Wages, taxes, and labor supply elasticities: The role of social preferences*

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August 6, 2025

ABSTRACT: Economists typically treat labor supply responses to wages and taxes as equivalent. We show that social preferences towards tax-funded government expenditures induce differences between the wage and net-of-tax rate elasticities of labor supply in canonical models. We use a large-scale vignette experiment to show that wage elasticities of labor supply are meaningfully larger than their net-of-tax rate counterparts, consistent with overall positive social preferences. We show relevance for real labor market decisions by leveraging an existing elasticity of taxable income meta-analysis. Hence, models calibrated using net-of-tax rate elasticities when wage elasticities are more suitable understate individuals' labor supply responses.

JEL: J22, H24, H41.

*Chirakijja: janjala.chirakijja@monash.edu; Ong: ong.pinchuan@nus.edu.sg. We thank Sascha Becker, Marianne Bertrand, Adeline Delavande, Jason Faberman, Lorenz Goette, Jie Gong, Naijia Guo, Jon Guryan, Hilary Hoynes, Anders Humlum, Supreet Kaur, Patrick Kline, John Klopfer, Matthew Notowidigdo, Amanda Pallais, Jessica Pan, Simon Quach, Jesse Rothstein, Benjamin Schoefer, Uta Schoenberg, Dmitry Taubinsky, Basit Zafar, Anson Zhou, James Ziliak, and participants of the NUS SIG and Macro Brownbags, NUS Labor Mini-Conference, CUHK Lunch Brownbag, HKU seminar, SOLE 2024 Meeting, Berkeley Labor Lunch, Australasian Public Choice Conference, PIER seminar, EEA-ESEM 2024 Congress, WZB Seminar, EALE 2024, ESAM 2024, and NTU seminar for valuable comments and suggestions. We are grateful to Carina Neisser for making her paper's replication kit publicly available. Justin Goh, Ke Li, and Hongqing Qiu provided outstanding research assistance. Research reported in this paper received financial support from the MOE AcRF Tier 1 Grant A-0003317-00-00. This study received IRB Approval from the NUS Business School under Protocol SP-23-0103 and was pre-registered as AEARCTR-0011052.

1 Introduction

Economists are generally interested in understanding the responsiveness of labor supply to wages and taxes—the labor supply elasticity. This elasticity plays a key role in business cycle models and for assessing the efficiency costs of labor income taxation, and differences in its magnitude can give rise to different conclusions (Keane 2011).

When thinking about this elasticity, economists seldom distinguish between responses to wages and taxes. Despite a nominal distinction—the tax response is more accurately called the elasticity with respect to the net-of-tax rate (e.g. Saez et al. 2012)—virtually all models of labor supply assume that people care about wages and income taxes only through their effects on disposable income. Since wage increases and tax cuts equivalently raise disposable income, most empirical labor supply elasticity estimates are based on responses to after-tax wages (see e.g. Eissa and Hoynes 2004; Ziliak and Kniesner 2005; Blau and Kahn 2007; Keane and Wasi 2016; Blundell et al. 2016).

This paper identifies a reason—beyond salience, see Chetty et al. (2009); Finkelstein (2009); Blumkin et al. (2012); Taubinsky and Rees-Jones (2018); Kroft et al. (2024)—to distinguish between wage and net-of-tax rate elasticities of labor supply. A large literature documents the existence of other-regarding or social preferences (Andreoni 1989, 1990; Fehr and Schmidt 1999; Charness and Rabin 2002). Applied to income taxation, people might like or dislike the fact that tax dollars eventually go towards (or are wasted in the course of providing) public goods expenditure. Moreover, while wage changes are often viewed as being specific to the individual, tax rate changes almost always apply to broad groups (e.g. taxpayers in the same tax bracket). Hence, tax changes potentially affect the aggregate provision of public goods. Such government-related social preferences would lead individuals to derive utility or disutility from income taxation over and above what would be explained by its impact on their disposable income.

We show that incorporating government-related social preferences in a labor supply model drives a wedge between the responses of labor supply to wages and the net-of-tax rate. Intuitively, if people derive satisfaction from their or others' contributions to public good provision, a tax increase hurts less than an equivalent wage decrease—despite reduced disposable income, the public good or warm glow compensates. In contrast, a wage increase benefits both the government budget and personal consumption. This implies that if people derive satisfaction from their or others' tax dollars, the wage elasticity of labor supply should be larger than its net-of-tax rate counterpart.

To estimate the size of this "wage-tax elasticity wedge" (i.e. the wage less the net-of-tax rate elasticities), we field a large online vignette experiment in the US. A vignette (or

hypothetical choice) experiment is the preferred methodology for our purpose since it allows us to obtain causal estimates of the two different elasticities (wage and net-of-tax rate) for the same population, which is difficult to achieve using observational data.[1] Our wedge estimates have high internal validity since we control the randomization process, and our method ensures that participants hold market frictions and other factors constant when making their choices. In particular, wages and taxes are made equally salient, ruling out salience as the source of differences. Our vignette experiment is similar in spirit to Kosar et al. (2019), who randomly vary wages and work hours in their scenarios to study labor supply heterogeneity across demographic groups.[2] To fit our purpose, we additionally vary a tax rate across scenarios.

We find that respondents, on average, exhibit positive social preferences towards tax-funded government expenditures. Our estimated wage elasticities are meaningfully larger than net-of-tax rate elasticities, and are robust to many variations in specifications.[3] The wedge is larger among respondents with more favorable views of government, consistent with government-related social preferences affecting labor supply. We also find evidence that government-related social preferences can be usage-specific: the wage-tax elasticity wedge is larger if taxes are earmarked for specific programs that the respondent likes more.

Although estimates based on stated preferences have been shown to correspond to actual market decisions in several settings (Mas and Pallais 2017; Wiswall and Zafar 2018; Parker and Souleles 2019; Maestas et al. 2023), a natural concern is how externally valid our results are for workers' choices in the labor market. To address this, we build on a recent meta-analysis of the elasticity of taxable income (ETI) with respect to the net-of-tax rate by Neisser (2021). Because it examines taxable income rather than measures of labor supply (e.g. work hours), the ETI generalizes the standard labor supply elasticity by additionally capturing other behavioral responses (e.g. compensation timing, tax avoidance) that are relevant for income taxation analysis (Feldstein 1995; Saez et al. 2012).[4] Impor-

[1] Suppose we used observational data with one instrument for wages and another for tax rates to estimate the two types of elasticities. Even if both estimates came from the same sample, there is no guarantee that the compliers to the two different instruments (Angrist et al. 1996) are the same people. This would result in a biased estimate of the wedge.

[2] Vignette experiments (also known as conjoint analysis) have been used in labor economics to estimate preferences for nonpecuniary job (dis)amenities (Eriksson and Kristensen 2014; Mas and Pallais 2017; Wiswall and Zafar 2018; Mas and Pallais 2019; Kosar et al. 2019; Folke and Rickne 2022; Maestas et al. 2023; Burbano et al. forthcoming), including distaste for work via the inclusion of work hours in the list of vignette disamenities (Wiswall and Zafar 2018; Mas and Pallais 2019; Kosar et al. 2019; Maestas et al. 2023). However, Kosar et al. (2019) and Mas and Pallais (2019) are the only prior studies to report labor supply elasticities—the relevant parameter used in many applications—after estimating the distaste for work.

[3] Our labor supply elasticities are relatively large, in line with estimates from quasi-experimental settings with minimal frictions (Fehr and Goette 2007; Stafford 2015; Giné et al. 2017; Chen et al. 2019). This adds to evidence that the dampening effects of market frictions are central to interpreting labor supply elasticities.

[4] ETI estimates are always net-of-tax rate estimates and hence should implicitly capture social preferences.

tant for our purposes, government-related social preferences should also be reflected in the ETI (including in the additional behavioral margins)—a better opinion of the government should be correlated with a lower ETI. Using Neisser's replication kit, we show that the ETI is negatively correlated with variables that capture institutional trust in the World Values Survey (WVS) and European Values Survey (EVS), even after controlling for a large number of study-related covariates. This suggests that government-related social preferences matter for the labor supply response to taxation—a policy-relevant finding in itself.

Our paper contributes to a large literature on the labor supply elasticity (see Keane 2011, 2022 for reviews). Prior work estimated it using wage (MaCurdy 1981; Altonji 1986; Camerer et al. 1997; Oettinger 1999; Pistaferri 2003; Ziliak and Kniesner 2005; Farber 2005; Blau and Kahn 2007; Fehr and Goette 2007; Stafford 2015; Giné et al. 2017; Chen et al. 2019) or tax variation (Eissa 1995; Blundell et al. 1998; Bianchi et al. 2001; Eissa and Hoynes 2004; Chetty et al. 2011; Gelber 2014; Blundell et al. 2016; Sigurdsson 2019; Stefánsson 2019; Unrath 2020; Martinez et al. 2021; Elder et al. 2023; Sigaard 2023), treating the response to the two as equivalent. However, a small but growing research suggests that people may respond differently to wage versus income tax changes for reasons other than salience, although the evidence is still mixed. Using real-effort experiments on smaller samples, Kessler and Norton (2016) find more negative worker-effort responses to the introduction of a tax compared to an equivalent wage cut, whereas Mori et al. (2022) find no wage-tax differences when they increase the tax rate from a non-zero base, and Esslinger et al. (2024) find no differences for tax cuts and some differences for tax increases. Djanali and Sheehan-Connor (2012) and Rick et al. (2018) find larger responses to wage (i.e. in line with our results). While we do not use a real-effort experiment, our approach better reflects tax variation outside of a laboratory—our sample is nationally representative, our tax variation is closer to policy-relevant magnitudes, and reflects how tax changes affect many people in the same bracket. A separate body of work documents that taxes which are perceived to fund worker benefits (e.g. individual pension benefits) induce small labor supply responses (Gruber 1997; French et al. 2022; Bozio et al. 2023). We generalize beyond a tax-benefit linkage that benefits the self to government-related social preferences broadly defined—our results suggest factors beyond benefits to the self (in particular a fair redistribution system) plays a role as well. More broadly, we provide a theory—most similar to Djanali and Sheehan-Connor (2012)—that could be used to think about the results of the studies discussed here.

A related literature investigates whether estimates of the intertemporal elasticity of labor supply (Frisch elasticity) based on microdata can be used to calibrate the labor supply

However, we are unaware of any prior study that discusses social preferences as a reason for variation in the ETI.

response to business cycle fluctuations. Previous work has argued that estimates based on life-cycle models are underestimated due to credit constraints (Domeij and Floden 2006), precautionary savings (Low 2005), endogenous human capital accumulation (Imai and Keane 2004; Keane and Wasi 2016), optimization frictions (Chetty 2012), and failure to model participation margins (Chang and Kim 2006; Rogerson and Wallenius 2009; Keane and Wasi 2016). Recent Frisch elasticity estimates based on tax holiday natural experiments are designed to be robust to many of the above (Martinez et al. 2021; Sigurdsson 2019; Stefánsson 2019), but remain too small to account for business-cycle variation in work hours. We partially explain the discrepancy—labor supply responds to the wage signal of the business cycle, implying larger elasticities than estimates based on tax variation. Similar considerations apply to estimates based on life-cycle models that exploit exogenous variation in taxes for identification of Frisch elasticities (e.g. Blundell et al. 2016). This is particularly relevant when we notice that quasi-experimental estimates tend to be based on tax variation, possibly because national-level tax changes are more easily observed by the econometrician than the wage offers of individual employers.

Our paper draws insights from a large tax compliance literature (see reviews in Luttmer and Singhal 2014; Alm 2019), particularly an active sub-literature linking tax morale to attitudes about government spending (Cowell and Gordon 1988; Alm et al. 1993; Hall and Preston 2000; Cullen et al. 2021; Giaccobasso et al. 2022; Falsetta et al. 2023). More broadly, researchers have studied social preferences in the context of charitable giving (review in Andreoni and Payne 2013), volunteering (Freeman 1997; Bauer et al. 2013; Lilley and Slonim 2014), redistribution (reviews in Alesina and Giuliano 2011; Mengel and Weidenholzer 2023), and optimal taxation (Saez 2004; Diamond 2006). We contribute by demonstrating the importance for non-volunteering labor supply. Additionally, we add to the understanding of intrinsic motivations for paying taxes—we find that the wage-tax elasticity wedge is larger if the tax funds a program that the respondent likes.

Finally, we contribute to a growing literature on people's views about taxation. This literature has shown that social preferences matter more than efficiency reasons for people's attitudes towards taxation and inequality (Fisman et al. 2020; Almås et al. 2020; Stantcheva 2021). We show that these views can translate to behavioral responses.

The paper proceeds as follows. Section 2 formalizes the intuition for the wage-tax elasticity wedge in a model. Section 3 describes our survey, vignette experiment, and estimation strategy. Section 4 presents results of our vignette experiment. Section 5 presents correlations between the elasticity of taxable income and proxies for government-related social preferences. Section 6 concludes.

2 Model

We start by incorporating government-related social preferences in the canonical dynamic model of labor supply, and derive implications for the wage and net-of-tax rate elasticities of labor supply. While our model below can be interpreted on its own, we show in Appendix B.1 that it can be derived from a more complex model with utility that depends separately on own and others' contributions, as well as total government expenditure. We use the elasticities from this section later when we estimate the wage-tax elasticity wedge in Section 4.

In each period, an individual i with initial assets a_i chooses consumption c_i, next period assets a_i', and labor supply h_i to solve (prime denotes the next period)

$$V(a_i, w_i, \tau, N_i) = \max_{c_i, a_i', h_i} U(c_i, h_i, g_i) + \beta E\left[V(a_i', w_i', \tau', N_i')\right] \tag{1}$$

$$\text{s.t. } c_i + \frac{1}{1+r} a_i' = a_i + (1-\tau) w_i h_i + N_i, \tag{2}$$

$$g_i = \tau w_i h_i, \tag{3}$$

where w_i is the person's wage, τ is the tax rate on earnings from work $w_i h_i$, N_i is non-labor income, β is an impatience parameter, r is the interest rate, $V(\cdot)$ is the indirect utility function, and $E[\cdot]$ is the expectations operator. Equation (2) is a usual budget constraint: consumption c_i and savings $\frac{1}{1+r} a_i' - a_i$ equals post-tax earnings and non-labor income.

We make only one change compared to the usual labor supply model: per-period utility in Equation (1) also depends on the amount of government expenditure from the individual's taxes paid g_i (tax-funded government expenditure), equivalent to the tax rate applied to their total earnings from work by Equation (3). In our main analysis, we specialize utility to

$$U(c_i, h_i, g_i) = u(c_i, h_i) + v(g_i) \tag{4}$$

so that we have an easily interpretable social preferences term $v(g_i)$. Similar to DellaVigna et al. (2012), $v(g_i)$ can encompass both pure altruism (people value the public goods being provided) or warm glow (people like contributing to nation building, regardless of the public goods' value). We do not take a stand on which is more important, nor whether $v(g_i)$ is driven by the perceived benefit of taxes to oneself (e.g. French et al. 2022; Bozio et al. 2023) or to society. $v(g_i)$ allows for both positive and negative social preferences. We expect individuals to value tax-funded public goods to some degree, and there might be diminishing marginal returns; this translates to $v(g_i)$ having positive first and negative second derivatives. However, in principle, $v(g_i)$ might have a negative first derivative if the individual sees public

goods provision as net-detrimental to society or himself.

We model τ as a common tax rate that does not depend on i to reflect tax rate changes in practice—taxes often affect broad groups of people in similar circumstances. Thus, individuals may get social preferences utility from the increased (or decreased) contributions of others, in addition to their own, as well as from changes in the aggregate provision of public goods. When τ goes up, everyone's g_i increases, and hence $v(g_i)$ should be interpreted as a summary measure that also captures social preferences from others' contributions. Our vignette experiment wording also reflects this feature of taxes, although we do not seek to separately identify social preferences from others' contributions versus one's own contribution.

In Appendix B.2, we derive the form for three commonly-used labor supply elasticity types: the uncompensated Marshallian elasticity, the Hicksian elasticity which compensates for income effects, and the Frisch elasticity which holds the marginal utility of wealth constant. For all three elasticity types, the wage elasticity differs from the net-of-tax rate elasticity. For example, denoting partial derivatives using subscripts and dropping utility's dependence on its arguments and i, the Frisch wage elasticity is

$$\epsilon_w^F = \frac{-w_i(1-\tau)U_{cc}\left[U_c + \frac{\tau}{1-\tau}(U_g + U_{gg}g_i)\right]}{h_i(U_{cc}U_{hh} - U_{ch}^2 + \tau^2 w_i^2 U_{cc}U_{gg})} \tag{5}$$

while the Frisch net-of-tax rate elasticity is

$$\epsilon_{1-\tau}^F = \frac{-w_i(1-\tau)U_{cc}\left[U_c - (U_g + U_{gg}g_i)\right]}{h_i(U_{cc}U_{hh} - U_{ch}^2 + \tau^2 w_i^2 U_{cc}U_{gg})}. \tag{6}$$

The key difference between the two elasticities is the sign on the $U_g + U_{gg}g_i$ term. This term captures the intuition for the wage-tax wedge. Typical concavity assumptions on $U(\cdot)$ ensure that $\frac{-w_i(1-\tau)U_{cc}}{h_i\left(U_{cc}U_{hh} - U_{ch}^2 + \tau^2 w_i^2 U_{cc}U_{gg}\right)}$ and U_c are positive, with their product capturing the usual intuition that increases in disposable earnings encourage substitution towards working. For the Frisch wage elasticity, $U_g + U_{gg}g_i$ reinforces this substitution effect, assuming that taxes were not so high that diminishing marginal utility starts to kick in. (We find limited diminishing marginal utility in our data.) In contrast, in the Frisch net-of-tax rate elasticity, $U_g + U_{gg}g_i$ counters the substitution effect, as increases in tax rates fund more public goods even as they reduce disposable income available for consumption.

The immediate implication is that social preferences cause the Frisch wage elasticity to be different from the Frisch net-of-tax rate elasticity, with the wage-tax elasticities wedge

$$\Delta\epsilon^F = \epsilon_w^F - \epsilon_{1-\tau}^F = \frac{-w_i U_{cc}(U_g + U_{gg}g_i)}{h_i(U_{cc}U_{hh} - U_{ch}^2 + \tau^2 w_i^2 U_{cc}U_{gg})} \tag{7}$$

widening as social preferences strengthen (i.e. $U_g + U_{gg} g_i$ increases). This holds for all three types of elasticities. We next turn to our vignette survey experiment to estimate the size of the wedge.

3 Survey, vignette experiment, and estimation strategy

Our empirical goal is to estimate how individuals' labor supply decisions react to wage changes compared to tax changes. Since observed labor supply choices are influenced by various other determinants, it is difficult to identify the labor supply elasticities using observational data without imposing some additional assumptions. To overcome this challenge, we designed a vignette experiment that allows us to obtain causal estimates for the two types of elasticities (wages and net-of-tax rates) that are internally consistent. Our experimental design was inspired by Kosar et al. (2019) which estimated labor supply elasticities using a vignette method in order to investigate heterogeneity across demographic groups. The key advantages of this approach are that the variations are all exogenous, and we do not need to make assumptions about other factors that affect individuals' work hours. Throughout the survey, we employed several approaches to ensure that respondents understood and paid attention to the questions we asked—Appendix C.1 discusses the details. (Appendix C also provides webpage links to the full questionnaire and a live version of the online survey.)

3.1 Survey structure and sample

We conducted a large-scale vignette experiment embedded in an online survey fielded between February and June 2023. Our survey targeted US residents aged 25–64 who were working, excluding self-employed workers as they might have difficulty relating to our vignettes. We recruited participants via Bilendi (previously called Respondi), a survey company commonly used in social science research (see e.g. Alesina et al. 2021; Stantcheva 2021; Jäger et al. 2023).[5] The median time for our survey completion was 20.1 minutes.

Our survey was structured as follows:

1. Demographic and employment questions: We collected information on demographic and work characteristics, including work hours, wage/salary income of self and spouse, assets, and consumption. The survey instrument was programmed to use this information to compute each respondent's hourly wage and simulate their income tax rate,

[5] Stantcheva (2023) describes the recruitment strategies generally employed by survey companies (including Bilendi) and how their respondent pools compare with the broader population. Of note, participants were informed that their responses would be subject to statistical checks, and that low-quality responses might be dropped from our study.

needed for our vignette experiment.[6] Appendix C.3 provides details about our tax simulation procedure.

