Production Efficiency and Principles of Taxation in an International Setting

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Background

- There is a presumption that the 'destination principle' of commodity taxation is superior, not accounting for market imperfections, to the 'origin principle'
- This 'fundamental result' in optimal taxation is an application of the **production efficiency theorem** of Diamond and Mirrlees (AER:1972)
- . . . which has had an enormous influence on international tax policy design, notably VAT
- But this presumption might not hold, for the production efficiency theorem is not in a form directly applicable to issues of co-operative international tax setting
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Related literature

- Diamond and Mirrlees (AER:1972)
- Keen and Wildasin (AER:2004)
- Kotsogiannis and Makris (EL:2002)
- Keen and Kotsogiannis (JIE: 2013)
- Woodland and Kotsogiannis (JEEM: 2014)

Description of the model (informal)

- GE model with S countries trading freely in N goods [adding no tradeable goods into the frame adds nothing], H^s residing in each s
- Goods and services are taxed (consumption and trade taxes) to finance public good provision
- Consistent with Diamond and Mirrless (AER:1972), profits are fully taxed by the government in the country in which they arise
- The analysis characterizes the set of Pareto-efficient allocations (with the complete set of the instruments available – as many as markets)
- In general there are an infinite number of such allocations, and could focus on just one by appealing to some specific social welfare function, but the approach here will be generic to any process that leads to a Pareto-efficient outcome

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The production sector

- S countries producing output, with production sector characterized
-

$$r^s(p^s, v^s) = \max_{y^s}\{p^{s\prime} y^s \quad : \quad y^s \in V(v^s)\} \tag{1}$$

  - y^s is N-vector of (net) output
  - w is the N-vector of international prices
  - τ^s in the N-vector of tariffs in s
  - $p^s = w + \tau^s$ in the N-vector of prices
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Preferences

- H^s consumer reside in each s, with preferences represented by the expenditure function
- $$e^{hs}(u^{hs}, q^{hs}) = \min_{x^{hs}} \{q^{s\prime} x^{hs} \ : \ U^{hs}(x^{hs}) \geqslant u^{hs}\} \tag{2}$$
- With
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Equilibrium

$$
\begin{aligned}
e^{hs}(q^s, g^s, u^{hs}) &= 0, \text{ for all } s, h && (4)\\
q^s &= p^s + t^s, \text{ for all } s && (5)\\
p^s &= w + \tau^s, \text{ for all } s && (6)\\
t'^s x^s + \pi^s(p^s) + \tau'^s (x^s - y^s) &\geqslant w' g^s \text{ for all } s && (7)\\
\sum_{s=1}^{S} m^s &= 0_{(N-1)\times 1} && (8)
\end{aligned}
$$

Motzkin's Theorem of the Alternative

- Analysis proceed by using Motzkin's Theorem of the Alternative to characterize Pareto-efficient commodity and trade tax tariff structures
- Mechanically, we are looking for solution, in terms of a set of multipliers, to a system of equations

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Analysis

- Perturb the economy for some $\{dw, d\tau, dt\}$ (and if required $d\alpha$) and stack resulting perturbations to obtain

$$\Lambda_u du = \Lambda_w dw + \Lambda_\tau d\tau + \Lambda_t dt \tag{9}$$

  and then look for $du > 0$

- Convenient to use Motzkin's Theorem of the alternative
- By Motzkin's Theorem of the Alternative, an initial equilibrium is either Pareto inefficient in the strict sense $du > 0$, for some perturbation $\{dw, d\tau, dt\}$ (satisfying (9)) or
- There exists some y vector such that

$$y'\Lambda_u \ll 0' \tag{10}$$
$$y'\Lambda_l = 0' \tag{11}$$

for each of Λ_l, $l = w, \tau, t, g$ (and $d\alpha$ if required, but with y being the appropriate vector)

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Results

Proposition

At any Pareto efficient allocation

(a) $\sum_{s=1}^{S} z^s m'^s = 0_{1\times(N-1)}$

(b) (Many person Ramsey rule)

$$\sum_{h=1}^{H^s} \sigma_h x'^h = z^s (t'^s \nabla x^s + x'^s) \text{ for any } s$$

(c) (Collinearity of trade taxes)

$$z^\kappa \tau'^\kappa = z^j \tau'^j \text{ for all countries } \kappa, j$$

Intuition

- Market clearing implies $M'\iota = 0_{(N-1)\times 1}$, so that M' has column rank of no more than $S-1$.
- If it has precisely this rank, then $z_{S\times 1}$ must be collinear with $\iota_{S\times 1}$ implying that $z^s = z$, for $s = 1, \ldots, S$
- $\rightarrow$ so if maximal rank then production efficiency! Very loosely speaking (in taking maximal rank for granted), production efficiency is desirable if there are at least as many tradable goods as there are countries ($N > S$).
- When this condition is not met, however, the use of tariffs may nevertheless serve to ensure a Pareto gain from domestic tax reforms even though it entails some production inefficiency

Summary

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- It shows that one should be cautious with the argument that the destination principle of taxation is superior to the origin because it ensures international production efficiency

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