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A CHINESE RECIPE FOR CURBING TAX EVASION?

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A Chinese recipe for curbing tax evasion?

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Abstract

In this paper the resort to monetary or in-kind transfers for the consumers who ask for the official receipt when they buy goods is studied. A system of this type has been recently introduced in China: consumers receive lottery tickets. The paper develops a model of indiredt tax evasion in a competitive market and describes the likely effects of transfers, according to the environment in which they are granted (high or low tax evasion, enforcement costs, demand elasticity, etc.).

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1 Introduction

In China a quite peculiar system for discouraging sales tax evasion has been recently introduced. To encourage customers to ask for official receipts as proof of payment in the services and in the retail commerce, local tax authorities in many provinces have mandated the resort to receipts that fulfill a technical standard and work also as lottery tickets. To avoid fakes, businesses must purchase specific machines for printing these receipts. Records of the printed receipts are automatically registered and are used to assess the taxes payable on sales. The customer can win small amounts using the receipt as a scratch card; moreover the receipt represents also a lottery ticket for winning larger amounts.

In this paper the pros and cons of this approach are studied from a theoretical point of view. If the market value of the lottery tickets can be easily established and realized, the system is equivalent to the resort to a monetary subsidy paid to consumers who participate in legal transactions. Subsidies to consumption are often granted also in developed countries, for many purposes, among which also fighting tax evasion may have a relevant role. Often subsidies are introduced by granting the deductibility from the income tax of a given percentage of the expenditure for specific items. In Section 2 the role of price subsidies with respect to the evasion of sales taxes is modelled and discussed. The resort to

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lottery tickets, however, involves specific problems whenever one cannot rely upon a clear cut monetary equivalent. In the latter case one must directly refer to the subjective value placed on the lottery ticket by consumers in order to assess the effects of the policy under consideration. This approach is developed in Section 3. In Section 4 some empirical evidence about both approaches is reported. Section 5 concludes.

2 Monetary Subsidies

Following Cremer and Gahvari [2], Etro [4] and Cowell [1], let us 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 in the market: let us call x the firm's output and X the industry output. The product is sold at a consumer price P. There is an ad valorem tax at rate t.

The firm can cheat the government at a total cost given by $g(\beta) P_c x$, where β is the share of sales concealed and $g(\beta)$ is a strictly increasing convex function. Costs increasing in the share of sales concealed can arise if firms, in order to engage in tax evasion, need to hide part of their activity, with increasing waste and inefficiencies[1].

Audits occur with a given probability p and perfectly reveal if cheating occurred. Evasion is punished with a sanction which is a multiple $s > 0$ of the evaded tax. The firm's expected profit is

$$\begin{aligned}&(1-p)\{P[(1-t)(1-\beta)+\beta-g(\beta)]-m\}x+\\&p\{P[(1-t)(1-\beta)+(1-t(1+s))\beta-g(\beta)]-m\}x\end{aligned} \tag{1}$$

Let us assume that $[1-p(1+s)] > 0$ holds, that is the expected return of tax evasion is positive. Let us assume also that parameters have values such that full evasion does not occur, so that an internal solution arises with reference to the share of sales concealed. By considering the F.O.C. with respect to β, one gets:

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

that is the marginal cost of concealment $\frac{\partial g(\beta)}{\partial \beta}$ must equal the marginal benefit $t[1-p(1+s)]$ when β is optimally chosen. The decision pertaining to tax evasion is thus separable in this model from that about output[2].

The equilibrium price P can be calculated by considering that expected profits are zero in a competitive market equilibrium, and thus, by simplifying (1) and equating to zero:

$$\begin{aligned}&P[1-t-g(\beta)+t\beta(1-p-ps)] = m\\&P = \frac{m}{1-t+t\beta(1-p-ps)-g(\beta)} = \frac{m}{1-t^e-g(\beta)}\end{aligned} \tag{3}$$

[1] On this topic see also Virmani [8].
[2] About separability in this case see also Sandmo [7].

where t^e stands for the expected tax rate, while the denominator is evaluated at the optimal β value. The wedge between the consumer price P and the marginal cost is larger the larger are the expected tax rate and the unit concealment cost. In equilibrium the industry product X equals the quantity demanded at price P and each firm earns zero expected profits. The market equilibrium is represented in Figure 1.

