Rewarding the consumer for curbing the evasion of commodity taxes?*

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Abstract

Monetary or in-kind transfers can be used as an incentive for consumers to request official receipts for goods they purchase. A novel system of in-kind transfers in the form of lottery tickets has recently been introduced in China. Price subsidies (often granted through tax deductions or refunds) are also widely used. This paper extends the standard model of tax evasion for firms in a competitive market in order to describe the effects of subsidies on tax evasion and in terms of incidence and of government revenue. The role of search costs and of enforcement costs is also taken into account.

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1 Introduction

In China, a novel system for fighting sales tax evasion has recently been introduced[1]. To encourage customers to request official receipts as proof of payment in the service and retail commerce sectors, local tax authorities in many provinces have introduced a new type of receipt that doubles as a lottery ticket. To prevent forging of receipts, businesses must purchase special, patented machines for printing them. Records of the printed receipts are automatically transmitted to the tax authorities and are used to calculate the taxes payable on sales. The receipts can be used as scratch cards to win small amounts of cash, but they also serve as lottery tickets for winning larger amounts.

In the Chinese experiment, lottery receipts act as an in-kind subsidy, offering incentives to consumers who request legal transactions. The Chinese experiment is thus an example of an approach that relies on rewarding consumers to foster compliance in the field of commodity taxation. Monetary subsidies are also often granted in developed countries for a variety of purposes, not least of which is fighting tax evasion[2]. Subsidies are often introduced by allowing a fixed percent of expenses for specific items to be deducted from the income tax.

This paper examines the pros and cons of the consumption-subsidy approach by studying the effects of subsidies on tax evasion and examining their implications in terms of incidence and of government revenue. After a brief overview of the standard firm tax evasion model in Section 2, the role of monetary subsidies is discussed in Section 3. In Section 4, in-kind subsidies are analyzed. Empirical evidence concerning the working of subsidies is reported in Section 5, and Section 6 concludes.

2 The basic tax evasion model

Following Cremer and Gahvari [3], Etro [6] and Cowell [2], consider a firm in a competitive market. Production occurs at constant returns to scale and m is the marginal and average cost. There are many identical firms: let us call x the individual firm's output and X the industry output. The product is sold at a consumer price P. There is an *ad valorem* tax at the (tax inclusive) rate $t < 1$.

The firm can cheat the government at a total cost given by $g(\beta) Px$, where β is the share of sales concealed and $g(\beta)$ is a strictly increasing convex function, with $g(0) = 0$. The concealment cost per unit of revenue $g(\beta)$ may increase as firms seek to evade taxes by attempting to hide or camouflage their activity,

[1] For a description of this system and an evaluation of its effects see Wan [12].

[2] In Italy, for example,, expenditures for home improvements are partially deductible from the income tax. The main purpose of this provision is that of increasing the tax compliance of firms in the housing sector. New regulations have also been introduced with the specific aim of cracking down on moonlighting. According to the 2007 financial law, those who claim the home improvement deduction must supply an invoice from the building contractor, including specification of the expenditure for labor input.

leading to increasing inefficiency and waste[3].

Audits occur with a given probability p and perfectly reveal any cheating. Evasion is punished with a sanction which is a multiple $s > 0$ of the evaded tax. The firm aims at maximizing its expected profit, given by:

$$\{P\left[1 - t\left[1 - \beta\left(1 - p\left(1 + s\right)\right)\right] - g\left(\beta\right)\right] - m\}\, x = \{P\left[1 - t^e - g\left(\beta\right)\right] - m\}\, x \tag{1}$$

where t^e represents the expected tax rate. As in the standard economics of tax evasion, agents are assumed to be amoral. Let us also assume that $[1 - p\left(1 + s\right)] > 0$ holds, that is, the expected return on tax evasion is positive, while parameter values are also such that full evasion never occurs, resulting in an interior solution with reference to the share of sales concealed. From the F.O.C. with respect to β, one gets:

$$\frac{\partial g\left(\beta\right)}{\partial \beta} = t\left[1 - p\left(1 + s\right)\right] \tag{2}$$

that is, the marginal cost of concealment $\frac{\partial g(\beta)}{\partial \beta}$ must equal the expected marginal benefit $t\left[1 - p\left(1 + s\right)\right]$ when β is optimally chosen. The decision about tax evasion is thus separable in this model from that concerning output[4].

The equilibrium price P can be calculated by considering that expected profits are zero in a competitive market equilibrium. Thus, by setting:

$$\{P\left[1 - t^e - g\left(\beta\right)\right] - m\}\, x = 0$$

one gets:

$$P = \frac{m}{1 - t^e - g(\beta)} \tag{3}$$

where the optimal β value is considered in the denominator. The wedge between the consumer price P and the marginal cost grows as the expected tax rate and the unit concealment cost increase.

