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Taxation and mobility in dualistic models– (and) Some neglected issues of fiscal federalism

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Abstract. In this paper we present and confront the expected outcome of a raise in earnings taxes on the regional or sectoral allocation of labor force and employment. The basic frameworks are the benchmark dualistic scenarios. A single-input analysis of an homogeneous product economy is provided once extensions were designed to highlight the role of mobility barriers and how they interact with local wage-setting rules to determine regional allocation rather than trade issues or factor substitution. We report the main effects on equilibrium local after-tax wages, supply, employment and aggregate welfare surplus of a unilateral as well as a simultaneous unit tax increase of the (a) basic two-sector model in six different scenarios: free market; partial (one-sector) coverage with perfect intersector mobility; partial (one-sector) coverage with imperfect mobility (Harris-Todaro); multiple (two-sector) coverage with imperfect mobility (Bhagwati-Hamada); partial (one-sector) coverage with affiliation restrictions in the covered sector; partial (one-sector) coverage with limited employment generation ability in the traditional uncovered sector. Needless to say, the results would apply to any other production factor, one or other scenario being more appropriate for inference of the consequences of differential taxation systems.
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1. Introduction

The aim of this research is to contrast the expected long-run impact of taxation on labor force flows under alternative scenarios, highlighting the interplay of three environment features: institutional wage setting, barriers to mobility, and differential tax treatment across regions.

The subject is of interest to international factor mobility analysis, where income tax treatment of foreign residents and their consequences has deserved considerable debate (Bhagwati, 1982). In this area, skill distribution biases seem to be of major concern (See Bhagwati & Hamada, 1982, for example), as well as potential evasion – either legally, through emigration, or illegally through fraud.

At the national affairs level, fiscal federalism faces the same mechanisms on the revenue generation side. However, going over the literature (Oates,

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1999) provides a recent survey. Musgrave & Musgrave (1976), Atkinson & Stiglitz (1980), Tresch (1981) all contain fiscal federalism sections), it more frequently aims at redistribution issues, or the optimal level of local expenditures (in the tradition of the Tiebout (1956) insights). Optimal local taxation has, of course, been addressed (see Mieszkowski & Zodrow (1989) for an appraisal) – sometimes oriented towards exploring the existence and/or consequences of decentralization (after Gordon's (1983) good starting point), but generally assuming an underlying competitive labor or factor market.

Our goal was to expose the potential distortionary effects of differentiated labor income taxation schemes under different assumptions of mobility across regions, jurisdictions, or productive sectors, and to recognize that if compounded with non-competitive restrictions – unionisation, for example – it may imply quite unexpected efficient or second-best recommendations.

We focus on the impact of taxation working through potential labor flows – of taxpayers "voting with their feet" – and employment allocation. Redistribution of the revenue levied on the local population is superimposed – but, as a lump-sum, not affecting workers response, potentially arising from a general public good provided to both regions' consumers in an uniform manner. Under such assumptions, one could predict that a local earnings factor tax would have similar effects to an institutional wage floor; and such conclusion is traditionally cited in the general equilibrium two factor-two sector analysis textbook example (Layard & Walters (1978), section 3-5 and exercise Q3-10; Bosworth, Dawkins & Stromback (1996), section 10.3.2. Also, Johnson & Mieszkowski (1970)). As we will see, under different mobility assumptions, that is not at all the case. Complementarily, we compute the expected total welfare changes implied by the different fiscal environments - local assessments in these matters are difficult to disentangle, once (as noted) after a fiscal change individuals' affiliation also change.

The basic structures chosen to replicate the effects of taxation were simple dualistic models in the tradition of Harris (1969) and Harris-Todaro (1970) rural-urban migration analysis (a good survey of theoretical literature can be found in Bhattacharya (1993)). The principles behind its workings became widespread in the study of labor market regional as also sector – occupation, profession – allocation (see McNabb & Ryan (1990) for a survey of segmented labor markets. See also Saint-Paul (1996) for applications of the theory with microfoundations for several dualistic structures.) and under minimum or other wage legislation or restrictions (see, for example, Mincer (1976), McDonald & Solow (1985) and Fields (1989). Also Brown, Gilroy & Kohen (1982)). We follow the cases contrasted in Martins (1996), inspecting the consequences of introducing a local unit tax [2] on employment in each of the scenarios.

[2] Proportional earnings taxes would generate similar qualitative outcomes.

Total – national, worldwide according to context we may wish to simulate - labor force supply is assumed perfectly inelastic. The hypothesis was thought convenient once it neutralizes the welfare tax – the "deadweight" - loss under a uniform tax system.

Also, neither workers – that chose location, or sector affiliation, maximizing the expected after-tax wage - nor unions – setting net wages - possess any "tax illusion".

After notation is briefly settled in section I, we depart from the benchmark case - free market with perfect mobility across regions or sectors -, outlined in section II. In section III, partial coverage with perfect mobility - i.e., people not employed in the primary sector can immediately get a job in the secondary sector and wait there for an opportunity to switch, and thus, there is (again) no unemployment generation - is introduced. In section IV, a version of the Harris-Todaro model - with imperfect mobility and institutionally fixed wage in one of the sectors - is inspected. In section V, the Bhagwati-Hamada economy – with two covered sectors - is forwarded. Section VI deals with frameworks where there are size restrictions: in the primary sector size - the counterpart of the H.-T. model; and in the employment generation capacity of the secondary sector - the "dual" case of the B.-H. model. The exposition ends with a brief summary in section VII.