2. Vignette experiment: Respondents first clicked through an animated slideshow that walked them through the instructions for the vignettes. These ten non-skippable slides explained the hypothetical scenarios, the assumptions the respondents should be making and the choices they would be asked to make. Respondents then proceeded to answer the questions in our vignette experiment, described in Section 3.2.

3. Views on government and tax questions: Lastly, we elicited opinions on the federal government and tax system, and the extent to which they liked or disliked their tax money funding different spending categories (e.g. national defense, health insurance programs, and social security). The survey closed with miscellaneous questions, including an open-ended feedback question on the survey.

7,122 respondents completed our survey. To arrive at our main analysis sample, we drop individuals whose work hours, consumption, or tax amounts are below the 5th or above the 95th percentiles, to avoid the influence of outliers on our simulated elasticities.[7] We also exclude a small number of respondents who skipped our compulsory instructions slide show—this could be achieved if the respondent knew how to manipulate Javascript in a browser console—and respondents whose consumption information in the vignettes cannot be imputed (e.g., if they always reported the maximum or minimum values on the consumption scale). Lastly, we drop one respondent whose utility function is not locally concave in our main specification; this issue does not arise for other respondents, and including this individual makes some results less precise but qualitatively unchanged.

Appendix Table A1 shows the characteristics of our final sample of 5,439 individuals and those of the US working population. By construction, our sample is representative along the targeted dimensions of age, gender, and income. There is also broad similarity along some non-targeted dimensions such as marital status and race, although the sample is slightly more educated, less Hispanic, and more Democrat.[8] Appendix C.2 provides more details about our sample.

[6] Respondents were asked to verify the hourly wage and amend their reports of income or work hours if the hourly wage did not make sense. Simulated tax rates were not similarly verified to avoid emphasizing taxes early in the survey. We did not inquire directly about taxes paid for the same reason.

[7] For example, if the the utility function in Equation (1) contained $\log c$, the elasticities in Equation (5) and (6) would contain $1/c$ terms. Observations with very small consumption values would then have a big influence on the elasticities that we simulate.

[8] This latter pattern seems to be a common feature of online samples (see e.g. Stantcheva 2022, Table 1). We show robustness to reweighting the sample in Section 4.2.

3.2 Vignette experimental design

The vignette experiment showed respondents ten pairs of hypothetical scenarios. In all scenarios, respondents were asked to assume that everything about them was the same as their situation at the time of the survey except that they had to leave their job and find a new one. (Appendix Figure A1 shows the first two instructional slides). The scenario description read:

> "You have to leave your current job and find a new one. You have received a job offer that will pay you $*[wage]* per hour and require that you work *[hour]* hours per week. You will have to pay the federal income tax on the amount you earn from this job at the rate of *[tax rate]*%."

The scenarios randomized the three bracketed variables in the description above around the respondents' actual values. Wages and tax rates were drawn uniformly from the 21 and 11 even numbers closest to the actual wage and tax rate, respectively, and work hours were drawn uniformly from the 9 multiples of five closest to the actual work hours. We constrained the wage and hours grids to be positive, and the tax rate grid to be nonnegative.[9] In each pair of scenarios, respondents were asked if they would take up the job in each scenario and which of the two scenarios they preferred.

We instructed respondents to assume the following as they thought about the hypothetical scenarios:

- Jobs and family members' situations were otherwise identical to actual situations (hence our estimates are partial equilibrium responses);
- The income tax rate in the scenarios was the federal income tax, and applied to people "with similar income and employment situation to you" (reflecting both reality and our modeling of the common tax rate in Section 2);
- The federal government balanced its budget; and
- If they chose not to take the job, they would have access to the same financial resources that are available if they were to quit their actual job, and the same chance of finding a new job.

[9] For example, a respondent earning 31 dollars per hour at a 40 hour-per-week job and facing a tax rate of 8 percent would see wages drawn from 12, 14, ..., 52, work hours drawn from 20, 25, ..., 60, and tax rates drawn from 0, 2, ..., 20 (these being the eleven even numbers closest to the actual tax rate while still being nonnegative).

Appendix Figure A2 shows the basic layout of our scenario pairs. To facilitate understanding our vignettes, we computed and explained the workings for all relevant details—specifically the monthly pre-tax earnings, take-home income, and tax amounts paid. Participants answered the questions step-by-step, starting with the choice of whether to take up the job in each of the two scenarios before selecting their preferred scenario. Additionally, we repeated the instructions at the top of the screen for respondents' reference.

Pairs 1 to 4 followed the basic layout. Pairs 5 to 8 (shown in Appendix Figure A3) involved an additional step—delayed to minimize cognitive load—by also collecting information on consumption, required for estimating our model. Specifically, we asked respondents how much their household would spend in total each month if they took up the job in each scenario. Pairs 9 and 10 added an earmarked tax for a specific program, that allow us to investigate whether the size of the wage-tax elasticity wedge varies with whether the taxes fund specific programs that respondents like. We discuss the design of pairs 9 and 10 together with the analysis in Section 4.3. The vignette part of our survey is necessarily more complex than other sections; to help respondents along and to maintain attention, we showed an interactive "guided website tour" every time we introduced a change in the layout (pairs 1, 5, and 9).

We built in two attention checks in our survey. The first doubles as a comprehension check, and asked participants a simple question following the instructional slideshow mentioned in Section 3.1 point 2—whether the income tax rate in the scenarios referred to federal, state or local tax rate (the correct answer being federal). Second, pair 7 of our vignette experiment presented a strictly dominating relationship, with both scenarios showing the same tax rate and work hours but different hourly wages. We expect attentive participants to prefer the scenario with the higher wage. About 7 and 8 percents of our sample failed the two checks, respectively, a rate comparable with Mas and Pallais (2017) and the literature on inattention in online surveys (see e.g. Peer et al. 2022). (Combined, 13% of respondents failed at least one of the two attention checks).

Estimating the model in Section 2 requires consumption information, which we collected in only pairs 5 to 8 by design. To use information in all pairs, we impute consumption for all scenarios. We first assess if respondents are correctly basing their consumption decisions on take-home earnings rather than pre-tax earnings in pairs 5 to 8. Appendix Table A2 reports that, in a horse-race regression of log consumption on log take-home earnings and log pre-tax earnings, the effect of "more earnings" loads on take-home earnings.[10] We therefore predict

[10]Our estimate implies that a 1 percent increase in take-home income is associated with a 0.37 percentage increase in consumption. This elasticity is of a similar magnitude to the elasticity of consumption with respect to permanent income shocks estimated by Baker (2018).

log consumption for all scenarios using log take-home earnings at the individual-level.[11] That is, the variation in consumption comes from each respondent's take-home earnings (which varies across scenarios) and a respondent-specific slope based on eight data points collected in pairs 5 to 8.

3.3 Main empirical strategy

Using the vignette data, we estimate the wage and net-of-tax rate elasticities for the three types that are commonly used in the literature (Marshallian, Hicksian, and Frisch). We start by estimating the structural parameters of a choice model using the data. These structural parameters are then used to simulate the elasticities of interest.

To estimate the structural utility parameters using our vignette experiment, we parameterize the utility function in Equation (4) with

$$\begin{aligned} U\left(c_i, h_i, g_i\right) = & \beta_c \log c_i + \beta_h \log\left(\bar{L} - h_i\right) + \beta_{cc}\left(\log c_i\right)^2 \\ & + \beta_{hh}\left(\log\left(\bar{L} - h_i\right)\right)^2 + \beta_{ch} \log c_i \log\left(\bar{L} - h_i\right) \\ & + \beta_g g_i + \beta_{gg} g_i^2 + \beta_{ggg} g_i^3, \end{aligned} \tag{8}$$

where the β's are coefficients to be estimated and $\bar{L}$ is the maximum time available so that $\bar{L} - h_i$ represents leisure. The first two lines of Equation (8) model preferences over consumption and leisure with a translog specification as in prior work (Hotz et al. 1988; Shaw 1989; Van Soest 1995; Ziliak and Kniesner 2005; Elder et al. 2023). Our results are robust to a quadratic utility specification that models c_i and $\bar{L} - h_i$ in levels instead of logs (Blundell et al. 2000; Bargain et al. 2010), but we prefer the translog specification for our main analysis due to better precision. The third line models social preferences as a flexible function of tax-funded government expenditure. Importantly, the polynomial specification for social preferences imposes no restriction on whether respondents like or dislike (in the manner of Levine 1998) tax-funded government expenditure, or the degree of diminishing marginal utility (Carpenter 2021).

In the main analysis of our vignette experiment, each respondent i saw eight pairs t of scenarios j (pairs 1 to 8 of our vignettes). The scenarios randomly varied three parameters (wage, tax rate, and work hours), which map to consumption c_{itj}, work hours h_{itj}, and tax-funded government expenditure g_{itj} (the last two were presented to the respondent directly). To estimate the model, we assume that respondents made their choices in the vignette ex-

[11] We control for pair and scenario order (whether the scenario is the first or second) fixed effects, and drop observations in which consumption is at the minimum or maximum of the range slider used to collect consumption information.

periment—namely to work or not for each scenario Work_{itj} and which scenario she preferred Choice_{itj}(our two outcome variables)—by maximizing $U(c_{itj}, h_{itj}, g_{itj}) + \boldsymbol{x}_{itj}\boldsymbol{\kappa} + \xi_{itj}$, where $\boldsymbol{x}_{itj}$ is a vector of controls (listed below) with associated coefficient vector $\boldsymbol{\kappa}$, and ξ_{itj} is independent and identically distributed Type I extreme value, conditional on the respondent-pair. In other words, choices are made based on the utility function evaluated at the scenario's parameter values, plus a ξ_{itj} term that captures all other factors that might affect utility when making the choice, including possible model misspecification. This allows us to estimate the coefficients in Equation (8) using standard fixed-effects logit regressions (McFadden 1974):

$$\Pr\left(\text{Work}_{itj} = 1 | c_{itj}, h_{itj}, g_{itj}, \boldsymbol{x}_{itj}\right) = \mathcal{F}\left[\gamma_{it} + U\left(c_{itj}, h_{itj}, g_{itj}\right) + \boldsymbol{x}_{itj}\boldsymbol{\kappa}\right] \tag{9}$$

and

$$\Pr\left(\text{Choice}_{itj} = j | c_{itj}, h_{itj}, g_{itj}, \boldsymbol{x}_{itj}\right) = \mathcal{F}\left[\gamma_{it} + U\left(c_{itj}, h_{itj}, g_{itj}\right) + \boldsymbol{x}_{itj}\boldsymbol{\kappa}\right], \tag{10}$$

where $\mathcal{F}(z) = \exp(z) / [1 + \exp(z)]$ is the cumulative logistic distribution, and γ_{it} is the individual-pair level fixed effect.

In $\boldsymbol{x}_{itj}$, we control for the order of the scenario (first of the pair shown versus second). Equation (1) includes the expected indirect utility of the next period; we account for this by controlling for $\log(assets_i + spouseincome_i + savings_{itj})$ and its square, where $assets_i$ and $spouseincome_i$ are respectively the wealth and spouse's income, and $savings_{itj}$ is the after-tax disposable income less consumption for the scenario. We also control for whether the scenario's work hours was below 35 hours per week, following previous papers which model a part-time utility cost (Van Soest 1995; Euwals and Van Soest 1999; Elder et al. 2023).[12] Standard errors are clustered at the respondent level.

After estimating the model, we simulate the elasticities and their differences using Equations (B19), (B20), (B31), (B32), (5), and (6). These elasticities are computed using the estimated model coefficients (the β's) and the respondents' actual (non-vignette) consumption, work hours, wages, and tax rates. Standard errors are computed using the delta method.

To investigate heterogeneity with respect to an opinion of the government K_i, we allow the coefficients to depend on K_i with the parameterization $\beta_l = \alpha_{0l} + \alpha_{1l}K_i$, where $l \in \{c, h, cc, hh, ch, g, gg, ggg\}$ is an index of a coefficient in Equation (8). We estimate the model as before, and then simulate the difference between high and low opinions of the government as the average partial effect of K_i on the wage-tax elasticity wedge.

[12] These papers usually also include a fixed cost of working and model coefficient heterogeneity in demographics. The former is not relevant in our analysis because we only showed scenarios with positive work hours. We show robustness to modeling demographic heterogeneity in Section 4.2.

4 Results

4.1 Main vignette experiment

We start by investigating whether respondents indeed exhibit government-related social preferences using a reduced form specification. Our vignette experiment was not designed to show evidence on this in a straightforward manner, but we can still examine social preferences by controlling for the disposable income and work hours of the scenario. Conceptually, holding constant disposable income and work hours leaves us with variation that comes from higher wages that are immediately channeled into taxes, our regressor of interest. A preference for scenarios with higher (lower) taxes would then indicate that our respondents exhibit positive (negative) social preferences towards tax-funded government spending.

Figure 1 and Appendix Table A3 present regressions of the choices that respondents made—whether the respondent would work and preference of the scenario over the pair's alternative—against taxes paid in the vignette experiments. An observation is a respondent-pair-scenario, and all regressions include individual, pair, and order fixed effects. We control nonparametrically for disposable income and work hours by including fixed effects for cells constructed by interacting the 200-quantiles of disposable income with all possible levels of work hours, and further protect against possible within-cell correlations by interacting the cells with linear slopes in disposable income and work hours.

Controlling flexibly for disposable income and work hours, respondents were more willing to work and preferred scenarios with higher tax amounts. Furthermore, the relationship appears relatively linear and is not driven by outliers. We interpret this result as evidence that people do derive positive utility from government expenditure.[13]

We next turn to our main structural estimates of utility parameters in order to investigate the wage-tax elasticity wedge. Table 1 reports estimates of the utility parameters estimated via logit. The first two columns report estimates based on the choice of whether to work in the scenario, and the next two columns report estimates based on the choice of the preferred scenario. Odd columns report estimates ignoring social preferences, and even columns report estimates with a third-degree polynomial in tax-funded government expenditure. The social preferences parameters are quite precisely estimated.

At the bottom of the table, we report that the average marginal utility of tax-funded government expenditure $E(U_g)$ is positive, consistent with our reduced form results. We also

[13]The relationship between choice and the tax rate is positive as well (Appendix Figure A4 and Appendix Table A4). We focus on the tax amount because it is more consistent with theory—after controlling for disposable income, the tax rate has first-order effects on labor supply only through its correlation with taxes paid (Appendix B.3).

report $E(U_{gg}g)$, the curvature of social preferences multiplied by the amount of tax-funded government expenditure. Its negative value implies that the social preferences function is concave (i.e. there is diminishing marginal utility). Despite this, $E(U_g)$ is still positive at a high tax rate (50 percent) often used in real-effort experiments (e.g. Djanali and Sheehan-Connor 2012; Kessler and Norton 2016; Rick et al. 2018). Note, however, that even $E(U_g|\tau = 50\%)$ is not directly comparable with the results in such literature for at least two reasons. First, previous papers often start participants off in an environment with no taxes before introducing a large tax increase, which would likely lead to more tax aversion than when a pre-existing tax rate changes (conceptually closer to our setting). Second, our tax variation also allows for social preferences to act through other people's contributions and changes in the aggregate public goods provision, a factor that is missing thus far in the literature. Another implication of concavity is that it would reduce the impact of positive social preferences on the wage-tax elasticity wedge, by Equations (5) and (6). Comparing the magnitudes of $E(U_g)$ and $E(U_{gg}g)$, we still obtain a net-positive $E(U_g + U_{gg}g)$.

Table 2 reports estimates of the wage elasticities, net-of-tax rate elasticities, and the differences between the two. The columns correspond to those from Table 1, with each cell estimated using the parameters of the model and the actual (or tax-simulated) values of the respondents (see Section 3.3 for details). The three panels show estimates for, respectively, the Marshallian, Hicksian, and Frisch elasticities of labor supply.

Columns 1 and 3 show the estimates of the elasticities without incorporating social preferences, as assumed by all previous models of labor supply that we are aware of. Without social preferences, the differences between the wage and net-of-tax rate elasticities are necessarily zero. The estimated elasticities are at the high end of what others have estimated in real labor market situations (see e.g. Chetty et al. 2013; Bargain and Peichl 2016; Elminejad et al. 2023), which is not surprising given that the literature thus far conflates wage and tax variation. Furthermore, the labor supply elasticities in this paper are better interpreted as (larger) frictionless elasticities, since many market frictions—including salience and constraints on work hours (e.g. imposed by employers)—should not be in play as our respondents made their choices. The larger Frisch elasticity estimate in column 3 compared to column 1 also points to the role of frictions. Whether one should accept a job offer depends on one's available time and monetary resources and the job-finding probability—these frictions are less likely to play a role when asked "which scenario do you prefer". Our estimates of the Frisch wage elasticity are in line with several market-based estimates that are more likely to be frictionless—1.2 for bicycle messengers (Fehr and Goette 2007), 1.3 for fishermen (Stafford 2015; Giné et al. 2017), and 1.9 for Uber drivers (Chen et al. 2019).[14]

[14]These estimates are based on shorter decision-making time horizons and, as the authors emphasize, are

Our key results are shown in columns 2 and 4 of the table. With social preferences, the wage elasticity is always larger than the net-of-tax rate elasticity, and the difference—the wage-tax elasticity wedge—is statistically significant for all three types. This wedge is meaningfully large. In our preferred specification in column 4 (which generally has better precision), the Hicksian net-of-tax rate elasticity becomes essentially zero, and the Frisch net-of-tax rate elasticity is 30 percent smaller than the corresponding wage elasticity.

4.2 Robustness

Table 3 shows robustness of our estimated wage-tax elasticity wedge to a variety of specification changes. Row 0 of the table repeats our main estimates in Table 2, column 4, and all subsequent rows show a deviation in specification from row 0.

The first five rows examine robustness to varying the specification of the utility function in Equation (8). In row 1, we use a more flexible social preferences term $v(g_i)$, increasing the polynomial order of g_i from three to five. Row 2 allows tax-funded government expenditure to be complements or substitutes to consumption and leisure by including interactions of g_{itj} with $\log(c_{itj})$ and $\log\left(\bar{L} - h_{itj}\right)$. Another commonly-used parameterization in discrete choice labor supply models is the quadratic utility function $\tilde{u}(c,h) = \beta_c c + \beta_h\left(\bar{L} - h\right) + \beta_{cc}c^2 + \beta_{hh}\left(\bar{L} - h\right)^2 + \beta_{ch}c\left(\bar{L} - h\right)$, although Löffler et al. (2018) and Elder et al. (2023) report that estimated elasticities are not sensitive to the choice of translog versus quadratic utility. To check this, row 3 replaces the terms involving $\log(c_{itj})$ and $\log\left(\bar{L} - h_{itj}\right)$ in Equation (8) with $\tilde{u}(c_{itj}, h_{itj})$. (Appendix Table A5, formatted similarly to Table 2, shows that the estimated elasticities and wedges are generally less precise under the quadratic model.) Previous papers also frequently model parameter heterogeneity in demographics. Row 4 allows β_c and β_h to vary with sex, marital status, their interaction, education, and quadratic terms in log age and number of children.[15] Row 5 uses an alternative social preferences term $v(g_i, \tau)$ implied by the more complex model (discussed in Appendix B.1) that provides a foundation for the theory in Section 2 (elasticities are shown in Appendix B.4). In general, the estimated wage-tax elasticity wedge is qualitatively similar to our main estimates.

Our main specification balances survey burden and statistical power by collecting consumption information only for pairs 5 to 8 and then imputing using the observed income-

for workers who are more likely to freely choose their labor supply decisions. Additionally, Mui and Schoefer (2025) use representative surveys in the US and Germany to elicit wage changes that would induce a person to work (or stop working), and find implied Frisch elasticities that exceed 3 for small wage changes.

[15] Appendix Table A6 uses this model to simulate elasticities for the four combinations of sex and marital status. Unlike papers using market data, we do not find larger labor supply elasticities for women than for men. This suggests that institutional setting or market frictions, more than workers' preferences, drive the differences across gender.

consumption relationship. Row 6 shows that our estimates are not sensitive to the imputation procedure by directly using the non-imputed consumption information (restricting the sample to pairs 5 to 8). Row 7 shows that our results are qualitatively similar if we alternatively impute using empirical Bayes prediction, treating the individual-specific slope of log consumption on log take-home earnings as random.

