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Imperfect factor mobility, unemployment, and the short-period incidence of a capital income tax

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Abstract

A crucial feature of the short-run perspective in many policy-relevant issues is the existence of unemployment due to wage rigidities. At the same time, imperfections in the degree of factor mobility between sectors or regions determine the nature and flexibility of the responses of the economy to exogenous shocks. It is no wonder then that the incidence of taxation upon employment and income distribution is a central preoccupation of the fiscal authorities. In this paper we explore the structure of the incidence and the economic effects of a selective capital income tax in a neoclassical, two-sector, two-factor, short-period model in which the existence of a sticky wage that exceeds the maximum level consistent with full-employment leads to unemployment of labour.

Key words: tax incidence, capital mobility, unemployment, general equilibrium.

JEL Classification: H22, H25.

1. Introduction: Unemployment, factor mobility and taxes

A crucial feature of the short-run perspective in many policy-relevant issues is the existence of unemployment due to wage rigidities. At the same time, imperfections in the degree of factor mobility between sectors or regions determine the nature and flexibility of the responses of the economy to exogenous shocks. It is no wonder then that the incidence of taxation upon employment and income distribution is a central preoccupation of the fiscal authorities.

Surprisingly, the theory of public finance has devoted relatively little attention to the analysis of the microeconomic effects of taxation in the presence of unemployment. The first contributions on this issue may be found in the literature on regional development of the 60's and early 70's. The need for regional policies is justified in this literature on the grounds of differences in both regional income and regional employment.

The works in the field of regional economics suffer from two main shortcomings. First, rigorous general-equilibrium arguments are absent in the analysis of the employment effects of taxation, perhaps with the exceptions of McLure (1971) and Behuria (1984). On the other hand, despite the fact that regional economics has been equated to the «economics of resource immobility» by many authors (Bird, 1965), systematic analysis of mobility assumptions and the diversity of taxes and subsidies is lacking in these contributions. The recent surveys on tax incidence by Kotlikoff and Summers (1987) and Fullerton and Metcalf (2003) do not report any attempts to fill out these deficiencies.

This paper focuses on these aspects of tax policy, in an attempt to extend the analysis of the imperfect-mobility-full-employment case (González-Páramo, 1993) to a less-than-full-employment context. Our concern is with a time frame so short that factor supplies and the wage rule do not change, but long enough to allow for all markets to clear —the labour market by quantity rationing, the capital and the goods markets by price adjustments— for any degree of capital mobility. Applied to this context, our model will have the following features: i) changes in employment and its sectoral distribution will be explained by changes in relative prices; ii) the distributional incidence of taxation will depend upon both changes in relative prices and changes in employment, and iii) the impact of changes in mobility conditions upon the price effects and the employment effects of taxation will be explicitly identified.

The organization of the paper is the following. Section 2 presents the general structure of the model and the equations of change following the introduction of a variety of selective taxes. The main novelties with respect to González-Páramo (1993) are the formulation of a wage function relating changes in the nominal wage with respect to changes in a basket of consumer prices, and the absence of explicit labour mobility conditions. In the presence of a generalized minimum wage, movements of (homogeneous) labour across sectors cannot be made dependent upon intersectoral wage differentials. In order to simplify the analysis, it will be assumed that firms are not rationed in any market, i.e. there are no impediments to any desired adjustments in factor demands at the prevailing prices. This postulate makes labour mobility irrelevant in our context. Two features of the workings of the model should be mentioned. First, when intersectoral capital movements are sluggish to some extent, the model does not exhibit «fix price» characteristics, in the sense that the feedback effects of quantities upon prices must be taken into account, contrary to the perfect factor mobility case (Atkinson and Stiglitz, 1980). Secondly, the price effects of taxation are determined without any intervention of the labour market conditions.

Sections 3 and 4 will analyse the price effects and the employment effects, respectively, of the imposition of a selective capital income tax, both in terms of balanced-budget incidence and differential incidence. The taxes considered as a basis of comparison will be a selective consumption tax and a selective wage tax. One of the most interesting results establishes that employed labour in both sectors and capital in the taxed sector share a common interest with regard to policies intended to increase the degree of capital mobility and equal-yield tax substitutions. Both groups will favour policies oriented to increase capital mobility, and they will prefer a selective wage tax to a selective consumption tax and the latter to a selective capital income tax. The rationale behind these curious implications of the analysis -which are in sharp contrast with Mieszkowski's (1967) well-known results, i.e. labour always prefers a tax on capital and vice versa- has to do with the differential impact of the taxes under consideration upon the consumer price index. When capital is imperfectly mobile, a wage tax is preferred by employed labour because it produces the largest increase in the wage rate. At the same time, this tax has the strongest factor substitution effect in favour of capital employed in the taxed sector.

Of course, the above ranking of taxes does not apply when we focus upon the employment effects of taxation. As we shall show in Section 4, taxes which harm capital the most -i.e. those which produce the lowest increases in wages- are the best from the employment perspective. In general, policies aimed to alter the degree of capital mobility have ambiguous effects upon the level of employment, depending upon the elasticities of factor substitution in both sectors, the elasticity of substitution in demand and the differential in factor intensities, among other parameters. This section is completed by analyzing the sectoral distribution of tax-induced employment changes and the related question of which is «the» best regional subsidy for employment creation. As we shall show, for a given resource cost and any degree of capital mobility, a regional subsidy given to capital will cause larger capital inflows than does a subsidy on production, with a wage subsidy causing the smallest inflows (this result holds in the full-employment case as well; see McLure, 1970). However, this ordering of subsidies is reversed when the policy objective is employment creation, as long as substitution possibilities exist in the subsidized region. In fact, capital subsidies might reduce employment in the target region. The paper concludes with section 5, which presents the main conclusions and includes some final comments.

2. A simple general equilibrium model

Before beginning our analysis, we list three issues upon which our discussion in this paper has some bearing: i) Mobility and shifting. How does the mobility effect of a selective capital income tax work when part of the labour force is unemployed? ii) Capital income taxation versus a wage tax. In the presence of unemployment, we may gain some insight by comparing the incidence of a capital income tax to the distributional impact of a wage tax. iii) Employment effects and the distribution of the tax burden. When the level of employment is sensitive to the imposition of a selective capital income tax, the distribution of the burden between labour and capital does not depend only upon the price effects of taxation. Tax induced changes in employment will have an effect upon labour's income as well.

2.1. Structure

The model can be sketched as follows. A closed economy is assumed to have two primary factors of production that may be used to produce two final *outputs, X* and *Y.* The endowments of the two factors, labour *(L)* and capital *(K)*, are fixed at the levels $\overline{K}$ and $\overline{L}$, respectively. Constant returns to scale and non-specialization characterize production in this economy. The goods and the capital markets are competitive. Competition in production is represented by the zero-profits conditions:

$$p = c_X(w\tau_{LX}, r_X\tau_{KX}) \qquad [1]$$

$$1 = c_Y(w, r_Y) \qquad [2]$$

where p is the relative price of X, c_i is the unit cost of production in sector $i(i=X,Y)$, and $\tau_{jX} = 1+t_{jX}$ is the tax factor, where t_{jX} is the *ad valorem* tax rate on the net reward of factor j ($j = K,L$) in sector X.

Full employment of capital is represented by the equality:

$$K_X(r_X\tau_{KX},\ w\tau_{LX},\ X) + K_Y(r_Y,\ w, Y) = \bar{K} \qquad [3]$$

while the assumption of unemployment implies that the wage rate is such that labour demand will fall short of the endowment of labour:

$$L_X(r_X\tau_{KX},\ w\tau_{LX},\ X) + L_Y(r_Y,\ w, Y) = L < \bar{L} \qquad [4]$$

It is assumed that some labour remains unemployed before and after the introduction of any taxes or subsidies.

The main features of the model are those related to wage rigidity and factor mobility. The former has implications for the formulation of the demand side of the model. Now we turn to these assumptions.

Unemployment is introduced by postulating the existence of an exogenously given wage function of the type:

$$w = w(q,1), \qquad \partial w(.)/\partial q \geq 0 \qquad [5]$$

homogeneous of degree one in consumer prices, where w is the generalized wage measured in terms of good Y, $q=p\tau_x$ is the consumer price of X in terms of Y, and $\tau_x=1+t_x$ is the selective consumption tax factor, where t_x is the «ad valorem» tax rate on the consumption of good X. Following Brecher (1974), we restrict the analysis to situations where the real wage exceeds the minimum level consistent with full employment. Although the above wage rule may be subject to much criticism [1], here we follow the standard tradition in taking [5] as a reasonable simplification of reality (see Brecher, 1971, 1974, Johnson, 1965, Helpman, 1971, Dixit, 1976, 1981, and Das, 1981, among others). Essentially, the wage rule is treated here as a «fact of life» which, for social or political reasons, government and unions are unable or unwilling to alter in the short-run [2]. In fact, a wage rule depending only upon prices of goods may be optimal in a second-best world (Blanchard, 1979). Further, it is consistent with the observed short-run behaviour of wages (Blanchard, 1998) [3].

As in the full-employment case (González-Páramo, 1993), capital is assumed to respond to rental differentials with any parametrically given speed. This condition may be represented by the expression:

$$K_X = K_0 (r_X / r_Y)^{\sigma_K}, \qquad 0 \leq \sigma_K < \infty \tag{6}$$

(which holds only locally) where K_O is the allocation of capital to sector X at the initial equilibrium, and σ_K is the elasticity of supply of capital to sector X with respect to the relative net earnings differential. The assumption of generalized sticky wage does not allow to introduce a similar mobility condition for labour. However, if we assume that firms are not rationed in any market (i.e. there are no impediments to any desired adjustments in factor demands at the prevailing prices), labour mobility is irrelevant. As long as a unit of labour is employed, it obtains the wage *w.*

It was suggested above that the existence of rationing in the labour market due to the presence of a rigid real wage has special implications for the specification of the demand for goods. In an influential article, Dixit (1976) pointed out that when employment is constrained to a level below the total supply of labour, consumer's choice may be represented by means of the «partial expenditure function»:

$$e(q, L, U) = \underset{\{X,Y\}}{Min} \{qX + Y \mid U(X, Y, L) \geq \bar{U}\} \tag{7}$$

where *U(X,Y,L)* is the «partial» or constrained direct utility function. According to equation [7], changes in compensated demands respond not only to changes in *q,* but also to any adjustments in the level of employment, i.e.:

$$X = X(q,L,U) \tag{8}$$

$$Y = Y(q,L,U) \tag{9}$$

For small changes, we have:

$$\hat{X} = \xi_{XX}(\hat{p} + \hat{\tau}_X) + \xi_{XL}\hat{L} + \frac{1}{X}\frac{\partial X}{\partial Z}\frac{\partial e}{\partial U}dU \tag{10}$$

$$\hat{Y} = \xi_{YX}(\hat{p} + \hat{\tau}_X) + \xi_{YL}\hat{L} + \frac{1}{Y}\frac{\partial Y}{\partial Z}\frac{\partial e}{\partial U}dU \tag{11}$$

where «^» indicates proportional changes, and ξ_{iX} and ξ_{iL} are the compensated elasticities of good i with respect to the relative price of X and labour, respectively, and Z is aggregate income. If we retain the standard assumption of homotheticity of preferences over goods (for a given employment level), we have $dU(\partial e/\partial U)[\varepsilon_{XZ}-\varepsilon_{YZ}](1/Z) = 0$ (where ε_{iZ} is the income elasticity of the demand for good *i).* Thus,

$$\hat{X}-\hat{Y}=(\xi_{XX}-\xi_{YX})\quad(\hat{p}+\hat{\tau}_X)+(\xi_{XL}-\xi_{YL})\hat{L} \qquad [12]$$

From the zero-degree homogeneity in prices of X and Y, $-\xi_{YX}=\xi_{YY}$, which implies:

$$\hat{X}-\hat{Y}=-\sigma_S(\hat{p}+\hat{\tau}_X)+(\xi_{XL}-\xi_{YL})\hat{L} \qquad [13]$$

where $\sigma_S = -(\xi_{XX} + \xi_{YY})$ is the elasticity of substitution in demand between X and Y.

The latter formulation explicit takes into account the reactions of the rationed consumer [4], and shows that homotheticity does not suffice to ensure a one-to-one relationship between the composition of demand, X/Y, and the relative price of good X, q. It turns out, however, that the results of the analysis become ambiguous when $\xi_{XL} \neq \xi_{YL}$. For simplicity, we assume in the remainder of the present paper that $\xi_{XL} = \xi_{YL}$, i.e. X and Y are equally good substitutes for (complements of) labour (relaxation of this assumption is a straightforward but tedious exercise), an assumption that amounts to posit separability between goods and labour.

This completes the specification of the model. The incidence of a selective capital income tax can be determined by the familiar comparative-static approach. Before doing so, a note on the role of capital mobility is in order.

2.2. Comparative-static analysis

a) The role of capital mobility

In order to convey the intuition of some of the effects of taxation in the presence of unemployment, we begin this section with a brief comment on the relationship between prices and quantities in the present model. Take the standard case of a small open economy. Here the terms of trade are given from abroad, and the resulting price system:

$$\begin{aligned}\bar{p}&=c_X(w,r)\\ 1&=c_Y(w,r)\end{aligned} \qquad [14a]$$

is self-contained and independent of demand factors [5]. This situation also corresponds to the case of a closed economy with perfect factor mobility and an infinitely elastic demand. However, once we allow imperfectly elastic demands, the relative price p will be determined only if demand considerations are introduced.

