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## Working Paper Asymmetric Labor Supply Responses to Taxation

CESifo Working Paper, No. 11317

**Provided in Cooperation with:** Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

*Suggested Citation:* Esslinger, Anna; Pfeil, Katharina; Feld, Lars P. (2024) : Asymmetric Labor Supply Responses to Taxation, CESifo Working Paper, No. 11317, CESifo GmbH, Munich

This Version is available at: https://hdl.handle.net/10419/305559

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#### Impressum:

CESifo Working Papers ISSN 2364-1428 (electronic version) Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute Poschingerstr. 5, 81679 Munich, Germany Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de Editor: Clemens Fuest https://www.cesifo.org/en/wp An electronic version of the paper may be downloaded • from the SSRN website: www.SSRN.com

- from the RePEc website: <u>www.RePEc.org</u>
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# Asymmetric Labor Supply Responses to Taxation

## Abstract

Are the effects of tax aversion on labor supply symmetric? In a real-effort online experiment, participants are exposed to manipulated wages and taxes after first experiencing the same reference wage. More participants change their labor supply when encountering a tax increase than when experiencing an equivalent wage decrease. However, there is no significant difference in labor supply change between the groups that received tax decreases and wage increases. Tax averse behavior existing only in the presence of net wage decreases implies asymmetric labor supply responses to taxation.

JEL-Codes: H200, H300, D910, J220.

Keywords: tax aversion, loss aversion, labor supply asymmetry, online experiment.

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This version: August 26, 2024 This study was pre-registered on OSF, see <u>https://osf.io/b2x3d/?view\_only=d0a9aeb81fff48988fc897fab818e28f</u> and we obtained an IRB approval from the German Association for Experimental Economic Research, no. 8JrdNS7f. The experimental screens, data and analysis files are available on <u>https://osf.io/b2x3d/?view\_only=d0a9aeb81fff48988fc897fab818e28f</u>. We thank participants in the WEI Jour Fixe for helpful comments. Declaration of interest: none.

#### 1 Introduction

Governments can reform wage and tax rates to address changes in the cost of living due to inflation. The Inflation Reduction Act (IRA) which passed in Summer 2022 decreased the tax burden of nearly all income levels except the highest 1% (Buhl, 2022). Wage increases are another strategy to decrease the cost-of-living burden under inflation, as ten states in the US index minimum wages with inflation (Frosch, 2009). As behavioral reactions to these reforms affect labor supply, studying the labor supply effect of wage and tax rate changes is highly relevant for informed policy-making. However, most literature on behavioral responses to taxation focuses on the negative reaction to tax increases instead of tax cuts or equivalent changes in wages.

Increasing taxes can elicit strong negative reactions among taxpayers, and this negative reaction is possibly stronger than the reaction to other forms of loss of income (Kessler and Norton, 2016; Sussman and Olivola, 2011). Psychology-informed theory on tax aversion argues that individuals feel an additional burden associated with paying taxes, leading to an irrationally negative response to taxation (Blaufus and Möhlmann, 2014; McCaffery, 1994). In the presence of high taxes, tax averse individuals are more willing to substitute labor for leisure than in the presence of an equivalent wage cut (Kessler and Norton, 2016).

If increasing taxes causes a more negative response than cutting wages, symmetry in the labor supply would suggest that decreasing taxes causes a mirrored stronger positive response than increasing wages. However, several mechanisms such as reference-dependent behavior and loss aversion suggest asymmetric responses in labor supply. How a tax or wage is framed relative to a reference point (a previous wage or tax) can influence how it is perceived by individuals, which in turn alters their behavior.

While previous literature identifies tax aversion and reference-dependent behavior in the labor supply separately, this paper combines them to examine the research question: Does tax aversion have symmetric effects in the labor supply? We run a real-effort online experiment to determine the labor supply effect of net-increases and net-decreases of income framed as taxes or wage changes. In the experiment, participants are asked to transcribe strings of letters. Upon receiving the same wage and tax in the first round of the experiment, participants are exposed to five different wage and tax manipulations in the second round. One group receives the same wage and tax as in the first round, the other groups receive a tax increase or tax decrease, or a wage increase or wage decrease by 25%.

Observing changes in effort between rounds, we find that tax aversion affects labor supply asymmetrically when net wages are decreased. The framing of an increase in taxes changes labor supply more than the framing of an equivalent wage cut. However, there is no significant difference when net wages are increased, that is, between the labor supply response to the framing of a tax decrease and the framing of a wage increase.

Our results imply an asymmetric labor supply response to tax changes. This can be attributed to two effects: reference-dependence and tax aversion. The effects of reference-dependence and tax aversion on labor supply characterize the influence of framing effects on individual decision-making. Since decisions are influenced by the context of choice and the language of presentation, individuals respond differently to varying presentations of the same problem (Thaler, 1999; Tversky and Kahneman 1986). In the decision to supply labor, workers choose between labor and leisure. Experiments confirm that higher wages can incentivize workers to exert more effort (Charness and Kuhn, 2011; Fehr and Goette, 2007). However, framing effects suggest that it is not only how much individuals are paid but how their pay is presented that affects the labor supply decision.

Reference-dependence shows the influence of the context of choice on decision-making. When an individual's utility function is dependent on a reference point based on rational expectations of wages, feelings of losses and gains are derived from that reference point. Without a reference wage, the presentation of the same income could lead to a different labor supply decision (Tversky and Kahneman, 1991; Köszegi and Rabin, 2006). Workers are more likely to show up to work and work more when expected income is high (Köszegi and Rabin, 2006; Abeler et al., 2011).

Reference-dependence can also influence fairness concerns. Fehr et al. (2009) predicts that entry-level wages react differently to labor market conditions than incumbent-wages due to reference-dependent behavior. Because incumbent workers use their previous wages as a reference point instead of outside options shaped by the labor market, the authors attribute

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downward nominal wage-rigidity to reference-dependent fairness concerns among the labor supply (Fehr et al., 2009).

Tax aversion refers to the heavier weighting of a loss of income framed as a tax specifically (Kessler and Norton, 2016). Tax aversion shows the influence of the language of presentation on decision-making in the labor supply. The framing of a wage deduction as a tax rather than a wage cut can alter the labor-leisure decision of a worker because the language of taxation triggers a negative reaction to taxes that goes beyond the rational reaction to a deduction in wages (Sussman and Olivola, 2011; Blaufus and Möhlmann, 2014). Tax aversion can be motivated by the disentanglement of taxation with public goods, the lack of agency taxpayers have over how taxes are spent, and fairness concerns (Kessler and Norton, 2016; Spicer and Becker, 1980; Fortin et al., 2007). Ultimately, tax aversion is present when an individual alters their behavior to avoid paying greater taxes, this altered behavior can in turn affect consumption and labor supply decisions (Sussman and Olivola, 2011). Since our study also examines the opposite mechanism, i.e., individuals responding to lower taxes, we will use tax sensitivity throughout the paper as an umbrella term that accommodates tax aversion and its positive equivalent.

Previous literature uses experiments to show the influence of tax sensitivity on decisionmaking. Experiments on tax salience support the existence of tax aversion. When an individual is more aware that they are being taxed, their consumption or labor supply decision in response to taxes changes (Finkelstein, 2009; Congdon et al., 2009; Chetty et al., 2009; Chetty and Saez, 2013). Kessler and Norton (2016) compare the response to taxation versus equivalent wage decreases to show the effect of tax aversion. Participants in their experiment worked less when taxes were increased than when wages were cut, despite earning the same net income.

There is some skepticism in the literature on the existence of tax aversion. In the labor supply literature, Mori et al. (2022) find no difference in effort provision between treatment groups whose wages are cut and treatment groups whose taxes are increased. They state that tax aversion found in Kessler and Norton (2016) could come from a "surprise effect" of taxes being introduced. Additionally, Djanali and Sheehan-Connor (2012) confirm a tax affinity hypothesis in a labor-leisure framework, suggesting that individuals derive utility out of paying taxes due to pro-social tendencies. In the consumption literature, Olsen et al. (2019) find no or a

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very small effect of tax aversion in hypothetical purchase decisions and no effect in a generalized value added tax system. However, literature on behavioral responses to taxes on specific consumer goods further indicates the presence of tax sensitivity. Hardisty et al. (2019) and Douenne and Fabre (2022) find evidence of carbon tax aversion. In a field experiment, Donnelly et al. (2021) show that increasing the salience of excise taxes on sugar-sweetened beverages decreased purchasing. While there is ambiguity on the impact of taxation on behavior, most of the cited literature shows some sensitivity to taxation.

