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International commodity taxation in the presence of unemployment*

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Abstract

This paper analyses the effect of consumption taxes on unemployment in presence of wage rigidity and compares non-cooperative tax setting under the destination and origin principle of commodity taxation. We show that, in a two country economy, consumption taxes negatively affect domestic employment and cause an employment externality which is negative under the destination and positive under the origin principle. Whereas the non-cooperative tax rate is inefficiently high under both principles, we show that, when the level of rigid wages is high, the origin principle is superior to the destination principle from the viewpoint of employment as well as social welfare.

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1 Introduction

During the last two decades, there has been an ongoing debate on the choice of the principle for consumption taxation in the EU. The EU VAT after the 1993 reform still relies on a hybrid system that, roughly speaking, applies the origin principle to consumers transactions and the destination principle to firms transactions.[1] Policy makers claim that a complete switch to the origin principle would be necessary since the destination principle is becoming unsustainable in the EU due to increases in administrative costs, which make monitoring and tax collection difficult and hence, enhance the risk of tax fraud and erosion (Nam et al. [25]).

On the ground of this debate, existing studies on international commodity taxation (see Lockwood [22] and Haufler and Pflüger [14] for reviews) gave normative support to the destination principle in perfect competitive settings (e.g., Kanbur and Keen [16]; Mintz and Tulkens [24]). However, results are much less clear-cut in imperfect competitive settings. Keen and Lahiri [18] considered duopoly and showed that, when goods are homogeneous in consumption, non-cooperative taxation under the origin principle restores production efficiency and delivers the first best outcome. Lockwood [22] and Haufler and Pflüger [15] showed that the result obtained in Keen and Lahiri [18] does not hold in a monopolistically competitive setting with mobile firms. Behrens et al. [7] qualified some of the results of Haufler and Pflüger [15] and concluded that under the destination principle a tax increase always generates an outflow of firms while this is not always true under the origin principle.

This literature focuses on the impact of commodity taxes on the product market and disregards 'side effects' they may have on markets that are not meant to be directly affected. This paper wants to mind this gap and provides a theoretical investigation of the way commodity taxes interact with the labour market. More specifically, we claim that *consumption taxes have an 'unemployment impact' that is non-negligible when the labour market is imperfect competitive and identify the determinants of such effect under both destination and origin principle.*

Even though little attention has been paid thus far to the underpinnings of the relation between unemployment and taxation[2], an already vast empirical literature exists on this topic. Bean et al. [4] and Layard et al. [21] conclude that, in presence of wage rigidity due to high decentralised union power, taxes discourage labour demand. Those papers however claim that the total 'tax wedge'[3] (rather than the single tax items) affects unemployment.

[1] The difference between the two principles is that local production is taxed and imports exempted under the origin principle whereas local consumption is taxed and exports exempted under the destination principle.

[2] Ogawa et al. [26] already analysed the relationship existing between capital taxation and unemployment due to wage rigidities; Lockwood et al. [23] study the equivalence of destination and origin principle of commodity taxation when wages are fixed and check for the unemployment effects of a switch from destination to the origin when tax rates are fixed

[3] Difference between total labour costs borne by firms and the net real wage accruing to workers; it is the sum of labour, income and consumption taxes.

Moreover the few works that try to disentangle the employment effects of different kind of taxes reach controversial results. Daveri and Tabellini [12] claim that labour taxes are employment distortive as reduce the income of employed relatively to that of unemployed; consumption taxes, conversely, do not have employment effects as weigh in the same way on both labour and non labour income. A somehow opposite result is obtained by Fiorito and Padrini [13] who highlight a mechanism similar to the one we describe in this model finding a positive correlation between commodity taxes and unemployment rate.

In this model we consider an economy with two countries and two goods, which are differentiated in consumption and sold on a perfectly competitive market. Each good is produced in only one country under constant returns to scale using labour and capital. Consumption of both goods is allowed in each country *via* international trade at zero transport costs. The capital market is perfect competitive; the labor market is local and imperfect in the sense that there is unemployment due to minimum wage provision[4]. Governments choose the head tax and commodity tax rates to finance the public expenditure. In doing so, each government maximizes the weighted sum of the utilities of employed and unemployed individuals in its country.

The novelty of our analysis is that wage rigidity associates an additional *employment (e.g wage income) externality* to commodity taxation. Such externality takes opposite signs under the two principles. *Under the destination principle, a rise in the domestic tax rate has a negative impact over foreign employment and welfare. Under the origin principle a domestic tax rise boosts foreign employment and welfare.*

Non-cooperative tax policy leads to inefficiently high tax rates under either principle. Moreover we show that, when the level of the rigid wage is high, the origin principle is superior to the destination principle. In this case in fact, the positive wage income externality is strong enough to balance the negative consumer price externality and equilibrium tax rate under the origin principle gets closer to the optimal one. Accordingly, lower taxes imply that employment and welfare are higher under origin than under destination.

Our model is indeed very simple and does not pretend to be realistic in many respects. We abstract from public good provision[5] and from endogenous wage setting to focus on the relation between consumption taxes and labour market imperfections. However, we believe that our main results are robust to more complex and realistic modelisations.

The paper is structured as follows. Section 2 introduces the basic structure of the model and shows the existence of an employment externality of commodity taxes. Section 3 characterises the welfare properties of non-cooperative taxation under both principles. Section 4 compares the two principles regarding employment and welfare. Section 5 concludes.

[4]We consider minimum wage provision because they provide the simplest way to deal with wage rigidity and because existing studies pointed out they play a significant role in determining unemployment in EU countries. In fact, the most commonly shared view about EU unemployment takes an institutional perspective; see Brown [9], Bazen and Martin [3], Checchi and Lucifora [11], Bertola Blau and Kahn [2] for analyses of labour market institutions in Europe and of their role in explaining European unemployment.