3 Monetary Subsidies

Assume now that in a competitive market with tax evasion the tax administration decides to grant consumers a proportional subsidy rtP_p each time a legal transaction takes place, where $r < 1$ and P_p is the producer price. For legal transactions, the subsidy introduces a wedge between the producer price P_p and the consumer price $P_c = P_p(1 - rt)$. This policy aims at rewarding consumers

[3] One can also describe the total cost of evasion as:

$$f\left(\beta\right)\beta P x$$

where $f(\beta)$ is the cost per unit of sales concealed and is strictly increasing in β. This formulation reduces to the one used in the text as long as $g(\beta) = f\left(\beta\right)\beta$. On this topic, also see Virmani [11] and Cowell [2].

[4] On separability in this case, also see Sandmo [10] and Cowell [2].

who "police" transactions, and can be considered as a substitute for other interventions having the same aim, such as increasing the probability of monitoring, increasing sanctions or punishing consumers who accept illegal transactions. One potential advantage of the subsidy-based approach is that it can help overcome asymmetries of information, since consumers are directly involved in each transaction while auditors are not. In fact, the proponents of this approach seek to extend and complete the chain of conflicting interests characteristic of VAT. While sanctions for consumers might be able to perform a similar role, subsidies are politically more viable: we therefore assume that subsidies are introduced, while no sanction is foreseen for consumers who participate in illegal transactions.

For a first appraisal of this approach, let us introduce some assumptions that are in a sense biased in favor of it, postponing more general discussion to later in the paper. It is thus assumed that:

i) The choice of making a legal transaction inflicts no cost on the consumer, as, e.g., there are no enforcement costs, such as the psychological or transaction costs of asking for the intervention of a policemen whenever the receipt is denied. This assumption will be relaxed in Section 3.3.

ii) At a cost, the tax administration can fully detect and disregard illegitimate claims with certainty, paying subsidies only when they are actually due[5].

Since under these assumptions all consumers can freely choose to engage in legal transactions, firms resorting to illegal transactions are forced into offering the consumer at least an equivalent deal, i.e. they must be ready to receive only $P_p(1-rt)$ per unit of x in order to ensure indifference with respect to legal transactions. Let us consider the firm's expected profit in this case:

$$\left\{P_p\left[1-t\left[1-\beta\left(1-r-p\left(1+s\right)\right)\right]-g\left(\beta\right)\right]-m\right\}x= \tag{4}$$

$$\left\{P_p\left[1-t^E-g\left(\beta\right)\right]-m\right\}x \tag{5}$$

where $t^E = t - t\beta\left(1-r-p\left(1+s\right)\right)$.

Proposition 1 *Monetary transfers to consumers who resort to legal transactions reduce tax evasion.*

Proof. *Considering an interior solution, the F.O.C. for profit maximization in (4) with respect to β implies that:*

$$\frac{\partial g\left(\beta\right)}{\partial \beta} = \left[1-r-p\left(1+s\right)\right]t \tag{6}$$

where the expected rate of return on tax evasion $\left[1-r-p\left(1+s\right)\right]$ is positive. By differentiating both sides of (6) with respect to r one gets:

$$\frac{\partial^2 g\left(\beta\right)}{\partial \beta^2}\frac{\partial \beta}{\partial r} = -t < 0 \tag{7}$$

[5] The topic will be more thoroughly discussed in Section 5.

i.e., since $\frac{\partial^2 g(\beta)}{\partial \beta^2} > 0$ *by assumption (strictly increasing concealment costs),* r *has a negative impact upon the share of concealed sales* β*. Moreover, by setting* r *at a value that satisfies:*

$$1 - r - p(1+s) = 0$$

tax evasion can be eliminated altogether. ■

While the classical theoretical prescription for eliminating tax evasion is to introduce large enough sanctions, the many potential problems caused by this approach in practice are widely known[6]. Hence, subsidies to consumers may provide a better alternative. Subsidies, in fact, work as sanctions applied with certainty to firms resorting to tax evasion, since the consumers involved must receive compensation. One must bear in mind, however, that such rewards, unlike sanctions, are paid to the consumer and not to the tax administration: government revenue is thus affected. This problem is considered in detail in Section 3.2.

One interesting implication of the simple model considered is that its results can easily be extended to non competitive markets by resorting to the conjectural variations approach[7]. This is due to the separability property of the firm's tax evasion model[8], which carries over to the case in which monetary transfers are introduced.

3.1 The incidence of monetary subsidies

Let us now consider the equilibrium producer price of legal transactions P_p, which can be calculated by setting the expected profits (4) to zero:

$$P_p = \frac{m}{1 - t - g(\beta) + t\beta(1 - r - p(1+s))} = \frac{m}{1 - t^E - g(\beta)} \tag{8}$$

Let us differentiate (8) with respect[9] to r:

$$\begin{aligned} \frac{\partial P_p}{\partial r} &= \frac{mt\beta}{[1 - t^E - g(\beta)]^2} \\ &= P_p \frac{t\beta}{1 - t^E - g(\beta)} \end{aligned} \tag{9}$$

The derivative has a positive sign. The producer price increase thus implies that consumers never fully benefit from the subsidy, that is, the subsidy is at least partially shifted backward to suppliers. One may wonder whether there

[6] See, e.g., Marchese [8].

