Public Choice (2005) **122:** 39–68.

Testing the Mill hypothesis of fiscal illusion *

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Accepted 1 October 2003

Abstract. According to the "Mill hypothesis", the tax burden from indirect taxation is underestimated because indirect taxes are less "visible" than direct taxes. We experimentally test the Mill hypothesis and identify tax framing as a cause of fiscal illusion. We find that the tax burden associated with an indirect tax is underestimated, whereas this is not the case with an equivalent direct tax. In a referendum to tax and redistribute tax revenue, fiscal illusion is found to distort democratic decisions and to result in "excessive" redistribution. Yet, voters eventually learn to overcome fiscal illusion.

1. Introduction

> "Perhaps ... the money which [the taxpayer] is required to pay directly out of his pocket is the only taxation which he is quite sure that he pays at all. ... If all taxes were direct, taxation would be much more perceived than at present; and there would be a security which now there is not, for economy in the public expenditure."
>
> John Stuart Mill (1848: 237)

The quotation above summarizes the "Mill hypothesis" of fiscal illusion. Fiscal illusion prevails if people are prone to systematic misperception of the tax burden. The Mill hypothesis suggests a particularly relevant aspect of taxation as a cause fiscal illusion: the relative "invisibility" of indirect taxes as compared to more "visible" direct taxes. Taxpayers may systematically underestimate the tax burden from indirect taxes as compared to direct

* We are grateful for comments by James Buchanan, James Cox, Dirk Engelmann, Simon Gächter, Werner Güth, Georg Kirchsteiger, Kevin McCabe, Dennis Mueller, Dave Porter, Stephen Rassenti, Vernon Smith, Frans van Winden, as well as by seminar participants at the University of Zürich and Humboldt University Berlin. We gratefully acknowledge financial support by the Zaugg Foundation under project no. B11162107, by the International Foundation for Research in Experimental Economics (IFREE) at the University of Arizona, and by the Austrian National Bank, Jubiläumsfonds project no. 9134.

taxes because indirect taxes are incorporated into (and therefore "hidden" in) the prices of goods. This hypothesis about a cause of fiscal illusion has a long intellectual pedigree (see Buchanan, 1967; Schmölders, 1960). Fiscal illusion may have important consequences because of its potential to distort democratic decisions on fiscal issues. The Mill hypothesis suggests that fiscal illusion may lead to "excessive" public expenditure (see quotation above). Government spending is considered to be "excessive" if a tax-expenditure package is implemented which voters-taxpayers would have opposed had they correctly perceived the resulting tax burden. Therefore, fiscal illusion is a candidate explanation for the dramatic increase in government spending experienced in many countries during the 20th century (e.g., Mueller, 2002: Ch. 19.7). For example, U.S. government expenditures as a percentage of GNP have increased by approximately 500 percent over the last nine decades (Holsey and Borcherding, 1997: 563). Of course, the massive government growth has several causes. In fact, various explanations which do not refer to fiscal illusion, but are based on the assumption that all agents are rational have been suggested to account for this phenomenon (e.g., Becker and Mulligan, 1998).

Despite the considerable number of empirical studies on fiscal illusion available to date, the Mill hypothesis has not been tested so far. As will be argued in Section 2 in more detail, it is difficult to measure a misperception of the tax burden, and it appears to be impossible to unambiguously show with survey studies or field data that excessive government spending is a consequence of fiscal illusion (see Oates, 1988; Dollery and Worthington, 1996 for detailed reviews). In particular, the available empirical research methods did not allow to distinguish between the rationality-based and the illusion-based explanations.

We suggest an experimental approach to test the Mill hypothesis about the causes and consequences of fiscal illusion. Experimental techniques allow for control of preferences and information conditions, and this control is necessary to discriminate between rationality-based and illusion-based explanations. We present an experimental design appropriate to investigate whether tax framing is a cause, and whether excessive redistribution is a consequence of fiscal illusion. To do so, we provide a novel combination of two well-established lines of experimental research. We combine a competitive experimental market (e.g., Smith et al., 1982) with an experimental voting study (see Palfrey, 1991). In our experiment, subjects earn income in a competitive experimental market from trading, and vote on a proposal to tax market transactions and to redistribute tax revenues. The tax is either framed as a "visible" direct tax or an "invisible" indirect tax. Except for the framing the two tax regimes are perfectly equivalent. In our experiment, subjects can

repeatedly vote on the tax-redistribution proposal. A particular sequence of tax frames is implemented allowing us to study whether people eventually learn to overcome fiscal illusion.

With respect to the causes of fiscal illusion, our results show that the tax burden resulting from indirect taxation is systematically underestimated, whereas this is not the case with direct taxation. With respect to the consequences of fiscal illusion, we show that fiscal illusion induces inexperienced voters to approve of a tax-redistribution proposal which is not in their material self-interest. In particular, we find that redistribution is accepted in 9 out of 10 cases when taxation is indirect, while it is rejected in 9 out of 10 cases when taxation is direct. However, we also find significant effects of learning from experience. When the referendum is repeated under constant conditions, fiscal illusion is still present at the individual level, but ceases to have significant effects on redistribution. If voters who are experienced in one tax frame are confronted with the other tax frame (e.g., those who voted on financing redistribution with direct taxes twice now vote on financing it by indirect taxes), we find no effect of fiscal illusion. Therefore, subjects not only learn from experience, but also seem to be able to do "transfer learning" (Cooper and Kagel, 2003).

The paper is organized as follows: Section 2 discusses empirical problems in identifying the causes and consequences of fiscal illusion by means of survey studies and field data. Section 3 provides a description of the experimental design. Section 4 reports the results, and Section 5 concludes the paper.

2. Requirements for testing the Mill hypothesis

This section discusses the requirements that have to be met by an empirical investigation to test the Mill hypothesis, i.e., to unambiguously show whether (i) fiscal illusion exists, (ii) fiscal illusion is caused by tax framing, (iii) excessive government activity is a consequence of fiscal illusion, and whether (iv) voters eventually learn to overcome fiscal illusion, if it exists at all. These requirements are very demanding. To our knowledge, neither survey nor econometric studies are available which fulfill all requirements. We claim that the experimental design presented in Section 3 meets all of the requirements explained below.

(i) To be able to show that fiscal illusion exists, the individual perception of the tax burden resulting from a particular tax has to be measured. Several survey studies have investigated the "visibility" of various taxes (e.g., Schokkaert, 1988; Cullis and Lewis, 1985). Economists tend to be skeptical about the reliability of survey studies because respondents have no incentives

to report their perception thoughtfully or truthfully. A more important limitation of survey studies is that they do not provide any indication of the extent of *mis*perception of the tax burden.[1] To evaluate whether there is misperception, one has to compare the true tax burden an individual bears with his or her perception of the tax burden. Unfortunately, even specialized economists disagree on the tax burden of indirect taxes (see for example, the debate on the "double dividend" from indirect taxes on energy). Therefore, it appears to be difficult to establish even the very existence of fiscal illusion (however, for interesting attempts see Gemmell et al., 2003 or Fujii and Hawley, 1988).

(ii) Suppose the problems mentioned in (i) could somehow be solved, i.e., suppose the misperception of the tax burden from a particular tax could be reliably measured. To be able to show that tax framing causes this misperception, the researcher would have to find two taxes that are identical with respect to the tax burden, and to compare the relative misperception associated with these taxes. This is so because a framing effect prevails if different representations of the objectively same situation provoke different cognitive evaluations of the situation (Tversky and Kahneman, 1981). For example, a researcher would have to find a tax reform in which taxpayers are first exposed to a direct tax, then to an indirect tax which is shifted to taxpayers to such an extent that the resulting tax burden is the same in both cases. He could then (in principle) measure and compare the misperception in both cases. Unfortunately, such a natural experiment appears to be difficult to find.

(iii) Suppose the problems discussed in (i) and (ii) could be solved, i.e., suppose that it is possible to identify tax framing as a cause of fiscal illusion. To be able to show that fiscal illusion indeed translates into distorted fiscal decisions, a researcher would have to analyze the effect of individual misperception on individual voting decisions. However, such individual-level data are usually not available because voting is frequently anonymous.

(iv) Finally, to investigate whether voters eventually learn to overcome fiscal illusion, one would have to analyze a sequence of differently framed referenda under constant conditions. While such referenda are held in some places (e.g., in Switzerland), they take place under widely varying economic and political conditions.

