Società italiana di economia pubblica
XIX CONFERENZA

ECONOMIA DEL CAPITALE UMANO
Istituzioni, incentivi e valutazioni

Pavia, Aule storiche Università, 13 - 14 settembre 2007

LAFFER CURVE IN A NON-LEVIATHAN SCENARIO, A REAL EFFORT EXPERIMENT

STEFANIA OTTONE, PONZANO FERRUCCIO

pubblicazione internet realizzata con contributo della

COMPAGNIA di San Paolo

società italiana di economia pubblica

dipartimento di economia pubblica e territoriale – università di pavia

1. Introduction

The assumption that taxes are distortionary leads to the hypothesis that workers' labor supply decreases as the level of taxation increases. Then, if a proportional income tax is introduced, the amount of supplied labor will decrease as the tax rate increases. The Laffer curve is a graphical representation of this effect. We have some experimental evidence that provides an analysis of this topic and supports the Laffer scenario (Sutter and Weck-Hannemann, 2003; Lévy-Garboua et al., 2005; Swenson, 1988, Sillamaa, 1999).

Unfortunately, most of the analyses of the Laffer curve imply rather incomplete scenarios. Levy Garboua et al. (2005) and Sutter and Weck-Hannemann (2003) introduce a 'Leviathan State scenario' where the tax revenue is not destined to supply services for the taxpayers, while the Swensson (1988) and Sillamaa (1999) experiments simply distribute the tax revenue equally among participants.

The aim of our paper is to analyze the reaction of taxpayers in a more complex scenario of a non-Leviathan state as the tax rate increases, but rather a welfare state. In order to better mimic a real welfare state, we assume that it provides two goods: an universalistic insurance and a universalistic public good. To incorporate these features we introduce a given level of risk in our experiment. Moreover, we assign to the production of public goods the larger share of the tax revenue.

The paper is organized as follows. The second section describes the experimental model, while the experimental design is described in section 3. Section 4 contains the results and section 5 the main conclusions.

2. The experimental model: theoretical background.

This experiment follows Ortona et al. (2006) where a welfare state and a no-state scenario are compared. In this experiment we apply the strategy method to compare different tax rates in the *Welfare State*. We use as a benchmark the no-state scenario where participants are subject to risk but they are not required to pay taxes. Consequently, there is no insurance nor public good. We labeled it as *State of Nature*. On the other hand, in the *Welfare State* – whatever the treatment – participants are subjected to risk and are burdened with a proportional income tax that will finance a universal insurance and a residual public good.

In our experiment, we pay a wage of 1 euro for each unit of labor. Both in the *State of Nature* and in the *Welfare State* there is 1 out of 6 probability to lose 50% of the total wage and 1 out of 36 probability to lose it all. As we said, in the *Welfare State* a proportional income tax is levied. Part of the revenue is employed to compensate the unlucky ones. The income of those who lost all (half) the income is restored to 80% (90%) of their after-tax income in the absence of loss. The remainder of the tax revenue is equally distributed among the subjects that participate in the *Welfare State* – this is the public good.

Consequently, labor in the *State of Nature* has an expected marginal income (for each subject) equal to 0.889.

In the *Welfare State*:

- the expected marginal income of a unit of labor (for each subject) is:

$$(1-t)\left(1-0.1\frac{1}{6}-0.2\frac{1}{36}\right)+\frac{\left(t-(0.1t+0.4)\frac{1}{6}-(0.2t+0.8)\frac{1}{36}\right)}{n} \quad (1)$$

where:
t: tax rate
n: number of individuals in the *Welfare State*
- the expected value of the insurance is

$$(1-t)\cdot\left(0.4\frac{1}{6}+0.8\frac{1}{36}\right) \quad (2)$$

- the expected value of the residual public good is

$$\left(t-0.1\frac{1}{6}t-0.2\frac{1}{36}t-0.4\frac{1}{6}-0.8\frac{1}{36}\right) \quad (3)$$

In our treatments the value of (3) (between 0.204 and 0.4) is always higher than the value of (2) (never greater than 0.1). This is to support the idea that insurance is not the main function of our *Welfare State*. As it usually happens in experiments on public goods, we assume that an egalitarian redistribution is tantamount to the production of a universalistic public good.

