample size to 103 participants in the analysis.

The field experiment aims to nudge participants towards higher self-consumption with the help of small, subtle interventions in their energy management system. Thereby, the so-called nudges (e.g., catchy indicators and motivating comparisons on dashboards) stimulate behavioral change in an intuitive manner[1]. Two sets of nudges are provided to alternating treatment and control groups during 2022. Since the analysis focuses on the impact of the energy crisis and not on the nudges themselves, we only control for the effect of the nudges through a time-varying binary variable (1 = nudge is applied, 0 = no nudge applied).

We use the indexed national-level Google Trends[2] for the German search term "electricity" ("Strom") as a proxy for public awareness about electricity consumption and sensitivity regarding electricity prices. While electricity prices already increased in 2021, they peaked in 2022 at the time of Russia's invasion of Ukraine and its political consequences. The general population has been strongly alert to energy matters, which is reflected in the Google search requests for the term "Strom", which increased 1.5 times from 2021 to 2022.

When examining the Google Trends, we observed the following trends: After the regular peak in "Strom" search requests at the beginning of the year, when most suppliers adapt

[1] For more information, visit https://www.nudgeproject.eu/

[2] The daily data on Google Trends was downloaded with the R package gtrendsR.

their fixed-price electricity tariffs, a second peak is recorded in February 2022, coinciding with the start of Russia's invasion of Ukraine (see Figure 1). The requests surged by mid-September when several political measures were announced. The measures protected households from the increased electricity prices (e.g., setting retail price caps, making extra payments, and nationalizing the largest German gas supplier Uniper). The third peak in the search requests by mid-November can be associated with an unscheduled increase of electricity tariffs by several suppliers due to the price pressure.

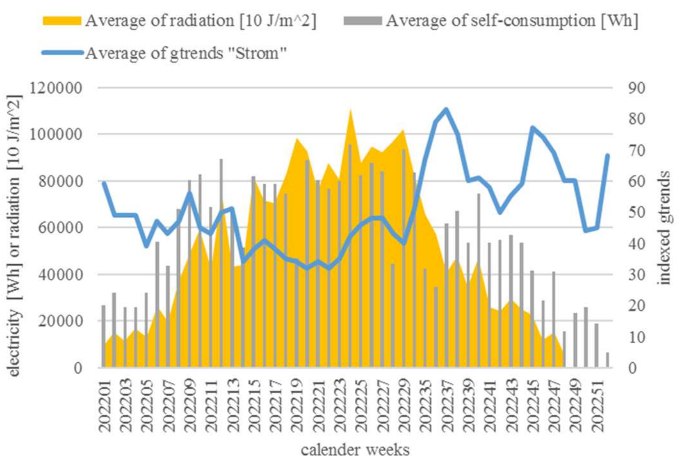

Figure 1 Self-consumption of the participating households, national-level Google Trends for the term "Strom" as well as solar radiation in the city of Mannheim in 2022

B. *Analytical strategy*

The survey data focus on the self-reported intention to save electricity and the impact of the perceived increase in electricity prices. As outlined, we descriptively outline the results from two surveys in 2022. Both contained three items asking participants about (1) the occurrence of a change in their electricity tariff, as well as (2) whether and (3) to what extent the electricity price has impacted their electricity-saving behavior.

Our smart meter data combine high temporal resolution data with a limited sample size, rendering the evaluation of field experiments suitable for panel data regressions. While several scholars successfully identified energy savings and related determinants based on panel data regressions [17–19], it has rarely been applied to self-consumption. Thus, a linear panel data regression with random effects is conducted to analyze the effect of (national-level) Google Trends for "electricity" on the participants' self-consumption, controlling for the applied nudging treatments and the solar radiation in the city of Mannheim. As illustrated in Figure 1, self-consumption follows seasonal trends due to varying solar radiation. Hence, we include the solar radiation time series provided by in Copernicus (2023) in the analyses as a control variable [20]. The random effects variant of panel regression controls for (unobserved) differences among the participants (e.g., different levels of installed PV capacity, ownership of heat pumps).

We analyze several models to show the effects of different factors. In the first two models, the effect of the Google Trends is tested both with and without solar radiation. Further, the third model includes an interaction term of Google Trends and solar radiation. This was motivated by frequent statements from participants in surveys and workshops organized by the NUDGE project that they feel limited in their impact by the natural conditions, i.e., solar radiation. This third model assesses whether the effect of Google Trends changes based on the level of radiation (and to which extent).

Acknowledging that consumption changes usually occur with a hysteresis of a few days after an electricity-related topic trended, we complemented the original models with a version that introduces a time lag, i.e., we consider Google Trends recorded some days earlier as a predictor.