In view of the insufficient quality of available field data, Wallace E. Oates (1988: 66) concludes in his survey that the empirical "literature has not made a persuasive case for [the] existence and importance" of fiscal illusion.[2] The main reason is that field observations which are consistent with the fiscal illusion hypothesis are usually also consistent with hypotheses based on the assumption of fully rational agents (e.g., Marshall, 1991).

3. An experimental approach to fiscal illusion

3.1. *Experimental design and hypotheses*

This experimental study compares behavior in two treatments. In both treatments, subjects first participate in a competitive experimental market where they earn market income from trading. In both treatments, subjects vote in a referendum on a proposal to tax market transactions and to redistribute tax revenues. If the proposal passes, the tax-redistribution scheme is implemented. If the proposal fails, trading continues as before. The two treatments exclusively differ by the sequence of tax regimes. Redistribution is either financed by a transaction tax levied on buyers or sellers. As a consequence of our parameter choices, the transaction tax cannot be shifted if levied on the buyers, but is fully shifted in equilibrium if levied on the sellers. By definition, direct taxes are taxes which cannot be shifted, whereas indirect taxes can be shifted.[3] Therefore, the two tax regimes exclusively differ by whether redistribution is financed by a direct tax or by an indirect tax.

Figure 1 serves two purposes. First, it illustrates the basic idea of our experiment. Second, the figure is drawn using actual experimental parameters. These will be explained in detail in Section 3.2, and the figure serves as a reference for that discussion. In both treatments, subjects first trade under the same market conditions (induced supply and demand S_0, D_0). If a transaction tax is levied on the buyers (left part of Figure 1), the demand schedule is shifted down to D_1. Since demand and supply intersect in the perfectly inelastic range of demand, the imposition of the tax affects neither the equilibrium price nor the equilibrium quantity. Since the direct tax cannot be shifted in equilibrium, the entire tax burden is borne by the buyers.

If a transaction tax is levied on the sellers (right part of Figure 1), the supply schedule is shifted up to S_1. The imposition of the tax does not affect the equilibrium quantity, but causes equilibrium prices to rise exactly by the amount of the tax. That is, the indirect tax is fully shifted to the buyers, and the entire tax burden is borne by the buyers. Therefore, the tax burden is the *same* in both tax regimes, and the two regimes are perfectly equivalent in economic terms. This follows from the proposition of tax liability side equivalence which claims that the same rent distribution prevails in equilibrium irrespective of whether the tax is levied on the buyers or on the sellers (see e.g., Kotlikoff and Summers, 1987).

When subjects vote on the proposal to introduce the tax and redistribute a part of the revenues, they know all market parameters and the terms of the proposal in detail. Therefore, they possess sufficient information to take a rational voting decision. In particular, subjects know that the amount of money redistributed to subjects is smaller than the tax revenue in both treat-

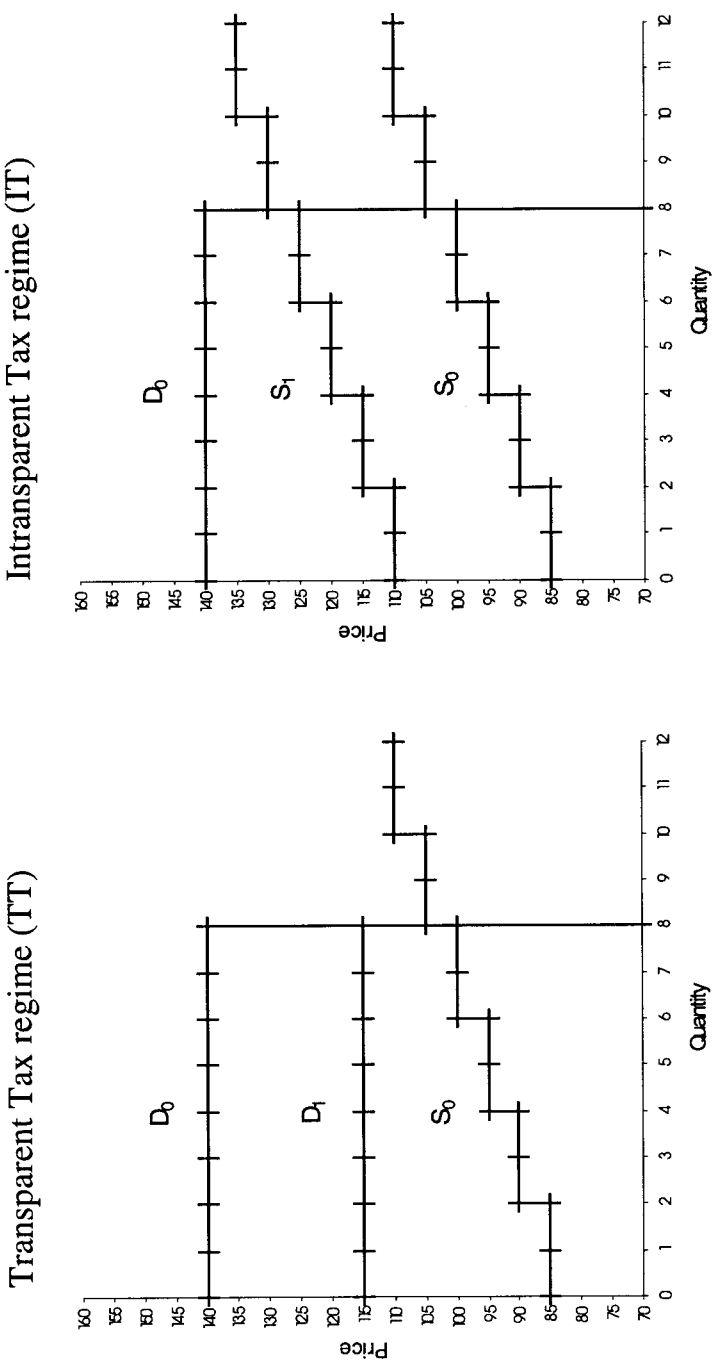

Figure 1. Induced supply and demand in the two tax regimes

ments. A rational voter approves of the proposal if the proposal increases his net income. Since the entire tax burden is borne by buyers and their per capita income from redistribution is smaller than their per capita tax burden in equilibrium, rational buyers will reject the proposal in both treatments.

Even though the treatments are identical in terms of equilibrium incomes, they may not be cognitively identical. We hypothesize that the *framing of taxation* (i.e., direct vs. indirect taxation) systematically affects the perception of the tax burden. In particular, we hypothesize that the tax burden resulting from direct taxation is "transparent" whereas the tax burden resulting from indirect taxation is "intransparent" to subjects. The reason for this intransparency is that subjects have to perceive that the indirect tax will be incorporated into prices. As a consequence, we call the tax regime with direct taxes the Transparent Tax (TT), and the regime with indirect taxes the Intransparent Tax (IT). More specifically, we hypothesize that the tax burden from indirect taxation will be underestimated compared to perfectly equivalent direct taxation. If this underestimation is pronounced enough, some buyers may hold the illusionary belief to gain from redistribution. This illusionary belief may then induce them to vote for redistribution when it is financed by indirect taxes, but not when it is financed by direct taxes.

In the following, we argue that our design is appropriate to investigate whether (i) fiscal illusion exists, (ii) tax framing causes fiscal illusion, and (iii) fiscal illusion distorts fiscal choices in a referendum, and whether (iv) voters learn to overcome fiscal illusion.

(i) To investigate whether there is fiscal illusion at all, we have to measure a subject's actual perception of the tax burden and to determine to what extent this perception is erroneous. Subjects are asked to provide expectations about market prices and quantities in case of rejection and acceptance of the referendum. From these expectations the expected change in net income can be calculated (see Section 4.2 for details). As will be shown below, we do observe systematic differences between perceived and actual changes in net income in the two tax frames.

(ii) To isolate tax framing as a cause of fiscal illusion we need to implement a ceteris paribus variation in which only the representation but not the rent distribution is varied. For the two types of taxes to produce identical economic outcomes, tax liability side equivalence must hold. For this equivalence to hold, markets must equilibrate. As a consequence, we chose an experimental market institution that rapidly converges to competitive equilibrium outcomes.