[7] This topic is addressed in details in Marchese [9].

[8] See Cowell [2] and the references quoted therein.

[9] While β depends on r, since we are considering the maximum value function and the optimal value β, the envelope theorem states that only the partial derivative with respect to parameter r must be considered.

might be backward overshifting, which would imply a consumer price increase, i.e., $\frac{\partial P_c}{\partial r} > 0$. The consumer price is given by:

$$P_c = \frac{m\left(1-rt\right)}{1-t-g\left(\beta\right)+t\beta\left(1-r-p\left(1+s\right)\right)} = \frac{m\left(1-rt\right)}{1-t^E-g\left(\beta\right)}$$

Let us calculate:

$$\begin{aligned}\frac{\partial P_c}{\partial r} &= \frac{mt\left[\beta\left(1-rt\right)-\left(1-t^E-g\left(\beta\right)\right)\right]}{\left[1-t^E-g\left(\beta\right)\right]^2} \\ &= \frac{m\left(1-rt\right)t\left[\beta-\frac{1-t^E-g(\beta)}{1-rt}\right]}{\left[1-t^E-g\left(\beta\right)\right]^2} \\ &= P_c t\left(\frac{\beta}{1-t^E-g\left(\beta\right)}-\frac{1}{1-rt}\right) \end{aligned} \tag{10}$$

Thus overshifting occurs if the term in parentheses in (10) is positive. Considering the limits within these parentheses immediately establishes the following:

Lemma 1 *$\beta \to 1$ implies that $\frac{\beta}{[1-t^E-g(\beta)]} \to \frac{1}{1-g(1)-tp(1+s)-rt} > \frac{1}{1-rt}$*

Lemma 1 says that very large levels of tax evasion favor the occurrence of overshifting. The intuition for this result is that the firm must collect extra revenue in order to be able to adjust the reward for illegal transactions when the subsidy increases. This extra revenue exceeds the increase of the reward, since it must also cover the expected tax and the concealment cost per unit of revenue. When tax evasion is widespread, this effect involves virtually all transactions. While the subsidy increase also negatively affects tax evasion, as shown by (7), this is only a second order effect.

3.2 Net tax revenue

With reference to the standard firm's tax evasion model, let us consider the tax revenue net of the cost for running audits $c(p)$, which is assumed to be increasing in the probability of audit:

$$t\left[\left(1-\beta\right)+p\beta\left(1+s\right)\right]PX(P)-c(p) \tag{11}$$

When the subsidy is introduced, further costs arise in order to prevent illegitimate requests for subsidies. Since retail sales are considered, the number of transactions is likely to depend on the amount of output. As each transaction can potentially give rise to a false receipt, we assume that costs borne by the tax administration to avoid fakes $h\left(X\left(P_c\right)\right)$ are increasing in output. When the subsidy is granted, the net revenue can then be written as:

$$t\left[\left(1-r\right)\left(1-\beta\right)+p\beta\left(1+s\right)\right]P_p X(P_c)-c(p)-h\left(X\left(P_c\right)\right). \tag{12}$$

Let us call $f(r) = t\left[\left(1-r\right)\left(1-\beta\right)+p\beta\left(1+s\right)\right]$ the actual marginal revenue rate.

Lemma 2 *Tax revenue is increasing in the monetary subsidy if: i) $\beta \to 1$ and ii) the market demand is anelastic.*

Proof. By differentiating the revenue (12) with respect to r, one gets:

$$f(r)P_p\frac{\partial X}{\partial P_c}\frac{\partial P_c}{\partial r}+f(r)X\left(P_c\right)\frac{\partial P_p}{\partial r}+P_pX(P_c)\frac{\partial f(r)}{\partial r}-\frac{\partial h\left(X\left(P_c\right)\right)}{\partial X}\frac{\partial X}{\partial P_c}\frac{\partial P_c}{\partial r} \quad (13)$$

where $\frac{\partial f(r)}{\partial r}$ is given by:

$$\frac{\partial f(r)}{\partial r}=-t\left[1-\beta\right]-t\left[1-r-p\left(1+s\right)\right]\frac{\partial \beta}{\partial r} \quad (14)$$

The first and the last term in (13) are equal to zero since $\frac{\partial X}{\partial P_c}=0$ by assumption. The second term is positive, as the producer price is increasing in the subsidy. The third term might be either positive or negative. More specifically, the sign of (14) depends on two components. Namely, a loss of revenue from legal transactions, which now also involve some outlay by the government in order to pay for the subsidy r; and a gain due to the reduction of the concealment rate β. However, if $\beta \to 1$ the first term $\to 0$ and thus $\frac{\partial f(r)}{\partial r}>0$. ■

Hence, if monetary transfers boost tax revenue enough, (12) might surpass (11).

