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Gross-wage illusion in a real effort experiment

by

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Abstract

In a controlled laboratory experiment, subjects had to fold letters in order to earn money. While the net income per letter was the same in the three treatments, the gross income varied and the tax rate was 0, 25% and 50%. Although work incentives should be the same in all treatments, subjects worked harder and longer when they were taxed. We conclude that this is due to a 'gross-wage illusion effect'. The existence of this effect demonstrates that not only the tax rate and the tax base are of importance for work incentives, but also the perception of a tax.

JEL Classification: H2, C91

Introduction

How do people react if they are taxed? In particular: How is the work-versus-leisure decision affected by a tax? This question has been intensively debated in theoretical models and in a couple of experimental papers. While the theoretical predictions are quite clear, the experimental evidence is mixed. Some experiments seem to confirm even very sophisticated theoretical predictions and others show that subjects' decisions are far away from rational choice.

For example SILLAMAA (1999b) tested the theorems presented by PHELPS (1973), SADKA (1976) and SEADE (1977) that show that social welfare and total work effort is higher under a zero top marginal tax rate than under any other non-linear tax rate. In her experiment, she offered subjects after-tax wage rates and observed the work effort following this offer. Using a decoder sheet, subjects had to translate numbers into letters. It turned out that the efforts were higher under a zero top marginal tax than under a regressive tax rate. In SILLAMAA (1999a) differences between (Hausman equivalent) linear and non-linear taxes are investigated. Once again, the theoretical prediction that work incentives under a linear tax are higher is confirmed. SWENSON (1988) and SILLAMAA (1999c) more directly tested the effect of different linear tax rates on labor supply. Both experiments show that subjects react to increasing tax rates as theory predicts. This result is confirmed in the experiment by SUTTER & WECK-HANNEMANN (2003). On the other hand, BARTOLOME (1995) found that individuals tend to use the *average* tax rate when making marginal economic decisions, instead of the marginal tax rate. Furthermore, there is empirical evidence that the perception of an individual's marginal tax rate is not always correct (LEWIS 1978, FUJII & HAWLEY 1988, KÖNIG ET AL. 1995, RUPERT & FISCHER 1995, ARRAZOLA ET AL. 2000).

Chetty, Looney and Kroft (2009) have demonstrated in a field experiment that taxes on consumer goods are totally ignored if they are not explicitly posted on the price tags. They conclude that taxes without salience will not be perceived correctly. Beside the discussion on tax

salience the coherence of the complexity of tax systems and their perception has entered the scientific agenda. Congdon, Klink and Mullainathan (2009) make the point very clear: “Individuals will respond not to the tax rate as it is set but as they construe it.” (p. 378). The more complex taxes are, the larger may be the difference between the taxes as they are set and what tax payers construe. What does this mean for the impact of income taxes on the work-leisure-decision? Chetty and Saez (2009) find that additional information over the EITC system leads to behavioral reaction and they conclude that the EITC is too complicated to be perceived correctly. But what is about simple forms of taxation on earned income, which can easily be understood? Are they perceived correctly? In this paper we show that this is not the case. We use an experimental approach and we designed our experiment in a way that deviates from the experimental literature on this topic.

The experimental designs used in the aforementioned experimental papers are quite artificial and do not mirror the decisions of real tax payers. The experimenters renounce a high external validity of their designs, but seek to build an optimal platform for the test of tax theories. For example, in all the experiments of SILLAMAA only the after-tax wage was announced and any kind of tax-framing was avoided. SWENSON (1988) and SILLAMAA (1999c) used a within subject design, in which subjects had to decide on their work effort while being taxed sequentially at different rates. Whether or not the sequence of tax rates influences behavior was not controlled. Furthermore, in order to control for income effects, the tax revenue is redistributed to the subjects. The work-leisure decision is established in the laboratory by offering subjects newspapers and computer games they could use instead of working – which is quite different from the real work-leisure decision people have to make when they decide on their work effort. SWENSON had three different treatments with only six subjects in each, which is a very small sample even for experiments. It should be clear that differences in individual ability and

willingness to work may play an important role. With only six subjects in each treatment this effect may dominate the results.