Previous experiments contribute to the policy discussion related to labor supply responses to payroll versus income taxes, mainly focused on wage cuts and tax increases. Since income tax is a more salient tax than payroll taxes, workers may withhold labor more when taxes are imposed directly on them in the form of income taxes. The debate on payroll versus income taxes pertains to policy decisions related to increasing taxes and decreasing wages. This paper adds to the literature by investigating the labor supply effect of wage increases and tax cuts. To our knowledge, we present the first evidence regarding tax cuts and equivalent wage increases, contributing to the policy debate on governments' inflation response. While we find tax aversion present in labor supply when taxes are increasing, we cannot find an equivalent tax sensitivity when taxes are decreasing. By finding an asymmetric labor supply response to increasing and decreasing taxes, this paper shows that tax aversion in the labor supply has less of an impact when taxes are decreasing.

The paper proceeds as follows. Section 2 outlines the experimental design. Section 3 presents the results and discusses mechanisms to explain them. Section 4 reviews the validity of the results, discusses policy applications, and concludes.

#### 2 Experiment Design

We conduct an online experiment to test whether tax aversion is symmetric in the labor supply when net increases and net decreases of income are framed as taxes or wage changes. In this online experiment, participants complete a real effort task for pay (see Appendix A.1. for the instructions ). The goal of the experiment is to see whether participants exert different amounts of effort when faced with varying wage and tax rates. Similar to Kessler and Norton (2016) and Doerrenberg et al. (2023), participants are asked to transcribe text sequences and face varying wage and tax rates across two rounds. Figure 1 shows the transcription task, which is a simple typing task similar to Augenblick et al. (2015) and Dickinson (1999). In the instructions, participants are told that they can complete as many sequence transcriptions as they want within each two-minute period. They are also told they could stop the task and take breaks.

Correct Text Sequences: 0					
Text Sequence:	olkxngjxpo				
	Answer:				
οικχησίχρο					
	Submit				

Figure 1: Transcription Task in Experiment

#### 2.1 Treatments: Wage and Tax Manipulations

In the first two-minute round of the experiment, all participants receive the same wage and tax rate. Prior to starting the round, each participant receives the message: "For each string you complete, you will receive **\$0.12**, but **\$0.04** of your earnings will be deducted as a tax." Figure 2 shows how this message is displayed in the experiment. This message is also visible while the participants are completing the task. All participants receive the same treatment in the first round, so that they all have the same reference point of \$0.08 net (see also Kessler and Norton, 2016; or Doerrenberg et al., 2023, for establishing a reference point in the first round). This should give them similar expectations of their wage and tax rate in the next round.

After the first round, we randomly assign participants into one of five groups. Prior to starting the task in the second round, the participants are again alerted of the wage and tax rate. The *Control Group* receives the same message as they did in the first round, meaning there is no change in their wage or tax rate. *WageDecreaseT* receives the message: "For each string you complete, you will receive **\$0.10**, but **\$0.04** of your earnings will be deducted as a tax."

*TaxIncreaseT* receives the message: "For each string you complete, you will receive **\$0.12**, but **\$0.06** of your earnings will be deducted as a tax." These two treatment groups receive the same net wage of \$0.06 per text transcribed, which is lower than that of the control group and their reference point. They receive a decrease in net wage of the same amount; however, the framing of that decrease differs.

# Round 1: Working Stage

In this round, you receive the following wage and tax rate:

For each string you complete, you will receive **\$0.12**, but **\$0.04** of your earnings will be deducted as a tax.

Continue

		Round 1			Round 2		
		Wage rate	Tax rate	Net	Wage rate	Tax rate	Net
	Control	0.12	0.04	0.08	0.12	0.04	0.08
Net wage	WageDecreaseT	0.12	0.04	0.08	0.10	0.04	0.06
decrease	TaxIncreaseT	0.12	0.04	0.08	0.12	0.06	0.06
Net wage	WageIncreaseT	0.12	0.04	0.08	0.14	0.04	0.10
increase	TaxDecreaseT	0.12	0.04	0.08	0.12	0.02	0.10

Figure 2: Presentation of Wage and Tax Rate in Experiment

Table 1: Treatments and Piece-rate Pay in USD (\$) for Completing Task

The next two treatment groups receive a net increase in wage. *WageIncreaseT* receives the message: "For each string you complete, you will receive **\$0.14**, but **\$0.04** of your earnings will be deducted as a tax." *TaxDecreaseT* receives the message: "For each string you complete, you will receive **\$0.12**, but **\$0.02** of your earnings will be deducted as a tax." The two groups receive a higher net wage of \$0.10 per task, this is higher than the net wage of the *Control Group* and the reference point. As an inverse to the first two treatment groups, *WageIncreaseT* and *TaxDecreaseT* receive a net increase of the same amount with different framing. Among the four

treatment groups, there is symmetry of the monetary incentives between net increases and net decreases. Table 1 displays the piece-rate pay for completing each task according to treatment group: showing the different framing and the symmetry in net wage changes.

#### 2.3 Hypotheses

This experiment is designed to test whether tax aversion is symmetric in the labor supply. Asymmetric labor supply responses to wage changes and tax changes would imply tax aversion, but reference-dependence may also be present in the sample. Based on previous literature and experimental findings on tax aversion and reference-dependence, we test four hypotheses. All four hypotheses include a framing effect and not just an income effect into the participants' decision-making. Reference-dependence in the sample shows the framing effect of context, i.e., whether losses as opposed to gains in net wages matter more for labor supply. Alternatively, tax aversion in the sample shows the framing effect of language, i.e., whether framing the change with tax or wage language affect labor supply more. Asymmetric labor supply responses to tax changes suggest that individual decision-making is influenced by both context of choice and language of presentation.

**Hypothesis 1:** The change in labor supply should be larger for the treatment groups that receive a net wage decrease than for the treatment groups that receive a net wage increase.

This hypothesis implies an asymmetric labor supply response to net wage changes irrespective of a tax or wage framing. The hypothesis states that the labor supply response to losses is larger than the response to gains, with losses and gains relative to the exogenously determined reference point established in the first round. Confirming this hypothesis would fall in line with the findings from Doerrenberg et al. (2023) and Kube et al. (2013) that the estimated treatment effect of a wage decrease is larger than the effect of a wage increase.

Instead of reference-dependence based on the context of choice and its monetary incentives, the framing of language may matter more for labor supply changes. On the aggregate, we expect that a tax framing has a stronger effect on labor supply than a wage framing, irrespective of the type of change (increase versus decrease). In Hypotheses 2 to 4, we specify this intuition precisely regarding the type of change and framing.

**Hypothesis 2:** A tax increase should lead to a larger change in labor supply than an equivalent wage cut.

This hypothesis implies tax aversion in the labor supply among those that receive a net wage decrease. Despite some findings showing no effect of tax aversion on the labor supply (Mori et al., 2022) and in general (Olsen et al., 2019), Kessler and Norton (2016) find tax averse behavior in the labor supply in a similar comparison. Additionally, tax aversion found in consumption behavior (Donnelly et al., 2021; Hardisty et al., 2019) indicates the presence of tax averse behavior. Thus, this hypothesis would confirm the effect of tax aversion in the labor supply. When receiving a reduction in income is framed in terms of taxes, individuals change their labor supply more strongly.

**Hypothesis 3:** A tax cut should lead to a larger change in labor supply than an equivalent wage increase.

This hypothesis predicts that tax sensitivity is also present among those that receive a net wage increase. The framing of a tax decrease instead of a wage increase elicits a stronger positive response because there are irrationally stronger feelings towards taxation in the labor supply. This hypothesis tests whether the findings in Kessler and Norton (2016) can be mirrored with decreasing taxes and increasing wages. It predicts that tax framing not only elicits a stronger response when there is a net wage decrease, but also when there is a net wage increase.

**Hypothesis 4:** A tax increase should have a stronger effect on labor supply than a tax decrease.

This hypothesis predicts that the labor supply response to taxes is asymmetric. This assumes that utility is reference dependent (Köszegi and Rabin, 2006), where the tax rate from the previous period is the reference tax. The framing of a new tax rate above or below this reference point, can affect individuals' preferences and fairness considerations, ultimately leading to different labor supply decisions (Tversky and Kahneman, 1991; Fehr et al., 2009). Tax rates above this reference point should change the labor supply more than tax rates below this point. While Hypothesis 3 states that tax sensitivity in the labor supply elicits a strong response when taxes are decreasing, Hypothesis 4 states that the magnitude of this response is not as large as the magnitude of the response to taxes increasing

#### 2.4 Implementation and Procedure

Participants are recruited through CloudResearch on the online labor market MTurk (Litman et al., 2017). Using a sample from MTurk allows for a more geographically and demographically diverse subject pool than typical university in-person lab samples in the US (Buhrmester et al., 2011, 4). Although there are concerns of non-naivete and information sharing among MTurk workers (Chandler et al., 2014), due to the simplicity of the task, having expertise on completing HIT's and additional information should not give participants a special advantage that would alter results.

