2.2.5 Policy Implications

Tax Harmonization & Over-provision

As we have seen, in case $\lambda < 0$ competition is ruinous what calls for the government to intervene.

Moreover, if $\lambda < 0$ the 'optimal' tax on capital ($\tau = c_K(K, W)K$) is not sufficient to cover the cost for infrastructure.

To avoid the effects from fiscal competition, governments can cooperate and set higher tax rates on capital. If the government collects more revenue from capital taxation it could mitigate the distributional consequences.

But the provision of public infrastructure, W, is still determined on a non cooperative basis. So, it is unclear whether the government will continue to chose an infrastructure W compatible with the Samuelson condition.

So we pose the question: how are the rents of the domestic population affected by an increase in the provision of infrastructure, given the tax rate τ?

$\Longrightarrow$ In other words, what is the sign of $\frac{dR}{dW}$?

We must go through a few steps to answer this question.

First recall our old equation for rents in the society

$$R = f(K, L) - r(K + \overline{K}) - c(K, W)K - \rho W.$$

We now total differentiate this equation with respect to infrastructure, W

$$\begin{aligned} \frac{dR}{dW} &= [f_K - r - c_K(K, W)K - c(K, W)] \frac{dK}{dW} \\ &- c_W(K, W)K - \rho. \end{aligned} \tag{9}$$

But how does an increase in infrastructure affect the capital stock, i.e. what is the sign of $\frac{dK}{dW}$?

Second, recall the first order condition from firm maximization $f_K(K, L) = r + c(K, W) + \tau$. Total differentiation gives:

$$\phi \equiv \frac{dK}{dW} = \frac{c_W(K, W)}{f_{KK}(K, L) - c_K(K, W)} > 0, \qquad (10)$$

since we know that $c_W < 0$ and $f_{KK}(K, Ll) < 0$ and $c_K(K, W) > 0$ by assumption. Therefore, any increase in infrastructure lures additional capital into the country.

Third, if we substitute the firm's first order condition into equation (9), we get

$$\frac{dR}{dW} = [\tau - c_K(K, W)K] \frac{dK}{dW} - c_W(K, W)K - \rho. \qquad (11)$$

In the national optimum, R is maximized with respect to infrastructure, i.e., $\frac{dR}{dW} = 0$.

Hence, we finally get the optimality condition

$$[\tau - c_K(K, W)K] \, \phi = c_W(K, W)K + \rho. \qquad (12)$$

Results:

$\Longrightarrow$ When the tax rate is equal to the congestion externality, $\tau = c_K(K, W)K$, the left hand side is equal to zero.

$\Longrightarrow$ In case the tax rate equals the congestion externality, the right hand side could be rewritten according to the Samuelson condition which holds in the unconstrained optimum (in case each government maximizes the rents of its citizen).

$\Longrightarrow$ Under tax harmonization, the Samuelson rule, however, does not hold. Why?

- As we said before, $\lambda < 0$ ($\Longrightarrow$ ruinous competition) is, according to the *Selection Principle*, a necessary prerequisite for the government to intervene.
- In case of $\lambda < 0$, the optimal tax on capital which fully internalizes the congestion externality ($\tau = c_K(K, W)K$) is not sufficient to cover the cost of infrastructure.

- Therefore, higher tax rates, $\tau^H > \tau$, are levied on capital in the cooperative equilibrium (so, under tax harmonization) such that each government collects sufficient revenues from capital taxation to mitigate the distributional consequences for the immobile factor.

Accordingly, the equilibrium tax rate levied under tax harmonization, τ^H, exceeds the congestion externality

$$\tau^H > c_K(K, W)K.$$

and therefore it is necessary that

$$-c_W(K, W)K < \rho.$$

for the equation to hold.

- Given that capital is deterred by a tax rate higher than necessary to cover the marginal congestion externality, it pays domestic residents to lure more of it into the country by offering a better infrastructure

- If this country was the only to face this constraint the capital stock would shrink in order to satisfy the Samuelson condition.

- However, since all countries face this constraint, the capital stock is fixed and the interest rate adjusts to compensate for the high tax rate,

$$f_K(K, L) - r - c(K, W) - \tau^H = 0.$$

- Hence, there is an over-provision of public infrastructure, since the willingness to pay, summed over all usage acts, is less than the cost of providing the public infrastructure

$$-c_W(K, W)K < \rho.$$

$\Longrightarrow$ *Proposition* 2.4: Tax Harmonization intensifies infrastructure competition and leads to an over-provision of the public infrastructure in equilibrium.

A self-financing constraint on capital

As we have shown, tax harmonization is a problematic means to avoid the distributional consequences of tax competition.

An alternative strategy is to agree not to tax labor and let capital pay the costs for infrastructure.

Suppose that states, instead of tax harmonization, agree not to subsidize capital.

So instead of levying taxes on labor, they finance the infrastructure investment exclusively with capital charges.

That is

$$\tau^L = 0,$$

which implies the following budget constraint

$$\tau K = \rho W.$$

As before, the single competitive government seeks to maximize the sum of all national rents

$$R = f(K, L) - f_K(K, L)K + r\overline{K} - \tau^L L \qquad (13)$$

How is R affected by an increase in the tax rate on capital?