Let us now introduce into the system the wage rule [5]:

$$\begin{aligned}p&=c_X\left[w(p\tau_X,1),r\right]\\ 1&=c_Y\left[w(p\tau_X,1),r\right]\end{aligned} \qquad [14b]$$

It becomes clear that the wage rule brings us back to a two-equation system in two variables, p and r, whose solution (if it exists) is unique. The price system is again self-contained, and the relationship between prices and quantities is unidirectional [6].

Of course, the crucial element that explains this curious result is the assumption of perfect capital mobility. This assumption implies that capital responds to exogenous shocks with enough speed as to equate capital rentals by means of intersectoral movements of capital before the wage rule changes in response, say, to the persistence of an excess supply of labour. However, as noted by Neary (1982), perfect capital mobility and stability of the wage rule are not consistent assumptions in a short-run perspective. In our context, introducing imperfect capital mobility amounts to restore the feedback from quantities to prices. In effect, the price system becomes:

$$p = c_X \left[w(p\tau_X, 1), r_X \right]$$
$$1 = c_Y \left[w(p\tau_X, 1), r_Y \right] \qquad [14c]$$

where the relationship between r_X and r_Y is determined by the mobility condition [6] and, indirectly, by the remaining variables of the model. Given the levels of q and $w(q)$, there exists a single value of r_i that enables the i-firms to produce and satisfy the zero-profit condition. If this r_i is consistent with the mobility condition and we rule out complete specialization, p and w must change, and hence, the composition of demand, the output level of each sector and the demand for labour will change. The degree of capital mobility, thus, becomes a crucial determinant of incidence and the employment-effects of selective capital income taxes and subsidies.

b) The system of incidence

The system just described in subsection 2.1 contains seven independent equations in seven variables (p, w, r_X, r_Y, X, Y and L). In terms of proportional changes, these equations are:

$$\hat{w} = \alpha(\hat{p} + \hat{\tau}_X) \qquad [15]$$

$$\hat{p} = \theta_{LX}(\hat{w} + \hat{\tau}_{LX}) + \theta_{KX}(\hat{r}_X + \hat{\tau}_{KX}) \qquad [16]$$

$$0 = \theta_{LY}\hat{w} + \theta_{KY}\hat{r}_Y \qquad [17]$$

$$\hat{K}_X = \sigma_K(\hat{r}_X - \hat{r}_Y) \qquad [18]$$

$$0 = \lambda_{KX}\hat{K}_X + \lambda_{KY}\hat{K}_Y \qquad [19]$$

$$\hat{L} = \lambda_{LX}\hat{L}_X + \lambda_{LY}\hat{L}_Y \qquad [20]$$

$$\hat{X} - \hat{Y} = -\sigma_S(\hat{p} + \hat{\tau}_X) \qquad [21]$$

where α is the elasticity of the nominal wage with respect to the consumer price of good *X,* θ_{ji} is the share of the *j-th* factor in the value of the *i-th* product, and λ_{ji} is the share in the total supply of factor *j* of the amount of this factor employed in sector *i.* The analysis will concentrate upon changes in factor incomes. For this reason, we will not deal explicitly with changes in *X* and *Y.* On the other hand, the relationship that exists between *w,* r_Y and *p* through the zero-profit conditions allows to derive all the relevant results once the system of is solved for the changes in *p,* r_X. and *L.*

The first equation of change of the system is obtained directly from the zero-profit condition in sector *X.* Combining expressions [15] and [16], we get:

$$(1-\alpha\theta_{LX})\hat{p}-\theta_{KX}\,\hat{r}_X=\theta_{KX}\hat{\tau}_{KX}+\theta_{LX}\hat{\tau}_{LX}+\alpha\theta_{LX}\hat{\tau}_X \qquad [22]$$

On the other hand, introducing the zero-profit condition [17] into the full-employment expression [19], and taking into account the conditions on mobility and demand, our second equation of change can be expressed as [7]:

$$\Pi_1\hat{p}-(\theta_{LX}\sigma_X+\tilde{\sigma}_K)\hat{r}_X=\theta_{LX}\,\sigma_X(\hat{\tau}_{KX}-\hat{\tau}_{LX})-\Pi_1\hat{\tau}_X \qquad [23]$$

where:

$$\Pi_1=\alpha\theta_{LX}\sigma_X-\frac{\alpha\ \ \theta_{LY}}{\theta_{KY}}(\sigma_Y+\tilde{\sigma}_K)-\sigma_S$$

and $\tilde{\sigma}_K=\sigma_K/\lambda_{KY}$.

The only relationship of the model not used so far is the employment demand expression [20]. Using the equivalences:

$$\hat{L}_X=\hat{c}_{LX}+\hat{X}$$
$$\hat{L}_Y=\hat{c}_{LY}+\hat{K}_Y-\hat{c}_{KY}$$

and the conditions on demand, substitution and factor mobility, we can write:

$$\Pi_2\hat{p}+(\lambda_{LX}\theta_{KX}\sigma_X-\lambda_{KX}\hat{\tau}_K)\hat{r}_X-\hat{L}=-\lambda_{LX}\theta_{KX}\sigma_X(\hat{\tau}_{KX}-\hat{\tau}_{LX})-\Pi_2\hat{\tau}_X \qquad [24]$$

where:

$$\Pi_2=-\alpha\lambda_{LX}\theta_{KX}\sigma_X-\frac{\alpha}{\theta_{KY}}(1-\lambda_{LX}\theta_{KY})\sigma_Y-\frac{\alpha\lambda_{KX}\theta_{LY}}{\theta_{KY}}\tilde{\sigma}_K-\lambda_{LX}\sigma_S$$

We can now rewrite the system [22]-[24] in matrix form as:

$$\begin{bmatrix}1-\alpha\theta_{LX} & -\theta_{KX} & 0\\ \Pi_1 & -(\theta_{LX}\sigma_X+\tilde{\sigma}_K) & 0\\ \Pi_2 & (\lambda_{LX}\theta_{KX}\sigma_X-\lambda_{KX}\tilde{\sigma}_K) & -1\end{bmatrix}\begin{bmatrix}\hat{p}\\ \hat{r}_X\\ \hat{L}\end{bmatrix}=\begin{bmatrix}\theta_{KX}\hat{\tau}_{KX}+\theta_{LX}\hat{\tau}_{LX}+\alpha\theta_{LX}\hat{\tau}_X\\ \theta_{LX}\sigma_X(\hat{\tau}_{KX}-\hat{\tau}_{LX})-\Pi_1\hat{\tau}_X\\ -\lambda_{LX}\theta_{KX}\sigma_X(\hat{\tau}_{KX}-\hat{\tau}_{LX})-\Pi_2\hat{\tau}_X\end{bmatrix} \qquad [25]$$

The system of incidence reveals a noteworthy feature of the response of the economy to exogenous shocks when the wage rule is binding. Given the parameters of demand, substitution and mobility, competition in production determines the equilibrium changes in *p, w,* r_X and r_Y, irrespective of the employment conditions of the economy. Notice that the system [25] is recursive: the first two relationships determine $\hat{r}_X$ and $\hat{p}$ —and, thus, *w* and $\hat{r}_Y$— without any intervention of $\hat{L}$. Once the competitive rates of change of the price variables are determined, firms will adjust their demand for labour accordingly.

Denoting the determinant of the system [25] by $|\Sigma|$, it is easily checked that:

$$|\Sigma| = (1-\alpha)\theta_{LX}\sigma_X + \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y + \frac{\delta_\alpha}{\theta_{KY}}\tilde{\sigma}_K + \theta_{KX}\sigma_S > 0$$

where:

$$\delta_\alpha = (1-\alpha)\theta_{KY} + \alpha\theta_{KX}$$

Having determined the sign of $|\Sigma|$, it is now a straightforward matter to compute the expressions for the impact of a change in the tax rate on factor prices and the level of employment. This is the focus of the analysis in the following sections.

3. Tax incidence (I): Price effects

In presence of unemployment (or underemployment) of the labour force, the focus of interest of incidence analysis is somewhat different to that in a full-employment context. The usual way of considering the (weighted) rental-(weighted) wage ratio is obviously not sufficient. This is because changes in the price variables of the model will tend to generate changes in the equilibrium level of the demand for labour and, hence, in total labour's income. If we think in unemployment as the fraction of labour that consumers are unable to sell in the labour market at the prevailing prices, we can easily see that relative prices do not convey enough information so as to determine whether the imposition of a selective capital income tax benefits labour or not. Indeed, the ratios w/r_X and w/r_Y could rise as a result of the tax with labour as a whole being worse off relative to the pre-tax situation. Although the tax change will make labour owners better off with regard to the units of labour that remain employed, the fall in total employment could outweigh the former effect and reduce the relative share of labour in the functional distribution of income. In order to deal separately with these issues, in the present section we analyse the price-effects of taxation and leave to Section 4 the study of the employment-effects.

3.1. Balanced-budget incidence: The mobility effect

In order to determine the price-effects associated to the introduction of selective tax on profits, it is natural to start the analysis by assuming that the tax revenue is returned back to consumers in a lump-sum fashion. In this case, the incidence of the tax can be determined by solving the system [25] for $\hat{p}$ and $\hat{r}_X$, with $\hat{\tau}_{LX} = \hat{\tau}_X = 0$ and $\hat{\tau}_{KX} > 0$:

$$\hat{p} = |\Sigma|^{-1}\, \theta_{KX}\tilde{\sigma}_K \tau_{KX} \geq 0 \qquad [26]$$

$$\hat{r}_X = |\Sigma|^{-1}\left\{-(1-\alpha)\theta_{LX}\sigma_X - \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}(\sigma_Y + \tilde{\sigma}_K) - \theta_{KX}\sigma_S\right\}\hat{\tau}_{KX} \leq 0 \qquad [27]$$

Combining equation [26] and the wage rule [15], we get:

$$\hat{w} = |\Sigma|^{-1}\, \alpha\theta_{KX}\tilde{\sigma}_K \hat{\tau}_{KX} \geq 0 \qquad [28]$$

Finally, substituting [28] into the zero-profit condition [17], we obtain the tax-induced change in the untaxed sector's profits:

$$\hat{r}_Y = -|\Sigma|^{-1}\, \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\tilde{\sigma}_K \hat{\tau}_{KX} \leq 0 \qquad [29]$$

Comparing the above incidence expressions with those obtained in González-Páramo (1993) for the full-employment case, we can see the marked differences. Under full-employment, tax incidence is determined by the relative factor intensities (the factor intensity differential effect), the relative degrees of factor mobility (the factor mobility differential effect) and the elasticities of factor substitution (the factor tax effect). These three effects do not always work in the same direction, and tax incidence is *a priori* indeterminate. In the unemployment model, relative factor intensities and the relative degrees of mobility do not play any role. Mobility differentials are not important because —provided that firms are not rationed in any market— labour mobility is irrelevant. On the other hand, intensity differentials are absent from [26]-[29] because of the relaxation of the full-employment assumption. When sector *X,* say, is not constrained to absorb the labour force released by sector *Y,* the Stolper-Samuelson-type effect ceases to hold.

The equations of change [26]-[29] establish a simple and determinate pattern of incidence. As a result of the introduction of a selective tax on capital in sector *X,* factor and product prices change according to:

$$\begin{array}{c} \hat{\tau}_{KX} > \hat{p} \geq \hat{w} \geq 0 \geq \hat{r}_Y > \hat{r}_X > -\hat{\tau}_{KX} \quad as \;\; \alpha \geq 0 \quad all \quad 0 < \tilde{\sigma}_K < \infty \\ \hat{\tau}_{KX} > 0 = \hat{p} = \hat{w} = \hat{r}_Y > \hat{r}_X = -\hat{\tau}_{KX} \quad when \quad \tilde{\sigma}_K = 0 \end{array} \qquad [30]$$

The results only depend upon the degree of capital mobility, $\tilde{\sigma}_K$, and the parameter of wage indexation, α. Provided that capital is mobile and assuming that good *X* has a positive weight in the consumer price index, the tax will raise the wage rate and lower the rate of return to capital in both sectors, with capital in the taxed sector bearing most of the burden. When capital is sector-specific, we get back the familiar full-capitalization result, with capital in sector *X* bearing the full burden of the tax. Thus, the fact that unemployment exists does not alter the well-known immobility result [8]. Finally, note that the ranking in [30] for $\tilde{\sigma}_K > 0$ establishes that subsidization of the cost of use of capital in sector *X* will tend to make capital owners better-off in terms of both goods, and will worsen the distributional position of employed labour in terms of good *Y*.