Our main specification accounts for the expected indirect utility term in Equation 1 by controlling for a quadratic in the log of the sum of the individual's assets, spouse's income, and the scenario's unconsumed income (or money borrowed, if applicable). Row 8 shows that omitting this control results in an even larger wedge. Because our vignettes were designed with an intertemporal framework in mind to better reflect real-world decision making, our preferred specification includes this control.

By preference transitivity, a respondent who would work in one scenario of a pair but not the other should also prefer the former in the "choice between scenarios" question. When designing the survey, we worried that allowing the inconsistent choices might lead respondents (who noticed) to view the survey as poorly designed and lose motivation. To avoid this, we included a non-intrusive prompt about the inconsistency whenever it was made. A natural worry is whether this leads to experimenter effects (e.g. the respondent may want to avoid seeing the text even though it does not interrupt the flow of his choices). To assess this, we tracked when the prompt was observed. In our final sample, 19% of respondents saw the prompt at least once, with the median first-observation of the prompt at pair 4, and 4% of respondents still made the intransitive choice despite the prompt. In row 9, we show that estimates are similar when we restrict the sample to pairs before any prompt was observed, suggesting that neither experimenter effects nor intransitivity meaningfully affect our results.[16]

Alternatively, intransitive choices might indicate waning attention. Assuming that intransitive choices were unintentional, the 19% of respondents who ever made an intransitive choice are less careful respondents whom we might want to exclude. In row 10, we show that estimates are robust to this exclusion.

We tracked various measures of response quality throughout the survey. Row 11 reports

[16]The logit functional form used in this paper imposes an independence of irrelevant alternatives (IIA) assumption, and papers that estimate discrete choice labor supply models frequently relax this by including random parameter slopes (Van Soest 1995; Euwals and Van Soest 1999; Löffler et al. 2018). Since IIA is related to transitivity through the weak axiom of revealed preference (Peters and Wakker 1991, Lemma 3.4), the robustness of our result suggests that the IIA assumption is benign. This aligns with Elder et al. (2023) who report that their results are similar whether random slopes were included or not, despite the added computational cost. Because of this, and because the primary goal of this paper is not in investigating heterogeneity in social preferences (e.g. as in Kosar et al. 2019; Burbano et al. forthcoming), we do not use a random slopes specification.

that our results are robust to using a quality sample that excludes respondents who were inattentive, impatient, or responded too quickly. Specifically, we exclude respondents who failed either of our two attention check questions described in Section 3.2, clicked "next slide" more than twenty times in our instructions slides (only ten clicks were needed, and the user interface made this obvious), or answered any of the overall, vignette, or government expenditure liking questions in less than half the median time taken by all respondents.[17]

Our main estimates use the means of the simulated values. In row 12, we check that the estimated wedge is not driven by outliers by reporting the median simulated wedge instead. The estimated medians are similar in magnitude to our main estimates.

As noted in Section 3.1, Appendix Table A1 shows minor demographic imbalances in our sample compared to the US population. To address this, we construct post-stratification weights using a raking procedure based on all the variables in the table (DeBell and Krosnick 2009), and apply it in the last row of Table 3. The estimated wedge remains similar with larger standard errors.

4.3 The role of attitudes towards the government and programs

If social preferences towards tax-funded government expenditure plays a role in driving the wage-tax wedge, the wedge should be larger if the respondent is more politically-aligned with or has a better opinion of the government, or if the taxes fund programs that the respondent likes.[18] We examine this issue in three ways.

We start with what might be the simplest division in a two-party democracy like the US—political affiliation. Our survey was fielded when a Democrat president (President Biden) was in power, and our scenarios specified that taxes in the scenario were federal taxes. Hence, we expect Democrats to have greater government-related social preferences, leading to a larger wage-tax elasticity wedge. Table 4 Panel A shows that Democrats were weakly more likely to have a larger wage-tax elasticity wedge, but the difference is only marginally significant for the Marshallian and Hicksian elasticity wedges.

Political affiliation is a noisy measure of one's opinion of the government—Democrat-aligned respondents might still disapprove of the policies implemented by a Democrat ad-

[17] Responses submitted too quickly are generally associated with lower quality. While defining "too fast" is difficult, using a threshold relative to median time is frequently done in practice.

[18] We do not claim that tax-funded government expenditure is the only channel through which social preferences induce the wedge. While our vignette experiment shut down job- and environment-specific reasons (because we told respondents to assume that the jobs are identical to actual situations), social preferences related to reciprocity to the employer's (un)generosity (Krueger and Mas 2004; Gneezy and List 2006; Mas 2006; Kube et al. 2012, 2013; DellaVigna et al. 2022) or pay inequality and worker's morale (Cohn et al. 2014; Bracha et al. 2015; Breza et al. 2017; Huet-Vaughn 2017; Dube et al. 2019; Cullen and Perez-Truglia 2022) might also play a role.

ministration.[19] For this reason, Table 4 Panel B targets the opinions of the government directly by examining five measures that we included in our survey (two slightly different questions each, by design): satisfaction with the government and the way it spends tax money, whether the government has an important role to play, trust in the government, whether the respondent thought she benefitted from government policies, and whether the existing redistribution system is fair. We standardize the questions to be on the same scale, take the average score of the questions in each category, and dichotomize this average. The choice variable in the logit specification is whether the respondent preferred the scenario over the other. With the exception of *Importance of government*, all heterogeneity coefficients are positive, and most of the heterogeneity coefficients for the Frisch and Hicksian wedges are statistically or marginally significant as well.

The wedge should also be larger if taxes fund specific programs that respondents like. (In a similar vein, previous papers have found that the programs that taxes fund matters for tax compliance [Alm et al. 1993; Hall and Preston 2000; Giaccobasso et al. 2022; Falsetta et al. 2023].) To investigate this, the last two pairs of scenarios in our survey showed respondents randomly-drawn wages and work hours as before, but the randomly-drawn tax rates were now earmarked for a specific program (e.g. education). Appendix Figure A5 shows the instructions and layout. Each pair of scenarios received the same program, and the programs differed across pairs 9 and 10 for greater within-person variation.[20] The program-specific tax rate was drawn from a more restricted grid (2, 4, ..., 10 percent), and to maintain continuity with previous pairs, respondents were shown a general tax rate set at the center of the tax rate grid from previous scenarios.

Near the end of the survey (six screens later), we asked respondents how much they liked or disliked their tax money being used to fund five different programs, including these two. The five programs were randomly drawn from a list of ten US federal budget functions—we did not elicit opinions on the full list to minimize respondent burden. Liking was measured on a 5-point Likert scale, with the two extremes corresponding to "dislike a lot" and "like a lot" (we randomized the scale direction between respondents). To ensure that respondents understood the programs, we included a short description in both the last two pairs of vignettes and the liking questions. Appendix Figure A6 plots the mean liking of the ten programs that we use, additionally broken down by political affiliation. On average,

[19] In the months that we fielded the survey (February–June 2023), more Americans disapproved (56%) than approved (40%) of President Biden's job performance, suggesting disapproval even among Democrats. In fact, his approval rating achieved its lowest point (37%) in April 2023 (Gallup 2025).

[20] We elected not to show two programs on the same screen (i.e. in the same pair) to avoid experimenter effects. Assuming respondents focused on the decision between the two scenarios on the screen, different programs on different screens would avoid this.

respondents liked their tax monies being used for retirement-related programs the most (social security and Medicare) and international affairs (which includes international aid) the least, with Democrats liking tax-funded expenditure more than Republicans on all programs except for national defense. This pattern is broadly consistent with what one might expect and suggests that respondents were careful in their responses.

We model the general and specific tax rates separately in the utility function:

$$V\left(a_i, w_i, \tau, \sigma, N_i\right) = \max_{c_i, a_i', h_i} U\left(c_i, h_i, g_i, s_i\right) + \beta E\left[V\left(a_i', w_i', \tau', \sigma', N_i'\right)\right] \tag{11}$$

$$\text{s.t. } c_i + \frac{1}{1+r} a_i' = a_i + \left(1 - \tau - \sigma\right) w_i h_i + N_i, \tag{12}$$

$$g_i = \tau w_i h_i, \tag{13}$$

$$s_i = \sigma w_i h_i, \tag{14}$$

where the new terms s_i and σ stand for the program-specific taxes paid and tax rate respectively. (Appendix B.4 shows the functional forms for the elasticities based on this model.) Utility is parameterized with

$$\begin{aligned} U\left(c_{itj}, h_{itj}, g_{itj}, s_{itj}\right) = {} & \beta_c \log c_{itj} + \beta_h \log\left(\bar{L} - h_{itj}\right) + \beta_{cc}\left(\log c_{itj}\right)^2 \\ & + \beta_{hh}\left(\log\left(\bar{L} - h_{itj}\right)\right)^2 + \beta_{ch} \log c_{itj} \log\left(\bar{L} - h_{itj}\right) \\ & + \beta_g g_{itj} + \beta_s s_{itj}, \end{aligned} \tag{15}$$

$$\beta_l = \alpha_{0l} + \alpha_{1l} K_{it}, \quad l \in \{c, h, cc, hh, ch, g, s\}, \tag{16}$$

where K_{it} is respondent i's liking score for the program shown in pair t, modeled as a continuous variable.

Table 4 Panel C reports the relationship between the wage-tax elasticity wedge and liking score for the program, respectively. For better precision, we use the quality sample that excluded respondents who were inattentive, impatient, or responded too quickly from Section 4.2. As the table shows, the wage-tax elasticity wedge is larger if taxes go into funding programs that respondents like more, consistent with government-related social preferences driving our findings.

5 Government-related social preferences and the ETI

The vignette experiment allows us to experimentally manipulate wages and tax rates to obtain wage and net-of-tax rate elasticities for the same individuals. Its main drawback is that the result is based on stated preferences, and we have no way of verifying if the

respondents would make the same choices in the real labor market. (That said, estimates based on stated preferences have been shown to correspond to actual market decisions in several other settings [Mas and Pallais 2017; Wiswall and Zafar 2018; Parker and Souleles 2019; Maestas et al. 2023].) In this section, we examine correlational evidence between proxies for government-related social preferences and estimates of the ETI with respect to the net-of-tax rate collected by Neisser (2021).

We use the ETI meta-analysis for two reasons. First, ETI estimates should also be affected by government-related social preferences since they are always estimated using tax variation. Second, this literature has a sizable body of estimates with comparable methodologies. In contrast, the more mature labor supply elasticities literature has much greater variability in methods and modeling decisions, which makes comparability more difficult, and in some cases it is unclear if the variation comes from wage or tax changes.

In total, Neisser (2021) examined 61 studies covering 17 countries. We drop Israel (one study) from the list because it participated in only one wave of the WVS, and its inclusion of WVS questions was only partial in that wave. (Results including Israel are qualitatively similar.) We examine seven government-related social preferences proxies: trust in the government, political parties, parliament, and civil service; whether income should be made more equal (to proxy for a desire for redistribution); whether the government should increase its ownership of businesses (more state ownership implies a more important government), and national pride (a general state-related social preference). Question wording of the proxies are similar in the WVS and EVS, and all proxies appear in multiple waves. We collapse the proxies to the country-wave level, and match to Neisser's dataset based on the mean study year in the latter.

Empirically, we follow Neisser's main specification in column 6 of her Tables 2 and 3 with three modifications. First, we include the proxy for government-related social preferences. Second, we exclude her country group variable in order to exploit all variation across countries. Third, we combine both after- and before-deductions elasticities for more statistical power.[21] Note that using Neisser's specification means that we already control for a large number of study-related covariates (e.g. the estimation technique used).

Table 5 Panel A shows results based on this specification. In general, the proxies for government-related social preferences are negatively correlated with the ETI. Two proxies, the level of confidence in the civil service and the desire for equality in incomes, are not statistically significant, with the former significant at the 10% level. Significance level aside,

[21] The fact that the after-deductions ETI is larger than the before-deductions ETI—a key point in Neisser (2021)—is not relevant for our purposes. We therefore analyze both ETI types as one sample, include a dummy for whether the ETI is before- or after-deductions, and interact it with all control variables.

the negative correlations suggest that when people have more positive opinions on the functions of the government, the response of taxable income to increases in the tax rate becomes smaller.

Panel B of the table shows robustness checks, with each row showing a change in specification compared to that in Panel A. The first two rows show that estimates based on only after- or before-deductions elasticities are qualitatively similar to our main estimates. Correlations for the after-deductions elasticities in row 1 remain strong and slightly larger, consistent with after-deductions elasticities having more possible margins of responses—including avoidance responses like deductions-claiming and changes in the timing of income—that might still be affected by social preferences (Slemrod and Kopczuk 2002; Kopczuk 2005; Neisser 2021). That said, these avoidance margins do not drive the correlations entirely—while correlations for the before-deductions elasticities in row 2 are smaller in magnitude, they are all still negative, and several are statistically significant.

Differences in the ETIs can be driven by institutional differences as well, and these might drive the results if institutional factors are correlated with social preferences. In row 3, we control for six institutional factors noted in Neisser (2021): the Gini coefficient, the top 10 percent of income shares, whether the tax reform also introduced a top tax bracket, the unemployment rate, the fraction of self-employed, and the share of taxes that are exposed to third-party information reporting (Kleven et al. 2011, 2016). In row 4, we control for the share of public spending on the provision of child care, preschool, and elderly care. This variable is from Kleven (2014), who notes that these public goods are complementary to labor supply, and hence the mechanism could be due to the way that taxes are used rather than government-related social preferences. The correlations are robust to the inclusion of these variables.

Our main estimates exploit all variation across countries because repeat studies within a country are less common, and furthermore social preferences are unlikely to change in a big way over the time span available in the data. In the last two rows, we probe robustness by including country-group fixed effects that Neisser (2021) includes in some of her specifications, and further including time fixed effects, where time corresponds to the waves of the WVS. The correlations are still robust to the inclusion of these fixed effects.

6 Conclusion

This paper studies the implications of social preferences on the response of labor supply to wages and taxes. Using a vignette experiment, we show that when social preferences are incorporated in the canonical labor supply model, estimates of the labor supply elasticity

that exploit exogenous variation in wages are larger than those that exploit variation in tax rates. This wage-tax elasticity wedge is meaningfully large—in our main estimate, the frictionless Frisch wage elasticity is 1.5 times as large as the corresponding net-of-tax rate elasticity. This wedge would be even larger if income tax changes are less salient and induce under-reaction compared to wage changes. Furthermore, the wedge is larger if the respondent has a better opinion of the government, or if the taxes are earmarked for funding a program that the respondent likes better. In a complementary analysis, we find that estimates of the ETI with respect to the net-of-tax rates are correlated with proxies for government-related social preferences, consistent with people exhibiting social preferences when faced with real life labor market decisions.

Our results have implications for how we use estimates of the labor supply elasticity from the literature in model calibration. In particular, macroeconomic models frequently model the labor supply response to wage changes over the real business cycle. If a net-of-tax rate elasticity is used (e.g. from tax holiday natural experiments), the calibrated parameter would be too small, with implications for the possible recommendations made by such models.

Conversely, the profession is likely already using the correct elasticity when assessing tax changes—most quasi-experimental estimates tend to be net-of-tax rate elasticities. That said, incorporating government-related social preferences can still subtly alter model outcomes. In Appendix B.5, we replicate the main arguments in Piketty and Saez (2013) to draw two conclusions about optimal taxation. First, admitting government-related social preferences into individuals' utility functions naturally changes the social welfare function, and if social preferences are positive as our results suggest, optimal tax rates would be higher relative to a world without government-related social preferences. Intuitively, knowing that people have preferences on taxation beyond its immediate impact on disposable income means that the government can (and should) raise taxes. Second, heterogeneity in social preferences affects the optimal nonlinear tax rate. We leave further detailed explorations along this line for future work.

Lastly, our findings that the wedge (and the ETI) varies by opinion of the government and funded programs have tax policy implications. The tax morale literature emphasizes that attitudes towards government and programs affect tax compliance; we show such buy-in also reduces the distortionary effect of taxes on labor supply. This supports policies promoting government transparency and accountability—for example, highlighting how tax monies are used, or reminders that they fund services. To the extent that people have more positive attitudes towards local rather than geographically larger communities, our results also highlight an overlooked benefit of fiscal devolution (e.g. a review by Martinez-Vazquez et al. 2017 barely discusses labor responses). More speculatively, our findings also suggests

that tax collection practices that engender negative attitudes (e.g. differential opportunities to reduce or avoid tax liabilities, or distrusting tax systems described in Frey [1997]) are particularly harmful, because of their additional consequences for labor supply.

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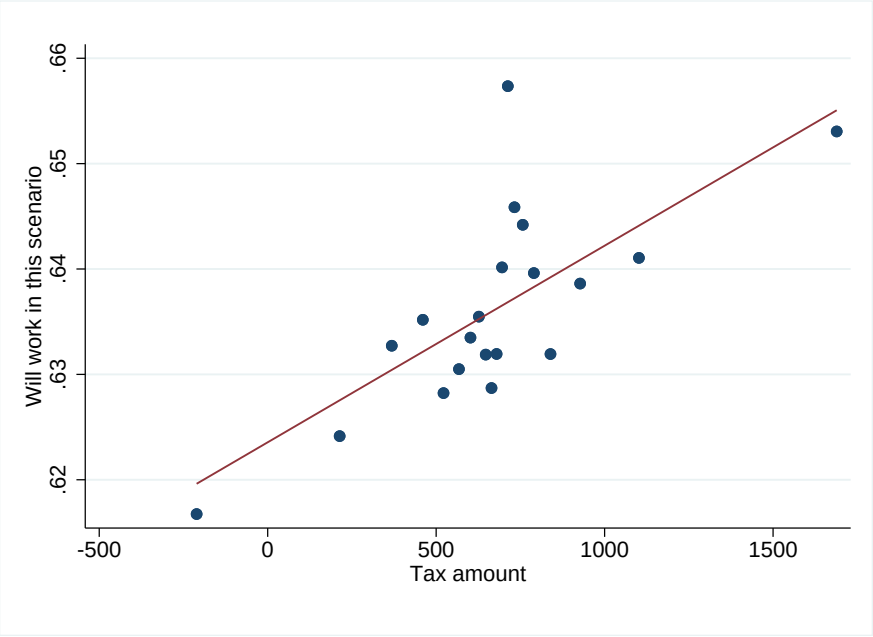
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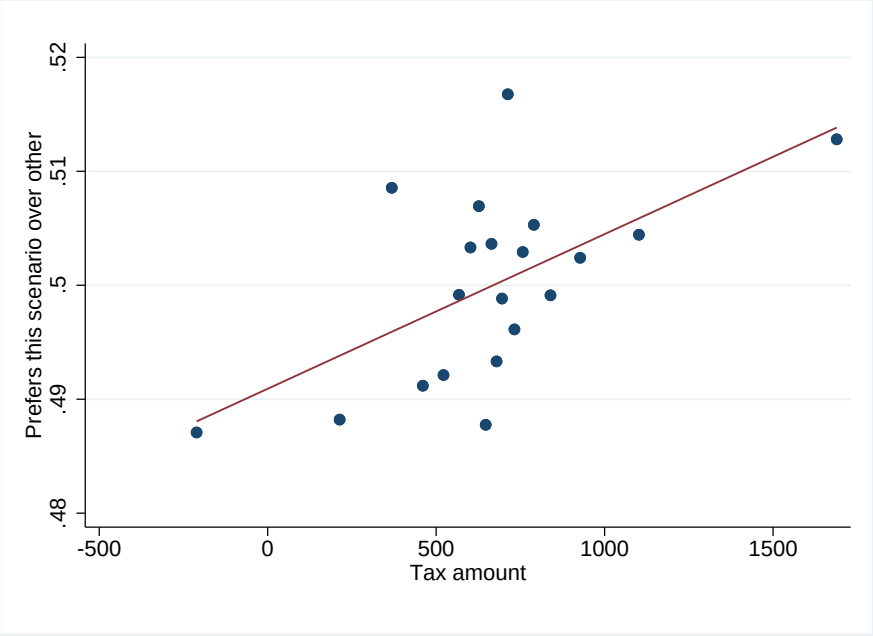
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Figure 1: Binscatter plots of choices made against tax amount

(a) Choice of work or not



(b) Choice of whether to pick the scenario over the other



Notes: The sample comprises respondent-pair-scenarios with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. The two panels show binscatter plots of the choices made by respondents against the amount of taxes paid in the scenario. In Panel A, the choice made is whether to work or not in the scenario. In Panel B, the choice made is whether the respondent preferred the scenario over the other in the pair. Both binscatter plots partial out individual, pair, and option fixed effects, as well as fixed effects for the interaction of the 200 quantiles of disposable income and all possible levels of work hours.

