Review of Economics & Finance
Submitted on 21/May/2012
Article ID: 1923-7529-2012-04-55-16 Silvia Fedeli, and Francesco Forte

Border Tax Adjustment without Borders: The EU Carousel of VAT Fraud

Silvia Fedeli
Faculty of Economics; Department of Economics and Law, Sapienza - University of Rome
Via del Castro Laurenziano, 9 00161 Roma – ITALY
Tel. and Fax: +39 06 4976 6399 E-mail: silvia.fedeli@uniroma1.it

Francesco Forte (Correspondence author)
Faculty of Economics, Department of Economics and Law, Sapienza - University of Rome
Via del Castro Laurenziano, 9 00161 Roma – ITALY
Tel. and Fax: +39 06 4976 6399 E-mail: francesco.forte@uniroma1.it

***A*bstract:** This article focuses on the carousel of VAT fraud consisting in multiple undue VAT rebates for goods exported and re-exported between EU countries. This fraud has been developed as a form of border VAT adjustment since the abolition of the borders within the EU countries. The carousel is modelled as a Nash equilibrium chain-game beginning at the retail stage where fraudsters try to capture an unsatisfied demand for the traded goods by means of a reduction of its final price. This can occur because at the final stage the good can benefit from multiple subsidies deriving from undue VAT rebates and because of the power of the fraudster in affecting the prices of production factors. We explore the effects of the carousel fraud game on intra-community trade and analyse the implications for tax authorities.

JEL Classifications: H24, H25, H26
Keywords: European Union Value Added Tax; Income tax and VAT evasion; VAT carousel; Nash equilibrium fraud-chain

1. Introduction

Competition in a free market area may result in low consumer prices due to a better allocation of production factors. However, in the free trade area consisting of EU countries, low prices may also be due to distortions and inequities resulting from intra-community tax fraud which exploits the existing rules on VAT as a consumption tax based on the destination principle. These frauds may take the form of a "carousel" that originates a flow of repeated illicit rebates for goods moving across the EU countries, thus generating illegal state subsidies resulting in sizable gains for the fraudsters and the black economy, as well as in substantial price reductions for the consumers.

This paper explores the issue of direct and indirect tax evasion in the presence of international trade in order to examine its effect both on prices in the markets of the countries involved in the scam and on the payoffs of the fraudsters participating, at various stages, in the criminal operations. We further look at the tax revenues of the countries involved as well as at the effects for their residents (producers and consumers). In particular, we explore:

- how the fraud game takes place and how its gains are divided among the players at various stages;
- which additional gains those players may get by the direct evasion thus made possible;
- how benefits and losses are shared among the countries involved and their residents;
- how the prices of the goods which are the object of the fraud are affected at the various stages.

On this basis, we explore policy implications for the tax authorities, both in terms of controls and of penalties, looking at how changes in the strategies adopted by the tax authorities contrasting the fraud may affect the fraudsters' payoffs and hence their incentive to participate in the fraud. We argue that, in the context analysed, controls should be concentrated mostly at the last stage, both because here one can detect the fraud by monitoring the prices of the commodities which are likely to be the object of the fraud, and because it is at the last stage that we can find both the largest gains for the fraudsters and the greatest losses for the government. It is true that here the consumers may get a sizable increase of welfare from lower prices, but this is accompanied by welfare losses due to the distortion of competition between legal and illegal economy. As for policy of penalties, one should not merely consider punishments relating to the specific VAT fraud on rebates, but also those for direct and indirect tax evasion.

The introduction of a value added tax (VAT), as a consumption-type tax based on the destination principle, was required by the need for a European single market which was tax neutral for international (intra-community) trade. The VAT system was attractive for European countries at the time of its introduction because it allows the exemption of VAT on exports and its application at the domestic border on the full value of imports, by self invoicing (i.e., without border controls within EU member states). Moreover, the method can accommodate multiple tax rates, which may be different in different member states. Finally, the widely recognised self-enforcing property of the VAT system[1] (buyers of intermediate goods and services have opposing interests to the sellers) could be expected to reduce the scope for tax evasion.[2]

However, with the abolition of border among EU countries, the application of VAT became less certain and criminals were able to abuse the system in sophisticated and organised ways.[3] The incentive for tax fraud has greatly increased following the enlargement of the EU to new countries

[1] In principle, the advocates of VAT suggest that the VAT system gives each trader the incentive to ensure that his suppliers have properly paid VAT in order for the former to be able to claim the relevant credits. In this respect, Cnossen (1990) recognised VAT as probably the best tax for raising tax revenue (see also Cnossen, 1994, 1998, 2001). Nevertheless, since the '80s Hemming and Kay (1981) have stressed the illusory nature of the notion of VAT self enforcement.

[2] For all these reasons, with few exceptions (see Fedeli and Forte (1999, 2011a, 2012), and Fedeli, (2003)) the behaviour of firms as tax evaders has been mostly studied outside the VAT system. Sandmo (2005), surveying the formal models on tax evasion, noticed that most of them (such as Marrelli, 1984, and Marrelli and Martina, 1988) are built upon Allingham and Sandmo (1972) and concern evasion by individual taxpayers. The firms are left in the background, in spite of their important role in the black labour market and also in tax evasion activities related to indirect taxes for which they act as tax collectors for the government. Nevertheless, according to the European Court of Auditors (2008) most VAT evasion is linked to undeclared economic activities of firms. This evasion also occurs as a side-effect of the VAT arrangements put in place when the single market was introduced in 1993. Keen (2007) and Fedeli and Forte (2011b) give an overall description of the main types of VAT fraud, evasion and elusion as well as of the remedies devised at European and national level which are discussed in the literature. On specific effect of VAT fraud see, among others, Keen (2006a; 2006b; 2001, 2000a; 2000b); Keen and Lockwood (2006); Keen and Mintz (2004); Keen and Smith (1996); Pashev (2007).

[3] For the general issue relating to VAT in the EU, after the creation of the single market see Forte (1990); Genser and Haufler (1996). For a general treatment of the issue of the origin versus the destination principle, see, among others, Tait (1988), Bovenberg (1994), Lockwood, de Meza and Myles (1995).

characterised by lax regulations and, often, by weak tax administrations as well as large borders with non-EU countries. It is therefore easier than before for goods to enter the EU, VAT-free, through the new EU States' borders with non EU States. The enlargement of the EU has also broadened the scope for contraband relating to "transit traffic goods", i.e. to goods entering the EU through a country different from that of final destination. Goods in transit from outside the EU are under seal, being subject to VAT only in the State of destination. Some of these "sealed goods" may disappear, while in transit, entering the black market. Finally high direct taxation and high social security contributions associated with the high costs of official labour contracts and other regulations provide a powerful incentive to evade VAT in the most developed EU Member States.