(iii) To isolate the consequences of fiscal illusion, i.e., to be able to show that fiscal illusion distorts voting decisions, we have to eliminate other factors which may also distort voting decisions as far as possible. The design was

chosen to foster voting consistent with material self-interest. This consistency may fail to hold for two reasons. First, voters may not vote consistent with material self-interest even though material self-interest is their only motive. For example, voters may cast their votes randomly because they may believe that their individual vote will not affect the outcome of the referendum. This type of behavior is more likely if the electorate is large. To minimize the incidence of this type of random voting, we chose a relatively small electorate. Second, voters may not vote consistent with material self-interest because they have non self-interested motives. Suppose, for example, that the pre-proposal distribution of rents is such that buyers earn higher market incomes than sellers. If a buyer is inequality averse he or she may vote for redistribution in order to reduce income inequality. To avoid this type of confound, we use automated sellers instead of human subjects in the role of sellers. These automated sellers trade according to pre-specified and commonly known rules on the market (see Section 3.2 for details), but they do not vote.

Rapid equilibration of the experimental market is not only important to isolate tax framing as a cause of fiscal illusion as explained in (ii) above. It is also important to unambiguously identify the consequences of fiscal illusion. We explained earlier that buyers lose net income *in equilibrium* if the proposal passes. This is not necessarily the case if markets do not equilibrate. Suppose, for example, that market prices adjust very slowly to the indirect tax. Suppose a buyer correctly anticipates such a disequilibrium price path and approves of the proposal. This voting decision is not the result of fiscal illusion (no misperception) but of a market in disequilibrium. To avoid this type of confound we chose a market institution which is known to equilibrate quickly.

(iv) To investigate whether voters eventually learn to overcome fiscal illusion, we let subjects vote three times on the proposal. We vary the sequence of the tax regimes across treatments to assess whether experience learning and transfer learning can explain a vanishing effect of fiscal illusion on redistribution.

3.2. *Procedures and parameters*

Subjects first participate in a competitive experimental market where they earn market income (see Phase 0 in Figure 2). Subjects then go through 3 phases, each consisting of two parts. The first part is a referendum on a proposal to tax subsequent market transactions and to redistribute the revenues from this tax to market participants. The second part of a phase is a series of 15 market periods in which subjects earn market incomes, and receive income from redistributed tax revenues if the proposal has been accepted. If the proposal has been rejected the same conditions as in phase 0 prevail.

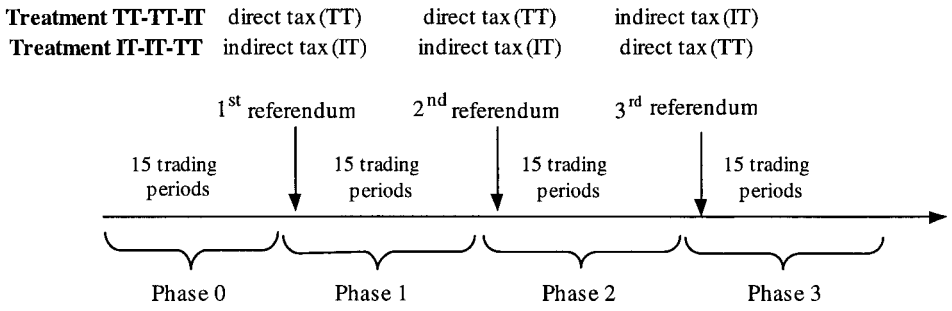

Figure 2. Sequence of voting and trading

The treatments exclusively differ by the sequence of tax regimes (see Figure 2). In treatment TT-TT-IT, participants vote on a referendum to finance redistribution by a direct tax in phases 1 and 2, followed by an in direct tax. In treatment IT-IT-TT, the 1st and 2nd referendum is on an indirect tax, followed by a direct tax. The purpose of this sequencing is threefold. First, the comparison in the 1st phase across treatments serves to uncover whether there is fiscal illusion at all. Second, the comparison of the 1st to the 2nd phase within a treatment serves to detect experience learning. Finally, the comparison of the 1st and 3rd phase across treatments serves to test for transfer learning.

Experimental market

The competitive experimental market is a computerized two-sided auction with 4 human buyers and 2 automated sellers (see instructions in appendix A). Each of the 4 buyers can buy at most two units having a value of v_i = 140 points each, and total supply by the 2 automated sellers is 12 units (see Figure 1 and Table 1). The equilibrium quantity is $q^* = 8$ units in all cases. The equilibrium price is $p^* \in [100, 105]$ points in phase 0 as well as in TT, and in IT if the proposal is rejected. If the proposal passes, a transaction tax of 25 points is levied on the buyers (in TT) or on the sellers (in IT). In this case, the equilibrium price in IT increases to $p^* \in [125, 130]$ points. During the experiment all payoffs are denoted in points. At the end of the experiment point incomes are converted into Euros at the exchange rate of Euro 0.05 per 10 points.

In both treatments, buyers bear the full tax burden and lose net income in equilibrium. The following calculation shows that this is indeed the case, using TT as an example (see also Table 1). Since the equilibrium price is p^* = 100 (105) points, a buyer's net income is 80 (70) points if the proposal is rejected. If it is accepted, income falls by the amount of the tax (= 25 points) on each of the two units to 30 (20) points. The redistribution income

Table 1. Overview over parameters in the regimes with Transparent Tax (TT) and Intransparent Tax (IT)

	Transparent Tax (TT)	Intransparent Tax (IT)
Number of buyers (n)	4	4
Number of automated sellers (m)	2	2
Number of market periods (t = 1, . . . , T)	15	15
Equilibrium quantity (q^*)		
(if proposal accepted and if rejected)	8	8
Equilibrium price (p^*)		
before proposal and if proposal rejected	100 to 105	100 to 105
Transaction tax (Tax) (if proposal accepted)	25	25
Transaction tax levied on	*Buyers*	*Sellers*
Equilibrium price if proposal accepted	*100 to 105*	*125 to 130*
Equilibrium tax burden (per period t)		
on each buyer i if proposal accepted	–50	–50
Equilibrium redistribution income [$R_i(t)$]		
(per period t) for each buyer i if		
proposal accepted	+200/6	+200/6
Equilibrium net tax burden ($\Delta E_i^*[Inc(t)]$)		
(per period t) on each		
buyer i if proposal accepted	–16.66	–16.66
	(= –50 + 200/6)	(= –50 + 200/6)

is obtained by dividing the total tax revenue of 200 (= 8 units times 25 points) by the number of agents in the market (6 = 2 sellers plus 4 buyers). As a consequence, a buyer's net income falls from 80 (70) points to 63.33 (53.33) points per period if the proposal is accepted. Therefore, the acceptance of the proposal induces a net income loss of 16.66 for each buyer.

The competitive market we use is a uniform price sealed bid/offer auction.[4] In this auction, buyers can submit integer bids for each unit they can buy. The automated sellers are programmed to submit offers for each unit equal to the true unit costs. After the decision time[5] has elapsed, the bids are ordered from highest to lowest, and the offers from lowest to highest. The first q bids higher or equal than the first q offers are accepted. If bids are tied, priority is given randomly. The uniform market-clearing price is set equal to the q^{th} (= last accepted) bid, and the number of transactions is q. Note that

the instructions (see appendix A) provide subjects with full information on all market parameters, the programming of the automated sellers, and the price and quantity determination rule.

Proposal and voting rules

At the beginning of each of the 3 main phases, buyers vote on a proposal (see Figure 2). Subjects are handed out instructions explaining the proposal and the rules of the referendum in great detail (see appendix B). Only the 4 buyers can vote, and the referendum is anonymous. Each voter either approves or disapproves, abstentions are not possible. If at least two voters approve of the proposal, the redistribution scheme is implemented for the following 15 market periods. If the proposal is rejected, trading goes on as in phase 0. Subjects are given 12 minutes to study the instructions and to think about the proposal. Meanwhile, subjects can access data from the past 15 trading periods. The computer shows individual information (unit values, individual purchases, accumulated and per period earnings) as well as information on the market as a whole (market quantity and price for each period).