Table 1: Estimates of utility parameters

	Dependent variable:			
	Will work in this scenario		Prefers this scenario over other	
	(1)	(2)	(3)	(4)
Log(Consumption)	2.28	0.81	1.20	0.12
	(1.63)	(1.65)	(1.37)	(1.37)
Log(672 - Work hours)	219.6***	201.5***	143.9***	131.4***
	(20.7)	(20.9)	(13.5)	(13.6)
Log(Consumption) × Log(Consumption)	0.18***	0.17***	0.19***	0.18***
	(0.018)	(0.018)	(0.032)	(0.032)
Log(672 - Work hours) × Log(672 - Work hours)	-16.9***	-15.5***	-11.0***	-10.1***
	(1.63)	(1.65)	(1.07)	(1.07)
Log(Consumption) × Log(672 - Work hours)	-0.44*	-0.21	-0.30*	-0.13
	(0.25)	(0.25)	(0.18)	(0.18)
Part-time	-0.23***	-0.23***	-0.17***	-0.17***
	(0.056)	(0.057)	(0.036)	(0.036)
Tax paid ($1000)		1.02***		0.69***
		(0.13)		(0.054)
Tax paid ($1000) ^ 2		-0.24***		-0.16***
		(0.071)		(0.025)
Tax paid ($1000) ^ 3		0.015*		0.0092***
		(0.0085)		(0.0027)
Observations	36,032	36,032	80,422	80,422
Respondents	4,670	4,670	5,380	5,380
$E(U_g) \times 1,000$		0.77***		0.52***
$E(U_{gg} g_i) \times 1,000$		-0.23***		-0.15***
$E(U_g \mid \tau = 50\%) \times 1,000$		0.19***		0.14***
Log pseudo-likelihood	-8606.2	-8427.5	-21761.8	-21545.1

Notes: Standard errors clustered by respondents in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$. The sample comprises respondent-pair-scenarios with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. All variables are on a per-month basis. Estimates are based on a conditional (on respondent-pair) logit model, controlling for option fixed effects, an indicator for whether the scenario's weekly work hours is below 35, and a squared polynomial term in $\log(assets_i + spouseincome_i + savings_{itj})$, where $assets_i$ is the wealth in dollars of the individual, $spouseincome_i$ is the individual's spouse's income (or zero if not applicable), and $savings_{itj}$ is the after-tax disposable income less consumption for the scenario. Consumption is the imputed consumption for the scenario, see Section 3.2 for details. Work hours are the work hours for the scenario, so that 672 (the number of hours in 4 weeks) is the amount of leisure time for the scenario. Tax paid is amount of taxes to be paid for the scenario, in thousand dollars. $E(U_g)$ is the marginal utility with respect to tax-funded government expenditure, i.e. the derivative of the utility function with respect to g_i in Equation (8), computed using the estimated parameters in the table and the actual values reported (for non-tax variables) or simulated (for taxes paid and tax rates) by the respondent, averaged over respondents in the sample (one per respondent). $E(U_{gg} g_i)$, which measures the curvature of the social preferences function, is the similarly-computed second-order derivative multiplied by the product of the simulated tax rate, reported hourly wage, and reported work hours of the respondent. $E(U_g \mid \tau = 50\%)$ is computed similar to $E(U_g)$, except that it is computed at a tax rate of 50% instead of the actual tax rate. We multiply utility derivatives by 1,000 to ease interpretation. Standard errors are computed using the delta method.

Table 2: Elasticities of labor supply

	Based on dep. var.: Will work in this scenario		Based on dep. var.: Prefers this scenario over other	
	No social preferences (1)	With social preferences (2)	No social preferences (3)	With social preferences (4)
Panel A: Marshallian elasticity of labor supply with respect to:				
Wage	-0.12***	-0.10***	-0.11***	-0.095***
	(0.012)	(0.012)	(0.016)	(0.016)
Net-of-tax rate	-0.12***	-0.38***	-0.11***	-0.34***
	(0.012)	(0.024)	(0.016)	(0.021)
Wage-tax elasticity wedge	0	0.27***	0	0.24***
	(.)	(0.025)	(.)	(0.019)
Panel B: Hicksian elasticity of labor supply with respect to:				
Wage	0.42***	0.47***	0.50***	0.54***
	(0.019)	(0.021)	(0.021)	(0.022)
Net-of-tax rate	0.42***	-0.26***	0.50***	-0.078*
	(0.019)	(0.055)	(0.021)	(0.041)
Wage-tax elasticity wedge	0	0.73***	0	0.62***
	(.)	(0.062)	(.)	(0.045)
Panel C: Frisch elasticity of labor supply with respect to:				
Wage	1.29***	1.21***	1.84***	1.74***
	(0.11)	(0.10)	(0.15)	(0.14)
Net-of-tax rate	1.29***	0.64***	1.84***	1.15***
	(0.11)	(0.085)	(0.15)	(0.11)
Wage-tax elasticity wedge	0	0.57***	0	0.59***
	(.)	(0.068)	(.)	(0.063)
Respondents	4,670	4,670	5,380	5,380

Notes: Each cell shows the average simulated elasticity or difference in elasticities based on the model specified in the column header. The sample comprises respondents with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. Elasticities and differences are simulated using the parameters of the model (shown in Table 1), at the reported (for non-tax variables) or tax-simulated values of each respondent (one for each respondent), and then averaged over respondents. In each panel, the wage-tax elasticity wedge is the wage elasticity less the net-of-tax rate elasticity. Standard errors computed by delta method in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$.

Table 3: Robustness of the wage-tax elasticity wedge

		Wage-tax elasticity wedge		
		Marshallian (1)	Hicksian (2)	Frisch (3)
0	Main estimates	0.24***	0.62***	0.59***
		(0.019)	(0.045)	(0.063)
1	Fifth order polynomial in g_i	0.21***	0.63***	0.50***
		(0.019)	(0.045)	(0.071)
2	g_i interacted with $\log(c_i)$ and $\log(\bar{L} - h_i)$	-0.0074	0.38***	0.46***
		(0.050)	(0.059)	(0.097)
3	Quadratic utility	0.43***	0.62***	0.57***
		(0.040)	(0.049)	(0.12)
4	β_c and β_h varies with individual characteristics	0.23***	0.59***	0.56***
		(0.018)	(0.043)	(0.060)
5	Social preferences function is $v(g_i, \tau)$	0.40***	1.65***	1.21***
		(0.025)	(0.090)	(0.14)
6	Using non-imputed consumption	0.26***	0.64***	0.73***
		(0.024)	(0.056)	(0.10)
7	Consumption imputed based on Empirical Bayes	0.083***	0.21***	0.38***
		(0.010)	(0.024)	(0.071)
8	No $\log(assets_i + spouseincome_i + savings_{itj})$ controls	0.42***	1.18***	0.98***
		(0.029)	(0.083)	(0.084)
9	Exclude pairs since observation of the intransitivity prompt	0.23***	0.61***	0.53***
		(0.019)	(0.045)	(0.059)
10	Exclude respondents who ever made an intransitive choice	0.23***	0.61***	0.54***
		(0.020)	(0.046)	(0.062)
11	Exclude inattentive or impatient or speeding respondents	0.19***	0.49***	0.43***
		(0.019)	(0.045)	(0.052)
12	Median estimate	0.24***	0.62***	0.59***
		(0.018)	(0.047)	(0.057)
13	Reweight for demographics	0.23***	0.64***	0.58***
		(0.036)	(0.086)	(0.13)

Notes: Standard errors computed by delta method in parentheses, unless stated otherwise below. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$. Each cell shows the average simulated difference in elasticities (wage elasticity minus net-of-tax rate elasticity), estimated analogous to Table 2, column 4, repeated in Row 0. Each row shows a specification deviation Row 0. Row 1: The utility function uses a fifth-order polynomial in the tax-funded government expenditure. Row 2: The utility function interacts tax-funded government expenditure with log consumption and leisure. Row 3: The utility function uses a quadratic utility specification instead of a translog specification. Row 4: The utility function models heterogeneity in the main coefficients of consumption and leisure. Specifically, these two coefficients are allowed to vary linearly with sex, marital status (married or not), sex interacted with marital status, a quadratic in log age, a quadratic in the number of children in the family (top-coded at 9), an indicator for education level of high-school graduate or less, and an indicator for education level of four-year college degree or more. Row 5: The utility function is Equation 8 plus an additional interaction between g_i and the scenario tax rate τ. Row 6: We restrict the sample to pairs 5 to 8 and use the (non-imputed) consumption information of each scenario directly. Row 7: We use empirical Bayes prediction as an alternative imputation method for consumption. Specifically, we allow the coefficient on log take-home earnings to be random, and add (non-random) interactions of the log take-home earnings with each of sex, marital status, sex interacted with marital status, an indicator for high-school graduate or less, an indicator for four-year college degree or more, a quadratic in log age, and a quadratic in the number of children in the family. Row 8: We do not control for the quadratic in the log of the sum of assets, spousal income, and the scenario's savings. Row 9: Our survey shows text below the question grid that informs respondents about possible intransitivity in choices when committed; this row uses only pairs before observation of the text. Row 10: We exclude respondents who ever made an intransitive choice. Row 11: We exclude respondents who were inattentive in our two attention check questions, clicked "next" more than twenty times when viewing the instruction slides, or answered any of the overall, vignette, and government expenditure liking questions in less than half the median time. Row 12: We report the median simulated wage-tax elasticity wedge instead of the mean. Standard errors in this row are bootstrapped standard errors based on 199 replications clustered at the respondent level. Row 13: We weight the estimation and simulated differences using post-stratification weights constructed based on the variables in Appendix Table A1.

Table 4: The effect of attitudes towards government and programs on the wedge

	Average partial effect of the specified heterogeneity variable on the wage-tax elasticity wedge		
	Marshallian (1)	Hicksian (2)	Frisch (3)
Panel A: Effect of political affiliation on the wedge			
Respondent is Democrat	0.032*	0.070*	0.13**
	(0.017)	(0.041)	(0.062)
Number of Respondents	4,994	4,994	4,994
Panel B: Effect of attitudes towards the government on the wedge			
General opinion of government	0.045**	0.12**	0.26***
	(0.021)	(0.048)	(0.085)
Importance of government	-0.0041	0.0054	0.017
	(0.019)	(0.044)	(0.060)
Trust in government	0.044	0.16**	0.29**
	(0.029)	(0.068)	(0.13)
Programs benefit people like me	0.042*	0.11**	0.17**
	(0.024)	(0.056)	(0.083)
Government revenue allocation is fair	0.047***	0.12***	0.20***
	(0.018)	(0.042)	(0.065)
Number of Respondents	5,380	5,380	5,380
Panel C: Effect of liking the program that taxes fund on the wedge			
Likes program funded by taxes	0.15**	0.41**	0.40*
	(0.071)	(0.19)	(0.21)
Number of Respondents	3,136	3,136	3,136

Notes: Standard errors computed by delta method in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$. Estimation method follows that of Table 2 column 4; details for the estimation method and specifications are in Section 3.3 (for Panels A and B), Section 4.3 (for Panel C) and Appendix B.4 (for Panel C). Sample for Panels A and B is that from Table 2 column 4, additionally excluding respondents who reported *Non-Affiliated* or *Others* political affiliations for Panel A; sample for Panel C is the same sample excluding respondents who failed either of two inattention check questions, clicked "next slide" more than 20 times in the instructions slides, or answered any of the overall, vignette, and government expenditure liking questions in less than half the median time taken by all respondents. Each cell shows the average partial effect of the heterogeneity variable specified in the row title on the wage-tax elasticity wedge (type specified in the column title). For Panel C, the net-of-tax rate elasticity used for computing the wedge is specific to the program of the vignette. The heterogeneity variable in Panel A equals 1 if the respondent considered himself to be a Democrat, and 0 if he considered himself to be a Republican or Independent. Each heterogeneity variable in Panel B is constructed by standardizing each of the two questions such that the extreme positive score (e.g. strongly agree) equals 1 and the extreme negative score (e.g. strongly disagree) equals -1, taking the average of the two scores, and then dichotomizing such that average scores above zero equals 1 (and zero otherwise). The liking of a program in Panel C was elicited on a 5-point Likert scale (5 being liking the program the most), and is modeled as a continuous variable.

Table 5: The relationship between government-related social preferences and the elasticity of taxable income

	Dependent variable: ETI. Government-related social preferences proxy is:						
	Confidence in government	Confidence in political parties	Confidence in parliament	Confidence in civil service	Income should be made more equal	Gvt should increase ownership of businesses	Proud to be a citizen
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Main estimates							
Gvt-related social preferences proxy	-0.50***	-0.36***	-0.41***	-0.49*	-0.047	-0.16**	-0.37***
	(0.079)	(0.073)	(0.12)	(0.25)	(0.057)	(0.078)	(0.13)
Observations	1,701	1,701	1,701	1,701	1,701	1,701	1,701
Number of studies	60	60	60	60	60	60	60
Panel B: Robustness							
1 After-deduction elasticities only	-0.53***	-0.38***	-0.46***	-0.76**	-0.051	-0.30**	-0.48*
	(0.082)	(0.074)	(0.13)	(0.36)	(0.12)	(0.11)	(0.25)
2 Before-deduction elasticities only	-0.36***	-0.28	-0.23*	-0.19	-0.044	-0.00071	-0.28***
	(0.12)	(0.17)	(0.12)	(0.11)	(0.046)	(0.053)	(0.097)
3 Include Neisser's contextual factors	-0.44***	-0.48***	-0.48***	-0.73***	-0.12	-0.21***	-0.010
	(0.078)	(0.091)	(0.072)	(0.21)	(0.094)	(0.060)	(0.12)
4 Control for labor share subsidy	-0.54***	-0.42***	-0.50***	-0.56**	0.012	-0.14	-0.38**
	(0.092)	(0.073)	(0.12)	(0.25)	(0.038)	(0.088)	(0.14)
5 Include country-group FE	-0.51***	-0.36***	-0.41***	-0.42	-0.027	-0.24***	-0.28*
	(0.089)	(0.082)	(0.15)	(0.29)	(0.061)	(0.083)	(0.15)
6 Include country-group and time FE	-0.54***	-0.42***	-0.43***	-0.68*	-0.042	-0.31***	-0.29
	(0.080)	(0.064)	(0.14)	(0.38)	(0.10)	(0.11)	(0.20)

Notes: Standard errors clustered by study in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$. The sample comprises all ETI estimates in Neisser (2021), excluding one study from Israel that participated in only one wave of the WVS. The government-related social preferences proxies are country-wave level averages from the WVS and the EVS (Inglehart et al. 2022; EVS 2022); we match observations to the nearest WVS or EVS year using the mean study year. All estimates control for the regression technique used (five possible categories, including the omitted base category), whether and how the study controls for income (five categories), the difference length (e.g. 1 year) for the first-differences technique used in estimation (4 categories), whether the study weights by income, whether the study restricts the sample by age, the income restriction used by the study if any (five categories), the publication decade (3 categories), and the decade that the tax policy changed (three categories). See Neisser's Table 2 and 3 column 6 for further details on the above variables. All estimates additionally control for whether the elasticity is a after-deductions (AD) or before-deductions (BD) elasticity, and the interactions of this dummy variable with all control variables listed above. Panel A shows the main estimates; Panel B shows robustness estimates that deviate in the specified manner. Rows 1 and 2: The sample is restricted to AD and BD elasticities respectively, and we no longer control for the AD-or-BD dummy and its interactions. Row 3: We additionally control for all contextual factors except the top 1% income share from Neisser's Table 5 and their interactions with the AD-or-BD dummy. Row 4: We additionally control for the share of public spending on the provision of child care, preschool, and elderly care, available in Kleven (2014), and it's interaction with AD-or-BD dummy. Row 5: We include the country-group FEs and their interactions with AD-or-BD dummy. Row 6: We include the fixed effects from Row 5, and additionally include FEs for the year ranges 1981–1984, 1989–1993, 1994–1998, 1999-2004, 2005–2009, 2010–2014, 2017–2022 (and their interactions with the AD-or-BD dummy). These years are WVS survey years, and the five EVS surveys match (uniquely) to the first, second, fourth, fifth, and seventh year ranges.

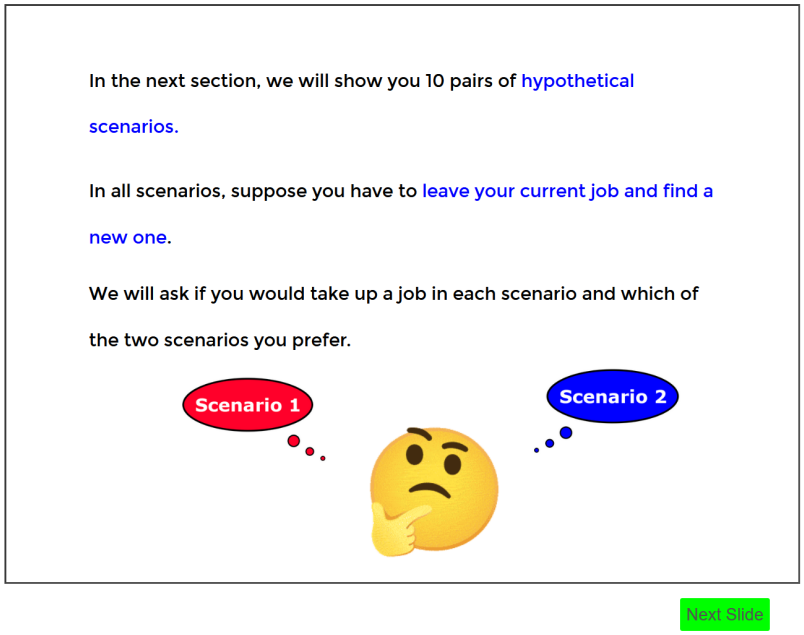
Online Appendix for
Wages, taxes, and labor supply elasticities: The role of social preferences

By Janjala Chirakijja and Pinchuan Ong

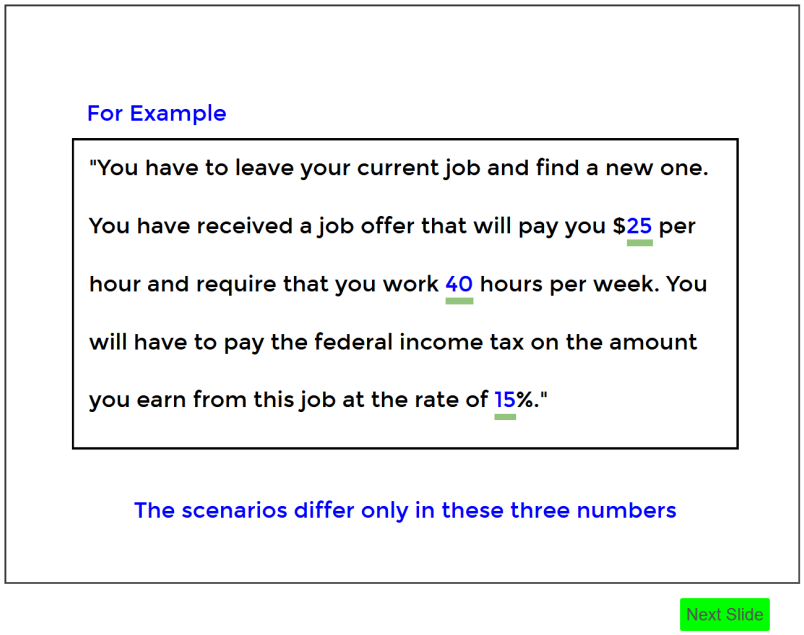
A Appendix tables and figures

Appendix Figure A1: First two instructional slides

(a) Slide 1



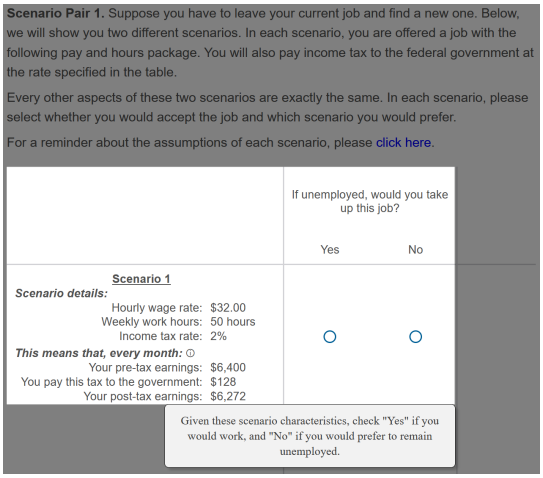
(b) Slide 2



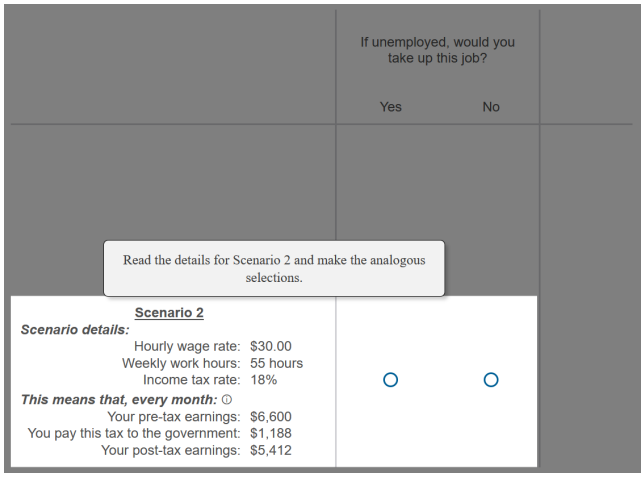
Notes: The figure shows the first two slides presented to respondents. Sentences appeared at 250 words per minute (between the usual reading and speaking speed), and the "Next Slide" button was grayed out (i.e., not responsive) until all the text had appeared.