The fraud might occur according to different modalities: in a "single operation" of fictitious export-import which unduly benefits from VAT rebate, and/or through a so called "carousel". The "simplest fraud" occurs when an importer buys tax free goods from a trader who may also belong to a non EU country. The importer sells the goods to an exporter with VAT added, does not remit the VAT to the tax authority and then disappears as a "missing trader". The tax authority of the destination country looses the VAT revenue even if the fraud is discovered because the exporter is lawfully entitled to the VAT rebate; unless it can be proved that he was aware of the fraud. The sophisticated variant of VAT cross-border fraud known as "carousel" consists in continuing the forgery into another EU country. The scam can be repeated several times, with the goods being exported and imported through a complex criminal network up to the final sale.

In the current article we formalize the second type of VAT fraud. The model explores a carousel type of VAT evasion in the presence of international transactions, and its effects on international trade and on domestic markets. From a theoretical point of view, Fedeli and Forte (1999) studied the gain from direct and indirect tax evasion deriving from the chain of black transactions activated on the supply side, whereas Fedeli (2003) concentrated on the demand side. Moreover, Fedeli and Forte (2011a) have examined both the simple fraud and the carousel in a competitive context. Here, we look at gains from tax evasion made by the firms involved in the black chain as a consequence of the VAT mechanism and in the presence of international trade. Of particular interests here is the capture of a market share at a market price lower than that bearable by the firms which regularly pay taxes; this market share is the reason why the firms organize themselves into a criminal chain that, other than likely sweating illegal (off-the-book) job, exploits the system of VAT rebates in the presence of international trade. Our purpose is to study the effects of this fraud on the prices of factors involved in the production of the exchanged goods and also on the payoffs of the individual fraudsters in the countries involved in the carousel, restricting the case to complete information and considering a finite number of exchanges. In this respect the firms, organised in an international criminal network, bargain their own purchasing prices along the chain in order to maximize their advantages from tax evasion and black labour. We show how the carousel works as a type of government subsidy both for the firms, which gain from tax evasion and from productive factors' illegal exploitation, and for the final customers, who gain from access to the goods.

In section 2, we describe VAT fraud originating from international trade and formalise the collusive games into a model capturing their effects on the equilibrium prices of the goods exchanged as well as on the earnings of the fraudsters taking part in the complex type of VAT fraud known as carousel and also involving income tax evasion and illegal job exploitation. The policy implications of the model are illustrated in section 3. Conclusions follow in section 4.

2. The Carousel of VAT Fraud: Purchasing Prices' Adjustments to Tax Fraud

We now model the carousel as a chain of bargaining between each couple of fraudsters participating in the criminal international operation.[4] Given the standard chain of exchange going from origin to destination, we assume that traders bargain the unit price of the productive factors (both intermediate goods and labour). We consider the simplest case of a carousel involving 3 countries and 4 players, where the consumer price at the final stage is taken as given and the firms of the criminal organization "adjust" their purchasing prices in order to capture that share of market. As depicted in figure 1, country C is assumed to be the country of origin. Country B is not a mere transit country, because operations of transformation of the goods will also take place here. There is unsatisfied consumer demand for a certain good at a given reduced price in country A, the country of destination. Fraudster 3 (importer from country B to country A) sells the good in the market of country A taking the consumers' demand and price as given. The goods might be sold in the "regular" market to a consumer who is unaware of the carousel. We assume that, given the final consumer demand and price, each fraudster along the production chain determines with each supplier the purchasing price that maximizes the product of their payoffs from tax evasion

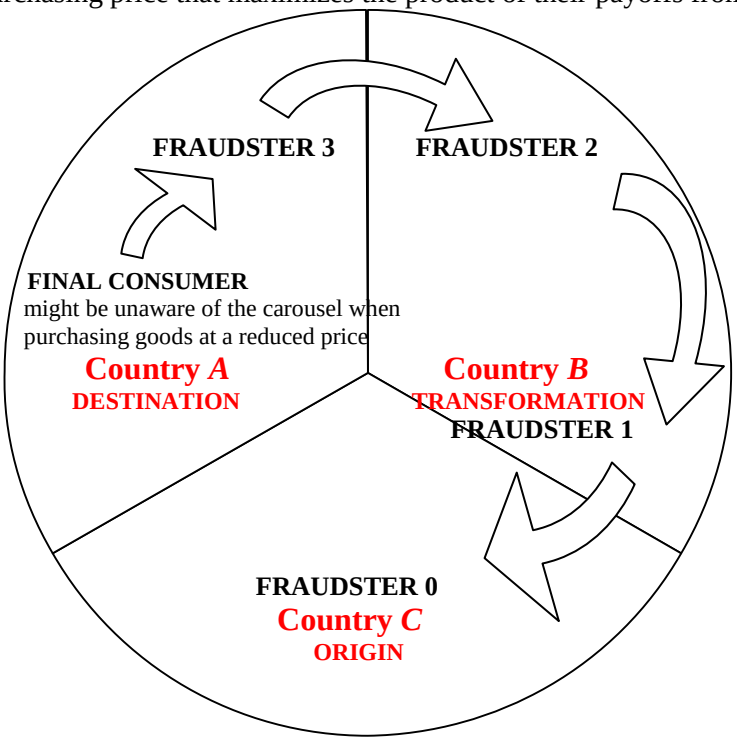

Figure 1. The chain of black transactions involving carousel over 3 EU countries

Note: We have not introduced bogus or buffer companies in the model because they are not relevant players in affecting the final prices. Yet they are important because they might reduce the *key fraudsters*' risk of detection by covering their tracks.

The carousel begins at the final stage in country A, where fraudster 3, importer from country B and retailer in country A, knows that he can sell the *good* in the market at the price P_3, taken as given. In order to capture this share of the market, fraudster 3 bargains his purchasing prices with

[4] For the basic analysis of the chain of Nash bargain see Basu et al. (1992).

fraudster 2, who is assumed to be an exporter from country B to country A, with fiscal residence in country B. The price P_2 - to be defined by the Nash bargain - is the purchasing and sale price of, respectively, fraudster 3 and fraudster 2. We assume that the purchasing price for fraudster 2 is P_1, which, in turn, is determined by fraudster 2 in his bargaining with fraudster 1, who imports the good into country B from country C. P_0 is the purchasing price of fraudster 1 with fraudster 0, exporter from country C to country B. We assume that the purchasing price for fraudster 0 is L_0 (<1) times his sales price of the raw good in country C. P_i - with i=0,1,2 - are bargained by the traders. They represent the purchasing prices of, respectively, fraudster 2 and fraudster 3 as well as the sale prices of, respectively, fraudster 1 and fraudster 2. We assume that fraudster *i's* (*i*= 1,2,3) production costs are $L_i > 1$ (i=1,2,3) times the purchasing price.