Before subjects cast their votes in the computerized ballot, they have to correctly answer several control questions. In particular, they have to calculate their individual redistribution income and their tax payment in case the proposal passes, assuming that the equilibrium quantity prevails (see appendix C). Subjects have to report their expectations about market prices and quantities for the subsequent periods 1, 4, 7, 10, and 13. Subjects report their expectations before the results of the referendum are announced, and they do so for both possible outcomes of the referendum. Expectations are motivated by monetary incentives.[6]

4. Results

We ran 20 laboratory markets in 2003 at the University of Innsbruck. 80 students from all disciplines at the University of Innsbruck participated in one of the two treatments. The average subject earned Euro 28 (including a Euro 4 show-up fee) within about 2.5 hours. The experiments were programmed with the software z-Tree (Fischbacher, 1998).

This study yields two main results. First, fiscal illusion distorts democratic decisions and leads to “excessive” redistribution when voters are inexperienced. In particular, redistribution which causes voters to lose money is accepted in 9 out of 10 cases when taxation is indirect, but rejected in 9 out of 10 cases when taxation is direct in the 1st referendum. Below, we show step by step that the income-effects of redistribution are intransparent to

subjects if it is financed by an indirect tax, and that it is indeed fiscal illusion that causes these distorted democratic outcomes. We begin by showing that markets equilibrated which implies that redistribution in fact caused monetary losses to voters (see 4.1). We then show that tax framing induced different expectations about the income-effects of the proposal in the two tax frames. Section 4.2 shows that voters correctly expected to lose with direct taxation while they expected to gain from redistribution with indirect taxation, and that these biased perceptions translated into voting decisions.

The second main result is that voters eventually learn to overcome fiscal illusion to some extent. Section 4.3 shows that if the referendum is repeated under exactly the same conditions, expectations are more accurate, and fiscal illusion ceases to have a significant effect on redistribution. We also find some evidence of transfer learning. If voters who are experienced with referenda on transparent taxes are confronted with an intransparent tax, the distorting effects are less pronounced than if voters have no such experience.

4.1. *Tax liability side equivalence and tax framing*

With respect to market outcomes, we find the following:

Result R1. Experimental markets equilibrate quickly and reliably. Equilibration prevails irrespective of tax framing, i.e., tax liability side equivalence holds. Therefore, redistribution causes considerable net income losses in both tax regimes.

Figure 3 shows the per-period prices averaged across all 20 markets. As can be seen, average transaction prices remained in the predicted range (see Table 1) in almost all periods irrespective of whether the proposal was accepted or rejected.

To test whether tax liability side equivalence holds, we run a regression of profits on the tax regime (= 1 in IT), phases, whether the proposal was accepted, with interaction effects for regime*acceptance, regime*phase, and regime*acceptance*phase (regression with robust standard errors, 20 clusters, n = 3600 observations, $R^2 = 0.598$). The only significant variable is the acceptance of the proposal. The estimated value is a loss of 16.79 points while the predicted value is a loss 16.66 points (see Table 1). Most importantly, the estimate for the interaction term regime*acceptance is far from being significant (coefficient = –1.24, p = 0.638). This means that the acceptance of the proposal reduced profits almost exactly as theoretically predicted, and that the income-reducing effect of accepting the proposal was not different in the two tax regimes. From this, we conclude that markets almost perfectly equilibrated and that tax liability side equivalence in fact holds.[7] As a con-

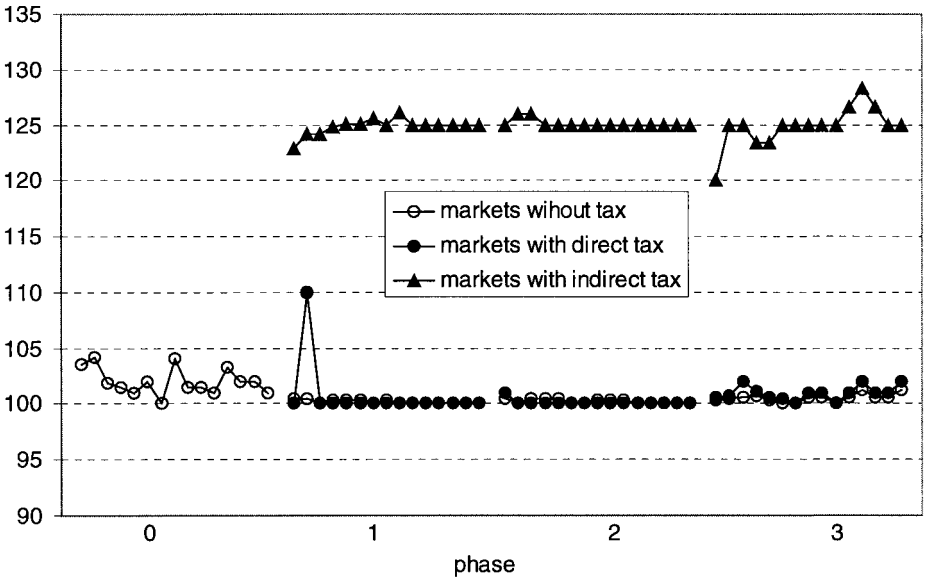

Figure 3. Average transaction prices (20 markets per phase)

sequence, the two treatments indeed are different representations of the same decision situation.

4.2. *Perception of the tax burden and voting*

Our main finding with respect to the perception of the tax burden is stated in result R2.

Result R2. Misperception of the tax burden is much more pronounced with the indirect tax than with the direct tax. Therefore, the indirect tax is intransparent, and tax framing causes fiscal illusion.

To provide support for result R2, we calculate a measure of misperception of the net tax burden from individual expectation data. Subjects report expectations on market prices and quantities for periods t = 1, 4, 7, 10 and 13 of the current phase in case the proposal is accepted and in case it is rejected. From these data, we calculate a measure of the perceived net tax burden for each subject, i.e., the expected change in net income from the acceptance of the proposal. We use the following notation:

v_i	Subject *i*'s induced value for each transaction (constant at 140, see Figure 1).
$e_ip(t\|j)$	Subject i's price expectation for period t, provided the proposal is accepted (j = 1), or rejected (j = 0).
$e_iq(t\|j)$	Subject i's expectation about market quantity in period t, provided the proposal is accepted or rejected.
$e_iQ_i(t\|j)$	Measure of subject i's expectation about quantity bought by buyer i in period t, provided the proposal is accepted or rejected. $e_iQ_i(t\|j) = (1/n)e_iq(t\|j)$, where n: number of buyers (= 4).[8]
Tax	Per unit transaction tax of 25 points.
$R_i(t)$	Measure of subject i's expected redistribution income. $R_i(t) = \text{Tax} \cdot e_iq(t\|1) \cdot [1/(n+m)]$, where m: number of sellers (= 2).
$\Delta E_i[\text{Inc}(t)]$	Measure of subject i's expected change in net income in period t from implementing the proposal.

In TT, the expected change in net income from redistribution in period t for buyer i is

$$\begin{aligned}\Delta E_i[\text{Inc}(t)|\text{TT}] \;=\; & \{[v_i - e_ip(t|1)] \cdot e_iQ_i(t|1) - [v_i - e_ip(t|0)] \cdot e_iQ_i(t|0)\} \\ & +\; R_i(t) - e_iQ_i(t|1) \cdot \text{Tax}.\end{aligned} \tag{1}$$

The corresponding expression for the intransparent tax regime IT is

$$\Delta E_i[\text{Inc}(t)|\text{IT}] = \{[v_i - e_ip(t|1)] \cdot e_iQ_i(t|1) - [v_i - e_ip(t|0)] \cdot e_iQ_i(t|0)\} + R_i(t) \tag{2}$$

According to (1) and (2), the expected net tax burden consists of three elements: the change in expected market income, the expected redistribution income, and (in TT) an expected tax payment. From the per-period measures (1) and (2), we calculate a measure of the net tax burden for each subject over all T = 15 periods of the respective phase ($\Delta E_i[\text{Inc}(T)]$). To do so, we simply average expected net income changes over reported periods.

Suppose a subject expects no change in market income due to direct taxation. In this case, the first term in (1) is equal to zero. That is, the net tax burden in TT is the difference of the expected redistribution income $R_i(t)$ and the expected tax payment:

$$\Delta E_i[\mathrm{Inc}(T)|TT;\, p,\, q = \text{const.}] \;=\; [(1/(m+n)) - (1/n)][e_i q(t|1) \cdot \mathrm{Tax}] \;<\; 0 \quad \text{for } m > 0. \tag{3}$$

It is easy to see that (3) is always negative if $m > 0$. The intuition for this result is that the tax is paid and borne exclusively by the n buyers whereas the tax revenue is redistributed to all $m + n$ market participants, including the m sellers. Hence, it should be cognitively simple to perceive that the proposal results in income losses in TT because losses are correctly expected given the correct expectation that market income remains constant.