Appendix Figure A2: Example of scenarios presentation for pairs 1 to 4

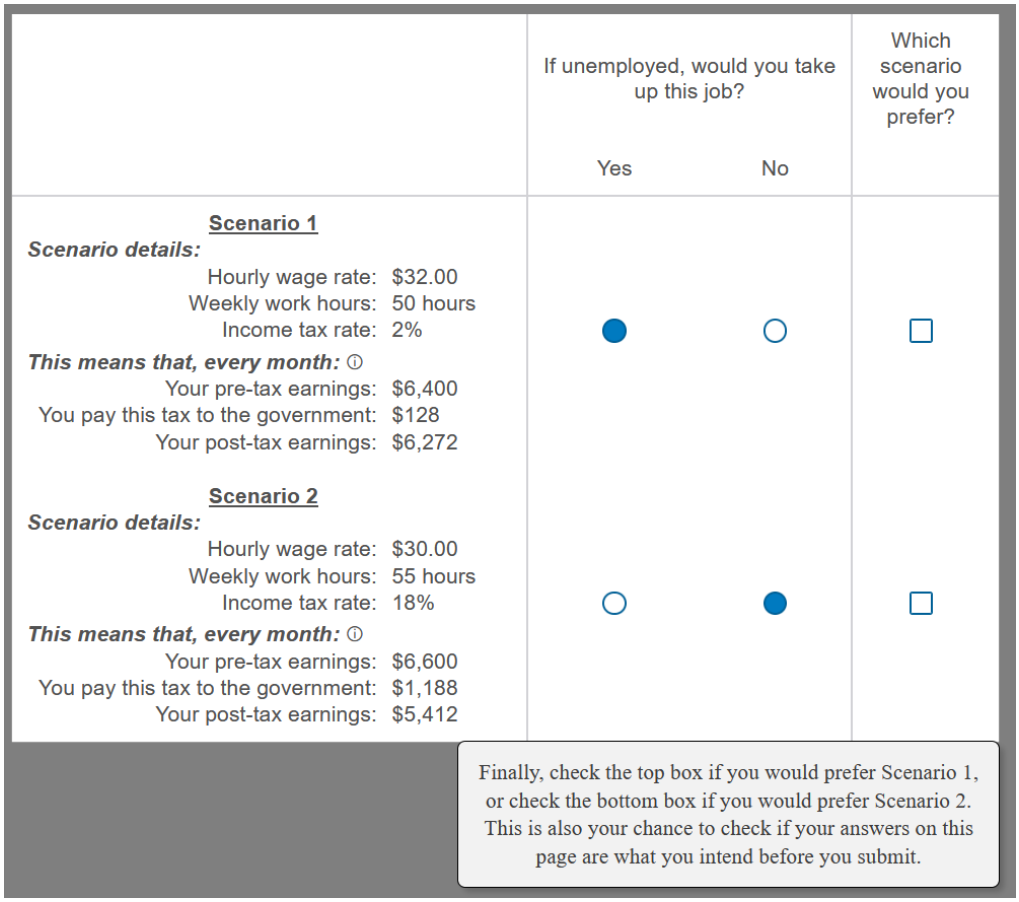
(a) Work or not in first scenario



(b) Work or not in second scenario



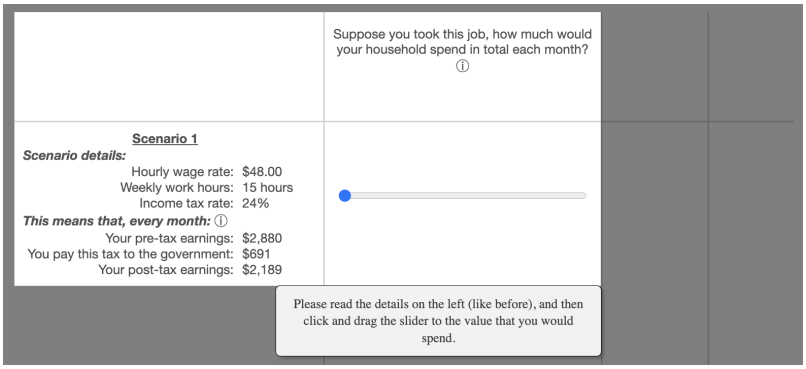
(c) Choice between scenarios



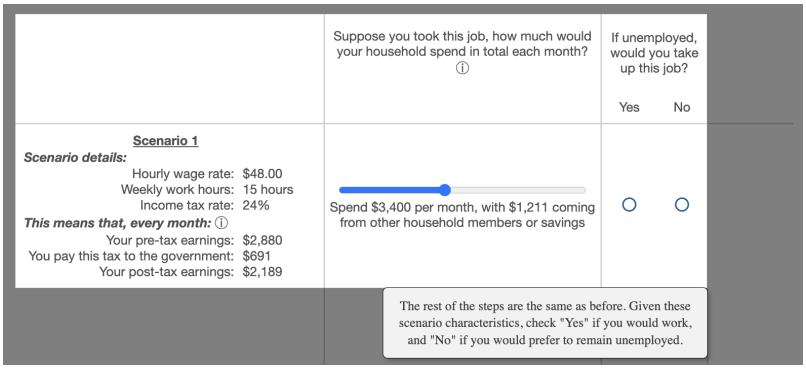
Notes: The figure shows an example of the scenario presentation for pairs 1 to 4. Panels A and B shows that the other scenario of the pair was hidden when the respondent was asked to make a choice of whether to work or not. Panel C shows that both scenarios were shown again when the respondent was asked to choose between the two. The guided website tour (white focus on black background, with explanatory text) was shown only in pair 1 of the first four pairs.

Appendix Figure A3: Example of scenarios presentation for pairs 5 to 8

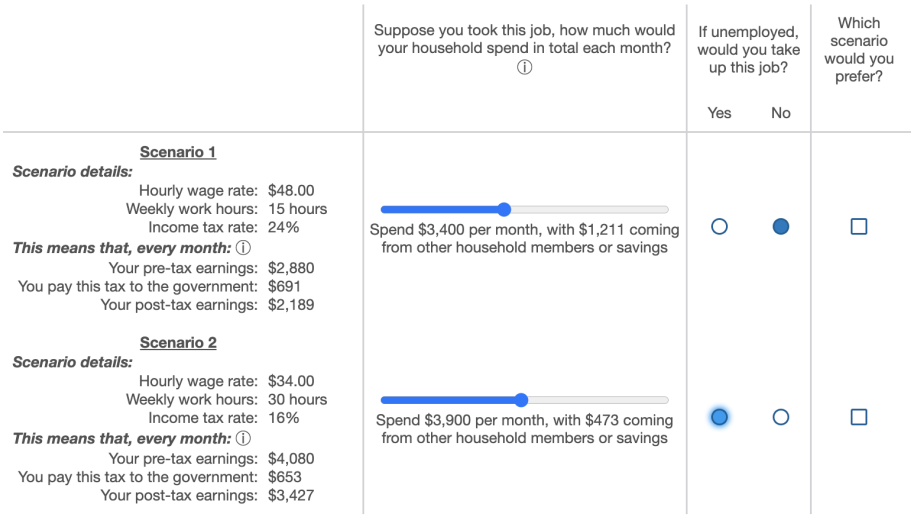
(a) Consumption amount



(b) Work or not



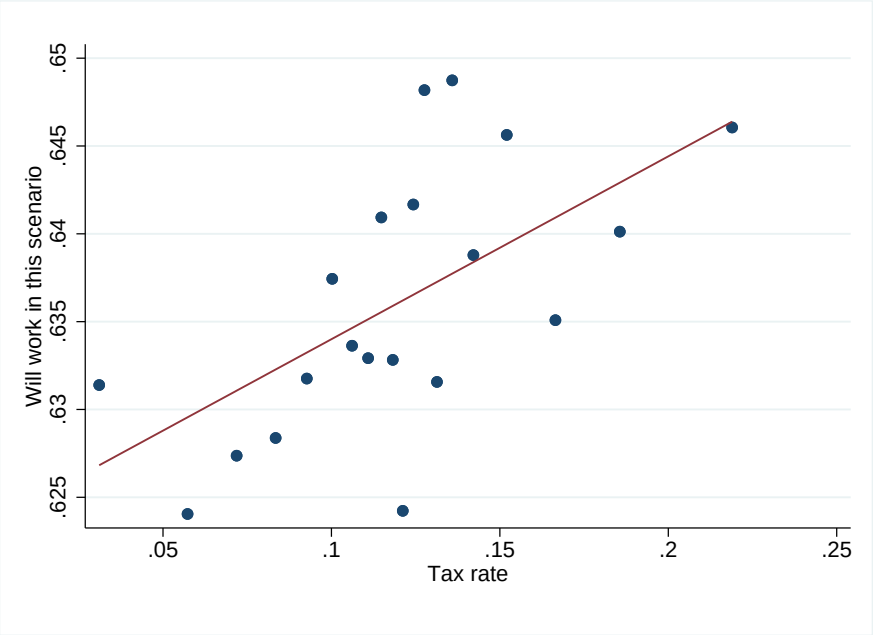
(c) Choice between scenarios



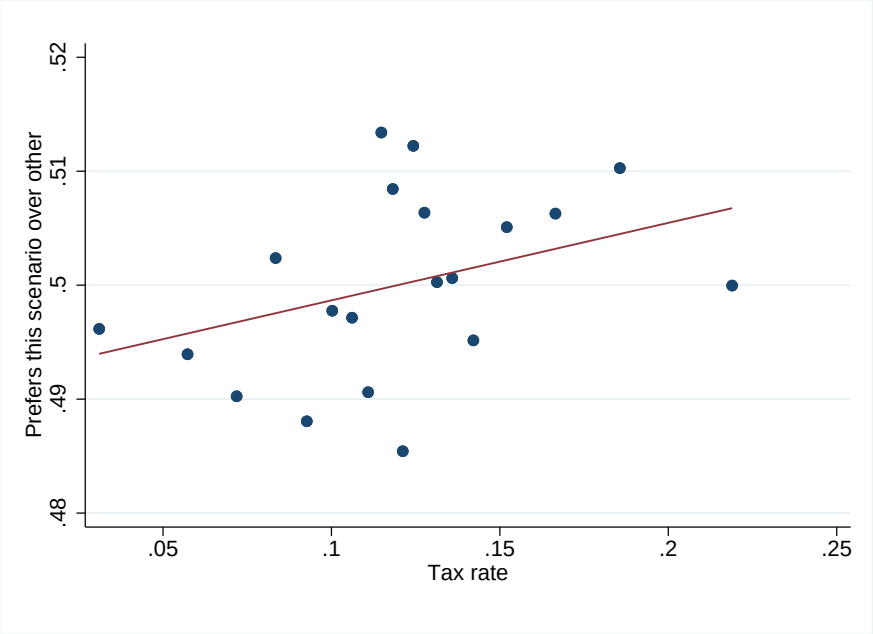
Notes: The figure shows an example of the scenario presentation for pairs 5 to 8, omitting a repeat of the instructions shown above the questionnaire matrix. Panels A and B show that the choice of whether to work was hidden when eliciting the amount of consumption using the slider bar shown, and revealed only after the respondent made the consumption choice. The second scenario was hidden when the respondent made choices for the first, and vice versa, analogous to Appendix Figure A2. Panel C shows the full layout, revealed only when the respondent was asked to choose between the two scenarios. The guided website tour (white focus on black background, with explanatory text) was shown only in pair 5 of pairs 5 to 8.

Appendix Figure A4: Binscatter plots of choices made against tax rate

(a) Choice of work or not



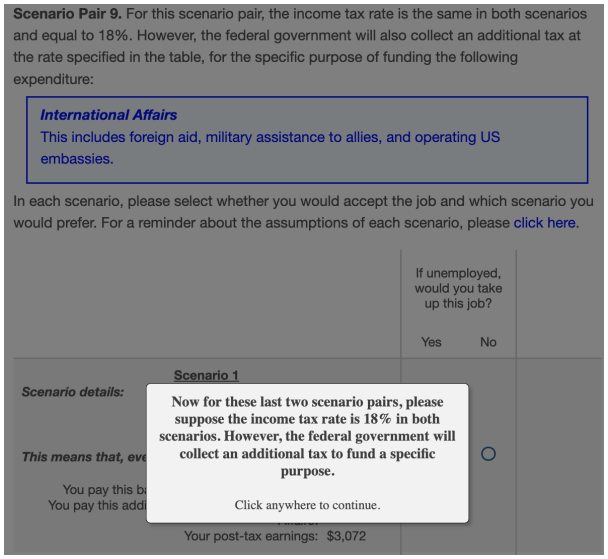
(b) Choice of whether to pick the scenario over the other



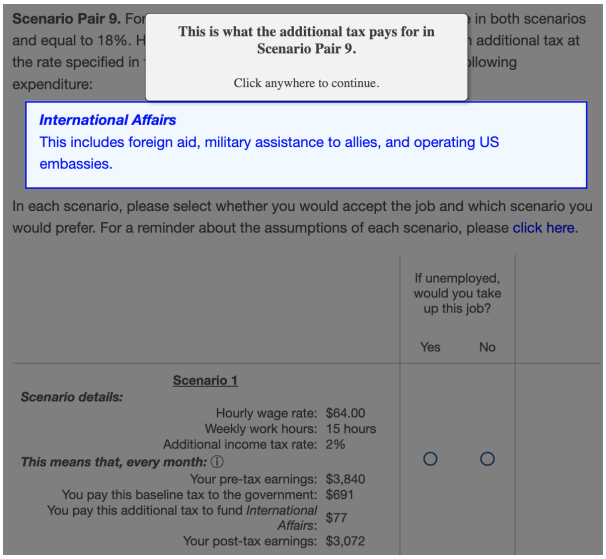
Notes: The sample comprises respondent-pair-scenarios with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. The two panels show binscatter plots of the choices made by respondents against the tax rate of the scenario. In Panel A, the choice made is whether to work or not in the scenario. In Panel B, the choice made is whether the respondent preferred the scenario over the other in the pair. Both binscatter plots partial out individual, pair, and option fixed effects, as well as fixed effects for the interaction of the 200 quantiles of disposable income and all possible levels of work hours.

Appendix Figure A5: Example of scenarios presentation for pairs 9 and 10

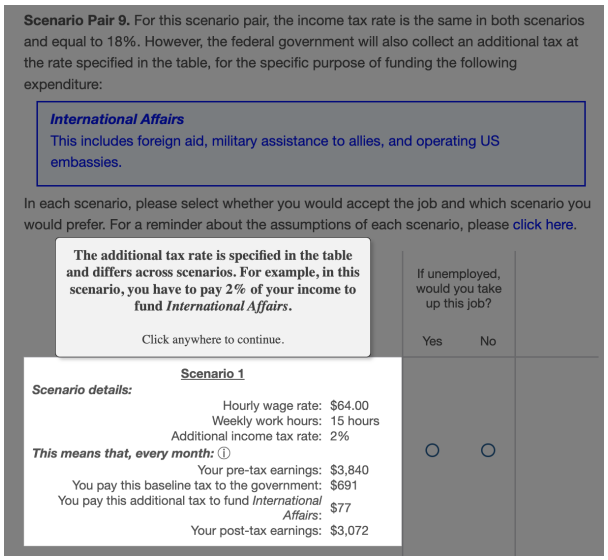
(a) Screen on entering the ninth pair



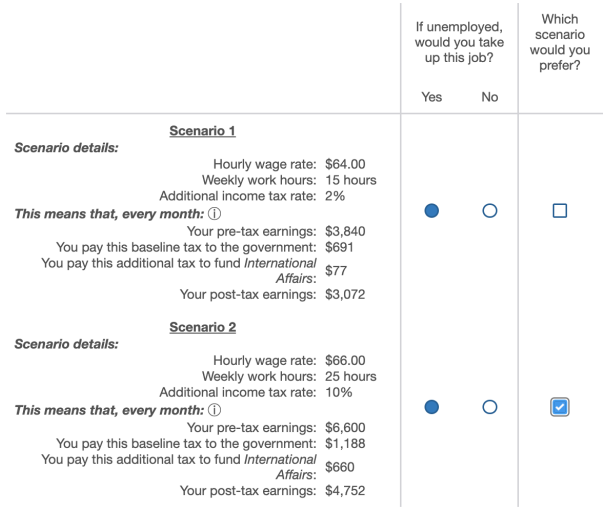
(b) First transition of website tour



(c) Second transition of website tour

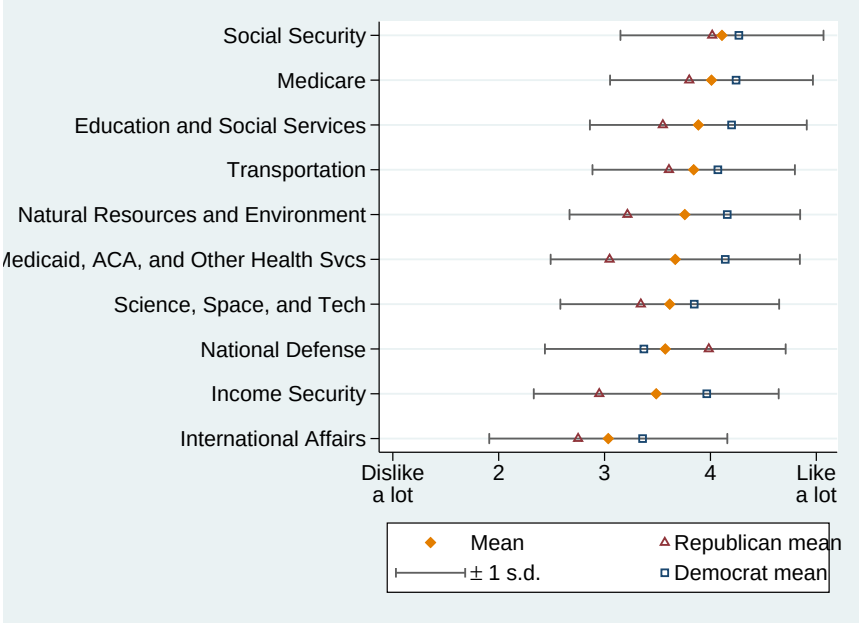


(d) Full matrix



Notes: The figure shows an example of the scenario presentation for pairs 9 and 10. Panels A shows the instructions displayed on entering the ninth pair. Panels B and C similarly show the information that we highlighted to respondents on the first two transitions of the guided website tour. Panel D shows the full layout. The second scenario was hidden when the respondent made choices for the first, and vice versa, analogous to Appendix Figure A2. The transition in Panel B was also displayed in pair 10 to highlight the new program that the change in program being funded.