In other words, following the standard production chain from the origin of the raw material in country C, fraudster 0 is the first exporter, who sells the quantity Q of the considered good to fraudster 1 in country B. The goods exported are sold tax free to fraudster 1, with fraudster 0 getting the rebate for the VAT paid on his purchasing costs. In order to get the rebate, we assume that fraudster 0 regularly pays direct and indirect taxes, but as a member of the criminal network organising the carousel, he may be fined for the rebate obtained on his purchasing costs with a fine which is D times the rebate. This occurs only if he is found to be aware of belonging to the carousel-network. Fraudster 1, importer from country C, after transformation, sells the goods purchased tax free in country B to fraudster 2, who exports them from country B to country A. Fraudster 1 draws invoices to fraudster 2 charging VAT (thus allowing fraudster 2 to claim a VAT rebate) and then disappears, pocketing the charged VAT and also gaining from direct tax evasion. Fraudster 2, in turn, buys fraudster 1's goods paying VAT because he further exports the goods and gets the VAT rebate on the purchasing invoices. In order to get the rebate, fraudster 2, like fraudster 0, is assumed to regularly pay income tax. Fraudster 3, who is importing the goods back into country A, purchasing them tax free from fraudster 2, in principle might repeat the fraud, thus beginning another round of the carousel. For sake of simplicity, we assume that fraudster 3 is the last player of the carousel and sells the goods to the final consumers at *the price P_3 taken as given.*

To compute the Nash solutions determining the prices for each couple of fraudsters within the carousel, we have to know the outcome of the bargaining which takes place between any two agents in the chain. We shall assume that, given the consumers' demand for the goods, taken as given at price P_3 by fraudster 3, each pair of fraudsters bargains on the unit purchasing price, all the way to fraudster 0, in the country of origin, who is assumed to find the goods at a purchasing price equal to L0 times his sale price. We assume that all taxpayers are both risk neutral and ethically neutral to tax fraud. As in Allingham and Sandmo (1972), we assume that tax misreporting requires little time and effort. We assume also that direct taxation on registered traders is levied at a constant average rate equal for all taxpayers in all countries. The registered traders have, as their only form of income, the income from their activities. Their direct tax base is determined by the difference between their receipts as stated on the invoices and their production costs (excluding investments, which, however, are not modelled here). We assume that direct taxation is accompanied by indirect taxation on domestic consumption. Imports are subject to a consumption type-VAT according to the country of destination principle,[5] which means that exports are tax-free and the exporter obtains a refund of the VAT paid for his purchases. VAT may be levied at different rates depending on the nature of the goods and on the distributive aims of the governments. When VAT is levied on consumption, at each stage of the chain of exchanges within the same country the reported value added is taxed and each trader is expected to pay his supplier the VAT due on the reported purchases, with the importer self invoicing his purchases and paying the due amount to his own tax authority. At the end of each fiscal period (month, quarter, or year), each honest registered trader

[5] The imports not directly sold to a consumer are taxed as domestic goods when they cross the border with a mechanism of self-invoicing by the importer.

who has collected VAT from his customers transfers to the tax authority the difference between the VAT collected on sales and the VAT paid on purchases, as stated on the invoices. In this form, the VAT base is given by the difference between VAT on sales and VAT on purchases of goods (excluding investment). In what follows, we shall maintain the following assumptions and notation:

π indicates the probability of tax control by tax authorities, assumed to be the same in all the countries involved and, thus, for all traders;

ϑ_i, i=0, 1 ,..3, are the average VAT rates on exchanges;

$D > \vartheta_i$ is the fine for VAT evasion to be applied to the sum of VAT evaded on sales and VAT evaded on purchases;

t is the average direct tax rate, inclusive of social security contributions;

$F > t$ is the fine for income tax evasion to be applied to the evaded income tax base.

π, F, D and t are assumed to be the same in all countries. This assumption does not change the essence of the problem.

We denote with *MO* the expected payoff of fraudster 0 entering the carousel.

$$MO = \underbrace{(1-\pi)}_{\substack{probability\ of\ not\ being\\ controlled\ by\ tax\ authority}} Q\underbrace{[P_0 - P_0L_0 - t(P_0 - P_0L_0)]}_{\text{unit gain from entering the carousel}} + \underbrace{\pi}_{\substack{probability\\ of\ being\\ controlled\\ by\ tax\ authority}} Q\left[\underbrace{[P_0 - P_0L_0 - t(P_0 - P_0L_0)]}_{\text{unit gain from entering the carousel}} - \underbrace{D(\vartheta_0 L_0 P_0)}_{\substack{\text{fine for undue VAT}\\ \text{rebate obtained}}}\right] \quad (1)$$

where the VAT does not appear in the equation (1) because VAT paid on purchases is fully refunded to fraudster 0 by the tax authority given that fraudster 0 exports the goods purchased. P_0 is the unit price to be bargained between fraudster 0 and his purchaser, fraudster 1, and the unit gains from entering the carousel are given by the difference between the unit sales prices and production costs net of income tax. Moreover, in case the fraud is fully discovered a fine for the undue VAT rebate is paid. Fraudster 0's individual rationality constraint requires $M0 > 0$, e.g., $P_0[(1-t)(1-L_0) - \pi D L_0 \vartheta_0] > 0$.

By analogous reasoning, we denote with *M1* the expected payoff of fraudster 1 entering the carousel.

$$M1 = \underbrace{(1-\pi)}_{\substack{probability\ of\ not\ being\\ controlled\ by\ tax\ authorities}} Q\left[\underbrace{\underbrace{P_1}_{\substack{sale\\ price}} + \underbrace{\vartheta_1 P_1}_{\substack{VAT\ charged\\ and\ kept}} - \underbrace{L_1 P_0}_{\text{purchasing cost}}}_{\text{unit gain from black transactions}}\right] + \quad (2)$$

$$+ \underbrace{\pi}_{\substack{probability\ of\\ being\ controlled\\ by\ tax\ authorities}} Q\left[\underbrace{\underbrace{P_1}_{\substack{sale\\ price}} + \underbrace{\vartheta_1 P_1}_{\substack{VAT\ charged\\ and\ kept}} - \underbrace{L_1 P_0}_{\text{purchasing cost}}}_{\text{unit gain from black transactions}} - \underbrace{Ft((1+\vartheta_1)P_1 - L_1P_0)}_{\text{Fine for direct tax evaded}} - \underbrace{D(\vartheta_0 P_0 + (1+\vartheta_1)\vartheta_1 P_1)}_{\substack{fine\ \text{for VAT evasion}}}\right]$$

Here fraudster 1 plays as a missing trader, importing and selling with regular invoices, charging VAT to fraudster 2, and then disappearing. Therefore, if discovered he is assumed to be fined for

both direct and indirect tax evasion. Fraudster 1's individual rationality constraint requires that $M1>0$, e.g. $P_1(1+\vartheta_1)(1-\pi Ft-\pi D)-P_0[L_1(1-\pi Ft)+\pi D\vartheta_0]>0$.

