Quantitative Economics for the Evaluation of the European Policy

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Solow model with public expenditure

Barro (1990) proposes a model where public expenditure has a positive impact on the productivities of private factors. In particular:

$$Y = K^{\alpha} H^{1-\alpha} G^{1-\alpha}, \tag{1}$$

where G is the total amount of public expenditure.
Assuming that public expenditure is financed in balanced budget with a flat tax rate on income:

$$G = \tau Y, \tag{2}$$

where τ is the tax rate, then:

$$Y = K^{\alpha} H^{1-\alpha} (\tau Y)^{1-\alpha}, \tag{3}$$

i.e.

$$Y = KH^{(1-\alpha)/\alpha} \tau^{(1-\alpha)/\alpha} \tag{4}$$

Net income and optimal level of taxation

The net income of economy is given by:

$$(1-\tau)\,Y = (1-\tau)\,KH^{(1-\alpha)/\alpha}\tau^{(1-\alpha)/\alpha}; \tag{5}$$

the maximum net income is reached for $\tau = 1-\alpha$.
This result is mainly due to the specification of production function.

To complete the model we can add an equation for the accumulation of capital.

$$\dot{K} = sY - \delta K = s\left(1-\tau\right)KH^{(1-\alpha)/\alpha}\tau^{(1-\alpha)/\alpha} - \delta K, \tag{6}$$

i.e.

$$\frac{\dot{K}}{K} = g_K = s\left(1-\tau\right)H^{(1-\alpha)/\alpha}\tau^{(1-\alpha)/\alpha} - \delta \tag{7}$$

and therefore:

$$g_k = s\left(1-\tau\right)H^{(1-\alpha)/\alpha}\tau^{(1-\alpha)/\alpha} - \delta - g_L \tag{8}$$

Here the growth rate of capital per worker can be positive also in the long run without any other source of growth (as technological progress and/or accumulation of human capital).

The growth rate of **output per worker** will be growing at the same rate of the capital per worker.

This a model of **endogenous** growth, where the long-run growth depends also on the level of the flat tax rate.

Structural and cohesion funds could be assimilated to G.

Limited technological spillovers

In the Solow model we have assumed that technological spillovers are not limited, i.e. each region has access to the same technology. However, this is hardly true in the real world (Erthur and Koch, 2008 and Fiaschi et al. 2016).
Suppose that:

$$Y_{it} = K_{it}^{\alpha} \left(A_{it} L_{it}\right)^{1-\alpha} \tag{9}$$

and

$$A_{it} = \Omega_{it} \Pi_{j \neq i}^{N} A_{jt}^{\theta w_{ij}} \tag{10}$$

where Ω_{it} is the part of technological progress of region i not depending on the other regions, A_{jt} is the technological progress of region j, θ is the parameter measuring the **intensity** of spatial spillovers and w_{ij} the element (i, j) of **spatial matrix** W.

Growth rate with limited spatial spillovers

Assume that:

$$\Omega_{it} = \Omega 0_i e^{\mu t} \tag{11}$$

then:

$$A_{it} = \Omega 0_i^{v_{it}} \Pi_{j \neq i}^{N} \Omega 0_j^{v_{jt}} e^{\frac{\mu t}{1-\theta}} = \overline{\Omega 0}_i e^{\gamma^A t}, \tag{12}$$

where $v_{ij} = \sum_{r=1}^{\infty} \theta^r w_{ij}^{(r)}$ and

$$\gamma^A \equiv \frac{\mu}{1-\theta} \tag{13}$$

is the **growth rate of the technological progress** of region i.

The intensity of spatial spillovers is crucial for the long-run growth of region i.

From which factors this intensity depends is an open question.