Framing urban tolls

Johanna Arlinghaus* Théo Konc† Linus Mattauch‡
Stephan Sommer§

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1 Introduction

Urban tolls can effectively address externalities from urban road transport, yet they are rarely implemented. To date, London and Stockholm are the only European capitals with urban tolls. A main barrier to implementation is public support [Anas and Lindsey, 2011], yet, experience and information seem to increase the acceptance of tolls [Baranzini et al., 2021, Eliasson, 2008, 2014].

In this project, we analyse how different policy framing affect citizens' acceptance of urban tolls in two major European metropolitan areas: Paris-Ile de France and the Berlin-Brandenburg agglomeration. Furthermore, we investigate heterogeneity in views based on urban vs. suburban residence, trust in institutions and political views. To this end, we implement a large-scale survey of a total of 4000 urban and suburban households, representative for gender, education and age across the two metropolitan areas with the survey company respondi/bilendi. Within the survey, we randomize in-built video treatments to inform respondents of the tolls' expected effects on (i) air pollution, (ii) time savings or (iii)

*Mercator Research Institute on Global Commons and Climate Change. Corresponding author. E-Mail: arlinghaus@mcc-berlin.net.
†Berlin Technical University, Potsdam Institute for Climate Impact Research (PIK)
‡Berlin Technical University, Potsdam Institute for Climate Impact Research (PIK)
§Bochum University of Applied Sciencs, RWI-Leibniz Institute for Economic Research

greenhouse gas emissions. The effects of the treatment videos on support for a urban toll are compared to a control group, which receives a video with largely uninformative content. Using this design, we will test the following main hypotheses:

1. The effect of the air pollution treatment on the support of urban tolls is larger than the effect of the climate change treatment. Highlighting time savings is least effective at changing the acceptance of urban tolls.

2. Support for tolls is increasing with the severity of air pollution: The treatment effect of "air pollution" video is larger in Ile-de-France than in the Berlin agglomeration, since air pollution is more pervasive in Ile-de-France.

3. Treatment effects vary across urban and suburban populations:

    - The treatment effect of the "time-savings" video is stronger among the suburban population, since they are likely to commute longer distances and spend more hours in traffic.
    - The treatment effect of the "air pollution" information is smaller for individuals in suburban areas, as they are less likely to benefit from any reductions in air pollution.
    - The treatment effect of the "GHG" video is the same across rural and urban people (controlling for socio-economic variables and environmental attitudes).

4. Lower-income households support urban tolls less, due to the perceived regressive effects of the policy.

The research design allows testing additional hypotheses relating to interactions of these main hypothesized effects with several individual characteristics, such as political attitudes and mobility behavior. We test these hypotheses in the two largest European agglomerations without urban tolls.

We add to prior literature in several ways. First, we systematically analyze the effect of targeted information provision on views, including across cities, urban and suburban populations as well as other socioeconomic characteristics. While this has been done for income and estate taxes [Stantcheva, 2021] and climate policies at an international [Dechezleprêtre et al., 2022] and national level [Carattini et al., 2017, Sælen and Kallbekken, 2011], such research is missing for urban tolls. Second, we analyze heterogeneity in views among urban and suburban populations (akin to "place-based resentment" research in national politics [Munis, 2022]), thus far only analysed by Baranzini et al. [2021] for urban toll proposals for Geneva as well as in theoretical work [De Borger and Proost, 2012, Fageda et al., 2022]. Toll incidence can be expected to strongly differ across urban and suburban populations, making this distinction crucial to consider. Third, we analyse fairness perceptions across groups, a crucial determinant of the acceptance of any pricing policy [Douenne and Fabre, 2022, Sommer et al., 2022], and congestion pricing in particular [Dietz and Atkinson, 2010, Eliasson, 2014].

2 Sample

We partner with the institute respondi/bilendi to carry out the survey in the Berlin and Paris metropolitan areas. For each metropolitan agglomeration, the targeted sample comprises 2000 households, representative for gender, education and age. As is customary in French survey design, the education stratum is coded for social class in the French sample. We chose to include urban areas, as well as the immediately surrounding areas, since these are most relevant for commuting flows within our metropolitan agglomerations. We select all zip codes in the urban areas, as well as all zip codes in the respective metropolitan agglomerations around the city centers. For Berlin, this implies choosing all zip codes in the Berlin-Brandenburg metropolitan area ("Hauptstadtregion Berlin-Brandenburg"[1]). For Paris, we select all zip codes within the Ile-de-France agglomeration.

[1]https://www.statistik-berlin-brandenburg.de/raumbezuege

Respondents can complete the survey at home or via mobile devices, and they are able to flexibly interrupt and continue the survey. We collect a range of socioeconomic and demographic data, and we include a set of questions on environmental and political attitudes and mobility behavior within the survey. The survey is pre-tested for functionality (”soft launch”) and is carried out in February 2023.