We now consider fraudster 2's expected payoff from the carousel. Fraudster 2 is expected to export the goods to country A in order to get the rebate of the VAT paid against a presumed true invoice. For this reason he is assumed to regularly pay income tax. Only if discovered as belonging to the carousel he pays the fine for the undue rebate.

Fraudster 2's expected payoff is

$$M2=\underbrace{(1-\pi)}_{\substack{\text{probability of}\\ \text{not being controlled}\\ \text{by tax authority}}}\ Q\underbrace{\left[P_2-L_2P_1-t(P_2-L_2P_1)\right]}_{\text{unit gain from entering the carousel}}+\underbrace{\pi}_{\substack{\text{probability}\\ \text{of being}\\ \text{controlled}\\ \text{by tax authority}}}\ Q\left[\underbrace{\left[P_2-L_2P_1-t(P_2-L_2P_1)\right]}_{\text{unit gain from entering the carousel}}-\underbrace{D(\vartheta_1P_1)}_{\substack{\text{fine for undue VAT}\\ \text{rebate obtained}}}\right] \quad (3)$$

where VAT on purchases paid to fraudster 1 is fully refunded by the tax authority given that fraudster 2 exports the goods purchased; therefore VAT does not appear into equation (3). P_2 is the unit price to be bargained between fraudster 2 and his purchaser at the subsequent stage in country A. Fraudster 2's individual rationality constraint requires $M2>0$, e.g., $P_2(1-t)-P_1(L_2-tL_2+\pi D\vartheta_1)>0$.

As already mentioned, we assume that fraudster 3, who purchases the goods from fraudster 2, resells the them in country A at the final stage at the price P_3, taken as given. We assume that fraudster 3 charges VAT without remitting it to the Treasury, also evading income tax, at least for the traded carousel goods. Fraudster 3 is assumed to have an expected payoff equal to

$$M3=\underbrace{(1-\pi)}_{\substack{\text{probability of}\\ \text{not being}\\ \text{controlled}\\ \text{by tax authority}}}\ Q\underbrace{\left[(1+\vartheta_3)P_3-L_3P_2\right]}_{\substack{\text{unit gain from black}\\ \text{transactions}}}+\underbrace{\pi}_{\substack{\text{probability of}\\ \text{being controlled}\\ \text{by tax aquthority}}}\ Q\left[\underbrace{(1+\vartheta_3)P_3-L_3P_2}_{\substack{\text{unit gain from black}\\ \text{transactions}}}-Ft\underbrace{((1+\vartheta_3)P_3-L_3P_2)}_{\substack{\text{Fine for direct tax evasion}}}-\underbrace{D(\vartheta_3(1+\vartheta_3)P_3+\vartheta_2P_2)}_{\substack{\text{fine for VAT evasion}}}\right] \quad (4)$$

where the unit gains for fraudster 3, as for fraudster 1, include the VAT paid on his sales, which he pockets. Fraudster 3's individual rationality constraint requires $M3>0$, that is
$P_3(1+\vartheta_3)(1-\pi Ft-\pi D\vartheta_3)-P_2(L_3-\pi FtL_3+\pi D\vartheta_2)>0.$

Recall that the carousel, in this hypothesis, is organized by the participants in the criminal network with the purpose of capturing a share of the market for the goods at price P_3. Thus, the carousel begins with fraudster 3, who bargains the purchasing price with fraudster 2, who, in turn, bargains his purchasing price with fraudster 1. Fraudster 1 bargains the purchasing price with fraudster 0.

We solve the game by backward induction, beginning with the bargain between fraudster 0 and fraudster 1. They choose the price P_0 which maximises the product of their expected payoffs (1) and (2), that is

$$\underset{P_0}{Max}(MO)\times(M1) \quad (5)$$

Fraudster 1 and fraudster 2 choose the price P_1 which maximises the product of their expected payoffs (2) and (3), that is

$$\underset{P_1}{Max}(M1)\times(M2) \quad (6)$$

Finally, we find the Nash bargaining solution between fraudster 2 and fraudster 3, that is

$$\underset{P_2}{Max}(M2)\times(M3) \quad (7)$$

In order to simplify notations, we shall assume that $L_i = L > 0$ for all traders i=1,2,3, whereas L_0<1 for fraudster 0, who is assumed to simply export raw goods purchased at a share L_0 of his selling price. By differentiating (5) with respect to P_0[6] and solving for P_0

$$\hat{P}_0 = \frac{P_1(1+\vartheta_1)(1-\pi D-\pi Ft)}{2(\pi D\vartheta_0 - \pi FtL + L)} \qquad (8)$$

By substituting back (8) into (6) and maximising with respect to P_1 we get[7]

$$\hat{P}_1 = \frac{P_2(1-t)}{2[\pi D\vartheta_1 + L(1-t)]} \qquad (9)$$

By substituting back (9) into (7) and maximising with respect to P_2 we get[8]

$$\hat{P}_2 = \frac{P_3(1-\pi Ft-\pi D\vartheta_3)(1+\vartheta_3)}{2[L(1-\pi Ft)+\pi D\vartheta_2]} \qquad (10)$$

We now express the Nash bargain equilibrium prices at the two stages in terms of P_3 under the assumption that $\vartheta_o = \vartheta_1 = \vartheta_2 = \vartheta_3 = \vartheta$ we obtain

$$\hat{P}_0 = \frac{P_3(1+\vartheta)^2(1-\pi D\vartheta-\pi Ft)(1-t)(1-\pi D-\pi Ft)}{8[\pi D\vartheta + L(1-\pi Ft)]^2[\pi D\vartheta + L(1-t)]}, \quad \hat{P}_1 = \frac{P_3(1+\vartheta)(\pi D\vartheta - 1 + \pi Ft)(t-1)}{4[L(1-t)+\pi D\vartheta][L(1-\pi Ft)+\pi D\vartheta]}, \quad \hat{P}_2 = \frac{P_3(1+\vartheta)(1-\pi D\vartheta-\pi Ft)}{2[L(1-\pi Ft)+\pi D\vartheta]}$$

The reduced form equations for the expected payoffs from the Nash bargaining of each agent are

FRAUDSTER 0 : $$\overline{M0} = \overline{M1}\frac{[1-t-L_0(1-t+\pi D\vartheta)]}{[\pi D\vartheta + L(1-\pi Ft)]} \qquad (11)$$

FRAUDSTER 1 : $$\overline{M1} = \overline{M2}\frac{(1+\vartheta)(1-\pi Ft-\pi D)}{2[\pi D\vartheta + L(1-t)]} \qquad (12)$$

FRAUDSTER 2: $$\overline{M2} = \overline{M3}\frac{(1-t)}{2[L(1-\pi Ft)+\pi D\vartheta)} \qquad (13)$$

FRAUDSTER 3: $$\overline{M3} = \frac{P_3Q(1+\vartheta)(1-\pi D\vartheta-\pi Ft)}{2} \qquad (14)$$

Notice that the gains for the fraudsters depend not only on the gains from the illicit rebates on VAT obtained by the carousel and on the tax evasion in the black chain of the transactions, but also on the size of the net revenue at the consumer stage for the considered good obtained through the share of market gained, i.e. QP_3.