Now consider the intransparent tax regime IT. Suppose again a subject expects his or her market income to remain unaffected by the tax. In this case, however, the assumption of constant market income is incorrect, and would lure a subject to believe that he or she gains from redistribution:

$$\Delta E_i[\mathrm{Inc}(T)|IT,\, p.q = \text{const.}] = R_i(t) > 0 \quad \text{for } e_i q(t|1) > 0. \tag{4}$$

Therefore, to correctly perceive a loss from redistribution, a subject has to perceive that market income falls at least by $R_i(t)$, or, assuming unchanged quantities, that prices rise at least by two thirds of the imposed indirect tax [$= n/(n + m) \cdot \mathrm{Tax}$]. Therefore, it is cognitively difficult to perceive that the indirect tax will result in income losses because losses are only correctly predicted if a considerable price increase is correctly expected.

How did expectations on the income-effect of the proposal ΔE_i differ across tax regimes in the 1st referendum? The average subject expected to lose 9.9 points of net income in TT, but to *gain* 10.3 points in IT. According to a Mann-Whitney test, income expectations are different between IT and TT at all conventional levels of significance ($p = 0.000$). Since subjects in fact lost income if the proposal was accepted (see Section 4.1), the average misperception of the net tax burden was much more pronounced in IT than in TT.

In principle, tax framing could affect the misperception of the net tax burden through price or quantity expectations [see equations (1) and (2)]. However, tax framing did not significantly affect quantity expectations $e_i q(T|j)$($p = 0.490$, Mann-Whitney test). In fact, the lions share of misperception results from underestimation of the effect of the indirect tax on prices in IT. For example, a large majority of 72 percent of subjects expected prices below the equilibrium level [$e_i p(T|1) < 125$], and 30 percent of subjects believed that the tax would not be shifted to them at all in IT.[9] A Mann-Whitney test shows that price expectations were less accurate in IT than in TT ($p = 0.009$) in the 1st phase.

These marked differences in expectations translate into voting decisions in the 1st referendum. In TT, 23 percent (= 9/40) of subjects expect to gain from redistribution, and 28 percent (= 11/40) vote for the proposal. In IT, 55 percent of subjects expect to gain from redistribution, and 63 percent (= 25/40) vote for the proposal. These pronounced differences in individual voting cause the proposal to be rejected in 90 percent of the cases in TT, but to be accepted in 90 percent of the cases in IT in the 1st referendum (see also Figure 4).

4.3. *Learning to overcome fiscal illusion*

The main result with respect to learning is

Result R3. Fiscal illusion causes excessive redistribution when voters are inexperienced. With experience, fiscal illusion is still present at the individual level, but induces no redistribution. Experience and transfer learning explain this evolution.

Support for result R3 comes from Figure 4. The figure shows acceptance rates of the proposal in the respective referenda. As can be seen, tax framing has a very pronounced effect when voters are inexperienced. However, the effect of tax framing is smaller in the 2nd than in the 1st, and almost completely vanishes in the 3rd referendum. In particular, the proposal is accepted in 50 percent of the cases in IT, and in 20 percent of the cases in TT in the 2nd referendum, and there is almost no difference in acceptance rates in the 3rd referendum across tax frames (30 and 20 percent, respectively). We now argue that this vanishing effect of fiscal illusion can be explained by experience learning and by transfer learning.

Experience learning is simply the ability of subjects to take better decisions in an environment in which subjects are experienced. To assess experience learning, we compare the 1st and the 2nd phase within each treatment.

In TT, subjects on average expected to lose 9.9 points in the 1st referendum, and to lose 20.5 points in the 2nd. To test whether these expectations are different, we take average expectations over all subjects in a market as units of observation. We find that expectations are not significantly more accurate in the 2nd than in the 1st referendum according to a Wilcoxon signed-rank test ($p = 0.114$). This absence of experience learning should not be too surprising since the proposal was rejected in almost all markets in TT in the 1st referendum. In other words, since almost everyone "got it right" from the beginning, there was not much scope for learning.

In IT, experience learning should be more pronounced since redistribution is accepted in almost all markets in the 1st referendum. In IT, subjects expec-

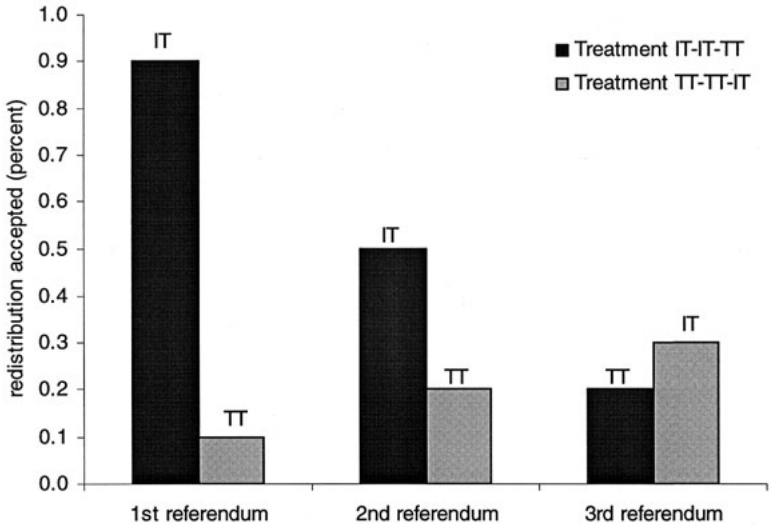

Figure 4. Acceptance rates of the tax-redistribution proposal (n = 10 in each treatment)

ted to gain 10.3 points in the 1st, and to lose 2.1 points in the 2nd referendum. Taking again market averages as units of observation, expectations are significantly more accurate in the 2nd than in the 1st referendum according to a Wilcoxon rank-sum test ($p = 0.009$). Hence, experience learning is present in IT.

While expectations are significantly different across tax regimes in the 2nd referendum (Mann-Whitney test, $p = 0.001$), voting behavior is not. According to a chi-square test, referendum outcomes are not significantly different in TT and IT in 2nd referendum ($\chi^2 = 1.98$, $p = 0.160$). We conclude that experience learning is not strong enough to entirely eliminate fiscal illusion at the individual level, but strong enough to eliminate its effects on redistribution outcomes.

Transfer learning is the ability of subjects to take what has been learned in one economic environment and to generalize it to related environments (see Cooper and Kagel, 2003). In the context of our investigation, transfer learning means that subjects who are experienced with one tax regime take better decisions in the other tax regime than subjects without such experience. To test for transfer learning, we compare expectations ΔE_i in the 3rd referendum in one treatment with the 1st referendum in the other treatment.

In TT, subjects on average expect to lose 9.9 points without experience (1st referendum in TT-TT-IT), while they expect to lose 19.8 points with experience (3rd referendum in IT-IT-TT). These averages are not significantly different according to a one-sided Mann-Whitney test ($p = 0.227$,

group averages as units of observation). Given this insignificant effect on expectations, it is no surprise that transfer learning has no significant effect on redistribution outcomes in TT. In the 1st referendum, the proposal was accepted once, and was accepted twice in the 3rd referendum which is far from being significantly different ($\chi^2 = 0.39$, $p = 0.531$). Hence, there is no evidence of transfer learning in TT.

In IT, subjects on average expect to gain 10.3 points without experience (1st referendum in IT-IT-TT), while they expect to lose 4.2 points with experience (3rd referendum in TT-TT-IT). These averages are significantly different according to a one-sided Mann-Whitney test ($p = 0.034$, based on group averages). Did this significant effect of transfer learning on expectations translate into referendum outcomes in IT? In the 1st referendum, the acceptance rate of the proposal was three times higher than in the 3rd referendum (see Figure 4). This difference is significant according to a chi-square test ($\chi^2 = 7.50$, $p = 0.006$). Therefore, the effect of fiscal illusion on the acceptance of redistribution is significantly weaker if voters are experienced with a similar proposal than if they are not.