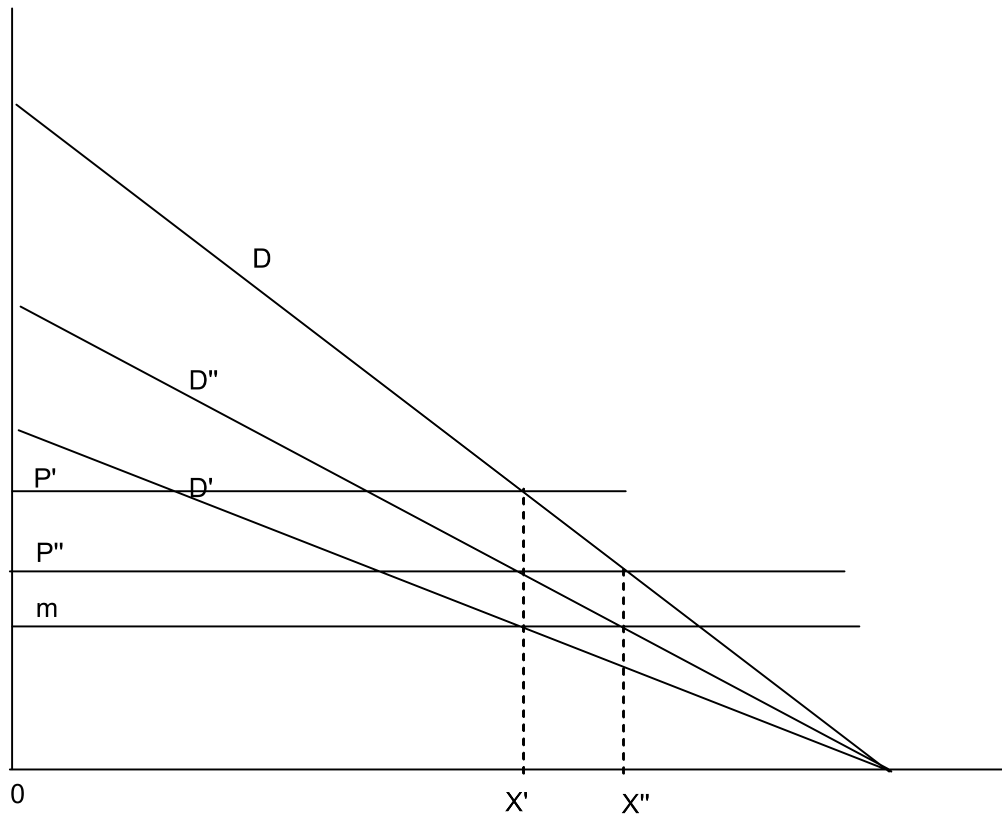


Figure 1: Market equilibrium with tax evasion

If firms were full compliers the demand net of tax would be D'. Thanks to tax evasion the expected tax is lower, the demand net of the expected tax is D'' and the industry output $X^{''} > X^{'}$ is thus larger than that without tax evasion, while the price $P'' < P'$ is lower[3].

In this context, the Tax Administration establishes that whenever there is

[3]Note that this is a partial equilibrium analysis, that does not keep into account the effects of the expenditure financed by the tax, etc.

a legal transaction (i.e., the tax is actually paid), the consumer will receive from the government a proportional subsidy rtP_p, with $r < 1$, where P_p is the producer price. Hence the consumer demand shifts upwards. 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 paying a bonus to consumers who "police" the transaction, and can be considered as a substitute for other interventions having the same aim, like, e.g., increasing the probability of control or increasing sanctions. The potential advantage of the approach stays in the possibility of overcoming asymmetries of information, as consumers are directly involved in each transaction while auditors are not. In fact supporters of this approach aim at extending and completing the chain of conflicting interests that, e.g., characterizes VAT.

Let us assume that consumers can choose, without bearing any cost, the type of transaction, i.e., whether it will be legal or illegal. It is thus assumed that there are neither enforcement costs (psychological or transaction costs of reporting to the tax auditor that the seller refused a legal transaction, in order to enforce compliance) or search costs (i.e., costs of looking for a seller who is willing to trade legally). Moreover, the tax administration is able, at a cost, at avoiding fakes completely, i.e. at paying subsidies only when they are due.