How do changes in the degree of capital mobility alter the magnitude of factor price responses to the imposition of the tax? The answer to this question (which is implicit in 30) is easily established if we make use of a notion introduced in González-Páramo (1993): the «mobility effect», i.e. the fraction of the tax that capital in sector *X* succeeds in passing on to other factors of production. Denoting the mobility effect by $\hat{r}_X^M$, we have:

$$\hat{r}_X^M = \left[(\hat{r}_X / \hat{\tau}_{KX}) + 1\right]\hat{\tau}_{KX} = |\Sigma|^{-1}(1-\alpha\theta_{LX})\tilde{\sigma}_K\hat{\tau}_{KX}, \quad 0 \le \hat{r}_X^M \le 1 \qquad [31]$$

This simple expression and equation [28] allow us to synthesize the main effects of autonomous changes in the degree of capital mobility in the following:

Proposition 1:

Following the imposition of a selective capital income tax in sector *X:*

i) The mobility effect is always positive (i.e. capital in sector *X* will never bear more than 100 percent of the tax) and tends to operate «rapidly», in the sense that increases in capital mobility will benefit capital owners more the lower is the initial degree of capital mobility;

ii) Employed labour in both sectors and capital in the taxed sector share a common interest with regard to policies intended to increase the degree of capital mobility, for al $0 \le \tilde{\sigma}_K < \infty$, $\alpha > 0$; and,

iii) Capital employed in the taxed and the untaxed sectors have conflicting interests with regard to policies intended to increase the degree of capital mobility, for all $0 \le \tilde{\sigma}_K < \infty$, $\alpha > 0$.

In order to prove the above results, we just need to differentiate partially the expressions for $\hat{r}_X^M / \hat{\tau}_{KX}$ and $\hat{w} / \hat{\tau}_{KX}$ with respect to $\tilde{\sigma}_K$:

$$\frac{\partial \ \hat{r}_X^M}{\partial \ \tilde{\sigma}_K} = |\Sigma|^{-2}\left(1-\alpha\theta_{LX}\right)\left[\left(1-\alpha\right)\theta_{LX}\sigma_X + \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y + \theta_{KX}\sigma_S\right]\hat{\tau}_{KX} > 0 \qquad [32a]$$

$$\frac{\partial^2 \hat{r}_X^M}{\partial \tilde{\sigma}_K^2} < 0 \qquad [32b]$$

(since the numerator of 32a does not contain terms in $\tilde{\sigma}_K$), which establish part i). Similarly,

$$\begin{aligned} \operatorname{sgn}\frac{\partial \hat{w}}{\partial \tilde{\sigma}_K} &= \operatorname{sgn}\left[(1-\alpha)\theta_{LX}\sigma_X + \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y + \theta_{KX}\sigma_S\right]\hat{\tau}_{KX} \\ &= \operatorname{sgn}\frac{\partial \hat{r}_X^M}{\partial \tilde{\sigma}_K} > 0, \quad \mathit{all} \quad \alpha \ge 0 \end{aligned} \qquad [33]$$

and

$$\operatorname{sgn}\frac{\partial \hat{r}_Y}{\partial \tilde{\sigma}_K} = \operatorname{sgn}\left[-\frac{\theta_{LY}}{\theta_{KY}}\ \frac{\partial\ \ \hat{w}}{\partial\ \ \tilde{\sigma}_K}\right] = -\operatorname{sgn}\frac{\partial \hat{r}_X^M}{\partial \tilde{\sigma}_K} < 0 \qquad [34]$$

imply parts ii) and iii) of Proposition 1. Although i) does not contradict the results in a full-employment economy, ii) and iii) are of special interest both because of their paradoxical nature and their generality (which contrasts with the most of results associated to the full employment case):

$$\operatorname{sgn}\frac{\partial(\hat{r}_X\ /\ \hat{\tau}_{KX})}{\partial \tilde{\sigma}_K} = \operatorname{sgn}\frac{\partial(\hat{w}\ /\ \hat{\tau}_{KX})}{\partial \tilde{\sigma}_K} = -\operatorname{sgn}\frac{\partial(\hat{r}_Y\ /\ \hat{\tau}_{KX})}{\partial \tilde{\sigma}_K} > 0 \qquad [35]$$

The above result is not difficult to understand. As the degree of capital mobility increases, the tax-induced outflow of capital from sector X will tend to increase, thus raising the value of the marginal product of capital units that remain employed in X (i.e. the tax-induced fall in r_X will be smaller than otherwise). With the unit cost of X rising, $\hat{p}$ and $\hat{w}$ must rise. Given $p_y = 1$, the fact that $\hat{w}$ rises implies that $\hat{r}_i$ will tend to fall. Obviously, these adjustments may show themselves inconsistent with the employment level prevailing before the change in $\tilde{\sigma}_K$. Section 4 shall deal with these (potential) mobility-induced employment effects.

3.2. Differential incidence: a consumption tax and a wage tax

The findings in the foregoing subsection hinge upon the possibility of returning back the tax proceeds to consumers in a lump-sum fashion. When the fiscal adjustments to keep the government budget balanced are non-neutral, we must examine the composite effects of the introduction of the tax and the use of the revenues by the government. Here we consider two plausible alternatives of revenue use: a selective subsidy on consumption of good X, $-t_X$, and a wage subsidy on labour employed in industry X, $-t_{LX}$. This exercise shall further illuminate the nature of the incidence of a selective capital income tax —since it amounts to analyse the differential incidence of all three selective taxes— and will enable us to compare the unemployment results to the classic full-employment differential tax incidence propositions established by Mieszkowski (1967).

The balanced-budget. incidence expressions for a consumption tax and a wage tax are obtained by solving [25] for $\hat{\tau}_{LX}$ and $\hat{\tau}_X$ [9]. The equal-revenue conditions are given by the equalities $t_X pX = t_{KX} r_X K_X$ and $t_{LX} wL_X = t_{KX} r_X K_X$, respectively. Differentiating totally and noting that all taxes are zero at the initial equilibrium (which implies $\hat{\tau} = dt$), the tax rates that ensure equal revenues are:

$$\hat{\tau}_X = \theta_{KX}\hat{\tau}_{KX} \qquad [36a]$$

for a selective tax on consumption of X, and

$$\hat{\tau}_{LX} = (\theta_{KX}\ /\ \theta_{LX})\hat{\tau}_{KX} \qquad [36b]$$

for a selective wage tax. Substituting conditions [36a]-[36b] into the balanced-budget expressions, and subtracting the resulting expressions from results [26]-[29], we obtain the differential incidence equations, which appear in *Tables 1* and *2*. Some inspection of the expressions in these tables reveals the importance of capital mobility and technical substitution in the taxed sector. The main results are the best summarized in the following proposition:

Proposition 2:

i) Employed labour in both sectors and capital in the taxed sector share a common interest with respect to equal-yield tax substitutions, provided that capital is imperfectly mobile ($0 \leq \tilde{\sigma}_K < \infty$): both factors prefer a selective wage tax to a selective tax on consumption, and the latter to a selective capital income tax.

ii) Capital employed in the taxed and the untaxed sectors have conflicting interests with regard to the above equal-yield tax substitutions, as long as $0 \leq \tilde{\sigma}_K < \infty$.

iii) When capital is perfectly mobile ($\tilde{\sigma}_K \to \infty$), labour and capital employed in both sectors are indifferent to all three taxes.

Table 1
Differential incidence: a tax on capital in sector *X versus* a tax on consumption of *X* (in elasticity terms)

Price effects	$0 \leq \tilde{\sigma}_k < \infty$	$\tilde{\sigma}_k \to \infty$
$\left.\frac{\hat{p}}{\hat{\tau}_{KX}} - \frac{\hat{p}}{\hat{\tau}_X}\right\vert_{\hat{\tau}_X = \theta_{KX}\hat{\tau}_{KX}}$	$\lvert\Sigma\rvert^{-1}\theta_{KX}\left\{-\alpha\theta_{LX}\sigma_X + \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y + \frac{\delta_\alpha}{\theta_{KY}}\tilde{\sigma}_K + \theta_{KX}\sigma_S\right\}$	θ_{KX}
$\left.\frac{\hat{w}}{\hat{\tau}_{KX}} - \frac{\hat{w}}{\hat{\tau}_X}\right\vert_{\hat{\tau}_X = \theta_{KX}\hat{\tau}_{KX}}$	$-\lvert\Sigma\rvert^{-1}\alpha\theta_{KX}\theta_{LX}\sigma_X$	0
$\left.\frac{\hat{r}}{\hat{\tau}_{KX}} - \frac{\hat{r}}{\hat{\tau}_X}\right\vert_{\hat{\tau}_X = \theta_{KX}\hat{\tau}_{KX}}$	$-\lvert\Sigma\rvert^{-1}\theta_{LX}(1-a\theta_{LX})\sigma_X$	0
$\left.\frac{\hat{r}_Y}{\hat{\tau}_{KX}} - \frac{\hat{r}_Y}{\hat{\tau}_X}\right\vert_{\hat{\tau}_X = \theta_{KX}\hat{\tau}_{KX}}$	$\lvert\Sigma\rvert^{-1}\frac{\alpha\theta_{LX}\theta_{KX}\theta_{LY}}{\theta_{KY}}\sigma_X$	0

Table 2
Differential incidence: a tax on capital in sector *X* versus a tax on wages of labor *X* (in elasticity terms)

Price effects		$0 \leq \tilde{\sigma}_k < \infty$	$\tilde{\sigma}_k \to \infty$
$\frac{\hat{p}}{\hat{\tau}_{KX}} - \frac{\hat{p}}{\hat{\tau}_{LX}}$	$\hat{\tau}_{LX} = (\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}$	$-\lvert\Sigma\rvert^{-1}\theta_{KX}\,\sigma_X$	0
$\frac{\hat{w}}{\hat{\tau}_{KX}} - \frac{\hat{w}}{\hat{\tau}_{LX}}$	$\hat{\tau}_{LX} = (\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}$	$-\lvert\Sigma\rvert^{-1}\alpha\,\theta_{KX}\sigma_X$	0
$\frac{\hat{r}_X}{\hat{\tau}_{KX}} - \frac{\hat{r}_X}{\hat{\tau}_{LX}}$	$\hat{\tau}_{LX} = (\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}$	$-\lvert\Sigma\rvert^{-1}(1-\alpha\,\theta_{LX})\sigma_X$	0
$\frac{\hat{r}_Y}{\hat{\tau}_{KX}} - \frac{\hat{r}_Y}{\hat{\tau}_{LX}}$	$\hat{\tau}_{LX} = (\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}$	$\lvert\Sigma\rvert^{-1}\frac{\alpha\theta_{LX}\theta_{LY}}{\theta_{KY}}\sigma_X$	0

If we recall Mieszkowski's (1967, Math. Appendix) basic finding —under full-employment and perfect factor mobility capital (labour) always prefers a selective wage (selective capital income) tax to a selective consumption tax, and the latter to a selective capital income (selective wage) tax—, we must conclude that the results in Proposition 2 are surprising. However, the rationale behind this proposition is not difficult to understand. Let us start with part iii). The solution of system [25] for $\tilde{\sigma}_K \to \infty$ can be represented in matrix form as:

$$\begin{bmatrix} \hat{p} \\ \hat{w} \\ \hat{r} \end{bmatrix} = \frac{1}{\delta_\alpha} \begin{bmatrix} \alpha\lvert\theta\rvert\hat{\tau}_X + \theta_{LX}\theta_{KY}\hat{\tau}_{LX} + \theta_{KX}\theta_{KY}\hat{\tau}_{KX} \\ \alpha[\theta_{KY}\hat{\tau}_X + \theta_{LX}\theta_{KY}\hat{\tau}_{LX} + \theta_{KX}\theta_{KY}\hat{\tau}_{KX}] \\ -\ \alpha[\theta_{LY}\hat{\tau}_X + \theta_{LX}\theta_{LY}\hat{\tau}_{LX} + \theta_{KX}\theta_{LY}\hat{\tau}_{KX}] \end{bmatrix} \qquad [37]$$

where $\lvert\theta\rvert = \theta_{LX} - \theta_{LY} = \theta_{KY} - \theta_{KX}$ ($\theta_{KX} + \theta_{LX} = \theta_{KY} + \theta_{LY} = 1$). When the nominal wage responds to changes in p ($\alpha > 0$), any tax raises the wage rate (because $\hat{q} = \hat{p} + \hat{\tau}_X > 0$) and reduces profits in both sectors of the economy. As we pointed out in subsection 2.2.a) above, when the wage rate is set above the level consistent with full-employment and mobility is perfect, the price system is self-contained:

$$\begin{gathered} p = c_X\ [r\tau_{KX},\ \ w(p\tau_X, 1)\tau_{LX}] \\ 1 = c_Y\ [r, w(p\tau_X, 1)] \end{gathered} \qquad [38]$$

i.e. factor substitution and demand considerations have no bearing upon the price effects of taxation. In absence of incentives for factor substitution in the taxed sector (factor substitution is precisely the source of Mieszkowski's full-employment result), any equal-yield tax change will be neutral with regard to its impact upon relative prices, i.e. the price effects of all three taxes will be identical.