3. Policy Implications

We now consider how the instruments available to tax authorities can affect the payoffs of the fraudsters. With this purpose we differentiate equations (11) to (14) with respect to the parameters under the control of the tax authority, i.e., ϑ, t, π, D and F. The direction of the effects is reported in table 1.

[6] With S.O.C. for a maximum requiring: $[(1-L_0)(1-t)-\pi D\vartheta_0 L_0][\pi(D\vartheta_0 - FtL)+L] < 0$.

[7] With S.O.C. for a maximum requiring: $(\pi Ft + \pi D - 1)[L(1-t)+\pi D\vartheta_1] < 0$.

[8] With S.O.C. for a maximum requiring: $(1-t)\ (\pi FtL - L - \pi D\vartheta_2) < 0$.

Table 1. Effects on the fraudsters' expected payoffs due to changes to the parameters under the control of tax authorities

	$\overline{M3}$	$\overline{M2}$	$\overline{M1}$	$\overline{M0}$
$\frac{\partial}{\partial\theta}$	$sign(1-\pi(Ft+D+2D\vartheta))$	*ambiguous*	*ambiguous*	*ambiguous*
$\frac{\partial}{\partial t}$	< 0	*ambiguous*	*ambiguous*	*ambiguous*
$\frac{\partial}{\partial\pi}$	< 0	< 0 if $FtL > D\vartheta$	*ambiguous*	*ambiguous*
$\frac{\partial}{\partial D}$	< 0	< 0	*ambiguous*	*ambiguous*
$\frac{\partial}{\partial F}$	< 0	< 0	*ambiguous*	*ambiguous*

It turns out that, with the exception of those two fraudsters closest to the destination country (i.e. fraudster 3 and fraudster 2), the policy instruments available to the tax authority have ambiguous effects on the payoffs of the fraudsters closer to the origin of the productive chain. As for the latter fraudsters we shall consider below such effects with numerical examples.

Consider now fraudster 3, i.e. the one closest to the final stage (destination). Although it can happen that after him and before the final consumer there might be multiple buffer companies which might be wholly unaware of the fraud, as well as bogus traders set up to generate regular invoices before the good reaches the consumers,[9] Fraudster 3 is the one more clearly affected by the policy instruments available to the tax authority. It turns out that Fraudster3's payoff, $\overline{M3}$, is reduced by increases $t,\ \pi,\ D$ and F. An apparently counterintuitive result is given by the effect of a change in income tax rate, whose increase determines a reduction of the expected payoff for fraudster 3. However, fraudster 3 is one of those along the chain who fully evade income tax, therefore his payoff is only affected if he is discovered, in which case, the effect of t would be in the same direction of the fine for income tax evasion, F, which applies to the evaded income tax (i.e., the product of t and the evaded tax basis). The effect of the VAT rate, ϑ, is ambiguous because fraudster 3 on the one side pockets the VAT received on his sales and, on the other side, he is fined, if discovered, for the VAT evaded. It turns out that for very high penalties for tax evasion and very high probability of control, $(1-\pi(Ft+D+2D\vartheta)$ <0, the increase of the VAT rate reduces fraudster 3's expected payoff for the fraud.

As for fraudster 2's payoff, $\overline{M2}$ is reduced by increases, of fines and probability of control - $\pi,\ D$ and F. Recall that fraudster 2 is fully paying all taxes in order to get the VAT rebate, and he is fined only if discovered to belong to the criminal network and charged with a fine for the undue rebate. Therefore, the fine for income tax evasion, F, affects his payoff indirectly, through the effect on fraudster 3's payoff. The effects of both income tax and VAT rates are ambiguous.

Notice here that increasing fines and tax control at those stages closer to final consumption (i.e., in the destination country) seems to be the most effective practice to combat this type of tax evasion. Moreover, the fine F for income tax evasion seems particularly effective in the carousel

[9] Buffer and bogus companies can add no value. These companies are used with the purpose of making it impossible to cross check the issuing of invoices (Keen 2007).

chain also for the indirect effect it determines on the payoffs of those fraudsters that actually do not evade income tax, as in the case of fraudster 2.

In order to appreciate the effects of the carousel, we offer some numerical examples, assuming that the final price allowing the gain of a share of the market is $P_3 = 100$. Table 2 reports the effects of the carousel on the equilibrium unit prices P_j (j=0,1,2) and the equilibrium unit earnings of each fraudster M_i (i=0,1,2,3) for (nine) different cases with respect to direct tax and VAT rates as well as for fines and probability of control. Notice that, in all cases, we have kept a low probability of tax control (either 2% or 5%), together with high fees for both direct and indirect tax evasion (from 10 to 20 times the evaded tax), which seems to be the actual case in Europe. The VAT rate at each stage is assumed to be either 20% or 10%. The burden of direct taxes is assumed to be either 30% or 45% of the taxable bases. Notice also that the carousel is satisfied for different values of $L_0 <1$ (in table 1 we keep $L_0 =0.8$) and also for quite high values of $L_i >1$ (in table 1 we assume $L_i =5$ for all i). In any case, with the parameters mentioned above, fraudster 3 is in the position of getting the greatest gains from the carousel.

The payoffs of the other players vary depending on various parameters. It turns out that, for example, case 6 is the one providing the highest payoff for each fraudster, whereas case 8 allows the lowest payoff. Case 6 is the one with the lowest probability of control (2%) and the lowest fines for income tax and VAT evasion (*D*=10 and *F*=10), whereas case 8 has the highest probability of control (5%) joint with a high fine for income tax evasion (*F*=20), although the fine for VAT evasion (*D*=10) is quite low.

Table 2 also presents – with respect to the equilibrium prices in the various cases – the amount of income tax and VAT evaded by each fraudster and the total amount of evasion. Notice here that the amount of VAT evaded by each fraudster is almost the same in the various cases, basically depending on the VAT rate applied (either 10% or 20%). The income tax evaded varies for each fraudster in the various cases, being affected by t, but also by L.

In the next few figures (2 to 5) for each fraudster we compare the expected payoff with his amount of evasion as resulting from table 2. Recall that fraudster 0 and fraudster 2 only evade VAT, by means of illicit rebate, whereas fraudster 1 and fraudster 3 evade both income tax and VAT.