2. Notation

There are two sectors - or two regions - and a fixed exogenous labor supply, $\bar{L}$. This total labor supply decides whether to locate in region (or affiliate to sector) 1 or 2. Denote by $\bar{L}_i$ local/industry supply in region/sector i. Then:

$$\bar{L}_1 + \bar{L}_2 = \bar{L} \tag{1}$$

An inelastic supply in single-sector models is known to generate no deadweight loss. The assumption is thus useful to assess tax implications with respect to the reallocation of resources in dualistic frameworks – potentially implying welfare losses that would not arise with uniformity and total mobility.

In sector i, the aggregate demand function is given by:

$$L_i = L^i(W_i) \quad , \quad i = 1, 2 \tag{2}$$

A non-positive slope – that is, $L^i(W_i)' = dL^i(W_i)/dW_i \leq 0$ – is always assumed. Denote the corresponding inverse demand function by:

$$W_i = W^i(L_i) \quad , \quad i = 1, 2 \tag{3}$$

There are no cross effects, i.e., $dL^i/dW_j = 0$ for $i \neq j$. The wage elasticity of demand of sector i at a particular point of labor demand will be denoted by

$$\varepsilon^i = L^i(W_i)' \, W_i \, / \, L^i(W_i) = W^i(L_i) \, / \, [W^i(L_i)' \, L_i]. \tag{4}$$

The background technology and preferences in the economy are anything but complex: an homogeneous good is produced and consumed in both regions. Identical workers as "land-owners" consume directly what they produce or receive as income: there is no (reason to) trade, nor (need for) money. Also, there is no inter-regional (sectoral) imbalance in terms of affiliation preferences: all the individuals value is income and the regions do not differentiate otherwise by any intrinsic characteristics.

We will assume further through sections II to V a subset of the following:

1. individuals are risk neutral and maximize expected (after-tax) income.
2. there is no fiscal (tax) illusion and institutional wages are set in net terms.

3.a. there is perfect mobility across sectors alternatively:
3.b. job rotation is only accomplished locally or within the industry.
4.a. wage in sector 1 is determined by market conditions; alternatively:
4.b. wage in sector 1 is institutionally determined.
5.a. wage in sector 2 is market determined; alternatively:
5.b. wage in sector 2 is institutionally determined.

Assumptions 1 and 2 insure that comparative statics may be adequately performed for a model – equilibrium conditions - set in reference to net or after-tax wages and are always superimposed. For simplicity, assume a unit tax T_i per unit of employment is levied on sector i. Then, labor demands can be expressed as:

$$L_i = L^i(W_i + T_i) \quad ; \quad \text{and} \quad W_i = W^i(L_i) - T_i \quad , \; i = 1, 2 \tag{5}$$

where W_i is the after-tax wage. One might argue that the assumptions ignore the possibility of higher taxes being re-collected in the form of higher local public expenditures; then, a raise in the local tax could have similar effects to that of a local minimum wage. We adopt those assumptions to measure the effect of a distortionary tax under "non-distortionary" expenditures: say, the whole economy's fiscal revenue is evenly distributed by the total labor force. (Or they can chose in which region to spend vacations - reside - and consume the local public good).

They will be appropriate if we are inspecting industry-specific rather than regional labor force flows.

In another angle, a tax on one region's employment – specially in an uncovered region – is expected to have the same effect as a negative relative local public expenditure disadvantage – say, the region requires higher or more expensive infrastructure to maintain its equal appeal to the other. Or a negative effect due to relative location intrinsic cost of living – a requirement of more expensive heating/housing costs due to climatic reasons – or appeal; on a sector's employment, of a relative worker distaste for industry affiliation – say, a compensating differential is required for a riskier profession. These imbalances would generate – and provide a rationale for - a persistent or long-run equilibrium differential of expected wages – even if not of expected individual welfare - across sectors or regions in favor of one of the areas in the absence of government intervention. The models' mechanics would not be much altered if we added an exogenous differential "a" to the expected wages of the favored region in the equilibrium conditions below. One should keep in mind that such a differential would not create the need for intervention under a complete mobility assumption – maximization of total welfare (including the externality "consumption" by residents of the favored region) would be guaranteed by a competitive market equilibrium dynamics.

Assumptions 3 to 5 characterize the mobility environment. Different combinations of alternatives a and b generate backgrounds of benchmark dualistic models that we shall stage. For instance, 3.a. insures that there will be no unemployment in the economy – provided that the wage is market determined in at least one of the sectors.

In the presence of one sector only and inelastic supply, a tax has no aggregate welfare consequences – of course, under the utilitarian social-welfare criteria underlying consumer surplus(or economic rent)-based analysis -, provided the net wage is free. With institutionally set wages – and because supply is inelastic – the welfare – total surplus - change from an increase in the tax rate can be approximated in monetary terms by, in space (L, W), the area below the (inverse) labor demand schedule between the before and after-tax employment levels. If $L_i(T_1, T_2)$ is the equilibrium employment in sector i when tax levels are, respectively, T_1 and T_2 in sectors 1 and 2, the welfare surplus of the two-sector/region economy is:

$$\int_0^{L_i(T_1,T_2)} W^i(L_i)\, dL_i + \int_0^{L_j(T_1,T_2)} W^j(L_j)\, dL_j \tag{6}$$

Then, the effect on sector i of a unitary change in region j's tax rate can be approximated by:

$$\Delta_i = \text{Welfare change in sector i per unit of } \partial T_j = W^i(L_i)\, \partial L_i(T_1, T_2)/\partial T_j$$

The total effect in the two areas of the tax levied on sector j would naturally add to:

Total Welfare Change per unit of ∂T_j =

$$= W^i(L_i)\ \partial L_i(T_1, T_2)/\partial T_j\ +\ W^j(L_j)\ \partial L_j(T_1, T_2)/\partial T_j \tag{7}$$

Such expressions simplify in each of the simulated environments.

