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# Tax Framing and Productivity: evidence based on the strategy elicitation

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## Abstract

People usually don't like to pay income tax and can behave differently when the wage is defined with and without tax deductions. This aspect of human behavior has been tested by several researchers only with the help of the direct method in the lab, and the description of wage has been found to have significant influence on the human behavior. This paper is one of the first one to use the strategy elicitation to explore impacts of tax and no-tax frames on the productivity and willingness to work. The results of the experiment show that the productivity is significantly higher under the tax as compared to the no-tax frame, while no significant differences in the subject's willingness to work exist between the two frames.

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# 1. Introductions and Relevant Literature Review

The concept of framing introduced by Tversky and Kahneman (1981) identifies the possible differences in behavior under situations having identical outcomes, but different descriptions. In contrast to the idea of framing, a standard assumption in economics is that consumers maximize their utility by perfectly calculating the after-tax wage and price of leisure and should not be influenced significantly by the way these choices are framed. Even though there is significant literature on the effects of framing on consumer behavior, public economics has recently started to explore the effects of tax framing on consumer behavior. If the choices related to labor supply and productivity could be significantly influenced by different tax frames this can have profound impact on the outcome of the tax related experiments. It also means effects of taxes on the consumers and the consequent change in the welfare not only depend on the magnitude of the taxes, it also depends on how those taxes are defined and implemented during the experiment. Hence research in this direction can help in understanding the behavioral reactions to different frames, and subsequently make important contribution to the experimental methodology (Hayashi et al. 2013).

The existing literature typically relies on the use of lab experiments for exploring the impacts of tax framing on work decisions. Lab experiments are preferred because they provide a controlled environment, flexibility over the independent variables under study, and are easy to replicate. Moreover it is difficult to think of situations out of the experimental lab that offer identical wages under different wage frames in a manner that would allow exploration of the framing effects. Due to all these benefits, the current paper also relies on the lab experiments to explore the tax framing effects. The lab experiments are implemented either by using the direct method or the strategy method. Under the direct method, subjects make actual choices based on the experimental conditions while under the strategy method subjects provide a complete set of choices they would exercise based on the experimental conditions (Brandts and Charness 2011). The direct method provides incentives after the exertion of an effort while the strategy method does so before an effort has been exerted. The two methods can lead to identical results provided the subjects have a complete knowledge of their abilities, understand the monetary consequences of their actions and know the monetary and non-monetary costs associated with the exertion of effort in the lab (Umer 2018). The two methods can also lead to different results because of the following reasons: 1) the strategy method involves a hypothetical situation and hence the behavioral elements tend to get minimized. On the other hand the direct method involves an actual response to the experimental conditions and hence the role played by behavioral elements is expected to be stronger. 2) As subjects make choice while taking into account the complete set of strategies under the strategy method, their choice is expected to be an informed one. This aspect is not a part of the direct method.

Almost all of the existing literature exploring the impacts of tax framing on productivity and labor supply relies on the use of the direct method and reports either positive or negative effects of tax framing. For example Hayashi et al. (2013) explores productivity in tax and no-tax framed treatments such that the monetary incentives per task are identical in the two treatments. The authors report higher productivity in tax frame as compared to the no-tax frame treatment. Furthermore the willingness to work, or labor supplied, is higher under the no-tax frame as compared to the tax frame. Fochmann et al. (2013) also explores productivity in a tax and no-tax

frame with identical wage per task in both the frames and report higher productivity under the tax frame as compared to the no-tax frame. Sielaff and Wolf (2016) study productivity under four tax frames varying by the level of complexity in the description of the taxes and report a decline in the productivity with an increase in complexity of the tax description. Djanali and Shehan-Connor (2012) make a comparison of the productivity between tax and no-tax treatments having identical wages and report higher productivity for the tax treatment. The authors explain this higher productivity based on the tax affinity hypothesis that argues people pay taxes as they consider it as obeying rules and hence derive utility from it. Sillamaa (1999a) explores productivity under the decreasing marginal tax rates versus a zero top marginal tax rate, and finds higher productivity under the later case. Sillamaa (1999b) also explores effort under a linear and non-linear tax setting and finds effort is significantly higher under the linear tax setting. Swenson (1988) explores the impacts of increasing marginal tax rates on the labor supply and finds a negative relation between tax increment and labor supply. Sillamaa (1999c) and Sutter and Hannemann (2003) also find results identical to Swenson (1988). Researchers also find consumers tend to ignore taxes when they are less salient or are not displayed exclusively (Ott and Andrus 2000; Sausgruber and Tyran 2005; Finklestein 2009; Chetty et al. 2009).

