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# Negative income shocks and the support of environmental policies – Insights from the COVID-19 pandemic

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## *Abstract*

This study explores whether negative income shocks from the COVID-19 pandemic affect the demand for environmental policy. By running a survey in Germany in May 2020, we show that there is a large and negative correlation between the COVID-19 income shocks and the willingness to support green policies. Importantly, this relation is separate from the effect of long-run income. Building on this first evidence, our study provides directions for future valuation studies. Specifically, our results provide a proof of concept that welfare analyses based on willingness-to-pay estimates to assess the benefit of an environmental good or the cost of an environmental damage may be downward biased if temporary changes in income are not considered.

## *JEL Classification*

Q51, Q58, D61

## *Keywords*

COVID-19, Environmental policy, Income shock, Welfare analysis, Willingness to pay

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## 1. Introduction

To limit the spreading of the COVID-19 pandemic, many countries have adopted social-distancing measures. A negative side effect of these social-distancing measures is income and employment loss, as documented by a number of recent COVID-19 studies (Bartik et al. (2020), Coibion et al. (2020), Gupta et al. (2020), Hanspal et al. (2020), Schröder et al. (2020)). For Germany, a representative survey with the German Socio-Economic Panel indicates that 20 percent of the working population experienced income loss due to reductions in working hours (Schröder et al. (2020)). This paper exploits the negative income shocks caused by the COVID-19 outbreak to provide a proof of concept of the importance of controlling for temporary income shocks when eliciting individuals' willingness to pay for environmental policy.

We motivate our work by the fact that the COVID-19 income shocks are perceived both as temporary (Schröder et al. (2020)) and, due to prior observations from China and Italy, were also anticipated. Starting on from late February, both newspapers and the German Council of Economic Advisors were issuing warnings of an upcoming severe economic downturn due to COVID-19 (Feld et al. (2020), Jung (2020), Gatzke (2020), Marx (2020)). According to the life-cycle/permanent income hypothesis, an expected or temporary income shock should not affect consumption. Any predicted or temporary shock to income should have been accounted for by a rational agent, and hence be absorbed through consumption smoothing over the time horizon.

However, the behavioral finance literature provides evidence that behavior is inconsistent with models of consumption smoothing, as purchases are sensitive to the receipt of payments (see e.g., Stephens (2002), Stephens (2003), Shapiro (2005), Johnson et al. (2006), Parker et al. (2013), Baker et al. (2020) and Beshears et al. (2018) for an overview). We integrate this insight from the behavioral finance literature into the willingness-to-pay literature, with the aim of exploring whether a temporary change in income has a similar effect on the demand for environmental goods as it has been shown to have for consumption goods.

To do so we conducted an online survey in May 2020. The survey elicited subjects' support for environmental policies in general and specific policies targeting clean air and renewable energy in particular. We further elicited subjects' income levels and whether/how their income has changed due to social-distancing measures implemented to fight the COVID-19 pandemic. By regressing the willingness to support these policies measures on both permanent income and temporary change in income, we show that COVID-19 induced changes in income adversely affect the probability of supporting environmental policies. This decrease is particularly pronounced for specific measures targeting air pollution mitigation and renewable energy generation; estimates are highly significant and robust upon controlling for various socio-demographic characteristics. Hence, our study provides the first evidence of the importance of considering temporary changes in income when assessing support for and the valuation of environmental goods and policies.

Prior literature on the willingness to pay for environmental goods and policies long has acknowledged income levels as a potential driver for heterogeneity in results, both theoretically (Barbier et al. (2017)) and empirically. Willingness to pay responds to changes in income as elicited, e.g. for climate mitigation (Diederich and Goeschl (2014), Löschel et al. (2013), Löschel et al. (2017), Uehleke and Sturm (2017), Carlsson et al. (2012)), carbon offsets for air travel (Brouwer et al. (2008), Mackerron and Gaskell (2009)), the implementation of the Kyoto protocol (Berrens et al. (2004)), green car transport (Hulshof and Mulder (2020)) and biomass ethanol (Solomon and Johnson (2009)), eutrophication reduction in the Baltic Sea (Barbier et al. (2017)), or forest

biodiversity (Liebe et al. (2011)) and preventing an oil spill in the Gulf of Mexico (Bishop et al. (2017)). These studies, however, do not distinguish between different potential measures of income - i.e., current income, temporary or persistent income shocks, and permanent income or wealth. Our paper is the first to study how temporary income shocks relate to the willingness to support green policies, and to highlight the importance of distinguishing between these measures as they have differential impacts on the demand for environmental protection.