We may want to contrast total revenue generation ability of a unitary tax raise, using the fact that revenue levied on region j is:

$$RF_j\ =\ L^j(W_j + T_j)\ \ T_j \tag{8}$$

and thus:

$$\partial RF_j/\partial T_j\ =\ L^j(W_j + T_j)\ +\ T_j\ \partial L_j/\partial T_j \tag{9}$$

For simplicity, we will be interested in measuring effects for T_j around 0. Then, the welfare change implied by an unitary increase in fiscal revenue obtained from region j will be higher the lower is $L^j(W_j + T_j)$. That is:

Welfare change (total, or in sector i) per unit of ∂RF_j =

[Welfare change (total, or in sector i) per unit of ∂T_j] / $[L^j(W_j + T_j) +\ T_j\ \partial L_j/\partial T_j$
] (10)

To obtain one extra (a given…) monetary revenue unit, the government would extract it by raising the tax rate T_j for which that measure - for the total economy - is lower. Under well-behaved second-order conditions and existence of interior solutions, an efficient scheme (T_i, T_j) – guaranteeing a minimum $RF_i + RF_j \leq R$ - would equalize the (total welfare change per unit of ΔRF_i) to the (total welfare change per unit of ΔRF_j).

3. Competitive labor markets under perfect mobility

Assume 3.a, 4.a and 5.a. of the previous section. Then:

$$\bar{L}_i = L_i = L^i(W_i + T_i)\ \ ,\ \ \ i = 1,2 \tag{11}$$

In the present scenario, people will move from one to the other sector's employment till equalization of net wages. That is, after-tax wage W will adjust till W* that solves:

$$L^1(W^* + T_1) + L^2(W^* + T_2) = \bar{L} \quad \text{or}$$

$$W^* = W^i(L_i) - T_i = W^j(L_j) - T_j = W^j(\bar{L} - L_i) - T_j \tag{12}$$

The increase of the tax rate has mainly effects on the regional allocation of labor and on the net wage bill. The net wage decreases:

$$\partial W^*/ \partial T_i = - L^i(W^* + T_i)' / [L^1(W^* + T_1)' + L^2(W^* + T_2)'] < 0 \tag{13}$$

$$\partial L_i/\partial T_i = -\partial L_j/\partial T_i = L^1(W^*+T_1)'L^2(W^*+T_2)'/[L^1(W^*+T_1)'+L^2(W^*+T_2)'] =$$
$$= 1 / [1/ L^1(W^*+T_1)' + 1/ L^2(W^*+T_2)'] < 0 \tag{14}$$

Given perfect mobility and inelastic supply, there will be no unemployment but there will be some "deadweight loss" as long as there is some reallocation of labor resources relative to the free market solution:

$$\text{Welfare Change per unit of } \partial T_i = \tag{15}$$
$$= W^i(L_i)\, \partial L_i(T_1, T_2)/\partial T_i + W^j(L_j)\, \partial L_j(T_1, T_2)/\partial T_i =$$
$$= [W^i(L_i) - W^j(L_j)]\ \partial L_i(T_1, T_2)/\partial T_i =$$
$$= [W^i(L_i) - W^j(L_j)] / [1/ L^1(W^*+T_1)' + 1/ L^2(W^*+T_2)'] =$$
$$= (T_i - T_j) / [1/ L^1(W^*+T_1)' + 1/ L^2(W^*+T_2)']$$

Provided $T_i > T_j$, the welfare effect of the increase in the tax is negative. An unilateral rise in T_i will move resources away from region i – and farther away from the allocation that maximizes total welfare, occurring with either equal tax rates or no tax (see below). If T_j is lower than T_i, however, the opposite occurs – then, an unitary increase in the tax rate approximates the two tax rates and labor allocation to the efficient outcome.

Let there be a uniform fiscal treatment across regions such that $T_i = T$. Then:

$$\partial W^*/ \partial T = - 1 < 0 \tag{16}$$

Any tax rate change is completely passed on to the net wage. This implies that a change in the tax rate will have no impact on local employment or total welfare.

Summarizing:

Proposition 1: 1.1. Under free market, the usual dualistic model will result in equalization of net wages across regions or sectors and there will be no unemployment.

1.2. Any labor tax rate increase depresses the equilibrium after-tax wage.

1.3. An unilateral increase in the tax rate will decrease local employment and population. It will be welfare enhancing iff the region has lower taxes than the neighbour. The induced labor flow will be larger the higher the slopes of both local labor demands in absolute value.

1.4. A uniform tax rate (due to the inelastic total supply assumption) has no effect on the regional allocation of the labor force – and hence it is compatible with total welfare (product) maximization.