Since under this assumption all the consumers can freely choose a legal transaction, while only in this case they receive the subsidy, whenever the firm prefers to resort to an illegal one, it must at least offer to the consumer the same deal, i.e. it must be ready to cash only $P_p(1 - rt)$ per unit of x in order to ensure the indifference with respect to the legal transaction. Let us consider the firm's expected profit function in this case:

$$\begin{aligned}&(1-p)\left\{P_p\left[(1-t)(1-\beta)+\beta(1-rt)-g(\beta)\right]-m\right\}x+\\&p\left\{P_p\left[(1-t)(1-\beta)+\beta(1-t(1+s)-rt)-g(\beta)\right]-m\right\}x\end{aligned} \tag{4}$$

Considering an internal solution, the F.O.C. for profit maximization with respect to β now implies that:

$$\frac{\partial g(\beta)}{\partial \beta} = [1 - r - p(1 + s)]\, t \tag{5}$$

It is clear that the expected rate of return of tax evasion $[1 - r - p(1 + s)]$, which must be positive when an internal solution is reached, is pushed down the more the larger is r, and thus a lower share of concealed sales β arises thanks to this policy. This observation is confirmed by noting that since (5) must hold at the firm's internal optimum, one can differentiate both sides of (5) with respect to r to get:

$$\frac{\partial^2 g(\beta)}{\partial \beta^2}\frac{\partial \beta}{\partial r} = -t < 0 \tag{6}$$

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:

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

it is possible to eliminate tax evasion altogether. While the classical suggestion for eliminating tax evasion is that of resorting to a large enough sanction, it is well known that many problems might arise with this approach in practice[4]. Hence subsidies to consumers can provide an alternative tool. One must bear in mind, however, that subsidies, unlike sanctions, are cashed by consumers and not by the tax administration: revenue is thus affected. This problem will be considered in details later on.

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

$$P_p = \frac{m}{1 - t - g(\beta) + t\beta(1 - p - ps - r)} = \frac{m}{1 - t^E - g(\beta)} \tag{7}$$

where $t^E = 1 - t + t\beta(1 - p - ps - r)$ and β is set at its optimal value in this framework. Let us derive (7) with respect[5] to r :

$$\begin{aligned} \frac{\partial P_p}{\partial r} &= \frac{mt\beta}{[1 - t^E - g(\beta)]^2} \\ &= P_p \frac{t\beta}{1 - t^E - g(\beta)} \end{aligned} \tag{8}$$

The derivative has a positive sign. The producer price increase thus implies that consumers never fully benefit of the subsidy, that is the subsidy is at least partially shifted. One may wonder whether there might be overshifting, i.e., a producer price increase larger than that necessary to keep the consumer price constant. Since $P_p(1 - rt) = P_c$, by implicit differentiation one gets $\frac{dP_p}{dr} = P_p \frac{t}{1-rt}$. Thus overshifting occurs if:

$$P_p \frac{t\beta}{1 - t^E - g(\beta)} > P_p \frac{t\beta}{1 - rt}$$

With overshifting the beneficial effect of a subsidy rate increase for the consumer is more than fully offset by the producer price increase.

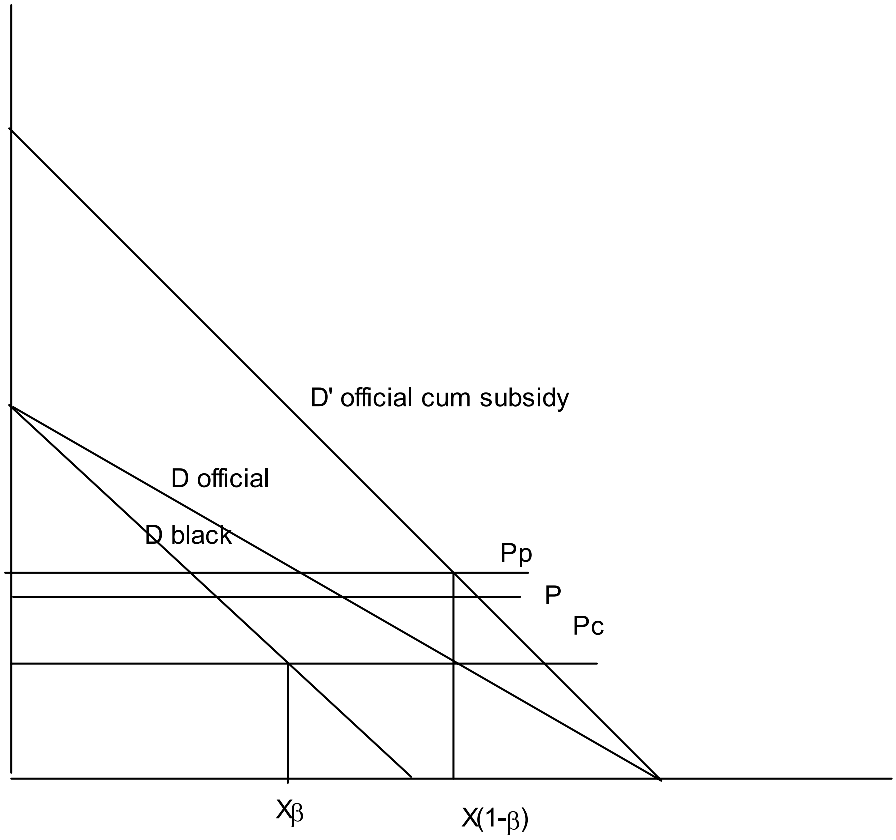
Lemma 1 $\beta \to 1$*implies that* $\frac{\partial P_p}{\partial r} \to P_p \frac{t}{1-g(1)-t(p+ps)-rt} > P_p \frac{t}{1-rt}$