Appendix Figure A6: How much respondents like government programs



Notes: The figure shows means and standard deviations of responses to the question "To what extent do you like or dislike that your tax money is used to fund each [federal government spending] category?" The sample comprises respondents with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. Each respondent received five of the ten categories shown. Each category was displayed with a tooltip which, on mouse hover, would provide more details. Republican (Democrat) mean indicates the mean computed among respondents who reported a Republican (Democrat) political affiliation.

Appendix Table A1: Survey sample and U.S. population characteristics

	U.S. Population	Survey Sample
Male	0.52	0.51
25-34 years old	0.29	0.28
35-44 years old	0.27	0.26
45-54 years old	0.24	0.24
55+ years old	0.21	0.22
0-19,999 dollars	0.12	0.08
20,000-39,999 dollars	0.23	0.24
40,000-59,999 dollars	0.23	0.27
60,000-99,999 dollars	0.24	0.28
100,000+ dollars	0.18	0.13
Four-year college degree or more	0.43	0.60
High-school graduate or less	0.31	0.12
Married	0.61	0.52
White	0.76	0.82
Black	0.12	0.08
Asian	0.08	0.07
Others	0.04	0.04
Hispanic	0.20	0.09
Republican	0.30	0.27
Democrat	0.29	0.40
Independent	0.38	0.26
Voted for Biden in the 2020 presidential election	0.51	0.51
Voted for Trump in the 2020 presidential election	0.47	0.32
Sample Size		5,439

Notes: This table presents statistics for the overall U.S. population aged 25-64 who are employed and compares them to the characteristics of our survey respondents. National statistics on gender, age, income brackets, education, marital status, and race are from the IPUMS Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS) data set for 2022 (Flood et al. 2022). National statistics on party affiliation for May 2023 are from Gallup (2023). Note that these statistics are based on surveys of adults 18 years and older and are not restricted to employed individuals. Presidential election results from 2020 are from Leip (2023).

Appendix Table A2: Horse-race regression of consumption and earnings

	Log(consumption) (1)
Log(Take-home earnings)	0.37***
	(0.036)
Log(Pre-tax earnings)	0.024
	(0.036)
Observations	43494
Respondents	5439

Notes: Standard errors clustered by respondents in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$. The sample comprises respondent-pair-scenarios with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. The specification controls for individual, pair, and scenario order fixed effects.

Appendix Table A3: Reduced form evidence for social preferences

	Dependent variable:	
	Will work in this scenario (1)	Prefers this scenario over other (2)
Tax paid ($1000)	0.019***	0.014***
	(0.0036)	(0.0045)
Observations	86,875	86,878
Respondents	5,439	5,439

Notes: Standard errors clustered by respondents in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$. The sample comprises respondent-pair-scenarios with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. All columns control for individual, pair, and scenario order fixed effects. All columns also control non-parametrically for disposable income and work hours by including fixed effects for the interaction of the 200 quantiles of disposable income and all possible levels of work hours, and these fixed effects interacted (separately) with disposable income and work hours.

Appendix Table A4: Reduced form evidence for social preferences based on tax rate

	Dependent variable:	
	Will work in this scenario (1)	Prefers this scenario over other (2)
Tax rate	0.10***	0.068*
	(0.032)	(0.038)
Observations	86,875	86,878
Respondents	5,439	5,439

Notes: Standard errors clustered by respondents in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$. The sample comprises respondent-pair-scenarios with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. Tax rate (the main regressor) is on a 0-to-1 scale. All columns control for individual, pair, and scenario order fixed effects. All columns also control non-parametrically for disposable income and work hours by including fixed effects for the interaction of the 200 quantiles of disposable income and all possible levels of work hours, and these fixed effects interacted (separately) with disposable income and work hours.

Appendix Table A5: Elasticities of labor supply based on a quadratic utility specification

	Based on dep. var.: Will work in this scenario		Based on dep. var.: Prefers this scenario over other	
	No social preferences (1)	With social preferences (2)	No social preferences (3)	With social preferences (4)
Panel A: Marshallian elasticity of labor supply with respect to:				
Wage	0.41***	0.41***	0.59***	0.57***
	(0.076)	(0.074)	(0.074)	(0.060)
Net-of-tax rate	0.41***	-0.047	0.59***	0.14***
	(0.076)	(0.049)	(0.074)	(0.047)
Wage-tax elasticity wedge	0	0.46***	0	0.43***
	(.)	(0.054)	(.)	(0.040)
Panel B: Hicksian elasticity of labor supply with respect to:				
Wage	0.67***	0.68***	0.83***	0.83***
	(0.044)	(0.044)	(0.054)	(0.051)
Net-of-tax rate	0.67***	-0.031	0.83***	0.21***
	(0.044)	(0.056)	(0.054)	(0.054)
Wage-tax elasticity wedge	0	0.71***	0	0.62***
	(.)	(0.062)	(.)	(0.049)
Panel C: Frisch elasticity of labor supply with respect to:				
Wage	1.06***	0.96***	1.40***	1.35***
	(0.11)	(0.11)	(0.13)	(0.50)
Net-of-tax rate	1.06***	0.40***	1.40***	0.78
	(0.11)	(0.11)	(0.13)	(0.59)
Wage-tax elasticity wedge	0	0.56***	0	0.57***
	(.)	(0.070)	(.)	(0.12)
Respondents	4,670	4,670	5,380	5,380

Notes: Each cell shows the average simulated elasticity or difference in elasticities based on the model specified in the column header. The sample comprises respondents with valid in-vignette consumption data, excluding respondents in the top and bottom 5 percent of actual work hours, consumption, and simulated tax rate. Elasticities and differences are simulated using the procedure analogous to those in Table 2, with utility specification $U(c_i, h_i, g_i) = \beta_c c_i + \beta_h\left(\bar{L} - h_i\right) + \beta_{cc} c_i^2 + \beta_{hh}\left(\bar{L} - h_i\right)^2 + \beta_{ch} c_i\left(\bar{L} - h_i\right) + \beta_g g_i + \beta_{gg} g_i^2 + \beta_{ggg} g_i^3$ in place of that in Equation (8). In each panel, the wage-tax elasticity wedge is the wage elasticity less the net-of-tax rate elasticity. Standard errors computed by delta method in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$.

Appendix Table A6: Elasticities of labor supply, by sex and marital status

	Subsample:			
	Non-married men (1)	Non-married women (2)	Married men (3)	Married women (4)
Panel A: Marshallian elasticity of labor supply with respect to:				
Wage	-0.20***	-0.17***	-0.10***	0.023
	(0.015)	(0.013)	(0.014)	(0.015)
Net-of-tax rate	-0.43***	-0.39***	-0.29***	-0.24***
	(0.020)	(0.019)	(0.021)	(0.023)
Wage-tax elasticity wedge	0.23***	0.23***	0.19***	0.26***
	(0.020)	(0.019)	(0.021)	(0.024)
Panel B: Hicksian elasticity of labor supply with respect to:				
Wage	0.49***	0.51***	0.50***	0.49***
	(0.018)	(0.018)	(0.021)	(0.018)
Net-of-tax rate	-0.11**	-0.077	-0.059	-0.11**
	(0.049)	(0.051)	(0.043)	(0.049)
Wage-tax elasticity wedge	0.60***	0.59***	0.56***	0.60***
	(0.050)	(0.050)	(0.045)	(0.050)
Panel C: Frisch elasticity of labor supply with respect to:				
Wage	2.01***	2.06***	1.60***	2.01***
	(0.20)	(0.19)	(0.16)	(0.20)
Net-of-tax rate	1.30***	1.38***	1.22***	1.30***
	(0.16)	(0.17)	(0.14)	(0.16)
Wage-tax elasticity wedge	0.71***	0.68***	0.38***	0.71***
	(0.072)	(0.065)	(0.067)	(0.072)
Respondents in subsample	1,304	1,251	1,456	1,304

Notes: Each cell shows the average simulated elasticity or wage-tax elasticity wedge in elasticities for the subsample specified in the column header. To compute the elasticities and wedge, we first estimate the extended model from Table 3 row 4, and then simulate the elasticities and wedges for the indicated subsample at the reported (for non-tax variables) or tax-simulated values of each respondent (one for each respondent), and then averaged over respondents. Standard errors computed by delta method in parentheses. Asterisks denote significance: * $p < .10$, ** $p < .05$, *** $p < .01$.

B Derivations

B.1 Micro-foundation of our main model

In this section, we elaborate the utility function to explicitly include social preferences from the tax contribution of other people. We show that the model simplifies to our main model used in Section 2 given an assumption that is likely to hold in our vignette experiment.

In any time period, a person with initial assets level a_i chooses consumption c_i, next period assets a_i', and labor supply h_i to solve the utility maximization problem

$$V\left(a_i, w_i, \tau, N_i\right) = \max_{c_i, a_i', h_i} \tilde{U}\left(c_i, h_i, g_i, g_{-i}, G\right) + \beta E\left[V\left(a_i', w_i', \tau', N_i'\right)\right] \tag{B1}$$

$$\text{s.t. } c_i + \frac{1}{1+r} a_i' = a_i + \left(1-\tau\right) w_i h_i + N_i, \tag{B2}$$

$$g_i = \tau w_i h_i, \tag{B3}$$

$$g_{-i} = \tau Y_{-i}, \tag{B4}$$

$$G = G_0 + \tau Y_{-i} + g_i, \tag{B5}$$

where w_i is the person's wage, τ is the tax rate on earnings from work $w_i h_i$, N_i is non-labor income, β is an impatience parameter, r is the interest rate, $V\left(\cdot\right)$ is the indirect utility function, and $E\left[\cdot\right]$ is the expectations operator. Equation (B2) is a usual budget constraint which specifies that consumption c_i and savings $\frac{1}{1+r} a_i' - a_i$ equals post-tax earnings and non-labor income.

Compared to the usual labor supply model, per-period utility $\tilde{U}\left(\cdot\right)$ in Equation (B1) depends on three additional factors: the individual's own tax contribution g_i (reflecting warm glow from own contribution), the other people's tax contribution g_{-i} (reflecting warm glow from others' contribution), and the total government expenditure G (reflecting pure altruism, which by definition would not distinguish between a contribution by self or by others). g_i is equivalent to the tax rate applied to the individual's total earnings from work by Equation (B3), and g_{-i} is equivalent to the same income tax rate applied to the total earnings of everyone else Y_{-i} by Equation (B4). Equation (B5) computes total government expenditure as the sum of non-income tax revenue G_0, g_i and g_{-i}. Notice that $\tilde{U}\left(\cdot\right)$ depends (through g_{-i} and G) on the common tax rate τ. Hence, when tax rates increase, the individual gets social preferences utility not just from her own contribution but also the increased contributions of others. This modeling aspect reflects the fact that tax changes in practice often apply to broad groups of people, while wage changes are often perceived by the individual to be specific to herself.

While conceptually easy to describe, the maximization problem (B1) does not yield equations that can be easily estimated. This is because estimating the problem directly requires data on the individual's expectations of Y_{-i}, which is difficult to elicit. However, notice that substituting Equation (B4) and (B5) into the utility function yields $\tilde{U}\left(c, h, g_i, \tau Y_{-i}, G_0 + g_i + \tau Y_{-i}\right)$, with G_0 and Y_{-i} exogenous to the individual. Hence, treating these as parameters in the utility function, we can rewrite utility as

$$U\left(c_i, h_i, g_i, \tau\right) = \tilde{U}\left(c, h, g_i, \tau Y_{-i}, G_0 + g_i + \tau Y_{-i}\right). \tag{B6}$$

The maximization problem then becomes

$$V\left(a_i, w_i, \tau, N_i\right) = \max_{c_i, a_i', h_i} U\left(c_i, h_i, g_i, \tau\right) + \beta E\left[V\left(a_i', w_i', \tau', N_i'\right)\right] \tag{B7}$$

subject to Equations (B2) and (B3). This formulation yields estimating equations involving τ, which are more easily observed in the data.

For our empirical analysis, we specialize this utility function to

$$U\left(c_i, h_i, g_i, \tau\right) = u\left(c_i, h_i\right) + v\left(g_i, \tau\right) \tag{B8}$$

so that we have an easily interpretable social preferences term $v\left(g_i, \tau\right)$. Furthermore, since taxes paid are highly correlated with tax rates, we expect the model misspecification that comes from ignoring the dependence of $v\left(g_i, \tau\right)$ on τ to be relatively benign. In that case, we can further simplify to

$$U\left(c_i, h_i, g_i, \tau\right) = u\left(c_i, h_i\right) + \tilde{v}\left(g_i\right). \tag{B9}$$

This is equivalent to the utility function that we use in our main analysis, as described in Section 2. The first derivative of $\tilde{v}\left(g_i\right)$ will be positive if people had positive social preferences—broadly defined, since social preferences in our model also includes the tax money that comes from other individuals g_{-i} (in addition to the usual discussion about pure altruism and warm glow from the individual's own contribution).

B.2 Derivation of the solution for the main model

The utility maximization problem from Section 2, slightly rewritten, is

$$V\left(a_i, w_i, \tau, N_i\right) = \max_{c_i, a_i', h_i} U\left(c_i, h_i, g_i\right) + \beta E\left[V\left(a_i', w_i', \tau', N_i'\right)\right] \tag{B10}$$

$$\text{s.t. } c_i = A_i + \left(1 - \tau\right) w_i h_i + N_i, \tag{B11}$$

$$A_i = a_i - \frac{1}{1+r} a_i', \tag{B12}$$

$$g_i = \tau w_i h_i, \tag{B13}$$

where utility $U(\cdot)$ depends on consumption c_i, labor supply h_i, and tax-funded government expenditure g_i, the state variables for the maximization problem are asset level a_i, wage w_i, tax rate on earnings τ, and non-labor income N_i, β is an impatience parameter, r is the interest rate, $V(\cdot)$ is the indirect utility function, $E[\cdot]$ is the expectations operator, and the prime symbol ($'$) denotes the next period. A_i is the intertemporal resource allocation amount, useful for connecting this to static models.

Let λ_i be the Lagrangian multiplier on Equation (B11). The (intratemporal) first order conditions for c_i and h_i are, respectively,

$$U_c(c_i, h_i, g_i) = \lambda_i \tag{B14}$$

and

$$U_h(c_i, h_i, g_i) + \tau w_i U_g(c_i, h_i, g_i) + \lambda_i (1-\tau) w_i = 0. \tag{B15}$$

Substituting Equation (B14) into Equation (B15) and rewriting in matrix form (more convenient for derivation of the Marshallian and Hicksian elasticities), we have

$$\mathcal{M}(h_i; c_i, A_i, a_i, w_i, \tau, N_i) \equiv DU(c_i, h_i, g_i) \begin{bmatrix} (1-\tau) w_i \\ 1 \\ \tau w_i \end{bmatrix} = 0, \tag{B16}$$

where D is the directional derivative operator so that

$$DU(c_i, h_i, g_i) \equiv \begin{bmatrix} U_c(c_i, h_i, g_i) & U_h(c_i, h_i, g_i) & U_g(c_i, h_i, g_i) \end{bmatrix}$$

is the Jacobian matrix of $U(c_i, h_i, g_i)$, and the optimal-choice c_i and g_i satisfy Equations (B11) and (B13) respectively.

B.2.1 Marshallian elasticities

In a life-cycle framework, the Marshallian elasticity holds constant the intertemporal allocation of resources A_i (see Blundell and MaCurdy 1999, Section 4.2.2). Implicit differentiation of Equation (B16) gives

$$\epsilon_w^M \equiv \left. \frac{\partial \log h_i}{\partial \log w_i} \right|_{A_i} = -\frac{w_i \frac{\partial \mathcal{M}(h_i)}{\partial w_i}}{h_i \frac{\partial \mathcal{M}(h_i)}{\partial h_i}} \tag{B17}$$

and

$$\epsilon_{1-\tau}^{M} \equiv \left.\frac{\partial \log h_i}{\partial \log (1-\tau)}\right|_{A_i} = -\frac{(1-\tau)\frac{\partial \mathcal{M}(h_i)}{\partial (1-\tau)}}{h\frac{\partial \mathcal{M}(h_i)}{\partial h_i}}, \tag{B18}$$

where we have suppressed the dependence of the elasticities on i to reduce notational burden. Similarly suppressing the dependence of derivatives $U(c_i, h_i, g_i)$ on their arguments and on i, the derivatives of the $\mathcal{M}(h_i)$ terms in Equations (B17) and (B18) are

$$\frac{\partial \mathcal{M}(h_i)}{\partial h_i} = \begin{bmatrix} (1-\tau)w_i & 1 & \tau w_i \end{bmatrix} D^2U \begin{bmatrix} (1-\tau)w_i \\ 1 \\ \tau w_i \end{bmatrix},$$

$$\frac{\partial \mathcal{M}(h_i)}{\partial w_i} = \begin{bmatrix} (1-\tau)h_i & 0 & \tau h_i \end{bmatrix} D^2U \begin{bmatrix} (1-\tau)w_i \\ 1 \\ \tau w_i \end{bmatrix} + DU \begin{bmatrix} (1-\tau) \\ 0 \\ \tau \end{bmatrix},$$

and

$$\frac{\partial \mathcal{M}(h_i)}{\partial (1-\tau)} = \begin{bmatrix} w_i h_i & 0 & -w_i h_i \end{bmatrix} D^2U \begin{bmatrix} (1-\tau)w_i \\ 1 \\ \tau w_i \end{bmatrix} + DU \begin{bmatrix} w_i \\ 0 \\ -w_i \end{bmatrix},$$

where D^2U is the Hessian matrix of $U(c_i, h_i, g_i)$. Specializing to the separable social preferences utility in Equation (4) and evaluating (we use the Python symbolic mathematics package SymPy), Equations (B17) and (B18) simplify to

$$\epsilon_{w}^{M} = \frac{-w_i(1-\tau)\left\{\left[U_c + \frac{\tau}{1-\tau}(U_g + U_{gg}g_i)\right] + h_i\left[(1-\tau)w_i U_{cc} + U_{ch}\right]\right\}}{h_i\left[(1-\tau)^2 w_i^2 U_{cc} + 2(1-\tau)w_i U_{ch} + U_{hh} + \tau^2 w_i^2 U_{gg}\right]} \tag{B19}$$

and

$$\epsilon_{1-\tau}^{M} = \frac{-w_i(1-\tau)\left\{\left[U_c - (U_g + U_{gg}g_i)\right] + h_i\left[(1-\tau)w_i U_{cc} + U_{ch}\right]\right\}}{h\left[(1-\tau)^2 w_i^2 U_{cc} + 2(1-\tau)w_i U_{ch} + U_{hh} + \tau^2 w_i^2 U_{gg}\right]} \tag{B20}$$

respectively.