4. Partial coverage - The perfect mobility case

Assume 3.a, 4.b and 5.a. of section I. The wage in the two sectors differ. In sector 1, the net wage is fixed at level W_1. As the other sector's wage is free, it will decrease till all the labor force is employed – the equilibrium after-tax wage of sector 2, $W_2 < W_1$ for the latter to be a binding restriction:

$$\bar{L}_i = L_i = L^i(W_i + T_i) \quad , \quad i = 1,2 \tag{17}$$

and

$$L^1(W_1 + T_1) + L^2(W_2 + T_2) = \bar{L} \quad \text{or} \tag{18}$$

$$W_2 + T_2 = W^2[\bar{L} - L^1(W_1 + T_1)]$$

An increase in the covered sector tax rate will expel local population while depressing the uncovered sector's net wage:

$$\partial W_2/\partial T_1 = -L^1(W_1 + T_1)' / L^2(W_2 + T_2)' < 0 \tag{19}$$

$$\partial L_1/\partial T_1 = -\partial L_2/\partial T_1 = L^1(W_1 + T_1)' < 0 \tag{20}$$

Welfare Change per unit of ∂T_1 = (21)

$$= W^1(L_1)\, \partial L_1(T_1, T_2)/\partial T_1 + W^2(L_2)\, \partial L_2(T_1, T_2)/\partial T_1 =$$

$$= [W^1(L_1) - W^2(L_2)]\, \partial L_1(T_1, T_2)/\partial T_1 =$$

$$= [W^1(L_1) - W^2(L_2)]\, L^1(W_1 + T_1)' =$$

$$= [(W_1 + T_1) - (W_2 + T_2)]\, L^1(W_1 + T_1)'$$

The tax will be welfare improving iff

$$W_1 + T_1 < W_2 + T_2 \tag{22}$$

That is possible if gross wages are higher in region 2 (even if net wages are there smaller for the minimum wage in sector 1 to be binding). Then, by raising taxes in region 1, it will be possible to lower sector's 2 net wages enough to boost employment and generate a welfare rise.

A tax on the uncovered sector is passed to the local net wage and has no allocation effects:

$$\partial W_2/\partial T_2 = -1 < 0 \quad ; \quad \partial L_i/\partial T_2 = 0,\ i = 1,2. \tag{23}$$

Hence, an optimal global policy to raise a given fiscal revenue will start by taxing region 1 till (22) holds in equality. Henceforth, if possible, both sectors will be taxed preserving it.

Assume that (instead) a uniform tax system must be established. Then:

$$L^1(W_1 + T) + L^2(W_2 + T) = \bar{L} \tag{24}$$

$$\partial W_2/\partial T = -[L^1(W_1 + T)' + L^2(W_2 + T)'] / L^2(W_2 + T)' < 0 \tag{25}$$

$$\partial L_1/\partial T = -\partial L_2/\partial T = L^1(W_1 + T)' < 0 \tag{26}$$

The implied welfare change will be:

Welfare Change per unit of ∂T = (27)

$$= W^1(L_1)\ \partial L_1(T_1, T_2)/\partial T + W^2(L_2)\ \partial L_2(T_1, T_2)/\partial T =$$

$$= [W^1(L_1) - W^2(L_2)]\ \partial L_1(T_1, T_2)/\partial T =$$

$$= [W^1(L_1) - W^2(L_2)]\ L^1(W_1 + T)' =$$

$$= [(W_1 + T) - (W_2 + T)]\ L^1(W_1 + T)' =$$

$$= (W_1 - W_2)\ L^1(W_1 + T)'$$

The tax will never be welfare improving because for a binding minimum wage

$$W_1 > W_2 \tag{28}$$

Summarizing:

Proposition 2: 2.1. In a dualistic model with perfect mobility and institutional wage fixed in one of the sectors, the equilibrium after-tax wage in the second sector is lower than the free market after-tax wage. There will be no unemployment.

2.2. An unilateral increase in the tax rate of the institutionally covered sector will depress the wage of the other sector, which will see its employment increase. It will be welfare improving if and only if the gross wage in the covered sector is lower than in the uncovered one.

2.3. An increase in the tax rate of the uncovered sector will have no impact on the regional allocation of the labor force.

2.4. Under a uniform fiscal system, an increase of the (common) tax rate will relocate the labor force, increasing employment in the uncovered sector (by the same magnitude as a unilateral increase of the tax rate of the uncovered sector would). It will never be welfare improving.

A final comment can be made. At first glance, we could think that taxes would have the same effect as an institutionally set wage. As we see, they do not, even in this simple structure – where total supply does not respond to wages -, provided that the sector's net wage is free. And they have different implications not due to distributional considerations, which we discarded, but due to the generation of different regional or sector employment allocation.

5. Partial coverage and imperfect mobility - The Harris-Todaro Model

Assume 3.b, 4.b and 5.a. of section I. The wage in the two sectors differ. In sector 1, the net wage is fixed at level W_1. As the other sector's wage is free, it will decrease till all the local labor force is employed:

$$\bar{L}_2 = L_2 = L^2(W_2 + T_2) \tag{29}$$

However, to have access to wage W_1, people have to locate there, or to specialize if we are addressing industry rather than regional affiliation – implying that unemployment will be generated in the region. There will be labor force flows till

$$W_1 \times \text{ Probability of Employment in region } 1 = W_2 \tag{30}$$

That is, in the long run we expect that:

$$W_1\, L^1(W_1+T_1) / \bar{L}_1 = W_1\, \{L^1(W_1+T_1) / [\bar{L} - L^2(W_2+T_2)]\} = W_2 \tag{31}$$

$$W_1 L^1(W_1+T_1) = W_2 [\bar{L} - L^2(W_2+T_2)] = W_2 \bar{L} - W_2 L^2(W_2+T_2) \quad (32)$$

