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MESC (Marginal Effective Statutory Charge), an extension of King-Fullerton methodology

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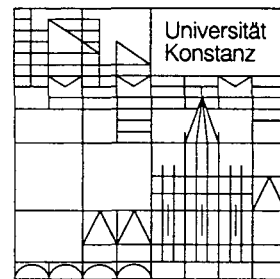
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Sonderforschungsbereich 178
„Internationalisierung der Wirtschaft“

Diskussionsbeiträge



Juristische
Fakultät

Fakultät für Wirtschafts-
wissenschaften und Statistik

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MESC (Marginal Effective Statutory Charge), An extension of King-Fullerton Methodology*

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Abstract

The purpose of this paper is twofold.

On the one hand it aims at extending King-Fullerton methodology to a larger scope of liabilities and primarily, in the empirical section of the paper, to statutory charges associated to labour costs, basically employers' contributions to social security. Thus it proposes substituting MESC or *Marginal Effective Statutory Charge*, for King-Fullerton METR, and enlarging the p -statistics to requirements in terms of labour cost coverage, then reinterpreting it in terms of *marginal value added*. A further extension to environmental levies as well as a generalisation to any market failure inefficiency loss are also presented.

On the other hand the paper intends to emphasize the key role of factor supply *elasticities* or *relative mobility* and *market rigidities* in determining the impact of the - or part of the - MESC statistics on the location decision of an MNE, a Multinational Enterprise. Indeed, in a setting where no rigidities are at work on the market for the immobile factor, like labour, levies on the compensation of that factor don't matter for MNE decision. Unlike that, in a setting where such rigidities are present, they do matter since they refrain the possibility to pass the burden of the tax on the holder of the rather immobile factor.

The ultimate goal of the paper is, through the topics mentioned above, to cope with issues especially relevant for interjurisdictional behaviour of multinational enterprises without the framework of a next Federation like the European Union.

Keywords : Marginal Effective Tax Rate, Excess Burden, Optimal Taxation, Corporate location decision.

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1 Introduction

When King and Fullerton (1984) proposed a method to compute marginal effective tax rates on investment income, they intended to summarise the provisions of usually complicated tax codes in one and intuitively appealing statistics. Their METR, or *Marginal Effective Tax Rate*, became quickly popular¹ and has been often computed both at national and international level (see e.g. OECD, 1991 or the Ruding Committee Report, 1992). It is defined as the pre-tax internal rate of return on an investment, less the post-tax rate of return, that difference being divided by the pre-tax internal rate of return; that pre-tax rate is usually denoted by p and is called the p -statistics in the sequel of the paper. That latter statistics is quite relevant too and we will especially emphasize its role in this paper.

METR, and p as well, might have at least two different uses.

On the one hand they allow the economist to measure the efficiency loss involved through the complexity of the various provisions of a tax system.

On the other hand, they enable the corporate decider to have a synthetic view of which part of the return on an investment will be diverted to the government and which part will be kept to the company. Such an information is also relevant for the government since it informs it on the cost, and the effectiveness as well, of the incentives it grants to companies.

Those two uses of METR however don't perfectly coincide.

Indeed the interpretation and use of the statistics for, say, corporate location decision needs a careful evaluation of how the burden of the tax is actually distributed between the economic agents implied. That distribution - in the paper we use indifferently the terms *tax burden* and *excess burden*, most often the first one - relies on elasticities of factor demand and supply to that jurisdictions, which are in turn affected by the degree of mobility of those factors across jurisdictions, the degree of competitiveness in the economic area investigated and, conversely, the size and importance of economic rigidities in that area.

Moreover King-Fullerton method only considers tax provisions associated with capital income taxation, at the level of the company which actually invests as well as at the level of the suppliers of the funds. However corporate behaviour might rely on other tax or quasi tax parameters that we name after EU Commission practice, *statutory charges*; those levies might also increase or possibly reduce, e.g. in the case of a Pigouvian tax, the efficiency loss in a given economy. They are primarily related to social security contributions and other statutory liabilities to be supported by employers (see Browning, 1994, Emerson, 1988). But they should also include such items like environment levies.

¹The concept of an effective tax seems to be already present in Feldstein and Summers, 1979, and in Feldstein, Dicks-Mireaux and Poterba, 1983. King and Fullerton basically add the notion of marginality - see also section 4 thereafter - which allows us to use it for measuring the efficiency loss implied by a tax system.

Therefore the purpose of this paper is twofold.

On the one hand it aims at *extending King-Fullerton methodology* to a larger scope of liabilities and primarily, in the empirical section of the paper, to statutory charges associated to labour costs, basically employers' contributions to social security. Thus it proposes substituting MESC or *Marginal Effective Statutory Charge*, for METR, and enlarging the p -statistics to requirements in terms of labour cost coverage, then reinterpreting it in terms of *marginal value added* and using p^* instead of p . Accordingly MESC actually measures the effective tax on marginal value added and is then a marginal effective value added tax rate².

A further extension to environmental levies as well as a generalisation to any market failure inefficiency loss are also presented.

On the other hand the paper intends to *emphasize the key role of factor supply elasticities or relative mobility and market rigidities in determining the impact of the - or part of the - MESC statistics on the location decision of an MNE, a Multinational Enterprise*. Indeed, in a setting where no rigidities are at work on the market for the immobile factor, like labour, levies on the compensation of that factor don't matter for MNE decision. Unlike that, in a setting where such rigidities are present, they do matter since they refrain the possibility to pass the burden of the tax on the holder of the rather immobile factor.

The ultimate goal of the paper is, through the topics mentioned above, to cope with issues especially relevant for interjurisdictional behaviour of multinational enterprises without the framework of a next Federation like the European Union.

The paper is organised as follows.

We derive the p^* and MESC statistics in section 2. For that purpose we first assume only one factor, capital, and recall how King-Fullerton statistics can be built up, starting with social equilibrium and then introducing tax. Then we add a second factor, labour, and build up our statistics. We complete the section by suggesting some further extensions of our approach, to n factors, to environmental levies and to market structure inefficiencies.

In section 3 we focus on the use of p^* and MESC for corporate location decision and thus we deal with the important issue of how the burden of MESC is distributed between the user and the supplier of each factor. We especially examine the case where capital is internationally mobile while labour is not mobile and thus inelastically supplied, a situation consistent with the European one today. Then we suggest a decomposition of the statistics into a tax on the user and a tax on the supplier. We complete the section by shortly examining the effect of institutional rigidities on the labour market, especially in economies experimenting Keynesian unemployment and by a remark on market disequilibria and the concept of marginality at work in both METR and MESC.

²In French we use the terms *Pompé* for Prélèvement Obligatoire Marginal sur le Produit Economique, a word which refers to pumping, see Gérard, Jamaels and Valenduc, 1996b; alternatively we could add d'un Investissement, turning then to *Pompei* and an evocation of ruins.

Section 4 is an attempt to compare our statistics with some other approaches nl. the Marginal Effective Tax Rate on Marginal Cost proposed by McKenzie, Mintz and Scarf (1996), the Average Effective Tax Rate suggested by Devereux and Griffith (1996) and the method based on macroeconomic and tax revenue data used by Mendoza, Razin and Tesar (1995).

Finally section 5 produces an application to Member States of the European Union under two assumptions regarding the suppliers of the funds - individual shareholders on the one hand, multinational companies on the other hand - and two assumptions regarding the determination of the wage rate of the workers, deemed to be immobile - competition or flexibility on the one hand, rigidities on the other hand -. In the former case - competition - the burden of the tax on the immobile factor, labour, is entirely supported by the worker and levies on labour don't matter for corporate decision and consequently King-Fullerton p is a sufficient statistics to evaluate location opportunities. Unlike that, in the latter case - rigidities, e.g. a statutory wage rate determined by a process like collective bargaining - levies on labour clearly matter and we have to use our extension to value added. The distinction is thus central for both corporate decision and the conduct of regional policy.

Policy lessons precisely, as well as some remarks, are suggested in section 7.

Figure 1 helps understanding the organisation of the paper and we will refer to it in the sequel.

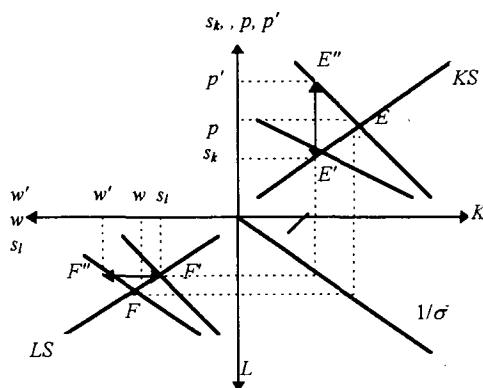


Figure 1 : MESC, p and the distribution of the tax burden.

2 From METR to MESC

In this section we derive our statistics as a generalisation of King-Fullerton seminal work to levies on the *value added generated by a marginal investment*, thus to both capital and labour. Since that latter factor is usually regarded as closely associated with capital, in that derivation labour is supposed to be

incremented by investment³. However as pointed out in the section the statistics can apply to any inefficiency wedge generated by a market failure. Therefore we complete the section with a generalisation to a larger number of factors of production, an extension to an environmental damage and a possible Pigouvian tax, and the monopoly generated inefficiency wedge.

But first of all we examine a pure competitive economy i.e. a framework where there is no tax nor any other distortion with respect to social optimum, and, of course, where private and social equilibria coincide. That provides us with a useful benchmark. In such a framework we assume a representative individual - the only one after all - and consider him (or her) successively in his (or her) capacity of stockholder, worker and corporate decider.