[5]In Appendix B we carry on a natural experiment introducing endogenous public good provision.

2 The model

In order to describe unemployment due to minimum wage provision, we use a fixed-wage model *á la* Bhagwati [6] in which exogenously fixed wages lead to unemployment.

2.1 Consumption

Consider two symmetric countries, labeled H (home) and F (foreign).[6] Each country is endowed with a continuum of immobile workers/consumers of measure one. Workers obtain utility from consumption of three goods: X, Y and Z. X and Y are produced in H and F, respectively. They are freely traded and consumption of them is taxed. Z is the numeraire, which is assumed to be untaxed. Workers in this model are assumed to have an identical utility function of the quadratic form:[7]

$$U(X,Y,Z) = a(X+Y) - \frac{b-c}{2}(X^2+Y^2) - \frac{c}{2}(X+Y)^2 + Z, \tag{1}$$

where a, b, and c are positive constants satisfying $a > 0$ and $b > c$. Here, a represents the intensity of preference for X and Y whereas $b > c$ implies that consumers are biased toward a dispersed consumption of the two goods.

Because of a binding fixed wage in the economy workers can be either employed (e) or unemployed (u). The budget constraint of type h worker ($h = e, u$) in H is given by:

$$q_x X + q_y Y + Z = I_h, \tag{2}$$

where I_h, q_x and q_y are the total income and consumer prices of X and Y, respectively. We consider an ad valorem consumption tax that is levied according to either the destination principle (DP) or the origin principle (OP). DP and OP are equivalent when applied to 'intranational consumption' (*i.e.*, consumption of X in H and that of Y in F). Letting p_x and p_y denote the producer prices, we have

$$q_x = p_x(1+t_k), \qquad q_y^* = p_y(1+t_k^*),$$

where $k = d, o$ denotes destination and origin principle respectively, and t represents the commodity tax rate. DP and OP imply different taxation regimes for 'international consumption' (*i.e.* of X in F and of Y in H):

$$\begin{aligned} q_x^* &= p_x(1+t_d^*), \qquad q_y = p_y(1+t_d), \qquad \text{under } DP \\ q_x^* &= p_x(1+t_o), \qquad q_y = p_y(1+t_o^*), \qquad \text{under } OP. \end{aligned} \tag{3}$$

[6] In the remainder of the paper, all variables related to F are described by $*$.

[7] This type of utility function is often used in the literature of the New Economic Geography. See Ottaviano, Tabuchi and Thisse [27], and Picard and Zeng [28], for example.

Hereafter, since the two countries are symmetric in all respects, we focus on H. Results regarding F can be obtained analogously.

Workers maximize their utility (1) under the budget constraint (2). First-order conditions for the maximization give

$$\begin{aligned} X &= A - Bq_x + Cq_y, \\ Y &= A + Cq_x - Bq_y, \\ Z_h &= I_h - q_x X - q_y Y, \end{aligned} \tag{4}$$

where A, B, and C are defined as

$$A = \frac{a}{b+c}, \qquad B = \frac{b}{b^2 - c^2}, \qquad C = \frac{c}{b^2 - c^2}.$$

Under DP, demand in each country is affected only by the domestic tax rate whereas under OP, it is affected by both domestic and foreign tax rates.

Each worker (either employed or unemployed) in both countries is endowed with one unit of labor, some units of capital $\overline{K}$ and of the numeraire $\overline{Z}$[8]. We assume that the capital market is global and the two countries are small open regarding the capital market, *i.e.*, the capital price is exogenously determined. Without loss of generality, we normalize the capital price to one, implying that the capital income is also $\overline{K}$. Employed workers inelastically supply one unit of labour and obtain an exogenously fixed wage rate $\overline{w}$. Moreover, each worker is imposed the head tax h by the government.[9] To keep our our main focus on the relation between commodity taxation and unemployment, we disregard the possible inefficiency of public goods provision and assume that national governments tax consumption to make their residents better off. Total income of each worker is:

$$I_e = \overline{w} + \overline{K} + \overline{Z} - h_k, \qquad I_u = \overline{K} + \overline{Z} - h_k. \tag{5}$$

Notice that in order to involve only the effect of unemployment and abstract from the effect of fixed wage differentials, the level of the fixed wage is assumed to be the same in both countries.

2.2 Production

X and Y are produced in H and F, respectively, and their production functions take the identical Cobb-Douglas form:

$$x = K^{\alpha} L^{1-\alpha}, \qquad y = K^{\alpha} L^{1-\alpha},$$

[8] We assume that $\overline{Z}$ is large enough to guarantee the positive demand for the numeraire ($Z > 0$).

[9] Due to the assumption that the utility function is quasi-linear, our results do not change if we consider tax revenue partly accruing to unemployed individuals as unemployment benefits.

where α is a positive constant satisfying $0 < \alpha < 1$. K and L represent the capital and labor inputs, respectively[10].

In each country, there is a continuum of firms of mass 1. Each firm is assumed to be a price taker. Hence, a firm in H maximizes its profits Π with respect to L and K taking prices as given, where Π is given by

$$\Pi = p_x x - \overline{w}L - K.$$

The first-order conditions for the maximization are

$$\alpha p_x \left(\frac{L}{K}\right)^{1-\alpha} = 1, \qquad (1-\alpha) p_x \left(\frac{K}{L}\right)^{\alpha} = \overline{w}, \tag{6}$$

which fix the producer prices for X and Y at their unit costs:[11]

$$p_x = p_y = \frac{1}{\alpha}\left(\frac{\overline{w}\alpha}{1-\alpha}\right)^{1-\alpha} = p(\overline{w}). \tag{7}$$

This implies that higher level of $\overline{w}$ leads to higher labour costs and thus higher producer price.