Taken together, we find evidence of both experience and transfer learning in IT but not in TT. The joint effect of these two types of learning nullifies the effect of fiscal illusion on redistribution. While learning considerably improves the accuracy of expectations, it fails to entirely eliminate fiscal illusion at the individual level. In particular, expectations in the 3rd referendum are still significantly less accurate in IT (–4.2) than in TT (–19.8) according to a Mann-Whitney test ($p = 0.005$, one tailed).

5. Summary and conclusion

John Stuart Mill (1848) suggested indirect taxation as a cause, and distorted fiscal choices leading to excessive government spending as a consequence of fiscal illusion. While plausible, the Mill hypothesis is empirically highly controversial. The reason is that it appears to be difficult, if not impossible, to test the Mill hypothesis with field data. As a consequence, the empirical literature on fiscal illusion failed to provide unambiguous evidence for the existence and relevance of fiscal illusion. There are two reasons for this failure. First, field studies are frequently beset with measurement problems, and a misperception is particularly difficult to measure. The second reason is more fundamental, and methodological in nature. There are three canonical principles in standard economics: rationality, self-interest and equilibrium. To clearly isolate fiscal illusion (which is a violation of the rationality assumption) one has to investigate an environment in which the other two

principles apply. In naturally occurring economies, however, one usually cannot establish beyond doubt whether these principles fully apply.

We claim that our experimental study meets the requirements to isolate the causes and consequences of fiscal illusion. To test for the existence of fiscal illusion, we elicit taxpayers' estimates of the tax burden and compare these perceptions to the actual tax burden. To test whether tax framing causes fiscal illusion, we implement two treatments which exclusively differ with respect to direct vs. indirect taxation. In particular, the two tax regimes are identical with respect to efficiency and rent distribution. Our main hypothesis is that the tax burden resulting from indirect taxation is cognitively more difficult to perceive than the one from direct taxation because indirect taxes are incorporated in market prices. To investigate the consequences of fiscal illusion, we observe whether a misperception of the net tax burden translates into redistribution.

Our results clearly show that fiscal illusion has powerful effects when voters are inexperienced. Redistribution is accepted in 90 percent of the referenda if it is financed by an intransparent tax while it is rejected in 90 percent of the referenda if it is transparently financed. However, voters eventually learn to overcome fiscal illusion to some extent. Fiscal illusion continues to distort expectations of twice experienced voters but ceases to induce excessive redistribution.

Our study for the first time provides unambiguous evidence supporting the Mill hypothesis of fiscal illusion. To be able to test the Mill hypothesis, we created a simple, highly stylized decision environment. Despite the clear results of our study, we believe that further research on the causes and consequences of fiscal illusion in more complex environments is needed.

With respect to the causes of fiscal illusion, we show that indirect taxation is cognitively intransparent because the tax is incorporated ("hidden") in the product price. However, the degree to which indirect taxes are cognitively intransparent in practice may depend on the particular "framing" of indirect taxes. For example, the tax payment is stated separately on receipts in some cases (e.g., VAT), but not in other cases (e.g., excise taxes). For a detailed discussion of this issue, see Slemrod and Krishna (2003), and McCaffery (1994) for a survey.

With respect to the consequences of fiscal illusion, our design was chosen to distinguish fiscal illusion from other explanations of distorted voting. For example, our design minimizes the possibility that a concern for a fair distribution affects voting decisions. However, fairness considerations are important in voting on redistribution (see Tyran and Sausgruber, 2002). These considerations may interact with fiscal illusion, and may exacerbate or mitigate its effects.

Our design forwards learning, and this may have biased results against long-run effects of fiscal illusion. Learning is facilitated because our experimental environment is simple and stable, and the information feedback we provide is rich and unambiguous. In contrast, natural environments are much more noisy, and it may be much more difficult to overcome fiscal illusion there. On the other hand, the long-run effects of fiscal illusion may depend on opportunities to communicate (see Frey and Bohnet, 1994) which were absent in our design but are present in the field.

This study investigated whether fiscal illusion translates into distorted fiscal choices by means of a (direct democratic) referendum. This is a natural choice since it is the simplest democratic mechanism, and it is in fact used in some places to determine fiscal choices (e.g., in Switzerland and some U.S. states, see Butler and Ranney, 1994). However, fiscal choices are frequently made indirectly (representative democracy). In a seminal paper, Pommerehne and Schneider (1978) have provided evidence that the type of democratic institutions may have important consequences for the pervasiveness of fiscal illusion. We believe that the interaction of institutions and cognitive limitations has important implications for taxation and the size of government. Therefore, this interaction deserves much more attention from economists than at present.

In our view, our results raise serious doubts about the rationality of fiscal choices involving indirect taxation. Since indirect taxation (in the guise of value-added taxes, energy taxes, social security contributions etc.) is widespread and of growing importance in modern democracies, our findings are of great potential importance. However, the discussion above reminds us to be cautious with simple extrapolation of such findings. In particular, the issue of under which (institutional) conditions voters are able to overcome fiscal illusion remains to be further explored. In terms of policy advice, our findings support the venerable presumption that a transparent tax structure advances the rationality of political decisions.

Notes

1. In contrast to economic incidence (which determines the tax burden), a misperception of the legal incidence is easy to measure. For example, Boeri et al. (2001: 23) ask respondents: “As you know, both employers and employees pay pension contributions. Which fraction of your gross monthly salary/wage goes to public pensions? (Please take into account also your employer contributions).” The authors find that in France 52 percent of respondents underestimate this fraction while only 4 percent overestimate the fraction. In Germany, 45 percent underestimate and 13 percent overestimate, and in Spain the respective figures are 68 and 5 percent.
2. Dollery and Worthington (1996) reconfirm this conclusion.

3. According to Atkinson and Stiglitz (1980: 427), this incidence-based distinction between direct and indirect taxes is the one that is most common in the public finance literature. However, criteria based on the method of administration of tax payments or on the possibility to adjust the tax payment to individual characteristics of the taxpayer are also used in the literature to distinguish between direct and indirect taxes.
4. See Smith et al. (1982) for a detailed description of the sealed bid/offer auction. We did not use the double auction (which is well-known for its capacity to generate competitive equilibria) because it is very difficult to simulate sellers in this auction.
5. Decision time was gradually reduced from 60 seconds (first market period) to 25 seconds (last market period).
6. A subject receives 30 points of additional earnings if the expected price does not deviate by more than 5 points from the actual price in the corresponding period. In addition, 30 points are paid if the expected quantity is equal to the actually traded quantity.
7. This finding is in line with Kachelmeier et al. (1994), Ruffle (2001), Borck et al. (2002), and Riedl and Tyran (2003) who show that the tax liability side equivalence holds in various experimental markets.
8. Subject *i*'s indication of the expected market price in a particular period $e_i p(t|j)$ is a perfect measure of the price subject i expects to pay since all subjects pay the same price for all transactions in each period (uniform price auction). Even though all subjects are symmetric by design, subjects may trade different quantities (in disequilibrium). The measure $(1/n)e_i q(t|j)$ therefore is an imperfect proxy for individual quantity expectations.
9. On the other hand, 28 percent of subjects correctly expected equilibrium prices of 125 to 130 to prevail in IT (55 percent in TT), given the proposal is accepted. This suggests that the instructions were clear and information was sufficient to correctly perceive the net tax burden.

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Appendix A: Instructions on the auction

General Instructions for Participants
((Original instructions were in German))

You are now taking part in an economics experiment. The purpose of the experiment is to analyze decision behavior in markets. You will be paid Euro 4 for showing up on time. If you carefully read the instructions and follow the rules you can earn additional money. This Euro 4 and all other money earned during the experiment will be paid to you in cash immediately after the experiment. In this experiment you earn points. These points will be exchanged for Euros according to the following exchange rate:

10 Points = 5 Cents (Euro 0.05)

During the experiment we ask that you do not speak to other participants. If you have a question, please ask us. We will gladly answer your questions individually. It is very important that you follow this rule. Otherwise the results of the experiment will be of no value from a scientific perspective.

The following is a short description of the experiment; detailed instructions will come later. You are now participating in a market experiment. In this market there are buyers and sellers who trade units of some commodity. You earn money by trading. How much you earn depends on your decisions and the decisions of others. The experiment consists of two practice periods and then a number of trading periods. In the practice periods you do not earn money but you should take these periods seriously since you will gain valuable experience for the paid trading periods.