Then we introduce statutory charges or levies on factor income before addressing the issue of externalities and Pigouvian tax.

2.1 Social equilibrium

Thus, suppose first a pure competitive economy, a framework where there is no tax and where private and social equilibria coincide. In such a framework assume a representative individual and consider him successively as a stockholder, a worker and the corporate decider.

Consider first his (or her) problem as a stockholder and simultaneously refer to point E in Northeastern quadrant of Figure 1. If he buys on the market, for one monetary unit, an asset which provides him with a perpetuity at yearly nominal rate i , he will obtain a discounted flow of returns in real terms

$$\int_0^{\infty} i e^{-(\rho-\pi)u} du \geq 1$$

assuming ρ his rate of time preference and π the inflation rate. That discounted flow needs to be not smaller than unity, otherwise he doesn't buy the asset. Moreover he requires i such that $i + \pi \geq \rho$, i.e. that the nominal rate of interest at least offset the pure real discounting rate grossed up with inflation. For the marginal unit of saving that requirement holds as an equality. Accordingly the flow of interest payments that the firm will serve him for that marginal unit will be 1. Accordingly too the internal rate of return in real terms for him, on that saving, is $s_k = i + \pi = \rho$ since then,

$$\int_0^{\infty} i e^{-(s_k-\pi)u} du = \int_0^{\infty} i e^{-(\rho-\pi)u} du = 1$$

Now look at him as a worker and move to F on the Southwestern quadrant of Figure 1. He will accept to give up a flow of leisure or equivalently a flow of compensations at reservation wage s_l , for a flow of work if and only if he doesn't loose welfare in such a decision. Formally he requires that, assuming

³McKenzie, Mintz and Scarf (1996) mention that our approach parallels Boadway, Chua and Flatters (1995) on that point.

the wage rate w is going up with inflation, that

$$\int_0^{\infty} we^{-\rho u} du \geq \int_0^{\infty} s_l e^{-\rho u} du$$

Again at the margin, that expression holds as an equality and the effective wage rate will equal the reservation wage.

Finally turn to him as the corporate decider. He will accept the marginal unit of saving and undertake the corresponding investment if and only if

$$\int_0^{\infty} (f'_k + \sigma f'_l) e^{-(\rho+\delta)u} du \geq 1 + \int_0^{\infty} \sigma w e^{-(\rho+\delta)u} du \quad (1)$$

thus if and only if

$$f'_k + \sigma f'_l \geq \rho + \delta + \sigma w \quad (2)$$

where f'_k and f'_l stand for the marginal productivity of capital and labour respectively, p is the internal rate of return of the project in real terms, δ is the rate of capital decay and σ is the number of labour units *incremented* by the marginal investment, see the Southeastern quadrant of Figure 1,

$$\sigma \equiv \frac{dl}{dk}, dk = 1$$

Note that f'_k , f'_l and the wage rate are deemed to go up with inflation while σ is supposed to decrease with the rate of decay δ .

Moreover the left hand side of (1) can still be regarded as the *value added* generated by the investment.

If the unit of investment is the marginal one, (1) holds as an equality, and we name the corresponding value added, the *marginal value added*. Then one can compute the internal rate of return in real terms, p , using equation (3)

$$\int_0^{\infty} (f'_k + \sigma f'_l) e^{-(\rho+\delta)u} du = \int_0^{\infty} (f'_k + \sigma f'_l) e^{-(\rho+\delta)u} du = 1 + \int_0^{\infty} \sigma s_l e^{-(\rho+\delta)u} du \quad (3)$$

Solving that integral we get

$$\frac{f'_k + \sigma f'_l}{\rho + \delta} = \frac{f'_k + \sigma f'_l}{\rho + \delta} = 1 + \frac{\sigma s_l}{\rho + \delta} \quad (4)$$

and a solution to that equation is provided by usual equilibrium equalities,

$$\int_0^{\infty} f'_k e^{-(\rho+\delta)u} du = 1$$

so that,

$$f'_k = \rho + \delta = i - \pi + \delta = s + \delta$$

on the one hand, and

$$\int_0^{\infty} \sigma f'_l e^{-(\rho+\delta)u} du = \int_0^{\infty} \sigma s_l e^{-(\rho+\delta)u} du$$

so that,

$$f'_l = s_l$$

on the other hand.

Then, still by (4), the internal rate of return in real terms is,

$$p = \rho = i - \pi = s_k$$

Moreover *the marginal value added, net of deterioration, produced by the marginal investment at social equilibrium*, can usefully be defined and written,

$$p^* = p + \sigma w$$

while *the marginal value added, net of deterioration, received by the supplier of the factors implied by the marginal investment, at social equilibrium*, is

$$s^* = s_k + \sigma s_l$$

Then we define MESC as the difference between those value added, the whole divided by the first one. Thus,

$$t = \frac{p^* - s^*}{p^*} = \frac{p + \sigma w - s_k - \sigma s_l}{p^*} \quad (5)$$

which is clearly zero here since $p = s_k$ and $w = s_l$.

However it turns out that *any market failure, by creating a wedge between those two value added and also between possibly each of them and the one at social equilibrium, give rise to a non zero value of MESC*. That will be especially the case in any circumstance where the internal rate of return for the producer no longer equals the one for the supplier of the funds, or where the labour cost for the producer differs from the labour income of the worker. Obviously taxation can be a source of such discrepancy but the existence of an externality in the production process also creates a wedge between p^* and s^* .

To complete let us observe that (5) can still be written,

$$t = \frac{t_k p + \sigma t_l w}{p + \sigma w} \quad (6)$$

if we define

$$t_k = \frac{p - s_k}{p}$$

and

$$t_l = \frac{w - s_l}{w}$$

2.2 Statutory charges on capital and labour income

Now let us leave the idealistic beach of social equilibrium and pure competition to cope with a sea full of market failures, and first with levies on capital and labour income.

As announced we first suppose capital alone and rederive King-Fullerton statistics, then we introduce labour and levies associated to that factor. In terms of figure 1 we first focus on the Northeastern quadrant and then turn to the entire figure. It is to be noted that now we leave E (viz. F) to E' and E'' (viz. F' and F'').

2.2.1 Capital income taxation

Let us ignore labour at this stage, define τ the corporate income tax rate and A the discounted value of a tax shield consisting primarily of depreciation allowances⁴, and redefine ρ as nominal discounting rate from a private investor viewpoint. Also we now reserve p for value at social equilibrium and note p' the corresponding actual value for the producer. Then from (1) we have,

$$\int_0^{\infty} (1 - \tau)(p' + \delta)e^{-(\rho - \pi + \delta)u} du = 1 - A \quad (7)$$

Solving that integral we obtain

$$\frac{(1 - \tau)(p' + \delta)}{\rho - \pi + \delta} = 1 - A \quad (8)$$

and thus

$$p' = \frac{(\rho - \pi + \delta)(1 - A)}{1 - \tau} - \delta \quad (9)$$

which is the minimal value added required to serve s_k , yearly, to the owner of the capital.

We now need to specify the private internal rate of return ρ . The expression for that parameter will depend on the finance policy the investor has decided to follow. We first suppose the investment financed by debt, and for simplicity, through perpetuities. Then we assume equity finance and finally retained earnings finance.

debt finance If in (7) we substitute for the unit money value of the marginal investment the discounted flow of net interest payment, still denoting by i the nominal interest rate,

$$\int_0^{\infty} (1 - \tau)ie^{-\rho u} du$$

(8) becomes,

$$\frac{(1 - \tau)(p + \delta)}{\rho - \pi + \delta} = \frac{(1 - \tau)i}{\rho} + A \quad (10)$$

⁴Actually A is a hodge podge of depreciation allowances, tax base reductions, investment tax credits, government subsidies and capital stock levies; the precise content of that parameter has to be adapted to each jurisdiction, looking carefully at keeping statistics comparable (see the empirical section of the paper).

The first terms on the right hand side of equations (8) and (10) are equal if the value of ρ in (10) is

$$\rho_2 = (1 - \tau)i \quad (11)$$

which is the nominal usual discounting rate (cost of capital) in case of debt finance⁵.

equity finance If now in (7) we substitute for the unit money value of the investment the discounted flow of dividend payment the investor owes to pay out to the supplier of the funds,

$$\int_0^{\infty} de^{-\rho u} du$$

denoting by d the dividend supposed to be equal over time, then

$$\frac{(1 - \tau)(p + \delta)}{\rho - \pi + \delta} = \frac{d}{\rho} + A \quad (12)$$

The first terms on the right hand side of equations (8) and (12) are equal if the value of ρ in (12) is,

$$\rho_1 = d$$

which is the nominal discounting rate in case of equity finance.

To determine the value of d we then need an arbitrage mechanism on the financial market. At equilibrium indeed, assuming no risk in our economy (or that we are in the same class of risk whatever the corporate finance policy may be), the supplier of funds, irrespective he is an individual or a company, has to be indifferent between buying shares and purchasing bonds. He will be so if the discounted flow of net dividends he expects from shares equals the discounted flow of net interests. Denoting by m_1 the supplier of funds tax rate on dividends and similarly by m_2 his tax rate on interest income, it turns out that,

$$d = \frac{1 - m_2}{1 - m_1} i \quad (13)$$

and,

$$\rho_1 = \frac{1 - m_2}{1 - m_1} i \quad (14)$$

retained earnings When asking a shareholders to give up a current dividend in exchange of an increased flow of future dividends, the company already provides him with a tax benefit since he escapes the tax on that current dividend.

Then the financial market arbitrage is between the net value of that flow of extra dividends on the one hand and the flow of net interest on the net current dividend that the shareholder is willing to give up, $1 - m_1$.