Consider a change in the tax rate applied to employment in sector 1. Then:

$$\partial W_2 / \partial T_1 = W_1 L^1(W_1+T_1)' / [\bar{L} - L^2(W_2+T_2) - W_2 L^2(W_2+T_2)'] < 0 \quad (33)$$

$$\partial L_1/\partial T_1 = L^1(W_1+T_1)' \;;\; \partial L_2/\partial T_1 = W_1 L^2(W_2+T_2)' L^1(W_1+T_1)' / \quad (34)$$

$$/ [\bar{L} - L^2(W_2+T_2) - W_2 L^2(W_2+T_2)'] > 0$$

Then, the effect on total unemployment, $U = \bar{L} - L^1(W_1+T_1) - L^2(W_2+T_2)$, is:

$$\partial U/\partial T_1 = - L^1(W_1+T_1)' \{1 + W_1 L^2(W_2+T_2)' / \quad (35)$$

$$/ [\bar{L}-L^2(W_2+T_2)-W_2 L^2(W_2+T_2)']\} \text{ (> 0 if but not only if } W_1 \text{ is close to } W_2)$$

An increase in the covered sector tax rate will necessarily depress the uncovered sector's wage and raise its employment. We note, once again but now under the H.-T. scenario, that – because we assume that workers respond to after-tax income – the effect does not coincide with the impact of an increase in the covered sector's wage rate [3].

Welfare Change per unit of ∂T_1 = (36)

$$= W^1(L_1)\, \partial L_1(T_1, T_2)/\partial T_1 + W^2(L_2)\, \partial L_2(T_1, T_2)/\partial T_1 =$$

$$= W^1(L_1)\; L^1(W_1 + T_1)' + W^2(L_2)\; W_1 L^2(W_2+T_2)' L^1(W_1+T_1)' /$$

$$/ [\bar{L} - L^2(W_2+T_2) - W_2 L^2(W_2+T_2)'] =$$

$$= \{W^1(L_1)\; L^1(W_1 + T_1)' [\bar{L} - L^2(W_2 + T_2)] +$$

$$+ [W_1 W^2(L_2) - W^1(L_1) W_2] L^2(W_2 + T_2)' L^1(W_1 + T_1)'\} /$$

$$/ [\bar{L} - L^2(W_2 + T_2) - W_2 L^2(W_2 + T_2)']$$

[3] For a direct contrast, see Martins (1996) for example.

The first term is negative. Yet, the second may be positive. For $T_1 = T_2 = 0$, the expression solves for the first term only:

$$W^1(L_1)\ L^1(W_1 + T_1)'\,[\bar{L} - L^2(W_2 + T_2)] / [\bar{L} - L^2(W_2 + T_2) - W_2\, L^2(W_2 + T_2)'] < 0$$

The effect of the tax on welfare is then unambiguously negative.

(Interestingly, Srinivasan & Bhagwati (1975), analysing the impact of a wage subsidy to the institutional sector on a version of the H-T. model find it welfare enhancing. However, their setting differs from ours, once, by imposing redistribution and production of an homogeneous good, we discard – unlike them – any implicit terms-of-trade effect.)

If it is the uncovered sector tax that rises:

$$\partial W_2 / \partial T_2 = W_2\, L^2(W_2+T_2)' / [\bar{L} - L^2(W_2+T_2) - W_2\, L^2(W_2+T_2)'] < 0 \tag{37}$$

$$\partial L_1/\partial T_2 = 0 \ ;\ \partial L_2/\partial T_2 = L^2(W_2 + T_2)'\ [\bar{L} - L^2(W_2+T_2)] / \tag{38}$$

$$/ [\bar{L} - L^2(W_2+T_2) - W_2\, L^2(W_2+T_2)'] < 0$$

$$\partial U/\partial T_2 = - \partial L_2/\partial T_2 > 0 \tag{39}$$

Welfare Change per unit of $\partial T_2 =$ (40)

$$= W^1(L_1)\ \partial L_1(T_1, T_2)/\partial T_2 + W^2(L_2)\ \partial L_2(T_1, T_2)/\partial T_2 =$$

$$= W^2(L_2)\ \partial L_2(T_1, T_2)/\partial T_2 =$$

$$= W^2(L_2)\ L^2(W_2 + T_2)'\ [\bar{L} - L^2(W_2+T_2)] /$$

$$/ [\bar{L} - L^2(W_2+T_2) - W_2\, L^2(W_2+T_2)'] < 0$$

The welfare change of a rise in T_2 will be negative.

Supposing now a uniform tax system and (32) becoming:

$$W_1\, L^1(W_1+T) = W_2\,[\bar{L} - L^2(W_2+T)] = W_2\,\bar{L} - W_2\, L^2(W_2+T) \tag{41}$$

$$\partial W_2 / \partial T = [W_1\, L^1(W_1+T)' + W_2\, L^2(W_2+T)'] / \tag{42}$$

$$[\bar{L} - L^2(W_2 + T) - W_2\, L^2(W_2 + T)'] < 0$$

$$\partial L_1/\partial T \; = \; L^1(W_1 + T)' \; < \; 0 \tag{43}$$

$$\partial L_2/\partial T \; = \; L^2(W_2{+}T)' \; [\bar{L} - L^2(W_2 + T) + W_1\, L^1(W_1 + T)'] \; /$$

$$/ \; [\bar{L} - L^2(W_2 + T) - W_2\, L^2(W_2 + T)']$$

$\partial L_2/\partial T < 0$ iff $\mid \varepsilon^1 \mid < (W_1 + T) / W_2$, where ε^i denotes $L^1(W_1 + T)' (W_1 + T) / L^1(W_1 + T)$.