Almost all of the experimental literature related to tax framing has used the direct method. To the best of my knowledge there is no literature on tax framing using the strategy method. This paper makes important contribution to the tax framing literature by reporting statistical results on tax framing from the data collected with the help of the strategy elicitation, and is the first one to do so. It also reports a comparison on the proportion of subjects supplying labor under the tax and no-tax framed treatments. The result from the experiments show average productivity is significantly higher for the tax as compared to no-tax frame. However there are no significant effects of framing on the proportion of subjects supplying labor across the two frames.

## 2. Experimental Design

The experimental design used in this paper is similar to a typical framing experiment where subjects exert real effort for money. An addition of three-digit numbers has been used as the real effort task in the current experiment. Additions tasks are used because they require considerable effort, no prior knowledge is required for solving them, and have already been used in the literature by Umer (2018) and Sutter and Hanemann (2003).

Three tax rates (15%, 50% and 85%) have been used in this experiment. These tax rates cause a significant change in the earnings making them salient, and are based on the work of Umer (2018) and Ottone and Ponzano (2007). Subjects were instructed to imagine the tax revenue would go to the government as it does in the real life. The specific use of the tax revenue was not mentioned to avoid any positive or negative behavioral response that could be associated to the selected use of the tax revenue. The experiment had two treatments; tax and no-tax. The no-tax treatment was framed as “piece rate” treatment during the experiment. The earnings per task in both these treatments were identical. 3 Pakistani rupees (approximately 0.03 US dollars at the time of the experiment) were used as gross wages per task in the tax treatment while 0.45, 1.5 and 2.55 Pakistani rupees were used as net wages per task (framed as piece rate per task) in the piece rate treatment. Subjects were provided with gross wage and tax rates during the tax treatment while net wage was not provided. The earnings per task are derived from the work of Umer (2018) focusing on Pakistan as well. The participation fee is selected to match the average

per hour wage for students. Before the start of the experiment subjects participated in a practice round of 60 seconds to estimate the time and effort required solving the addition tasks.

Subjects could solve maximum 10 tasks in each of the two treatments. Subjects first declared the number of tasks they are willing to solve in each of the two treatments for all three possible wages. If subjects did not want to solve any task for a particular wage, they could write zero for that wage. Once subjects declared the number of tasks, randomly one of the three wages was selected in each treatment and subjects were instructed to complete the number of declared tasks. There was no strict time limit to complete the declared number of tasks. There was no money provided as a leisure option as the subjects were free to move out of the lab once they complete the experiment. The choice of moving out of the experimental lab and enjoying time as per individual preferences can be treated as the non-monetary leisure option. The current implementation of the strategy elicitation with maximum limit on the tasks and no monetary leisure option is based on the work of Sutter and Hannemann (2003) and Ottone and Ponzano (2007). Half of the subjects were first assigned the tax treatment while the other half were assigned the no-tax (piece rate) treatment to control for the possible ordering effects of the treatments.

The subjects were recruited by posting a notification about the experiment on the student events forum at the Lahore University of Management Sciences (LUMS) located in the city of Lahore in Pakistan. Subjects were randomly seated in the experimental lab and instructions about the experiment were already placed on the table of each subject. Once all the subjects were seated, they were instructed to read the instructions and inquire clarifications if any part of the instructions were unclear. Experimental instructions clearly stated that the data collected would only be used for research purposes. Once subjects read the instructions, the experiment was conducted with the help of zTree software (Fischbacher 2007) and its duration was 50 minutes.

A total of 54 volunteers (30 male and 24 female) participated in the experiment. Two experimental sessions were performed; in the first session 28 participated, while in the second session 26 subjects participated. Average age of the participants was 22 years. All the subjects were enrolled in the undergraduate program at LUMS and 49% of the subjects had filed income tax at least once in their lives. The experiments were carried out using the English language because at LUMS, the medium of instruction is English. On average, subjects earned 275 Pakistani rupees including the fixed participation wage of 250 Pakistani rupees. The participation wage was more than the average hourly wage in Pakistan.[1]

**Hypothesis 1**: Average productivity of the subjects for the tax treatment will be higher as compared to the no-tax treatment.

**Hypothesis 2**: The proportion of subjects working in the no-tax treatment will be higher as compared to the tax treatment.

Hypothesis 1 is based on the existing results in the literature coming from the direct method. Most of the researchers report higher labor productivity for the tax treatment as compared to the no-tax treatment. If subjects can make a true evaluation of the monetary benefits and costs

[1] The experimental instructions are provided in the supplemental materials.

associated with work, the strategy elicitation should also lead to the same results. Hypothesis 2 is also based on the results from the existing literature where researchers including Hayashi et al. (2013) find a decrease in the labor supply under the tax frame in comparison to the no-tax frame.

# 3. Results

There are no significant ordering effects observed for the tax and no-tax treatments and hence the data has been pooled together for the statistical comparisons.