2.3 Market equilibrium

For given tax rates, a market equilibrium is summarized by a tuple (L_H, L_F, K_H, K_F) determined by the firm's first-order conditions (6) in both countries and the product market clearing conditions:[12]

$$x = X + X^*, \qquad y = Y + Y^*. \tag{8}$$

Notice here that the population size in each country is normalized to one, implying that X_d and Y_d (X_d^* and Y_d^*) also represent the aggregate demands in H (F).

Substituting (7) into (6), we obtain firm's input requirements for a given level of output:

$$\begin{aligned} L &= (1-\alpha)\,\frac{p(\overline{w})}{\overline{w}}\,x, \qquad L^* = (1-\alpha)\,\frac{p(\overline{w})}{\overline{w}}\,y, \\ K &= \alpha\; p(\overline{w})\; x, \qquad K^* = \alpha\; p(\overline{w})\; y. \end{aligned} \tag{9}$$

[10] Notice that the presence of capital in the production function is absolutely irrelevant for our analysis; nevertheless we prefer to keep capital to improve comparability of our model with existing theoretical and empirical papers.

[11] From the first-order conditions for the cost minimization the unit cost is $(1/\alpha)\,[\overline{w}\alpha/(1-\alpha)]^{1-\alpha}$ for both X and Y. Notice that, as both factor prices are exogenous, producer prices are fixed. This allows us to avoid producer price spillovers. See also Haufler and Pflüger [15](footnote 14) and Lockwood [22].

[12] In fact, as the measure of a continuum of firms is one, aggregate supply is x (y) for good X (Y).

Substituting (3) and (7) into (4), we obtain workers demands for X, Y and Z in H under DP:

$$\begin{aligned} X_d = Y_d &= A - \frac{(1+t_d)\ p(\overline{w})}{b+c}, \\ Z_{h,d} &= I_h - p(\overline{w})(1+t_d)\left(X_d + Y_d\right). \end{aligned} \tag{10}$$

The demands X_d^*, Y_d^* and Z_d^* in F are obtained in the same way. Similarly, we obtain the demands under OP:

$$\begin{aligned} X_o &= A - B\ p(\overline{w})(1+t_o) + C\ p(\overline{w})(1+t_o^*), \\ Y_o &= A + C\ p(\overline{w})(1+t_o) - B\ p(\overline{w})(1+t_o^*), \\ Z_{h,o} &= I_h - p(\overline{w})\left[(1+t_o)X_o + (1+t_o^*)Y_o\right]. \end{aligned} \tag{11}$$

Again, X_o^*, Y_o^* and Z_o^* in F are obtained in the same way.

Substituting (8), (10) and (11) into (9), we obtain firms input requirements under DP and OP. Firms labour requirements are:[13]

$$\begin{aligned} L_d &= \frac{(1-\alpha)p(\overline{w})}{\overline{w}}\left[2A - \frac{p(\overline{w})(2+t_d+t_d^*)}{b+c}\right], \\ L_o &= \frac{2(1-\alpha)p(\overline{w})}{\overline{w}}\left[A - Bp(\overline{w})(1+t_o) + Cp(\overline{w})(1+t_o^*)\right]. \end{aligned} \tag{12}$$

In the remainder of the paper we analyze only the case in which the fixed wage is binding. For this condition to be met either b or c have to be sufficiently large. This condition implies that a household obtains utility less from dispersed consumption of X and Y, leading to smaller labor demands. Hence, the market clearing wage falls below the fixed wage and there is unemployment i.e. $0 < L_k < 1$ $k = d, o$ (see Appendix A).

Equation (12) shows that commodity taxation affects both domestic and foreign employment. An increase in commodity tax rate always (both under DP and OP) increases domestic consumer prices, which reduces the demand for domestic product. This lowers domestic labour demand and employment ($\partial L_k/\partial t_k < 0$, $k = d, o$).

Lemma 1 *Any tax set by a country has a negative impact on its domestic employment.*

Moreover, commodity taxation have opposite effects on foreign employment under DP and that under OP. We denote such effect as an *employment externality*. Under DP, an

[13] We do not need to write the capital requirements as we do not use them in the welfare analysis given the assumption of global capital market.

increase in the foreign tax rate t_d^* lowers country F's demand for good X, leading to a reduction in employment in country H ($\partial L_d/\partial t_d^* < 0$), *i.e.*, *under DP, commodity taxation has a negative employment externality.* In contrast, under OP, an increase in t_o^* shifts demand in H from Y toward X and increases production of X and employment in H ($\partial L_o/\partial t_o^* > 0$), *i.e.*, *under OP, commodity taxation has a positive employment externality.* Put differently, whereas commodity taxation under DP amplifies labour market distortions by exporting unemployment, it plays a corrective role under OP by exporting employment.

Summarizing these arguments, we have

Proposition 1 *Under the destination principle, commodity taxation has a negative employment externality, whereas under the origin principle, it has a positive employment externality.*

As existing studies have never dealt with the 'employment effects' of consumption taxes, the existence of an employment externality is new in the literature on international commodity taxation[14].

3 Welfare analysis of commodity taxation

Governments in both countries finance their expenditure using commodity and head taxes. Since we want to abstract from the effects of public goods provision, we exogeneously fix government expendiure at level G, which is assumed to be common to both countries. Governments tax consumption according to either the destination or the origin principle. Let h_k and T_k ($k = d, o$) denote the head tax rate and the tax base of commodity taxation, respectively. Government's budget constraint in H is given by

$$\begin{aligned} T_d &= p_x X_d + p_y Y_d, \\ T_o &= p_x \left(X_o + X_o^* \right), \\ G &= t_k T_k + h_k, \qquad k = d, o. \end{aligned} \tag{13}$$

[14]Notice that the nature of the externality is different between under OP and DP: under DP, the employment externality is a 'by-product' of the effect that foreign taxation has on foreign consumption decisions. This implies that under the DP, despite the employment externality, there cannot be any strategic interaction between governments. Under the OP, on the other hand, the externality modifies governments' strategic interaction; in fact, part of the externality is due to the *i.e.*, to the effect that foreign taxation has on domestic consumer prices.