Lemma 1 implies that very large tax evasion levels favor the occurence of overshifting.

The market equilibrium when subsidies are introduced is illustrated in Figure 2. Agents involved in legal transactions (whose share of the market is $(1 - \beta)$) receive the transfer and thus their demand shifts up from $D\ official$ to D' $official$ cum *subsidy*. They pay a gross price P_p while their actual net price is P_c. Agents involved in illegal transactions (whose market share is β) pay P_c. In the example shown in the figure $P_p > P > P_c$, where P is the equilibrium price in absence of subsidies, i.e., in this example the net consumer price is lower when the subsidy is granted.

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

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



Market equlibrium with subsidies

Consumers are indifferent as whether the transaction is legal or illegal[6], while when it is legal there is a wedge between the price cashed by the firm P_p and that (net of subsidy) paid by the consumer P_c. While without tax evasion consumers would benefit in full of the subsidy, through a net consumer's price drop, in this case the consumer price drop is smaller, as producers bear a cost in order to give the same benefit also to the consumers who are partners of an illegal transaction. At any rate, whenever the subsidy implies a drop of the consumer price under this policy, a larger total amount X is produced.

Let us now consider the tax revenue net of enforcement cost $c(p)$ pertaining to the ad valorem tax, which are assumed to be increasing in the probability of detection[7]. If no subsidy is paid, the net tax revenue is given by:

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

When the subsidy is introduced, further costs arise in order to avoid fakes. Since retail sales are considered, the number of transactions is likely to depend on the

[6] The standard assumption of amorality is followed on this purpose.

[7] As a competitive market with a large number of firms is considered, p represents both the ex-ante probability of detection and the ex-post frequency of audits.

amount of output. Since each transaction can potentially give rise to a false receipt, we assume that costs born by the tax administration to avoid fakes $h(X(P_c))$ are increasing in the output. When the subsidy is granted, the net revenue can then be written as:

$$t\left[(1-r)(1-\beta)+p\beta(1+s)\right]P_pX(P_c)-c(p)-h(X(P_c)) \tag{9}$$

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

Lemma 2 *Sufficient conditions for a tax revenue increase occur if: i) $\beta \to 1$; ii) the market demand is unelastic.*

Proof. By deriving the revenue (9) with respect to r, one gets:

$$f(r)P_p\frac{\partial X}{\partial P_c}\frac{\partial P_c}{\partial r}+f(r)X(P_c)\frac{\partial P_p}{\partial r}+P_pX(P_c)\frac{\partial f(r)}{\partial r}-\frac{\partial h(X(P_c))}{\partial X}\frac{\partial X}{\partial P_c}\frac{\partial P_c}{\partial r} \tag{10}$$

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

$$\frac{\partial f(r)}{\partial r}=-t\left[1-\beta\right]-t\left[1-r-p(1+s)\right]\frac{\partial \beta}{\partial r} \tag{11}$$

The first and the last term in (10) 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, looking at (11), one can distinguish two components that contribute to shape the response. Namely, a loss of revenue from legal transactions, which now involve also some outlays for the Government in order to pay the subsidy r; ii) a gain due to the reduction of the concealment rate β. However, if $\beta \to 1$ the first term $\to 0$ and thus $\frac{\partial f(r)}{\partial r}>0$. ■

Of course there are many other cases not considered in Lemma 2 in which the subsidy policy might be beneficial. Consider, e.g., a case in which, while $\beta << 1$, nevertheless the tax evasion reduction 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. It seems at any rate that in general the subsidy policy is more likely to be beneficial if tax evasion is widespread (as this reduces the payment to do for legal transactions), if the subsidy exert an expansionary effect on the market, and if the reduction of tax evasion prompted by the policy is large. Also what we termed administrative costs (i.e., $h(X(P_c))$), play a very relevant role. It has been assumed in fact that the administrative effort is large enough as to ensure that no fake occurs: if this assumption is relaxed, the tax revenue definition must be modified in order to keep into account the corresponding leakages of resources.