3. Experimental design.

The experimental design consists of three treatments with different values of the tax rates: 30%, 50% and 70%. All the sessions were run at the Laboratorio di Economia Sperimentale e Simulativa (AL.EX) of the University of Eastern Piedmont, in Alessandria, Italy[1].
In all treatments participants were requested to carry out a secretarial task. In particular, they were asked to copy information about fictitious students (enrolment number, name, surname and mark) into a file, in blocs of 9. Each task (i.e., to copy a bloc) was paid 1 euro (before taxes, if the case). After some unpaid training, participants were requested to choose the number of blocs they were willing to copy. Participants were informed that the computer would signal mistakes and wait for corrections, and therefore the blocs had to be copied exactly. A 50% fine was established for those who completed a smaller number of tasks than freely chosen. After the training task, but before the choice of the number of blocs to be copied, the participants were informed of the characteristics of their *working contracts*. Two contracts were submitted, one corresponding to the State of Nature (SN) and the other to the Welfare State (WS). Participants were requested to state the number of tasks they wanted to

[1] The program was written by the programmer of the Laboratory, dr. Marie-Edith Bissey.

carry out under each contract (strategy method), and informed that the assignment to one of the two contracts was to be decided, randomly, only after their decision. At the time of the choice it was common knowledge that two-thirds of the participants worked under WS contract and one third under SN contract. After choosing the number of tasks, but before the assignment to one of the contracts, participants were requested to state their preference for one of the contracts, on a 5-point scale (from strong preference for SN to strong preference for WS). Each participant could leave the lab whenever s/he wanted. There was no time constraint and the end of each session corresponded to the end of the experiment for the last participant. There was no show-up fee.

The Contracts. Under the first contract (State of Nature), each participant, after having carried out his job, was asked to toss two dice: if the sum was 2 (1 out of 36) all the earned income was lost; if the sum was 7 (1 out of 6) half of it was lost[2]. The risk was known to participants at the moment of the choice of the number of tasks to carry out. In the second contract (Welfare State), the wage and the risk were the same, but the wage was burdened by respectively a 30% (1st treatment), 50% (2nd treatment), or 70% tax (3rd treatment). However, the participants were informed that the tax revenue would have partially refunded the unlucky ones, bringing the income of those who tossed a 2 (7) to 80% (90%) of their after-tax income. After that, what was left of the tax revenue was going to be divided equally among all the members of the group, irrespective of individual contribution.
We performed one session for each treatment, with 21, 22 and 18 undergraduate students of the faculties of Political Sciences and Law. No student took part in more than one session. All together, 61 students participated in the experiment.

4. Results

Result 1. Subjects' labor supply significantly decreases only when tax rate grows from 50% to 70%, while per capita tax revenue significantly increases only when tax rate shifts from 30% to 50%.
From Table 1, it turns out that subjects strongly decrease their labor supply[3] – and, consequently, the level of their output – in the Welfare State scenario when tax rate grows from 50% to 70%. A Kruskal – Wallis test rejects the null hypothesis that the observations come from the same population ($p = 0.077$). Mann – Whitney tests run on pairs of treatments confirm that there is no difference between the level labor supply when the tax rate is 30% and when it is 50% ($p = 0.69$), while subjects work significantly less when the tax rate

[2] This "experimental risk" is a metaphor for the risks necessarily connected to any economic activity, be it bankruptcy, theft, illness, disappointment or whatever.
[3] As we mentioned in the previous paragraph, we used the strategy method and we asked each participant to choose the number of tasks they were willing to perform under each contract. Per capita effort under each contract is computed on the basis of the aggregate output declared by all the subjects, and not only by those afterwards assigned to that contract.

shifts from 50% to 70% (p = 0.02). To check whether this difference is due to the tax rate and not to subjects' different characteristics, we run a Kruskal – Wallis test on the median effort level, exerted in each treatment under the State of Nature. This choice is due to the fact that the State of Nature has the same features in all the treatments. If the null hypothesis is not rejected when we consider the State of Nature, but it is when we consider the Welfare State, we may deduce that the differences are due to the contract features and not to the population. The test does not reject the null hypothesis that the observations come from the same population (p = 0.42).