Our results are fully consistent with those of other studies in perfect competitive markets. The general remark from this literature (Lockwood [22], Haufler and Pflüger [14] for reviews) is that under the DP no strategic interaction between governments exists as each country cannot influence consumption decisions in the other. This is no longer true under the OP as any tax increase changes the relative consumer prices in both countries triggering a consumer price externality.

When taxes are set non cooperatively, each government maximizes national welfare W_k, which is defined as the weighted sum of utilities:[15]

$$W_k = L_k U(X_k, Y_k, Z_{e,k}) + (1 - L_k) U(X_k, Y_k, Z_{u,k}). \tag{14}$$

Each government chooses its tax rates, taking the other government's tax rates as given and anticipating the resulting market equilibrium. Substituting (1), (10) (or (11)), (12), and (13) into (14), we obtain:

$$\begin{aligned} W_d &= [2a - (b+c)X_d]\, X_d + \overline{K} + t_d T_d + \overline{w} L_d - 2p(\overline{w})(1+t_d)X_d - G, \\ W_o &= -\frac{b(X_o^2 + Y_o^2)}{2} + a(X_o + Y_o) - cX_oY_o + \overline{K} + t_o T_o \\ &\quad + \overline{w} L_o - p(\overline{w})\left[(1+t_o)X_o + (1+t_o^*)Y_o\right] - G, \end{aligned} \tag{15}$$

in which derivation, we use the fact that $p_x = p_y = p(\overline{w})$.

3.1 Cooperative tax policy

Before turning to the non cooperative tax game, we derive the optimal cooperative tax rate as a benchmark. As countries are symmetric we derive the cooperative tax choice by maximizing the Benthamite social welfare function $(W_d + W_d^*)$. Here, we derive the cooperative tax rate under DP.[16] The first order conditions for the social welfare maximization are

$$\frac{\partial(W_d + W_d^*)}{\partial t_d} = \frac{\partial(W_d + W_d^*)}{\partial t_d^*} = 0.$$

Solving these yields the cooperative tax rate t_c as

$$t_c = -(1 - \alpha). \tag{16}$$

Proposition 2 *The cooperative tax rate is negative and its level is* $t_c = -(1-\alpha)$ *under both the destination and origin principles.*

[15] W_k can be interpreted also as the expected utility before the employment status of each worker is determined. Moreover if we rewrite (14) as $W_k = U(X_k, Y_k, Z_{u,k}) + \overline{w} L_k$, we may interpret it as the objective of a 'corporatist' government (Buti et al. [10]).

[16] It would make no difference to derive it under the OP as at the cooperative tax policy DP and OP are equivalent.

The optimal policy for governments is to subsidize consumption and finance public expenditure and consumption subsidies via the lump sum tax. Suboptimally high unemployment[17], makes it efficient to increase demands for consumption to boost demand for labour in the economy. With flexible wages and full employment in this framework, there would be no scope for taxation (see Appendix C). Other types of market imperfection generate a similar result. For example, Haufler and Pflüger [15] showed that under monopolistic competition in the product market, it is optimal to subsidize consumption.

Finally notice that, in order to ensure demands for X and Y under the cooperative tax rate to be nonnegative, we have to impose the fixed wage rate $\overline{w}$ to be lower than some threshold level $\overline{w}_{th} \equiv a^{1/(1-\alpha)}(1-\alpha)/\alpha$. From now on, in our analysis, we assume that the inequality $\overline{w} < \overline{w}_{th}$ holds.

3.2 Non cooperative taxation under the destination principle

In this section, we analyze non cooperative tax policy under DP. The central question here is how taxation by a government that maximizes the national welfare affects foreign country's welfare. We examine the effect of an increase in the foreign tax rate on domestic welfare, and evaluate this expression at the cooperative tax rate t_c. Notice here that in W_d, only L_d depends on t_d^*. From (15), we have

$$\left.\frac{\partial W_d}{\partial t_d^*}\right|_{t_d=t_d^*=t_c} = \overline{w}\left.\frac{\partial L_d}{\partial t_d^*}\right|_{t_d=t_d^*=t_c} = -\frac{(1-\alpha)p(\overline{w})^2}{b+c} < 0.$$

The above equation tells us that *non cooperative taxation under DP has a negative wage income externality*, which comes from the negative employment externality described in Proposition 1.

Solving the first-order conditions for the national welfare maximization ($\partial W_d/\partial t_d = 0$ and $\partial W_d^*/\partial t_d^* = 0$), we obtain the non cooperative tax rates under DP:

$$t_d = t_d^* = -\frac{1-\alpha}{2} < 0. \tag{17}$$

Comparing (17) with (16), we can see that countries set the subsidy rate at an inefficiently low level ($0 > t_d = t_d^* > t_c$).[18]

[17]The cooperative equilibrium in this framework is not Pareto-efficient as it is consistent with some involuntary unemployment. In fact, inefficiently high unit costs constrain firms production scale and labour requirements. This fact is captured by the term $(1-\alpha)\ p(\overline{w})/\overline{w}$ in (12).