With reference to the effect of the subsidy upon tax evasion, note that from (6), one gets:

$$\frac{\partial \beta}{\partial r}=-\frac{t}{\frac{\partial^2 g(\beta)}{\partial \beta^2}}$$

which means that the effects depend on the tax rate and on the shape of the concealment cost function. A larger effect occurs if the concealment cost function is about flat at the optimal β value. The concealment cost function might, however, become steep if there are evasion thresholds above which visibility is so high that hiding becomes prohibitively costly.

One may also wonder if, from a welfare point of view, subsidies received by consumers can be considered as substitutes for government revenue. A full substitutability cannot be assumed in general, as clearly government revenue can finance the production of public goods or be redistributed according to a given social welfare function, while the distribution of subsidies depend on that of consumption. At any rate, from a welfare point of view, subsidies can potentially involve also some beneficial role, thus contributing to the relevance of the policy considered.

2.1 Search costs

Let us now drop the assumption that consumers can always opt for legal transactions without incurring any cost. To focus upon search costs, let us assume that enforcement costs are prohibitively high (i.e., larger than the subsidy). Hence, consumers will consider the option of searching for a supplier willing to transact legally. To keep the model simple, let us assume that each consumer buys just one unit of the good.

Proposals that consumers receive are considered as independent random selection from the distribution of transactions that the suppliers are willing to conclude. Proposals take two values: r with probability $(1-\beta)$ for legal transactions, r^*, with $0 \leq r^* \leq r$, for illegal transactions. Moreover, everyone knows this probability distribution. It is assumed also that all the consumers bear the same cost $\gamma P_p < rtP_p$ for eliciting a new proposal, either from the same or from another firm. Search costs are thus described as proportional to the market producer price of the good, as transactions are likely to be more difficult the higher is the value involved. Let us consider a consumer with an offer r^* in hand. Then a simple reservation price model implies that the customer accepts the proposal if it equals the expected net benefit of a further search, i.e.:

$$r^* tP_p = -\gamma P_p + r^* tP_p + tP_p (r - r^*)(1-\beta)$$

where on the r.h.s. the additional costs γP_p and the expected additional benefit $tP_p [r - r^*](1-\beta)$ of making a further search are considered. Hence the proposal is accepted if:

$$\begin{aligned} r^* tP_p &= rtP_p - \frac{\gamma P_p}{(1-\beta)} \text{ if } rt > \frac{\gamma}{(1-\beta)} \\ &= 0 \qquad\qquad\qquad\quad \text{if } rt \leq \frac{\gamma}{(1-\beta)} \end{aligned}$$

Note that when $r^* tP_p > 0$ the reservation discount $r^* tP_p$ is decreasing in β, i.e. the customer accepts a smaller compensation the larger is the share of tax evasion.

In order to describe the market equilibrium in this case, let us assume that firms behave in a Nash fashion, i.e. they take as given the discount $\overline{r^* t P_p}$ requested for illegal transactions.

Proposition 1 *If subsidies are introduced, the equilibrium share of tax evasion is larger when consumers bear search costs. Subsidies lose any disciplining effect upon tax evasion if $\gamma \geqslant rt(1-\beta)$, i.e. if search cost are so high that consumers are discouraged from searching and accept illegal transactions without requesting any compensation.*

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

$$\begin{aligned} &(1-p)\left\{P_p\left[(1-t)(1-\beta)+\beta\left(1-\overline{r^* t}\right)-g(\beta)\right]-m\right\}x+ \\ &p\left\{P_p\left[(1-t)(1-\beta)+\beta(1-t(1+s)-\overline{r^* t})-g(\beta)\right]-m\right\}x \ \text{ if } rt > \frac{\gamma}{\left(1-\overline{\beta}\right)} \end{aligned} \tag{12}$$

while, If $rt \leq \frac{\gamma}{\left(1-\overline{\beta}\right)}$, $\overline{r^* t}=0$ and expected profit is given by (1). From the F.O.C. for the maximization of (12) with respect to β one gets:

$$\frac{\partial g(\beta)}{\partial \beta}=[1-r-p(1+s)]\,t+\frac{\gamma}{\left(1-\overline{\beta}\right)} \tag{13}$$

Since all firms are identical the equilibrium share of tax evasion can be found by setting $\overline{\beta}=\beta$ and solving the F.O.C. By comparing (13) to (5) it turns out that tax evasion must be larger if there are search costs. If $\gamma \geqslant rt(1-\beta)$ the F.O.C. for profit maximization is (2) and subsidies do not play any role with respect to tax evasion. ■

Note that the effects of search costs might imply that the transfer policy has a negative impact upon the tax revenue; if the effect 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 the transfers for legal transactions. Only the expansionary effect of the policy on the economy output might mitigate these consequences upon the tax revenue.