In SILLAMAA (1999a) subjects had to decide on their work effort at 8 different tax rates, which were applied sequentially for 12 minutes each. In the first and in the last treatment, the tax rate was zero. On comparison of the (identical) first and the last treatment, a clear learning effect shows up. The average work effort increased from the first to the last no-tax treatment by more than 18%. The maximum difference was 6% in the 6 remaining tax treatments. Besides a learning effect, it is clear that subjects differ with respect to their ability to translate numbers into letters. SILLAMAA tried to control for both effects, but given that the effort levels under different taxes differ by no more than 6%, the results, although significant, are not very resilient.

With the experiment we report on in this paper, we do not want to test how individuals react to changes in the marginal tax rates or to compare linear and non-linear tax functions. We are asking a much simpler question. Imagine that an individual earns one euro for a fixed work effort. Does it make a difference whether this euro is after-tax income with a positive tax rate or whether the work is not taxed at all? At first sight this seems to be a trivial question, because obviously the individual work decision should be the same in both cases. But the point is that in the case of a positive tax on labor income, labor has two prices (net of tax and the gross price). The question is: Does the gross price influence the individual labor decision? This depends on how the tax part of the gross wage is perceived. If individuals discern it correctly the tax should not change the work-leisure decision. Notice that a tax with a constant marginal rate of 25% or 50% is very simple but not very salient. Thus the question is if simplicity of a tax is enough to ensure that it is perceived correctly.

Since we want to investigate the *perception of taxes* in order to learn how taxation may affect real individual labor supply, we designed the experiments in contrast to the existing literature

in such a way as to get as much external validity as possible. For this reason, we used employed people as subjects (no students) and conducted a real effort experiment. Furthermore, subjects had to make a real work-leisure decision because they decided not only about their work effort but also about the time they spent on work. There was no time restriction. Because the experiment was financed by the German Federal Ministry of Finance, we could use real taxes. On the other hand, we did not redistribute the taxes to the subjects because in the real tax world, the quantity of public goods taxpayers consume is, in fact, independent of the taxes they personally pay. The income effect of the taxation does not play a role in our experiments, because we only compare treatments with identical net income. It turns out that our subjects are not neutral with respect to the gross price for their work. They show a kind of 'gross-wage illusion', e.g. they work longer and harder when the gross price exceeds the net price compared to a situation in which net and gross wage are identical.

In the next section, we describe the experiment in more detail. The results are presented in section 3 and the paper ends with a short discussion in section 4.

2. Experimental design

We recruited our subjects by making a random selection of addresses from the local telephone book. We wrote a letter to all the selected households and invited them to participate in our study, announcing that we would contact the household by phone a few days later. In this telephone call, we clarified whether the person was willing to participate and whether he or she fulfilled our minimum requirement of being employed with at least 30 regular working hours per week. All the experiments started in the late afternoon and were conducted in the rooms of the MaXLab (Magdeburg Laboratory for Experimental Economics). No more than 13 persons participated in a single session at the same time. Subjects were located in soundproofed booths and at computer desks which were separated from each other. No communication was allowed during the experiment.

Subjects had to fold letters and put them into envelopes. We used three different treatments. In the reference treatment, subjects were told that they would earn 9 eurocent per folded letter. They were further informed that they could stop working whenever they wanted to and that there was no time limit. After finishing work, every subject in each treatment was immediately paid in cash and was asked to fill out a questionnaire, in which we asked for demographic parameters such as age, education, kind of employment and income. All subjects agreed to answer these questions.

In the second treatment, subjects were told that they would earn 12 eurocent per letter, but that this income would be taxed at a constant rate of 25%. The subjects were informed that their net income would be paid after they had finished work. In the third treatment, the gross wage was 18 eurocent per letter and the tax rate was 50%. Therefore, the net wage was the same (9 Cent) in all three treatments. The taxes which were not refunded to the subjects can be seen as a real tax insofar as they reduced the amount of money the Federal Ministry of Finance had to pay for the experiment. We played the reference treatment twice with a time lag of about 5 months (winter and early summer) in order to check whether the opportunity costs might be higher in summer than in winter. Because we could not find any significant differences, we pooled the data. Table 1 shows the number of observations in our three treatments.