Figure 1 illustrates the case of t_{KX} *versus* t_{LX}. For a given relative producer price of *X, p,* cost minimization implies:

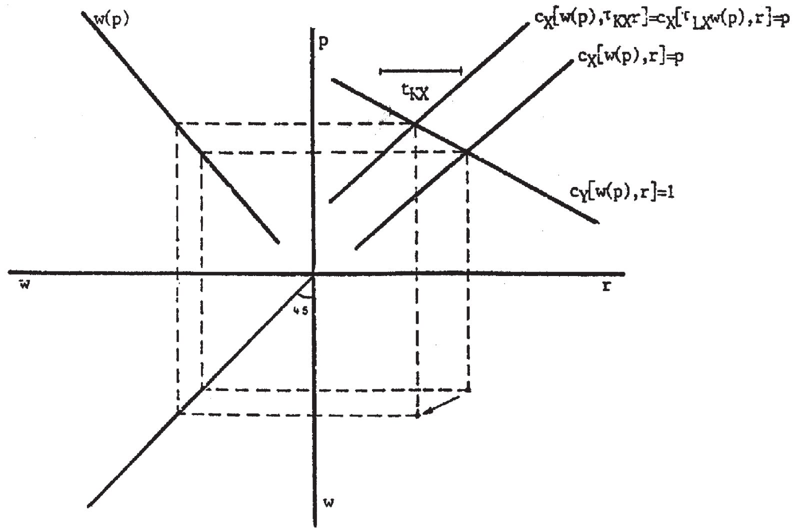
$$\hat{r}_X = -\hat{\tau}_{KX}$$
$$\hat{r}_Y = 0$$

and

$$\hat{r}_X = -(\theta_{LX} / \theta_{KX})\hat{\tau}_{LX}$$
$$\hat{r}_Y = 0$$

respectively. On the other hand, the equal-yield condition [36b] requires that the tax rate in sector *X* be $\hat{\tau}_{LX} = -(\theta_{KX} / \theta_{LX})\hat{\tau}_{KX}$. According to the above expressions, this implies that the horizontal shift of the unit-cost schedule $c_X(.)$ will be identical under both taxes.

Figure 1. Differential tax incidence under perfect capital mobility: t_{KX} *versus* t_{LX}



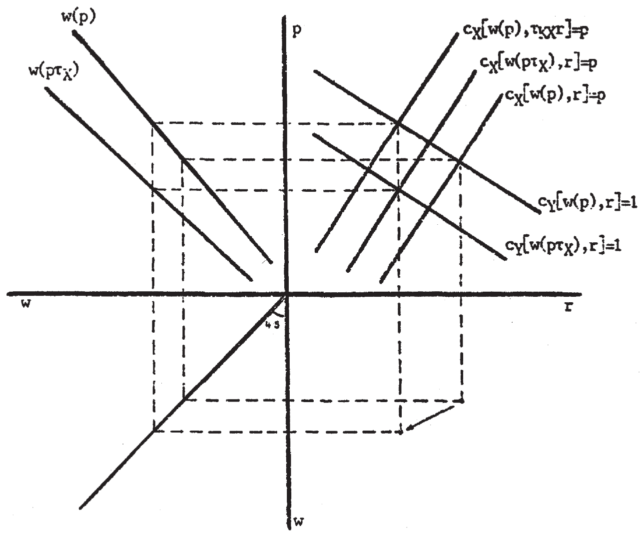
The case of t_{KX} *versus* t_X is slightly more complicated, because both unit-cost curves, $c_X(.)$ and $c_Y(.)$ and the wage rule schedule will shift (see *Figure 2*) according to (for a given *p*):

$$\hat{r}_X = -\alpha\theta_{LX}\hat{\tau}_X$$
$$\hat{r}_Y = -\alpha\theta_{LX}(\theta_{KX} / \theta_{KY})\hat{\tau}_X$$

i.e. $-\hat{r}_X \geq (<) -\hat{r}_Y$ *as* $|\theta| \geq (<) 0$. The final result will be identical to that under a selective capital income tax, with *p* now rising θ_{KX} times less than under t_{KX} (due to the fact that $\hat{\tau}_X = \theta_{KX}\hat{\tau}_{KX}$, according to condition 36a).

When capital is imperfectly mobile ($\tilde{\sigma}_K < \infty$), factor substitution and demand forces play a role (see subsection 2.2.a) and the above tax equivalences break down (except in the special case of fixed-coefficients technology in sector *X*). Under partial capital mobility, the preferences of the owners of capital —which is fully employed— between the three taxes coincide with those in Mieszkowski's ranking: a selective capital income (selective wage) tax is the worst (best) tax, because it generates the strongest (weakest) substitution effect against capital use in the taxed sector. For a given (net) wage rate, it can be seen that taxes which hurt capital the least are precisely those which raise the relative consumer price of *X*, *q*, the most. This implies, in turn, that labour units employed in both sectors will get the highest (lowest) increase under a wage (capital) tax. Hence the result in part i) of Proposition 2. On the other hand, from the price equation of the untaxed sector we can see that whatever benefits labour in *Y* harms capital employed in this industry. This fact, combined with the coincidence of interests of capital used in sector *X* and labour employed in both industries, explain the result in ii).

Figure 2. Differential tax incidence under perfect capital mobility: t_{KX} *versus* t_X



4. Tax incidence (II): Employment effects

Having analysed the price effects of taxation in our model in the last section, the stage is now set for the derivation of the equations that determine the employment effects associated to the imposition of a selective capital income tax. The conclusion reached above that any tax improves the position of «employed labour» in both sectors, though surprising to some extent, is not difficult to understand once we recognize the possibilities that firms have to readjust their demand for labour to a level consistent with the cost-minimizing conditions facing them (i.e. the nominal wage equals the value of the marginal product of labour). The purpose of exploring the employment effects of taxation needs little justification. The existence of minimum wage laws and COLA mechanisms (established under the pressures exerted by unions and/or enacted by paternalist governments with the purpose of ensuring an «adequate» minimum living standard to workers) is a widespread phenomenon both in developed and less developed economies. On the other hand, the very presence of unemployment is generally regarded as a social evil. Thus, it might seem reasonable to have an explicit employment objective in economic policy-making. In this spirit we will now present two versions of the equation that describes the employment effects of a selective capital income tax, each serving a different analytical purpose.

4.1. Employment effects: Structure

In this subsection, we aim at presenting an equation which clearly separates the effects of changes in the price variables upon the level of employment and its distribution between sectors, i.e. the «structural form» of the employment effects. The information provided by the structural form will be useful in our later analysis in conveying the rationale behind the «reduced form» results. Rewriting equation [24] above, we have:

$$\hat{L} = \Pi_2(\hat{p}+\hat{\tau}_X)+(\lambda_{LX}\theta_{KX}\sigma_X-\lambda_{KX}\tilde{\sigma}_K)\hat{r}_X+\lambda_{LX}\theta_{KX}\sigma_X(\hat{\tau}_{KX}-\hat{\tau}_{LX}) \quad [39]$$

Similarly, we can manipulate the system [10] to obtain the employment effects at the sector level:

$$\hat{L}_X = \Pi_2^X(\hat{p}+\hat{\tau}_X)+(\theta_{KX}\sigma_X-\lambda_{KX}\tilde{\sigma}_K)\hat{r}_X+\theta_{KX}\sigma_X(\hat{\tau}_{KX}-\hat{\tau}_{LX}) \quad [40]$$

$$\hat{L}_Y = \Pi_2^Y(\hat{p}+\hat{\tau}_X)-\lambda_{KX}\tilde{\sigma}_K\hat{r}_X \quad [41]$$

where Π_2 is as defined in equation [24] and:

$$\Pi_2^X = -\alpha\left[\theta_{KX}\sigma_X+\frac{\theta_{LY}}{\theta_{KY}}(\sigma_Y+\lambda_{KX}\tilde{\sigma}_K)\right]-\sigma_S \le 0$$

$$\Pi_2^Y = -\frac{\alpha}{\theta_{KY}}(\sigma_Y+\lambda_{KX}\theta_{LY}\tilde{\sigma}_K)\le 0$$

Consider now the impact of a selective capital income tax imposed in sector *X*. Expressions [40] and [41] can be decomposed, for analytical purposes, into four effects:

i) *Direct tax-substitution effects.* If we take the levels of p and r_X as fixed, the imposition of the tax generates a direct substitution effect which stimulates the demand for labour in sector *X* as the use of capital in the taxed sector becomes more expensive.

ii) *Indirect substitution effect.* The former effect is partly offset by an indirect substitution effect that decreases employment in sector *X,* as a result of the tax induced reduction in r_X. This effect can never exceed the direct tax-substitution effect, since $\hat{r}_X + \hat{\tau}_{KX} \geq 0$ (see subsection 3.1) and $\hat{w} = 0$ (for *p* is given at a constant level). The balance of the substitution effects on employment is thus non-negative.

iii) *Mobility effect.* This effect, which operates through changes in r_X, tends to increase employment when the net rental to capital in sector *X* falls. The justification of this expansionary effect is artificial to some extent, since mobility operates through changes in r_Y as well, but in the opposite direction (this is so because as *p* falls, r_Y rises, with the same qualitative impact upon capital movements as a fall in r_X). In what follows, we shall abstract from the latter. Let us start with sector *Y.* Given *p* —and, thus, r_Y and *w*—, a reduction in the net rate of profits in the taxed industry, $r_{X,}$ will stimulate the migration of capital units to sector *Y.* But with a constant wage-rental ratio and homogeneous production functions, any increase in the capital stock employed in the untaxed sector must take place at the initial capital-labour ratio. Hence the expansionary mobility effect upon L_Y associated with a fall in r_X (see expression 41). Now we may ask how is it possible that the ratio *X/Y* be constant (as implied by homotheticity and a constant *q)* with K_X falling? Clearly, industry *X* will not be able to increase production unless new labour units are hired. This explains the sign of the coefficient in $\tilde{\sigma}_K$ in equation [40].

iv) *Output price effect.* This effect, which is represented by the Π terms in [39]-[41], is a composite of substitution, demand and mobility influences that tend to depress employment in both sectors. Any increase in *p,* given α>0, rises the wage-rental ratio and favours substitution of capital for labour in both sectors (in sector *Y* the rise in w/r_Y is further encouraged by r_Y). The ensuing reduction in r_Y leads to an increase in the ratio r_X/r_Y, thus moderating the outflow of capital from sector *X.* Finally, any rise in *p* will tend to discourage consumers demand for *X* and reduce employment in the taxed industry.

Figures 3 and *4* present two different types of adjustment of the employment level following the introduction of a selective capital income tax. The length of the horizontal axis is equal to the total supply of labour, and L_X(.) and *Ly*(.) measure the demand for labour by sector *X* and *Y,* respectively, for any given value of *w.* Shifts in the *L*-curves are decomposed into the direct tax effect and the indirect effects that operate through changes in r_X (note that the *output* price effects are represented by movements along the *L*-curves, since $\hat{w} = \alpha\hat{p}$). In the case depicted in Figure 3, the degree of capital mobility is relatively «high» (i.e. $\tilde{\sigma}_K >$ $(\theta_{KX}/\lambda_{KX})\sigma_X$)' which implies that for any given *p,* a reduction, in r_X increases employment in both sectors. However, the fact that *p* will rise as a result of the tax (see equation 26) contributes to an increase in unemployment through a higher *w.* The final effect is «a priori» indeterminate: $\hat{L} \gtrless 0$ as $AB \gtrless CD$. Figure 4 illustrates the case characterized by a relative «low» degree of capital mobility (i.e. $\tilde{\sigma}_K$ $<(\theta_{KX}/\lambda_{KX})\sigma_X$): contractions in r_X will tend to reduce employment in sector *X* for any given level of *p* and *w.* As in the previous case, $\hat{L} \gtrless 0$ as $AB \gtrless CD$.

Figure 3. «High» capital mobility

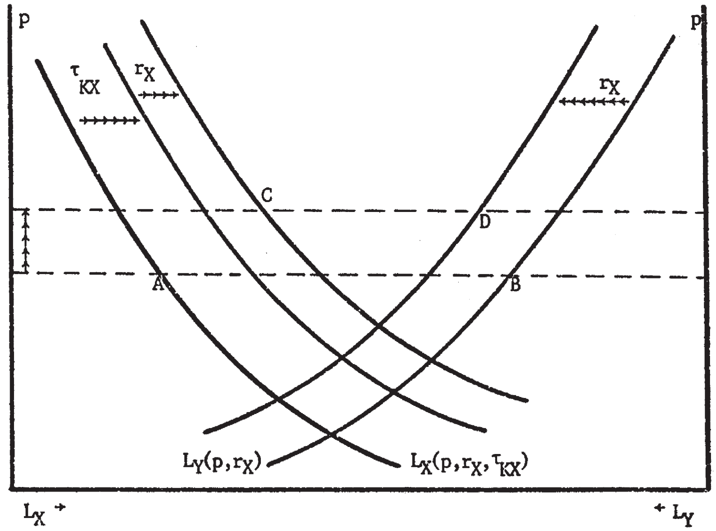
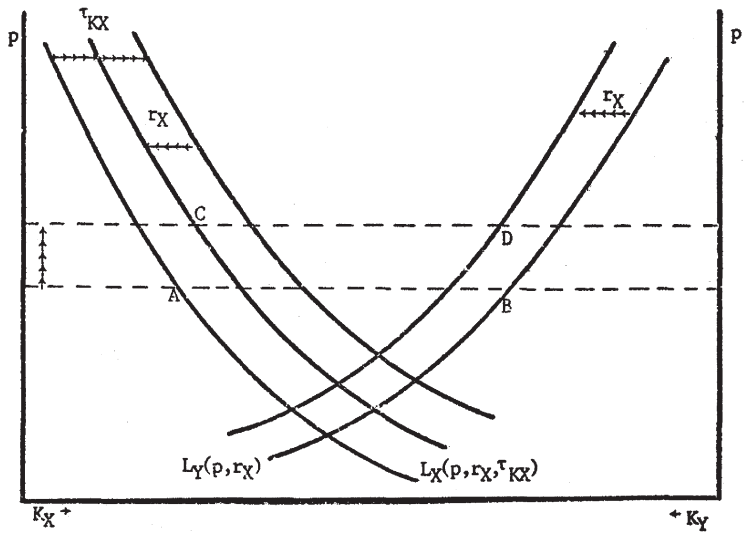


Figure 4. «Low» capital mobility



4.2. Balanced budget incidence: The mobility effect

The decompositions above show the main channels through which the incidence effects are propagated and identify parameters determining the employment effects of taxation. Now we seek a «reduced form» equation that can be used to evaluate the total impact of a selective capital income tax on employment once relative prices have reached their new equilibrium values.