Of course there are many other cases not taken into account by Lemma 2 in which the subsidy policy might be beneficial. Consider, e.g., a case in which, while $\beta << 1$, the reduction in tax evasion nevertheless entails benefits large enough to overcome the costs of the policy. Positive results could be achieved even if the consumer price increase entails an output contraction. Generally speaking, at any rate, the subsidy policy is more likely to be beneficial if tax evasion is widespread (as this reduces the amount paid out to reward legal transactions), if the subsidy exerts an expansionary effect on the market[10], if the reduction of tax evasion prompted by the policy is large and if the administrative costs $h\left(X\left(P_c\right)\right)$ are low.

3.3 Search costs

In order to develop a more realistic scenario, let us drop the assumption that consumers can always opt for legal transactions without incurring any costs. A more realistic assumption is that consumers geared towards forcing legal transactions must bear the psychological and time costs of prompting a control. In high evasion countries or in economic sectors plagued by tax evasion, these costs might be heavy. The subsidy approach can, however, be effective in fighting tax evasion even if enforcement costs are prohibitive, i.e., larger than the subsidy, as long as there are some legal transactions available in the market. In other words, consumers who have the option of searching for a vendor willing to trade legally create a threat for those willing to engage in illegal transactions. In the

[10] There is, however, a trade-off between this and the former effect according to Lemma 1.

following, the focus is thus on the case in which the (only) option available to a consumer who is not satisfied with the offer made is that of searching for another vendor. The search problem pertains strictly to the subsidy, while the market for the good remains unaffected.

Some additional assumptions, often introduced in search models, are needed in order to proceed:

- each consumer buys just one unit of the good;

- there is a continuum of consumers ordered according to their (decreasing) willingness to pay, so that the market demand is downward sloping;

- the market for the good is fully competitive, as the price P_p, is publicly disclosed, e.g., on the internet, while the first visit to a firm is free;

- Consumers, however, bear costs $\gamma P_p < rtP_p$ for visiting further firms. These costs are described as increasing in P_p as a higher market price involves a smaller equilibrium output, and thus the costs of finding another vendor are likely to be higher;

- both consumers and firms behave according to the Nash conjecture.

Consumers therefore take as given the prevalence of tax evasion in the market: this value will be denoted as $\overline{\beta}$. Since each consumer expects to receive in a further visit a proposal for a legal transaction (implying the subsidy rate r) with probability $\left(1-\overline{\beta}\right)$, the reservation compensation rate r^* for accepting a deal must assume a value such that:

$$-\gamma P_p + tP_p\left(r-r^*\right)\left(1-\overline{\beta}\right) = 0\ .$$

where γP_p is the additional cost and $tP_p\left[r-r^*\right]\left(1-\overline{\beta}\right)$ the expected additional benefit of a further search[11]. Hence the reservation compensation rate is:

$$r^* = r - \frac{\gamma}{t\left(1-\overline{\beta}\right)} \text{ if } r > \frac{\gamma}{t\left(1-\overline{\beta}\right)} \tag{15}$$

The agent might, however, be discouraged form searching, i.e.,

$$r^* = 0 \qquad \text{if } r \leq \frac{\gamma}{t\left(1-\overline{\beta}\right)} \tag{16}$$

Note that when $r^* > 0$ the reservation rate r^* is decreasing in $\overline{\beta}$.

Firms, too, behave in a Nash fashion, i.e., they take as given the reservation rate $\overline{r^*}$ currently requested for illegal transactions.

Proposition 2 *Search costs reduce the effectiveness of monetary transfers in fighting tax evasion. Subsidies lose any disciplining effect upon tax evasion if search costs are so high that consumers are discouraged from searching and decide to accept illegal transactions without requesting any compensation.*

[11] The consumer can also conduct a further search with the same firm later on: in this case it is assumed that she must visit it anew, incurring the same search cost as with every other firm. As each firm is a partial evader, for the sake of simplicity it is assumed that each one randomly allocates its proposals for legal or illegal transactions.

Proof. The expected profit for the firm in this case is:

$$\left\{P_p\left[1-t\left[1-\beta\left(1-\overline{r^*}-p\left(1+s\right)\right)\right]-g\left(\beta\right)\right]-m\right\}x \tag{17}$$

The F.O.C. for the maximization of (17) with respect to β implies that:

$$\frac{\partial g\left(\beta\right)}{\partial \beta}=\left[1-\overline{r^*}-p\left(1+s\right)\right]t \tag{18}$$

In equilibrium $\overline{\beta}=\beta$ and $\overline{r^*}=r^*$ must hold. When there are search costs and (15) holds, $0<r^*<r$, and hence the tax evasion share in equilibrium must be larger than that implied by (6). For $r^*=0$ the F.O.C. for profit maximization is (2) and subsidies have no impact on tax evasion. ■

Note that the effects of search costs might imply that the transfer policy has a negative impact upon tax revenue; if the effects in terms of reduction of tax evasion are negligible, the main implication of the policy is likely to be the outlay of resources in order to finance transfers for legal transactions. Only the expansionary effects of the policy on the economy output might mitigate these consequences upon tax revenue.