Due to their unobservability while completing the task, one concern with the use of MTurk workers is that they may multi-task or exert less effort (Berry et al., 2022). However, this experiment assumes in its design that people might multi-task or exert less effort when completing the labor task and wants to observe whether the choice to do so is affected by varying wage and tax rates. Additionally, the use of recruitment through CloudResearch, captcha tests, and attention checks should improve the quality of the workers and thus the data. Due to the repetitiveness of the task and the lower attention span of workers in online experiments (Chandler et al., 2014), the rounds are only two minutes.

Participants receive a flat payoff of \$1.30 for participating in the experiment. This payoff is for entering the HIT, completing surveys interspersed between tasks, and taking the time to read the instructions. Participants are immediately told of this payoff and that they could make an additional \$1.50 as a bonus depending on their decisions. Upon entering the HIT, participants complete a captcha-test and are given an overview of the experiment. They then take a demographic survey to provide information on age, gender, education, income, and time spent working on MTurk. At the end of the survey, they also complete an attention check. We filter out inattentive subjects using a question like the Eckel Grossmann task (Eckel and Grossman, 2002). We adapt the question so that participants read a brief text in which they are asked to select the third option of a multiple-choice question. Only those that pass the attention check continue to the rest of the experiment, improving the quality of participants (Berry et al. 2022).

After passing the attention check, participants are given more detailed instructions on the task and payoffs and are asked to complete one transcription to familiarize themselves with the

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task. Then they proceed to the experiment, which consists of six stages (Figure 3). In the first round of the experiment, they all receive the same wage and tax treatment. They are told their wage and tax rate for the first round and are then given two minutes to complete as many transcriptions as desired. After the two-minute labor period, the participants are told how many text sequences they completed, how much they made in the first round, and how much they were taxed. They are then asked to confirm their wage and tax rate to ensure that they understood their treatment. Before entering the next round, they are asked what they would like their wage and tax rate to be in the next round, priming them to expect that their wage and tax rate may change.

			Net wage decrease		Net wage incre	ease
		Control Group	Wage	Tax IncreaseT	Wage	Tax DecreaseT
1	Round		Exposure to san	ne reference wag	ge and tax rate	Decreaser
2	1		Two-	minute labor pei	riod	
3		Sur	vey to test unde	rstanding of trea	atment in Round	1
4	Round	Exposure to	Exposure to	Exposure to	Exposure to	Exposure to
	2	reference	wage	tax increase	wage	tax decrease
		wage and tax	decrease		increase	
5		Two-minute labor period				
6		Sur	vey to test unde	rstanding of trea	atment in Round	2

#### Figure 3: Stages of the Experiment

Notes: The reference wage is \$0.12, and the reference tax rate is \$0.04. *WageDecreaseT* results in a wage rate of \$0.10, *TaxIncreaseT* in a tax rate of \$0.06, *WageIncreaseT* in a wage rate of \$0.14 and *TaxDecreaseT* in a tax rate of \$0.02.

Upon entering the second round of the experiment, the participants are then randomly assigned to one of the five wage and tax manipulations. The same procedure as in round 1 follows, the only difference is they are assigned different wage and tax rates, and they are not asked what wage and tax rate they would like in the next round after completing the task. After completing the labor in the second round, the participants complete a behavioral survey with questions on fairness and loss aversion and questions related to their preferences on tax policy.

Participants are only paid for the work completed in one of the rounds; this round is determined at random. This utilizes the pay-one-approach to increase the piece rate payoff for the task, such that the wages and taxes could be manipulated by \$0.02 between rounds, while keeping the average total payoff at around \$2.50. The pay-one-approach can prevent wealth and portfolio effects and cross-task contamination, as such behavior in each round is isolated to that round (Charness et al., 2016). Upon completion, the participants are then told which round they get paid for, and their total payoff for the experiment. The experiment is programmed with LIONESS LAB (Giamattei et al., 2020). All screens can be found in Appendix A.1., all screens and experimental code can be found on OSF.

#### 3 Results

Results were collected in November 2022. The Human Intelligence Task (HIT) was posted on MTurk, and participants completed the HIT on LIONESS LAB. In total, 322 participants entered the HIT.<sup>1</sup> 248 participants completed the experiment. Most (96%) of the dropouts left the experiment while receiving the instructions or because they failed the attention check. Two participants started the real effort task and left the experiment after the first round. Only one participant dropped out after being randomized into a treatment group. This participant received the wage increase treatment, completed one transcription, and then left the experiment. The number of participants in each stage of the experiment is plotted in Figure 18 in Appendix A.3. For the analysis, only the 248 participants that completed the experiment, the HIT took on average thirteen minutes to complete, and the average payoff was \$2.48. This gives an average payoff equivalent to an hourly wage of \$11.44.

#### 3.1 Sample and Descriptive Statistics

Table 2a presents the descriptive statistics for the sample, including performance and demographic variables. The demographic variables are self-reported from the survey participants

<sup>&</sup>lt;sup>1</sup> A test session was conducted prior to conducting the experiment with a full sample. In this test session, the payoffs differed slightly though the treatment groups remained the same. The payoffs for this test session are in section A.2. in the Appendix. 57 participants completed the experiment in the test session.

completed at the beginning of the experiment. The only demographic variable where there is significant variation is the below median income variable. Overall, 60% of the sample earns an income below the median income in 2022 in the US, ranging from 41% in *TaxDecreaseT* to 71% in *WageIncreaseT*. Despite this significant variation for the income variable, Table 2a shows that treatment effects should not be impacted by socio-demographics since there is no significant variation between treatment groups for the other variables.

	Total	Control	Wage	Тах	Wage	Тах	F-Test
	Sample	Group	DecreaseT	IncreaseT	IncreaseT	DecreaseT	
Age	40.56	40.62	40.41	41.82	40.22	39.71	0.21
(in years)	(11.73)	(12.41)	(9.72)	(12.88)	(12.75)	(11.27)	
Female	0.54	0.58	0.54	0.57	0.46	0.51	0.42
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.51)	
Bachelor's	0.58	0.60	0.52	0.53	0.66	0.59	0.42
Degree	(0.50)	(0.49)	(0.50)	(0.51)	(0.48)	(0.50)	
Works Full-	0.57	0.53	0.61	0.49	0.66	0.57	0.84
time	(0.50)	(0.50)	(0.49)	(0.51)	(0.48)	(0.50)	
Below Median	0.60	0.69	0.65	0.57	0.71	0.41	3.11**
Income	(0.49)	(0.47)	(0.48)	(0.50)	(0.46)	(0.50)	
Experience	12.96	13.16	14.46	12.16	12.83	11.98	0.43
with MTurk	(10.81)	(8.83)	(13.2)	(9.32)	(12.31)	(11.98)	
(in hours)							
Number of	248	55	54	49	41	49	
Observations							

Table 2a: Descriptive Statistics – Demographic Variables

Notes: Table 2 presents descriptive statistics. Table 2a shows mean and standard deviation (in parentheses) for demographic variables. For the variable Female, female=1, else=0. For the variable Bachelor's Degree, at least bachelor =1, else=0. For the variable Works Full-time, works full-time =1, else=0. For the variable Below Median Income, below = 1, above = 0.

F-Tests test the hypothesis that the mean values between the five groups are the same.

\* Significance at 0.1 \*\* Significance at 0.05 \*\*\* Significance at 0.01

We observe the following performance variables: the number of strings completed in round 1 ( $s_1$ ), the number of strings completed in round 2 ( $s_2$ ), and the difference in the strings completed (d =  $s_2 - s_1$ ). These performance variables serve as a proxy for productivity, where  $s_1$  and  $s_2$  represent productivity in rounds 1 and 2, respectively, and d represents the difference in productivity. The first two rows of Table 2b show that all groups completed more strings on

average in the second round. As a result, the average difference in strings completed (d) for each group is positive. F-tests show no significant variation between treatment groups for any of these three performance variables.

The variable Labor Supply Change is a binary variable representing whether participants changed their productivity in the second round upon receiving treatment. The variable is coded as a 0 if the difference in strings completed is zero and coded as a 1 if the difference in strings completed is non-zero. Table 2b shows the percentage of participants in each treatment group that changed their labor supply in the second round. With an F-statistic of 2.25, statistically significant at the 90% level, there is significant variation between the treatment groups. We use the labor supply change variable as the main outcome variable in the analysis of results.