IV. Results

A. *Self-reported survey data (perceived impact)*

The first survey question asked the participants whether their electricity tariff price had changed during the last three months. In the first survey, 90 participants answered this question, with more than half (59%) reporting no change in their electricity prices. About 6% answered that the electricity prices had decreased (a little or a lot), and 20% stated that the prices increased (a little or a lot). Another 16% did not know whether their electricity price had changed in the last three months. In the second survey, 55% (n = 53) reported no change in their electricity prices, while only 4% stated a small decrease, and 34% reported that their electricity prices have increased (a little or a lot). Only 6 participants (6%) did not know whether their prices had changed. This demonstrates a higher awareness and a slight (perceived) increase in electricity prices for some participants during the course of 2022.

The second question was a multiple-choice item, asking what affected participants' saving behavior in the last three months. In the first survey in the summer of 2022, 24% (of 90 participants) stated that increased electricity prices influenced their electricity-saving behavior. However, only four respondents chose this answer exclusively; all other participants ticked further options as influencing factors for their energy-saving behavior. By the end of 2022, in the second survey, 44% (of 97 participants) stated that the increased electricity prices impacted their behavior regarding electricity consumption. Almost half of those (21%) chose increased electricity prices as the only response option, demonstrating an elevated awareness and caution regarding electricity prices during 2022.

We also asked participants *to what extent* the increasing electricity prices impacted their saving behavior or, framed differently, whether they use less, more, or the same amount of electricity based on the increasing electricity rates. In the first survey, 64.5% (of 90 respondents) stated no change in their

TABLE I RANDOM EFFECTS PANEL REGRESSION MODELS AS PREDICTORS OF SELF-CONSUMPTION. FOR EACH MODEL N=1,2,3, ITS N.B VARIANT CORRESPONDS TO ADDING A TIME LAG OF 3 DAYS TO THE GOOGLE TRENDS VARIABLE

	Model 1.a: Gtrends		Model 1.b: with time lag for Gtrends		Model 2.a: Radiation		Model 2.b: with time lag for Gtrends		Model 3.a: Interaction term		Model 3.b: with time lag for Gtrends	
	Coeff (SE)	z-value	Coeff (SE)	z-value	Coeff (SE)	z-value	Coeff (SE)	z-value	Coeff (SE)	z-value	Coeff (SE)	z-value
Intercept	13611.85 (914.41) ***	14.88	13667.12 (950.67) ***	14.38	4370.77 (314.13) ***	13.91	3576.51 (312.89) ***	11.43	6684.70 (396.27) ***	16.87	6090.0 (420.81) ***	14.47
Gtrends	-90.36 (8.98) ***	-10.06	-89.54 (9.46) ***	-9.45	3.65 (3.83)	0.38	16.10 (3.77) ***	4.26	-34.58 (4.74) ***	-7.67	-27.64 (5.25) ***	-5.27
Nudge	849.84 (222.86) ***	3.80	733.67 (219.30) ***	3.35	-230.92 (156.50)	-1.31	-309.41 (158.34)	-1.95	-132.17 (155.99)	-0.96	-227.68 (169.71)	-1.42
Radiation					9.24 (0.85) ***	11.09	9.53 (0.85) ***	11.25	5.15 (1.00) ***	5.02	4.96 (0.96) ***	5.16
Gtrends x radiation									0.08 (0.01) ***	9.31	0.08 (0.01) ***	9.29
Adjust. R^2 (between)	0.06		0.06		0.25		0.25		0.25		0.25	
Adjust. r2 (overall)	0.41		0.41		0.55		0.55		0.55		0.55	
Significance codes: '***': 0.001, '**': 0.01, '*': 0.05												

electricity consumption, 31% reported using less electricity due to increased prices, and 4.5% stated using more electricity. In the second survey, this self-reported saving behavior shifted: 48% stated no change in their electricity consumption, while more than half (51% of 94 participants who answered the question) reported using less electricity due to the increased electricity prices. Only one person reported using more electricity despite the increased prices.

These descriptive results match the perceived and reported change in electricity prices: People who perceived an increase in electricity tariff prices tend to report reduced electricity consumption. However, the sample size is too small to make statistical inferences.

B. Smart meter data (measured impact)

All panel data regression models in Table 1 use the measured self-consumption as the dependent variable. The first two models (without (1.a) and with time lag (1.b)) show a negative, significant effect of Google Trends ("Gtrends") on the self-consumption, while the control variable, namely the nudging treatment ("Nudge"), exhibits a positive, significant effect indicating an increase of self-consumption when the treatment is in place. However, the model exhibits an adjusted between R^2 of only 0.06. This low goodness-of-fit indicates that the two variables can hardly explain differences between participants' consumption behavior, compared to the overall adjusted R^2, which also includes the individual-specific effects.