To further assess the role of search costs, note that in equilibrium, if $0<r^*<r$, the F.O.C. (18) can be rewritten as:

$$\left[1-r-p\left(1+s\right)\right]t+\frac{\gamma}{\left(1-\beta\right)}-\frac{\partial g\left(\beta\right)}{\partial \beta}=0 \tag{19}$$

This condition implies that multiple equilibria are possible, such that more than one level of tax evasion share β might be viable[12] (see Figure 1). This effect is due to network externalities: whenever a firm decides to evade, it originates a positive externality for the whole set of suppliers, as the search costs for the customers increase and the compensation requested for accepting an illegal transaction falls. As typically happens in these cases, once a critical mass of tax evasion is reached, it can jump to much larger values. Hence for a given γ value there might be a small share of tax evasion β with low values of both the opportunity cost of search and concealment costs, or a large β value with the opposite implications. The Nash conjecture implies, however, that firms are not able to internalize the network effects.

[Figure 1 about here]

A second possible scenario is that where the enforcement costs ζ per unit of expenditure, which for the sake of simplicity are assumed to be constant and equal to marginal costs, are not prohibitive, as they are lower than rt. In this case enforcement costs would become relevant at the evasion level β for which $\frac{\gamma}{(1-\beta)}\geq\zeta$. Above this threshold, consumers stop searching and report to tax auditors. The compensation to those who enter an illegal transaction per unit of expenditure would thus become $rt-\zeta$.

[12] The following values of the parameters have been used to draw Figure 1: $t=0.4$, $r=0.9$, $s=0.8$, $p=0.01$, while $g\left(\beta\right)=0.2\beta^2$. Of course one can also construct examples in which there is just one equilibrium β value: consider, e.g., a case in which $\frac{\partial g(\beta)}{\partial \beta}=\frac{2\gamma}{(1-\beta)}$.

4 In-kind transfers

Let us now consider the case in which the government decides to encourage legal transactions by introducing an in-kind transfer rather than a monetary subsidy. Hence we consider 2 goods denoted by the pedix $i = 1, 2$, where $i = 1$ refers to the good sold in the market and already considered in former sections, while $i = 2$ refers to the good transferred by the government. Those who participate in legal transactions receive $x_2 = tP_p x_1$ as an in-kind transfer.

To discuss the implications of this approach, let us resort to some simplifying assumptions, some of which have already been considered in previous sections:

- consumers can opt for legal transactions without bearing any cost[13];
- consumers cannot buy or sell[14] good 2, but can only receive it as a reward for opting for a legal transaction;
- each consumer buys just one unit of good 1 and the quantity of the in-kind transfer $x_2 = tP_p$ to which she is entitled is small, so that each consumer's demand price for good 2 (equal to the unit compensation requested c_h) is constant;
- the distribution of c_h is uniform and lies on the interval $[0, 1]$;
- good 2 is produced by the government at a constant marginal cost $\delta < 1$;
- consumers and producers behave according to the Nash conjecture.

Hence each firm chooses its evasion share β in a fashion analogous to that previously described, i.e., according to the F.O.C.:

$$\frac{\partial g(\beta)}{\partial \beta} = \left[1 - \overline{c_h^*} - p(1+s)\right] t \tag{20}$$

where $\overline{c_h^*}$ represents the unit compensation requested in the market.

Proposition 3 *If in-kind transfers are introduced and there are no search costs, ceteris paribus the tax evasion share β is smaller than in the absence of transfers of any type. In-kind transfers outperform money subsidies in fighting tax evasion whenever consumers are rationed in the transferred good.*

Proof. With in-kind transfers, in equilibrium, the compensation paid for illegal transactions must be equal to the marginal demanded compensation. Under the assumption that the requested compensation is uniformly distributed over the unit interval, β represents both $\Pr(0 \leq c_h \leq \beta)$ and the marginal demanded compensation. Hence:

$$\overline{c_h^*} = c_h^* = \beta \tag{21}$$

Thus condition (20) in equilibrium becomes:

$$\frac{\partial g(\beta)}{\partial \beta} + \beta t = [1 - p(1+s)] t \tag{22}$$

[13] That is, the analysis parallels that of Section 3 for monetary subsidies, ignoring enforcement or search problems. For the case in which this assumption is relaxed see the Appendix.

[14] Because no market exists, due to factors such as prohibitive transaction costs, legal barriers to entry, etc. This assumption is chosen so as to pave the way to considering the case of lotteries, where tickets are distributed exclusively as an in-kind transfer and cannot be resold.

which implies a smaller tax evasion share than when condition (2) applies. This proves the first statement. With reference to the comparison with money transfers, let us consider introducing a monetary transfer at the rate $r^{\S} = \beta$, where β is the value that solves (22). Hence we consider a case in which a monetary transfer determines the same equilibrium share of tax evasion as an in-kind one. The unit cost of the monetary transfer would be $r^{\S} = \beta$. If instead $\delta < c_h^* = \beta$, the resort to the in-kind transfer is more cost effective. ■

Condition (21) implies that the larger the share of illegal transactions β, the larger is the compensation demanded by the marginal consumer. If the share of tax evasion is small, firms might conduct illegal transactions with agents whose evaluation of good 2 is low; instead, when there is a larger share of tax evasion, even agents with larger demand prices for good 2 must be involved. When the equilibrium compensation for those who give up good 2 and accept an illegal transaction is larger than δ, i.e., larger than the marginal production cost of good 2, in-kind transfers outperform the monetary ones, as they involve the exploitation of some consumer surplus for good 2.