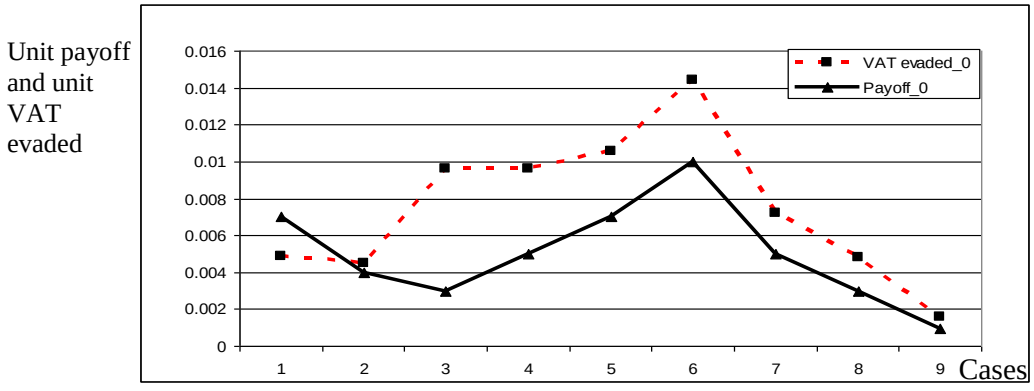

Figure 2. FRAUDSTER 0 (expected payoff and VAT evaded)

Table 2. Examples of carousel

		CASE 1 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 2\%$ $D = 20$ $\vartheta = 10\%$ $F = 20$ $L_0 = 80\%$ $L = 5$ $t = 30\%$	CASE 2 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 2\%$ $D = 20$ $\vartheta = 10\%$ $F = 20$ $L_0 = 80\%$ $L = 5$ $t = 45\%$	CASE 3 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 2\%$ $D = 20$ $\vartheta = 20\%$ $F = 20$ $L_0 = 80\%$ $L = 5$ $t = 45\%$	CASE 4 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 2\%$ $D = 20$ $\vartheta = 20\%$ $F = 20$ $L_0 = 80\%$ $L = 5$ $t = 30\%$	CASE 5 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 2\%$ $D = 20$ $\vartheta = 20\%$ $F = 10$ $L_0 = 80\%$ $L = 5$ $t = 30\%$	CASE 6 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 2\%$ $D = 10$ $\vartheta = 20\%$ $F = 10$ $L_0 = 80\%$ $L = 5$ $t = 30\%$	CASE 7 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 5\%$ $D = 10$ $\vartheta = 20\%$ $F = 10$ $L_0 = 80\%$ $L = 5$ $t = 30\%$	CASE 8 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 5\%$ $D = 10$ $\vartheta = 20\%$ $F = 20$ $L_0 = 80\%$ $L = 5$ $t = 30\%$	CASE 9 Equilibrium prices (net of VAT), gains from tax evasion for fraudster $\pi = 5\%$ $D = 15$ $\vartheta = 20\%$ $F = 10$ $L_0 = 80\%$ $L = 5$ $t = 30\%$
Fraudster 0	**VAT evaded**	0.00488	0.00448	0.0096	0.0096	0.01056	0.0144	0.0072	0.0048	0.0016
	M0	0.007	0.004	0.003	0.005	0.007	0.01	0.005	0.003	0.00098
Fraudster 1	**Income Tax evaded**	0.24774	0.3789	0.4212	0.2844	0.2718	0.2466	0.2925	0.3114	0.3306
	VAT evaded	0.10698	0.1066	0.2352	0.2376	0.234	0.2364	0.231	0.2316	0.2284
	M1	0.27	0.23	0.26	0.3	0.31	0.43	0.19	0.1	0.05
Fraudster 2	**VAT evaded**	0.1028	0.102	0.206	0.208	0.206	0.212	0.2	0.198	0.192
	M2	3.64	2.8	2.9	3.75	3.65	3.75	3.58	3.52	3.44
Fraudster 3	**Income Tax evaded**	17.4	26.19	30.105	19.35	20.34	19.92	20.655	20.985	21.21
	VAT evaded	9.96	9.96	21.876	21.858	21.912	21.856	21.954	21.998	22.028
	M3	46.02	42.9	44.4	48	49.05	50.6	44	35.75	42.62
	Tot. income tax evaded	17.6477	26.569	30.5262	20.22	20.6118	20.1666	20.9475	21.2964	21.504
	Tot. VAT evaded	10.1746	10.17708	22.3268	22.3132	22.36256	22.3118	22.392	22.4324	22.45
Equilibrium Prices at various stages	**P0L**	0.049	0.046	0.05	0.05	0.051	0.073	0.036	0.02	0.0098
	P0	0.061	0.056	0.06	0.06	0.066	0.09	0.045	0.03	0.01
	P1	1.028	1.02	1.03	1.04	1.03	1.06	1	0.99	0.96
	P2	10.42	10.36	10.62	10.71	10.44	10.72	10.23	10.1	9.86
	FINAL P	100	100	100	100	100	100	100	100	100

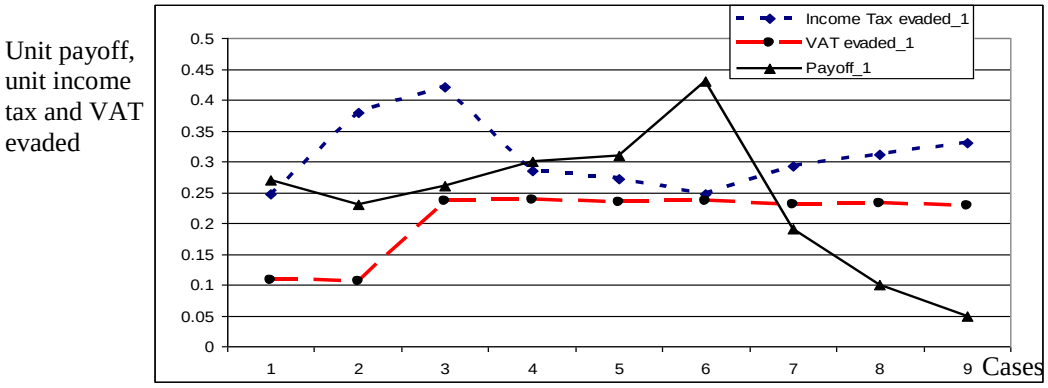

Figure 3. FRAUDSTER 1 (expected payoff, income tax and VAT evaded)

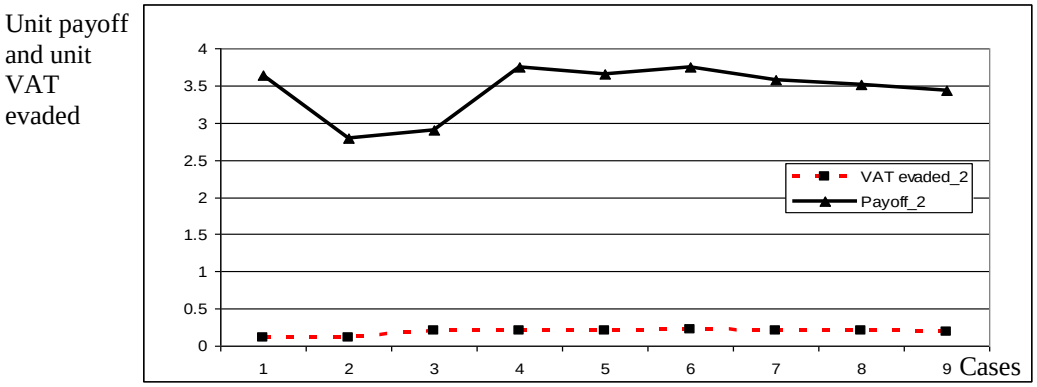

Figure 4. FRAUDSTER 2 (expected payoff and VAT evaded)