Detailed Instructions for Buyers
In this experiment each participant is a buyer. You will buy units from automated sellers. These automated sellers will sell to you according to the rules of the market. There are several markets running at the same time during the experiment. What is happening on other markets is irrelevant for your market and hence for your earnings. In **your market** there are 4 buyers who can buy units from sellers in each of the trading periods.

What participants can do:
As a **buyer** you can submit 'bids' to buy from the sellers during a trading period. A *bid* is the maximum price that you are willing to pay for a unit. Each buyer will be assigned a certain number of 'unit values'. Each buyer can at most buy as many units as the number of unit values assigned. You can submit a bid for each unit for which you have a value.
In every trading period, the **sellers** submit 'offers' to sell units to the buyers. An *offer* is the minimum price at which a seller is willing to sell a unit. Each seller will be assigned a certain number of 'unit costs'. Each seller can at most sell as many units as the number of unit costs assigned.

How the market works:
At the end of each trading period the 'market quantity' and the 'market price' are

determined. The market quantity is the total number of units traded in the market. The market price is a uniform price at which all units are traded in the market.

How the **market quantity** is determined:
First, the *bids* you and other buyers in your market have submitted are collected and ranked *from high to low*. The highest bid is ranked above the 2nd highest bid. The 2nd highest bid is ranked above the 3rd highest bid, and so on. If two or more bids are the same, ranks will be randomly assigned by the computer.
Second, all the sellers' *offers* in your market are collected and ranked *from low to high*. The lowest offer is ranked above the 2nd lowest offer. The 2nd lowest offer is ranked above the 3rd lowest offer, and so on.
A first unit is traded if the 1st ranked bid is higher or equal to the 1st ranked offer. A second unit is traded if the 2nd ranked bid is higher or equal to the 2nd ranked offer. This process continues until bids are smaller than offers at a given rank. The total number of units that have been traded when the process stops is the 'market quantity'.
Example:
Assume we collect four bids and four offers in a market period.
The highest bid is 145, the 2nd highest bid is 130, the 3rd highest bid is 110, and the 4th highest bid is 90.
The lowest offer is 60, the 2nd lowest offer is 80, the 3rd lowest offer is 95, and the 4th lowest offer is 105.
A first unit is traded since the highest bid (145) is greater than the lowest offer (60).
A second unit is traded since the 2nd highest bid (130) is greater than the 2nd lowest offer (80).
A third unit is traded since the 3rd highest bid (110) is greater than the 3rd lowest offer (95).
The process stops after the third trade since the 4th highest bid (90) falls below the 4th lowest offer (105). Hence, the market quantity is equal to 3 units.

How the **market price** is determined:
The market price is set at the bid for the last unit that has been traded before the process stopped. All units are traded at that market price.
In the example above three units have been traded. The bid for the last unit that has been traded is 110. Hence the market price is set equal to 110. It is important to note that all units in the market are traded at this same price of 110.

How many units do you trade individually:
The number of units you buy is determined by the number of bids you have submitted *above* the market price. You do not buy the units for which you have submitted bids *below* the market price. You may or may not buy if your bid is exactly at the market price (your bid may randomly happen to be ranked below another bid at the market price so that the offer at that rank exceeds your bid). If you do not submit a bid on a unit (this is equivalent to submit a bid of 0), you never buy that unit.

The number of units the sellers sell is determined by the number of offers *at or below* the market price. The sellers do not sell the units they have offered above the market price.

How your profit is computed:
All participants can earn profits only if they buy units. Your profit as a **buyer** is computed as follows:

Profit = unit value *minus* market price

Note that if you buy a unit you will *pay less than* what you have bid for that unit unless your bid is at the market price. In our example, suppose that you submitted the bid of 130 for a unit you value at 150. This bid is above the market price of 110. Since you buy this unit at a market price of 110 your profit will be 150 – 110 = 40.
The profit of a **seller** is computed as follows:

Profit = market price *minus* unit cost

Hence, sellers *receive more than* they have offered for their sold units unless the offer is at the market price.

How the automated sellers make their offers:
At any time the sellers follow two rules in offering:

1. 'Submit an offer for each unit assigned'
   This means that the sellers will submit an offer for every unit they have been assigned a unit cost.
2. 'Submit offers equal to the cost of a unit'
   This means that an offer to sell a unit is always exactly equal to the unit cost. Since the sellers do not sell the units that they have offered above the market price, a seller never trades at a loss.

How is the trade presented on the computer screen?
In each trading period a Decision Screen appears (Figure 1). At the end of each period an Outcome Screen appears (Figure 2). After 15 trading periods a History of Results appears (Figure 3). *All the numbers in the figures in the instructions serve illustrative purposes only. Actual numbers may be different.*

In the uppermost area of the Decision Screen on the left side you see the number of the current trading period (here: 2) and the total amount of trading periods (here: 15). Each trading period ends after a predefined **time limit**. The remaining time within a period is seen in the uppermost area to the right (here: 19 Seconds). In the beginning of the experiment, the available time for trading is generous and will be continuously shortened afterwards.
The column in the middle shows your values and your current bids for the units. In this example the buyer has values for two units. Hence, this buyer can buy two units

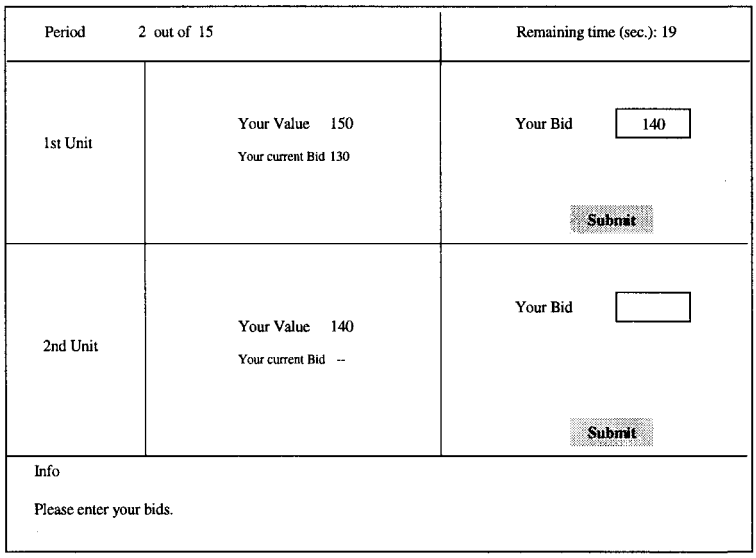

Figure 1. Decision screen

at most. For this buyer the first unit has a value of 150. The second unit has a value of 140. Right under your value of the unit you see your current bid for that unit.
The **input field on the right** serves to enter your bids. To enter a bid you click with the mouse on the field labeled 'Your Bid' and type in a number. To submit that bid you have to click on the 'Submit' button. In our example this buyer has already submitted a bid of 130 on his first unit. Consequently, this number is shown right below the value of the first unit. During the trading period the buyer can change his or her current bid on a unit. This buyer has already typed in a number to the input field of the 1st unit. Pressing 'Submit' will let appear a message box asking 'Do you want to replace your current bid?' Confirming by clicking 'Yes' will change your current bid.