	Total	Control	Wage	Тах	Wage	Тах	F-
	Sample	Group	DecreaseT	IncreaseT	IncreaseT	DecreaseT	Test
Round 1: No. of	14.46	14.27	14.11	15.45	13.76	14.65	0.49
Strings	(6.34)	(5.16)	(7.13)	(6.61)	(6.19)	(6.57)	
Completed (s <sub>1</sub> )							
Round 2: No. of	15.31	15.45	15.30	15.86	14.29	15.37	0.28
Strings	(6.73)	(6.10)	(7.05)	(7.08)	(6.41)	(7.11)	
Completed (S <sub>2</sub> )							
Difference in	0.85	1.18	1.19	0.41	0.63	0.71	1.12
Strings	(2.34)	(2.65)	(2.05)	(2.51)	(1.97)	(2.36)	
Completed (d)							
Labor Supply	0.83	0.90	0.72	0.89	0.80	0.84	2.25*
Change	(0.37)	(0.29)	(0.45)	(0.31)	(0.40)	(0.37)	
Number of	248	55	54	49	41	49	
Observations							

Table 2b: Descriptive Statistics – Performance Variables

Notes: Table 2b shows mean and standard deviation (in parentheses) for performance variables. For the variable Labor Supply Change, change in labor supply = 1, no change in labor supply = 1.

F-Tests test the hypothesis that the mean values between the five groups are the same.

\* Significance at 0.1 \*\* Significance at 0.05 \*\*\* Significance at 0.01

#### 3.2 Non-Parametric Analysis of Labor Supply Change

To observe whether a change in net incentives or the framing has a stronger effect on labor supply responses, we first aggregate the treatment groups according to how their net wage changed in the second round of the experiment. Thus, we observe *WageDecreaseT* and *TaxIncreaseT* together as the groups that received a net increase. And we observe *WageIncreaseT* and *TaxDecreaseT* together as the groups that received a net decrease. Figure 4 shows the labor supply response between the groups based on receiving a net decrease or a net increase. Among the groups that received a net increase, 81% changed their labor supply. Similarly, among the groups that received a net decrease, 82% changed their labor supply. A Mann-Whitney U Test produces a z-statistic of 0.291 (p = 0.7711) showing no significant difference between the groups regarding net changes. This means that we cannot reject nor confirm Hypothesis 1 proposing that a change in labor supply should be larger for the treatment groups that receive a net decrease than for the treatment groups that receive a net increase.





Notes: Figure 4 displays the probability of changing labor supply for net change or framing treatment with 95% confidence intervals. On the left panel, we collapse the treatments *WageDecreaseT* and *TaxIncreaseT* that received a net increase. In turn, we combine *WageIncreaseT* and *TaxDecreaseT* that received a net decrease. On the right panel, we collapse *WageDecreaseT* and *WageIncreaseT* that experienced the change of incentives in a wage framing versus *TaxIncreaseT* and *TaxDecreaseT* that experienced the change in a tax framing.

**Result 1:** There is no significant difference in the change in labor supply between groups that received a net decrease and groups that received a net increase.

To analyze whether the framing has an effect irrespective of the incentives, we observe *TaxIncreaseT* and *TaxDecreaseT* together as the groups that receive a tax framing. We further collapse *WageDecrease* and *WageIncreaseT* as the groups that experience a wage framing. When comparing the two types of framing in a Mann-Whitney U Test, we find a z-statistic of -1.946 (p < 0.1), implying that the framing significantly affects the decision to change labor. Figure 4 shows this larger gap in labor supply response between groups that received the tax framing and groups that received the wage framing.

**Result 2:** There is a large and statistically significant change in labor supply when taxes are increased compared to when wages are decreased. This confirms our hypothesis that there is tax aversion in the labor supply.

To determine whether tax aversion is present in the sample, we observe differences in labor supply response on the treatment level. First, we compare the labor supply change among the two groups that received a net decrease. In WageDecreaseT, 72% of participants changed their labor supply in the second round. This is comparatively less than the participants that changed their labor supply in TaxIncreaseT, where 89% of participants changed their labor supply. A Mann-Whitney U-Test confirms a significant difference in labor supply change between *WageDecreaseT* and *TaxIncreaseT* with a z-statistic of -2.24 (p < 0.05). This indicates that tax aversion is present in the sample among the groups that received a net wage decrease. However, among the groups that experienced a net increase there is not a significant difference in labor supply change. Among those that received WageIncreaseT, 80% changed their labor supply. This is slightly less than the 84% of participants in *TaxDecreaseT* that changed their labor supply. The Mann-Whitney U Test gives a z-statistic of 0.391 (p = 0.6954) showing no significant difference between groups. This implies that tax sensitivity is not present among groups that received a net wage increase. Figure 5 shows that a larger gap in labor supply change exists between WageDecreaseT and TaxIncreaseT; however, there is no gap between WageIncreaseT and TaxDecreaseT.



Figure 5: Probability of Labor Supply Change by Treatment

Note: Figure 5 displays the probability of changing labor supply for each treatment group with 95% confidence intervals.

**Result 3:** The differences in labor supply between a tax cut and a wage increase is statistically indistinguishable and economically small. We cannot reject the null hypothesis that a tax decrease has the same effect on the change in labor supply as a wage increase.

These two results indicate that tax aversion is asymmetric in the labor supply since tax aversion is present when net wages are decreasing but tax sensitivity cannot be confirmed when net wages are increasing. This confirms Hypothesis 2 that a tax increase should lead to a larger change in labor supply than an equivalent wage cut confirming the results in Kessler and Norton (2016). However, since we can neither confirm nor reject Hypothesis 3 that a tax cut should lead to a larger change in labor supply than an equivalent wage increase, we cannot conclude that there is also an effect of tax sensitivity when subjects experience a net wage increase.

To additionally test whether tax aversion is asymmetric in the labor supply, we compare the effects of the two tax framing treatments. For tax aversion to be symmetric in the labor supply, the effect of the tax increase on labor supply change would be equivalent to the effect of the tax decrease. Both tax framing treatment groups show a larger change in labor supply than the wage framing groups. *TaxIncreaseT* had the largest labor supply change, the probability of labor supply change in *TaxIncreaseT* is 5 percentage points larger than in *TaxDecreaseT*. However, a Mann-Whitney U Test shows that this difference is not statistically significant (p = 0.3741). Hence, we can neither reject nor confirm Hypothesis 4 stating that a tax increase should affect labor supply more than a tax decrease.

**Result 4:** A tax increase does not have a statistically significant larger effect on labor supply change than a tax decrease.

#### 3.3 Multivariate Analyses of Labor Supply Change

To find out whether the results from the non-parametric analysis hold with the inclusion of controls, we conduct parametric analyses with probit models with marginal effects and test for significant changes in labor supply between the treatment groups. First, to compare the effects of net incentive changes versus framing on labor supply, we conduct parametric analyses collapsing treatments. This allows us to make a decision related to Hypothesis 1 and confirm Result 1.

Table 3 shows the marginal effects of the two dimensions, net change and framing, on labor supply change. Columns 1 and 2 report the results for the model that compares the groups that received a net wage increase to the groups that received a net wage decrease, in which the coefficient shows the change in the labor supply of participants that received a net wage decrease. There is no statistically significant effect of receiving a net wage decrease on labor supply change when receiving a net wage increase is the reference category. The inclusion of controls does not change this result, as the marginal effect remains statistically insignificant. This result matches the descriptive results and non-parametric analysis.

Columns 3 and 4 report the results for the framing comparison with the coefficient showing the change in the labor supply of participants that experienced a tax framing. A tax framing significantly affects the probability of changing labor supply by 41 percentage points as compared to experiencing a wage framing. This effect remains significant at the p < 0.05 level

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	Pr	ge		
-	Reference Category: Net Increase		Reference Wage	e Category: Framing
-	(1)	(2)	(3)	(4)
Net Decrease	-0.061	-0.108		
	(0.210)	(0.213)		
Tax Framing			0.414*	0.429**
			(0.213)	(0.223)
Age		-0.002		-0.003
		(0.009)		(0.009)
Female		-0.397*		-0.397*
		(0.206)		(0.210)
Bachelor's Degree		-0.098		-0.063
		(0.221)		(0.226)
Full Time Worker		-0.119		-0.033
		(0.224)		(0.224)
Below Median Income		0.020		0.107
		(0.222)		(0.231)
Experience		-0.002		-0.001
		(0.008)		(0.009)
Observations	193	192	193	192
Pseudo R2	0.000459	0.0257	0.0207	0.0444

when control variables are included. This matches the non-parametric analyses and shows that framing effects matter more for changes in labor supply than a change in net incentives.