To further assess the role of search costs, note that in equilibrium the F.O.C. (13) can be rewritten as:

$$[1-r-p(1+s)]\,t+\frac{\gamma}{(1-\beta)}-\frac{\partial g(\beta)}{\partial \beta}=0 \tag{14}$$

This condition implies that multiple equilibria are possible, i.e., more than one level of tax evasion share β is viable. This effect stems from 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 diminish. 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

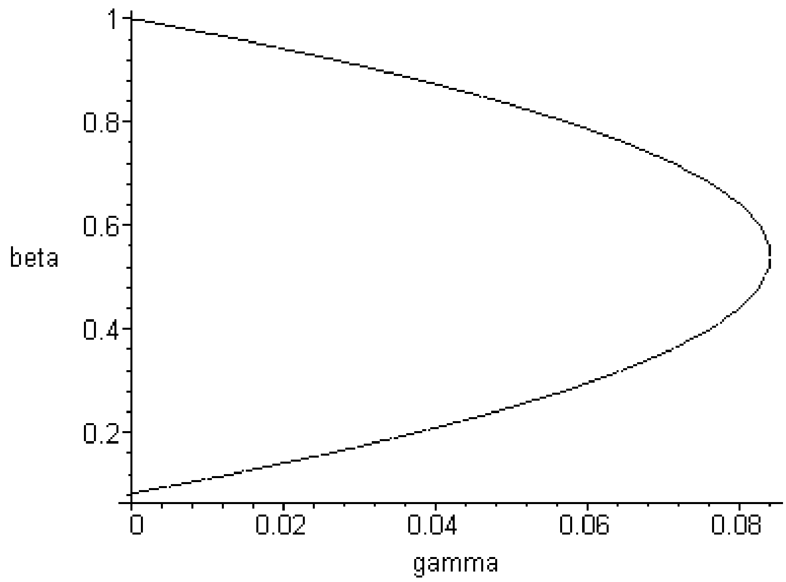


Figure 2: Share of tax evasion β as a function of search costs

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 2 presents a numerical example, in which $g(\beta) = 0.2\beta^2$, $t = 0.4$, $r = 0.9$, $s = 0.8$, $p = 0.01$.

A second scenario to consider is that in which enforcement costs ζ per unit of expenditure, that 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 begin reporting to tax auditors. The compensation that must be paid to those who enter an illegal transaction per unit of expenditure would thus become $rt - \zeta$.

To resume the findings so far, it seems very important to asses the characteristics of the environment in which the subsidy is introduced. If consumers bear no cost in opting for a legal transaction, the impact of subsidies is likely to be significant. It has turned out that, in a competitive market and under CRS, when indirect ad valorem taxes are partially evaded, the introduction of a subsidy entails an increase in the producer price for legal transactions. This is due to the cost that producers must bear in order to give to all the consumers a benefit equivalent to the subsidy. Tax evasion thus becomes less profitable and decreases. If instead consumers face costs of reporting violations to the authorities, subsidies might induce them to search for sellers willing to conclude legal transactions. As this activity is costly, the opportunity value of the subsidy decreases. Hence the aforementioned effects of subsidies on tax evasion and prices are diluted and in the limit disappear.

3 In-kind transfers

Let us now consider the case in which the Government, to encourage legal transactions, instead of a monetary subsidy, introduces an in-kind transfer, i.e. it delivers to the consumer who participates in a legal transaction a quantity tP_px of good $\theta \neq x$. It is also assumed that the consumer bears no cost in opting for a legal transaction.

As long as there is a market price for good θ, and the transaction costs for reselling it are negligible, the analysis of Section 2 directly applies, as the in-kind transfer has a clear-cut monetary value. If instead one or both of these conditions are lacking, the firm faces the problem of compensating those who participate in illegal transactions. The firm might resort to the supply of a closely substitutive good, in order to give a gift to those who participate in illegal transactions, at conditions that parallel those of the legal market. In the example of the lottery on which this paper is specifically focussed, an illegal gambling system might provide this opportunity. The likelihood of such an evolution depends on the costs of supplying the substitutive good, which could e.g., be low if an illegal market already exists and has gained credibility and if the enforcement against illegal gambling is mild. In-kind compensations in terms of goods which are not close substitutes might involve high transaction costs. They seem thus rather unlikely, at least under the assumption of a competitive market, in which the supplier has no patronage and market power to exploit.