As we saw in section 2 above, the system of incidence is recursive with respect to changes in employment. Thus, in order to solve for $\hat{L}/\hat{\tau}_{KX}$ all that we need to do is to substitute the price effects [26] and [27] into the employment equation [24] to obtain:

$$\hat{L} = |\Sigma|^{-1}\,\tilde{\sigma}_K \left\{(1-\alpha)\delta_X\sigma_X - \frac{\alpha\theta_{KX}}{\theta_{KY}}\delta_Y\sigma_Y - |\lambda|\,\theta_{KX}\sigma_S\right\}\hat{\tau}_{KX} \qquad [42]$$

where:

$$\delta_X = \lambda_{LX}\theta_{KX} + \lambda_{KX}\theta_{LX}$$
$$\delta_Y = \lambda_{LY}\theta_{KY} + \lambda_{KY}\theta_{LY}$$

Expression [42] neatly illustrates the role of substitution, mobility and demand in the determination of tax induced employment changes.

Some inspection of the employment equation enables us to establish a preliminary observation: although the qualitative sign of $\hat{L}/\hat{\tau}_{KX}$ is ambiguous, it does not depend upon the size of the elasticity of capital mobility. It is worth noting that the elasticities of factor substitution will always move employment in opposite directions, due to the type of tax under consideration: a selective tax on capital in sector *X.* The indirect substitution effects on employment are always non-positive, reflecting the rise of wages in both sectors. However, in the presence of a selective capital income tax there exists a positive direct substitution effect which raises the user's cost of capital in the taxed industry. Equation [42] reveals that the net substitution effect in sector *X* will be non-negative. To see why, suppose that the wage paid by *X*-firms is held constant in terms of *X,* i.e. $\alpha = 1$. From the expressions of the price effects of the tax (see section 3) we can see that the gross-of-tax relative cost of capital is left unchanged, i.e. $\hat{w}-\hat{r}_X = \hat{\tau}_{KX}$ with $\alpha = 1$. In this case, factor substitution in sector *X* will not produce any employment effects. Industry *Y,* however, will have an incentive to reduce employment, since $\hat{w}-\hat{r}_Y > 0$ when $\alpha > 0$. In the general case, $0 < \alpha < 1$ implies $\hat{w} - \hat{r}_X - \hat{\tau}_X < 0$ and $\hat{w}-\hat{r}_Y > 0$, which explains the signs of the coefficients in σ_X and σ_Y.

The direction of the impact of tax-induced adjustments in demand depends on the sign of the factor intensity differential coefficient, $|\lambda|$. The reason of course is the necessity for the expanding (declining) industry to increase (reduce) employment according to its initial relative factor intensity. A selective capital income tax will tend to raise the price of *X* and reduce the share of *X* in consumption, thus increasing (reducing) employment in sector *Y(X).* In a fixed-coefficients world, the question of which of these employment effects dominates will depend upon relative factor intensities: if the taxed sector is relatively labour-intensive (i.e. $|\lambda|>0$), the tax-induced change in demand will reduce total employment, and vice versa when $|\lambda|<0$.

The above results and expression [42] allow to summarize the employment effects of a selective capital income tax in the following:

Proposition 3:

Following the imposition of a selective capital income tax in sector *X,*

i) if $\alpha = l$ or $\sigma_X = 0$, a necessary (sufficient) condition for the level of employment to rise (fall) is that the taxed sector be relatively capital-(labour) intensive, i.e.

$$\begin{gathered} \hat{L} > 0 \quad \textit{only if} \quad |\lambda| < 0 \\ \hat{L} < 0 \quad \textit{if} \quad |\lambda| \geq 0 \end{gathered}$$

ii) if $\alpha = 0$ or $\sigma_X = 0$, a necessary (sufficient) condition for total employment to decline (expand) is that the taxed sector be relatively labour-(capital-)intensive, i.e.

$$\begin{gathered} \hat{L} < 0 \quad \textit{only if} \quad |\lambda| > 0 \\ \hat{L} > 0 \quad \textit{if} \quad |\lambda| \leq 0 \end{gathered}$$

iii) when $\sigma_X = \sigma_Y = 0$ (fixed coefficients of production in both sectors), total employment will fall (rise) if the taxed sector is relatively labour-(capital-)intensive:

$$\hat{L} \gtrless 0 \quad \textit{as} \quad |\lambda| \gtrless 0$$

iv) when $|\lambda|= 0$ and $\sigma_X = \sigma_Y > 0$,

$$\begin{gathered} \hat{L} < 0 \quad \textit{if} \quad \alpha = 1 \\ \hat{L} > 0 \quad \textit{if} \quad \alpha = 0 \\ \hat{L} \gtrless 0 \quad \textit{as} \quad \lambda_{KX}\theta_{LY} \gtrless \lambda_{LY}\theta_{KX} \quad \textit{if} \quad \alpha = \theta_{KY} \end{gathered}$$ [11]

v) when $\sigma_X = \sigma_Y = \sigma_S > 0$,

$$\begin{gathered} \hat{L} \gtrless 0 \quad \textit{as} \quad \lambda_{KX}\theta_{LY} \gtrless \theta_{KX} \quad \textit{if} \quad \alpha = 1 \\ \hat{L} > 0 \quad \textit{if} \quad \alpha = 0 \\ \text{for all} \quad \tilde{\sigma}_K > 0. \end{gathered}$$ [12]

Parts i) and ii) in Proposition 3 are obvious (see 42). The result in the generalized Leontief technology case (part iii) follows from the fact that substitution in demand is the only source of employment changes. Thus, since employment in sector *X(Y)* declines (increases) with the outflow (inflow) of capital from the taxed sector at the fixed initial factor proportions, the net result depends solely upon relative factor intensities. In part iv), with identical factor proportions and equal elasticities of substitution in both sectors, the employment effect of a selective capital income tax depends upon the weights in the wage function, α and $(1–\alpha)$. When the real wage is constant in terms of Y ($\alpha = 0$), the tax will make labour cheaper in terms of X. In this case, factor substitution will encourage employment in the declining industry, and sector Y will expand at a constant wage-rental ratio, thus increasing total employment. The remaining cases may be explained in a similar fashion.

Claims iv) and v) in Proposition 3 are of particular interest because they include the special case where the technology is of the Cobb-Douglas type, $\sigma_X = \sigma_Y = 1$, an assumption which has been widely used in applied work. In both iv) and v), when the nominal wage does not respond to changes in *p,* a tax (subsidy) on capital in sector X will be beneficial (harmful) for total employment. Finally, when $\sigma_X = \sigma_Y = \sigma_S$ the results do not depend upon relative factor intensities. A relatively small θ_{KX} will suffice for employment to increase following the introduction of the tax, even with the real wage rigid in terms of good X ($\alpha = 1$).

We now turn to the effect of a change in the degree of capital mobility upon the employment effect of a selective capital income tax. As we noted above, labour employed in both sectors and capital in the taxed sector will benefit from increase in the degree of capital mobility. What can we say concerning changes in employment?

Denoting the term in branckets in equation [42] by Ξ, we can readily obtain:

$$\frac{\partial(\hat{L} \;/\, \hat{\tau}_{KX})}{\partial\tilde{\sigma}_K} = |\Sigma|^{-2}\ \Xi \left[(1-\alpha)\theta_{LX}\sigma_X + \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y + \theta_{KX}\sigma_S\right] \gtrless 0 \quad as \quad \Xi \gtrless 0 \qquad [43]$$

$$\frac{\partial^2(\hat{L} \;/\, \hat{\tau}_{KX})}{\partial\tilde{\sigma}_K^2} = -2|\Sigma|^{-3}\ \frac{\Xi\delta_X}{\theta_{KY}}\left[(1-\alpha)\theta_{LX}\sigma_X + \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y + \theta_{KX}\sigma_S\right] \lesseqgtr 0 \quad as \quad \Xi \gtrless 0 \qquad [44]$$

The above expressions establish the following:

Proposition 4:

i) If the employment effect of the tax is positive (negative), policies intended to increase the degree of capital mobility will further increase (reduce) the level of employment.

ii) The magnitude of the sensitivity of the level of employment to changes in the degree of capital mobility will be greater the smaller is the initial degree of capital mobility.

This proposition has the following implication: the interests of labour with respect to wages and employment do not necessarily conflict: w and L can move in the same direction following an increase in $\tilde{\sigma}_K$. It is worth noting, however, that if there exists an explicit employment objective in economic policy-making, policies aimed at reducing (increasing) the degree of capital mobility will minimize (reinforce) the negative (positive) employment effects of taxation.

4.3. Differential incidence: consumption taxes and wage taxes

The foregoing analysis is built upon the assumption that the tax revenue can be returned back to consumers as a lump-sum subsidy. The balanced-budget incidence approach, though useful if we are interested in isolating «the» impact of the tax, is probably not the most meaningful approach for practical purposes. A more appealing method of evaluation of a tax scheme consists in comparing its incidence with that of an equal-yield tax (subsidy) adjustment that would keep the budget balanced. We now consider two such fiscal adjustments: a consumption subsidy on X and a wage subsidy to labour employed in X. In fact, this differential-incidence exercise allows us to compare the employment-effect of equal-yield taxes.

The equal-yield conditions are given by expressions [36a] and [36b]. Substituting into expression [39], after some manipulation we finally obtain:

$$\frac{\hat{L}}{\hat{\tau}_{KX}} - \frac{\hat{L}}{\hat{\tau}_X}\Big|_{\hat{\tau}_X = \theta_{KX}\ \hat{\tau}_{KX}} = |\Sigma|^{-1}\Big\{\sigma_X\Big[((1-\alpha)\delta_X + \frac{\alpha\theta_{KX}}{\theta_{KY}}(\delta_{XY}\theta_{LX} + \lambda_{LX}\theta_{KX}))\tilde{\sigma}_K + \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y + \lambda_{LX}\theta_{KX}\sigma_S\ \Big]\Big\} \geq 0 \quad as \quad \sigma_X \geq 0 \tag{45}$$

$$\frac{\hat{L}}{\hat{\tau}_{KX}} - \frac{\hat{L}}{\hat{\tau}_{LX}}\Big|_{\hat{\tau}_{LX} = (\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}} = |\Sigma|^{-1}\Big\{\sigma_X\Big[\frac{\delta_X\delta_\alpha}{\theta_{KY}\theta_{LX}}\tilde{\sigma}_K + \frac{\alpha\theta_{KX}\rho_L}{\theta_{LX}\theta_{KY}}\sigma_Y + \frac{\lambda_{LX}\theta_{KX}}{\theta_{LX}}\sigma_S\ \Big]\Big\} \geq 0 \quad as \quad \sigma_X \geq 0 \tag{46}$$

where:

$$\delta_{XY} = \lambda_{LX}\lambda_{KX} + \lambda_{LY}\lambda_{KY}$$
$$\rho_L = \lambda_{LX}\theta_{LY} + \lambda_{LY}\theta_{LX}$$

The above results have significant implications for the analysis of the employment effects of equal-yield, selective taxes. In particular, the following proposition may be established:

Proposition 5:

i) If substitution possibilities exist in the taxed sector, $\sigma_X > 0$, then a tax on capital decreases (increases) employment less (more) than a commodity tax on X, for all σ_X.

ii) If $\sigma_X > 0$, a wage tax reduces employment more than any other tax, for all σ_K.

iii) Sufficient conditions that ensure identical employment effects of the three taxes considered are: a) $\sigma_X = 0$, and b) $\tilde{\sigma}_K = \sigma_Y = \sigma_S = 0$.

These results are eminently plausible, and follow from the substitutability of factors in production. According to the above proposition, a partial tax (subsidy) on capital is the best (worst) fiscal instrument from the employment perspective. For any degree of factor mobility, a wage tax raises the (gross) relative cost of labour in *X* the most, and a tax on capital raises (lowers) the (gross) relative cost of labour in *X* the least (most). This is also true with respect to the wage-rental ratio in *Y* if capital mobility is less than perfect. Provided that substitution possibilities exist in the taxed sector, the results in Proposition 5 follow immediately.

If we put together the above results with the price effects analysed in the previous section, we may readily establish an interesting conclusion. Following an equal-yield tax substitution, consumers' interests with respect to wages and employment are irreconciliable: the tax which raises wages the most (least), $t_{LX}(t_{KX})$, is the worst (best) from the employment creation perspective, as long as substitution possibilities exist in the taxed sector, for any degree of capital mobility. Put in a different fashion, the taxes which harm capital the most are the best from the employment point of view.