Rules for bidding
There are three important rules that you have to follow in bidding:
1. 'Submit bids in the order of the units'
You have to bid in the order of units. If you have two units this means that you have to submit a bid on your 1st unit before you can submit a bid on your 2nd unit.
2. The 'Improvement-Rule':
A bid for a unit with a low value may not be above the current bid for a unit with a high value. If you have two units your bid on the 2nd unit may not be above your current bid on the 1st unit. In the example of Figure 1, the current bid on the first unit is 130. In this situation if the buyer wishes to bid on the 2nd unit his or her bid may not be higher than 130.
3. 'Trading at no Loss'

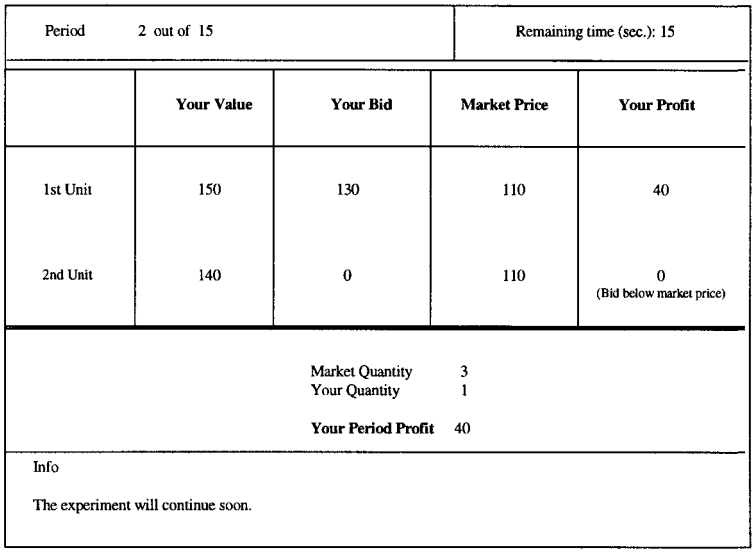

Figure 2. Outcome screen

You may not submit a bid above your unit value. In our example of Figure 1, the buyer's bid for the first unit must not be above 150. The bid for the 2nd unit must not be above 130.
If you violate any of these rules, a message box appears. You make this message disappear by pressing the 'OK' button. You can continue trading only after pressing the 'OK' button.
The Outcome Screen (Figure 2) appears at the end of the current trading period.

The uppermost area of this screen appears same as the Decision Screen.
In the table below, you find your value, your bid, the market price, and your per-unit profit from buying each unit. If you have not bought a unit the per-unit profit is 0.
The three **lines under the table** show the total number of units traded in the market (Market Quantity), the number of units that you have bought (Your Quantity), and the sum over your per-unit profits (Your Period Profit).

The **History of Results** (Figure 3) shows the results of a trading phase. A phase consists of 15 trading periods. The field to the top right displays your unit values. In the table under that you find the market price, the market quantity, your quantity, and, finally, your profit for each of the periods in the past trading phase. Actual numbers will replace the 'xx' in real trading. The example of Figures 1 and 2 is continued in Figure 3.
The row under the table shows **Your Total Profit** on all paid periods within this phase. Your Total Profit is computed as the sum of your period profits. The periods labeled as 'Trial' are not considered in the computation of the total profit.

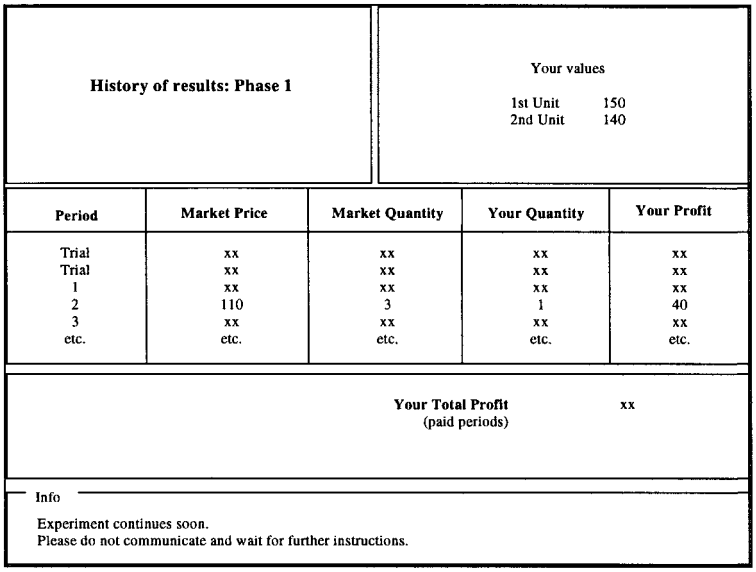

Figure 3. History of results

Information on unit values and unit costs for the 1st trading phase:
The following table lists the buyers' unit values and the sellers' unit costs in your market. **Important**: *These numbers are not hypothetical anymore*. These numbers are valid for the following 2 practice and 15 trading periods. Note that every buyer has the same value for two units each. The values and costs will be the same in each of the following 2 practice and 15 trading periods.

Buyer ID	Unit Values	Unit Costs
1	140	85
2	140	85
3	140	90
4	140	90
1	140	95
2	140	95
3	140	100
4	140	100
		105
		105
		110
		110

If you now have questions, please, raise your hand and wait until an experimenter will come by to answer your question individually.

Appendix B: Instructions on the Proposal

Below we reproduce instructions for the transparent treatment TT and in brackets [] for the intransparent treatment IT.

Proposal
You and 3 (three) other buyers will now vote on a project. If at least 2 buyers approve of the project (i.e., vote "yes"), it is accepted. Otherwise it is rejected. All participants will be immediately informed of the outcome of the voting. However, none of the other participants will be informed about your own decision.
If the project is **rejected,** we will continue **in exactly the same way** as before for another 15 trading periods. If the project is **accepted,** the conditions explained below will be used for the next 15 trading periods. At the end of the experiment, your profit in points will be paid out in US Dollars according to the exchange rate given in the instructions.

What the project is about:
This proposed project carries certain costs and benefits to you. Now, we will discuss in detail the costs and benefits for you. Under the rules of the proposed project, the **buyers [sellers]** will **pay a tax** on each unit that they buy [sell]. Additionally, you will **receive revenues** depending on the total number of units that are bought [sold] in the market. Here is how the tax and the revenues will be calculated under the terms of the proposed project:

- You, like all other buyers [The sellers], will **pay a tax** of 25 points on each unit that you buy [they sell].
- You, like all other buyers, will receive a revenue that depends on the *total number of units purchased [sold] (= market quantity).* In particular, the project generates a *total revenue* of twenty-five (25) times the number of units purchased [sold].

Your individual share of the revenue generated by the project is the *total revenue divided by* **six***:*
In sum, your individual revenue from the proposed project is:

$$\text{Your individual revenue} = \frac{\text{(market quantity X 25}}{6}$$

How to compute your profit if the project is accepted:
If the project is accepted, your profit will be your earnings in the market (your unit value minus the market price), **minus** the tax of 25 points, **plus** your revenue from the project [your profit will be your earnings in the market (your unit value minus the market price), **plus** your revenue from the project]. To calculate your earnings in the market, take your unit value and subtract the market price, just as in the previous 15 trading periods. From these earnings, you will also subtract a tax of 25 points for each unit you purchased. Finally, at the end of the period, you will add your

individual revenue from the project.
Therefore, if the project is **accepted**, your profit in any period is:
Your profit per period = unit value – market price **minus a tax of 25 points** per unit you buy **plus** your individual revenue from the project.

[Your profit per period = unit value – market price **plus** your individual revenue from the project.]
Remember: If the project is **rejected**, your profit is calculated just as before as follows: Your profit per period = unit value – market price
Note that whether the project is accepted or rejected, all unit values and unit costs will remain the same (see page 9 of instructions). Furthermore, all the rules that were explained to you previously continue to hold whether the project is approved or rejected.
For example, buyers [sellers] continue to trade at no loss.

Example: Suppose a buyer's unit value is 150. In the past, this buyer was not allowed to submit a bid above 150. If the project is accepted, this buyer will not be allowed to submit a bid above 125 because of the tax to finance the project.

REMEMBER: Under the rules of the proposed project, you pay a tax of 25 points FOR EACH UNIT THAT YOU BUY. You receive your individual revenue from the project ONLY ONCE PER PERIOD.

[*Example*: Suppose a seller's unit cost is 30. In the past, this seller has submitted an offer to sell this unit at 30. If the project is accepted, this seller will submit an offer of 55 because of the tax to finance the project.
REMEMBER: You receive your individual revenue from the project ONLY ONCE PER PERIOD.]

Appendix C: Control questions

(*These questions had to be answered before the ballot*)

Please answer the following questions now. Wrong answers do not have any consequences. If you have questions, please, raise your hand.

Suppose the proposal will be approved of. Suppose, in addition, there will be 8 units traded (Market Quantity = 8).
What is the total revenue from the tax in this case?
What is your individual revenue from the project in this case?

Suppose you buy two units in a period (Your Quantity = 2)
What is the amount of taxes that you pay in this case?
[Suppose a seller sells two units in a period.
What is the amount if taxes that this seller pays in this case?]