Note also that in this scenario each firm's decision to evade taxes gives rise to a kind of negative externality for the group of suppliers as a whole, as it increases the compensation that must be paid to all consumers who participate in illegal transactions. The disciplining effect of the increase in compensation operating in this framework is thus reinforced by the fact that firms are unable to internalize the negative externality.

With in-kind transfers the zero-profit condition in equilibrium becomes:

$$\{P_p [1 - t [1 - \beta (1 - c_h^* - p (1 + s))] - g (\beta)] - m\} x = 0 \tag{23}$$

By substituting (21) into (23) and solving for P_p one gets:

$$P_p = \frac{m}{1 - t - g (\beta) + t\beta(1 - p (1 + s)) - t\beta^2} \tag{24}$$

In this framework, the larger the share of tax evasion β, the larger[15] is P_p. This effect is explained by the increasing compensation required by agents who participate in illegal transactions when tax evasion increases. It also represents a sort of self-adjusting mechanism that pushes the tax base upward when tax evasion increases; this does not happen with monetary transfers.

In-kind subsidies thus allow the tax administration to exploit some market power. When good 2 is rationed, however, there is also an efficiency loss. But if good 2 entails negative externalities, as in the example of lottery tickets, one

[15] This can be established by differentiating (24) with respect to β. The derivative is:

$$\frac{\partial P_p}{\partial \beta} = \frac{-m \left\{ \left[t (1 - p - ps - \beta) - \frac{\partial g(\beta)}{\partial \beta} \right] - \beta \right\}}{[1 - t - g (\beta) + t\beta(1 - p (1 + s)) - t\beta^2]^2}.$$

The term in squared brakets in the numerator is 0 as each firm maximizes its profit according to condition (20), and this also holds in equilibrium. Thus the term in curly brackets is negative, so both the numerator and the denominator are positive.

may deem the social marginal cost of good 2 to be larger than the private one, thus offering some justification for rationing.

As with monetary transfers, the case for in-kind transfers is weakened when there are search costs. This is shown in the Appendix.

5 Empirical evidence about refunds and in-kind rewards

To fight VAT tax evasion, some developing countries have introduced a refund system for consumers who exhibit receipts.

Berhan and Jenkins [4] study the working of this system in Northern Cyprus and in Bolivia. In Northern Cyprus the scheme has been in use since 1996. The refund was 5% of the taxable purchases until 2000 and 2.5% thereafter, while the standard VAT rate is 13%. Purchases claimed must not surpass a threshold (the monthly salary for employees). Employers collect the receipts for their employees and claim the refunds on their behalf.

In Bolivia, since 1986 there has been a withholding tax on wages, salaries and pensions, introduced with the aim of reinforcing the working of VAT. Consumers deduct the VAT paid on purchases of goods and services, and thus the withholding tax has zero expected net revenue.

Berhan and Jenkins [4] find that these systems are burdened with very large administration and compliance costs, both in comparison with the VAT proceeds and with the corresponding costs of other taxes in the two countries. The process of collecting and verifying claims is extremely time consuming, and the net benefits for taxpayers are low. Moreover, the method is vulnerable to illicit practices. In Northern Cyprus this mainly consists in the collection of receipts issued to foreigners, students, etc., who cannot claim their own refunds. In Bolivia, instead, there is a black market where false receipts are also sold, at a price around 1% of their face value. The Bolivian system seems to work badly overall, yet abolishing it would damage some groups and therefore does not seem politically viable. Past attempts at reforms aimed at cancelling the refunds, and thus at transforming the withholding tax into a revenue producing tax (while giving up potential benefits on VAT), have resulted in riots.

Overall, it thus seems that a very important factor that hampered the working of rewards to consumers in developing countries is the cost associated to illegitimate claims. From this point of view, the approach based on in-kind transfers, and specifically on lottery tickets, represents a clear cut potential improvement, since only the receipts of lottery winners must be checked

The Chinese tax lottery experiment began in 1998, and has gradually been extended to include about 8% of districts or cities. It has also grown to include not only restaurants, beauty salons and real estate agencies but a number of other services and retail stores as well. The experiment has been widely reported on by the Chinese media. According to Wan [12] and to the sources quoted

therein, it has had a positive impact upon business tax[16] revenue and upon the growth of total tax revenue.

The use of lottery tickets in the battle against tax evasion has also been tried out previously elsewhere in Asia and in Latin America[17]. Lotteries are also often used in the private sector as a marketing device. For example, banks in Latin America offer lottery-linked deposit accounts. Those who keep an account for a given period are entered into lotteries for small and large prizes. According to Gillén and Tschoegl [7] these accounts are a cheaper source of funds for banks than other accounts. Lotteries are particularly appealing for low income agents, and behave as inferior goods.