[18]Notice that under the DP the condition $w < w_{th}$ is not enough to guarantee positive demands; we have to impose a more restrictive condition $w < (2\alpha/(1+\alpha))^{1/(1-\alpha)}w_{th}$. Moreover, we again assume that the market clearing wage is lower than the fixed wage (see Appendix A).

Proposition 3 *Non-cooperative taxation under the destination principle leads to subsidies for consumption. The subsidy rate is lower than the optimal level.*

At the non-cooperative equilibrium, each government subsidizes consumption; this in turn boosts aggregate demands and thus both foreign and domestic employment. However, each government does not recognize the effect in the foreign country, leading to inefficiently low consumption subsidies. Hence, harmonization for higher subsidy rate is welfare enhancing.

Proposition 3 makes sharp contrast with results under competitive labor markets (see Lockwood [22] (Proposition 1), and Haufler and Pflüger [14]). If we assume wage flexibility (thus the economy being at the full employment equilibrium), no net externality arises from commodity taxation under DP and the non-cooperative tax rate is set at the optimal level (See Appendix C).

The suboptimality of non-cooperative tax rate under the destination principle can be obtained in models with other types of market imperfection. Examples include Keen and Lahiri [18], Keen and Wildasin [20], Lockwood [22]. As already stressed, they focused on product market imperfection whereas we focus on labour market imperfection. Therefore, non-optimality of non-cooperative taxation under DP can be said to be a common feature of models with market imperfection.[19]

3.3 Non cooperative taxation under the origin principle

As we can see from (11), under OP, changes in the foreign tax rate affect the demand in H, thus creating a wider range of externalities than under DP. From (15), we obtain

$$\left.\frac{\partial W_o}{\partial t_o^*}\right|_{t_o=t_o^*=t_c} = \underbrace{(a-bX_o-cY_o)\frac{\partial X_o}{\partial t_o^*}+(a-bY_o-cX_o)\frac{\partial Y_o}{\partial t_o^*}}_{\text{effect on consumption of } X \text{ and } Y\ (<0)} \tag{18}$$

$$\underbrace{-p_x\left[(1+t_c)\left(\frac{\partial X_o}{\partial t_o^*}+\frac{\partial Y_o}{\partial t_o^*}\right)+Y_o\right]}_{\text{effect on expenditure on } X \text{ and } Y}$$

$$\underbrace{t_c\frac{\partial T_o}{\partial t_o^*}}_{\text{effect on public consumption } (<0)} + \underbrace{\overline{w}\frac{\partial L_o}{\partial t_o^*}}_{\text{effect on wage income } (>0)}$$

where all partial derivatives are evaluated at $t_o = t_o^* = t_c$.

The first two terms in (18) capture the *private consumption externality*. An increase in t_o^* makes Y relatively more expensive for residents in H, shifting demand from Y toward X.

[19] A relevant exception is Haufler and Pflüger [15]. They in fact show that DP delivers the first best in a setting with monopolistic competition and international firms' mobility.

This shift in consumption negatively affects individuals for two reasons; on one hand they prefer a balanced consumption of both goods (first term); on the other, total expenditure for X and Y increases if the demand is relatively inelastic (second term)[20]. The third term is the *public consumption externality*. Shifting demand toward consumption of X, a t_o^* rise increases T_o. As $t_c < 0$ the lump-sum taxes used to finance consumption subsidies increase; this has a negative impact on consumers welfare. The net effect of private and public consumption externality[21] is negative and is counteracted by a positive *wage income externality* (the fourth term in (18)):

$$\overline{w}\frac{\partial L_o}{\partial t_o^*}\bigg|_{t_o=t_o^*=t_c} = \overline{w}2C(1-\alpha)p(\overline{w})^2 > 0.$$

The wage income externality is a direct consequence of the employment externality described in Proposition 1 and gets stronger with $p(\overline{w})$: in fact at higher prices demand for consumption is more elastic to taxation and the employment effects of a tax increase are stronger.

Solving the first-order conditions for the national welfare maximization ($\partial W_o/\partial t_o = 0$ and $\partial W_o^*/\partial t_o^* = 0$), we obtain H's and F's reaction functions[22]. Combining them for the non cooperative tax rates obtain:

$$t_o = t_o^* = -1 + \frac{\alpha}{3b-c}\left[2b + (b-c)\left(\frac{a}{\alpha\ p(\overline{w})}\right)\right], \tag{19}$$

which is larger than t_c[23]. This leads to the following proposition:

Proposition 4 *Non-cooperative taxation under the origin principle leads to inefficiently high (low) consumption taxes (subsidies).*

Equation (19) is interesting as it shows that in our model the level of the fixed wage affects governments tax policies *via* the price level. When $\overline{w}$ is low, the wage income externality is relatively weaker than the consumer price externality. The chosen tax policy can be a consumption tax when $\overline{w}$ falls below some threshold. *i.e.*, $t_o^* \geq 0$ when $\overline{w} \leq \Gamma\overline{w}_{th}$ where $0 \leq \Gamma \equiv [\alpha(a-c)/(3a-c-2\alpha a)]^{1/(1-\alpha)} < 1$. However, when the fixed wage is

[20] This is true when it holds $p(\overline{w}) < b/2\alpha$.

[21] Private and public consumption spillover are already well known in the literature (see Mintz and Tulkens [24]). Lockwood [22] aggregates them in a *consumer price spillover* (see Lockwood [22], page 281). A t_o^* rise negatively affects consumers welfare as it increases the relative consumer price of Y with respect to X in country H.

[22] Differently from the DP, under the OP there is strategic interaction between governments; in fact demands in each country depend on both domestic and foreign tax rates. For this reason differently from t_d and t_c t_o is proportionate to the wage distortion. Notice moreover that $t_o(t_o^*)$ is an increasing function so that taxes are strategic complements.