### 3.1 Framing and Productivity

Table 1 reports productivities observed across the two treatments. Data pooled for the three net wages shows average productivity for the tax treatment (4.86 tasks) is significantly greater than for the no-tax treatment (3.97 tasks; $p<0.01$). The productivity for the tax treatment for three wage rates is also significantly greater than the no-tax treatment ($p<0.05$). These results support the existence of significant impacts of framing on the productivity of the subjects and hypothesis 1 as well.

**Table 1: Average Producitivty Based on Net Earnings**

| **Tax Rate/Piece Rate** | **15% / 2.55 Rs** | **50% / 1.5 Rs** | **85% / 0.45 Rs** | **Pooled** |
|---|---|---|---|---|
| Tax Frame | 4.56 | 5.06 | 4.96 | 4.86 |
| No-Tax Frame | 3.61 | 4.15 | 4.15 | 3.97 |
| z-stat | -2.12 (0.03)** | -2.44 (0.02)** | -3.04 (0.00)*** | -4.34 (0.00)*** |
| Observations | 54 | 54 | 54 | 54 |

Note: z-stat has been obtained from the Wilcoxon signed-rank test. p-values are in parentheses. ** Indicates significant at 5%; ***Indicates significant at 1%.

The maximum difference between the productivity is for 15% tax rate (difference of 0.95) while the minimum difference is for 85% tax rate (difference of 0.81).

Page's test has been performed to test the impact of three different net wages on the productivity. The results for pooled data for both treatments show no significant impact of increase in net wage on the productivity (z-stat = 1.47, p-value = 0.14). Similarly for both treatments separately, increase in net wage does not have significant influence on the productivity (for tax treatment: z-stat = 0.88, p-value= 0.38; for piece rate treatment: z-stat = 1.38, p-value = 0.19).

### 3.2 Framing and Willingness to Work

The framing has significant impact on the productivity of the subjects as reported earlier. This section explores another aspect of the consumer behavior, comparing the proportion of consumers willing to work under the tax and no-tax frames. Table 2 reports the proportion of subjects choosing to work under each frame.

**Table 2: Impact of Framing on Proportion of Subjects Opting to Work**

| Tax /Piece Rate | 15%/2.5 Rs | 50%/1.5 Rs | 85%/0.45 Rs | Pooled |
|---|---|---|---|---|
| Tax Frame | 47/54 | 51/54 | 52/54 | 42/54 |
| | (87%) | (94%) | (96%) | (78%) |
| No-Tax Frame | 50/54 | 52/54 | 52/54 | 46/54 |
| | (93%) | (96%) | (96%) | (85%) |
| chi2 | 1.29(0.45) | 0.33(0.56) | 0 (1.00) | 1.33(0.39) |

Note: The numbers for Tax Frame and No-Tax Frame report subjects supplying non-zero labor. chi2 has been obtained from the McNemar's change test. The numbers next to chi2 in parentheses represent exact McNemar's significance probability.

As table 2 shows, there are no significant differences in the proportion of subjects working under the tax and no-tax frames for all three net earnings and for the pooled data as well. Hence there is no support provided by the current data for hypothesis 2.

## 4. Discussions and Conclusions

Productivity under the tax frame is significantly greater than under no-tax frame for all three earnings per task as well as for the pooled data, supporting hypothesis 1. These results are also in line with the results reported by Hayashi et al. (2013), Fochmann et al. (2013) and Djanali and Shehan-Connor (2012) for the direct method. Possible factors that can derive higher productivity for the tax frame are discussed here. When subjects learn about the pre-tax wage, it becomes a part of their endowment. Once taxes are announced, subjects perceive them as a loss to their endowment and typically risk more and work harder to keep something that was endowed to them. As a result the productivity in the tax frame is greater than in the no-tax frame. This explanation is in line with the endowment effect proposed by Thaler (1980) as well as Knetsch and Sinden (1984). Another possible reason for higher productivity in the tax treatment could be a miscalculated higher net wage (subjects were only provided with gross wage and tax rates) deriving subjects to work harder. The proportion of subjects working under the tax and no-tax frame does not differ significantly for the three earnings and for the pooled data as well. Hence

there is no support for hypothesis 2. The lack of any observed effect on labor-force participation is probably due to the negligible fixed costs of "entering the workforce" in the experiment and the relative lack of alternatives to "work" in the experiment.

There are a few limitations of the study that are highlighted here. The monetary incentives per task during the experiment were fairly weak: the average variable payment during the experiment was approximately 25 rupees while the participation fee was ten times this. A second issue is the choice of two tasks to play out, rather than only one; choosing two might have led to "portfolio" behaviour. A third issue is capping the number of tasks at 10, rather than letting participants complete as many as they like. This could limit the power to detect treatment effects if many people reach the maximum constraint (though this seems to not have happened, given that participants only completed about 5 tasks on average).

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