3 Experimental Design

We use a questionnaire with in-built video treatments to analyse the effect of different policy framings on the support of urban tolls. After screening for the respective quotas within the questionnaire, we ask respondents a suite of questions on their personal background as well as on their personal and political attitudes and their mobility behavior. After these questions we introduce the topic of congestion prices. Specifically, we provide information on the functioning of the urban tolls by displaying short video messages within the survey. We decide to show videos, since this method has been shown to increase understanding compared to reading based learning content Hung et al. [2018].

The sample is divided in four randomised groups, three of which are shown a treatment video on the potential effects of urban tolls. The control group likewise views a city-specific video, but the contents bear no relation to congestion charges. The content of the video messages is delivered in French and in German, respectively. The information provided is identical across cities, except for any city-specific information and city names. The terminology used to name the congestion price is ”City-Maut” in German and ”péage urbain” in French, which for both cases translates to ”urban toll” in English. Broadly, the video messages have the following content:

1. Time-savings: While commuting to work, citizens lose time travelling on congested roads. A solution to reduce driving and tackle congested roads is to introduce an urban toll. A reduced number of cars on the road improves traffic flow, allowing the

remaining cars travel at faster speeds.

2. Air pollution: Motorised vehicles are an important source of air and noise pollution, causing a number of diseases. A solution to reduce driving and tackle air pollution is to introduce an urban toll. A reduced number of cars on the road reduces air pollution and is beneficial for everyone's health.

3. Environment/greenhouse gas (GHG) emissions: Motorised vehicles, such as cars, light-weight trucks or motorbikes are an important source of GHG emissions, contributing to global climate change. A solution to reduce driving and GHG emissions is to introduce an urban toll. A reduced number of cars on the road decreases GHG emissions and thus the climate impact of the transport sector.

4. Control: The German capital Berlin [French capital Paris] and the surrounding state of Brandenburg [cities of Île-de-France] together form the closely intertwined metropolitan region of Berlin-Brandenburg ["Métropole du Grand Paris"]. Berlin [Paris] is divided in 12 [20] administrative divisions. Each district is presided over by a mayor who resides in the mayor's office of his district.

After the video messages, we tell respondents to consider the introduction of an urban toll in their city and ask whether or not they would support this policy. We use the magnitude of the London congestion charge upon its introduction in 2003 as an anchoring price. We then ask a range of questions on revenue use, predicted behavior change as well as the potential winners and losers of the policy, including in the urban and suburban context.

4 Analysis and Expected Main Results

Our baseline specification measures a respondent's support for the introduction of a congestion charge in their city. The random allocation of households into experimental groups allows us to identify the causal treatment effect using a linear probability model with the following specification:

$$y_i = \alpha + \beta T_i + \theta_c + \epsilon_i, \tag{1}$$

where y_i is a variable that equals unity if respondent i states that she supports an urban toll and ϵ_i is a random error. In some specifications, we control for country or city-specific behavior in responding to questions using city fixed effects θ_c. This specification allows testing our first hypothesis, namely the differential effects of the respective treatments T_i on policy support. All effects are measured relative to the control treatment. The parameter of interest is β.

In addition, we quantify heterogeneous treatment effects by including interactions between socioeconomic characteristics and treatment status:

$$y_i = \alpha + \beta_1 X_i + \beta_2 T_i + \beta_3 T_i \times X_i + \theta_c + \varepsilon_i, \tag{2}$$

where X_i is a vector of socioeconomic as well as attitudinal control variables and ε_i is a random error term. $T_i \in [1, 2, 3, 4]$ is a treatment indicator for each treatment or control group. Our main effect of interest is β_3, the coefficient on the interaction between the socioeconomic variables and the treatments. Two interesting candidates for interactions are whether the respondents reside within the city center or in suburban areas and to what extent they use the car for commuting. We are also interested in the different coefficients of the control vector X_i, since they allow us testing our main hypotheses 2, 3 and 4, listed above.

5 Power Analysis

We include 4000 households in our survey who are randomly split into four groups (T =0.5), i.e. 1000 per group. Based on Hamilton et al. [2014], we assume that a third of respondents would support an urban toll in the absence of any treatment (P). Using the standard level of significance α =0.05, the standard power level of β=0.8 and a two-sided test, the minimum detectable treatment effect amounts to δ=5.7 percentage points.

$$\delta = (t_1 + t_2)\sigma_y \sqrt{\frac{1}{P(1-P)n}} \tag{3}$$

References

A. Anas and R. Lindsey. Reducing urban road transportation externalities: Road pricing in theory and in practice. *Review of Environmental Economics and Policy*, 5(1):66–88, 2011. doi: 10.1093/reep/req019.