Table 3: Effect of Net Change and Framing on Labor Supply Change

Notes: Table 3 presents marginal effects with labor supply change (binary variable) as the dependent variable. In specification (1) and (2) Net Decrease is a dummy, collapsing treatments *TaxIncreaseT* and *WageDecreaseT*. The reference group is Net Increase, a dummy that collapses *TaxDecreaseT* and *WageIncreaseT*. In specification (3) and (4) Tax Framing is a dummy, collapsing treatments *TaxIncreaseT* and *WageIncreaseT*. The reference group is Wage Framing, collapsing treatments *WageIncreaseT* and *WageDecreaseT*. For the variable Female, female = 1, else = 0. For the variable Bachelor's Degree, at least bachelor = 1, else = 0. For the variable Works Full Time, works full time = 1, else = 0. For the variable Below Median Income, below = 1, above = 0.

Robust standard errors in parentheses.

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01

To examine the asymmetry of tax aversion in the labor supply, we further conduct parametric analyses on the treatment level. By observing differences between groups that receive the same net wage with different framing, we can investigate how language influences the labor supply decision while the direction of incentive change (net increase/ net decrease) is the same. Table 4 shows the marginal effect of each treatment on the probability of changing labor supply. To identify whether the framing effect of tax aversion is present among the groups that received a net decrease, we compare *WageDecreaseT* and *TaxIncreaseT*.

	Probit (ME) – Labor Supply Change				
-	Net De	crease	Net Ir	icrease	
_	Reference Category:		Reference Category:		
_	WageDecreaseT		Wagelr	ncreaseT	
	(1)	(2)	(3)	(4)	
TaxIncreaseT	0.681**	0.696**			
	(0.305)	(0.301)			
TaxDecreaseT			0.122	0.116	
			(0.312)	(0.346)	
Age		0.004		-0.009	
		(0.014)		(0.014)	
Female		-0.510*		-0.337	
		(0.292)		(0.317)	
Bachelor's Degree		0.203		-0.478	
		(0.304)		(0.368)	
Full-Time Worker		-0.087		0.109	
		(0.295)		(0.350)	
Below Median Income		0.047		0.072	
		(0.311)		(0.351)	
Experience		0.010		-0.009	
		(0.010)		(0.015)	
Observations	103	102	90	90	
Pseudo R2	0.0522	0.0962	0.00183	0.0410	

Table 4: Treatment Effects on Labor Supply Change

Notes: Table 4 presents marginal effects with labor supply change (binary variable) as the dependent variable. In specification (1) and (2) *TaxIncreaseT* is the treatment dummy. The reference group is *WageDecreaseT*. In specification (3) and (4) *TaxDecreaseT* is the treatment dummy. The reference group is *WageIncreaseT*. For the variable Female, female=1, else=0. For the variable Bachelor's Degree, has at least a bachelor's degree =1, else=0. For the variable Full-time Worker, works full-time =1, else=0. For the variable Below Median Income, below = 1, above = 0.

Robust standard errors in parentheses. \*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01 Columns 1 and 2 present the results of this analysis, with *WageDecreaseT* as the reference group. The marginal effect of tax framing on labor supply change is positive and statistically significant at the p < 0.05 level, also with the inclusion of controls. This positive coefficient implies that the tax framing increases the probability of an individual changing their labor supply. The magnitude of this effect is between 68 percentage points without controls and 70 percentage points depending on the inclusion of controls. This shows that among the groups that received a net wage decrease, the tax increase has a large and significant effect on labor supply change, confirming that tax aversion is present for subjects that experience a decrease in their net wages.

To examine whether the effect of tax framing on labor supply change also exists when wages are increasing, we compare the two groups that received net increases. As an inverse to the comparison in Columns 1 and 2, this analysis looks at the impact of the language of tax framing with a subsample of participants who received a net wage increase in Columns 3 and 4. If tax framing elicits a stronger labor response, the marginal effect of *TaxDecreaseT* should be positive and of a similar magnitude as in the columns before.

Though the marginal effect of *TaxDecreaseT* is positive across both regressions, it is not statistically significant, and the magnitude is smaller. This shows that the framing effect of a tax is not present when participants receive a net increase. As only the marginal effect of the *TaxIncreaseT* is statistically significant and larger in magnitude than that of *TaxDecreaseT*, there is a framing effect of the tax increase, whereas we cannot conclusively identify a framing effect of a tax decrease. This supports the results from the non-parametric comparisons for Hypotheses 2 to 4 that there is asymmetry in tax sensitivity depending on the change in net incentives. The tax framing in the net decrease domain has a strong and significant effect on labor supply, whereas the effect of tax framing in the net increase domain remains inconclusive.

#### 3.4 Do Learning Effects Play a Role?

Previous parametric analysis compares treatment groups who received a change in their wage or tax rate during the experiment. The question remains to what extent learning among the two rounds occurred irrespective of the change in incentives or framing. A *Control Group* that received no change in wage nor tax rate in the second round sheds light on this open question. The *Control Group* serves to show whether any changes in performance between rounds is just due to ability and interest in the task. Table 2b shows that the *Control Group* contained the largest percentage of participants who changed their labor supply between the two rounds. This result implies that receiving the same wage and tax rate in the two rounds leads to the largest change in behavior, which appears counterintuitive and suggests strong learning effects.

Considering this, we recreate the main results using the control group as a reference category. Table 5 shows the marginal effects of net changes in Columns 1 and 2, framing effects in Columns 3 and 4, and treatments in Columns 5 and 6 on labor supply change. On the net change level, Columns 1 and 2 show that receiving a net decrease reduces the probability of participants changing their labor supply by 46 percentage points compared to no change in net wage. This effect is statistically significant at the p < 0.1 level and holds with the inclusion of controls. On the framing level, Columns 3 and 4 show that experiencing a wage framing irrespective of the direction of change decreased the probability of changing labor supply. This effect is statistically significant at the p < 0.05 level, and the significance and magnitude hold with the inclusion of controls.

On the treatment level, Columns 5 and 6 show that *WageDecreaseT* is the only treatment that significantly affects labor supply change compared to *Control*. When participants experience a net decrease which is framed as a wage decrease, the probability of them changing their labor supply decreases by 74 percentage points compared to the *Control Group* without a change in net wage. This effect is statistically significant at the p < 0.05 level.

Compared to the main results above, we find three counterintuitive results: First, while directly comparing net decrease to net increase does not render any significant difference, experiencing a decrease in net wage compared to no change reduces the probability of changing labor supply significantly. Second, experiencing a wage framing compared to no framing significantly reduces the probability of labor supply changes, whereas we found that a tax framing has a significantly positive effect on labor change compared to a wage framing. Third, *WageDecreaseT* significantly reduces labor supply change compared to the *Control Group*, whereas we find that comparing *TaxIncreaseT* to *WageDecreaseT* has a positive effect on changing labor supply.

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		Prob	oit (ME) – La	bor Supply	Change	
		R	eference Ca	ategory: Cor	itrol	
	(1)	(2)	(3)	(4)	(5)	(6)
Net Decrease	-0.473*	-0.460*				
	(0.277)	(0.277)				
Net Increase	-0.411	-0.388				
	(0.284)	(0.278)				
Tax Framing			-0.221	-0.186		
			(0.286)	(0.291)		
Wage Framing			-0.636**	-0.638**		
			(0.276)	(0.270)		
WageDecreaseT					-0.746**	-0.761**
					(0.299)	(0.297)
TaxIncreaseT					-0.065	-0.032
					(0.340)	(0.347)
WageIncreaseT					-0.476	-0.471
					(0.327)	(0.320)
TaxDecreaseT					-0.354	-0.326
					(0.320)	(0.323)
Demographic Controls	NO	YES	NO	YES	NO	YES
Observations	248	247	248	247	248	247
Pseudo R2	0.0146	0.0265	0.0315	0.0450	0.0391	0.0531

Table 5: Effect of Net Changes, Framings and Treatments on Labor Supply Change

Notes: The table presents marginal effects with labor supply change (binary variable) as the dependent variable. In Models (1) and (2) Net Wage Decrease and Net Wage Increase are dummies collapsing treatments by the type of net wage change. Models (3) and (4) include Tax Framing and Wage Framing dummies that collapse treatments by the type of framing. In Models (5) and (6), WageDecreaseT, TaxIncreaseT, WageIncreaseT, and TaxDecreaseT are treatment dummies. The reference group is the Control Group in all specifications. For the variable Female, female = 1, else = 0. For the variable Bachelor's Degree, at least bachelor = 1, else = 0. For the variable Full-time Worker, works full-time = 1, else = 0. For the variable Below Median Income, below = 1, above = 0. Robust standard errors in parentheses.