⁵A similar expression is obtained for most other long term debt structure.

Therefore, the dividend is now d' such that,

$$d' = (1 - m_2) i \quad (15)$$

and the investor discounting rate in case of retained earnings finance becomes,

$$\rho_3 = (1 - m_2) i \quad (16)$$

Comparison with original K-F expressions It might be useful to compare the expressions suggested above for the discounting rate under alternative sources of funds with the ones originally used by King and Fullerton (1984) as they appear in OECD (1991). Those expressions, derived under some assumptions as to the financial structure of firms are respectively,

$$\rho_1 = \frac{1 - m_2}{1 - m_1} i \left(1 + \frac{\tau^d - \tau^r}{1 - \tau^d} \right) \quad (17)$$

$$\rho_2 = (1 - \tau^r) i \quad (18)$$

and

$$\rho_3 = \frac{1 - m_2}{1 - z} i \quad (19)$$

Clearly the expressions for equity and debt finance are identical to ours up to the consideration of a possible difference between the corporate tax rate on distributed (superscript d) and retained (superscript r) earnings, a distinction especially relevant for Germany (It is easy to show that such a distinction can be introduced in our formula too). Therefore we consider that our expressions are consistent with King-Fullerton ones. The only difference is observed for retained earnings and it stems from the presence of the tax rate on accrued capital gains, z , in the denominator; since that parameter is often zero and the relation between accrued and realised gains is rather severe in original King-Fullerton work, which otherwise requires assumptions as to the financial structure of the companies, we will use the expressions derived above in the sequel of the paper. Finally the expression for p (actually p' in our notation) in King-Fullerton contribution is

$$p'_f = \frac{(\rho - \pi + \delta(1 + \pi))(1 - A_f)}{(1 - \tau)} - \delta \quad (20)$$

with $f = 1, 2, 3$ depending of the finance policy. Such a subscript has been associated with tax shield A since the discounting rate used to compute A now depends on the financing policy⁶. That expression only differs from ours by the presence of $\delta(1 + \pi)$ instead of δ in the numerator of the fraction; such a presence relies on the assumption that depreciated investment is systematically replaced at replacement cost but, unlike that, we simply assume that productivity deteriorates over time.

As long as conformity with fathers' work is a sign of consistency our equations are likely to be correct.

⁶In case of a finance mix, one usually discount using the average cost of capital; on the discounting rate see also Scott (1987).

METR The internal rate of return in real terms, for the supplier of one unit of funds compensated with perpetuities is now s_k such that,

$$\int_0^{\infty} (1 - m_2)ie^{-(s_k + \pi)u} du = 1$$

which implies

$$s_k = (1 - m_2)i - \pi \quad (21)$$

i.e. that the internal rate of return for the supplier of funds is equal to the net rate of interest in real terms he receives⁷.

It turns out from the arbitrage process used above that s_k is independent of the type of financial asset the supplier buys.

Then, by (5), (20) and (21) we can compute the tax wedge on the marginal investment, using

$$t_w = p' - s_k \quad (22)$$

and King-Fullerton METR,

$$t = \frac{p' - s_k}{p'} \quad (23)$$

2.2.2 Labour related statutory charges

We can now introduce labour again and take into account statutory charges associated with the amount of labour implied by the investment. We assume that those charges consist of two elements. On the one hand it is a payroll tax computed as a fraction c of statutory wage - the one in the labour contract - w_s , so that

$$w_s = \frac{w'}{1 + c}$$

with w' now interpreted as the wage cost for the employer; that payroll tax is usually a contribution to social security to be paid by the employer - we don't discuss here the issue of who actually supports the burden of the tax -. On the one hand it is a labour income levy $m_w w_s$ paid by the employee, which is possibly withhold at source by the employer. Most usually that levy combines employee's contribution to social security and labour income tax *stricto sensu*. The net wage rate for the employee is then $s_l = (1 - m_w)w_s$ or?

$$s_l = \frac{1 - m_w}{1 + c} w \quad (24)$$

Again we now reserve p^* for value at social equilibrium and note p'^* the corresponding actual value for the producer. Then from (1) we have,

$$\int_0^{\infty} (p'^* + \delta)e^{-(\rho - \pi + \delta)u} du - \int_0^{\infty} \tau(p'^* + \delta - \sigma w')e^{-(\rho - \pi + \delta)u} du$$

⁷Note that in original King-Fullerton (1984) work as well as in OECD (1991), the corresponding expression is $s = \frac{(1 - m_2)i - \pi}{1 + \pi}$

$$\begin{aligned}
& - \int_0^{\infty} c \frac{w'}{1+c} e^{-(\rho-\pi+\delta)u} du - \int_0^{\infty} m_w \frac{w'}{1+c} e^{-(\rho-\pi+\delta)u} \\
& = 1 - A + \int_0^{\infty} \sigma s_l e^{-(\rho-\pi+\delta)u} du
\end{aligned} \tag{25}$$

Solving that integral we obtain

$$\frac{(1-\tau)(p'^* + \delta) + \tau \sigma w'}{\rho - \pi + \delta} - \frac{c + m_w}{(\rho - \pi + \delta)(1+c)} = 1 - A + \frac{\sigma s_l}{\rho - \pi + \delta} \tag{26}$$

and thus

$$p'_f^* = \frac{(\rho_f - \pi + \delta)(1 - A_f)}{1 - \tau} + \sigma \frac{1 + c - \tau(1+c)}{(1-\tau)(1-m_w)} s_l - \delta \tag{27}$$

which is the *minimal value added* required to serve s_k , yearly, to the owner of the capital, and s_l to each supplier of labour.

Then, by (5), (21), (24) and (27), we can compute the tax wedge on the value added created by the marginal project, using

$$t_w^* = p'^* - s_k - \sigma s_l \tag{28}$$

and the MESC statistics ,

$$t^* = \frac{p'^* - s_k - \sigma s_l}{p'^*} \tag{29}$$

in terms of the producer value added.

2.2.3 Example

Consider as an example an economy where investment is financed by debt, actually perpetuities. Then, using the equations derived above, (29) becomes,

$$t_2^* = \frac{\frac{((1-\tau)i - \pi + \delta)(1 - A_2)}{(1-\tau)} + \sigma \frac{1+c-\tau(1+c)}{(1-\tau)(1+c)} w' - \delta - ((1 - m_2)i - \pi) - \sigma s_l}{\frac{((1-\tau)i - \pi + \delta)(1 - A_2)}{(1-\tau)} + \sigma \frac{1+c-\tau(1+c)}{(1-\tau)(1+c)} w' - \delta}$$

If we further assume no depreciation nor inflation, that latter expression can be rewritten,

$$t_2^* = \frac{(m_2 - A_2)i + \sigma \frac{(c + m_w)}{(1+c)} w'}{(1 - A_2)i + \sigma w}$$

or

$$\begin{aligned}
t_2^* & = \frac{\frac{m_2 - A_2}{1 - m_2} s_k + \sigma \frac{c + m_w}{1 - m_w} s_l}{\frac{m_2 - A_2}{1 - m_2} s_k + \sigma \frac{1+c}{1 - m_w} s_l} \\
& = \frac{t_{2k} s_k + t_{l} \sigma s_l}{p_2^*}
\end{aligned}$$

where the denominator is the value added before tax generated by the marginal unit of investment and s_k and s_i the net interest rate and the net wage rate respectively.

2.3 Generalisation to a multi-factor case

From the last equation above, the extension to a multi-factor case is straightforward.

Then, if there is n factors,

$$\begin{aligned} t &= 1 - \sum_{i=1}^n \frac{\sigma_i s_i}{p'^*} \\ &= \sum_{i=1}^n \frac{t_i \sigma_i s_i}{p'^*} \end{aligned} \quad (30)$$

with σ_i the amount of factor i incremented by the marginal unit of investment, assuming that capital is factor $i = 1$ such that $\sigma_1 = 1$, and,

$$t_i = \frac{p_i - s_i}{p_i}$$

with p_i the net marginal productivity of factor i and s_i the corresponding after-tax compensation of the supplier of that factor.

2.4 Production externalities and a Pigouvian tax

Let us now leave labour aside and capital income taxation as well but suppose there is a production externality, actually an environmental damage of η per unit of investment and unit of time, measured by the cost of its compensation supposed to be ν per unit.

Therefore, from a social point of view, the internal rate of return is p such that

$$\int_0^{\infty} (f'_k - \eta\nu) e^{-(p+\delta)u} du = 1$$

or,

$$p = f'_k - \eta\nu - \delta \quad (31)$$

while from a private point of view, it is p' such that,

$$\int_0^{\infty} f'_k e^{-(p'+\delta)u} du = 1$$

and thus,

$$p' = f'_k - \delta = s_k \equiv s \quad (32)$$

since there is no tax on capital income.

It turns out that,

$$p = s - \eta\nu$$

and the MESC statistics here is,

$$t = \frac{p - s}{p} = \frac{-\eta\nu}{s - \eta\nu} \quad (33)$$

The negative sign of the tax means that for the private sector the damage, or its compensation, is a free good.

Suppose now the company is hold to pay a levy of θ per unit of damage caused. Then,

$$\int_0^{\infty} (p' + \delta - \theta\eta)e^{-(s+\delta)u} du = 1$$

and

$$p' = s + \theta\eta \quad (34)$$

so that from a private point of view there is now an effective tax

$$t' = \frac{\theta\eta}{s + \theta\eta} \quad (35)$$

while in social terms, we now have,

$$t = \frac{\theta\eta - v\eta}{s + \theta\eta - v\eta} \quad (36)$$

If that statistics is zero the environmental levy is actually a Pigouvian tax and the damage has been correctly internalised.