B.2.2 Hicksian elasticities

The expenditure minimization problem is

$$e\left(a_i, w_i, \tau, \bar{U}_i\right) = \min_{c_i, a_i', h_i} c_i - A_i - (1-\tau)w_i h_i \tag{B21}$$

$$\text{s.t. } U(c_i, h_i, g_i) = \bar{U}_i \tag{B22}$$

and Equations (B12) and (B13). Let $h^H\left(a_i, w_i, \tau, \bar{U}_i\right)$ denote the solution. Duality gives

$$h^H\left(a_i, w_i, \tau, \bar{U}_i\right) = h\left(a_i, w_i, \tau, e\left(a_i, w_i, \tau, \bar{U}_i\right)\right), \tag{B23}$$

where $h(\cdot)$ is the Marshallian labor supply function, so that holding A_i constant and differentiating with respect to w_i and $(1-\tau)$ gives, respectively,

$$\begin{aligned}\left.\frac{\partial h_i^H}{\partial w_i}\right|_{A_i,\bar{U}_i} &= \left.\frac{\partial h_i}{\partial w_i}\right|_{A_i} + \left.\frac{\partial h_i}{\partial N_i}\right|_{A_i} \left.\frac{\partial e\left(a_i, w_i, \tau, \bar{U}_i\right)}{\partial w_i}\right|_{A_i,\bar{U}_i} \\ &= \left.\frac{\partial h_i}{\partial w_i}\right|_{A_i} - (1-\tau)\, h_i \left.\frac{\partial h_i}{\partial N_i}\right|_{A_i} \left(1 + \frac{\tau U_g}{(1-\tau)\, U_c}\right)\end{aligned} \tag{B24}$$

and

$$\begin{aligned}\left.\frac{\partial h_i^H}{\partial\left(1-\tau\right)}\right|_{A_i,\bar{U}_i} &= \left.\frac{\partial h_i}{\partial\left(1-\tau\right)}\right|_{A_i} + \left.\frac{\partial h_i}{\partial N_i}\right|_{A_i} \left.\frac{\partial e\left(a_i, w_i, \tau, \bar{U}_i\right)}{\partial\left(1-\tau\right)}\right|_{A_i,\bar{U}_i} \\ &= \left.\frac{\partial h_i}{\partial\left(1-\tau\right)}\right|_{A_i} - w_i h_i \left.\frac{\partial h_i}{\partial N_i}\right|_{A_i} \left(1 - \frac{U_g}{U_c}\right),\end{aligned} \tag{B25}$$

where we have used the envelope theorem and the first order condition with respect to c_i in the second equality. The elasticities are thus

$$\epsilon_w^H \equiv \left.\frac{\partial \log h_i^H}{\partial \log w_i}\right|_{A_i,\bar{U}_i} = \epsilon_w^M - (1-\tau)\, w_i \left.\frac{\partial h_i}{\partial N_i}\right|_{A_i} \left(1 + \frac{\tau U_g}{(1-\tau)\, U_c}\right) \tag{B26}$$

and

$$\epsilon_{1-\tau}^H \equiv \left.\frac{\partial \log h_i^H}{\partial \log\left(1-\tau\right)}\right|_{A_i,\bar{U}_i} = \epsilon_{1-\tau}^M - (1-\tau)\, w_i \left.\frac{\partial h_i}{\partial N_i}\right|_{A_i} \left(1 - \frac{U_g}{U_c}\right), \tag{B27}$$

with $\left.\frac{\partial h_i}{\partial N_i}\right|_{A_i}$ obtained by implicit differentiation of Equation (B16):

$$\left.\frac{\partial h_i}{\partial N_i}\right|_{A_i} = -\frac{\frac{\partial \mathcal{M}(h_i)}{\partial N_i}}{\frac{\partial \mathcal{M}(h_i)}{\partial h_i}} = -\frac{\begin{bmatrix} 1 & 0 & 0 \end{bmatrix} D^2 U \begin{bmatrix} (1-\tau)\, w_i \\ 1 \\ \tau w_i \end{bmatrix}}{\frac{\partial \mathcal{M}(h_i)}{\partial h_i}}. \tag{B28}$$

Substituting in the expressions from Equations (B17) and (B18), and simplifying, we get

$$\epsilon_w^H = \frac{\text{Num}_w^H}{h_i \frac{\partial \mathcal{M}(h_i)}{\partial h_i}}, \tag{B29}$$

$$\text{Num}_w^H = \begin{bmatrix} \frac{U_g}{U_c}\tau w_i h_i & 0 & -\tau w_i h_i \end{bmatrix} D^2U \begin{bmatrix} (1-\tau)\, w_i \\ 1 \\ \tau w_i \end{bmatrix} + DU \begin{bmatrix} -(1-\tau)\, w_i \\ 0 \\ -\tau w_i \end{bmatrix},$$

and

$$\epsilon_{1-\tau}^H = \frac{\text{Num}_{1-\tau}^H}{h_i \frac{\partial \mathcal{M}(h_i)}{\partial h_i}}, \tag{B30}$$

$$\text{Num}_{1-\tau}^H = \begin{bmatrix} -\frac{U_g}{U_c}(1-\tau)\, w_i h_i & 0 & (1-\tau)\, w_i h_i \end{bmatrix} D^2U \begin{bmatrix} (1-\tau)\, w_i \\ 1 \\ \tau w_i \end{bmatrix} + DU \begin{bmatrix} -(1-\tau)\, w_i \\ 0 \\ (1-\tau)\, w_i \end{bmatrix}.$$

Finally, specializing to the separable social preferences utility in Equation (4) gives

$$\epsilon_w^H = \frac{-w_i(1-\tau)\left\{\left[U_c + \frac{\tau}{1-\tau}(U_g + U_{gg}g_i)\right] - \frac{\tau}{1-\tau}h_i\frac{U_g}{U_c}\left[(1-\tau)\, w_i U_{cc} + U_{ch}\right]\right\}}{h_i\left[(1-\tau)^2 w_i^2 U_{cc} + 2(1-\tau)\, w_i U_{ch} + U_{hh} + \tau^2 w_i^2 U_{gg}\right]} \tag{B31}$$

and

$$\epsilon_{1-\tau}^H = \frac{-w_i(1-\tau)\left\{\left[U_c - (U_g + U_{gg}g_i)\right] + h_i\frac{U_g}{U_c}\left[(1-\tau)\, w_i U_{cc} + U_{ch}\right]\right\}}{h_i\left[(1-\tau)^2 w_i^2 U_{cc} + 2(1-\tau)\, w_i U_{ch} + U_{hh} + \tau^2 w_i^2 U_{gg}\right]}. \tag{B32}$$

Somewhat surprising, the income effect term $h_i\left[(1-\tau)\, w_i U_{cc} + U_{ch}\right]$ does not disappear from the compensated elasticity. (We ignore the denominator in this discussion for brevity.) This occurs because tax-funded government expenditure is outside the control of the individual (an agency problem), and hence does not envelope out when holding utility constant. To understand this, consider the extreme case of $U_g = U_c$ (i.e. when the person derives as much marginal utility from tax-funded government expenditure as from consumption). In this case, the Hicksian net-of-tax rate elasticity in Equation (B32) is the same as the Marshallian counterpart in Equation (B20)—no "Hicksian compensation" is needed to keep utility constant because government expenditures automatically compensate for the income effect. (Valuing consumption and taxation equally means that there is no longer an agency problem.) On the other hand, the Hicksian wage elasticity in Equation (B31) is larger than the Marshallian counterpart in Equation (B19)—on top of compensating for the income effect, we have to add a $-\frac{\tau}{1-\tau}h_i\left[(1-\tau)\, w_i U_{cc} + U_{ch}\right]$ term to compensate for the difference induced by the agency problem.

B.2.3 Frisch elasticities

The Frisch elasticities hold constant the marginal utility of wealth λ_i. To do this, rewrite Equations (B14) and (B15) in matrix form to get

$$\boldsymbol{\mathcal{F}}(c_i, h_i) \equiv \begin{bmatrix} U_c(c_i, h_i, g_i) \\ U_h(c_i, h_i, g_i) + \tau w_i U_g(c_i, h_i, g_i) \end{bmatrix} + \begin{bmatrix} -\lambda_i \\ \lambda_i (1-\tau) w_i \end{bmatrix} = \mathbf{0}.$$

This is a system of two equations in c_i and h, with parameters τ, w_i, and λ_i. (g_i is not a parameter since it is pinned down by Equation (B13)). Implicit differentiation gives

$$\begin{bmatrix} \frac{\partial c_i}{\partial w_i}\Big|_{\lambda_i} \\ \frac{\partial h_i}{\partial w_i}\Big|_{\lambda_i} \end{bmatrix} = -\left(D\boldsymbol{\mathcal{F}}(c_i, h_i)\right)^{-1} \frac{\partial \boldsymbol{\mathcal{F}}(c_i, h_i)}{\partial w_i}\Big|_{\lambda_i}, \tag{B33}$$

and

$$\begin{bmatrix} \frac{\partial c_i}{\partial (1-\tau)}\Big|_{\lambda_i} \\ \frac{\partial h_i}{\partial (1-\tau)}\Big|_{\lambda_i} \end{bmatrix} = -\left(D\boldsymbol{\mathcal{F}}(c_i, h_i)\right)^{-1} \frac{\partial \boldsymbol{\mathcal{F}}(c_i, h_i)}{\partial (1-\tau)}\Big|_{\lambda_i}, \tag{B34}$$

where

$$\frac{\partial \boldsymbol{\mathcal{F}}(c_i, h_i)}{\partial w_i}\Big|_{\lambda_i} = \begin{bmatrix} \tau h_i U_{cg} \\ \tau h_i U_{hg} + \tau U_g + \tau^2 w_i h_i U_{gg} + (1-\tau)\lambda_i \end{bmatrix},$$

$$\frac{\partial \boldsymbol{\mathcal{F}}(c_i, h_i)}{\partial (1-\tau)}\Big|_{\lambda_i} = \begin{bmatrix} -w_i h_i U_{cg} \\ -w_i h_i U_{hg} - w_i U_g - \tau w_i^2 h_i U_{gg} + w_i \lambda_i \end{bmatrix},$$

and

$$D\boldsymbol{\mathcal{F}}(c_i, h_i) = \begin{bmatrix} U_{cc} & U_{ch} + \tau w_i U_{cg} \\ U_{ch} + \tau w_i U_{cg} & U_{hh} + 2\tau w_i U_{hg} + \tau^2 w_i^2 U_{gg} \end{bmatrix}.$$

The Frisch elasticities are the lower components of the vectors in Equations (B33) and (B34), multiplied by w_i/h_i and $(1-\tau)/h_i$ respectively. Specializing to the separable social preferences utility in Equation (4) gives Equations (5) and (6).

B.3 Solution for model with utility function $u(c_i, h_i) + v(g_i, \tau)$

In Section 4.2, we discuss a robustness check that explicitly includes the common tax rate τ in the utility function along with g_i, shown in Equation B8. (The results are presented in Table 3.) Derivations of the solution proceed analogous to Section (B.2), except with four

components in the matrices rather than three. The elasticities obtained are

$$\epsilon_w^M = \frac{-w_i\left(1-\tau\right)\left\{\left[U_c + \frac{\tau}{1-\tau}\left(U_g + U_{gg}g_i\right)\right] + h_i\left[\left(1-\tau\right)w_i U_{cc} + U_{ch}\right]\right\}}{h_i\left[\left(1-\tau\right)^2 w_i^2 U_{cc} + 2\left(1-\tau\right)w_i U_{ch} + U_{hh} + \tau^2 w_i^2 U_{gg}\right]}, \tag{B35}$$

$$\epsilon_{1-\tau}^M = \frac{-w_i\left(1-\tau\right)\left\{\left[U_c - \left(U_g + U_{gg}g_i + \tau U_{g\tau}\right)\right] + h_i\left[\left(1-\tau\right)w_i U_{cc} + U_{ch}\right]\right\}}{h\left[\left(1-\tau\right)^2 w_i^2 U_{cc} + 2\left(1-\tau\right)w_i U_{ch} + U_{hh} + \tau^2 w_i^2 U_{gg}\right]}, \tag{B36}$$

$$\epsilon_w^H = \frac{-w_i\left(1-\tau\right)\left\{\left[U_c + \frac{\tau}{1-\tau}\left(U_g + U_{gg}g_i\right)\right] - \frac{\tau}{1-\tau}h_i\frac{U_g}{U_c}\left[\left(1-\tau\right)w_i U_{cc} + U_{ch}\right]\right\}}{h_i\left[\left(1-\tau\right)^2 w_i^2 U_{cc} + 2\left(1-\tau\right)w_i U_{ch} + U_{hh} + \tau^2 w_i^2 U_{gg}\right]}, \tag{B37}$$

$$\epsilon_{1-\tau}^H = \frac{-w_i\left(1-\tau\right)\left\{\left[U_c - \left(U_g + U_{gg}g_i + \tau U_{g\tau}\right)\right] + \left(h_i\frac{U_g}{U_c} + \frac{1}{w_i U_c}\right)\left[\left(1-\tau\right)w_i U_{cc} + U_{ch}\right]\right\}}{h_i\left[\left(1-\tau\right)^2 w_i^2 U_{cc} + 2\left(1-\tau\right)w_i U_{ch} + U_{hh} + \tau^2 w_i^2 U_{gg}\right]}, \tag{B38}$$

$$\epsilon_w^F = \frac{-w_i\left(1-\tau\right)U_{cc}\left[U_c + \frac{\tau}{1-\tau}\left(U_g + U_{gg}g_i\right)\right]}{h_i\left(U_{cc}U_{hh} - U_{ch}^2 + \tau^2 w_i^2 U_{cc}U_{gg}\right)}, \tag{B39}$$

and

$$\epsilon_{1-\tau}^F = \frac{-w_i\left(1-\tau\right)U_{cc}\left[U_c - \left(U_g + U_{gg}g_i + \tau U_{g\tau}\right)\right]}{h_i\left(U_{cc}U_{hh} - U_{ch}^2 + \tau^2 w_i^2 U_{cc}U_{gg}\right)}. \tag{B40}$$

Interestingly, the marginal utility with respect to the tax rate U_τ and the curvature term $U_{\tau\tau}$ do not appear in the elasticities. This occurs because, unlike g_i which depends on how much labor the individual decides to supply via Equation (B3), the tax rate is exogenous to the individual. Intuitively, increasing labor supply increases taxes paid which provide a direct utility benefit (or cost) beyond the effect on disposable income. In contrast, the tax rate is exogenous (working more would not change the tax rate), and hence working more does not provide any more first-order social preferences benefit once g_i and disposable income are accounted for. Consequently, only the complementarity or substitutability in utility between τ and g_i matters for labor supply when considering the effect of the tax rate on social preferences. This is another reason that our main specification does not model τ in addition to g_i.

B.4 Solution for program-specific taxes paid

Again, the solution proceeds analogous to Section (B.2). After specializing to the separable utility function

$$U\left(c_i, h_i, g_i, s_i\right) = u\left(c_i, h_i\right) + v\left(g, s_i\right),$$

the elasticities obtained are

$$\epsilon_w^M = \frac{-w_i\left(1-\tau-\sigma\right)\left(\mathfrak{S}_w + \mathfrak{I}\right)}{h_i\left(w_i^2\left(1-\tau-\sigma\right)^2 U_{cc} + 2U_{ch}w_i\left(1-\tau-\sigma\right) + U_{hh} + U_{gg}\tau^2 w_i^2 + 2U_{gs}\tau\sigma w_i^2 + U_{ss}\sigma^2 w_i^2\right)},$$

$$\epsilon_{1-\sigma}^{M}=\frac{-w_i\left(1-\sigma\right)\left(\mathfrak{S}_{1-\sigma}+\mathfrak{I}\right)}{h_i\left(w_i^2\left(1-\tau-\sigma\right)^2U_{cc}+2U_{ch}w_i\left(1-\tau-\sigma\right)+U_{hh}+U_{gg}\tau^2w_i^2+2U_{gs}\tau\sigma w_i^2+U_{ss}\sigma^2w_i^2\right)},$$

$$\epsilon_{w}^{H}=\frac{-w_i\left(1-\tau-\sigma\right)\left(\mathfrak{S}_{w}-\left(\frac{\tau}{1-\tau-\sigma}\frac{U_g}{U_c}+\frac{\sigma}{1-\tau-\sigma}\frac{U_s}{U_c}\right)\mathfrak{I}\right)}{h_i\left(w_i^2\left(1-\tau-\sigma\right)^2U_{cc}+2U_{ch}w_i\left(1-\tau-\sigma\right)+U_{hh}+U_{gg}\tau^2w_i^2+2U_{gs}\tau\sigma w_i^2+U_{ss}\sigma^2w_i^2\right)},$$

$$\epsilon_{1-\sigma}^{H}=\frac{-w_i\left(1-\sigma\right)\left(\mathfrak{S}_{1-\sigma}+\frac{U_s}{U_c}\mathfrak{I}\right)}{h_i\left(w_i^2\left(1-\tau-\sigma\right)^2U_{cc}+2U_{ch}w_i\left(1-\tau-\sigma\right)+U_{hh}+U_{gg}\tau^2w_i^2+2U_{gs}\tau\sigma w_i^2+U_{ss}\sigma^2w_i^2\right)},$$

$$\epsilon_{w}^{F}=\frac{-w_i\left(1-\tau-\sigma\right)U_{cc}\mathfrak{S}_{w}}{h_i\left(U_{cc}U_{hh}+U_{cc}U_{gg}\tau^2w_i^2+2U_{cc}U_{gs}\tau\sigma w_i^2+U_{cc}U_{ss}\sigma^2w_i^2-U_{ch}^2\right)},$$

and

$$\epsilon_{1-\sigma}^{F}=\frac{-w_i\left(1-\sigma\right)U_{cc}\mathfrak{S}_{1-\sigma}}{h_i\left(U_{cc}U_{hh}+U_{cc}U_{gg}\tau^2w_i^2+2U_{cc}U_{gs}\tau\sigma w_i^2+U_{cc}U_{ss}\sigma^2w_i^2-U_{ch}^2\right)},$$

where

$$\mathfrak{S}_{w}=U_c+\frac{\tau}{1-\tau-\sigma}\left(U_g+U_{gg}g_i\right)+\frac{\sigma}{1-\tau-\sigma}\left(U_s+U_{ss}s_i\right)+2\frac{\tau\sigma}{1-\tau-\sigma}U_{gs}h_iw_i,$$

$$\mathfrak{S}_{1-\sigma}=U_c-U_s-U_{ss}s_i-U_{gs}g_i,$$

and

$$\mathfrak{I}=U_{cc}h_iw_i\left(1-\tau-\sigma\right)+U_{ch}h_i.$$

B.5 Optimal income taxation

In this subsection, we derive implications of government-regarding social preferences for optimal income taxation. We examine two main cases: the optimal uniform tax rate and the optimal nonlinear tax schedule. Derivations below follow the steps in Piketty and Saez (2013).

B.5.1 Optimal uniform income taxation

Consider a uniform tax rate τ used to fund a demogrant R (a transfer of equal value for all individuals). The government chooses τ to maximize[22]

$$SWF=\int_i\omega_i\Gamma\left(\hat{V}_i\left(\tau,R\right)\right)d\nu\left(i\right), \tag{B41}$$

where the integration is over a measure-one population of individuals in the economy (indexed by i) with distribution $\nu\left(i\right)$, ω_i is a set of Pareto weights, $\Gamma\left(\cdot\right)$ is increasing and concave.

[22]Following the literature, we introduce the i notation to emphasize possible heterogeneity in the population. All other notational elements are chosen to maintain continuity with previous sections.

$\hat{V}_i(\tau, R)$ is the i-specific intratemporal value function from Section B.2:

$$\begin{aligned}\hat{V}_i(\tau, R) &\equiv V(a_i, w_i, \tau, N_i + R)|_{A_i} \\ &= U(A_i + (1-\tau) w_i h_i^* + N_i + R, h_i^*, \tau w_i h_i^*) + \beta E[\cdot], \end{aligned} \tag{B42}$$

where the $\beta E[\cdot]$ term is a constant once we hold A_i constant, and $h_i^* = h_i(a_i, w_i, \tau, N_i + R)|_{A_i}$. The demogrant R is evenly distributed to everybody, so

$$R = \tau \int_i z_i^* d\nu(i) - E \tag{B43}$$

where E is some government non-transfer spending and $z_i^* \equiv w_i h_i^*$ is total pre-tax income, introduced to save on some notation. Note that h_i^* (and hence z_i^*) is a function of τ, so

$$\begin{aligned}\frac{dR}{d\tau} &= \int_i z_i^* d\nu(i) + \tau \int_i w_i \frac{\partial h_i^*}{\partial \tau} d\nu(i) \\ &= \int_i z_i^* d\nu(i) - \frac{\tau}{1-\tau} \epsilon_{1-\tau}^M \int_i z_i^* d\nu(i) \end{aligned} \tag{B44}$$

after some derivations. As is well known in the literature, when the tax rate increases, the demogrant increases mechanically (the first term) but not as much as expected because labor supply decreases (the second term), the latter of which is governed by the Marshallian elasticity $\epsilon_{1-\tau}^M$.