We conclude this study with directions for future research. In the spirit of Roth (1986), we view this short paper as input for future experimental, empirical and theoretical work exploring the links between different income measures and environmental valuation. In particular, we hope our paper spurs future work exploring how to account for temporary income shocks caused by environmental damage or catastrophes in welfare analysis.

## 2. Survey description

To analyze whether income shocks induced by the COVID-19 pandemic affect the support for environmental policies, we conducted an online survey in Germany in May 2020. Our final sample includes 802 participants that were recruited from an online panel. Quota-based sampling ensured that our participants are representative of the German population with respect to age, gender and federal state.

As part of the survey, we elicited participants' support for environmental policies, by asking participants to state to what extent they agree with following set of statements:

1. Environmental issues should be addressed primarily by future generations.
2. Policies introduced by the government to address environmental issues should not cost me extra money.
3. Cars' usage in city centers should be severely limited in order to lower air pollution.
4. I agree to pay a higher price for electricity, if it is generated from renewable energy sources.

The first two statements intend to capture support of environmental policies in general, without specifying the exact costs and benefits to the participant. The last two statements capture the willingness to support two specific environmental policies, clean air and renewable energy expansion, which come at the costs of banning cars from inner cities and paying higher electricity prices.

Statement 1 and 2 were answered in one question block and utilized a 4-point scale, from "Strongly disagree" to "Strongly agree." Answers to statement 1 and 2 are reversely coded, such that a higher value indicates a greater support for the pro-environmental policy. Statement 3 and 4 were answered in a second question block, utilizing a 5-point scale with identical endpoints as the first two questions.

We gather information about temporary shocks to income due to COVID-19 using two distinct measures that are designed to capture changes in both immediate and future consumption. To do so, we asked participants to indicate on a five point scale how their ability to pay bills and their retirement savings have changed during the pandemic. Statements are coded such that -2 means that the income measure has improved a lot due to the pandemic, 0 means the measure is unchanged and 2 means it has become a lot worse. Hence, a higher value implies a greater negative income shock due to COVID-19.

Finally, we elicited a number of socio-demographic characteristics. Most importantly, to have a measure for permanent income, we asked participants to state their average monthly net household income in 2019 across ten brackets covering the deciles of the German income distribution.<sup>1</sup> Further, we collect participants' gender, age, marital status, number of children, education level, employment status and the federal state they live in.

### 3. Results

Tables 1 to 4 present ordered probit regression results of statements 1 to 4 on permanent income and on the measures of temporary income shocks due to the pandemic, *Change Bill* and *Change Retire*. We further vary whether socio-demographic covariates are included.

For statement 1 and 2, we find weak evidence of a negative relation between the willingness to support environmental policies and temporary income shocks (see Table 1 and 2, respectively). The coefficients of *Change Bill* and *Change Retire* are always negative, but only significant at the 10-percent level for *Change Retire*. In case of statement 2, this weakly significant relation remains robust upon controlling for covariates. Further, a higher income predicts more support of environmental policies in general. The permanent income coefficient is always positive, and significant for statement 1. This corresponds to findings from prior literature linking income to willingness to pay estimates (e.g., Alberini et al. (2018), Bishop et al. (2017), Carlsson et al. (2012), Löschel et al. (2017)).

To provide an estimate of how the temporary income shock compares to the effect of permanent income, we derive the marginal effects to 'completely agree' with statement 1.<sup>2</sup> At the mean of the average monthly income bracket, heavily aggravated retirement savings due to COVID-19 decrease the probability to completely agree with statement 1 by 8.7 percentage points. Holding retirement savings constant at 'no change,' this effect corresponds to a decrease in average monthly income akin to moving from bracket 9 ('2,586 – 3,200 Euro') to bracket 1 ('Up to 855 Euro'). Hence, the effect of COVID-19 on the willingness to support environmental policies compares to the effect of moving from the 9th decile of the German income distribution to the 1st decile. A more conservative measure is the *Change Bill* coefficient, which however still is equivalent to the effect of moving from the 7th decile ('1,946 – 2,221 Euro') of the income distribution to the 1st decile.

Yet, the relation between income shocks due to COVID-19 and willingness to support environmental policies is more strongly pronounced for statement 3 (see Table 3). Both decreases in the ability to pay bills and in retirement savings predict a lower support of banning cars from city centers to lower air pollution. Coefficients remain robust upon controlling for standard participant characteristics and are significant at the 5-percent level. Interestingly, the coefficient of permanent income is large, highly significant and *negative*. Contrary to the general statements 1 and 2, participants with higher income are less likely to support banning cars from inner cities to reduce air pollution. While we can only speculate, a potential reason is that the costs of banning

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<sup>1</sup>We obtained these deciles from Eurostat (2020), using their values for 2015 for comparability with a 2018 version of this survey.