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01

#### 3.4 Fairness as a Mechanism to Explain Results

The results of the experiment show that tax aversion is present in the labor supply among those that received a net decrease. However, tax sensitivity is not present in the labor supply among those that received a net increase. The strong response to taxes being increased does not mirror into a strong response to taxes being decreased. This implies that when there is a net decrease, the added framing of a tax increase changes labor supply. However, when there is a net increase, the added framing of a tax cut does not affect labor. When collapsing treatments on the net change level, there is no significant difference in behavior. However, when comparing treatment groups according to the framing (tax versus wage), we can see that a tax framing increased the probability of labor supply change.

Fairness considerations that we inquired in a post-experimental survey can help explain these results. After completing both rounds, participants were asked: "Compared to the first round, do you think the tax rate (wage rate) in round 2 was fair or unfair?" For both questions, they were asked to report fairness on a 5-point Likert scale where 1 means not fair at all and 5 means very fair.



Figure 6: Gap in Fairness Perceptions

Fairness considerations may be able to explain the variation in labor supply changes since there is a greater gap in fairness perceptions between subjects that experienced tax changes compared to subjects that experienced wage changes (Figure 6). Among those that experienced a tax framing, subjects that received the tax increase reported tax fairness at 1.9 on average, whereas those that received the tax decrease reported tax fairness at 4 on average. Among subjects that experienced a wage framing, those that received the wage decrease reported wage fairness at 2.6 on average and those that received the wage increase reported wage fairness at 3.7. Both differences are highly significant on the p < 0.001 level. This asymmetry in fairness considerations could explain asymmetries in labor supply change.

Table 6a and 6b present probit regressions to examine the relationship between labor supply changes and fairness perceptions. While this is not a causal analysis, it allows us to examine the relationship between fairness considerations and labor supply more closely. We transform fairness perceptions into a binary variable. If a person responded to the fairness question with a 1 or 2, they are coded as finding their tax or wage treatment as unfair and assigned the value of 1. All other responses are coded as a 0. Table 6a extends the findings of Table 3, including fairness considerations in the analysis of the collapsed treatments. In Column 1 and 2 of Table 6a, the marginal effect of a net decrease remains statistically insignificant when the reference category is a net increase. However, both tax unfairness and wage unfairness are significantly related to labor supply change. Finding the tax treatment unfair is significantly positively associated with the probability of changing labor supply, while finding the wage treatment unfair significantly decreases the probability of changing labor supply. Columns 3 and 4 of Table 6a show that with the inclusion of fairness considerations, there is no statistical significance of experiencing a tax framing instead of a wage framing anymore. Like in Columns 1 and 2, the tax unfairness coefficient is positive, whereas the wage unfairness coefficient is negative.

Table 6b extends the findings of Table 4, including fairness perceptions in the treatment level analysis. Columns 1 and 2 of Table 6b show a now statistically insignificant effect of *TaxIncreaseT* with the inclusion of fairness considerations in the probit model. The tax unfairness coefficient is positive, but only statistically significant at the p < 0.1 level when demographic controls are included. In Columns 3 and 4 of Table 6b the coefficient for *TaxDecreaseT* remains statistically insignificant and small in magnitude. The effect of tax unfairness is positive and statistically significant at the p < 0.1 level and the effect of wage unfairness is negative and statistically significant at the p < 0.05 level.

Across all specifications in Table 6a and 6b, the treatment effects are statistically insignificant, despite some coefficients being significant in previous tables without the inclusion of fairness considerations. The inclusion of fairness shows that finding the tax rate unfair is

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positively associated with the probability of participants changing their labor supply in the second round, while finding the wage rate unfair decreases this probability, implying that individuals change their labor supply less when they find the wage rate unfair.

These findings imply that tax unfairness affects changes in labor supply. The connection between fairness and effort provision is already discussed in Falk et al. (2008). Since contracts cannot typically control for effort provision, firms rely on the motivation of their workers for productivity. This creates a reciprocal relationship between firms and workers: firms are motivated to treat their workers well, so that fair-minded workers are more productive (Falk et al., 2008). Changes to pay can influence worker's fairness perceptions, with a pay cut triggering feeling of unfairness.

		, ,		, -	
—	Reference	Category:	Reference	e Category:	
	Net Inc	crease	Wage Framing		
_	(1)	(2)	(3)	(4)	
Net Decrease	-0.131	-0.250			
	(0.250)	(0.257)			
Tax Framing			0.253	0.269	
			(0.228)	(0.236)	
Tax Unfair	0.619**	0.758***	0.512*	0.599**	
	(0.273)	(0.281)	(0.270)	(0.269)	
Wage Unfair	-0.621**	-0.647**	-0.566**	-0.623**	
	(0.275)	(0.271)	(0.275)	(0.267)	
Demographic Controls	NO	YES	NO	YES	
Observations	193	192	193	192	
Pseudo R2	0.0486	0.0814	0.0539	0.0834	

Probit (ME) – Labor Supply Change

Table 6a: Effect of Net Changes and Framing on Labor Supply Change with Fairness Consideration

	Р	robit (ME) – Lab	Labor Supply Change			
	Net De	ecrease	Net Increase			
	Reference	e Category:	Reference	Category:		
	WageDe	ecreaseT	WageIncreaseT			
	(1)	(2)	(3)	(4)		
TaxIncreaseT	0.455	0.412				
	(0.349)	(0.335)				
TaxDecreaseT			0.065	0.020		
			(0.326)	(0.367)		
Tax Unfair	0.433	0.633*	0.891*	1.293*		
	(0.341)	(0.343)	(0.523)	(0.719)		
Wage Unfair	-0.305	-0.343	-1.166**	-1.476**		
	(0.335)	(0.333)	(0.521)	(0.643)		
Demographic Controls	NO	YES	NO	YES		
Observations	103	102	90	90		
Pseudo R2	0.0727	0.128	0.0579	0.111		

Table 6b: Treatment Effects on Labor Supply Change with Fairness Considerations

Notes: Table 6 presents marginal effects with labor supply change (binary variable) as the dependent variable. In Table 6a Models (1) and (2), Net Decrease is a dummy, collapsing treatments that include a net wage decrease. The reference group is Net Increase. In Models (3) and (4), Tax Framing is a dummy, collapsing treatments with a tax framing. The reference group is Wage Framing. In Table 6b, TaxIncreaseT and TaxDecreaseT are treatment dummies. The reference groups are WageDecreaseT and WageIncreaseT, respectively. We transform fairness perceptions into a binary variable, indicating if participants found the tax or wage rate unfair (1 and 2 on the Likert-scale). The demographic controls include the variable Female, female = 1, else = 0, Bachelor's Degree, at least bachelor = 1, else = 0, Full-time Worker, works full-time = 1, else = 0, and Below Median Income, below = 1, above = 0.

Robust standard errors in parentheses.

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01

Previous literature further suggests that the framing of pay cuts can further influence these fairness perceptions. Kahneman et al. (1986) state that perceived fairness of the wage cut does not only depend on the amount cut but also the reason why pay needs to be cut. Survey participants in Kahneman et al. (1986) did not find pay cuts done to avoid firm bankruptcy unfair. The results from our sample suggest that pay cuts for taxation are considered more unfair than pay cuts for no given reason. Additionally, when workers perceive wage cuts as losses in income, they are viewed more unfairly than identical reductions (Kahneman et al., 1986). There may also be asymmetries in fairness perceptions, as Offerman (2002) finds that the positive effect of fair treatment on behavior is usually smaller than the mirrored negative effect of unfair treatment. The larger gap in tax fairness perceptions among the treatment groups that received a tax rate change, as well as the opposite relationships of tax unfairness and wage unfairness on labor supply change, imply that manipulated tax rates more negatively affect fairness perceptions than manipulated wage rates. This in turn affects labor supply.

#### 4 Discussion and Conclusion

When presented with a simple labor-leisure decision, participants in this experiment reacted more strongly to the framing of a net wage deduction as a tax increase. This resulted in greater labor supply change among the participants that experienced a tax increase than in the participants that received a wage decrease, confirming that tax aversion has a significant effect on the labor supply. Inversely, when presented with the same labor-leisure decision, the participants who received a net wage increase framed as a tax cut behaved no differently than those whose wages were increased without the tax framing. This asymmetric labor supply response to increasing and decreasing taxes shows that the framing effects of tax aversion may only be relevant when net wages are decreasing.

