Taxing Perfectly Mobile Capital

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Abstract

Conventional wisdom has it that a tax on capital is exclusively borne by the immobile factors when capital is perfectly mobile across countries and the country introducing the tax is small. We demonstrate within a simple general equilibrium setting that this is only half the truth.

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1. Introduction

In public debate it is often maintained that a tax on a completely mobile factor has eventually to be borne by the less mobile factors if the country introducing the tax is small. The underlying argument is simple enough: consider a country too small to have an influence on world equilibrium prices, and assume that capital is the mobile factor. The introduction of a tax τ on capital in such a country will then not affect the world equilibrium rate of return on capital, r^w. And as capital is assumed to be perfectly mobile across borders, investors in the country with the tax will have to realize the same net return they may obtain abroad. Hence their gross return must equal $r^w + \tau$. This is at times interpreted to mean (a) that the tax is borne by the less mobile factors and (b) that capital owners remain spared.

It is the purpose of this brief note to demonstrate on the basis of a simple general equilibrium model that the first conclusion is misleading and that the second is false[1].

2. The model

Consider a two-factor world consisting of I countries producing a single output with an identical linear-homogeneous technology. Assume that factor markets are competitive so that factors earn their respective marginal product. Assume further that total world capital $K = \sum_i K^i$ and total world labour $L = \sum_i L^i$ are constant but that capital is perfectly mobile across borders whereas labour is completely immobile.

Given the linear homogeneity of the production functions we have the well-known identity $F(K^i, L^i) = L^i f(k^i)$ and the equally well-known relations

$$F_K(K^i, L^i) = f'(k^i) \quad (1)$$

$$F_L(K^i, L^i) = f(k^i) - k^i f'(k^i) \quad (2)$$

[1] For an analysis based on a model with n identical countries see *Bradford* (1978). Compare also *Kotlikoff* and *Summers* (1987), pp. 1065-7, who reach similar conclusions for a model with two countries of unequal size.

which state that the marginal products of capital and labour depend only on the country's capital intensity k^i. However, as is evident from the mixed derivatives

$$F_{KK}(K^i, L^i) = f''(k^i)/L_i \quad (3)$$
$$F_{LK}(K^i, L^i) = -k^i f''(k^i)/L_i, \quad (4)$$

the intensity with which these marginal products change as a country's capital stock changes depends as well on the country's size (as measured by its population L^i).

Now, assume that country 1 introduces a tax τ on capital invested within the country. Since capital is perfectly mobile by assumption, its net return must be equal in all countries irrespective of where it is invested. Hence,

$$r^w(\tau) + \tau = f'(k^1(\tau)) \quad (5)$$
$$r^w(\tau) = f'(k^i(\tau)) \quad , \quad i = 2, ..., I \quad (6)$$

must hold. Differentiating (5) and (6) with respect to τ we have

$$r^w_\tau(\tau) + 1 = f''(k^1(\tau))K^1_\tau/L^1 \quad (7)$$
$$r^w_\tau(\tau) = f''(k^i(\tau))K^i_\tau/L^i \quad , \quad i = 2, ..., I. \quad (8)$$

Now, multiply (7) by $\alpha_1 = L^1/L$ and (8) by $\alpha_i = L^i/L$ and sum the results to get[2] $r^w_\tau(\tau) + \alpha_1 = \sum_i f''(k^i(\tau))K^i_\tau/L$ which, at the point $\tau = 0$, simplifies to

$$r^w_\tau(0) + \alpha_1 = \sum_i f''(k^i(0))K^i_\tau/L = f''(k)\sum_i K^i_\tau/L = 0 \quad (9)$$

because, at $\tau = 0$, all countries still operate at identical capital intensities $k^i(0) = k = K/L$ and, given the fixed world capital stock K, the changes in the countries' capital stocks, $K^i_\tau = 0$, must sum to zero.

Before we proceed to interpret this key result, it is useful to derive the changes in tax revenue, world capital income and world wage income first.

Differentiating the tax revenue $T(\tau) = \tau K^1(\tau)$ with respect to τ one has

$$T_\tau(\tau) = K^1(\tau) + \tau K^1_\tau \quad \text{and} \quad (10)$$
$$T_\tau(0) = K^1(0). \quad (11)$$

[2] Note that the population shares α_i add up.

For world capital income $C(\tau) = r^w(\tau)K$ one finds accordingly

$$C_\tau(\tau) = r^w_\tau(\tau)K \quad \text{and} \tag{12}$$
$$C_\tau(0) = r^w_\tau(0)K = -\alpha_1 K = -K^1(0), \tag{13}$$

where use was made of (9) and the fact that $\alpha_1 K = L^1 K/L = K^1(0)$ must hold. And finally, for world wage income $W(\tau) = \sum_i [f(k^i(\tau)) - k^i(\tau)f'(k^i(\tau))]L^i$ we have

$$W_\tau(\tau) = -\sum_i [k^i(\tau)f''(k^i(\tau)]K^i_\tau \quad \text{and} \tag{14}$$
$$W_\tau(0) = -kf''(k)\sum_i K^i_\tau = 0. \tag{15}$$

3. Interpretation

Equations (9), (11), (13) and (15) tell an interesting story.

1. Equation (9) says that the introduction of a tax on capital in country 1 reduces the world market rate of interest r^w by exactly α_1, its share in world capital[3]. If country 1 is small, the world interest rate will fall by correspondingly little or, in the borderline case $\alpha \to 0$, not at all. Yet this does not spare the capital owners from eventually having to shoulder the entire tax burden.

2. That capital owners carry the full tax can be seen from (13) in conjunction with (11). Irrespective of how small country 1 and thus α_1 is, world capital income declines by exactly the amount of the tax revenue. From a global point of view it is thus the capital owners who pay the entire tax.

3. From a purely national point of view the outcome is somewhat different. When looking specifically at country 1, equations (9) and (11) state that its investors contribute merely the fraction α_1 to total tax revenue. The remaining share of $1 - \alpha_1$ has actually to be borne by country 1's wage earners[4].

4. From a global point of view, however, world wage income remains untouched. This is what (15) says, and that means that workers in the rest of the world gain exactly what the workers in country 1 loose.

[3]Remember that, at $\tau = 0$, all countries operate at an identical capital intensity. Hence, their share in world population, α_i, is also their share in world capital.

[4]That wage income in country 1 falls indeed by $W^1_\tau = -k_1(0)f''(k_1(0))K^1_\tau = -(1 - \alpha_1)K^1(0)$ is easily checked. Evaluate (7) at $\tau = 0$, multiply by $K^1(0)$ and substitute $r^w_\tau(0)$ by $-\alpha_1$ from (9).

Taxing mobile capital in a country thus triggers two parallel effects: it lowers world capital income by exactly the tax revenue without affecting world wage income, and it triggers outbound capital migration which causes income losses for the workers of this country and gains of equal size for the workers in the rest of the world.

4. Concluding remark

The argument of this brief note relates to the situation where no country taxes capital yet and one country is about to introduce such a tax. It is easy to check that in essence our results survive in a situation where countries already taxed capital at a uniform rate ($\tau^i = \tau$) and country 1 considered an isolated increase by a small amount[5]. However, without additional assumptions little may be said about the more realistic situation in which countries tax capital at different rates.

References

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[5] In this situation, it would be the total world revenue from capital taxation that rises by $K^1(\tau)$, and only a part of that would accrue to the government in country 1. But it would again be the capital owners who had to bear the entire additional tax burden.