[23] Since $p(\overline{w}) < a/\alpha$ holds under the assumption $\overline{w} < \overline{w}_{th}$.

sufficiently high (*i.e.* $\overline{w} \geq \Gamma \overline{w}_{th}$) the wage income externality gets relatively stronger than the consumer price externality and the optimal tax policy becomes a subsidy. However, as $\overline{w} < \overline{w}_{th}$, it is always $t_o^* > t_c$ and harmonization for a lower tax rate (for a higher subsidy rate) is welfare enhancing.[24]

4 Effects of commodity taxation on unemployment and welfare

The typical feature of our model is the presence of a fixed wage that generates unemployment. Now it is worth to analyse the impact commodity taxes under DP and OP have on employment. From (17) and (19) we have

$$t_d > t_o \quad \Leftrightarrow \quad \overline{w} > \Omega \overline{w}_{th}, \tag{20}$$

where $\Omega = \{2\alpha(b-c)/\left[3b - c - \alpha(b+c)\right]\}^{1/(1-\alpha)} < 1$. When the level of the fixed wage in the economy is sufficiently high (*i.e.* the wage income externality is strong), the non cooperative tax policy ensures the lower tax rate (higher subsidy rate) under OP than under DP. In a non-cooperative equilibrium, the tax rate is the same in two countries under either DP or OP. Hence, (12) implies that

$$L_d < L_o \quad \Leftrightarrow \quad 1 - L_d > 1 - L_o \quad \Leftrightarrow \quad t_d > t_o. \tag{21}$$

As the unemployment rate is $1 - L$, we can summarize these results in the following proposition:

Proposition 5 *The unemployment rate is higher (lower) under the destination principle than under the origin principle if the fixed wage is high (low).*

Notice that we focus on the case in which the fixed wage is binding. If this is not the case, our model becomes a standard perfect competitive model of commodity taxation. In those models, the OP leads to a higher non-cooperative tax rate than the DP when lump-sum taxes are available (Lockwood [22]: Propositions 1 and 2, and Haufler and Pflüger [14]: Proposition 1.)[25]. Hence, when wage is flexible, OP leads to lower labor demand and a lower wage than does DP. Then, the fixed wage is more likely to be binding under OP than under DP implying that OP is more likely to produce unemployment than DP. In contrast, Proposition 5 states that, when unemployment is already present in the economy, the unemployment rate can be higher under DP (OP) when the fixed wage is high (low).

[24] With other kinds of market imperfetions, harmonization may or may not be welfare improving depending on principles of taxation. See Keen et. al. [19].

[25] See Appendix C for a brief discussion of the benchmark case of competitive wage described by Lockwood [22] and Haufler and Pflüger [14].

Caution of course is needed in emphasizing the relation between consumption taxes and unemployment. Our oversimplified frawework just allows us to note that consumption taxes have interesting 'side effects' on unemployment in the spirit of Layard et al. [21] and that such effects may differ in size under DP and OP. Appendix B gives a numerical example that shows that changes in the unemployment rate due to a change in principle could be quantitatively significant.

Finally, differences in unemployment under DP and OP reflect analogous differences in welfare. At the non-cooperative equilibrium, the tax rate is the same in the two countries under either DP or OP. Furthermore, the welfare level depends on the tax rate in a way that

$$W_d < W_o \quad \Leftrightarrow \quad (t_d + 1 - \alpha)^2 > (t_o + 1 - \alpha)^2 \quad \Leftrightarrow \quad t_d > t_o. \tag{22}$$

Equations (20) and (22) imply the following proposition:

Proposition 6 *The welfare is higher (lower) under the origin principle than under the destination principle if the fixed wage is high (low).*

Thus, in presence of high unemployment, our analysis gives support to the origin principle from a welfare viewpoint. This result qualifies those obtained in perfect competitive product markets (Mintz Tulkens [24]; Lockwood [22]): when there is a fixed wage (high enough) in the economy, non cooperative tax policy under the origin principle is more efficient than under the destination principle even in absence of firms market power.

5 Concluding remarks

This paper investigated the connection between commodity taxation and unemployment by constructing a commodity taxation model with wage rigidity. Our analysis confirms that consumption taxes under either principle have a negative employment impact. Moreover we found out an employment externality attached to non cooperative taxation that takes opposite signs under destination and origin principle. Non-cooperative tax rates under both destination and origin principles are shown to be inefficiently high, implying that harmonization for lower (higher) tax (subsidy) rate is welfare enhancing. However we argued that switching the choice of tax regime affects the equilibrium unemployment rate and welfare, depending on the level of rigid wages.

We draw some policy implications for the EU agenda. First of all, on the ground of the conclusions of Daveri and Tabellini [12], there is a widespread belief that shifting the tax burden from direct to indirect taxation may reduce employment distortions in the EU. As a matter of fact, many European countries during the nineties have gradually shifted the tax burden away from direct to indirect taxation (e.g. Netherlands, Spain, UK). We

suggest that this might not be the right policy to pursue as employment distortions are attached to indirect taxation as well.

Our results give also some advices concerning the design process of the new VAT in the EU. In an area characterized by widespread wage rigidity such as the European Union, sticking to a destination based VAT can be costly not only in terms of higher administrative costs and lower tax compliance but also in terms of higher unemployment and lower welfare. As a corollary, if European national authorities want to stuck to the destination principle, they should encourage policies aimed to recover wage flexibility.

