Lancaster University Management School
Working Paper
2002/004

Going for Growth: Overeducation in a Tax Competition Game

Geraint Johnes

The Department of Economics
Lancaster University Management School
Lancaster LA1 4YX
UK

GOING FOR GROWTH: OVEREDUCATION IN A TAX COMPETITION GAME

Geraint Johnes

Department of Economics
Lancaster University Management School
Lancaster University
Lancaster LA1 4YX
United Kingdom

Voice: +44 1524 594215
Fax: +44 1524 594244
E-mail: G.Johnes@lancs.ac.uk

May 2002

ABSTRACT

A model of international tax competition is developed in which taxes are raised in order to finance education which in turn raises income. It is shown that, in contrast to results from the tax competition literature, the outcome of a non-cooperative game can be to raise the tax rate, with the result that investment in education exceeds that which is globally socially optimal. This provides an explanation for the tendency for countries to emphasise growth as an objective in spite of what empirical studies tell us about the impact of income on happiness; it also identifies a new type of overeducation.

JEL Classification: I20, H42, H21, H87, E62
Keywords: growth, overeducation, tax competition, income distribution, international social welfare function

1. Introduction

Numerous recent studies have established that the distribution of income is an important determinant of happiness. Some of this evidence suggests that raising the income of all individuals will not raise well-being (Easterlin 1995; see also Alesina *et al*., 2001; Easterlin, 2001; Oswald, 1997; Morawetz, 1977). In light of this, it is somewhat puzzling to observe that the authorities typically opt to pursue policies that are aimed at providing sustained growth, where inflation rather than inequality is seen as the limiting constraint. In this note, I provide one possible explanation for this.

In order to render the analysis as simple as possible, I focus on educational policy as the route by which governments seek to stimulate growth. Inasmuch as it increases human capital and the productivity of the educated worker, education affects both the level and distribution of income within an economy. I develop a model of educational investment by societies where education is financed through the exchequer, and where the goal is to choose a tax rate that maximises social welfare. Social welfare in turn is a function of both the level and the distribution of income both within the domestic economy and abroad. Tax is therefore chosen in each country to maximise welfare in that country, given the actions of the government of the other country in the model. There is therefore a game being played by the governments of each country in the fashion of Nash (1951). The nub of the paper is that a prisoners' dilemma effect within this game can lead to countries investing more in education (that is, they pursue more growth oriented policies) than they would do in a cooperative solution. Note that this provides a counterexample to a well known finding in the tax competition literature: namely that the Nash equilibrium implies the setting of tax rates that are below the levels required to finance efficient quantities of publicly provided goods (Edwards and Keen, 1996).

2. The Model

The disposable income of individual i is given by

$$Y_i = (Y_0 + s_i b)(1-\tau) \tag{1}$$

where Y_0 is basic income to be defined more precisely later, s_i is a binary variable that indicates whether the ith individual has undertaken schooling or not, τ is the proportional rate of income tax, and b is the income premium associated with schooling. Tax revenues are used solely for the purpose of financing education. I assume that education takes place instantaneously, and that the cost to the exchequer of educating an individual is a constant c.

Denote by λ the proportion of the population n that undertakes education. Total tax revenue is given by

$$\tau n(Y_0 + \lambda b) \tag{2}$$

This must equal the total cost of education $c\lambda n$, in order for the exchequer's books to balance. Solving for λ, which must lie within the unit interval, yields

$$\lambda = \tau Y_0/(c-\tau b) \tag{3}$$

In order to express simply the emphasis that society places on the distribution of income, a weight of less than unity, say σ, where $0\leq\sigma\leq1$, may be attached to the disposable incomes of those whose incomes exceed Y_0. The weighted sum of disposable incomes is therefore given by

$$V = n(1-\tau)[Y_0(1-\lambda)+\sigma\lambda(Y_0+b)] \tag{4}$$

So far I have considered only one country. Suppose now that the world comprises two countries, labelled a and b. The above analysis applies within each country. A subscripted a or b could be attached to each variable in order to indicate the country to which it refers.

To proceed further, I assume that there are positive and non-pecuniary externalities associated with education (McMahon, 1999). These may be country-specific or may spill over across country boundaries. Social welfare in a given country varies positively with disposable incomes and externalities due to education such that

$$W_j = \{\rho[(1-\lambda_j)Y_0+\lambda_j\sigma(Y_0+b)](1-\tau_j)+(1-\rho)[(1-\lambda_k)Y_0+\lambda_k\sigma(Y_0+b)](1-\tau_k)\}\lambda_j^{\alpha}\lambda_k^{\beta} \tag{5}$$

where $0\leq\rho\leq1$, and n comes out in the wash. For simplicity, I shall assume that $n_a=n_b$, $c_a=c_b$, $\sigma_a=\sigma_b$, $Y_{0a}=Y_{0b}$, $b_a= b_b$, $\rho_a=\rho_b$, $\alpha_a=\alpha_b$ and $\beta_a=\beta_b$. These assumptions allow countries a and b to be regarded symmetrically.