We included solar radiation as an additional control variable ("Radiation") in Model 2.a and Model 2.b. As expected, solar radiation has a positive, significant impact on the self-consumption in both models. Thus, the higher the radiation, the higher the self-consumption. The effect of the nudge treatment becomes negative, yet insignificant, again in both models. The effect of Google Trends on self-consumption becomes positive in both models. Yet, the effect is only significant in Model 2.b when considering a time lag for Google Trends. A sensitivity analysis of time lags of different days shows that the strongest effect of Google Trends (indicated by the size of the z-value) can be found with a lag of three days. Thus, a three-day time lag has been applied on Google Trends in Models 1.b., 2.b, and 3.b (see Table 1). After a lag of two days, a significant effect already appears. Overall, Models 2.a and 2.b imply that increased public awareness, indicated by Google Trends, only leads to an increase in self-consumption with a delay of a few days.

Models 3.a and 3.b included an interaction term comprising Google Trends and solar radiation. Thereby, due to the significant effect of the interaction term, we can show that the effect of Google Trends depends on the level of radiation (both in the model with and without a time lag). Therefore, to calculate the effect of Google Trends on self-consumption, we need to take into the level of solar radiation. For the following numerical analysis, we refer to Model 3.b. Considering the minimum (14.87 kJ/m^2) and maximum daily solar radiation (1213.63 kJ/m^2), the effect of Google Trends ranges between a reduction of the self-consumption of 26.5 Wh and an increase of 69.5 Wh, respectively. The effect turns positive at a daily radiation of 346 kJ/m^2. At the average daily radiation (536.14 kJ/m^2), the effect of Google Trends (15.25 Wh) is similar to the effect in Model

2.b (16.10 Wh). All in all, we were able to show that while Google Trends adds rather little to the explanatory power, the effect on the self-consumption is (at least in the lagged time models) significant.

V. Discussion

Our analyses demonstrate a noticeable effect of the European energy crisis in 2022 on the self-consumption of prosumers. However, the effect needs to be interpreted cautiously. Based on the self-reported survey results, only a few participating prosumers reported an increase in their electricity tariffs. However, an apparent increase in respondents' awareness can be observed in the survey data during the energy crisis, which also influences their self-reported consumption behavior. Thus, the perception of increased electricity prices goes hand in hand with a self-reported higher intention to save electricity (for about 20% of participants). Notably, this change occurred between the first survey in the summer of 2022 and the second survey in the winter of 2022. Consequently, the weather conditions and the decreased radiation could have influenced this change. However, it could also be caused by the upcoming annual adaptation of electricity tariffs by electricity providers (usually happening in January) and the related fear of an additional increase in electricity prices.

Based on the smart meter data, the effect on the measured self-consumption was dominated by the solar radiation in the city of Mannheim. In this context, the changes in public awareness of electricity-related topics, indicated by Google Trends data, can only marginally improve the models' predictive power. The research question suggested a random effects panel data regression. The delta between the overall and between adjusted r2 implies large individual-dependent effects. Other kinds of panel data regression are subject to further research to reveal the specific individual-dependent impact.

Concerning the time-dependent effects of electricity prices, the search requests of Google Trends are used as a proxy for public awareness of price-related topics due to the lack of further information. Distinguishing between search terms that incite energy savings (e.g., increased prices) and that protect households against them (e.g., price caps) could help to disentangle the effects of decreasing and increasing self-consumption. Moreover, receiving regional-specific Google Trends data (instead of results on the national level), matching the geographical level of radiation and sensor data, could improve the predictive power of Google Trends on self-consumption.

Also, information on the actual change in household electricity tariffs might explain the development of self-consumption more precisely. At the same time, the prevailing fixed electricity price tariffs lead to different price levels and price developments between households. This information was not available for the German participants.

The simplified representation of the nudging treatments in the regression shows little evidence for a significant effect on self-consumption. A more detailed analysis will likely lead to more nuanced insights and should be subject to further research.

VI. Conclusions

Increasing electricity prices during Europe's energy crisis in 2022 and increased awareness of electricity-related topics led to prosumers' intention to increase their self-consumption and their *actual* self-consumption.

While changes in the measured consumption behavior can already be well-explained by solar radiation, two insights help to understand how an increased awareness impacts self-consumption. First, the effects of increased awareness on consumption behavior are only recognized with a delay of more than two days. Second, considering solar radiation as a natural bounding condition of the self-consumption potential shows a more nuanced insight into how an increased awareness impacts it.

Further time-dependent (such as changes in electricity tariffs) and individual-dependent predictors (such as socio-demographics) should be assessed in subsequent research to explain changes in self-consumption.