4.4. Sectoral distribution of changes in employment. The «regional subsidy problem»

In many practical problems it is important to know not just the tax-induced change in total employment, but also the sectoral distribution of employment changes. How is agricultural employment affected by a tax on capital employed in the industrial sector? Is this tax always harmful for industrial employment? On the other hand, a generally accepted objective of regional policy consists in raising the level of labour's income in the target region. Are capital subsidies always effective concerning this objective? Finally, we have seen in the preceding subsection that capital subsidies are not the most effective means of increasing total employment. Is this also true at the regional/sectoral level? In what follows we shall briefly analyse this question in the light of our model.

Substituting equations [26] and [27] into the «structural» equations for $\hat{L}_X$ and $\hat{L}_Y$ (equations 40 and 41), we easily obtain the expressions for the tax-induced changes in sectoral employment.

$$\hat{L}_X = |\Sigma|^{-1}\,\tilde{\sigma}_K \left\{(1-\alpha)(1-\lambda_{KY}\theta_{KX})\sigma_X - \frac{\alpha\lambda_{KY}\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y - \lambda_{KY}\theta_{KX}\sigma_S\right\}\hat{\tau}_{KX} \qquad [47]$$

$$\hat{L}_Y = |\Sigma|^{-1}\,\tilde{\sigma}_K \left\{(1-\alpha)\lambda_{KX}\theta_{LX}\sigma_X - \frac{\alpha(1-\lambda_{KX}\theta_{LY})}{\theta_{KY}}\sigma_Y + \lambda_{KX}\theta_{KX}\sigma_S\right\}\hat{\tau}_{KX} \qquad [48]$$

The only source of asymmetry in the sectoral employment effects of a selective capital income tax has to do with the tax-induced adjustment of the goods market. In absence of substitution possibilities in either industry, the tax will reduce the share of *X* in demands, thus reducing(increasing) employment in sector *X(Y)*. On the other hand, if $\sigma_X = \sigma_S = 0$, employment will fall in both sectors. Other features of the sectoral responses of unemployment to the imposition of the tax may be summarized in the following:

Proposition 6:

For all, $\sigma_K = 0$,

i) A necessary condition for L_X to increase is $\sigma_X > 0$ with $\alpha < 1$; sufficient conditions for an increase in L_X are, among others: a) $\alpha = 0$ and $\sigma_X \geq \sigma_S$, and b) $\sigma_X = \sigma_S$, $\sigma_Y = 0$ and $\alpha \leq \lambda_{KX}$;

ii) A necessary condition for L_Y to fall is $\sigma_Y > 0$ with $\alpha > 0$; sufficient conditions for an increase in L_Y are, among others: a) $\alpha = 0$, and b) $\sigma_Y = 0$.

iii) If $\sigma_X = \sigma_Y = \sigma_S > 0$, employment in both sectors will change in the same proportion, i.e. $\hat{L}_X/\hat{\tau}_{KX} = \hat{L}_Y/\hat{\tau}_{KX}$ [13]; furthermore, $\hat{L}_X/\hat{\tau}_{KX} = \hat{L}_Y/\hat{\tau}_{KX} \gtrless 0$ as $\dfrac{\alpha}{1-\alpha} \lessgtr \theta_X/\theta_Y$ (where θ_Y is the distributive share of the its good in national income);

iv) If $\sigma_X = 0$, $\sigma_Y = 1$ and $\sigma_S = \alpha$, $\hat{L}_X = \hat{L}_Y < 0$.

Parts i) and ii) require little comment. Employment in sector *X* will fall if the substitution effect, always beneficial for labour [14], is zero (i.e. $\sigma_X = 0$ or $\alpha = 1$) or its size is not enough to cushion the negative impact of substitution in sector *Y* and the fall in the demand for *X*. On the other hand, if the technology of the untaxed sector is of the Leontief type, the tax will raise employment in this sector, since the capital inflow to this sector will be accommodated at the initial factor proportions. Changing signs, the above results give conditions under which employment-oriented fiscal policies based on the subsidization of the cost of use of capital will be successful: the smaller (larger) elasticity of substitution in the taxed (untaxed) sector, the larger elasticity of substitution in demand and the larger weight of the subsidized good in the wage function, the most effective will be a selective capital income subsidy from an employment perspective.

In the general case, there are no reasons to expect that employment in both sectors will move in the same direction in response to the tax. However, cases may be found in which changes in employment will be not just of the same sign, but also of the same proportional size. Part iii) in Proposition 6, for example, refers to the interesting case in which the technical elasticities of substituion are identical, and equal to the elasticity of substitution in demand Here, $\hat{L}_X/\hat{\tau}_{KX} = \hat{L}_Y/\hat{\tau}_{KX}$. This result will hold in the relevant case of Cobb-Douglas technology and preferences, $\sigma_X = \sigma_Y = \sigma_S = 1$.

Frequently, most regional policies for economic development of depressed areas are expressly aimed to increase labour's income in the target regions (see, for example, Bird, 1966, Gold, 1968 and Moes, 1962). The results in our discussion suggest that the objectives of increasing regional employment and raising labour's income are not necessarily equivalent. The reason is of course that any subsidy tends to reduce labour costs, since the subsidy results in a lower price of goods produced in the target region. Thus, wages and employment can move in opposite directions, in which case we cannot *a priori* predict the qualitative change in labour's income. In order to briefly explore the possibilities of success of capital-oriented subsidization policies to raise labour's income, $R_{LX} = wL_X$, differentiate totally and substitute equations [28] and [47] to obtain:

$$\hat{R}_{LX} = \hat{L}_X + \hat{w} = |\Sigma|^{-1}\,\tilde{\sigma}_K \left\{(1-\alpha)(1-\lambda_{KY}\theta_{LX})\sigma_X - \frac{\alpha\lambda_{KY}\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y - \lambda_{KY}\theta_{KX}\sigma_S + \alpha\theta_{KX}\right\}\hat{\tau}_{KX} \qquad [49]$$

expression which allows to establish:

Proposition 7: For all $\sigma_K > 0$,

i) A selective capital subsidy will raise labour's income in the target region if the regional production function is of the Leontief type and wages are inelastic with respect to the price of the subsidized region's *output,* i.e. $R_{LX} > 0$ if $\sigma_X = \alpha = 0$.

ii) Sufficient conditions for labour's income in the target region to fall are, among others: a) $\sigma_X \geq \sigma_S$ and $\alpha = 0$; and b) $\sigma_X = \sigma_S$, $\sigma_Y = 0$ and $\alpha \leq \lambda_{KX}$; and

iii) If $\sigma_X = \sigma_Y = \sigma_X = 1$ (Cobb-Douglas production and demand functions),

$$\alpha = 0 \text{ implies } \hat{R}_{LX} < 0$$

$$\alpha = 1 \text{ implies } \hat{R}_{LX} \gtrless 0 \quad \text{as} \quad \theta_{KY} \lessgtr \lambda_{KY}$$ [15]

The rationale of the result in i) is easily understood: *á* = 0 implies that the real wage (in terms of *Y*) does not change with the subsidy, and $\sigma_X = 0$ ensures that the subsidy-induced capital inflow is incorporated to production in sector *X* only if L_X rises in the same proportion. Part ii) refers to cases where R_{LX} falls because of the predominance of a substitution effect against labour, relatively more costly as a result of the subsidy. Finally, the Cobb-Douglas case iii) ensures that L_X falls with $\alpha = 0$; this fact, together with the constancy of the wage in terms of *Y* explains the reduction in R_{LX}. On the other hand, with $\alpha = 1$, the effect of the subsidy on R_{LX} could go either way, since the subsidy incentivates the demand for labour but reduces wages.

We now turn to the «regional subsidy problem», which may be stated as follows. For a given resource cost and any degree of capital mobility, which of the three selective subsidies under study —capital, labour, and production subsidies— is more effective from an employment perspective? This question was a matter of great concern in the 60s and early 70s. Although most opinions favour the use of wage subsidies, economic arguments have been offered to provide a rationale against labour-oriented subsidy policies for regional development:

> «(...) policies aimed at inducing firms to use more labour (for example, in regions of high unemployment) by directly subsidizing their wage bill may be theoretically deficient. Subsidies to capital may induce firms to use relatively less labour; but it does not follow that subsidies to labour will have the opposite effect (...), unless there is also a change in the rate of inte-

> rest; and there is no reason to expect the latter change merely because a subsidy in now given to the use of labour» [Bird, 1966, p. 119].

Two typical assumptions in this literature are those of perfect capital mobility across regions and wage rigidity in the target region. Nonetheless, this characterization of reality can be easily criticized from different perspectives. Perfect capital mobility is probably not the most sensible way of representing reality in the short-run, particularly so from a regional perspective. According to Bird (1965), «if this assumption were true, there would hardly be a branch of study called «regional economics"». On the other hand, the existence of wage rigidities is not an exclusive feature of depressed regions. Labour unions' pressures tend to equalize wages across regions and industries of developed economies. In the case of LDCs, it is frequent to observe regional/sectoral minimum wages (see Balassa, 1982) and generalized sticky wages (see Agarwala, 1983) originated by social policies aimed to ensure an *adequate* level of income to labour.

In order to shed some light into the problem, we can use our model to compute the differential incidence of the three selective subsidies. Using the equal cost conditions [36a] and [36b], and solving the model, we obtain:

$$\left.\frac{\hat{L}_X}{\hat{\tau}_{KX}}-\frac{\hat{L}_X}{\hat{\tau}_{LX}}\right|_{\hat{\tau}_{LX}=(\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}}=\left|\Sigma\right|^{-1}\frac{\sigma_X}{\theta_{KY}\theta_{LX}}\left\{(1-\lambda_{KY}\theta_{LX})\delta_\alpha\tilde{\sigma}_K+\alpha\theta_{LY}\theta_{KX}\sigma_Y+\theta_{KY}\theta_{KX}\sigma_S\right\}\geq 0 \quad \text{as} \quad \sigma_X\geq 0 \qquad [50]$$

$$\left.\frac{\hat{L}_X}{\hat{\tau}_{KX}}-\frac{\hat{L}_X}{\hat{\tau}_{X}}\right|_{\hat{\tau}_{X}=\theta_{KX}\hat{\tau}_{KX}}=\left|\Sigma\right|^{-1}\frac{\sigma_X}{\theta_{KY}}\left\{(1-\lambda_{KY}\theta_{LX})\delta_\alpha\tilde{\sigma}_K+\alpha\theta_{LY}\theta_{KX}\sigma_Y+\theta_{KX}\theta_{KY}\sigma_S\right\}\geq 0 \quad \text{as} \quad \sigma_X\geq 0 \qquad [51]$$

$$\left.\frac{\hat{L}_X}{\hat{\tau}_{X}}-\frac{\hat{L}_X}{\hat{\tau}_{LX}}\right|_{\substack{\hat{\tau}_{X}=\theta_{KX}\hat{\tau}_{KX}\\ \hat{\tau}_{LX}=(\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}}}=\left|\Sigma\right|^{-1}\frac{\theta_{KX}\sigma_X}{\theta_{KY}\theta_{LX}}\left\{(1-\lambda_{KY}\theta_{LX})\delta_\alpha\tilde{\sigma}_K+\alpha\theta_{LY}\theta_{KX}\sigma_Y+\theta_{KY}\theta_{KX}\sigma_S\right\}\geq 0 \quad \text{as} \quad \sigma_X\geq 0 \qquad [52]$$

Expressions [50] to [51] allow to establish two important conclusions: i) For a given resource cost and any degree of capital mobility, a regional subsidy on capital will cause larger capital inflows than does a subsidy on production, with a wage subsidy causing the smallest capital inflows [16]. This result holds in the full-employment case as well (see McLure, 1970); and ii) This ranking of subsidies is reversed when the policy objective is employment creation, as long as substitution possibilities exist in the subsidized region. This finding contradicts Bird's (1965, 1966) suggestion (see also Milliman, 1966). In fact, capital subsidies might increase unemployment in the target region.

Which subsidy is the «best» from an employment perspective? According to expression [52], the answer is unambiguous: as long as substitution possibilities exist in the target region, a wage subsidy is always preferable, for any degree of interregional capital mobility. When capital is region-specific, a subsidy to capital will raise profits in the target region, with no employment effects. On the other hand, a wage subsidy will increase employment even in the case of region-specific capital, because factor substitution favourable to labour implies in this case addition of labour units to a fixed capital stock. The advantage of a wage subsidy versus a production subsidy is in the fact that the former tends to induce a greater reduction in the consumer price of good *X* and, thus, a greater fall in the relative cost of labour to firms in *X.* This argument holds for any finite degree of capital mobility.