If no substitutive good can be supplied, a monetary compensation must be paid to those who accept an illegal transaction. The compensation cannot be lower than the marginal evaluation of the good. To discuss the implications of this approach in a simple framework, let us assume that each individual consumer i makes an identical and small expenditure for good x, so that $tP_px_i \leq 1$. The quantity of good θ to which the customer is entitled is thus marginal, and hence it seems reasonable to assume that each agent's demand price is constant in the relevant interval. The compensation requested by each consumer for an illegal transaction is thus c_itP_px, where c_i is the unitary compensation. Let us assume that the distribution of c_i is uniform and lies on the interval $[0, 1]$. Good θ is produced by the government at a constant marginal cost n. It is assumed that at least some consumers have an evaluation larger than the marginal cost n, i.e., there is a $\widetilde{c}_i \leq 1$ such that $\widetilde{c}_i > n$, or, equivalently, it is assumed that $n < 1$. Let us assume also that each firm behaves according to a Nash conjecture, i.e. it takes as given the unit compensation $\overline{c_i^*}$ observed in the market. Hence it chooses its evasion share β in a way that parallels that previously described, i.e., according to the F.O.C.:

$$\frac{\partial g(\beta)}{\partial \beta} = \left[1 - \overline{c_i^*} - p(1+s)\right] t \tag{15}$$

Proposition 2 *If in-kind transfers are introduced and there are no search costs, ceteris paribus the tax evasion share β is smaller than in absence of transfers of whichever type. In-kind transfers outperform money subsidies in fighting tax evasion as long as the value attributed to good θ by the marginal agent accepting an illegal transaction is larger than its monetary cost for the government.*

Proof. *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 on the unit interval,* $\int_0^\beta dx =$ β *represents both the marginal demanded compensation and* $\Pr(0 \leq c_i \leq \beta)$. *Hence:*

$$c_i^* = \beta \tag{16}$$

Thus Condition (15) in equilibrium becomes:

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

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, if $c_i^* = \beta \geq \widetilde{c}_i > n$, *the government can induce firms to pay a larger compensation for illegal transactions by resorting to the in-kind transfer than by setting* $r = n$. ■

Condition (16) implies that the larger is 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 conclude illegal transactions with agents whose evaluation of θ is low, while when there is a larger share of tax evasion also agents with larger demand prices for θ must be involved. Note also that in this scenario each firm's decision of evading taxes gives rise to a kind of negative externality for the group of suppliers as a whole, as it pushes up the compensation that must be paid to all the consumers who participate in illegal transactions. The disciplining effect of the increase of the compensation, which operates in this framework, is thus reinforced by the fact that firms are not able to internalize the negative externality.

With in-kind transfer the zero-profit condition becomes:

$$\begin{aligned} &(1-p)\left\{P_p\left[(1-t)(1-\beta) + \beta(1 - c_i^* t) - g(\beta)\right] - m\right\} x + \\ &p\left\{P_p\left[(1-t)(1-\beta) + \beta(1 - t(1+s) - c_i^* t) - g(\beta)\right] - m\right\} x = 0 \end{aligned} \tag{17}$$

By substituting (16) into (17) and solving for P_p one gets:

$$P_p = \frac{m}{1 - t - g(\beta) + t\beta(1 - p - ps) - t\beta^2} \tag{18}$$

In this framework, the larger is the share of tax evasion β, the larger[8] is P_p. This effect is explained by the increasing compensation requested by the agents who participate in illegal transactions when tax evasion increases, and represents a kind of self-adjusting mechanism that pushes upward the tax base when tax evasion increases, that is not available under monetary transfers.

All in all, in-kind transfers seem a tool more promising than monetary transfers. In-kind transfers introduce a kind of bundling and the results so far described arise if evasion is widespread enough in order to introduce some rationing in the supply of good θ, which is supplied in a less than efficient quantity. If one refers, however, to lottery tickets, one may deem that the social marginal cost is larger than the private one, and thus there are some justifications for rationing.

The analysis developed in Section 2.1 with reference to the role of enforcement and search costs can clearly be extended to the case of in-kind transfers. In this case too one can envisage a reduction of the compensation needed for inducing customers to accept illegal transactions when they face opportunity costs of search or enforcement costs. Nevertheless, the conclusions reached with reference to the relatively better performance of in-kind transfer are likely to carry on to this case.