For an answer, differentiate (13) with respect to τ in order to get

$$\frac{dR}{d\tau} = -f_{KK}(K, L)\frac{dK}{d\tau}K = 0 \qquad (14)$$

The expression $\frac{\partial K}{\partial \tau}$ can be qualified if we differentiate the firm's f.o.c., $f_K(K, L) - r - c(K, W) - \tau = 0$, with respect to the capital tax rate τ

$$\frac{dK}{d\tau} = \frac{\left[c_W(K, W)\frac{\partial W}{\partial \tau} + 1\right]}{\left[f_{KK} - c_K(K, W) - c_W(K, W)\frac{\partial W}{\partial K}\right]}. \qquad (15)$$

What are $\frac{\partial W}{\partial K}$ and $\frac{\partial W}{\partial \tau}$?

If we solve the government's budget constraint

$$\tau K = \rho W$$

for W and differentiate it with respect to capital and the tax rate, we get:

$$\frac{\partial W}{\partial K} = \frac{\tau}{\rho} \qquad and \qquad \frac{\partial W}{\partial \tau} = \frac{K}{\rho}.$$

Substituting these into the above formula (15) yields

$$\frac{dK}{d\tau} = \frac{\left[c_W(K,W)\frac{K}{\rho} + 1\right]}{\left[f_{KK} - c_K(K,W) - c_W(K,W)\frac{\tau}{\rho}\right]}. \quad (16)$$

- The denominator is negative when $f_{KK} < 0$, $c_K(K,W) > 0$ and if $c_W(K,W)\frac{\tau}{\rho}$ is small.
- Moreover, for a solution to exist $\frac{dR}{d^2\tau} < 0$ must be true.
- So we have an expression for $\frac{dK}{d\tau}$, but, what is the sign of that expression?

A higher tax rate affects capital in two ways:

1. There is one deterrent effect
$$\frac{1}{f_{KK}(K,W) - c_K(K,W) - c_W(K,W)\frac{\tau}{\rho}} < 0.$$

2. But a higher tax also attracts infrastructure, which is captured by
$$\frac{c_W(K,W)\frac{K}{\rho}}{f_{KK}(K,W) - c_K(K,W) - c_W(K,W)\frac{\tau}{\rho}} > 0.$$

In optimum, a marginal change in the tax rate should have no impact on the citizens' surplus $\frac{dR}{d\tau} = 0$. Since

$$\frac{dR}{d\tau} = -f_{KK}(K,L)\frac{dK}{d\tau} = 0 \qquad (17)$$

we must have
$$\frac{dK}{d\tau} = 0.$$

However, as the denominator of $\frac{dK}{d\tau}$ is negative the numerator has to be zero in order to assure equation (17) to hold. Therefore, we get

$$-c_W(K, W)K = \rho. \tag{18}$$

So, the Samuelson condition will be fulfilled if a self-financing constraint on capital exists. Note, this was not the case when labor was taxed!!!

Results:

$\Longrightarrow$ A self-financing constraint will do the job and induce the competitive government to provide an efficient amount of infrastructure.

$\Longrightarrow$ In optimum, the attraction effect of the infrastructure which can be financed with the additional tax revenue exactly annihilates the deterrent effect of the tax.

$\Longrightarrow$ Because capital carries the cost of infrastructure, the total sum of rents is maximized when the tax-infrastructure combination is chosen which meets the Samuelson condition and maximizes the country's capital import.

The last question to be considered is on the optimal tax rate, τ^*. We make use of the following (by now familiar?) equations:

1. The government's budget constraint
$$\rho W = \tau K \qquad \Longrightarrow W = \frac{\tau K}{\rho}.$$

2. The *Samuelson Rule*
$$-c_W(K,W)K = \rho \qquad \Longrightarrow c_W = -\frac{\rho}{K},$$

3. and the Euler equation of the user cost function
$$c_K(K,W)K + c_W(K,W)W = \lambda c(K,W).$$

Substitute for c_W and W to get

$$c_K(K,W)K + (-\frac{\rho}{K})\frac{\tau K}{\rho} = \lambda c(K,W), \qquad (19)$$

what simplifies to

$$\tau^* = c_K K - \lambda c.$$

Results:

$\Longrightarrow$ The tax rate exactly covers the congestion externality when $\lambda = 0$.

$\Longrightarrow$ In the relevant case, when $\lambda < 0$ then $\tau > c_K K$ so there is enough money to cover the costs of the externality.

Further Considerations:

If one country only imposes the self-financing constraint, then the capital stock would be reduced and so would infrastructure be.

However, if all countries impose the constraint, infrastructure will be constant as the capital stock is fixed (the interest rate compensates for the high tax rate so $-c_W k = \rho$ will hold).

"It would be a mistake to conclude from a failure in systems competition that a centralized solution must necessarily be sought".

A clever alternative could be to tax the cash flow, not investments, of firms. They are affecting the returns from previous investment, carried out before the cash flow taxes were introduced. But a redistributive issue arises since foreign shareholders can be used.