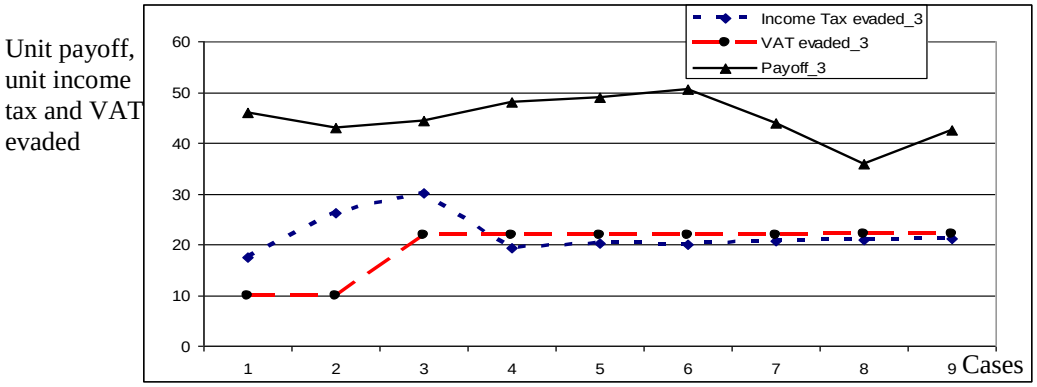

Figure 5. FRAUDSTER 3 (expected payoff, income tax and VAT evaded)

Beginning with the stage closest to the destination, in all nine cases considered fraudster 3's payoff is much higher than the VAT and income tax that he evades. The difference is reduced in case 8 - i.e. for high probability of control ($\pi = 5\%$), high fine for income tax evasion ($F = 20$) and almost standard VAT and income tax rates ($\vartheta = 20\%,\ t = 30\%$) - where he gets the minimum payoff. The difference is maximum in case 1, i.e. for lower probability of control, high fine for income tax and VAT evasion ($\pi = 2\%,\ F = 20,\ D = 20$) and lower VAT rates ($\vartheta = 10\%$). The maximum payoff is overall obtained in case 6, i.e. for low probability of control and low fines for income tax and VAT evasion ($\pi = 2\%,\ F = 10,\ D = 10$).

Additionally, fraudster 2's payoff is always higher than the VAT evaded – recall that he does not evade income tax. His maximum payoff is again in case 6 and the minimum is in case 2, i.e. for low probability of control, high fines for income tax and VAT evasion ($\pi = 2\%,\ F = 20,\ D = 20$), but low VAT rates ($\vartheta = 10\%$). The reason is that fraudster 2 mainly gains from the illegal rebate and does not evade income tax. Therefore, VAT mainly affects his expected payoff, which is in turn affected indirectly by the other parameters, through their effects on fraudster 3.

Fraudsters 1 and 0 are those whose amount of tax evasion can be much lower than their expected payoff, actually they serve to increase the gains of those players closest to the destination. In particular, fraudster 1 shows the minimum payoff in case 9, where he presents a quite high level of income tax and VAT evasions, which, as mentioned above, is likely to prove advantageous for the other players in the chain. His maximum payoff is in case 6. Fraudster 0 has the maximum payoff in case 6 and in case 1 his payoff is higher than the VAT evaded. In all the other cases considered, his evasion is higher than his expected gains, which means that the former goes to advantage of the other players.

Table 3. Percentage of revenues lost over the total amount of tax evasion due to the carousel in the countries involved

Percentage of Tot. evasion	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9
VAT evaded in country of origin C	0.02%	0.01%	0.02%	0.02%	0.02%	0.03%	0.02%	0.01%	0.004%
Income Tax evaded in production country B	0.89%	1.03%	0.80%	0.67%	0.63%	0.58%	0.67%	0.71%	0.75%
Total VAT evaded in production country B	0.75%	0.57%	0.83%	1.05%	1.02%	1.06%	0.99%	0.98%	0.96%
Total tax evasion in production country B	1.64%	1.60%	1.63%	1.72%	1.66%	1.64%	1.67%	1.69%	1.71%
Income Tax evaded in destination country A	62.54%	71.27%	56.96%	45.49%	47.33%	46.89%	47.66%	47.99%	48.25%
VAT evaded in destination country A	35.80%	27.10%	41.39%	51.39%	50.99%	51.45%	50.66%	50.31%	50.12%
Total tax evaded in destination country A	98.34%	98.38%	98.35%	96.88%	98.32%	98.35%	98.31%	98.29%	98.37%
Tot. income tax evaded	**63.43%**	**72.30%**	**57.76%**	**47.54%**	**47.96%**	**47.47%**	**48.33%**	**48.70%**	**48.92%**
Tot. VAT evaded	**36.57%**	**27.70%**	**42.24%**	**52.46%**	**52.04%**	**52.53%**	**51.67%**	**51.30%**	**51.08%**
Total tax evaded	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Table 3 reports, for the 9 cases analysed in table 2, the percentage of revenues lost over the total amount of tax evasion due to the carousel in the countries involved. It emerges that, in all the considered cases, the highest percentage of evasion is at the destination stage (from about 96.88% to about 98.38% of the total tax evasion due to the carousel), whereas at the origin the amount of evasion is a very low share of the total tax evasion due to the carousel. Depending on the tax rate and expected penalties, the overall shares of VAT evasion and direct tax evasions go from, respectively, 27.7% and 72.3% to about 49% and 51%. The former is the case where the VAT rate is kept at 10%, but the direct tax rate is fixed at 45% and the probability of a tax audit is 2%; the latter is the case where the VAT rate is 20%, the direct tax rate is 30% level and the probability of a tax audit is 5%.

4. Conclusions

The abolition of border controls among the member states of the EU, with the creation of the "European single market", has made it easier for firms the delocalization of the production process. In this context, the possibility of exploiting the VAT mechanism has introduced a new kind of fraudulent competition, which has substituted that wiped out by the abolition of intra-community borders. The result has been a persisting and perhaps growing presence of an underground economy in the EU. The aspect of interests here relates to the capture of a market share (at a market price lower than that bearable by the firms that regularly pay taxes) for which the firms organize themselves into a criminal activity that other than likely sweating illegal (off-the-book) job, exploit the system of VAT rebates in the presence of international trade. In this respect the firms, organised in an international criminal network, bargain their own purchasing prices along the chain in order to maximize their advantage from tax evasion and black labour. We have shown how the carousel might work as a type of government subsidy both for firms, which gain from tax evasion and from productive factors' illegal exploitation, and for the final consumers, who gain from the access to the goods.