2.5 The monopoly wedge

In case of a monopoly we can similarly define a MESC and denote it by t_M , such that,

$$t_M = \frac{p_M - MR}{p_M}$$

where p_M and MR stand for the price under monopoly conditions and the Marginal Revenue respectively.

Anticipating on the discussion which follows, that MESC can still be spread into two terms, the inefficiency supported by the buyer and the one supported by the seller. If we note p the competitive price, then the equation becomes,

$$t_M = \frac{(p_M - p) + (p - MR)}{p_M}$$

and the first term on the numerator is the monopoly tax supported by the seller while the second one is the tax supported by the buyer. The distribution of the burden between the two agents obviously depends on demand and supply elasticities.

Illustration by Figure 1 is straightforward.

3 The corporate location decision and the distribution of the tax burden

In this section we focus on the use of p^* and MESC for corporate location decision and thus we deal with the important issue of how the burden of MESC is distributed between the user and the supplier of each factor. Then we suggest a decomposition of the statistics into a tax on the user and a tax on the supplier.

If METR and MESC are useful tools to measure the deadweight loss generated by a tax system or another market failure, they cannot be used, however, as such, as a guideline for, say, a multinational company to decide of the location of its subsidiary or for a supranational administration to challenge government incentives, though such a use of the statistics could be of high practical interest. However for such a use of METR or MESC we need to say something about the distribution of the tax burden between the users and the suppliers of each factor.

As previously we first examine a one-factor case, which now be either labour or capital, and then we extend to two, and possibly n factors.

3.1 A one-factor case

For the purpose of the location decision, the one we focus on in this section, we need to make a distinction between the burden of the tax supported by the user of the factor - the company who has to decide of its location, say among two jurisdictions - and the one supported by the supplier of the factor. Therefore we rewrite MESC, which here reduces to an METR,

$$t = \frac{(p' - p) + (p - s)}{p'} \quad (37)$$

Suppose first that the burden of the effective tax is totally supported by the company who wants to use the factor. Then $p = s$, (37) becomes,

$$t = \frac{p' - p}{p'} \quad (38)$$

and the supplier of the factor is unaffected by the tax. However the cost to provide him with $p = s$ will depend of the tax and then possibly varies from one jurisdiction to another; we easily imagine that a multinational enterprise, an MNE, will locate where that cost is minimal, thus apparently minimising t but actually minimising p' which is the key statistics for corporate decision purpose.

Unlike that if the tax is entirely supported by the supplier of the factor, deemed to be a resident of the jurisdiction, then $p' = p$, (37) becomes,

$$t = \frac{p - s}{p} \quad (39)$$

and it is now up to the MNE to be indifferent as to the location of the investment since the owner of the factor supports the tax.

All that story is a question of elasticities of supply and demand.

Therefore consider a change in a component t_i of the tax system and ask how the variation of t in response to that change will be spread between p' and s , thus between the user and the supplier of the factor, or in other terms, what will be

$$\frac{\partial p'}{\partial t_i} \quad (40)$$

and

$$\frac{\partial s}{\partial t_i} \quad (41)$$

respectively knowing that $s = (1 - t)p'$.

To answer that question, the suggestion of McKenzie, Mintz and Scarf (1997) is useful. Start at equilibrium on the factor market, denoting the quantity by x . Then, using superscripts d and s for demand and supply respectively,

$$x^d(p') = x^s(s)$$

with $s = (1 - t)p'$ and differentiating both sides of that equation, we have,

$$\frac{\partial x^d}{\partial p'} \frac{\partial p'}{\partial t_i} = \frac{\partial x^s}{\partial s} \left[-p' \frac{\partial t}{\partial t_i} + (1 - t) \frac{\partial p'}{\partial t_i} \right]$$

or,

$$\left[\frac{\partial x^d}{\partial p'} - (1 - t) \frac{\partial x^s}{\partial s} \right] \frac{\partial p'}{\partial t_i} = -p' \frac{\partial x^s}{\partial s} \frac{\partial t}{\partial t_i}$$

Defining the elasticity of demand,

$$\eta^d = \frac{\partial x^d}{\partial p'} \frac{p'}{x}$$

and similarly the elasticity of supply,

$$\eta^s = \frac{\partial x^s}{\partial s} \frac{s}{x}$$

and rearranging, we obtain,

$$\frac{\partial p'}{\partial t_i} = - \frac{p'}{1 - t} \frac{\eta^s}{\eta^d - \eta^s} \frac{\partial t}{\partial t_i} \quad (42)$$

Since $s = (1 - t)p'$, we also have that,

$$\frac{\partial s}{\partial t_i} = -p' \frac{\eta^d}{\eta^d - \eta^s} \frac{\partial t}{\partial t_i} \quad (43)$$

To illustrate that consider Table 1 where the elasticity of demand is somewhere between 0 and $-\infty$, say -1 . One can justify that by the existence of an actual cost to move a factory from one jurisdiction to another. Then,

Tax change supported by		elasticity of supply		
		$\eta^s = 0$	$\eta^s = 1$	$\eta^s \rightarrow \infty$
the user	$\frac{1}{p'} \frac{\partial p'}{\partial t_i} \frac{\partial t_i}{\partial t}$	0	$\frac{1}{2} \frac{1}{1-t}$	$\frac{1}{1-t}$
the supplier	$\frac{1}{p'} \frac{\partial s}{\partial t_i} \frac{\partial t_i}{\partial t}$	-1	$-\frac{1}{2}$	0

Table 1: Distribution of a change in a tax parameter between the user and the supplier of the factor

Tax shifting functions	elasticity of supply		
	$\eta^s = 0$	$\eta^s = 1$	$\eta^s \rightarrow \infty$
$p'(t)$	p	$p \left(1 + \frac{t}{2}\right)$	$p(1+t)$
$s(t)$	$p(1-t)$	$p \left(1 - \frac{t}{2}\right)$	0

Table 2: Tax shifting functions

From (42), it turns out that a function $p'(t)$ can be designed such that,

$$\begin{aligned} p'(t) &\simeq p - p \frac{\eta^s}{\eta^d - \eta^s} \int \frac{dt}{1-t} \\ &\simeq p \left[1 + \frac{\eta^s}{\eta^d - \eta^s} \ln(1-t) \right] \end{aligned}$$

or, using a Taylor series expansion,

$$p'(t) \simeq p \left(1 - \frac{\eta^s}{\eta^d - \eta^s} t \right) \quad (44)$$

Similarly, from (43)

$$\begin{aligned} s(t) &\simeq p - p \frac{\eta^d}{\eta^d - \eta^s} \int dt \\ &\simeq p \left(1 - \frac{\eta^d}{\eta^d - \eta^s} t \right) \end{aligned} \quad (45)$$

In those two equations the elasticity ratio is a *tax shifting parameter* using McKenzie-Mintz-Scarf terminology again. Therefore we name the latter two functions, *tax shifting functions*. We can again illustrate that, by means of Table 2 thereafter

3.2 A two- and multi-factor case

The argument above can be extended to a two-factor case and a multi-factor economy as well. However the two-factor case is especially relevant for the

economy we focus on in this paper, the one which associates labour and capital. Therefore we will not consider a multi-factor case explicitly.

Thereafter we first reexamine MESC, then p'^* .

3.2.1 The distribution of the MESC

Let us proceed as previously and decompose MESC as,

$$\begin{aligned}
 t^* &= \frac{(p' - p) + (\sigma w' - \sigma w) + (p - s_k) + (\sigma w - \sigma s_l)}{p'^*} \\
 &= \frac{(p' - p) + (p - s_k) + (\sigma w' - \sigma w) + (\sigma w - \sigma s_l)}{p'^*} \\
 &= \frac{1}{p'^*} \left[\frac{(p' - p) + (p - s_k)}{p'} p' + \frac{(\sigma w' - \sigma w) + (\sigma w - \sigma s_l)}{w'} w \right] \\
 &= \frac{t_k p' + t_l w'}{p'^*} \tag{46}
 \end{aligned}$$

The most interesting case in reference to the issue of location and delocation of economic activities among jurisdiction within a capital integrated world, is certainly indeed, and from a European perspective, the one where capital supply to a jurisdiction is perfectly elastic, and thus capital is perfectly mobile, while labour supply is not, thus being immobile. Then, $s_k = p$, $w' = w$ and (46) can be rewritten,

$$t^* = \frac{(p' - p) + (\sigma w - \sigma s_l)}{p'^*} \tag{47}$$

where the first bracket on the numerator is the tax supported by the company while the second one is the tax supported by the workers. *It turns out that, in that case, as far as the issue of corporate location decision is concerned, the levies on labour income don't matter.*

If, on the contrary, labour supply, like capital, is perfectly elastic, then $s_k = p$, $s_l = w$ and (46) becomes,

$$t^* = \frac{(p' - p) + (\sigma w' - \sigma w)}{p'^*} \tag{48}$$

so that *levies on labour income now matter for corporate location decision.*

3.2.2 The decision location and the distribution of the MESC

The argument can also be developed in terms of the p'^* -statistics, the target marginal value added.