Treatment	Gross wage	Number of subjects
Reference	9 ct	60
25% tax	12 ct	36
50% tax	18 ct	31

Table 1: Overview of treatments and number of independent observations

Given that our subjects behave in line with the standard assumptions of rational choice, we should not observe significant differences between the three treatments.

3. Results

The most important result of our study is that subjects worked longer and folded many more letters in the tax treatments than in the reference treatment. Table 2 and figure 1 display the number of letters:

Treatment	Mean	Median	Minimum	Maximum	Variance
Reference	148.72	145.50	25	405	6,758.21
25% tax	256.06	170.50	19	1213	67,072.85
50% tax	202.16	182.00	31	356	7,485.14

Table 2: Number of letters folded

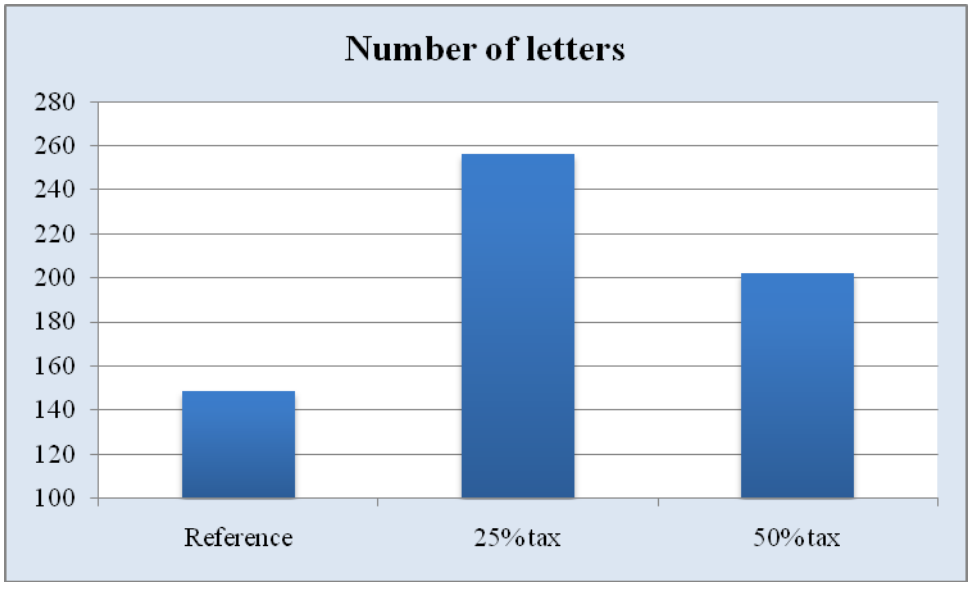

Figure 1: Number of letters folded

The differences between 'Reference' and the two tax treatments are significant at a 5% level (Mann-Whitney-U-test, two-sided). No significant difference exists between the two tax treatments. Table 3 and figure 2 show the working time in the three treatments:

Treatment	Mean	Median	Minimum	Maximum	Variance
Reference	64.87	61.50	14	169	960.83
25% tax	89.14	66.00	13	312	4,595.72
50% tax	77.81	79.00	11	124	864.96