The above ranking holds with perfect capital mobility as well. However, the explanation of this result is slightly more subtle. According to the differential incidence results in section 3 above, when capital is perfectly mobile the three subsidies under study are equivalent for a given revenue. Then, what does induce firms in region *X* to hire more labour? The answer is of course the fact that under a wage subsidy, firms in *X* face a lower real wage in terms of *X.* Given the distribution of capital units across regions, this implies that employment will rise. To see this, note that the real wage relevant for an *X* producer is $w\tau_{LX}/p$ under a wage subsidy, and w/p under a production subsidy. Noting that the equal resource cost conditions are $-\hat{\tau}_{LX} = -(\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}$ and $-\hat{\tau}_X = -\theta_{KX}\hat{\tau}_{KX}$, respectively, the differential incidence upon the real wage is:

$$-\left(\frac{\hat{w}}{\hat{\tau}_{LX}}-\frac{\hat{w}}{\hat{\tau}_X}\right)-\frac{\theta_{KX}}{\theta_{LX}}+\left(\frac{\hat{p}}{\hat{\tau}_{LX}}-\frac{\hat{p}}{\hat{\tau}_X}\right)=0-\frac{\theta_{KX}}{\theta_{LX}}+\theta_{KX}=-\frac{\theta_{KX}^2}{\theta_{LX}}<0 \qquad [53]$$

(see Section 3). Thus, since $w\tau_{LX}/p < w/p$ after subsidization, a wage subsidy will produce higher levels of employment and output as long as substitution possibilities exist in the target region.

Discussion of the implications for the non-target region is practically absent in the available literature, due perhaps to the lack of an explicit general equilibrium framework. Is there any clash of interests between target and non-target regions from the employment perspective? Our model provides an unambiguous answer to this question. Noting —in view of the results in Section 3— that $q = p\tau_X$, changes in the same proportion under the three equal-resource-cost subsidies, composition of demand will stay unchanged (homotheticity assumption). This requires parallel increases in employment and output in the non-target region. In fact, it can be shown that the ranking of subsidies with respect to their employment effect in region *Y* coincides with that of the target region [17], i.e.:

$$-\frac{\hat{L}_X}{\hat{\tau}_{LX}} \geq -\frac{\hat{L}_X}{\hat{\tau}_X} \geq -\frac{\hat{L}_X}{\hat{\tau}_{KX}} \qquad [54a]$$

$$-\frac{\hat{L}_Y}{\hat{\tau}_{LX}} \geq -\frac{\hat{L}_Y}{\hat{\tau}_X} \geq -\frac{\hat{L}_Y}{\hat{\tau}_{KX}} \qquad [54b]$$

This line of argument leads to the conclusion that -as long as technical substitution is possible in the target region- the superiority of labour oriented subsidies for employment creation does not depend in any way upon the degree of capital mobility, appreciation that runs against the suggestions made by some writers (for example, Milliman, 1966). The analysis has also shown that there is no conflict of interests between the «depressed» and «advanced» regions with respect to the type of subsidy policy chosen by the fiscal authority.

5. Concluding comments

In this paper we have explored the structure of the incidence of a selective capital income tax in a neoclassical, two-sector, two-factor, short-period model in which the existence of a sticky wage that exceeds the maximum level consistent with full-employment leads to unemployment of labour. Both the assumption of sluggish intersectoral capital movements and wage stickiness adequately characterize the scenario which is relevant for the evaluation of the short-run effects of tax policy.

The results reached in the paper are highly general by comparison to the richer set of potential outcomes in a full-employment context. For any positive and finite degree of capital mobility, the mobility effect of a selective capital income tax is non-negative, i.e. capital employed in the taxed sector can never bear more than 100 per cent of the tax. This result is in sharp contrast with its full-employment counterpart (González-Páramo, 1993). In general, the tax will tend to depress the rate of return to capital in both sectors, with capital in the taxed sector bearing most of the burden. As the cost of use of capital is increased, the relative price of the taxed good and the nominal wage in both sectors will tend to rise. Differences in factor intensities do not play any role in explaining the price effects of taxation.

Differential incidence analysis has revealed two interesting features of tax incidence in the presence of wage rigidities. First, when capital mobility is perfect, capital and employed labour are indifferent between equal-yield selective taxes on capital income, wages and consumption, contrary to the corresponding full-employment result due to Mieszkowski (1967). Second, if capital is partially mobile across sectors and the elasticity of technical substitution in the taxed sector is positive, capital in the taxed sector and employed labour in both sectors share a common interest with respect to equal-yield tax substitutions and exogenous increases on the degree of capital mobility: both groups will prefer a wage tax to a consumption tax, and the latter to a capital income tax. The rationale behind these results relates to the differential impact that these taxes have upon the price index in the wage rule.

Turning to the employment effects of a selective capital income tax, our results indicate that these are *a priori* ambiguous but qualitatively independent of the degree of capital mobility. Thus, if the employment effect of the tax is positive (negative), policies intended to increase the degree of capital mobility will further increase (reduce) the level of employment, with the sensitivity of this relationship being greater the smaller is the initial degree of factor mobility. On the other hand, the analysis has confirmed the intuitive conclusion that the interests of labour with respect to wages and employment are irreconcilable: taxes that raise wages the most are precisely the worst from an employment perspective, for any positive degree of capital mobility. This implies in turn that taxes which harm capital the most are best from the employment perspective.

These rankings of employment effects -which are valid at the sector level as well- have interesting implications for the design of subsidy policies for regional development. In particular, the best policy for employment creation in the target region is a wage subsidy, although this subsidy is the one that produces smallest capital inflows into the expanding region, for any degree of capital mobility. On the other hand, capital-oriented subsidies are those that promote the greatest capital inflows (as in the full-employment case), but might end up by reducing the level of employment in the target region.

Turning to the limitations of the analysis in this paper, it is as well to start with the shortcomings of the assumptions used. First, the parameterization of factor mobility deserves further research (see Mussa, 1978, 1982; Grossman, 1983, and Casas, 1984, for suggestive alternatives). Second, the wage rule used is deliberately simple and no microeconomic justification is given. In support of a constant real wage, the standard arguments may be used (Johnson, 1969, Brecher, 1974, Blanchard, 1979, and Blanchard and Fischer, 1989, among others). Although the results might be sensitive to different and more sophisticated specifications of the wage rule, one might also question the realism of more complex indexation mechanisms in a short-run context. Nonetheless, this is an issue for further research. Third, by assuming equal the elasticities of substitution between labour and the two goods, the generality of the results is somewhat limited. However, as pointed out in the text, relaxation of this assumption -which is a straightforward but tedious exercise- leads to ambiguous incidence results, depending upon the sign of the elasticities differential. All in all, we may argue that the assumptions made constitute reasonable simplifications of reality, given our interest in investigating the positive implications of tax incidence in an unemployment, short-run perspective. In this respect, the analysis has produced a rich set of possible outcomes which are directly comparable to those associated to a full-employment setting.

Notes

1. In effect, the wage function [5] is *ad hoc* in nature, and one may come up with different specifications that would perhaps change our results. In particular, the form of the wage rule could be made a function of a basket of goods consumed. COLA mechanisms, however, are not usually subject to short-run revisions, i.e. wage adjustments are made of the basis of an old CPI.
2. This assumption does not preclude the possibility that in the long-run, government actions or the behaviour of unions in response to the existence of unemployment might alter the wage rule (see, for example, Neary, 1982).
3. Thus, Blanchard (1998) finds that the evidence implies a long-run relationship between real wages, production and unemployment, but the adjustment of real wages to changes in real variables is rather slow.
4. Given the level of employment, changes in p uniquely determine the corresponding changes in the composition of demand. However, a shift in the level of hours worked will alter the map of preferences over X and Y. The outcome will be, in general, a different composition of demand for a given goods price ratio.

5. This is the main implication of the Stolper-Samuelson theorem (1941).
6. This point was first noted by Atkinson and Stiglitz (1980). Given $p = \overline{p}$ and $w = \overline{w}$ above their respective equilibrium levels, the cost of use of capital $\overline{r}_X$ exceeds the level that industry *Y* can pay to capital owners if the *Y*-firms are to produce a positive level of *output.* With negative profits in the *Y*-industry, all the capital units in sector *Y* would migrate to sector *X* and the economy would specialize in the production of *X,* contrary to our assumption of diversification in production. On the other hand, with the rate of profits $\overline{r}_X$, the X-firms would have pure profits, which contradicts the assumptions of perfect competition and constant returns to scale.
7. Algebraic derivation of equations [23] and [24] is available from the author upon request.
8. The alternative assumption of perfect capital mobility implies:

$$\hat{\tau}_{KX} > \hat{p} \geq \hat{w} \geq 0 \geq \hat{r}_Y = \hat{r}_X \geq -\hat{\tau}_{KX}, \quad \tilde{\sigma}_K \to \infty, \quad \alpha \geq 0$$

This case —briefly analysed in Atkinson and Stiglitz (1980, Chapter 7)—, has a straightforward interpretation once we recall the role of capital mobility in the present model: all the distributional results are uniquely determined by the «financial relations» of the economy (Jones, 1971), i.e. the price-equal-unit-cost equations. These relationships imply:

$$(1-\alpha\theta_{LX})\hat{p} = \theta_{KX}\hat{r} + \theta_{KX}\hat{\tau}_{KX}$$
$$-\alpha\theta_{LY}\hat{p} = \theta_{KY}\hat{r}$$

From the second expression we can see that if wages are «sticky» in terms of the *numéraire* (i.e. $\alpha = 0$), then $\hat{r} = \hat{w} = 0.$ In this case, tax incidence reduces to an increase in *p* equal to θ_{KX} $\hat{\tau}_{KX}$ percent. When wages are rigid in terms of good *X* (i.e. $\alpha = 1$), we know that $0 \geq \hat{r}_X > -\hat{\tau}_{KX}$, since the full capitalization result only satisfies the first equation, while $\hat{r} > 0$ would be consistent with the second equation only if firms in sector *X* cease in their activity as $\hat{p}$ tend to become negative. In the general case, with perfect capital mobility and $0 < \alpha < 1$, employed labour will gain from the imposition of the tax in terms of good *Y,* and capital will lose in both sectors.
9. Algebraic derivation is available from the author upon request.
10. Algebraic derivations of equations are available from the author upon request.
11. Denoting by Ξ the term in brackets in expression [42] $|\lambda| = 0$ and $\sigma_X = \sigma_Y > 0$ imply:

$$\begin{aligned}\text{sgn}\quad L = \text{sgn}\ \Xi &= \text{sgn}\left[-\lambda_{KX}\theta_{LX}(\alpha-\theta_{KY}) - \theta_{KX}(\alpha-\lambda_{LX}\theta_{KY}) + \alpha\lambda_{KX}\theta_{LY}\right] \\ &< 0 \quad \text{if} \quad \alpha = 1 \\ &= \text{sgn}\left[\theta_{LY}\lambda_{KX} - \theta_{KX}\lambda_{LY}\right] \quad \textit{if} \quad \alpha = \theta_{KY} \\ &< 0 \quad \text{if} \quad \alpha{=}0\end{aligned}$$

12. In this case we have:

$$\begin{aligned}\text{sgn}\quad \Xi = \text{sgn}&\left\{\lambda_{KX}\left[(1-\alpha)\theta_{KY} + \alpha\theta_{LY}\right] - \alpha\theta_{KX}\right\} \\ &\text{sgn}\left(\lambda_{KX}\theta_{LY} - \theta_{KX}\right) \quad \textit{if} \quad \alpha = 1 \\ &> 0 \quad \text{if} \quad \alpha = 0\end{aligned}$$

13. Using the short notation $\xi = \sigma_X = \sigma_Y = \sigma_S$, expressions [47] and [48] allow to write:

$$\hat{L}_i = \frac{|\Sigma|^{-1}\xi}{\theta_{KY}} \quad \left\{(1-\alpha)\lambda_{KX}\theta_{KY} - \alpha\lambda_{KY}\theta_{KX}\right\}\hat{\tau}_{KX}$$

Clearly, the sign of the change in employment is given by:

$$\text{sgn}\quad \hat{L}_i = \text{sgn}\left[(1-\alpha)\lambda_{KX}\theta_{KY} - \alpha\lambda_{KY}\theta_{KX}\right]$$

Therefore:

$$\hat{L}_i \gtrless 0 \quad as \quad \frac{\alpha}{1-\alpha} \lessgtr \frac{\lambda_{KX}\theta_{KY}}{\lambda_{KY}\theta_{KX}} = \frac{\theta_X}{\theta_Y}$$

The equality in the right-hand side is based upon the assumption that the net capital rentals are identical at the initial equilibrium, $r_X = r_Y$. Thus,

$$\frac{\lambda_{KX}\theta_{KY}}{\lambda_{KY}\theta_{KX}} = \frac{(K_X / K)(r_Y K_Y / Y)}{(K_Y / K)(r_X K_X / pX)} = \frac{pX}{Y} = \frac{\theta_X}{\theta_Y}$$

where θ_i is the distributional share of good $i = X, Y$ in national income.

14. It is easily checked that:

$$\hat{w} - \hat{r}_X - \hat{\tau}_{KX} = -|\Sigma|^{-1}(1-\alpha)\tilde{\sigma}_K \leq 0$$

15. With $\sigma_X = \sigma_Y = \sigma_S = \alpha = 1$, expression [47] becomes:

$$\hat{L}_X = \frac{|\Sigma|^{-1}\theta_{KX}}{\theta_{KY}}(\theta_{KY} - \lambda_{KY})\hat{\tau}_{KX}$$

16. To see why this conclusion is true, compute the differential impact of the three taxes upon the rental differential:

$$\frac{\hat{r}_X - \hat{r}_Y}{\hat{\tau}_{KX}} - \left.\frac{\hat{r}_X - \hat{r}_Y}{\hat{\tau}_X}\right|_{\hat{\tau}_X = \theta_{KX}\hat{\tau}_{KX}} = -|\Sigma|^{-1}\frac{\theta_{LX}}{\theta_{KY}}\delta_\alpha < 0$$

$$\frac{\hat{r}_X - \hat{r}_Y}{\hat{\tau}_{KX}} - \left.\frac{\hat{r}_X - \hat{r}_Y}{\hat{\tau}_X}\right|_{\hat{\tau}_{LX} = (\theta_{KX}/\theta_{LX})\hat{\tau}_{KX}} = -|\Sigma|^{-1}\frac{\delta_\alpha}{\theta_{KY}} < 0$$

Since the inflow to capital to sector X is given by the mobility condition $\hat{K}_X = \sigma_K(\hat{r}_X - \hat{r}_Y)$, the result in the text follows immediately.