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References

[1] H2020 NUDGE. https://www.nudgeproject.eu/: H2020 NUDGE project - Nudging consumers towards energy efficiency through behavioural science (last visited: 20/03/2023).

[2] Eurostat. Electricity price statistics [Online]. Available: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics#Electricity_prices_for_household_consumers (last visited: 20.03.2023).

[3] AG Energiebilanzen e.V. [Online]. Available: https://ag-energiebilanzen.de/energieverbrauch-faellt-2022-auf-niedrigsten-stand-seit-der-wiedervereinigung/: Energieverbrauch fällt 2022 auf niedrigsten Stand seit der Wiedervereinigung (last visited: 20.03.2023).

[4] BNetzA. https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/DE/2022/20220929_Verbrauchsdaten.html: Gasverbrauch der Haushalte steigt im Moment zu stark an (last visited: 20.03.2023).

[5] Guan Y, Yan J, Shan Y, Zhou Y, Hang Y, Li R et al. Burden of the global energy price crisis on households. Nat Energy 2023. https://doi.org/10.1038/s41560-023-01209-8.

[6] Saligkaras D, Papageorgiou VE. On the detection of patterns in electricity prices across European countries: An unsupervised machine learning approach. AIMSE 2022;10(6):1146–64. https://doi.org/10.3934/energy.2022054.

[7] Szymańska EJ, Kubacka M, Polaszczyk J. Households' Energy Transformation in the Face of the Energy Crisis. Energies 2023;16(1):466. https://doi.org/10.3390/en16010466.

[8] Roth L, Lowitzsch J, Yildiz Ö, Hashani A. Does (Co-)ownership in renewables matter for an electricity consumer's demand flexibility? Empirical evidence from Germany. Energy Research & Social Science 2018;46:169–82. https://doi.org/10.1016/j.erss.2018.07.009.

[9] Roth L, Lowitzsch J, Yildiz Ö. An Empirical Study of How Household Energy Consumption Is Affected by Co-Owning Different Technological Means to Produce Renewable Energy and the Production Purpose. Energies 2021;14(13):3996. https://doi.org/10.3390/en14133996.

[10] Öhrlund I, Stikvoort B, Schultzberg M, Bartusch C. Rising with the sun? Encouraging solar electricity self-consumption among apartment owners in Sweden. Energy Research & Social Science 2020;64:101424. https://doi.org/10.1016/j.erss.2020.101424.

[11] Nuti SV, Wayda B, Ranasinghe I, Wang S, Dreyer RP, Chen SI et al. The use of google trends in health care research: a systematic review. PLoS One 2014;9(10):e109583. https://doi.org/10.1371/journal.pone.0109583.

[12] Park S, Kim J. The effect of interest in renewable energy on US household electricity consumption: An analysis using Google Trends data. Renewable Energy 2018;127:1004–10. https://doi.org/10.1016/j.renene.2018.05.044.

[13] Afkhami M, Ghoddusi H, Rafizadeh N. Google Search Explains Your Gasoline Consumption! Energy Economics 2021;99:105305. https://doi.org/10.1016/j.eneco.2021.105305.

[14] Vosen S, Schmidt T. Forecasting private consumption: survey-based indicators vs. Google trends. J. Forecast. 2011;30(6):565–78. https://doi.org/10.1002/for.1213.

[15] Fu C, Miller C. Using Google Trends as a proxy for occupant behavior to predict building energy consumption. Applied Energy 2022;310:118343. https://doi.org/10.1016/j.apenergy.2021.118343.

[16] Gabriel M. et al. Report on pilot results: interim report: Deliverable D4.1 / D4.3 EU H2020 NUDGE project, : https://www.nudgeproject.eu/wp-content/uploads/2022/11/NUDGE-D4.1-D4.3-Report-on-pilot-results-interim-report-_-FINAL-SUBMITTED.pdf 2022.

[17] Schleich J, Faure C, Klobasa M. Persistence of the effects of providing feedback alongside smart metering devices on household electricity demand. Energy Policy 2017;107:225–33. https://doi.org/10.1016/j.enpol.2017.05.002.

[18] Weigert A, Hopf K, Günther SA, Staake T. Heat pump inspections result in large energy savings when a pre-selection of households is performed: A promising use case of smart meter data. Energy Policy 2022;169:113156. https://doi.org/10.1016/j.enpol.2022.113156.

[19] Iwafune Y, Mori Y, Kawai T, Yagita Y. Energy-saving effect of automatic home energy report utilizing home energy management system data in Japan. Energy 2017;125:382–92. https://doi.org/10.1016/j.energy.2017.02.136.

[20] Copernicus. https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land?tab=overview: ERA5-Land hourly data from 1950 to present (last visited: 20.03.2023) 2023.