Extending (44), we can write,

$$p'^*(t_k, t_l) \simeq p \left(1 - \frac{\eta_k^s}{\eta_k^d - \eta_k^s} t_k \right) + w \left(1 - \frac{\eta_l^s}{\eta_l^d - \eta_l^s} t_l \right) \tag{49}$$

As previously consider the case where capital supply is perfectly mobile while labour supply is immobile and suppose a change in a social security levy, the parameter c which belongs to t_l . Then, by the equation just above,

$$\frac{\partial}{\partial c} p'^*(t_k, t_l) = -w \frac{\eta_l^s}{\eta_l^d - \eta_l^s} \frac{\partial t_l}{\partial c} = 0 \quad (50)$$

since the labour supply elasticity is zero. Then, *in that case, as far as the issue of corporate location decision is concerned, social security levies don't matter.*

However, by adapting (45), the change will be entirely passed to the workers since then,

$$\frac{\partial}{\partial c} s_l(t_l) \simeq -w \frac{\eta^d}{\eta^d - \eta^s} \frac{\partial t_l}{\partial c} = -w \frac{\partial t_l}{\partial c} \quad (51)$$

3.2.3 Labour market rigidities and Keynesian unemployment

The argument developed so far however needs to be qualified.

Institutional rigidities exist in many countries, which prevent the net wage to go down, and up too, in response to change in the system of levies. If this is the case, the labour supply elasticity is artificially set to infinity and the above last two equations have different values. Then it can be also that the labour market, far to be at equilibrium, experiments Keynesian unemployment.

That situation is illustrated by Figure 2.

It is up to (50) now to be non-zero, i.e. to become

$$w \frac{\partial t_l}{\partial c}$$

since $\eta_l^s \rightarrow \infty$, while (51) now vanishes. Then *in that case, as far as the issue of corporate location decision is concerned, social security levies do matter.*

Of course (47) is then no longer correct and has to be adapted accordingly.

Inspection of Figure 2 is instructive. Without any tax or social security levy, the wage rate is w determined by inelastic labour supply LS and labour demand LD . Now, in the absence of any rigidity, introducing a social security levy will push the wage rate down to w' so that the tax burden is entirely supported by the supplier of the immobile factor - see the t^W distance on the figure -. By contrast, if for any reason, the wage rate is deemed not to go down, thus has to remain equal to w , then the levy is supported by the demander of the factor as indicated by the arrow and distance t^K . Obviously then effective labour demand will be smaller than labour supply and Keynesian unemployment KU will arise.

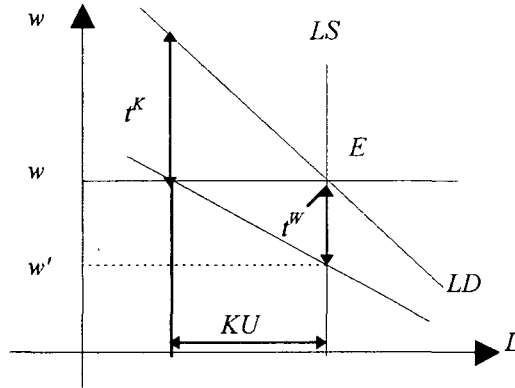


Figure 2 : Rigidities, Keynesian unemployment and the distribution of the tax burden (social security charge).

3.2.4 A final remark on market disequilibria and Marginality in METR and MESC

Let us complete the section by noting that the distribution of the MESC, as of any tax burden, is sensitive to the presence of market disequilibria.

We deliberately limit the discussion here to its graphical exposition by means of Figure 3.

Interested reader will refer to Marchand, Pestieau and Wibaut (1989) who examine optimal taxation and tax reform under Keynesian unemployment and to Gérard (1993) where a detailed discussion of METR, from that viewpoint, can be found. In that latter contribution the concept of marginality at work in METR is termed Classical or Walrasian and a corresponding concept under Keynesian unemployment is derived. To be convinced METR and MESC are such equilibrium concepts, remember that when deriving METR, see also Figure 1, we defined it as a difference with respect to s_k which is precisely the internal rate of return for the supplier of funds at equilibrium, i.e. when he is indifferent as to the use of the marginal unit of money.

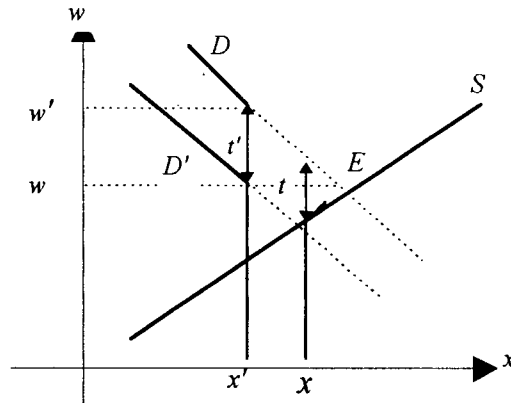


Figure 3 : The distribution of the tax burden and rationing (disequilibrium).

The Figure shows that at (Walrasian) equilibrium E the equilibrium price and quantity are w and x respectively and the burden of a tax t is supported by both the supplier and the demander. On the contrary, if demand is rationed, the demand line becoming Dx' the (dis)equilibrium price and quantity are now w' and x' and the tax t' is solely supported by the supplier, who is precisely the rationed agent in that setting.

4 MESC and alternatives

Let us briefly compare the statistics derived above with some other approaches n.l. the Marginal Effective Tax Rate on Marginal Cost proposed by McKenzie, Mintz and Scarf (1996), the Average Effective Tax Rate suggested by Devereux and Griffith (1996) and the method based on macroeconomic and tax revenue data used by Mendoza, Razin and Tesar (1995).

4.1 Marginal Effective Tax Rate on Marginal Cost

Proposed by McKenzie, Mintz and Scarf (1996), that method shares with our approach to consider together the levies on the different factors. Thus, after our terminology, McKenzie, Mintz and Scarf have designed a method to compute MESC.

The basic difference is that they don't consider labour, and other factors too, *incremented* by a marginal investment - they precisely criticise us on this point - but they focus on a *marginal unit of production*. Then they compute the Marginal Cost of producing that unit and define as Marginal Effective Tax Rate on Marginal Cost "the tax rate T which, if (hypothetically) applied to production costs directly would yield the same gross-of-tax marginal cost that results under the existing tax regime". Formally it is

$$T = \frac{MC(q; W')}{MC(q; W^0)} - 1$$

where q stands for the marginal unit of production, W' for the set of factor costs gross-of-tax, and W^0 for that set net-of-tax.

Observe that unlike us they express their rate as a percentage of the net-of-tax marginal cost.

An interesting feature of that approach is the possibility it offers to *modelise the production process* using a cost function.

One can show for a simple case that both their and our approaches are equivalent if their rate is expressed as a percentage of the gross-of-tax marginal cost rather than as a percentage of the net-of-tax marginal cost.

4.2 Average Effective Tax Rate

Suggested by Devereux and Griffith (1996), the Average Effective Tax Rate applies to a single factor and is thus in the tradition of King and Fullerton. However, unlike that seminal contribution it is no longer an equilibrium concept.

Remember again that when deriving METR, see also Figures 1 and 3, we defined it as a difference with respect to s_k which is precisely the internal rate of return for the supplier of funds at equilibrium, i.e. when he is indifferent as to the use of his marginal unit of money.

The Average Effective Tax Rate is defined as a difference of Net Present Values divided by the NPV either gross- or net-of-tax. Thus it is,

$$T = \frac{NPV_g - NPV_n}{NPV_g}$$

where superscript g refers to gross-of-tax and superscript n to net-of-tax.

That concept is close to Gérard (1993) and, interestingly, Devereux and Griffith observe, in an empirical study based on corporate decisions, that, for location decision, MNE's seem to be more sensitive to Average than Marginal Effective Tax Rate.

4.3 A Macroeconomic Approach

There are basically two ways for measuring the effective tax rate⁸ of a specific levy on an economic item. One consists in getting statistics on tax revenue from that levy on the one hand, on the corresponding tax base on the other hand, and then to compute the ratio of the former to the latter. This is typically a macroeconomic approach : it uses public finance statistics for the revenue and National Accounts or related data for the tax base, and produces Average or Implicit Effective Tax Rates. The other one, emphasised so far in this paper, formalises how the tax operates, then it values the tax parameters after the tax codes and computes the difference between the values of the economic item without and with taxation which is finally divided by either the former or the latter. This is typically a microeconomic approach using a formalisation

⁸In that paragraph we follow Beauchot, Gérard et al., 1995.

based upon microeconomic theory, which produces Marginal, and Average too, Effective Tax Rates.

The contribution of Mendoza, Razin and Tesar (1995) is a good example of that macroeconomic approach⁹.

Even if it is certainly quite informative (a tax, despite its high rate, can have a limited return for it is massively evaded) that purely *ex post* statistical exercise deserves serious comments and qualification, basically since it ignores what determines the behaviour of economic agents *ex ante*. From that point of view such an implicit tax rate is of limited interest and can be misleading since it fails to capture the

intertemporal character of many economic decisions, primarily on savings and investment. And it doesn't document on who supports the tax burden.

Moreover such an approach is also limited by the availability of statistics and subject to a lot of conceptual problems linked a.o. to the classification used by the various jurisdictions.

5 Application to EU Member States

Thereafter we apply the formula derived above to the European Union Member States using fiscal data available in the 1995 edition of The European Taxation Handbook.

Throughout that exercise we suppose labour to be the immobile factor. On the contrary capital supply is deemed to be perfectly mobile.

However we first consider, in line with standard theory, that the burden of the tax and other statutory charges levied on the income paid to the immobile factor is entirely supported by the owner of that factor. In other words, wage rate is flexible. Therefore only levies on capital income matter for a location decision purpose and, keeping that in mind, we limit our investigation to the measurement of METR statistics as developed by King and Fullerton. The first part of the exercise is thus just a replication of King-Fullerton approach but with an extended interpretation. It provides us with values of p^* (we omit the ' sign) which are relevant for the location decision but with t -statistics which are METR and not MESC.