$$\partial U/\partial T \; = \; - \{[L^1(W_1{+}T)' + L^2(W_2{+}T)'] \; [\bar{L} - L^2(W_2 + T)] + \tag{44}$$

$$\{L^1(W_1 + T)'\, L^2(W_2{+}T)' \, (W_1 - W_2)\} \; /$$

$$/ \; [\bar{L}{-}L^2(W_2{+}T){-}W_2\, L^2(W_2{+}T)'] \; (> 0 \text{ if but not only if } W_1 \text{ is close to } W_2)$$

We can assess the induced welfare change after a tax movement by:

$$\text{Welfare Change per unit of } \partial T = \tag{45}$$

$$= \; W^1(L_1)\; \partial L_1(T_1, T_2)/\partial T \; + \; W^2(L_2)\; \partial L_2(T_1, T_2)/\partial T \; =$$

$$= W^1(L_1) \;\; L^1(W_1 + T)' + W^2(L_2)\; L^2(W_2 + T)' \; [\bar{L} - L^2(W_2 + T) + W_1\, L^1(W_1 + T)'] \; /$$

$$/ \; [\bar{L} - L^2(W_2 + T) - W_2\, L^2(W_2 + T)']$$

Provided $W_1\, L^1(W_1 + T)'$ is negligible, the effect will be negative.

Proposition 3: 3.1. Consider a dualistic model with no mobility. The equilibrium after-tax wage in the second sector may be higher or lower than the free market equilibrium, in which there will be unemployment in the institutional sector or urban region.

3.2. An unilateral increase in the tax rate of the institutionally covered sector will depress the wage of the other sector, which will see its employment increase. Total unemployment will likely increase.

3.3. An increase in the tax rate of the uncovered sector will decrease its employment - and local population - and increase total unemployment by the same amount.

3.4. Under a uniform fiscal system, an increase of the (common) tax rate will relocate the labor force, increasing (decreasing) employment in the uncovered sector if the elasticity of demand of the covered sector is high (low) - higher (lower) than the ratio between the gross wage of the covered sector and the after-tax wage of the uncovered one. Total unemployment will likely increase.

3.5. In general, a raise in a tax rate will be welfare detracting.

6. Multiple or global coverage under imperfect mobility - The Bhagwati-Hamada Model

Assume 3.b, 4.b. and 5.b. of section I. The wage in both sectors are fixed at level's W_i, i =1,2. One can see this same (technically speaking) scenario in, for example, Bhagwati & Hamada (1974).

Then, local employment, being demand determined:

$$L_i = L^i(W_i + T_i) \tag{46}$$

Let U_i be the local unemployment in region i, i.e.:

$$U_i = \bar{L}_i - L_i \tag{47}$$

Denote by u_i the unemployment rate in sector/region i. Define:

$$u_i = U_i / \bar{L}_i = 1 - L_i / \bar{L}_i \tag{48}$$

The equilibrium condition will establish equalization of expected income in both sectors:

$$(1 - u_1)\, W_1 = (1 - u_2)\, W_2 \tag{49}$$

that is, equilibrium is defined by:

$$W_1\, L^1(W_1 + T_1) / \bar{L}_1 = W_2\, L^2(W_2 + T_2) / \bar{L}_2 \tag{50}$$

In equilibrium, the average net wage in the economy, $[W_1\, L^1(W_1 + T_1) / \bar{L}_1]\, \bar{L}_1 / \bar{L} + [W_2\, L^2(W_2 + T_2) / \bar{L}_2]\, \bar{L}_2 / \bar{L}$, is equal to the expected wage in each sector, $W_i\, L^i(W_i) / \bar{L}_i$.

One can re-write condition (50) as:

$$W_1\, L^1(W_1 + T_1)\, (\bar{L} - \bar{L}_1) \;=\; W_2\, L^2(W_2 + T_2)\, \bar{L}_1 \tag{51}$$

$$\partial\bar{L}_i/\partial T_i \;=\; -\,\partial\bar{L}_j/\partial T_i \;=\; \bar{L}_j\, W_i\, L^i(W_i + T_i)' \,/ \tag{52}$$
$$/\,[W_1\, L^1(W_1 + T_1) + W_2\, L^2(W_2 + T_2)] < 0$$

As $W_j\, L^j(W_j + T_j)$ is fixed, this also implies that equilibrium expected after-tax wage $W_2\, L^2(W_2 + T_2) / \bar{L}_2 = W_1\, L^1(W_1 + T_1) / \bar{L}_1$ will decrease with T_i. As both W_i's are fixed, the local unemployment rate in both regions will always increase with either T_i.

$$\text{Welfare Change per unit of } \partial T_i = \tag{53}$$
$$= W^i(L_i)\, \partial L_i(T_1, T_2)/\partial T_i \;=\; (W_i + T_i)\; L^i(W_i + T_i)' \;<\; 0$$