A. Baranzini, S. Carattini, and L. Tesauro. Designing effective and acceptable road pricing schemes: Evidence from the geneva congestion charge. *Environmental and Resource Economics*, 79(3):417–482, 2021. doi: 10.1007/s10640-021-00564-y.

S. Carattini, A. Baranzini, P. Thalmann, F. Varone, and F. Vöhringer. Green taxes in a post-paris world: Are millions of nays inevitable? *Environmental & Resource Economics*, 68(1):97–128, 2017. URL https://EconPapers.repec.org/RePEc:kap:enreec:v:68:y:2017:i:1:d:10.1007_s10640-017-0133-8.

B. De Borger and S. Proost. A political economy model of road pricing. *Journal of Urban Economics*, 71(1):79–92, 2012. ISSN 0094-1190. doi: https://doi.org/10.1016/j.jue.2011.08.002. URL https://www.sciencedirect.com/science/article/pii/S0094119011000519.

A. Dechezleprêtre, A. Fabre, T. Kruse, B. Planterose, A. S. Chico, and S. Stantcheva. Fighting climate change: International attitudes toward climate policies, 2022. URL https://www.oecd-ilibrary.org/content/paper/3406f29a-en.

S. Dietz and G. Atkinson. The equity-efficiency trade-off in environmental policy: Evidence from stated preferences. *Land Economics*, 86(3):423–443, 2010. ISSN 0023-7639. doi: 10.3368/le.86.3.423. URL https://le.uwpress.org/content/86/3/423.

T. Douenne and A. Fabre. Yellow vests, pessimistic beliefs, and carbon tax aversion. *American Economic Journal: Economic Policy*, 14(1):81–110, February 2022. doi: 10.1257/pol.20200092. URL https://www.aeaweb.org/articles?id=10.1257/pol.20200092.

J. Eliasson. Lessons from the stockholm congestion charging trial. *Transport Policy*, 15(6): 395–404, 2008. ISSN 0967-070X. doi: https://doi.org/10.1016/j.tranpol.2008.12.004. URL https://www.sciencedirect.com/science/article/pii/S0967070X0800053X.

J. Eliasson. The role of attitude structures, direct experience and reframing for the success of congestion pricing. *Transportation Research Part A: Policy and Practice*, 67:81–95, 2014. ISSN 0965-8564. doi: https://doi.org/10.1016/j.tra.2014.06.007. URL https://www.sciencedirect.com/science/article/pii/S0965856414001475.

X. Fageda, R. Flores-Fillol, and B. Theilen. Price versus quantity measures to deal with pollution and congestion in urban areas: A political economy approach. *Journal of Environmental Economics and Management*, 115:102719, 2022. ISSN 0095-0696. doi: https://doi.org/10.1016/j.jeem.2022.102719. URL https://www.sciencedirect.com/science/article/pii/S0095069622000778.

C. Hamilton, J. Eliasson, K. Brundell-Freij, C. Raux, and S. Souche. Determinants of congestion pricing acceptability. 2014.

I.-C. Hung, Kinshuk, and N.-S. Chen. Embodied interactive video lectures for improving learning comprehension and retention. *Computers Education*, 117:116–131, 2018. ISSN 0360-1315. doi: https://doi.org/10.1016/j.compedu.2017.10.005. URL https://www.sciencedirect.com/science/article/pii/S0360131517302312.

B. K. Munis. Us Over Here Versus Them Over There... Literally: Measuring Place Resentment in American Politics. *Political Behavior*, 44(3):1057–1078, Sept. 2022.

ISSN 1573-6687. doi: 10.1007/s11109-020-09641-2. URL https://doi.org/10.1007/s11109-020-09641-2.

S. Sommer, L. Mattauch, and M. Pahle. Supporting carbon taxes: The role of fairness. *Ecological Economics*, 195:107359, 2022. ISSN 0921-8009. doi: https://doi.org/10.1016/j.ecolecon.2022.107359. URL https://www.sciencedirect.com/science/article/pii/S0921800922000210.

S. Stantcheva. Understanding Tax Policy: How do People Reason?*. *The Quarterly Journal of Economics*, 136(4):2309–2369, Sept. 2021. ISSN 0033-5533. doi: 10.1093/qje/qjab033. URL https://doi.org/10.1093/qje/qjab033. _eprint: https://academic.oup.com/qje/article-pdf/136/4/2309/40566452/qjab033.pdf.

H. Sælen and S. Kallbekken. A choice experiment on fuel taxation and earmarking in norway. *Ecological Economics*, 70(11):2181–2190, 2011. ISSN 0921-8009. doi: https://doi.org/10.1016/j.ecolecon.2011.06.024. URL https://www.sciencedirect.com/science/article/pii/S0921800911002710. Special Section - Earth System Governance: Accountability and Legitimacy.