The first-order condition for the government, computed by differentiating Equation (B41) subject to Equation (B43), is

$$\int_i \omega_i \Gamma'\left(\hat{V}_i(\tau, R)\right) \left[U_{c,i}\left[-z_i^* + \frac{dR}{d\tau}\right] + U_g z_i^*\right] d\nu(i) = 0. \tag{B45}$$

Note that $U_g z_i^*$ does not envelope out since individuals cannot choose the amount of government expenditure. For comparative statics, it is convenient to use the "usual" social marginal welfare weight on person i (usual because it does not incorporate any U_g term):

$$\gamma_i \equiv \frac{\omega_i \Gamma'\left(\hat{V}_i(\tau, R)\right) U_c}{\int_j \omega_j \Gamma'\left(\hat{V}_j(\tau, R)\right) U_{c,j}}. \tag{B46}$$

Substituting Equations (B44) and (B46) into Equation (B45), and after some manipulation, we get

$$\tau = \frac{1 - \bar{\gamma}}{1 - \bar{\gamma} + \epsilon_{1-\tau}^M} \tag{B47}$$

where

$$\bar{\gamma} \equiv \frac{\int_i \gamma_i \left(1 - \frac{U_g}{U_c}\right) z_i^* d\nu\left(i\right)}{\int_i z_i^* d\nu\left(i\right)} \tag{B48}$$

is a penalized income-weighted average of the social marginal welfare weight, with penalty due to government-regarding social preferences.

Compared to a world without social preferences, the only difference is that $\bar{\gamma}$ in Equation (B48) now has $\left(1 - \frac{U_g}{U_c}\right)$ instead of 1 in the numerator. Hence, assuming that $U_g \geq 0$ for all individuals, the existence of government-regarding social preferences lead to smaller $\bar{\gamma}$.[23] From Equation (B47), this means that the optimal tax rate would be larger in the presence of positive social preferences.

B.5.2 Optimal nonlinear tax schedule

Now the government's problem is to choose a nonlinear tax schedule $T\left(z\right)$ to maximize

$$SWF = \int_i \omega_i \Gamma\left(\hat{V}_i\left(T, R\right)\right) d\nu\left(i\right) \tag{B49}$$

$$\text{s.t. } R = \int_i T\left(z_i^*\right) d\nu\left(i\right) - E$$

where

$$\hat{V}_i\left(T, R\right) = V\left(a_i, w_i, \tau_i, N_i + R\right)|_{A_i} = U\left(A_i + z_i^* - T\left(z_i^*\right) + N_i + R, h_i^*, T\left(z_i^*\right)\right) + \beta E\left[\cdot\right].$$

$T\left(z\right)$ gives the total amount of taxes paid, such that $T'\left(z\right)$ is the marginal tax rate at any income z, and $\hat{V}_i\left(\cdot\right)$ is a higher order function for notational simplicity. We assume away income effects, and follow the graphical argument around Piketty and Saez (2013, Figure 6) to consider the mechanical, behavioral, and welfare loss effects of a $d\tau$ increase in the

[23] $U_g \geq 0$ for all individuals is of course an overly-conservative bound, since the presence of some individuals with negative social preferences need not necessarily turn the whole average negative. The precise bound can be obtained by rewriting Equation (B48) as

$$\bar{\gamma} = E\left[\gamma_i \frac{z_i^*}{E\left[z_i^*\right]}\right]\left(1 - \left(E\left[\frac{U_g}{U_c}\right] + \frac{Cov\left[\gamma_i \frac{z_i^*}{E\left[z_i^*\right]}, \frac{U_g}{U_c}\right]}{E\left[\gamma_i \frac{z_i^*}{E\left[z_i^*\right]}\right]}\right)\right).$$

The first term $E\left[\gamma_i \frac{z_i^*}{E\left[z_i^*\right]}\right]$ is the non-penalized weighted average social marginal welfare weight (i.e. the $\bar{\gamma}$ in a world without social preferences). Hence, $\bar{\gamma}$ decreases relative to a world without social preferences if $E\left[\frac{U_g}{U_c}\right] + \frac{Cov\left[\gamma_i \frac{z_i^*}{E\left[z_i^*\right]}, \frac{U_g}{U_c}\right]}{E\left[\gamma_i \frac{z_i^*}{E\left[z_i^*\right]}\right]} > 0$.

marginal tax rate between z and dz.

The first two effects do not depend on the utility function and retain their standard forms (well known in the literature). The mechanical effect is the total increase in tax rate $dzd\tau$ applied to all incomes above z, hence:

$$dM = dzd\tau \left[1 - H\left(z\right)\right], \tag{B50}$$

where $H\left(z\right)$ is the (endogenous) cumulative distribution function of income with density $h\left(z\right)$. The behavioral effect only affects the $h\left(z\right)dz$ individuals with incomes between z and dz since all other incomes face no change in the marginal tax rate and we have assumed away income effects. An affected individual i changes her income by $w_i \frac{\partial h_i^*}{\partial \tau} d\tau = -z_i^* \frac{d\tau}{1-T'(z)} \epsilon_{1-\tau,i}$, where $\epsilon_{1-\tau,i}$ is the individual-specific ETI, yielding tax revenue consequences of $-z_i^* \frac{d\tau}{1-T'(z)} \epsilon_{1-\tau,i} T'\left(z\right)$. Put together, the behavioral effect is

$$dB = -dzd\tau h\left(z\right) \epsilon_{1-\tau} z \frac{T'\left(z\right)}{1 - T'\left(z\right)}. \tag{B51}$$

The welfare loss of the change is obtained by considering the effect on the social welfare function in Equation (B49), restricted to the people with incomes above z who pay $dzd\tau$ more in taxes, and noting that any labor supply effects envelope out when considering the effects on welfare. Using the marginal value of public funds for the government p to convert from utility to dollars, the money-metric welfare loss is (after some algebraic manipulation)

$$dW = -dzd\tau \int_{z_i > z} \gamma_i \left(1 - \frac{U_g}{U_c}\right) dH\left(z_i\right) \tag{B52}$$

$$= -dzd\tau \left[1 - H\left(z\right)\right] \gamma^+\left(z\right), \tag{B53}$$

where $\gamma_i \equiv \omega_i \Gamma' \left(\hat{V}_i\left(T, R\right)\right) U_c / p$ in Equation (B52) is again the "usual" social marginal welfare weight on person i, and in Equation (B53),

$$\gamma^+\left(z\right) \equiv \frac{1}{1 - H\left(z\right)} \int_{z_i > z} \gamma_i \left(1 - \frac{U_g}{U_c}\right) dH\left(z_i\right) \tag{B54}$$

is the average social marginal welfare weight for individuals with income above z, penalized by government-regarding social preferences.

The optimal marginal tax rate at any z is obtained by setting the sum of the effects in Equations (B50), (B51), and (B53) to zero. This yields

$$T'\left(z\right) = \frac{1 - \gamma^+\left(z\right)}{1 - \gamma^+\left(z\right) + \alpha\left(z\right) \epsilon_{1-\tau}}$$

where $\alpha(z) \equiv \frac{zh(z)}{[1-H(z)]}$ is a parameter that is related to the Pareto distribution.

Again, compared to a world without social preferences, the only difference is that $\gamma^{+}(z)$ in Equation (B54) incorporates a social preferences penalization term. On top of the interpretation from Section B.5.1—positive social preferences allows the government to levy higher income taxes on average—Equation (B54) reveals that heterogeneity in social preferences can also affect the marginal tax rate at different points of the income distribution.

C Survey and vignette experiment details

A live version of the survey is available at https://nus.syd1.qualtrics.com/jfe/form/SV_cAszYDfScYSrEUu. The full questionnaire is available at https://www.pinchuanong.com/wp-content/uploads/2024/07/appx-d.pdf. Some of our background and political view questions were adapted from Stantcheva (2022) and Doherty et al. (2015). Below, we provide details on specific elements of the survey.

C.1 Ensuring high-quality response

We maximized response quality in several ways.

In our survey landing page (consent page), we followed a good practice in the literature and warned participants that responding without adequate effort might result in their responses being marked as low quality and not used (see e.g. Stantcheva 2023). Also following the literature, we appealed to their sense of social responsibility by emphasizing that their responses might form the basis for policy recommendations, and requested that they read the questions carefully and answered honestly. To avoid selection based on survey topics, our landing page provided limited information about what the survey was about. (Specifically, "We are a group of independent non-partisan researchers studying how people around the world make decisions about their jobs.") Throughout the survey, we used simple and neutral language to avoid giving respondents the impression that we had a hypothesis in mind.

We took several steps to ensure accurate measurement of employment variables. For ease of answering, when asking respondents about their earnings, we adapted our questions to the respondents by offering the option of entering an annual, monthly or weekly figure. Because the hourly wage (earnings divided by work hours) can be difficult to measure (see e.g. Borjas 1980), we programmed a dynamic check of the wage in the survey instrument. Specifically, immediately after the respondent entered her earnings and work hours, we showed her the computed wage and asked her if it sounded "about right". If the answer was "No", we provided the computation formula and requested that she checked the figures again. The

key employment variables (work hours, earnings, and verified wage) were all asked on the same webpage to make internal consistency easy for the respondent (since there was no need to click the "back" button to change numbers).

Our vignette experiment was necessarily more complex than other parts of our survey which comprised simple-to-answer questions. We implemented four features to ensure the highest possible quality answers. First, before the vignette experiment, we required respondents to go through an animated slideshow that walked them through the instructions. In total, there were ten slides that explained the hypothetical scenarios, the assumptions (as described in Section 3.2), and the choices they would be asked to make. Sentences on the slides appeared at 250 words per minute (between the usual reading and speaking speed), and the next slide button was grayed out (i.e., not responsive) until all the text had appeared. Hence, unlike an instructional video, participants could not simply start the slideshow and return after some time to resume the survey—they had to advance the slides a total of ten times throughout the slideshow.

Second, we focused the respondents' attention on the question at hand by hiding all non-relevant information in the questionnaire matrix. For example, when the respondent had to choose whether to work or not in the first scenario, we hid the second scenario and the question on which scenario he preferred. When he had to make the analogous choice for the second scenario, we similarly hid the first scenario, including the previous response to minimize anchoring effects. We revealed all scenarios and choices only when the respondent was to choose between the two scenarios.

Third, on the first pair of scenarios, we ensured that respondents understood the layout and how to answer by showing an interactive "guided website tour" through each component (see Appendix Figure A2). Every time we introduced a change in the vignette layout afterwards (i.e., pairs 5 and 9), we showed a new interactive guided tour to explain the change and to maintain their attention.

Fourth, we programmed a check for answers exhibiting intransitive preferences—choices to work in a scenario of a pair and not the other, but yet the respondent preferred the latter scenario to the former—and showed a non-intrusive prompt asking respondents to double-check their answers when an intransitive choice was made. Without the prompt, the worry is that some (more attentive) respondents may notice that we allow inconsistent choices, think that the survey was badly designed, and lose motivation. We kept track of when the prompt was observed, and investigate robustness to observation of the prompt in Section 4.2.

When eliciting opinions about government spending on specific programs, we used a more complex sampling mechanism (of the programs) to balance multiple objectives. Our primary goal is to study how opinions of a program affects the program-specific wage-tax elasticity

wedge in the pairs 9 and 10 of vignettes (one program per pair). These two programs were selected from a list of ten using a randomization procedure that weighted dissimilar programs more. Specifically, each pair of programs (e.g. Social Security and Medicare) had a probability of selection that was proportional to the Euclidean distance in liking score between the programs of the pair.[24] Later on in the survey when we asked respondents how much they liked/disliked their tax money being used to fund specific programs, each respondent was asked to rate five programs including the two they saw in pairs 9 and 10 of the vignette and three other randomly chosen programs. We added the three randomly chosen programs to better mask our objective for asking about the opinion of government spending and because these opinions are of general interest in and of itself. (We did not present the full list of ten programs to every respondent to reduce response burden.) Liking was measured on a 5-point Likert scale, with the two extremes corresponding to "dislike a lot" and "like a lot" (we randomized the scale direction between respondents). To ensure that respondents understood the programs, we included a short description in both the last two pairs of vignettes and the liking questions.

We conducted the survey when there was some worry about bots being used to answer surveys (Goodrich et al. 2023). Thus, we followed good practices in the literature to ensure that our respondents are legitimate and verified (Stantcheva 2023). Besides distributing our survey through a reliable company which also performed checks of their participants, we incorporated Qualtric's bot detection capabilities and added a "honey pot" question on our landing page. The question "Check this box if it applies to you. [I am a piece of software/I am not a piece of software]" appeared for one second and was displaced downwards by one screen height, so that a human participant saw a blank screen for the first second (consistent with the webpage still loading). Among all participants who started the survey, this question only detected one bot that passed upstream bot checks. (We screened the respondent out.)

We kept track of three measures of response quality in the survey. First, we followed the literature (see e.g. Mas and Pallais 2017) to build two attention checks into the survey. The first check (which we refer to as the pre-vignette attention check) doubles as a comprehension check and asked participants a simple question about the instruction of the vignette following the slideshow. Specifically, respondents were asked whether the income tax rate in the hypothetical scenarios referred to federal, state or local income tax rate (the correct answer being federal). The second check (the in-vignette attention check) was built into pair 7 of our our vignette experiment. In this pair, by design, one of the two scenarios was strictly dominating: both scenarios showed the same tax rate and work hours but one

[24]The Euclidean distances were computed based on a pilot dataset. Interpretation of these distances as a measure of dissimilarity is frequently used in data clustering algorithms.

had a strictly higher hourly wage rate. We would expect attentive participants to prefer the strictly dominating scenario. We chose pair 7 as our in-vignette attention check since vignette fatigue would likely to affect respondents the most around this pair.

Second, we exploited the interactive nature of our instructional slideshow to identify "impatient" respondents. Since respondents could not advance the slides until all the text were displayed—and the graying out of the "next" button made this obvious—respondents who were thinking about the instructions carefully would only click "next" a total of ten times. Hence, the number of times this "next" button was clicked when it was still grayed out serves as a natural measure of response quality. In practice, we labeled respondents who clicked more than twenty times (twice as many as needed) as impatient respondents.

Finally, the the time spent by respondents on the survey as a whole, as well as on the vignette experiment and other questions, allow us to identify respondents who spent too little time answering questions. This is a standard measure used in the survey research and practitioner literature (Zhang and Conrad 2014; Greszki et al. 2015; Leiner 2019). The literature and practitioners often use thresholds relative to the median time (see e.g. Greszki et al. 2015); we follow this practice and label respondents who responded faster than half the median time as "too fast". We considered three time intervals when setting this measure: the overall time taken, the time taken on the vignette experiment (our main focus), and the time taken for the government expenditure liking questions (to measure quality near the end of the survey, and because we use a quality sample when investigating the impact of liking the program that taxes fund).

C.2 Sample

Our target sample comprised US residents aged 25–64 who were working at the time of the survey. Full-time students who might have worked part-time were excluded from the survey since they might be less familiar with the labor market implications of their choices. We also excluded the self-employed (including unpaid family workers) as they might find it more difficult to relate to the scenarios in our vignette which were about finding a new job with similar conditions to the participant's current job. We asked Bilendi (previously called Respondi), our survey company, to target participants such that our sample is representative along the age, gender, and income group dimensions. (We provided target proportions for different groups based on the working population in the 2022 CPS data.)

Our survey started with demographic questions to determine participants' eligibility: those who did not meet our sample definition were screened out of the survey. 12,164 respondents started the survey and were not screened out. Appendix Table C1 describes,

Appendix Table C1: Sample size and data-cleaning steps

	Number of Respondents
Started the survey and not screened out	12,164
Got to just before the instructional slideshow	8,338
Passed the instructional slideshow	7,856
Completed the vignette experiment	7,158
Completed the entire survey	7,122
Excluded:	
Work hours, consumption, or tax amounts below 5th or above 95th percentiles	1,611
Vignette consumption not imputable	90
Skipped slide show	45
Excluded: Failed second-order condition in main specification	1
Final Sample	5,439

Notes: This table shows the number of respondents who started our survey and the sample size reduction for each of our data-cleaning steps. Respondents may be excluded for more than one of the three reasons stated.

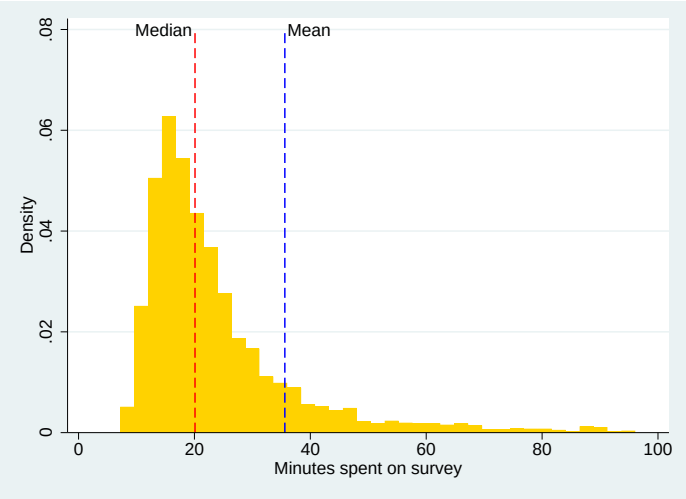
step-by-step, the sample size reductions for each of our data cleaning steps to arrive at our main sample. Appendix Figure C1 shows the distribution of the time respondents in our main sample spent on completing the survey. The mean and median duration was 35.6 and 20.1 minutes, respectively.

We flag respondents with potentially low-quality answers and exclude them in some of our analyses. We did this using the three measures—"inattentive", "impatient" and "too fast"—described in Appendix C.1. Appendix Table C2 reports the number of these respondents and their proportion of our main sample.

C.3 Income tax rate simulation

To avoid showing tax rates that differed too much from the respondent's actual situation, our vignette experiment randomly selected tax rates around the respondent's actual tax rate. The actual tax rate was computed by simulation, both to simplify the details that respondents should focus on (e.g. we simply needed them to focus on the average tax rate for our exercise, ignoring the complications that come with marginal tax rates) and because respondents might not recall the tax rates that they were paying. We did not ask

Appendix Figure C1: Time Spent on Survey



Notes: The figure shows the distribution of the time respondents in the main analysis sample spent on the survey (truncated at 100 minutes). The mean duration is 35.6 minutes, the median 20.1, and the 25th and 75th percentile are 15.5 and 28.6, respectively.

Appendix Table C2: Inattentive, impatient or too fast respondents

	Number of respondents	Percent of final sample
Inattentive in pre-vignette attention check	380	7.0
Inattentive in in-vignette attention check	446	8.2
Inattentive in either attention check	725	13.3
Clicked next slide >20 times during vignette instruction slideshow	909	16.7
Time taken for any of overall, vignette, and gov. expenditure liking questions is less than half the median time	1,286	23.6

Notes: This table shows the number of respondents and the proportion of the main sample that are "inattentive" (failed our pre-vignette or in-vignette attention checks), "impatient" (clicked next more than 20 times during the vignette instructional slideshow, and "too fast" (those with time spent on any of the overall, vignette and government expenditure liking questions less than half of the median time.

respondents directly about their taxes paid or asked them to verify the simulated tax rate to avoid emphasizing taxes beyond what was necessary. To avoid the internet speed reduction and risk of connection failure that comes with querying an external website, we elected to program the simulation directly in the survey, instead of obtaining the tax rate from an external source like the National Bureau of Economic Research TAXSIM.

We modeled three filing categories: married filing jointly if the respondent was married, single-filer if the respondent was non-married without any children, and head of household if the respondent was non-married with children. Total household income comprised wage income, interest and dividend income, capital gains income, and business income.[25] Wage income was directly collected in our survey (for both the respondent and their spouse if present). We imputed the other types of income separately for married and single respondents. To do this, we ran a regression of each income type on several demographic characteristics using the 2015–2019 Current Population Survey data. We then used these models and the demographic information collected in our survey to predict the interest and dividend income (set to zero if the resulting prediction was negative), capital gains income and business income for each respondent.

We modeled deductions as a weighted average of the standard deduction and an itemized deduction which varied across household income and filing category. The weights and itemized deduction amount were estimated based on the Internal Revenue Service's Statistics of Income (Internal Revenue Service 2021, Table 1.2). We computed taxable income as total household income less deductions, and applied the 2022 federal income tax brackets to obtain an income tax before credits amount for each respondent.

Next, we modeled two large tax credits, the Child Tax Credit and the Earned Income Tax Credit, using the federal tax credit formulas which consider income, number of children, and marital status. We chose these two credits to model because they were large credits that were likely to apply to our respondent sample and did not require additional questions that deviated from our main research question. We then computed the simulated income tax for each respondent as the income tax before credits less the imputed tax credits. Finally, we divided the income tax after credits by total household income to obtain the average tax rate for each respondent.

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