This would be the standard effect of a raise in taxes (as of the institutional wage) in a unionised single-sector economy that has inelastic supply. $W_i + T_i = W^i(L_i)$ and (expected to) equals the value of marginal product of labor $P\, f^{i\prime}(L_i)$ [4], where $f^i(L_i)$ denotes the local production function of region i. On the other hand, $L^i(W_i + T_i)' = 1 / W^i(L_i)'$ and:

$$\text{Welfare Change per unit of } \partial T_i \;=\; (W_i + T_i) / W^i(L_i)' \;= \tag{54}$$
$$= W^i(L_i) / W^i(L_i)' \;=$$
$$= [P\, f^{i\prime}(L_i)] / [P\, f^{i\prime\prime}(L_i)] \;=\; f^{i\prime}(L_i)] / f^{i\prime\prime}(L_i)$$

The welfare loss will be larger the less concave is the local production function – the less negative $f^{i\prime\prime}(L_i)$. For small tax changes, it will decrease with (minus) $- f^{i\prime\prime}(L_i) \,/\, f^{i\prime}(L_i)$ and we recall that $- f^{i\prime\prime}(L_i) \,/\, f^{i\prime}(L_i)$ is the Arrow-Pratt measure of absolute risk-aversion – of concavity embedded in a function $f^i(L_i)$. It is (here) equal to the inverse of the absolute value of the

[4] Implicitly, we could fix P = 1, once the only good in the economy is income or product.

inverse[5] semi-elasticity of labor demand, $|\, W^i(L_i) / W^i(L_i)' \,| = |\, W^i(L_i) L^i(W_i + T_i)' \,|$.

Consider an uniform tax system. Then:

$$W_1 L^1(W_1 + T)(\bar{L} - \bar{L}_1) = W_2 L^2(W_2 + T)\bar{L}_1 \tag{55}$$

$$\partial\bar{L}_i/\partial T = -\partial\bar{L}_j/\partial T = [\bar{L}_j W_i L^i(W_i + T)' - \bar{L}_i W_j L^j(W_j + T)'] / \tag{56}$$
$$/ [W_1 L^1(W_1 + T) + W_2 L^2(W_2 + T)] < 0$$

After an increase in the tax rate, there will be an inflow of population to region i iff:

$$\bar{L}_j W_i L^i(W_i + T)' > \bar{L}_i W_j L^j(W_j + T)' \tag{57}$$
or
$$- L^i(W_i + T)' / L^i(W_i + T) < - L^j(W_j + T)' / L^j(W_j + T)$$

There will be an inflow of population to the region of lower (absolute) semi-elasticity of labor demand.

$$\text{Welfare Change per unit of } \partial T = \tag{58}$$
$$= (W_1 + T) L^1(W_1 + T)' + (W_2 + T) L^2(W_2 + T)' < 0$$

Proposition 4: 4.1. With multiple coverage, the increase in a or both tax rates will increase total unemployment and both local unemployment rates.

4.2. An unilateral increase in the tax rate of one of the regions will generate an outflow of migrants to the other region, where the unemployment rate will (also) rise.

4.3. Under a uniform fiscal system, an increase of the (common) tax rate will relocate the labor force, increasing (decreasing) residence in the sector of lower absolute value of the semi-elasticity of labor demand.

4.4. The increase in taxes will always generate welfare losses – proportional to the gross wage and to the slope of the demand of the sector where the tax rate rises, decreasing with the concavity of the underlying production function - increasing with the absolute size of the inverse semi-elasticity of local labor demand.

[5] The term "inverse" may not be appropriate. The concept measures the change in labor demand (and employment) induced per unitary proportional increase of the gross wage rate.

7. Size restrictions in the sectors

In this section we want to quantify the effects of several changes in the two-sector model with institutional wage fixed in sector 1 but with size restriction in the areas. These could reproduce regional congestion, but not necessarily national boundaries. They are expected to independentize tax effects across regions.

We always assume 3.b. and 4.b. of section I. We distinguish two cases:

Model A:

Region 1 has a limited housing capacity, or there are barriers to membership or affiliation in region 1 (say, "insiders" limit entry). We add assumption:

5.c. Wage in the second sector is market determined and entry location restrictions in region 1 place an upper bound of $\bar{L}_1^*$ on the amount of people that can actually live there.

If the restriction is binding in equilibrium, supply in the second sector will be also fixed:

$$\bar{L}_2 = \bar{L} - \bar{L}_1^* \tag{59}$$

and the wage in the second sector:

$$W_2 = W^2(\bar{L} - \bar{L}_1^*) - T_2 \tag{60}$$

It must be the case that $\bar{L}_1^*$ is smaller than the equilibrium local supply in the institutional sector generated in the Harris-Todaro framework. As long as that condition holds, dynamics of this scenario have some of the same properties of the partial coverage - perfect mobility case.

It is straightforward to show that the tax on the uncovered sector has no allocation effects and implies no welfare loss:

$$\partial W_2/\partial T_2 = -1 \quad ; \quad \partial L_2/\partial T_2 = 0 \tag{61}$$

The impact of the tax on region 1 is totally reflected in local (un)employment:

$$\partial L_1/\partial T_1 = L^1(W_1 + T_1)' \tag{62}$$

A uniform tax will hurt only – and according to (62) – sector 1's employment. The welfare loss of an increase in the tax on the covered sector always results in:

$$\text{Welfare Change per unit of } \partial T_1 \text{ (or } \partial T) = \tag{63}$$

$$= (W_1 + T_1)\ L^1(W_1 + T_1)' < 0$$

Proposition 5: 5.1. In a dualistic model with housing or membership restrictions and institutional wage fixed in one of the sectors, the equilibrium after-tax wage in the uncovered sector is higher than for the perfect mobility case. There will be unemployment but less than in the H.-T. framework.