As for the effects of the carousel on prices, we have shown how low prices can be the result of a criminal organization which, exploiting the existing fiscal rules (among others, those currently in operation in Europe for VAT and income tax), is able to reverse the direction of the flow of tax revenue (from taxpayers to tax authorities), transforming it into a flow of illegal state subsidies to firms by allowing for a reduction in the price of the goods which are the object of the criminal organization's activities.

We have also explored how direct and indirect tax evasion in the presence of international trade affects the payoffs of the fraudsters participating, at the various stages, in the criminal operations. In particular, we have considered how the fraud gains are shared among the fraudsters demonstrating that the greatest payoff is obtained by the fraudster closer to the last stage, who leads the carousel because of his market power with his suppliers of productive factors. Typically, in the destination country, where the good which is the object of the carousel feeds a black economy trade and is sold at a reduced price to the consumers by fraudsters, we note an increased market share for that good and benefits for the consumers. The fiscal revenue losses are consequently highest for the destination country. Some benefits, although modest, are obtained by the firms in the countries of origin and transformation, who get the subsidy of the illegal rebate and exploit the tax savings due to direct and indirect tax evasion, thus, gaining a potential advantage in their exports and production.

As for the policy implications for tax authorities in terms of the effects of controls and of penalties for both indirect and direct taxation, we have shown that an increase of controls over tax evasion may significantly reduce the profitability of the criminal enterprise, and that the gains of the fraudsters are more sensible to the increase of penalties where the gains of the fraud include the side effects of evasion from income tax and other public burdens. The strategies adopted by the tax authorities in contrasting fraud for both VAT and direct taxation affect the payoff (and hence the incentive to commit the fraud) mostly in the destination country. Therefore this seems to be the stage to which tax administrations should apply most controls.

As for the welfare implications of the carousel for the various countries, what emerges is that it is true that consumers in the destination country may get a sizable increase of welfare from lower prices; these gains may exceed the loss of money by the government due to the illicit rebates; but they are accompanied by the welfare losses due to the distortion of competition between legal and illegal economy, as well as by other perverse effects deriving from the growing importance of the black economy.

References

[1] Allingham, M. G., & Sandmo, A. (1972), "Income tax evasion: A theoretical analysis", *Journal of Public Economics*, 1(3-4): 323-338.

[2] Bovenberg, L. (1994), "Destination- and Origin-Based Taxation under International Capital Mobility", *International Tax and Public Finance*, 1(3): 247-273.

[3] Basu, K., Bhattacharya, S., and Mishra, A. (1992), "Notes on bribery and the control of corruption", *Journal of Public Economics*, 48(3): 349-359.

[4] Cnossen, S. (1990), "Taxing value added: The OECD experience", *International VAT Monitor*, 5 (May): 2-16.

[5] Cnossen, S. (1994), "Administrative and compliance costs of the VAT: A review of evidence", *Tax Notes*, 63: 1609-1626.

[6] Cnossen, S. (1998), "Global trends and issues in value-added taxation", *International Tax and Public Finance*, 5 (3): 399-428.

[7] Cnossen, S. (2001), "Tax policy in the European Union: A review of issues and options", *Finanz Archiv*, 58 (4): 466-558.

[8] Commission of the European Communities (1996), *A common system of VAT: A programme for the single market*. COM 1996, 328 final.

[9] Fedeli, S. (2003), "The effects of the interaction between direct and indirect tax evasion: The cases VAT and RST", *Public Finance/Finances Publiques*, 53 (3-4): 385-418.

[10] Fedeli, S., and Forte, F. (1999), "Joint income-tax and VAT-chain evasion", *European Journal of Political Economy*, 15 (3): 391-415.

[11] Fedeli, S., and Forte, F. (2011a), "International VAT frauds: The carousel game", *Journal of Modern Accounting and Auditing*, 7 (3): 211-226.

[12] Fedeli, S., and Forte, F. (2011b), "EU VAT fraud", *European Journal of Law and Economics*, 31 (2): 143-166.

[13] Fedeli, S., and Forte, F. (2012), "A game theoretic approach to cross-border VAT evasion within EU member states and its relationship with the black economy", *Economic Analysis and Policy*, 42(2): 209-220.

[14] Forte F. (1990), *Iva, accise e grande mercato europeo*, Milano, Giuffrè

[15]Genser, B., and A. Haufler (1996), "Tax Competition, Tax Coordination and Tax Harmonization: The Effects of EMU," *Empirica*, 23 (1): 59–89.

[16] Hemming, R., and Kay, J. (1981), "The United Kingdom", In: H. J. Aaron (Ed.), *The value added tax: Lessons from Europe*. Washington: Brookings Institution.

[17] Keen, M. (2007), "VAT fraud and evasion: What do we know and what can be done", (IMF Working paper WP 07/31).

[18] Keen, M. (2006a), "VAT, tariffs and withholding: Tax design and the informal sector", Mimeo (Washington: International Monetary Fund).

[19] Keen, M. (2006b), "Is the VAT a money machine?", Mimeo (London: University of Warwick).

[20] Keen, M. (2001), "States' rights and the value added tax: How a VIVAT would work in the U.S.", *Proceedings of the National Tax Association*: 195-200.

[21] Keen, M. (2000a), "VIVAT, CVAT and all that: New forms of value-added tax for federal systems", *Canadian Tax Journal*, 48 (2): 409-424.

[22] Keen, M. (2000b), "Viva VIVAT!", *International Tax and Public Finance*, 7 (6): 741-751.

[23] Keen, M., and Lockwood, B. (2006), "The value added tax: Its causes and consequences", Mimeo (London: University of Warwick).

[24] Keen, M., and Mintz, J. (2004), "The optimal threshold for a value-added tax", *Journal of Public Economics*, 88(3-4): 559-576.

[25] Keen, M., and Smith, S. (1996), "The future of value-added tax in the European Union", *Economic Policy*, 11(23): 373-420.

[26] Lockwood B., D. de Meza and G. Myles (1995), "On the European Union VAT proposals: the superiority of origin over destination taxation", *Fiscal Studies*, Institute for Fiscal Studies, 16 (1): 1-17.

[27] Marrelli, M. (1984), "On indirect tax evasion", *Journal of Public Economics*, 25(1-2): 181-196.

[28] Marrelli, M., and Martina R. (1988), "Tax Evasion and Strategic Behavior of the Firms", *Journal of Public Economics*, 37(1): 55-69.

[29] Pashev, K.V.(2007), "Countering cross-border VAT fraud: the Bulgarian experience", *Journal of Financial Crime*, 14(4): 490 - 501.

[30] Sandmo, A. (2005), "The theory of tax evasion: A retrospective view", *National Tax Journal*, 58(4): 643-663.

[31] Tait, A. A. (1988), "Value Added Tax: International Practice and Problems", (Washington: International Monetary Fund).