<sup>2</sup>We use statement 1 because only in Table 1 (3), both permanent income and *Change Retire* are significant predictors of the support of green policies.

Table 1: Ordered probit regression of agreement to statement 1 on permanent income and income shocks experienced due to COVID-19

	(1)	(2)	(3)	(4)
	Statement 1	Statement 1	Statement 1	Statement 1
Permanent income	0.0243*	0.0362**	0.0258*	0.0377**
	(0.0136)	(0.0172)	(0.0141)	(0.0176)
Change Bill	-0.0790	-0.0608		
	(0.0737)	(0.0749)		
Change Retire			-0.112*	-0.0883
			(0.0677)	(0.0689)
Covariates	No	Yes	No	Yes
<i>N</i>	714	698	674	660

Agreement to statement 1 is reversely coded, such that a higher value corresponds to more support of environmental polices. A higher value of Change Bill and Change Retire implies an aggravated income. Covariates include federal state, age, gender, martial status, number of children, education level and employment status. Standard errors in parenthesis. Significance levels: \* :  $p < 0.10$ , \*\* :  $p < 0.05$ , \*\*\* :  $p < 0.01$ .

Table 2: Ordered probit regression of agreement to statement 2 on permanent income and income shocks experienced due to COVID-19

	(1)	(2)	(3)	(4)
	Statement 2	Statement 2	Statement 2	Statement 2
Permanent income	0.0250*	0.0276	0.0208	0.0257
	(0.0135)	(0.0171)	(0.0140)	(0.0175)
Change Bill	-0.0847	-0.0758		
	(0.0743)	(0.0757)		
Change Retire			-0.127*	-0.115*
			(0.0680)	(0.0691)
Covariates	No	Yes	No	Yes
$N$	683	667	647	633

Agreement to statement 2 is reversely coded, such that a higher value corresponds to more support of environmental polices. A higher value of Change Bill and Change Retire implies an aggravated income. Covariates include federal state, age, gender, martial status, number of children, education level and employment status. Standard errors in parenthesis. Significance levels: \* :  $p < 0.10$ , \*\* :  $p < 0.05$ , \*\*\* :  $p < 0.01$ .

Table 3: Ordered probit regression of agreement to statement 3 on permanent income and income shocks experienced due to COVID-19

	(1)	(2)	(3)	(4)
	Statement 3	Statement 3	Statement 3	Statement 3
Permanent income	-0.0593*** (0.0132)	-0.0605*** (0.0164)	-0.0554*** (0.0136)	-0.0588*** (0.0168)
Change Bill	-0.173** (0.0735)	-0.182** (0.0748)		
Change Retire			-0.138** (0.0673)	-0.166** (0.0683)
Covariates	No	Yes	No	Yes
<i>N</i>	707	691	668	654

Agreement to statement 3 is coded, such that a higher value corresponds to more support of environmental polices. A higher value of Change Bill and Change Retire implies an aggravated income. Covariates include federal state, age, gender, martial status, number of children, education level and employment status. Standard errors in parenthesis. Significance levels: \* :  $p < 0.10$ , \*\* :  $p < 0.05$ , \*\*\* :  $p < 0.01$ .



Table 4: Ordered probit regression of agreement to statement 4 on permanent income and income shocks experienced due to COVID-19

	(1)	(2)	(3)	(4)
	Statement 4	Statement 4	Statement 4	Statement 4
Permanent income	0.00100 (0.0129)	-0.00357 (0.0162)	0.0000662 (0.0134)	-0.00385 (0.0166)
Change Bill	-0.191*** (0.0733)	-0.218*** (0.0751)		
Change Retire			-0.173*** (0.0665)	-0.209*** (0.0681)
Covariates	No	Yes	No	Yes
<i>N</i>	717	701	678	664

Agreement to statement 4 is coded, such that a higher value corresponds to more support of environmental polices. A higher value of Change Bill and Change Retire implies an aggravated income. Covariates include federal state, age, gender, martial status, number of children, education level and employment status. Standard errors in parenthesis. Significance levels: \* :  $p < 0.10$ , \*\* :  $p < 0.05$ , \*\*\* :  $p < 0.01$ .

cars from city centers might be borne by higher income groups to a greater extent.<sup>3</sup>

Our observation that the temporary income shocks caused by the COVID-19 pandemic is negatively associated with the willingness to support green policies is strongest for statement 4 (see Table 4). While the coefficient on permanent income resembles a clear zero, both *Change Bill* and *Change Retire* predict a decrease in willingness to pay a higher price for renewable energies. Coefficients of the two income shock measures are significant at the 1-percent level and robust to including covariates. While our results on statement 1 and 2 are only weakly significant, the highly significant estimates of *Change Bill* and *Change Retire* for statement 3 and 4 provide evidence on the importance of distinguishing between general and specific policy measures when exploring the effects of temporary income shocks and permanent income or wealth on the demand for environmental protection. We do not know what drives these differences, but in contrast to the first two statements, costs and benefits of the policies of statement 3 and 4 are clearly defined and immediate – as they are when eliciting the willingness to pay for an environmental good.