4 Empirical evidence about refunds and in-kind prizes

A system that has been used in developing countries to fight VAT tax evasion is the provision of refunds to consumers, on the basis of the receipts that they exhibit.

Berhan and Jenkins [3] study the working of this system in Northern Cyprus and in Bolivia. In Northern Cyprus the scheme was used since 1996. The refund was 5% of the taxable purchases until 2000 and it has been reduced to 2.5% afterwards, 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 is a withholding tax on wages, salaries and pensions, introduced with the aim of reinforcing the working of VAT. Consumers can deduce the VAT paid on purchases of goods and services, and thus the withholding tax has zero expected net revenue.

Berhan and Jenkins [3] find that these systems showed very large administration and compliance costs, both in comparison with the VAT proceedings

[8] This can be established by deriving (18) with respect to β. The derivative is:

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

The term in squared brakets in the numerator is 0 as each firm maximizes its profit according to condition (15), and this holds also in equilibrium: hence the term in curly brackets is negative and thus both the numerator and the denominator are positive.

and with the corresponding costs of the other taxes in the two countries. The process needed to collect and validate the claims is highly time consuming and the net benefits for taxpayers are low. Moreover, the method is vulnerable with respect to illicit practices. In Northern Cyprus this consists mainly in collecting receipts issued to foreigners, students, etc., who cannot claim the refunds.

In Bolivia instead there is a black market where also false receipts are sold, at a price around 1% of their face value. All in all, the system seems to work badly, while, however, abolishing it would hurt some groups and hence does not seem to be politically viable. Reforms aimed at cancelling the refunds, and thus at transforming the withholding tax into a revenue producing tax (while renouncing to the potential benefits with respect to VAT), have given rise to riots.

In-kind transfers, and more specifically lottery tickets, have been used also in other Asian countries besides China. They are also often used in the private sector, as a marketing device. For example in Latin America banks offer lottery-linked deposit accounts. Those who keep the account for a given period participate in lotteries for small and large prizes. According to Gillén and Tschoegl [5] 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.

5 Conclusions

The resort to money or in-kind subsidies to encourage consumers to request compliance with sales taxes rests on the assumption that it is less costly to enforce compliance in this way than by auditing firms. In fact consumers have an informative advantage with respect to tax auditors, i.e. they necessarily and frequently contact the suppliers. While this assumption is reasonable, one must also take into account the costs and the many possible unwanted effects of this approach. When the system works smoothly, it might give rise to some kind of "revenge by the market" through the increase of gross or even net prices. Moreover, the effects are likely to be diluted whenever for psychological reasons or because of transaction costs, consumers find it costly to pass their information to the authorities. Last but not least, new forms of cheating might appear, as, e.g., consumers might try to cash the subsidies even when they are not entitled to receive them.

The resort to in-kind transfer seems to have one advantage with respect to the alternative of monetary transfers. At least some consumers are likely to have a large evaluation of the good chosen for the in-kind transfer, larger than its marginal cost: even if tax evasion is widespread they will request a legal transaction notwithstanding enforcement or search costs. In this framework each firm's decision of evading entails a negative externality, as it contributes to exhausting the pool of agents less interested in the good and ready to accept an illegal deal for a low compensation. On the other hand the advantages of the in-kind approach are linked to the exploitation of a form of bundling, i.e. they rest upon the resort to price discrimination. It is clear that there are obvious limitation to the possible role of in-kind-transfers, as long as conditions suitable for a profitable exploitation of forms of bundling are needed, while efficiency losses involved by the policy represent a cost.

With reference to the specific case of lotteries, rationing consumption seems a minor concern as long as gambling produces negative externalities. Among the advantages of choosing this specific form for in-kind transfers, there is also the savings in control costs: only the receipts of the lottery winners have to be collected and checked[9], while systems based on refunds usually involve large costs just for handling a large number of receipts. From the point of view of equity, as long as lotteries are inferior goods, they should give rise to transfers that have a larger value for the poor. On the other hand, also the redistributive characteristics of good X play a role with respect to the income classes who benefit from the policy. Among the *caveat*, one must include the possible substitution effect upon the demand for other public lotteries, with possible negative consequences for other components of the public budget.

A more general caveat with reference to both monetary and in-kind transfer stems by the possibility of some crowding-out effect with reference to intrinsic (moral) motivations for paying taxes and obeying fiscal laws: this danger is a concern since compliance becomes in a sense conditional on a compensation.

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