This experiment benefitted from an attentive and informed sample. Despite concerns that the environment of an online experiment is less controlled than a lab experiment (Berry et al., 2022), we are confident that participants in our experiment are attentive by examining three different types of quality controls. First, we screen out inattentive participants with an attention check before entering the main experiment. This screened out 71 out of 322 participants. Second, participants were asked to correctly identify their wage and tax rate after each round. In each round, over 90% of participants were able to correctly identify their wage and tax rate. These results and a robustness check including the difference in understanding of wage and tax rates as controls in the parametric analysis are reported in Tables 7 and 8 in section A.4. in the Appendix. Third, at the end of the experiment participants were asked to describe how they were taxed in their own words. 241 out of 248 participants provided detailed written responses describing their experiences in the experiment.

The findings of this experiment have important policy implications. Our results imply that payroll taxes may have less of an effect on the labor supply. This is because payroll taxes are

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often experienced as a wage decrease, rather than a tax increase (Kessler and Norton, 2016). The larger elasticities for changes in income taxes imposed directly on workers imply that payroll taxes affect labor supply less (Kessler and Norton, 2016; Lehman et al., 2013). The chosen number of strings to complete during the session serves as a proxy for effort that all workers choose to exert when working. More specifically, the findings of this experiment could be applied to freelance or gig economy workers who choose the amount of work they complete.

The results of the experiment can be applied to the current debate on how to combat rising cost of living under inflation. On one side of the debate, tax cuts are considered as an option to combat inflation. The Inflation Reduction Act (IRA) passed in Summer 2022 in the US consists of a mix of tax cuts and increases. The Tax Policy Center (TPC) finds that the IRA ultimately decreases the tax burden of nearly all income levels except the top 1% (Buhl, 2022). Additionally, the Internal Revenue Service (IRS) in the US confirmed that tax rates will be lower for those whose salaries have not kept pace with inflation in 2023 (Tankersley, 2022). On the other side of the debate, some states in the US increase their minimum wage with rising inflation. In ten states, the minimum wage is indexed with inflation (Frosch, 2009). So, to adjust for inflation, at least among the lowest earners and those whose real wages have not kept pace with inflation, there is a debate as to whether tax decreases or wage increases would help individuals with the cost of living. In this debate, policy-makers should be aware of the labor supply effect of each strategy, as well as the labor supply's fairness considerations and preferences.

At the end of this experiment in the behavioral survey, participants were asked about their preferences towards the policies discussed above (see Appendix A.5. for the exact wording of the question). When asked about their preference for payroll or income taxes, the preferences of the sample were split evenly, with 49.2% preferring payroll taxes and 50.8% preferring income taxes. These equal preferences run counter to the fairness perceptions of *TaxIncreaseT* and *WageDecreaseT*, as a salient tax increase was considered far more unfair and effort provision of *TaxIncreaseT* was lower. Alternatively, the post-experimental survey results show a clear preference for increased wages in the presence of rising inflation. The results of the survey showed that 74.6% of the participants preferred increased wages and 25.4% preferred decreased taxes, despite the results of the experiment showing no significant difference in behavior and

fairness perceptions between *TaxDecreaseT* and *WageIncreaseT*. These survey results run counter to the results of the experiment, highlighting the differences between stated and revealed preferences.

The asymmetry in tax sensitivity examined in this paper is an opportunity for further research. Tax aversion is also present in the behavioral response to commodity taxes, affecting consumption (Congdon et al., 2009; Chetty et al., 2009; Donnelly et al., 2021). As with observing behavioral responses to increasing wages and decreasing income tax, experiments to test the effect of decreasing prices versus decreasing commodity taxes will also inform the current debate on addressing the rising cost of living.

Assumptions of symmetric behavioral reactions to wage and tax changes can lead to misguided predictions of labor supply responses. Tax averse behavior when net wages are decreasing leads to a greater labor supply response to taxation. As governments attempt to use decreasing taxes or increasing wages to combat inflation, the results from this experiment suggest that to use decreasing taxes as a tool to influence labor supply would be no more effective than increasing wages.

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#### Appendix

#### A.1. Experimental Instructions and Screens

Before you proceed to the survey, please complete the captcha below.

I'm not a robot	2			
	reCAPTCHA Privacy - Terms			
lease indicate your Mturk ID	), so that we can pa	y you after c	completion of t	his stu
lease indicate your Mturk ID	), so that we can pa	iy you after c	completion of t	his stu
lease indicate your Mturk ID	), so that we can pa	y you after c	completion of t	his stu

#### Figure 7: Entry Screen

#### Welcome

You will now take part in an academic research study from the University of Freiburg, Germany. With your participation you will make an important contribution to research.

The study is about individuals' behavior towards taxation. You will participate in a demographic survey (Part I), a decision-making experiment (Part II), and a follow-up survey (Part III). Participation should take between 10 to 15 minutes.

It is very important that you read the instructions carefully and that you complete the entire study once you have started. This study will contain attention checks to ensure that you fully read the instructions. If you do not pass the attention checks, you will be excluded from the experiment.

For completing the study, you will receive \$1.30. Additionally, you can earn up to \$1.50 in a bonus depending on your decisions. Only after you completed the whole study, you will receive the MTurk code in order to receive your payment. Additional payments will be distributed as a bonus payment within three days upon completion of the study.

Confidentiality: You will remain anonymous throughout the study. Results may include summary data, but you will never be identified. All data collected are for research purposes only. By continuing, you consent to the publication of study results.

Participants' rights: Your participation is voluntary. You may stop participating at any time by closing the browser window or the program to withdraw from the study.

By continuing, you indicate that you are at least 18 years old, have read and understood the above, and you voluntarily agree to participate in this study.

Continue

Figure 8: Welcome Page with Initial Instructions

### Survey (Part I)

Please answer the following questions about yourself.

Please indicate your gender.

Please indicate your age.

What is your highest educational degree?

What is your current employment status?

How high was your total household income, before taxes, last year (2021)?

How many hours per week do you spend working online on MTurk or similar platforms?

Now, please imagine the following situation. You can choose between different payoffs which are related to different probabilities of winning. Option A earns a payoff of \$1.90 with a probability of 20%. Option B earns a payoff of \$1.80 with a probability of 30%. Option C earns a payoff of \$1.70 with a probability of 40% etc. We are interested in whether you take the time to read the instructions; if not, some results may not tell us much about decision-making in the real world. To show that you have read the instructions, please check the third option below.

Please choose a combination of payoff and probability:

Option A: Probability 20% and \$1.90
Option B: Probability 30% and \$1.80
Option C: Probability 40% and \$1.70
Option D: Probability 50% and \$1.60
Option E: Probability 60% and \$1.50
Option F: Probability 70% and \$1.40

Figure 9: Demographic Survey

~

~

~

~

#### Instructions to the Experiment (Part II)

You will now participate in a decision-making experiment on behavior towards taxation.

There are two rounds of the experiment, in which you need to complete a task. In each round, you will be informed of your income and tax rate before you start the task. You will then have four minutes in each round to complete the task.

For your task, you will be asked to transcribe text sequences. Each text sequence consists of 10 letters, see the example below. You can complete as many transcriptions as you want during each two minute round. At any time during the round, you can take breaks and stop the task. However, we ask that if you do take breaks, you stay in the experiment (do not close out of it in your browser), so that you can get paid for the transcriptions you have completed. A sequence is counted when you correctly type in every letter.

In each round, you will be paid the indicated wage per text sequence you transcribe correctly, the indicated tax will also be deducted per text sequence. At the end of the experiment, you will be paid for the work you completed in one of the rounds. Which round you will be paid for will be determined at random.

Please transcribe one text sequence below to familiarize yourself with the task.

A "Continue" button will appear once you have correctly typed in one sequence.

Correct Text Sequences: 0				
Text Sequence:	obkaxfelzj			
objaxfelzj				
	Submit			

Figure 10: Instructions and Sample Task

#### **Round 1: Working Stage**

In this round, you receive the following wage and tax rate:

For each string you complete, you will receive \$0.12, but \$0.04 of your earnings will be deducted as a tax.

Continue

#### Figure 11: Entry to Round 1

## Round 1: Working Stage

You have two minutes to transcribe as many strings as you want to.

After the two minutes have elapsed, you will automatically go to the next stage.

For each string you complete, you will receive \$0.12, but \$0.04 of your earnings will be deducted as a tax.

	Correct Text Sequences (this round): 6				
	Text Sequence: ckwvsknbiq				
_	Answer:				
	ckwvsknbig				
	Submit				
	Remaining time: 00:57				

Figure 12: Screen during task (Round 1)

#### Round 1: Recap

In round 1, you correctly transcribed 7 text sequences. For your work in round 1, you made \$ 0.84 but \$ 0.28 was deducted as a tax.

What was your wage rate in round 1?

Wage Rate: \$0.10
Wage Rate: \$0.11
Wage Rate: \$0.12
Wage Rate: \$0.13
Wage Rate: \$0.14

What was your tax rate in round 1?