#### 4. Conclusion and directions for future research

A number of recent projects investigating the consequences of COVID-19 have shown negative income effects resulting from social-distancing policies. We utilize the negative income shocks caused by the pandemic to investigate the importance of separately controlling for income and income shocks when estimating support for environmental policies. Existing literature in behavioral finance highlights the effects of temporary changes in income on consumer demand. However, this distinction has been largely ignored in studies exploring the valuation of environmental goods and/or support for environmental policy.

Our study is the first to investigate the relation between income shocks and the willingness to support environmental policies. In a survey conducted in Germany we find highly significant evidence of negative income shocks predicting a decrease in the willingness to support clean air and renewable energy policies. We view this result as a proof of concept that controlling for current income alone may not produce an unbiased estimate of the demand for environmental policy.

Taking our results as a starting point, we want to outline what we view as fruitful directions for future research. First, for the willingness-to-pay literature our results suggest that it is important to develop theoretical models and empirical methods that account for different income measures as has been done in behavioral finance (Beshears et al. (2018)). As our results show, researchers need to think deeper about what 'income' means and is designed to capture - i.e., researchers need to distinguish whether current or permanent income is the desired measure, whether changes to permanent income are temporary or persistent, and whether such changes are anticipated. In this respect, our study also provides input into the discussion on the discrepancy between the income elasticity consistent with willingness-to-pay studies (usually smaller than one) and consistent with the Environmental Kuznets Curve (usually greater than one) (Barbier et al. (2017)). Future research may explore both empirically and theoretically how temporary changes in income can contribute to explaining this discrepancy.

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<sup>3</sup>E.g., car ownership and parking fees in inner cities may be prohibitively high for low income groups, such that rather high income groups go by car to city centers instead of using public transportation.

Second, if not separating out changes in income from permanent income, resulting willingness-to-pay estimates will be biased. Imagine for example, a study implemented after a natural disaster and designed to assess participants' willingness to pay to avoid such a disaster in the future. If some of the participants also experienced temporary income losses due to the natural disaster (e.g. because fishing grounds were destroyed or their residence was flooded), our findings suggest that the resulting willingness-to-pay estimates will be downward biased. This also means that transferring environmental valuations from one study site to another is not only questionable due to a non-constant income elasticity of willingness-to-pay estimations (Barbier et al. (2017)), but also due to differential temporary income shocks.

Given the risk or costs of basing policy decisions on biased willingness-to-pay estimates, future work should integrate methods from the program evaluation literature studies to provide sensitivity analyses or develop bounds for estimates for the effect of various income measures on the willingness to pay (Imbens and Wooldridge (2009), Heckman (2010)). Adopting methods from that literature will provide a way to derive more robust estimates of value, and thus reduce the possibility of underestimating the benefits of an environmental good, or the costs of environmental damages.

Finally, our results speak for integrating concepts from the behavioral welfare literature into the willingness-to-pay literature to advance the theoretical grounds of welfare assessments that are grounded in valuation studies. Following the behavioral welfare literature (e.g., Allcott and Taubinsky (2015), Taubinsky and Rees-Jones (2018), Allcott and Kessler (2019)), one may understand temporary income shocks affecting demand for environmental goods as an internality that affects decision utility (i.e. the willingness-to-pay estimate) but not experienced utility from the environmental good. As such, future work should explore ways to derive welfare effects from estimates capturing decision as opposed to experience utility.

In that respect, we see a parallel between our study and early studies noting a difference between willingness-to-pay and willingness-to-accept elicitation formats (Knetsch and Sinden (1984), Kahneman et al. (1990) Shogren et al. (1994)). Just as welfare estimates are biased when not accounting for loss aversion, we argue that welfare estimates are biased when not accounting for a lack of consumption smoothing. It remains to explore how we can advance valuation studies to account for temporary changes in income affecting the demand for environmental policy. We hope our findings stimulate work in this area and provide a foundation for doing so.

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