Then we turn to the alternative assumption that rigidities exist on the labour market which prevent the excess burden to be entirely supported by the worker. More precisely we then assume that a statutory wage exists which can result from, say, a bargaining process between labour demand and labour supply, however when fixed that wage rate is no longer flexible. It turns out that levies on statutory wage, like social security charges, then matter. Therefore they are introduced into p^* and then t -statistics are MESC.

Actually in that second part we proceed in two steps.

We first suppose that the statutory wage rate, denoted by w (we omit the subscript s used above), is identical across the Member States and equal to a

⁹A study has been conducted in that line by the European Commission's Task Force on Statutory Charges.

European Union (EU) average figure. Then we use country specific statutory wage rates. Those rates consist of aggregate figures based on OECD data and the assumption that a typical worker is a mix of .70 blue collar and .30 white collar. However statutory charges on w are always country specific.

As far as labour is concerned we need to estimate the technological parameter σ . We also first assume it identical across Member States, and then make it country specific. In any case however, valuation of that parameter is uneasy. After examining different alternatives - including the use of estimated production functions - we decided to assume that actual labour-capital ratio based on figures estimated in 1985 US\$ is a good proxy for that incremental parameter; however we realise that it is just a good proxy for a marginal figure.

The observation that σw products are not equal across countries also reveals that rigidities exist on EU labour markets.

We are conscious that by considering two polar cases - perfectly flexible wage rates on the one hand, inflexible statutory wage rates on the other hand - we fail to give a correct representation of what actually happens within the European Union. In that federation indeed countries with more flexible wages and jurisdictions with less flexible wages co-exist.

Moreover we make two assumptions regarding capital supply and examine each of them.

On the one hand we suppose that the supplier of funds are individual stockholders who have to be indifferent as to the location of their funds and only pay withholding tax, if any.

On the other hand we assume that funds are supplied within a MNE and that the parent or head company, which is deemed to provide with the funds, has to receive an identical return on its investment, irrespective the location and source of finance may be.

The conclusion we draw from that exercise are given in the last section of the paper.

5.1 Capital is supplied by individual stockholders

As mentioned above we first suppose that the suppliers of funds are individual stockholders who have to be indifferent as to the location of their funds and only pay withholding tax, if any. That assumption, rather than the alternative one supposing capital income regularly reported, has been chosen on realistic grounds. Moreover it allows us to escape coping with issues related to detailed individual income taxation.

5.1.1 Sole capital income taxation

Results are reported in Table 3 which is organised as follows.

The first four columns provide with the value of p^* which is the target or minimal rate of return or value added, or still the cost of capital, for different sources of corporate finance referred to by a subscript ($i = 1$ for equity finance,

$i = 2$ for debt finance and $i = 3$ for after-tax retained earnings finance, respectively) and then for an equally weighted mix of those sources (thus it is an average cost of capital). The last four columns give corresponding METR figures. The penultimate line of the table documents on the average values over EU Member States and the last one provides us with a measure of the dispersion around the mean, i.e. the standard deviation.

In the prospect of the corporate location decision, which is quite natural in an international comparison, and to alleviate the comments too, we focus the discussion on the values of p^* (* have been omitted in the tables).

Inspection of table 3 first shows that best finance policy is debt and then - see p_2 column - that best location, i.e. the least demanding one in terms of rate of return or target value added, is Greece followed by Italy, Luxembourg, The Netherlands and Denmark. On the basis of weighted p , Denmark becomes the best location followed by Ireland, Greece and The Netherlands while Spain and Germany are the worst locations for an investment. Indeed, the tax system is particularly heavy in Germany which combines federal and local levies on quasi the same basis. However, a fiscal reform has reduced the rates of taxation both on distributed and undistributed profits to make Germany more attractive.

Table 3. Target Rates of Return p and Marginal Effective Tax Rates t

	p_1	p_2	p_3	p_{weigh}	t_1	t_2	t_3	t_{weigh}
Austria	0,1075	0,0539	0,0726	0,0636	0,5347	0,0730	0,3112	0,1739
Belgium	0,1106	0,0396	0,0745	0,0626	0,5481	-0,2623	0,3292	0,0439
Denmark	0,1142	0,0348	0,0714	0,0540	0,5622	-0,4383	0,2995	-0,1407
Finland	0,0919	0,0604	0,0604	0,0636	0,4562	0,1722	0,1722	0,2006
France	0,1033	0,0504	0,0691	0,0618	0,5159	0,0081	0,2763	0,1444
Germany	0,1029	0,0596	0,0959	0,0783	0,5142	0,1609	0,4785	0,3226
Greece	0,0846	0,0206	0,0846	0,0574	0,4092	-1,4232	0,4092	-0,3696
Ireland	0,0545	0,0742	0,0545	0,0571	0,0831	0,3258	0,0831	0,1147
Italy	0,1756	0,0290	0,0936	0,0744	0,7153	-0,7222	0,4658	-0,0141
Luxembourg	0,1300	0,0327	0,0771	0,0635	0,6155	-0,5306	0,3512	0,0029
Netherlands	0,1135	0,0340	0,0742	0,0609	0,5596	-0,4708	0,3259	0,0292
Portugal	0,1502	0,0459	0,0835	0,0667	0,6670	-0,0896	0,4012	0,1638
Spain	0,1341	0,0610	0,0821	0,0783	0,6271	0,1800	0,3910	0,3249
Sweden	0,1057	0,0680	0,0654	0,0684	0,5269	0,2649	0,2349	0,2606
Un.Kingdom	0,0696	0,0576	0,0696	0,0675	0,2813	0,1312	0,2813	0,2558
Average	0,1099	0,0481	0,0752	0,0652	0,5077	-0,1747	0,3207	0,1009
Dispersion	0,2651	0,3158	0,1460	0,1079	0,2994	-2,6219	0,3181	1,7756

5.1.2 Extension to Labour Costs : average European σ and w

Do most appealing countries in case of sole capital income taxation, remain as attractive when labour costs are taken into account, remembering that at the present stage we use EU average figures for labour intensity σ and compensation

rate w . Actually statistics as to capital stock and labour force support an average value of 9,87 for σ . Average compensations we use refer to the year 1993 and amount to 17,658 ecu for blue collars (70 per cent of the labour force) and 25,710 ecu for white collars (30 per cent of the labour force); thus w has been set equal to 20,074 ecu.

Results are reported in table 4.

If debt clearly remains the cheapest source of finance, Denmark becomes the most attractive location for a debt financed investment, followed by The Netherlands, Luxembourg and Greece. The first ranking of Denmark is due to the absence of social security statutory contributions paid by the employers - see table 5 -. Conversely, Italy leaves the top four as social security charges on employers are quite heavy in that country. And now Spain, Sweden, Italy and France are the least appealing countries.

Table 4. Target Rates of Return p and Marginal Effective Statutory Contributions t , average European σ and w

	p_1	p_2	p_3	p_{weigh}	t_1	t_2	t_3	t_{weigh}
Austria	0,3513	0,2978	0,3165	0,3075	0,5566	0,4770	0,5078	0,4920
Belgium	0,3794	0,3084	0,3433	0,3313	0,6292	0,5438	0,5902	0,5724
Denmark	0,3123	0,2328	0,2694	0,2521	0,4060	0,2034	0,3116	0,2554
Finland	0,3450	0,3134	0,3134	0,3166	0,4508	0,3955	0,3955	0,4011
France	0,3756	0,3228	0,3414	0,3342	0,5581	0,4857	0,5138	0,5021
Germany	0,3405	0,2972	0,3335	0,3159	0,5372	0,4697	0,5275	0,4994
Greece	0,3326	0,2686	0,3326	0,3054	0,4033	0,2611	0,4033	0,3428
Ireland	0,2767	0,2964	0,2767	0,2793	0,4100	0,4491	0,4100	0,4151
Italy	0,4727	0,3261	0,3907	0,3714	0,6248	0,4562	0,5461	0,5157
Luxembourg	0,3544	0,2570	0,3014	0,2878	0,5789	0,4193	0,5048	0,4759
Netherlands	0,3360	0,2565	0,2967	0,2834	0,5937	0,4677	0,5398	0,5149
Portugal	0,3967	0,2925	0,3301	0,3133	0,5578	0,4002	0,4685	0,4370
Spain	0,4048	0,3316	0,3528	0,3490	0,5411	0,4399	0,4734	0,4659
Sweden	0,3651	0,3275	0,3248	0,3278	0,4963	0,4384	0,4338	0,4386
Un.Kingdom	0,2882	0,2762	0,2882	0,2862	0,3575	0,3296	0,3575	0,3528
Average	0,3554	0,2936	0,3208	0,3107	0,5134	0,4158	0,4656	0,4454
Dispersion	0,1315	0,0983	0,0949	0,0941	0,1642	0,2075	0,1620	0,1775

Table 5. Employers and employees' social security statutory rates

	Employers' social security statutory rates		Employees' social security statutory rates	
	Blue Collars	White Collars	Blue Collars	White Collars
Austria	0,2335	0,2280	0,1695	0,164
Belgium	0,3669	0,3397	0,1412	0,1307
Denmark	0,0000	0,0000	0,0500	0,0500
Finland	0,2775	0,2775	0,0535	0,0535
France	0,3621	0,4104	0,2052	0,2052
Germany	0,1910	0,1910	0,1910	0,1910
Greece	0,2575	0,2435	0,1925	0,1508
Ireland	0,1220	0,1220	0,0550	0,0550
Italy	0,5000	0,5000	0,0855	0,0855
Luxembourg	0,1405	0,12025	0,1450	0,12575
Netherlands	0,0799	0,0799	0,1584	0,1584
Portugal	0,2405	0,2450	0,1100	0,1100
Spain	0,3920	0,3259	0,0610	0,0610
Sweden	0,3100	0,3100	0,0195	0,0195
United Kingdom	0,1040	0,1040	0,0900	0,0900

5.1.3 Extension to Labour Costs : country specific σ and w

Let us now introduce country specific figures for statutory wage and productivity of labour .