Tax Rate: \$0.02
Tax Rate: \$0.03
Tax Rate: \$0.04
Tax Rate: \$0.05
Tax Rate: \$0.06

What would you like your wage rate to be in the next round?

What would you like your tax rate to be in the next round?

Continue

#### Figure 13: Screen after completing task (Round 1)

#### Round 2: Working Stage

In this round, you receive the following wage and tax rate:

For each string you complete, you will receive \$0.10, but \$0.04 of your earnings will be deducted as a tax.

Continue

#### Figure 14: Entry to Round 2

#### **Round 2: Working Stage**

 You have two minutes to transcribe as many strings as you want to.

 After the two minutes have elapsed, you will automatically go to the next stage.

 For each string you complete, you will receive \$0.10, but \$0.04 of your earnings will be deducted as a tax.

 Correct Text Sequences (this round): 6

 Text Sequence:
 busmliaudo

 Answer:

 b

 Submit

 Remaining time: 00:03

Figure 15: Screen during task (Round 2)

#### **Round 2: Recap**

In round 2, you correctly transcribed 6 text sequences. For your work in round 2, you made \$ 0.6 but \$ 0.24 was deducted as a tax.

#### What was your wage rate in round 2?

Wage Rate: \$0.10
Wage Rate: \$0.11
Wage Rate: \$0.12
Wage Rate: \$0.13
Wage Rate: \$0.14

#### What was your tax rate in round 2?

Tax Rate: \$0.02
Tax Rate: \$0.03
Tax Rate: \$0.04
Tax Rate: \$0.05
Tax Rate: \$0.06
Continue

Figure 16: Screen after completing task (Round 2)

#### Survey (Part III)

In this third and last part of this experiment, we would like to know more about your decisions and attitudes.

Please describe how your income was taxed in the different rounds in your own words.				
Compared to the first round, do you think the wage rate in round 2 was fair or unfair?				
Please indicate this on a scale from 1 to 5, where 1 means "not fair all" and 5 means "very fair".				
1 = Not fair at all 5 = Very fair				
Compared to the first round, do you think the tax rate in round 2 was fair or unfair?				
Please indicate this on a scale from 1 to 5, where 1 means "not fair all" and 5 means "very fair".				
1 = Not fair at all 5 = Very fair				
How did you feel about the transcription task that you worked on?				
Please indicate this on a scale from 1 to 5, where 1 means "very tedious" and 5 means "not tedious at all".				
1 = Very tedious 5 = Not tedious at all				
Suppose you could earn \$0.10 per task without being taxed. You can choose up to 30 tasks.				
Please indicate the number of tasks you would work on by moving the slider below.				
For the next question, please imagine you are offered two options:				
Option 1: Have \$1 added to your compensation for this study.				
Option 2: Have \$2 donated to a charity of your choice.				
Which of these options would you choose?				
Option 1: \$1 added to compensation				
Option 2: \$2 donated to a charity of your choice				

In the following table you find a list of coin tosses with different payoffs. The payoffs differ in how much you lose if the coin turns up heads.

For each row, please indicate whether you would toss the coin or not.

1. If the coin turns up heads, then you lose $2;$ if the coin turns up tails, you win $6.$	Accept	Reject
2. If the coin turns up heads, then you lose $3;$ if the coin turns up tails, you win $6.$	Accept	Reject
3. If the coin turns up heads, then you lose \$4; if the coin turns up tails, you win \$6.	Accept	Reject
4. If the coin turns up heads, then you lose \$5; if the coin turns up tails, you win \$6.	Accept	Reject
5. If the coin turns up heads, then you lose \$6; if the coin turns up tails, you win \$6.	Accept	Reject
6. If the coin turns up heads, then you lose \$7; if the coin turns up tails, you win \$6.	Accept	Reject

In the presence of rising inflation, which of the following options would you prefer?

Option 1: Increased wages Option 2: Decreased taxes

Suppose the government needs to raise taxes, they could either tax employers with payroll taxes which could lead to decreased wages for employees or they could tax individual employees with income taxes which would result in increased taxes for employees. Which would you prefer?

(	Option 1: Payroll taxes
C	)ption 2: Income taxes

Which of the following wage or tax changes would elicit the strongest response from you? Which would alter your labor decisions the most?

Wage Increase
Wage Decrease
Tax Increase
Tax Decrease

Figure 17: Post-experimental behavioral survey

A.2. Description of Treatments for the Test Session

In the first round, all participants receive the same wage and tax treatment with the message prior to starting the round:

For each string you complete, you will receive **\$0.06**, but **\$0.02** of your earnings will be deducted as a tax.

In the second round, the participants are randomized into the five groups with different tax and wage treatments. They receive the following messages prior to starting the round.

Control Group receives the message:

For each string you complete, you will receive **\$0.06**, but **\$0.02** of your earnings will be deducted as a tax.

#### WageDecreaseT receives the message:

For each string you complete, you will receive **\$0.05**, but **\$0.02** of your earnings will be deducted as a tax.

TaxIncreaseT receives the message:

For each string you complete, you will receive **\$0.06**, but **\$0.03** of your earnings will be deducted as a tax.

#### WageIncreaseT receives the message:

For each string you complete, you will receive **\$0.07**, but **\$0.02** of your earnings will be deducted as a tax.

#### TaxDecreaseT receives the message:

For each string you complete, you will receive **\$0.06**, but **\$0.01** of your earnings will be deducted as a tax.

Participants were paid the earnings from both rounds in the total payoff.



#### A.3. Number of Participants in the Experiment Stages

Figure 18: Number of Participants in Each Stage

#### A.4. Understanding of Treatments

	Total	Control	Wage	Тах	Wage	Тах	F-
	Sample	Group	IncreaseT	IncreaseT	DecreaseT	DecreaseT	Test
Performance							
Round 1:	0.90	0.91	0.83	0.92	0.90	0.92	0.72
Understood Tax	(0.31)	(0.29)	(0.38)	(0.28)	(0.30)	(0.28)	
Round 1:	0.92	0.91	0.96	0.92	0.88	0.94	0.68
Understood Wage	(0.27)	(0.29)	(0.19)	(0.28)	(0.33)	(0.24)	
Round 2:	0.95	0.96	0.94	0.94	0.93	0.96	0.21
Understood Tax	(0.22)	(0.19)	(0.23)	(0.24)	(0.26)	(0.20)	
Round 2:	0.96	0.96	0.96	0.94	0.93	0.98	0.48
Understood Wage	(0.21)	(0.19)	(0.19)	(0.24)	(0.26)	(0.14)	
Number of	248	55	54	49	41	49	
Observations							

#### Table 7: Descriptive Statistics for Understanding of Treatments

F-Tests test the hypothesis that the mean values between the five groups are the same.

\* Significance at 0.1 \*\* Significance at 0.05 \*\*\* Significance at 0.01

	Probit (ME) – Labor Supply Change			
-	Net Decrease Reference Category: WageDecreaseT		Net Increase Reference Category: WageIncreaseT	
-				
-				
	(1)	(2)	(3)	(4)
TaxIncreaseT	0.174**	0.179**		
	(0.713)	(0.072)		
TaxDecreaseT			0.029	0.026
			(0.087)	(0.086)
Difference in		0.077		0.062
Understanding Taxes		(0.103)		(0.093)
between Rounds				
Difference in		-0.007		0.113
Understanding Wages		(0.094)		(0.095)
between Rounds				
Demographic Controls	YES	YES	YES	YES
Observations	102	102	90	90
Pseudo R2	0.0962	0.0997	0.0410	0.0505

Table 8: Understanding of treatments and labor supply change

Notes: Table 8 presents marginal effects of probit specifications with labor supply change (binary variable) as the dependent variable. In specification (1) and (2) *TaxIncreaseT* is the treatment dummy. The reference group is *WageDecreaseT*. In specification (3) and (4) *TaxDecreaseT* is the treatment dummy. The reference group is *WageIncreaseT*. We transform understanding of wages (taxes) into binary variables indicating if the difference of participants correctly identified their treatment incentives between rounds, understood wage (tax) = 1, did not understand wage (tax) = 0. Demographic controls include the variables female = 1, else = 0, has at least a bachelor's degree = 1, else = 0, works full time = 1, else = 0 and below median income = 1, above = 0. Robust standard errors in parentheses.

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01

#### A.5. Stated Preferences Questions

"Suppose the government needs to raise taxes, they could either tax employers with payroll taxes which could lead to decreased wages for employees, or they could tax individual employees with income taxes which would result in increased taxes for employees. Which would you prefer?"

"In the presence of rising inflation, which of the following options would you prefer? Option 1: Increased Wages or Option 2: Decreased Taxes?"