Our model is very simple and can be extended to many directions. Introducing firms market power and some mechanisms of wage bargaining with unions would increase the realism of our model and the degree of comparability with the theoretical frameworks developed by existing studies (e.g Layard et al. [21] and Belot and Van Ours [5] identify in firms market power the short run factors that trigger wage rigidity in the medium long run). Alternatively, endogenizing the fixed wage rate would allow us to examine whether or not governments have incentives to maintain the fixed wage rate that entails unemployment. Because commodity taxation has different externalities under the destination and origin principles, the resulting tax choice would be different under these two principles. Moreover, adding some degree of price flexibility into our model would add some interesting 'side effects' over employment due to terms of trade effects identified by Lockwood et al.[23]. It would be nevertheless important to consider other sources of unemployment such as the efficiency wages, job search and recruiting frictions. Considering the combined use of direct and indirect taxation would make it possible to study the employment impact of shifting the tax burden from the latter to the former. It would also be worth considering asymmetries between countries in many aspects such as population size and technology. Finally, since unmeployment mainly regards unskilled workers, also considering a production function that uses skilled and unskilled labour would increase the realism of our model. All these important and interesting topics are left to future research.

References

[1] Artis M. (2000) The Unemployment Problem, *The Oxford Review of Economic Policy* 14, 3.

[2] Bertola G., F. Blau, and D. Kahn (2001) Comparative analysis of labour market outcomes: lessons for the US from international long run evidence, *CEPR Discussion Paper* 3023.

[3] Bazen, S. and J.P. Martin (1991) The impact of the minimum wage on earnings and employment in France, *OECD Economic Studies* 16, 199-221.

[4] Bean, C.R., P.R.G. Layard and S.J. Nickell (1986) The rise in unemployment: A multi-country study, *Economica* 53, S1-S22.

[5] Belot, M. and J. van Ours (2000) Does recent success of some OECD countries in lowering their unemployment rates lie in the clever design of their labour market reforms?, *CEPR Discussion Paper* 2492.

[6] Bhagwati, J. (1968) The theory and practice of commercial policy: departures from unified exchange rates, *Special Papers in International Economics, No. 8, International Finance Section, Department of Economics, Princeton University* 17-22.

[7] Behrens, K., J.H. Hamilton, G.I.P. Ottaviano and J.-F. Thisse (2004) Destination- vs. origin-based commodity taxation and the location of industry, *CEPR Discussion Paper* 4671.

[8] Blanchard, O. and J. Wolfers (2000) The role of shocks and institutions in the rise of European unemployment: the aggregate evidence, *Economic Journal* 110/ 462: C1-C33.

[9] Brown, C. (1999) Minimum wages, employment, and the distribution of income," in O. Ashenfelter and D. Card (eds.), *Handbook of Labor Economics 3*. Amsterdam: Elsevier.

[10] Buti, M.; P. Sestito and H. Wijkander (2001) *Taxation, welfare and the crisis of unemployment in Europe: an overview'*. Cheltenham, U.K. and Northampton, Mass.: Elgar on behalf of the Commission of European Communities; distributed by American International Distribution Corporation, Williston, Vt.

[11] Checchi, D. and C. Lucifora (2002) Unions and labour market institutions in Europe, *Economic Policy: - A European Forum* 0(35): 361-401.

[12] Daveri, F. and G. Tabellini (2000) Unemployment, growth and taxation in industrial countries *Economic Policy* 0, (30) 47-88.

[13] Fiorito, R. and F. Padrini (2001) Distortionary taxation and labour market performance, *Oxford Bulletin of Economics and Statistics* 63, 2 173-197.

[14] Haufler, A. and M. Pflüger (2003) Market structure and the taxation of international trade, *CESifo Working Paper* 1080.

[15] Haufler, A. and M. Pflüger (2004) International commodity taxation under monopolistic competition, *Journal of Public Economic Theory* 6, 445-470

[16] Kanbur, R. and M. Keen (1993) Jeux sans frontiers: tax competition and tax coordination when countries differ in size. *American Economic Review* 63, 877-892.

[17] Keen, M. and S. Smith (1996) The future of value added tax in the European Union, *Economic Policy* 23, 373-411.

[18] Keen, M. and S. Lahiri (1998) The comparison between destination and origin principles under imperfect competition, *Journal of Public Economics* 45, 323-350.

[19] Keen, M., S. Lahiri, and P. Raimondos-Moller (2002) Tax principles and tax harmonization under imperfect competition: a cautionary example, *European Economic Review* 46, 1559-1568.

[20] Keen, M. and D. Wildasin (2004) Pareto-efficient international taxation, *American Economic Review* 94, 259-275.

[21] Layard, P.R.G., S.J. Nickell and R. Jackman (1991) Unemployment: macroeconomic performance and the labor market, *Oxford: Oxford University Press*

[22] Lockwood, B. (2001) Tax competition and tax coordination under destination and origin principles: a synthesis, *Journal of Public Economics* 81, 279-319.

[23] Lockwood, B., D. de Meza, and G. Myles (1994) When are origin and destination regimes equivalent?, *International Tax and Public Finance* 1, 5-25.

[24] Mintz, J. and H. Tulkens (1986) Commodity tax competition between member states of a federation: equilibrium and efficiency, *Journal od Public Economics* 29, 133-172.