Therefore consider table 6. Column 1, 2 and 3 refer to annual compensation in ecu, w , for blue collars, white collars and the representative worker respectively (remember he is .70 a blue collar and .30 a white collar). Columns 4 to 6 give corresponding figures for wage cost, obtained by summing up employers' contribution to social security statutory and employees' statutory wages. The number of jobs created per million of ecu invested in the country is reported on column 7; this is our σ . Finally columns 8 and 9 document on the annual labour cost associated to that investment, first without employer's social security charges, second with such charges included.

Figures on table 6 deserve some comments.

First of all economist will note that differences in wage rates don't offset differences in productivity. Indeed inspection of column (7) reveals that the most productive workers are to be found in Finland and Sweden followed by The Netherlands and Denmark, and then France and Germany, while the least productive workers are in Spain, Portugal and Greece. In other terms, if one unit of investment, to be operated, needs one worker in Finland, it needs 4.17 in Greece. Unsurprisingly - see column 3 - lowest wage rates are observed in Greece and Portugal while highest wages are paid in Denmark, Germany, The Netherlands and Luxemburg. If differences in wages just matched differences

in labour productivity, figures in column (8) should be equal across countries. This is not the case however : the dispersion is still equal to 20 percent of the mean, against 31 when only wages are considered - see column 3 -. Finland appears to be the cheapest country since it combines a high degree of labour productivity and a wage rate close to European average. The situation of Greece and Portugal is to be pointed out : though they have the lowest wage rates, they are not the cheapest in terms of labour cost due to the low productivity of their workers. Finally - see the last two columns - best place from a labour cost viewpoint, is Finland, followed by Sweden, Greece, Portugal, (or Portugal, Greece on the basis of column 10) and The Netherlands.

Based on column 9, the worst locations are Italy (social security charges are too high), Belgium, Germany (wages are too high) and Spain (social charges are too high and labour productivity is too low). Since labour cost is deductible against the corporate income tax, countries with high such tax, like Italy and Germany, slightly improve their position when introduced, while Ireland, with a 10 percent corporate tax deteriorates its own.

We can now turn to table 7¹⁰.

Figures confirm above results and set forth that labour cost is the major determinant of p^* : introduction of capital income taxation doesn't change the composition of the most attractive group. When costs of labour and capital are combined to produce p^* -statistics, Greece, Finland, Sweden, Portugal and The Netherlands remains best locations in case of debt finance -see column p_2 - and with a slightly different ranking in case of a mix finance as well (then Finland is first). At the other end we have Germany, Spain and Belgium in case of debt finance, and Italy, Germany and Belgium in case of mix finance.

¹⁰ Unfortunately the homogeneous data base we use for macroeconomic figures doesn't cover Austria so that we haven't been able to find an estimate of σ for that country.

Table 6. Labour Cost in the European Union Member States

	1	2	3	4	5
	$w(blue)$	$w(white)$	$w(repr.)$	$(1+c)x(1)$	$(1+c)x(2)$
Austria	19315	29939	22502	23825	36765
Belgium	20369	32300	23948	27855	43292
Denmark	28391	27870	28234	28391	27870
Finland	17207	32315	21739	21982	41282
France	16705	30070	20715	22662	42245
Germany	25550	30430	27014	30647	36501
Greece	4984	11020	6795	6268	13703
Ireland	15577	22530	17663	17477	25279
Italy	15226	24650	18053	22839	36975
Luxembourg	22801	31830	25510	26005	35658
Netherlands	24162	30230	25982	26880	34486
Portugal	5833	11210	7446	7262	13956
Spain	12048	20670	14634	16771	27406
Sweden	19361	30332	22652	25363	39735
United Kingdom	17344	20260	18219	19147	22367
Average	17658	25710	20074	21558	31835
Dipersion	6338	6940	6265	6944	9316
	6	7	8	9	10
	$(1+c)x(3)$	σ	$\sigma x(3)$	$\sigma x(6)$	$(1-t)x(9)$
Austria	27707	-	-	-	-
Belgium	32486	8,27377	198142	268781	160812
Denmark	28234	6,93505	195807	195807	121401
Finland	28537	7,83395	162278	223560	149048
France	27772	4,78898	104110	133000	99750
Germany	32403	7,99300	215922	258999	159802*
Greece	8498	19,9471	135539	169518	110186
Ireland	19818	11,0186	194618	218361	196525
Italy	27080	9,94464	179535	269302	140495
Luxembourg	28901	8,25844	210672	238675	144661
Netherlands	29162	6,30380	163787	183831	119490
Portugal	9270	18,4642	137484	171167	103385
Spain	19961	12,6084	184518	251680	162737
Sweden	29675	4,88447	110645	144944	104360
United Kingdom	20113	10,87399	198109	218712	146537
Average	24641	9,86631	170798	210453	137085
Dipersion	7310	4,39202	34967	43469	27322

* For Germany : 125614 in case of undistributed benefits

Table 7. Target Rates of Return p and Marginal Effective Statutory Contributions t , country specific σ and w

	p_1	p_2	p_3	p_{weigh}	t_1	t_2	t_3	t_{weigh}
Austria	-	-	-	-	-	-	-	-
Belgium	0,3794	0,3084	0,3433	0,3313	0,6295	0,5442	0,5906	0,5728
Denmark	0,3100	0,2306	0,2672	0,2498	0,4067	0,2023	0,3116	0,2548
Finland	0,2249	0,1934	0,1934	0,1966	0,4551	0,3662	0,3662	0,3751
France	0,3268	0,2740	0,2927	0,2854	0,5578	0,4725	0,5062	0,4920
Germany	0,3619	0,3186	0,3549	0,3373	0,5372	0,4742	0,5280	0,5018
Greece	0,2541	0,1902	0,2541	0,2269	0,4059	0,2060	0,4059	0,3209
Ireland	0,2729	0,2925	0,2729	0,2754	0,4087	0,4483	0,4087	0,4138
Italy	0,4449	0,2983	0,3629	0,3437	0,6288	0,4464	0,5449	0,5115
Luxembourg	0,3687	0,2713	0,3157	0,3022	0,5777	0,4261	0,5068	0,4796
Netherlands	0,2974	0,2178	0,2580	0,2447	0,5908	0,4415	0,5284	0,4983
Portugal	0,3213	0,2171	0,2547	0,2379	0,5760	0,3723	0,4650	0,4220
Un.Kingdom	0,2883	0,2763	0,2883	0,2862	0,3576	0,3296	0,3576	0,3528
Spain	0,3858	0,3127	0,3338	0,3300	0,5435	0,4368	0,4724	0,4644
Sweden	0,2506	0,2130	0,2103	0,2133	0,5020	0,4139	0,4065	0,4140
Average	0,3205	0,2581	0,2859	0,2758	0,5127	0,3986	0,4571	0,4338
Dispersion	0,1858	0,1721	0,1743	0,1705	0,1697	0,2357	0,1732	0,1911

5.2 Capital is supplied within an MNE

We now assume that investment funds are supplied by the head company of a multinational enterprise and we imagine that this head or parent company needs to get an identical after-tax return in each jurisdiction and for each source of finance (if the investment is financed by new shares, that company is deemed to buy the shares, in case of a new debt it is supposed to make the loan and in case of retained earnings financing, it gives up current dividend). We also assume that the investment is operated through a subsidiary, not a branch, and that income are repatriated. Finally we suppose that the conditions are fulfilled for the July 1990 EU Directive to apply.

Let us note that the discrepancies among sources of funds are now smaller than when suppliers are individuals. Indeed, due to the rules usually at work in international taxation, and especially the operation of the Directive, interest expenses, if deductible against corporate tax in the country of the subsidiary, are fully taxed in the one of the head company. And the converse applies to dividends : fully taxed in the jurisdiction of the subsidiary, they are at least 95 percent tax exempt in the one of the parent company (viz. there is full imputation of the corporate tax paid in the other country). Thus m_2 is close to τ and m_1 to 0.

We report results on p^* and for the mix source of finance only; we also drop the intermediate case with average values of w and σ .

Moreover we use matrices with at the top of each column the country of residence of the parent company and in front of each line the country of resi-

dence of the subsidiary. Therefore cell (3,1) of the matrix corresponds to the target value of an investment by an MNE of country 1 (Germany) in country 3 (Denmark). On the table, *to* and *from* refer to the direction of income repatriation. The last two lines and columns provide with average values and dispersion around the mean, the last row thus documents on *capital export neutrality* of a each domestic tax system and the last column on its *capital import neutrality*.

5.2.1 Sole capital income taxation

Results are reported in Table 8 and Ireland seems to be very attractive, both for locating a parent company - see the penultimate line - and a subsidiary - see the penultimate column - due to the very low tax rate on corporate income in that country (.10). This rate however is only granted in some sectors, it will end up on December 31, 2010 and there is some uncertainty as to the exemption of such Irish dividends when repatriated. Apart from that peculiar case, Finland, Sweden and Denmark appear to be interesting places to set up a subsidiary. At the other end, Greece, Spain and Italy are bad locations for a subsidiary and it is counterproductive to have a head company located in Italy.