5.2. Given the mobility barrier, an increase of a tax rate will have mainly local effects: no effect for the employment of the uncovered sector; a reduction in the covered sector employment, of local and total welfare when its tax rate rises.

Model B:

The traditional sector has a limited ability of employment generation, say land (and land productivity) is fixed or limited; or there are employment quotas in the region. We consider assumption:

5.d. Wage in second sector is demand determined but there is a(n exogenous) limit of access to employment in the sector given by L_2^*.

Then, the wage in the second sector is determined by:

$$L_2^* = L^2(W_2 + T_2) \qquad \text{or} \qquad W_2 = W^2(L_2^*) - T_2 \tag{64}$$

If employment in sector 2 is fixed, equilibrium is guaranteed by population flows which will be generated until:

$$W_1\ L^1(W_1 + T_1) / \bar{L}_1 = L_2^*\ [W^2(L_2^*) - T_2] / \bar{L}_2 \tag{65}$$

We will have the same type of scenario as in B.-H. – unemployment in both sectors. However, the fiscal implications differ.

As employment is fixed – rationed - in sector 2, any change in the local tax is totally absorbed by falls in net wages:

$$\partial W_2/\partial T_2 = -1 \ ; \quad \partial L_2/\partial T_2 = 0 \tag{66}$$

Population will flow to region 1 where local unemployment increases.

$$\partial \bar{L}_1/\partial T_2 = -\partial \bar{L}_2/\partial T_2 = \bar{L}_1\ L_2^* / [W_1\ L^1(W_1 + T_1) + W_2\ L_2^*] > 0 \tag{67}$$

An unilateral increase in taxes of region 1 has the same effect as in the B.-H. structure:

$$\partial\bar{L}_1/\partial T_1 = -\partial\bar{L}_2/\partial T_1 = \bar{L}_2 W_1 L^1(W_1+T_1)' / \tag{68}$$
$$/ [W_1 L^1(W_1+T_1) + W_2 L_2^*] < 0$$

$$\text{Welfare Change per unit of } \partial T_1 \text{ (or } \partial T) = \tag{69}$$
$$= (W_1+T_1)\ L^1(W_1+T_1)' < 0$$

A uniform system, under which:

$$W_1 L^1(W_1+T) / \bar{L}_1 = L_2^* [W^2(L_2^*) - T] / \bar{L}_2 \tag{70}$$

implies that (66) still holds for sector 2 and:

$$\partial\bar{L}_1/\partial T = -\partial\bar{L}_2/\partial T = [\bar{L}_1 L_2^* + W_1 L^1(W_1+T)' \bar{L}_2] / \tag{71}$$
$$/ [W_1 L^1(W_1+T_1) + W_2 L_2^*]$$

$$\partial\bar{L}_1/\partial T > 0 \text{ iff } -L^1(W_1+T)' (W_1+T)/L^1(W_1+T) = |\ \varepsilon^1\ | < (W_1+T) / W_2 \tag{72}$$

Proposition 6: With a employment-congested sector, we arrive at equilibrium conditions similar to B.H. structure – but not to the same conclusions about the response to fiscal changes.

6.1. An unilateral increase in the tax rate of the institutionally covered sector will depress its – and total – employment, local and total welfare, generating an outflow of population to the congested sector.

6.2. An increase in the tax rate of the congested sector will have no impact on employment or welfare but will imply an outflow of population from the congested sector, where after-tax wages fall.

6.3. Under a uniform fiscal system, an increase of the (common) tax rate will relocate the labor force, increasing (decreasing) residence in the congested sector if the elasticity of demand of the covered sector is high (low) - higher (lower) than the ratio between the gross wage of the covered sector and the after-tax wage of the congested one. Total unemployment will increase – by the amount that employment in the covered sector decreases. Welfare decreases.

8. Summary and conclusions

In the presence of competitive labor markets and perfect mobility across regions – or sectors -, uniform taxation offers first-best allocations. Moreover, as we always assume redistribution and inelastic total factor supply, uniform taxation under such circumstances implies no deadweight loss, being completely "neutral". Such result (even if not neutrality) – frequently encountered in the public finance literature [6] – was found to fall when the first condition fails, whether the second holds or not.

On the one hand, it was demonstrated that a unit tax on a minimum wage covered / unionised sector may be total welfare improving if the region communicates with an uncovered sector one. In general, the possibility requires differential taxation, heavier on the uncovered than on the covered sector.

On the other, with less than perfect mobility – hence with some unemployment in the economy – taxing the uncovered sector will more likely be detrimental to total welfare.

With two covered sectors, the welfare loss due to taxation is (approximately) inversely related to the concavity of the underlying production technology of the sector where the tax is levied – directly related to the (absolute) magnitude of the inverse semi-elasticity of the sector's labor demand.

The population outflow predictions after a unilateral increase in one of the tax rates were the expected ones for all scenarios: away from the increasingly taxed location. Interestingly, whenever a uniform tax system is required, an increase in the common tax rate under imperfect mobility will shift the labor force to the (un)covered sector if the wage-regulated demand elasticity is (high) low in absolute value; if both sectors are covered, to the region of lower (absolute) semi-elasticity of labor demand.

Under sector/region size or affiliation restrictions, mobility across regions is somehow lost. Then, an uncovered sector is always cushioned from fiscal welfare losses. A covered sector will always experience them after the own tax rate increases.

[6] For head taxes, in Mieszkowski & Zodrow (1989); in Gordon (1983), p.583, appraising taxation of a mobile commodity such as capital.

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