Table 1

	Per capita effort in contract…	
When tax rate is…	**…SN**	**…WS**
30%	15.24	17.24
50%	17.23	18.77
70%	13.28	12

At the same time, if we analyze the per capita tax revenue[4] (Table 2), it turns out that it increases as the tax rate changes from 30% to 50%, but that it decreases as the tax rate shifts from 50% to 70%. A Kruskal – Wallis test on the median per capita tax revenue rejects the null hypothesis that there is no difference among the treatments (p = 0.014). In particular, per capita tax revenues are significantly different between the 30% and the 50% treatment (p = 0.005), but not between the 50% and the 70% treatment (p = 0.307).
If we run an OLS regression (Table 4) where we check the effect of the tax rate – through treatment dummies (*T50* and *T70*) - on the individual tax revenue we find a positive and significant coefficient in both cases. At the same time the 50% and the 70% tax rates have no different effect on the tax revenue (χ^2 test, p > 0.503). This means that when the tax rate shifts from 30% to 50% the tax revenue significantly increases, while this is not the case when the tax rate increases up to 70%.

Table 2

	Per capita tax revenue
When tax rate is	
30%	5.17
50%	9.39
70%	8.4

[4] We refer to the potential per capita tax revenue, before dice are thrown.

Result 2. As the tax rate grows from 50% to 70%, the Welfare State becomes unpopular.

Table 3

	Preferred contract			
When tax rate is	**SN**	**WS**	**Indifference**	**Total**
30%	7	10	4	21
50%	8	11	3	22
70%	14	0	4	18
Total	29	21	11	61

From Table 3, it turns out that a tax rate of 70% shifts subjects' preferences towards contract SN, while in the first two treatments (tax rate equal to 30% and 50%), most subjects prefer the WS contract. This is supported by a Fisher exact test that confirms a positive (?) relation between the preferred contract and the tax rate ($p = 0.001$), and by a probit regression where the preference for contract WS decreases as the tax rate increases ($p = 0.002$).

5. Conclusions

The aim of this paper is to provide a further test on the existence of a Laffer curve. We used tax rates of 30%, 50% and 70% and we gave subjects the opportunity to determine their labor supply both under a Welfare – State contract and a State – of – Nature contract. The main evidence is that a tax rate of 70% is extremely unpopular and significantly decreases the quantity of labor that subjects' supply without any benefit for the tax revenue. On the other hand, an increase of the tax rate from 30% to 50% does not reduce the overall labor supply and therefore the tax revenue significantly increases.

References

.

Lévy-Garboua, L., D. Masclet and C. Montmarquette (2005), "Fiscalité et offre de travail: une étude experimentale", CIRANO (Montréal) working paper 2005 s-23.

Ortona, G., S. Ottone, F. Ponzano and F. Scacciati (2006), "Labour Supply in Presence of Taxation Financing Public Services. An Experimental Approach" Paper n.77, AL.EX Series, Dipartimento POLIS, Facoltà di Scienze Politiche, Università del Piemonte Orientale 'A. Avogadro', Alessandria, *forthcoming, Journal of Economic Psychology,* 2007

Sillamaa, M. A. (1999), "Taxpayer Behavior in Response to Taxation: Comment and New Experimental Evidence"*, Journal of Accounting and Public Policy*, 18.

Sutter, M. and H. Weck-Hannemann (2002), "Taxation and the Veil of Ignorance - a Real Effort Experiment of the Laffer Curve", *Public Choice,* 115.

Swenson, C. W. (1988) "Taxpayer Behavior in Response to Taxation. An Experimental Analysis"*, Journal of Accounting and Public Policy*, 7.

Table 4 - OLS regression – Dependent variable: Individual tax revenue

	I	II	III	IV
T50	4.21***	4.15***	4.15***	4.15***
	(1.4)	(1.43)	(1.44)	(1.44)
T70	3.23**	3.34**	3.27*	3.7**
	(1.48)	(1.51)	(1.7)	(1.65)
Time	-	0.94	0.94	0.99
		(1.34)	(1.34)	(1.35)
Contract	-	-0.14	-0.11	-0.28
		(1.23)	(1.29)	(1.27)
PrefA	-	-	-0.15	-
			(1.49)	
PrefB	-	-	-	-0.78
				(1.34)
Constant	-5.17***	4.57***	4.86***	4.63***
	(1.004)	(1.57)	(1.65)	(1.68)
F	4.85***	2.50**	1.97*	2.05*
T50 = T70	0.45			
N	61	61	61	61

Standard errors in parentheses
*** significance at 10%**
**** significance at 5%**
***** significance at 1%**