Table 3: Working time

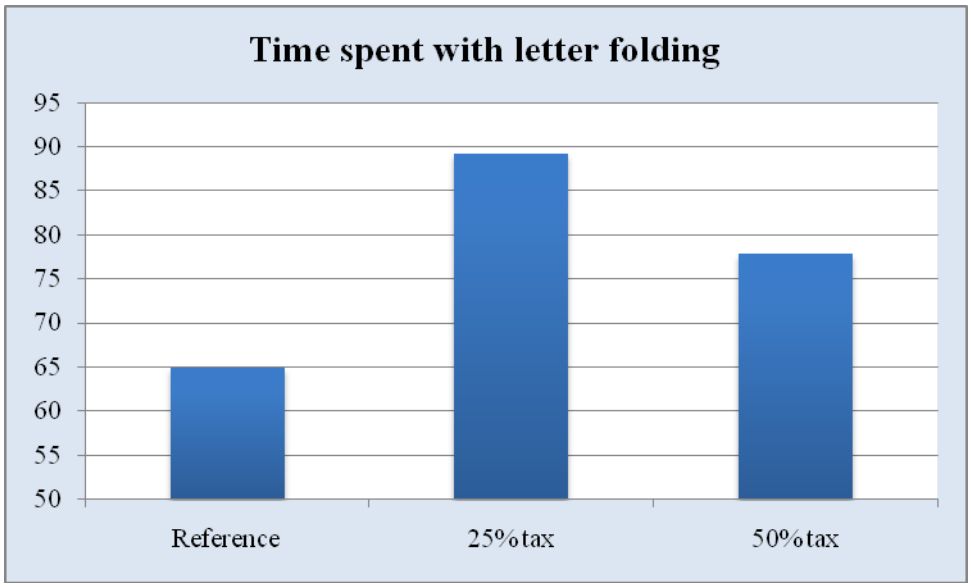

Figure 2: Working time

The difference between the reference treatment and the 50% tax treatment is still highly significant ($p < 0.04$) but the difference between the reference treatment and the 25% tax treatment is only weakly significant ($p < 0.11$). Differences between the two tax treatments are not significant. Work effort can be measured not only by the number of folded letters but also by productivity, e.g. the average time a subject needs to fold a letter. Figure 3 shows that productivity was much higher in the tax treatments than in the reference treatment and that these differences are both highly significant ($p < 0.01$).

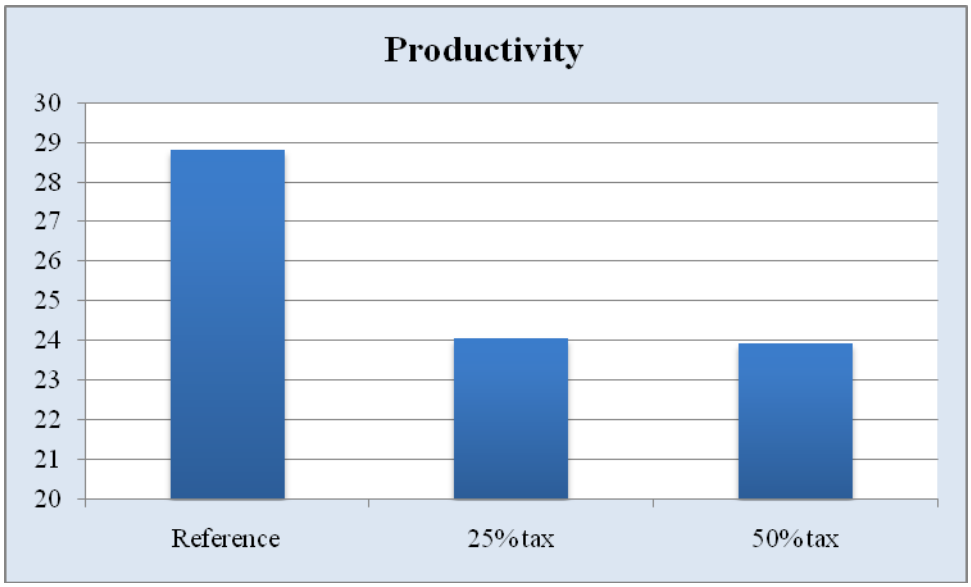

Figure 3: Productivity measured as seconds per letter

In order to check if individual characteristics such as income or age might be responsible for the "gross-wage illusion", we run a regression analysis using the data we collected after the experiment. Table 4 shows the results of a linear regression with the number of folded letters as the dependent variable. As independent variables, we use dummies for the treatment variables, which take the value of 1 if a subject participated in the respective treatment. Furthermore, we defined dummies for several variables: a dummy for 'gender' (female = 0, male = 1), a dummy which takes the value of 1 if the person is in an 'executive position', a dummy for 'brain work', and a dummy for the question of whether the person had worked the day the experiment was carried out ('worked today'). The variables 'age' and 'income' (net household income by month) were measured on a 6-point scale from 1 (20 – 25 / below 1,000 euro) to 6 (older than 65 / more than 3,000 euro). The variable 'education' was also measured on a point scale from 1 (no completed apprenticeship) to 5 (university degree). We further asked the subjects how they felt at work in general ('value work') and how exhausting they found the experiment ('experiment exertion'). Both were measured on a 10-point scale from 1 (totally dissatisfied / relaxing) to 10 (deeply satisfied / exhausting). The variable 'hours per week' indicates the number of hours a participant work per week on average.