With reference to the resort to rewards to consumers in developed countries, the Italian experience of tax deductions for home improvement expenditures is mixed. The bulk of claims for the subsidy come[18] from the northern part of the country, which is also commonly considered as less prone to tax evasion. While there are some cases of illegitimate claims under investigation, there is no black market for receipts; fraud seems to arise mainly through doctored receipts furnished by firms to unsuspecting consumers. While econometric studies of this experience are not available, raw data show an increase in reported income and in the number of firms and official workers in the sector. However, taxable income in the sector is still growing at a smaller rate than gross income as measured by national accounts. The tax administration is nonetheless still keen on maintaining this policy, although some modifications have been introduced in order to foster its role in discouraging moonlighting. Reading this experience through the lens provided by the theoretical part of this paper, one notes that search costs were disproportionate in areas where tax evasion was widespread, while some beneficial results were reached under more favorable starting conditions.

6 Conclusions

Reliance on money or in-kind subsidies as an incentive for consumers to demand compliance with sales taxes rests on the idea that consumers have an informative advantage over tax auditors, since they are necessarily in frequent contact with suppliers. One must also factor in, however, the costs and the many possible undesired effects stemming from this approach. When the system works smoothly, it is likely to give rise to some kind of "revenge by the market" through the increase of gross or even net prices.

Consumer reaction also plays an important role. If consumers bear no cost from opting for a legal transaction, they can credibly force the issuing of receipts, and the impact of subsidies is thus likely to be significant. Tax evasion becomes less profitable and declines. If, instead, consumers bear the brunt of costs for reporting violations to the authorities, subsidies might induce them

[16] This is a turnover tax paid on gross receipts.
[17] For a critical evaluation, see Bird [1].
[18] See [5]. Data refer to the period 1998-2006.

to search for vendors willing to participate in legal transactions. However, as searching is also costly, the opportunity value of the subsidy decreases. Hence, the aforementioned effects of subsidies on tax evasion and prices are diluted and, at the limit, disappear. Multiple equilibria may arise.

The resort to in-kind transfers seems to have one main advantage over monetary transfers. This is because at least some consumers are likely to have a large demand price for the good chosen for the in-kind transfer - even larger than its marginal cost. Thus, each firm's decision to evade entails a negative externality, as it contributes to depletion of the pool of agents not so interested in the good and who are willing to accept an illegal deal for low compensation. On the other hand, the advantages of the in-kind approach stem from the existence of a market power that the tax administration can exploit, which in general involves an efficiency loss.

Concerning the type of good offered, the recent experiment with lottery receipts in China seems promising. The market for gambling is routinely regulated all over the world, since gambling produces negative externalities. The rationing of consumption that might characterize also this specific lottery is thus a minor concern. A further advantage over monetary transfers is the savings in monitoring costs: only the receipts of lottery winners must be collected and checked[19], whereas systems based on refunds usually involve huge costs just for handling a large number of receipts. From the point of view of equity, so long as lotteries are inferior goods, they should give rise to transfers that have a larger value for the poor who receive them. On the other hand, one of the drawbacks to the lottery scheme is the possible substitution effect upon the demand for other forms of gambling supplied by the government.

A more general caveat relating to both monetary and in-kind transfers concerns to the potential for crowding-out effects in the realm of intrinsic (moral) motivations for paying taxes and obeying fiscal laws. This is a matter for concern, since, in a certain sense, compliance becomes conditional on some form of compensation.

A Appendix

If there are search costs that amount to γP_p, the reservation compensation $\widetilde{c_h}$ for an agent whose valuation of good 2 is c_h must have a value such that:

$$-\gamma P_p + tP_p\left(c_h - \widetilde{c_h}\right)\left(1-\overline{\beta}\right) = 0$$

where $\overline{\beta}$ is the share of tax evasion in the market as taken as given by the consumer. Hence:

$$\widetilde{c_h} = c_h - \frac{\gamma}{t\left(1-\overline{\beta}\right)} \text{ if } c_h > \frac{\gamma}{t\left(1-\overline{\beta}\right)}$$

The agent might, however, be discouraged from searching, i.e.,

[19] On this topic, see also [4].

$$\widetilde{c_h} = 0 \qquad \text{if } c_h \leq \frac{\gamma}{t\left(1-\overline{\beta}\right)}$$

In equilibrium, there must be a threshold compensation $\widetilde{c_h}^*$ that separates those who accept the compensation from those who refuse it. Let us assume, as in the main text of this paper, that c_h is uniformly distributed on the unit interval $[0,1]$. Thus, the compensation rate net of search costs

$$c_h - \frac{\gamma}{t\left(1-\overline{\beta}\right)}$$

is distributed on the shifted unit interval $\left[-\frac{\gamma}{t\left(1-\overline{\beta}\right)}, 1-\frac{\gamma}{t\left(1-\overline{\beta}\right)}\right]$. Then, applying the same reasoning as in paragraph 3.3, the threshold compensation must be:

$$\widetilde{c_h}^* = \overline{\beta} - \frac{\gamma}{t\left(1-\overline{\beta}\right)}$$