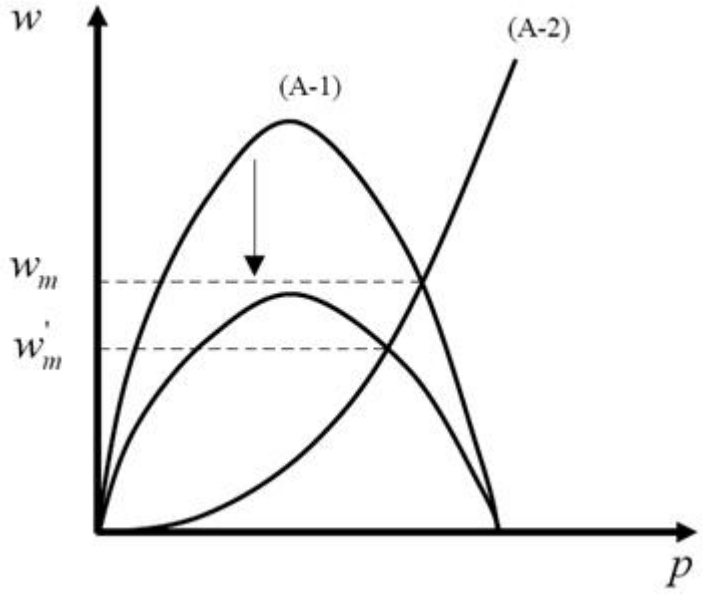
[25] Nam, C. W., R. Parsche, and B. Schaden (2001) Measurement of value added tax evasion in selected EU countries on the basis of national accounts data, *ifo Studien* 47, 127-144.

[26] Ogawa, H., Y. Sato and T. Tamai (2005) A note on unemployment and capital tax competition, forthcoming in *Journal of Urban Economics*.

[27] Ottaviano, G. I. P., T. Tabuchi, and J.-F. Thisse (2002) Agglomeration and Trade Revisited, *International Economic Review* 43, 409-436.

[28] Picard, P. and D.-Z. Zeng (2005) Agricultural sector and industrial agglomeration, *Journal of Development Economics* 77, 75-106.

Figure 1: The case of fexible wage



Appendix A

Substituting (10) and (16) into (12), we have

$$L_c = 2(1-\alpha)\frac{p(\overline{w})}{\overline{w}}\left[A - \frac{p(\overline{w})}{b+c}\right].$$

Therefore, the market clearing wage is determined by

$$1 = 2(1-\alpha)\frac{p}{w}\left[A - \frac{p}{b+c}\right], \tag{A-1}$$

$$p = \frac{1}{\alpha}\left(\frac{w\alpha}{1-\alpha}\right)^{1-\alpha}, \tag{A-2}$$

where (A-1) implies that $L_c = 1$ and (A-2) is the definition of $p(\overline{w})$. (A-1) and (A-2) are represented by a one-peaked curve and an upward sloping curve in the $p - w$ plain, respectively.

Figure 1 shows that the market clearing wage is uniquely determined. Moreover, for example, we can see that, as b increases, (A-1) moves downwards whereas (A-2) remains unmoved. (For b close to zero, w_m is close to zero.) Therefore, for sufficiently large b, the market clearing wage w_m becomes smaller than the fixed wage $\overline{w}$.

Appendix B

We use a numerical example to show that the effect of a change in principle on the unemployment rate might be quantitatively relevant. For the sake of realism, we introduce public good provision by governments and do not consider lump-sum taxes (as they are rarely observed in the real world). The utility function is then given by

$$U(X,Y,Z) = a(X+Y) - \frac{b-c}{2}(X^2+Y^2) - \frac{c}{2}(X+Y)^2 + Z + \log(G),$$

where the last term is the utility from public good provision. Welfare becomes

$$\begin{aligned} W_d &= [2a-(b+c)X_d]\,X_d + \overline{K} + t_d T_d + \overline{w}L_d - 2p(\overline{w})(1+t_d)X_d - G + \log(G), \\ W_o &= -\frac{b(X_o^2+Y_o^2)}{2} + a(X_o+Y_o) - cX_oY_o + \overline{K} + t_oT_o \\ &\quad + \overline{w}L_o - p(\overline{w})\left[(1+t_o)X_o + (1+t_o^*)Y_o\right] - G + \log(G). \end{aligned}$$

Governments choose the commodity tax rate and the level of public good provision that maximises welfare subject to the budget constraint (under DP and OP):

$$\begin{aligned} T_d &= p_x X_d + p_y Y_d, \\ T_o &= p_x\left(X_o + X_o^*\right), \\ G &= t_k T_k, \qquad k = d, o. \end{aligned}$$

We set the following parameter values: production parameter $\alpha = 1/2$; utility parameters $a = 2$, $b = 5.5$ and $c = 1$; and the fixed wage rate $\overline{w} = 2.5$[26]. We then examine the effect of the change from OP to DP. Under OP, the commodity tax rate is around 8.4 percent and the unemployment rate is 12.6 percent.

Table 1: The unemployment effects of the change from OP to DP

Variables	Origin Principle	Destination Principle
Commodity Tax Rate	0.084	0.137
Unemployment Rate	0.126	0.196

[26]The experiment can be of course replicated for any other parameter values that satisfy the existency conditions of the model.

Now we consider the change from OP to DP. Table 1 shows the resulting tax and unemployment rate. This change yields increases in both tax and unemployment rate. In fact, it gives 7 points increases in the unemployment rate. This example shows that in an economy with a high level of the fixed wage, the change from OP to DP raises the unemployment rate (see also Proposition 1). Such an increase can be quantitatively relevant.

Appendix C

In the benchmark case of flexible wages, $L_k = 1$, governments objective function simplifies to $W_k = U(X_k, Y_k, Z_k)$ (with $k = d, o$) and the negative (positive) employment impact of commodity taxes (subsidies) disappears. As a result, at the cooperative equilibrium governments choose not to subsidise consumption and set $t_c = 0$.

We thus obtain the results stated in Lockwood [22] (Propositions 1 and 2), and Haufler and Pflüger [14](Proposition 1). As with flexible wages the employment externality attached to non cooperative taxation vanishes, at the non cooperative equilibrium commodity taxes under the DP are Pareto efficient:

$$t_d = t_d^* = t_c = 0$$

Conversely, under the OP the negative consumer price spillover makes commodity taxes suboptimally high:

$$t_o = t_o^* = \frac{(b-c)(a-p(w))}{(3b-c)p(w)} > t_c$$