

同盟に対する国際公共財の供給

THE PROVISION OF INTERNATIONAL PUBLIC GOOD FOR ALLIANCE

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【要約】

Abstract :

When international public goods are provided at positive levels by allied countries, in Nash-Cournot behavior the smaller members devote smaller percentages of their incomes to the international public goods than do the larger members.

Keyword :

international public good, international public bad, Nash-Cournot behavior, Lindahl behavior (国際公共財, 負の国際公共財、ナッシュ=クールノー行動、リンダール行動)

1. Introduction

Olson and Zeckhauser(1966) showed that the United States and some of the other larger members are bearing a disproportionate share of the burden of the common defense of the NATO countries and that the smaller members of NATO devote smaller percentages of their incomes to defense than do larger members.

Sandler and Murdoch(1990) derived systems of demand equations for distinguishing between Nash(1950)-Cournot(1838) and Lindahl(1919) behavior in a group that either shares a pure public good or an activity that provides a private and a pure public joint product. Their systems of simultaneous equations were estimated based upon Nash-Cournot and Lindahl behavior for a sample of ten NATO allies for the 1956-1987 period, and nonnested hypothesis tests supported the Nash-Cournot specification for five of the ten sample allies while no evidence of Lindahl behavior was found.

Using Warr(1983)'s model, this note indicates that when an international public good is provided at positive levels by allied countries, the smaller members devote smaller percentages of their incomes to the international public good than do larger members in Nash-Cournot behavior while ambiguous in Lindahl behavior.¹

2. The model

We imagine an alliance among n nations. The utility of each depends on her consumption of a private good c^i and on an aggregate international public good g . Thus the utility of nation i is written

$$u^i = U^i(c^i, g).$$

The functions U^i are each assumed to be strictly quasi-concave, twice differentiable and increasing in two arguments, but individual utility functions need not be the same.

Each nation is endowed an income y^i . She then allocates this income between expenditure on the private good and the international public good. Nation i 's budget constraint is thus

$$y^i \geq c^i + g^i$$

where g^i denotes the provision of the international public good and her expenditure on it. Clearly seen,

$$g = \sum g^i.$$

Each nation behaves as a utility maximizing competitor in the determination of her provision of the public good and her consumption of private good. We now see that in this Nash-Cournot behavior any income redistribution does not affect equilibrium from Warr(1983)'s neutrality theorem.

In Lindahl behavior nation i 's implicit budget constraint is

$$y^i \geq c^i + p^i g,$$

where p^i denotes the Lindahl price of the aggregate international public good. Obviously,

$$\sum p^i = 1.$$

Each nation behaves as a cooperator whose marginal rate of substitution of consumption is equal to the Lindahl price.

3. The result

Suppose there are two countries whose incomes are endowed equal and expenditures on the international public good equal as well. In Warr(1983)'s model an international income transfer from nation i to nation j implies that ²

$$-dp^i = dy^i = -dg^i = dg^j > 0.$$

Since initially

$$y^i = y^i$$

and

$$g^i = g^i,$$

after the transfer we obtain

$$y^i/y^i > g^i/g^i$$

or

$$g^i/y^i > g^i/y^i$$

so that a smaller nation devotes smaller percentage of her income to the international public good than does a larger nation in Nash-Cournot behavior.

In cooperative behavior nation i 's first order conditions are written

$$y^i = c^i + p^i g$$

and

$$p^i = U^i_g / U^i_c$$

where

$$U^i_c = \partial U^i / \partial c^i$$

And

$$U^i_g = \partial U^i / \partial g.$$

From these conditions nation i 's demand for the private good is a function of the expenditure on the aggregate international public good and her income since

$$p^i = (y^i - c^i) / g,$$

$$U^i_c = U^i_c(c^i, g),$$

and

$$U^i_g = U^i_g(c^i, g).$$

We now see that an international transfer affects each nation's consumption of private good. A transferor's demand for the aggregate international public good decreases to reduce its Lindahl price while a transferee's increases to raise its price. To what extent the former expenditure on the international public good decreases and the latter increases depends on each nation's preference so that a relation between nation size and burden is not unambiguous.

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Notes

- 1 As to international public goods, see Boyer (1993) and Terasaki (1999).
- 2 Needless to say, this well-worn manipulation makes two different countries in income or size. The income transfer does not imply real economic assistance, but only a device to make them.