Differentiating each W_j with respect to τ_j given τ_k and setting the results to zero defines the FOCs allowing the optimal τ_j to be evaluated for each country in the non-cooperative Nash game; in view of the symmetry of the problem, note that *ex post* $\tau_j = \tau_k = \tau^*$, say.

Once τ^* is known, it is a routine matter to work back through the equations to find the common level of education in each country in the optimum, λ^*, and the level of global welfare, $W^* = 2W_j$.

To take an example, suppose that $\rho=0.6$, $\sigma = 0.3$, $b = 5$, $Y_0 = 20$, $c = 4$, $\alpha = 1$, and $\beta = -0.5$. In this case the FOCs are given by

$$(525\tau^{*3} - 1540\tau^{*2} + 1256\tau^* - 160)\,\xi = 0 \qquad (6)$$

where $\xi = 40\sqrt{[5\tau^*/(4-5\tau^*)]}/\tau^*(5\tau^*-4)^2$. From (6), (3) and (5) respectively, it is possible to establish that $\tau^* = 0.155$, $\lambda^* = 0.965$ and $W^* = 13.18$.

How does this non-cooperative solution compare with the cooperative solution? In the case of co-operation between the countries the optimand is the international social welfare function

$$W = \Sigma_m\{\rho[(1-\lambda_j)Y_0+\lambda_j\sigma(Y_0+b)](1-\tau_j)+(1-\rho)[(1-\lambda_k)Y_0+\lambda_k\sigma(Y_0+b)](1-\tau_k)\}\lambda_j^{\alpha}\lambda_k^{\beta} \qquad (7)$$

m=a,b; j=a,b; k=a,b; j≠k. Substituting from (3) into (7) yields an expression which may then be maximised with respect to the common tax rate, τ. Using the same parameter assumptions as earlier, the FOC satisfies

$$(175\tau^{*3} - 350\tau^{*2} + 218\tau^{*} - 16)\,\xi = 0 \tag{8}$$

Once again, knowledge of the optimal τ^*, obtained using numerical methods, permits simple calculation of the optimal values of education and social welfare. In the case of our example, the globally optimal values of the tax variables are $\tau^*=0.084$, yielding a value of $\lambda^*=0.471$. From (6), $W^*=17.74$.

For certain parameters, then, it is readily observed that the value of λ^* obtained in the cooperative solution is lower than the corresponding value in the non-cooperative solution. This finding suggests that the nature of the non-cooperative game is such that the authorities invest in growth enhancing activities to a greater extent than would occur in a situation of joint welfare maximisation, and this excess investment serves to reduce economic welfare. Moreover, and in contrast to standard findings in the tax competition literature, there exist parameter vectors that imply optimal tax rates that are greater under non-cooperation than under cooperation.

3. Conclusion

Recent empirical work has confirmed that aspirations rise as general incomes rise, and that the distribution of income has an impact on happiness. To resurrect an old catchphrase, it seems that indeed there are 'limits to growth' - or at least to the ability of growth to secure improvements in welfare. Governments have nonetheless been relentless in the pursuit of policies aimed at promoting growth. The thrust of this paper has been to argue that this may have resulted from the non-cooperative nature of games played between governments of different countries. The fragility of any cooperative agreement likely reinforces the tendency to grow at a rate that exceeds the global welfare optimum. In addition to providing a counterargument to the common finding that competitive taxation results in an inefficiently low level of provision, the arguments presented here provoke a new interpretation of the phenomenon of overeducation (Daly *et al*., 2000; Dolton and Vignoles, 2000).

References

Alesina, Alberto, Di Tella, Rafael and MacCulloch, Robert (2001) Inequality and happiness: are Europeans and Americans different?, NBER Working Paper 8198.

Daly, Mary C., Büchel, Felix and Duncan, Greg J. (2000) Premiums and penalties for surplus and deficit education: evidence from the United States and Germany, *Economics of Education Review*, **19**, 169-178.

Dolton, Peter J. and Vignoles, Anna (2000) The incidence and effects of overeducation in the UK graduate labour market, *Economics of Education Review*, **19**, 179-198.

Easterlin, Richard A. (1995) Will raising the incomes of all increase the happiness of all?, *Journal of Economic Behavior and Organization*, **27**, 35-47.

Easterlin, Richard A. (2001) Income and happiness: towards a unified theory, *Economic Journal*, **111**, 465-484.

Edwards, Jeremy and Keen, Michael (1996) Tax competition and Leviathan, *European Economic Review*, 40, 113-134.

McMahon, Walter W. (1999) *Education and development: measuring the social benefits*, Oxford: Oxford University Press.

Morawetz, David (1977) Income distribution and self-rated happiness: some empirical evidence, *Economic Journal*, **87**, 511-522 (with Ety Atia, Gabi Bin-Nun, Lazaros Felous, Yuda Gariplerden, Ella Harris, Sami Soustiel, George Tombros and Yossi Zarfaty).

Nash, John F. (1951) Non-cooperative games, *Annals of Mathematics*, **54**, 286-295.

Oswald, Andrew J. (1997) Happiness and economic performance, *Economic Journal*, **107**, 1815-1831.