The OLS regression shows that the coefficient of the 25% tax treatment variable is highly significant and the 50% coefficient is weakly significant. Not surprisingly, age also turns out to have a weakly significant negative influence.

	Non-standardized		Standardized
	Beta	Standard dev.	Beta
constant	232.81*	119.1	
25% tax	101.25***	35.5	.281
50% tax	61.47*	36.0	.162
age	- 27.12*	14.8	- .164
gender	- 27.39	31.6	- .083
education	1.33	12.4	.011
hours per week	.31	1.8	.016
brain work	59.43	43.7	.133
executive position	- 27.55	30.4	- .085
worked today	- 65.10	39.7	- .149
value work	1.90	8.2	.022
experiment exertion	- .34	7.1	- .004
income	5.14	10.2	.048

*** significant at a 1% level, ** 5%, * 10%

Table 4: OLS regression, dependent variable “number of letters folded”.

In addition to this OLS regression, we ran a logit regression on the basis of a cluster analysis. This allowed the number of letters folded by a subject to be classified as “high” or “low”. Once again, the tax treatment variables are significant, all others are not. Based on these results, we can be very sure that the “gross-wage illusion” effect is not driven by particular personal characteristics of our subjects but by the tax label itself.

4. Discussion

Our experiment demonstrates that the existence of a gross wage that differs from the net wage after-tax leads to higher work efforts compared to a gross wage that is identical to the net wage. We call this effect a ‘gross-wage illusion’ because we believe that the reason for the higher effort is that subjects mix up the gross wage and the net wage. It should be emphasized

that this cannot be explained by a lack of transparency, because the instructions and the design of the experiment made perfectly clear that only the net wage would be paid at the end of the experiment. Nevertheless, subjects tend to use the gross wage as an orientation when they decide on their work effort. The fact that the "gross-wage illusion" is of the same magnitude in both tax treatments shows that sensitivity to taxation increases with higher tax rates – otherwise the illusion effect would have been stronger in the 50% treatment.

Our experiment shows that the misperception of taxes is not limited to complex tax schedules. Even a simple tax rule like a constant marginal tax rate of 25% generates a distortion like the "gross wage illusion". One possible explanation is that it is exactly the simplicity of the tax that drives the results because a simple tax may be not salient. Further research should answer the question, if a more complex tax system will be perceived more correctly because it is more salient.

Acknowledgements

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Appendix: Instructions of the 25% tax treatment

With your participation in this experiment you have the opportunity to earn money. The payoff at the end of the experiment depends on your individual effort. Please read the instructions carefully. If you have any further questions, please contact the experimentator.

Primary note:

The aim of this experiment is to achieve information about the individual labor supply. For this purpose you will be confronted with a real work task, whereby you earn money. To compare the data of various research participants, work task is chosen in a way that absolutely no previous knowledge or special talent is required and that it is easy to measure.

Procedure:

We would like to point out that communicating with other participants or leaving your seat is not allowed for the duration of the whole experiment. After reading the instructions you receive letter papers and envelopes. Your task is to fold these letters and to put them into envelopes. Please seal up the envelopes. The letters are applied to acquire research participants in Magdeburg.

Depending on the number of folded and bagged letters you receive a payoff at the end of the experiment. For each letter you receive 12 Cent. If you fold on average 2 letters per minute, this leads to an hourly wage of 14.40 Euro, 2.5 letters on average 18.00 Euro and 3 letters 21.60 Euro. From your earned amount a tax with a rate of 25% is deducted, the rest is paid out to you at the end of the experiment in cash.

You determine your working time by your own. This means that there is no time limit and you can stop the experiment at any time. Afterwards, you receive your payoff dependent on the above stated rule and you are allowed to leave the laboratory.

Enjoy yourself!

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