In the case where the threshold compensation is positive, calculation of the firm's F.O.C., in equilibrium, gives:

$$\frac{\partial g\left(\beta\right)}{\partial \beta} + \beta t - \frac{\gamma}{\left(1-\beta\right)} = \left[1 - p\left(1+s\right)\right] t \tag{25}$$

The left hand side of (25) is increasing in β when the tax evasion share is small and thus search costs $\frac{\gamma}{(1-\beta)}$ are small, while it might become decreasing at large β values. In order to compare the equilibrium with in-kind transfers to that with monetary transfers, let us take the smallest β value that solves (25), and consider the possibility of introducing a monetary transfer $r^{\S} = \beta$. In this case both monetary and in-kind transfers would originate the same share of tax evasion β, while the in-kind transfer would be more cost effective as long as consumers are rationed in good 2, that is, Proposition 3 carries over. However, clearly $r^{\S}$ just supports this equilibrium, and not the one that could arise under in-kind transfers if tax evasion becomes widespread. An example[20] is shown in Figure 2, where the continuous curve refers to L.H.S. of (25), and the dotted line to the case in which a monetary transfer $r^{\S}$ is introduced, while the straight line refers to the R.H.S. of (25). In-kind-transfers might thus imply a worse effect in terms of tax evasion epidemics, and thus the trade-off in terms of costs and benefits should be evaluated on a case by case basis.

[Figure 2 about here]

[20] The following values of the parameters have been used to draw Figure 2: $t = 0.4$, $r = 0.9$, $s = 0.8$, $p = 0.01$, $\gamma = 0.02$, while $g\left(\beta\right) = 0.2\beta^2$.

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Figure Legends

Figure 1
Share of tax evasion β as a function of search costs.

Figure 2:
In-kind versus monetary transfers.

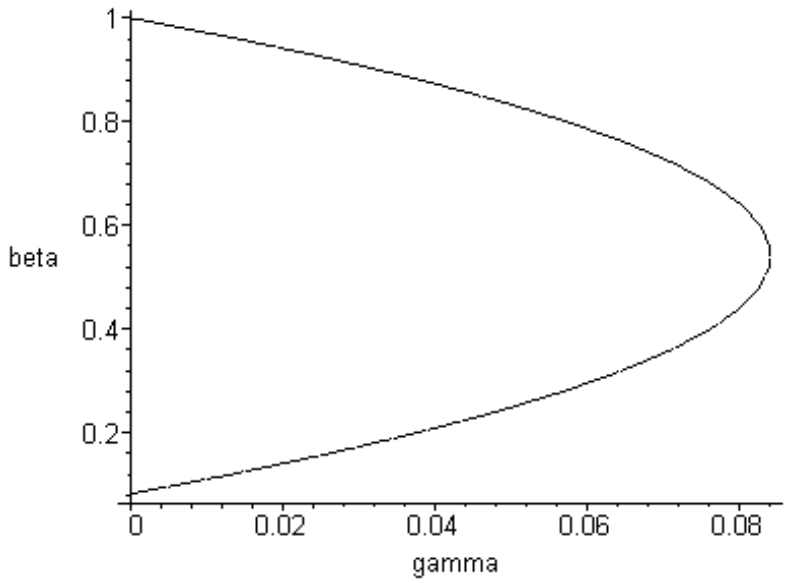

Figure 1: Share of tax evasion β as a function of search costs

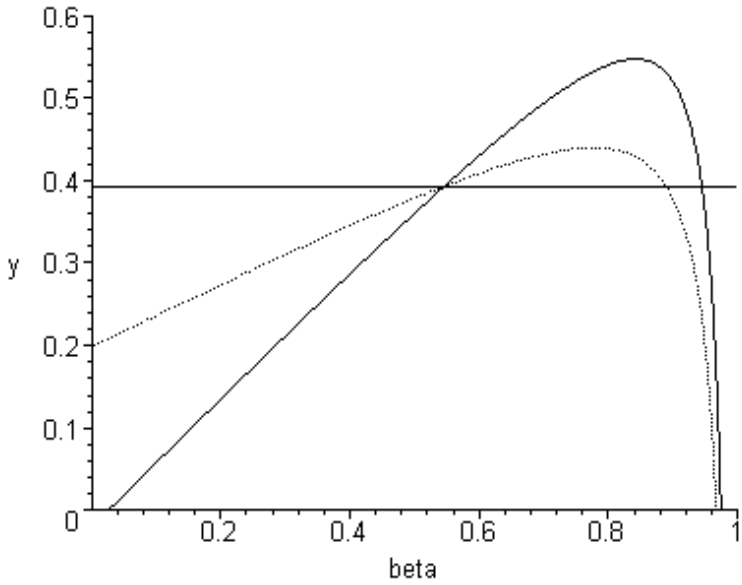

Figure 2: In-kind versus monetary transfers