5.2.2 Extension to Labour Costs : country specific σ and w

Results are reported in table 9 and it turns out that best locations for a subsidiary now are Finland, Sweden, Portugal, Greece and The Netherlands. Unsurprisingly it is the same group, with the same ranking, as when comparison is conducted on the sole basis of column 9 of Table 6, i.e. on labour costs corrected for differences of productivity. It is also the same group, with quasi the same ranking, as when suppliers of mixed funds are individuals. Moreover the composition of that group is much less correlated with that one when labour is ignored. And again Italy, Belgium and Germany are rather unattractive to set up a subsidiary, from a tax and statutory charges point of view.

As far as the location of a head company is concerned, best place remains Ireland, and worst place Italy.

Table 8. Target Rates of Return p when supplier of funds is a parent company, mix finance, sole capital

<i>To</i>	Aus	Belg	Dk	Fin	Fr	Ger	Gr	Irl	
<i>From</i>									
Aus	0,073	0,081	0,078	0,064	0,072	0,078	0,074	0,052	
Bel	0,069	0,075	0,073	0,063	0,069	0,073	0,070	0,056	
Dk	0,068	0,074	0,072	0,061	0,067	0,072	0,069	0,053	
Fin	0,066	0,071	0,069	0,061	0,066	0,069	0,068	0,054	
Fra	0,070	0,076	0,074	0,063	0,069	0,074	0,071	0,054	
Ger	0,075	0,080	0,078	0,070	0,075	0,078	0,076	0,063	
Gr	0,083	0,095	0,090	0,069	0,082	0,092	0,085	0,053	
Irl	0,059	0,060	0,059	0,057	0,058	0,060	0,061	0,055	
It	0,079	0,085	0,083	0,073	0,079	0,083	0,080	0,066	
Lux	0,073	0,078	0,076	0,068	0,073	0,077	0,074	0,062	
Neth	0,074	0,078	0,076	0,069	0,073	0,077	0,074	0,062	
Port	0,076	0,086	0,082	0,066	0,076	0,083	0,078	0,053	
Sp	0,081	0,088	0,085	0,073	0,080	0,085	0,082	0,064	
Sw	0,069	0,072	0,071	0,064	0,068	0,071	0,070	0,059	
UK	0,070	0,072	0,071	0,068	0,070	0,071	0,071	0,065	
Aver	0,072	0,078	0,076	0,066	0,072	0,076	0,074	0,058	
Dis	0,083	0,104	0,096	0,069	0,082	0,099	0,079	0,084	
<i>To</i>	It	Lux	Neth	Port	Sp	Sw	UK	Aver	Dis
<i>From</i>									
Aus	0,094	0,080	0,074	0,080	0,075	0,066	0,072	0,074	0,122
Bel	0,083	0,074	0,070	0,074	0,070	0,065	0,069	0,070	0,082
Dk	0,083	0,073	0,069	0,073	0,069	0,063	0,067	0,069	0,093
Fin	0,078	0,070	0,067	0,070	0,068	0,062	0,065	0,067	0,077
Fra	0,086	0,075	0,071	0,076	0,071	0,065	0,069	0,071	0,095
Ger	0,088	0,080	0,076	0,080	0,076	0,071	0,075	0,076	0,073
Gr	0,114	0,093	0,085	0,094	0,086	0,074	0,081	0,085	0,155
Irl	0,062	0,060	0,059	0,060	0,061	0,057	0,061	0,059	0,033
It	0,093	0,084	0,080	0,084	0,080	0,075	0,079	0,080	0,073
Lux	0,085	0,077	0,074	0,078	0,074	0,070	0,073	0,074	0,066
Neth	0,085	0,078	0,074	0,078	0,075	0,070	0,073	0,074	0,066
Port	0,100	0,084	0,078	0,084	0,078	0,069	0,075	0,078	0,128
Sp	0,098	0,087	0,082	0,087	0,082	0,076	0,080	0,082	0,087
Sw	0,078	0,072	0,069	0,072	0,070	0,066	0,068	0,069	0,060
UK	0,075	0,072	0,070	0,072	0,071	0,068	0,070	0,070	0,031
Aver	0,087	0,077	0,073	0,078	0,074	0,068	0,072		
Dis	0,134	0,100	0,086	0,101	0,080	0,072	0,076		

Table 9. Target Rates of Return p when supplier of funds is a parent company, mix finance, capital and labour

<i>To</i>	Aust	Belg	Dk	Fin	Fr	Germ	Gr	Irl	
<i>From</i>									
Aus	-	-	-	-	-	-	-	-	-
Belg	0,339	0,344	0,341	0,333	0,338	0,342	0,339	0,327	
Dk	0,264	0,270	0,267	0,258	0,264	0,268	0,265	0,250	
Fin	0,199	0,204	0,202	0,194	0,199	0,202	0,201	0,188	
Fr	0,294	0,300	0,297	0,288	0,293	0,298	0,295	0,280	
Ger	0,335	0,339	0,337	0,330	0,334	0,337	0,335	0,323	
Gr	0,253	0,265	0,260	0,240	0,252	0,262	0,255	0,224	
Irl	0,277	0,279	0,278	0,275	0,277	0,278	0,280	0,273	
It	0,349	0,354	0,352	0,344	0,349	0,352	0,350	0,337	
Lux	0,312	0,317	0,315	0,308	0,312	0,315	0,313	0,302	
Neth	0,258	0,262	0,260	0,253	0,257	0,261	0,258	0,247	
Port	0,248	0,256	0,253	0,239	0,247	0,254	0,249	0,227	
Sp	0,333	0,339	0,337	0,326	0,332	0,337	0,334	0,318	
Sw	0,214	0,217	0,216	0,210	0,213	0,216	0,215	0,205	
UK	0,289	0,291	0,290	0,287	0,289	0,290	0,289	0,284	
Aver	0,283	0,288	0,286	0,277	0,283	0,286	0,284	0,270	
Dis	0,160	0,156	0,157	0,164	0,160	0,157	0,158	0,171	
<i>To</i>	It	Lux	Neth	Port	Sp	Sw	UK	Aver	Dis
<i>From</i>									
Aus	-	-	-	-	-	-	-	-	-
Belg	0,350	0,343	0,339	0,343	0,339	0,335	0,338	0,339	0,015
Dk	0,278	0,269	0,265	0,269	0,265	0,260	0,263	0,265	0,022
Fin	0,210	0,203	0,200	0,203	0,201	0,196	0,199	0,200	0,024
Fr	0,308	0,299	0,295	0,299	0,295	0,290	0,293	0,295	0,020
Ger	0,346	0,338	0,335	0,339	0,336	0,331	0,334	0,335	0,015
Gr	0,282	0,263	0,255	0,264	0,255	0,244	0,251	0,255	0,049
Irl	0,281	0,278	0,277	0,278	0,280	0,276	0,279	0,278	0,007
It	0,361	0,353	0,350	0,354	0,350	0,345	0,348	0,350	0,015
Lux	0,323	0,316	0,313	0,316	0,313	0,309	0,312	0,313	0,014
Neth	0,268	0,261	0,258	0,262	0,259	0,255	0,257	0,258	0,017
Port	0,269	0,255	0,249	0,255	0,250	0,242	0,247	0,249	0,036
Sp	0,348	0,338	0,334	0,339	0,334	0,328	0,332	0,334	0,020
Sw	0,223	0,217	0,214	0,217	0,215	0,211	0,213	0,214	0,018
UK	0,293	0,290	0,289	0,291	0,289	0,287	0,289	0,289	0,007
Aver	0,296	0,287	0,284	0,288	0,284	0,279	0,283		
Dis	0,152	0,157	0,159	0,157	0,158	0,163	0,160		

6 Conclusion

In that paper we have extended King-Fullerton methodology to other statutory charges, primarily to social security contributions levied paid by employers on labour compensation. Results shows that such charges seem to dominate the capital income tax and thus to be the major determinant of the *target rate of return* in terms of *value added*, required to be reached in each possible location. However the relevance of that extension and thus of that assertion depends on the *degree of interjurisdictional mobility of labour* and on the *existence and importance of rigidities on the labour market*, an issue we investigated analytically in section 3.

Actually labour cost consists of four components which have been isolated in the empirical exercise, i.e. the wage rate, the productivity of labour, the social security charges and the corporate income tax as labour cost is deductible against that tax.

Note that though a positive relation is globally observed between the productivity of labour and the wage rate, combination of both doesn't lead to equal labour cost across EU Member States indicating that it is not, yet, true that lower wage rates and lower productivity fully offset each other, what could be expected in a federation without labour market rigidity.

More generally that exercise, as tentative it is from an empirical point of view, allows us to propose a ranking of countries which takes into account both the cost of marginal capital and the one of labour resources needed to operate that capital. And furthermore to set forth which parameters are responsible of the particular ranking of a given country.

Thus we are permitted to say something about employment policy in the various countries under investigation. In some country labour is particularly expensive since wage rates are higher than elsewhere, or because productivity is lower, while some other countries could relax their high degree of productivity and thus expand the number of workers associated to a given unit of investment.

The exercise also allows us to value and compare the efficiency losses caused by tax and statutory charges in the different countries.

The statistics computed in that research can finally be useful to conduct an empirical non-cooperative game in *target rates of return* or in *marginal effective statutory charges*.

Both the empirical results and the methodology seem to be appealing, even if that latter is still to be improved, and we think that further extensions to other statutory charges, like the one linked to environmental policy, or to non-tax wedges like those imposed by some labour, safety and environmental quality regulations, are promising.

Two possible improvements of the methodology are a better description of the technology, on the one hand, and the introduction of country specific labour market conditions - labour and demand elasticities, rigidities, unionisation, risk of strikes... - .

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¹¹Et al. means M. Eichler and B. Genser, for the field study on Germany, and S. Jamaels for the whole exercise.

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