17. The corresponding differential incidence expressions are:

$$\frac{\hat{L}_Y}{\hat{\tau}_{KX}} - \frac{\hat{L}_Y}{\hat{\tau}_X} = |\Sigma|^{-1}\frac{\sigma_X\theta_{LX}}{\theta_{KY}}\left\{\left[(1-\alpha)\lambda_{KX}\theta_{KY} + \alpha\lambda_{KY}\theta_{KX}\right]\tilde{\sigma}_K + \alpha\theta_{KX}\sigma_Y\right\} \geq 0$$

$$\frac{\hat{L}_Y}{\hat{\tau}_{KX}} - \frac{\hat{L}_Y}{\hat{\tau}_{LX}} = |\Sigma|^{-1}\frac{\sigma_X}{\theta_{KY}}\left\{\left[(1-\alpha)\lambda_{KX}\theta_{LX}\theta_{KY} + \alpha\lambda_{KX}\theta_{KY}\right]\tilde{\sigma}_K + \alpha\theta_{KX}\sigma_Y\right\} \geq 0$$

$$\frac{\hat{L}_Y}{\hat{\tau}_X} - \frac{\hat{L}_Y}{\hat{\tau}_{LX}} = |\Sigma|^{-1}\frac{\alpha\sigma_X\theta_{KX}^2}{\theta_{KY}}(\lambda_{KY}\tilde{\sigma}_K + \sigma_Y) \geq 0$$

Again, a wage subsidy given to labour in *X* is the best option from an employment perspective in sector *Y*.

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Resumen

Un hecho crucial en la perspectiva de corto plazo en muchas cuestiones de políticas públicas es la existencia de desempleo causada por rigideces salariales. Al mismo tiempo, las imperfecciones en el grado de movilidad de los factores de producción entre sectores o regiones determina la naturaleza y la flexibilidad de las respuestas de la economía ante perturbaciones exógenas. No debe extrañar que la incidencia de los impuestos sobre el desempleo y la distribución de la renta sea una preocupación central de los decisores públicos. En este trabajo se explora la estructura de la incidencia y los efectos económicos de un impuesto selectivo sobre las rentas del capital en un modelo neoclásico de dos factores y dos bienes, movilidad imperfecta del capital y desempleo debido a la existencia de indiciación salarial.

Palabras clave: incidencia impositiva, movilidad del capital, desempleo, equilibrio general.

Clasificación JEL: H22, H25.

Appendix A: Derivation of equations [23] and [24]

Equation [23]

Full-employment of capital allows to write:

$$\lambda_{KX}\hat{c}_{KX} + \lambda_{KX}\hat{X} + \lambda_{KY}\hat{K}_Y = 0 \qquad \text{[A.1]}$$

If we note that:

$$\hat{c}_{KX} = \theta_{LX}\sigma_X(\hat{w} + \hat{\tau}_{LX} - \hat{r}_X - \hat{\tau}_{KX}) \qquad \text{[A.2]}$$

$$\hat{Y} = \hat{K}_Y - \hat{c}_{KY} \qquad \text{[A.3]}$$

$$\hat{X} = -\sigma_S(\hat{p} + \hat{\tau}_X) + \hat{Y} \qquad \text{[A.4]}$$

then expression [A.1] becomes:

$$\lambda_{KX}\theta_{LX}\sigma_X(\hat{w} + \hat{\tau}_{LX} - \hat{r}_X - \hat{\tau}_{KX}) - \lambda_{KX}\sigma_S(\hat{p} + \hat{\tau}_X) + \lambda_{KX}(\hat{K}_Y - \hat{c}_{KY}) + \lambda_{KY}\hat{K}_Y = 0 \qquad \text{[A.5]}$$

where:

$$\hat{c}_{KY} = \theta_{LY}\sigma_Y(\hat{w} - \hat{r}_Y) \qquad \text{[A.6]}$$

In order to eliminate $\hat{w}$, $\hat{K}_Y$ and $\hat{r}_Y$ from equation [A.5], we can use the wage rule [15], the capital mobility condition $\hat{K}_Y = -\lambda_{KX}\tilde{\sigma}_K(\hat{r}_X - \hat{r}_Y)$ (solving 18 and 19 for $\hat{K}_Y$) and the zero-profits condition for good *Y*, $\hat{r}_Y = -(\alpha\theta_{LY}/\theta_{KY})(\hat{p} + \hat{\tau}_X)$. After some rearrangement of terms, we obtain:

$$\begin{aligned} &\left[\alpha\theta_{LX}\sigma_X - \frac{\alpha\theta_{LY}}{\theta_{KY}}(\sigma_Y + \tilde{\sigma}_K) - \sigma_S\right]\hat{p} - [\theta_{LX}\sigma_X + \tilde{\sigma}_K]\hat{r}_X = \\ &= -\left[\alpha\theta_{LX}\sigma_X - \frac{\alpha\theta_{LY}}{\theta_{KY}}(\sigma_Y + \tilde{\sigma}_K) - \sigma_S\right]\hat{\tau}_X + \theta_{LX}\sigma_X(\hat{\tau}_{KX} - \hat{\tau}_{LX}) \end{aligned} \qquad \text{[A.7]}$$

Expression [A.7] gives equation [23] in the text.

Equation [24]

The rate of change in labour demand by sector *X* can be expressed as:

$$\hat{L}_X = \hat{c}_{LX} + \hat{X} \qquad \text{[A.8]}$$

On the other hand, from the definition of $\hat{c}_{LX}$:

$$\hat{c}_{LX} - \theta_{KX}\sigma_X(\hat{w} + \hat{\tau}_{LX} - \hat{r}_X - \hat{\tau}_{KX}) \qquad \text{[A.9]}$$

After using the identity $\hat{c}_{KY} = \hat{K}_Y - \hat{Y}$, and equation [A.4], we get:

$$\hat{L}_X = -\alpha\theta_{KX}\sigma_X\left(\hat{p}+\hat{\tau}_X\right)+\theta_{KX}\sigma_X\left(\hat{r}_X+\hat{\tau}_{KX}-\hat{\tau}_{LX}\right)+\hat{K}_Y-\hat{c}_{KY}-\sigma_S\left(\hat{p}+\hat{\tau}_X\right) \qquad \text{[A.10]}$$

Using again the capital mobility condition given above, the definition of $\hat{c}_{KY}$ (equation A.6) and the price equation of sector *Y,* we obtain:

$$\begin{aligned}\hat{L}_X = &\left[-\alpha\theta_{KX}\sigma_X - \frac{\alpha\theta_{LY}}{\theta_{KY}}\left(\sigma_Y+\lambda_{KX}\tilde{\sigma}_K\right)-\sigma_S\right]\left(\hat{p}-\hat{\tau}_X\right)+\\ &+\left[\theta_{KX}\sigma_X-\lambda_{KX}\tilde{\sigma}_K\right]\hat{r}_X+\theta_{KX}\sigma_X\left(\hat{\tau}_{KX}-\hat{\tau}_{LX}\right)\end{aligned} \qquad \text{[A.11]}$$

The corresponding expression for the rate of change in L_Y can be derived making use of the following definition of $\hat{L}_Y$:

$$\hat{L}_Y = \hat{c}_{LY} + \hat{K}_Y - \hat{c}_{KY} \qquad \text{[A.12]}$$

Using the above procedure —i.e. substituting the definition of $\hat{c}_{LY}$ and $\hat{c}_{KY}$ and the mobility condition into [A.12] and eliminating $\hat{r}_Y$ and $\hat{w}$ through the zero-profit condition of sector *Y* and the wage rule—, it is easily checked that the relationship between $\hat{L}_Y$ and the remaining endogenous variables can be expressed as follows:

$$\hat{L}_Y = \left[-\frac{\alpha}{\theta_{KY}}\sigma_Y - \alpha\lambda_{KX}\frac{\theta_{LY}}{\theta_{KY}}\tilde{\sigma}_K\right]\left(\hat{p}+\hat{\tau}_X\right)-\lambda_{KX}\tilde{\sigma}_K\hat{r}_X \qquad \text{[A.13]}$$

Finally, if we recall the definition of $\hat{L}$ as a weighed average of the changes in sectoral employment (see equation 20), addition of expressions [A.11] and [A.13] yields:

$$\begin{aligned}\hat{L} = &\left[-\alpha\lambda_{LX}\theta_{KX}\sigma_X - \frac{\alpha\left(1-\lambda_{LX}\theta_{KY}\right)}{\theta_{KY}}\sigma_Y - \frac{\alpha\lambda_{KX}\theta_{LY}}{\theta_{KY}}\tilde{\sigma}_K - \lambda_{LX}\sigma_S\right]\left(\hat{p}+\hat{\tau}_X\right)+\\ &+\left[\lambda_{LX}\theta_{KX}\sigma_X-\lambda_{KX}\tilde{\sigma}_K\right]\hat{r}_X+\lambda_{LX}\theta_{KX}\sigma_X\left(\hat{\tau}_{KX}-\hat{\tau}_{LX}\right)\end{aligned} \qquad \text{[A.14]}$$

which coincides with equation [24] in the text.

Appendix B: A consumption tax and a wage tax in sector *X:* balanced-budget incidence

Solving the incidence system [25] for $\hat{\tau}_X$ under the assumption that the tax revenue is returned back to consumers in a lump-sum fashion, we obtain:

$$\hat{p} = |\Sigma|^{-1}\left(\alpha\theta_{LX}\sigma_X - \frac{\alpha\theta_{LY}\theta_{KX}}{\theta_{KY}}\sigma_Y + \frac{\alpha|\theta|}{\theta_{KY}}\tilde{\sigma}_K - \theta_{KX}\sigma_S\right)\hat{\tau}_X \qquad \text{[B.1]}$$

$$\hat{w} = |\Sigma|^{-1} \alpha \left(\theta_{LX}\sigma_X + \tilde{\sigma}_K\right)\hat{\tau}_X \qquad \text{[B.2]}$$

$$\hat{r}_X = |\Sigma|^{-1} \left\{ \alpha\theta_{LX}\sigma_X - \frac{\alpha\theta_{LY}}{\theta_{KY}}\left(\sigma_Y + \tilde{\sigma}_K\right) - \sigma_S \right\} \hat{\tau}_X \qquad \text{[B.3]}$$

$$\hat{r}_Y = -|\Sigma|^{-1} \frac{\alpha\theta_{LY}}{\theta_{KY}} \left(\theta_{LX}\sigma_X + \tilde{\sigma}_K\right)\hat{\tau}_X \qquad \text{[B.4]}$$

Following the same procedure, the corresponding solutions for $\hat{\tau}_{LX}$ are:

$$\hat{p} = |\Sigma|^{-1} \theta_{LX} \left(\sigma_X + \tilde{\sigma}_K\right)\hat{\tau}_K \qquad \text{[B.5]}$$

$$\hat{w} = |\Sigma|^{-1} \alpha\theta_{LX} \left(\sigma_X + \tilde{\sigma}_K\right)\hat{\tau}_{LX} \qquad \text{[B.6]}$$

$$\hat{r}_X = |\Sigma|^{-1} \left\{ \theta_{LX}\sigma_X - \frac{\alpha\theta_{LY}\theta_{LX}}{\theta_{KY}}\left(\sigma_Y + \tilde{\sigma}_K\right) - \theta_{LX}\sigma_S \right\} \hat{\tau}_{LX} \qquad \text{[B.7]}$$

$$\hat{r}_Y = -|\Sigma|^{-1} \frac{\alpha\theta_{LX}\theta_{LY}}{\theta_{KY}} \left(\sigma_X + \tilde{\sigma}_K\right)\hat{\tau}_{LX} \qquad \text{[B.8]}$$

Labour employed in both sectors gets a higher wage in terms of Y (with $\alpha > 0$), and capital employed in the taxed industry loses under both taxes, results which are similar to those that obtain under a selective capital income tax. However, the return to capital employed in the taxed sector responds in a different fashion. The incidence of both taxes upon r_X is seen to depend upon the balance between the elasticity of substitution in sector X, which tends to make capital owners better-off —due to the fact that both taxes tend to make labour relatively more expensive to firms in sector X—, and the elasticities of mobility, demand and technical substitution in sector Y. Finally, it is worth noting that in the case of a selective tax on consuption of X, w and p can move in opposite directions (for example, $\sigma_X = 0$ and $\theta_{LX} = \theta_{LY}$). This is due to the fact that, despite the possibility that p falls, the change in the consumer price of X, $\hat{p} + \hat{\tau}_X$, is always non-negative, thus implying $\hat{w} \geq 0$.