Explaining the Yeh Paradox: A Comment

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The Yeh Paradox

A recent paper by Y-H. Yeh (1986) asked the following question: suppose a country, which we shall label the home country, is initially using the maximum revenue tariff to raise revenue. If her trading partner, the foreign country, explicitly transfers that same amount of revenue to her in exchange for the elimination of her tariff is it possible that the foreign country can be made better off as a result of this "structural adjustment grant"? Yeh correctly concludes that foreign welfare may either rise or fall. The possibility that a country may increase its welfare by making a transfer in return for a lower tariff abroad seems counter intuitive. Consequently, it is termed here "the Yeh Paradox." This comment searches for an intuitive explanation of this bizarre result.

The Paradox Resolved

To make Yeh’s problem amenable to calculus, we pose his question slightly differently. Suppose that the home country offers to incrementally lower her tariff in exchange for an incremental adjustment in the transfer from her trading partner, which leaves the home total revenue from tariff plus transfer unchanged. Under what circumstances will foreign welfare rise as a result of the change in the tariff plus transfer?

As in Yeh, a two country world is postulated, all factors are fully employed, both countries consume and produce two commodities, and the home country's imports are financed by her exports plus the explicit transfer from her trading partner. Trade is free except for the home country’s import tariff. Preferences in both countries are defined by a well behaved social welfare function. All income is spent in both countries. The foreign country levies a lump sum tax to finance any transfer, and in the home country, the transfer plus any tariff revenues are disbursed using lump sum subsidies.

To explore the nature of the paradox, consider an alternative but economically equivalent regime. Suppose that the home country eliminates her tariff, and, in exchange, the foreigner imposes exactly the same export tariff that the home country was initially employing as an import tariff and explicitly transfers the tariff revenue that results to the home country. The system will settle in the same equilibrium as before, the only difference being that the foreign country has taken over the administration of the tariff. Finally, given this administrative set up, we ask the same question as posed in the previous paragraph by asking how large should the foreign tariff be if the total transfer to be made to the home economy out of tariff revenues plus lump sum taxes levied on foreign residents is to remain unchanged? In effect, the foreign country is permitted to vary the export tariff and to keep incremental changes in the proceeds above and beyond the amount remitted to the home country. Posed in this way, the optimum

*Economics Department, Duke University, Durham, NC 27706, The author is grateful to Phil Brock, Bill Diller, Jim Henderson, Kent Kimbrogh and Roy Riezman for helpful discussions and to Tom Lee, Y-H. Yeh and the Editor for comments.
strategy for the foreign country is obvious: raise the tariff up to the optimum level, but not beyond, where the optimum level is that which maximizes foreign real income given the fixed level of the total transfer to the home economy. Vaikh, the paradox is resolved!

To elaborate, as Tower (1977) and Yeh (1978) have noted the maximum revenue tariff is never less than the optimum tariff, where a country's optimum tariff is defined as the tariff that maximizes its real income (or equivalently welfare). If the initial tariff lies below the optimum level, a higher transfer will cause the home tariff to shrink further below the optimum level and reduce foreign welfare. When it lies above or below the maximum revenue level and above the optimum level, the case considered by Yeh, an incremental increase in the transfer will shrink the home tariff closer to the optimum level and raise foreign welfare. Thus in the case considered by Yeh, the paradoxical result necessarily holds in an incremental sense. Finally, when the tariff lies above the maximum revenue level, an incremental increase in the transfer will raise the home tariff further above the optimum level and shrink foreign welfare on account of the increases in both the transfer and the tariff.5

Deriving the Impact of an Incremental Transfer on Foreign Real Income

This section illustrates the foregoing points by deriving the formal relationship between the incremental change in the transfer and the incremental change in foreign real income.

Balance of payment dictates

\[ p^* M = M^* + T \]

where \( p^* \) is the relative price of the home import in the foreign economy, \( M \) is the level of home imports defined in physical units, \( M^* \) is foreign imports defined in physical units, and \( T \) is the size of the transfer to the home economy measured in units of the foreign import.

The relative price of the home importable in the home economy, \( p \), is related to the home import tariff, \( t \), and the foreign relative price according to

\[ p = (1 + t) p^* \]

The home demand for imports is given by

\[ M = -\alpha p + \frac{m}{M_p} dR + \delta \]

where \( -\alpha \) denotes a proportional change, \( \epsilon \) is the home elasticity of demand for the import, \( m \) is the (dimensionless) home marginal propensity to spend on the import, \( R \) is home revenues from the tariff cum transfer measured in units of the home exportable, and \( \delta \) is a shift variable which we need in order to assess stability.

The foreign demand for imports is given by

\[ M^* = -\epsilon^* p^* + m^* \frac{[-dT]/M^*}{M^*} \]

where \( \epsilon^* \) is the foreign elasticity of demand for the import, \( m^* \) is the (dimensionless) foreign marginal propensity to spend on the import, and \( T \) is the transfer to the home country, measured in units of the foreign importable.

Following Caves-Jones (1985, Supplement to Chapter 11) the change in foreign real income measured in units of the foreign exportable, \( dy^* \), is given by

\[ dy^* = p^* M^* dT \]

The change in revenue is given by

\[ dR = d(p^* M) + dT \]

and the tariff and transfer are balanced so that revenue remains unchanged:

\[ dR = 0. \]

Rewrite (1) as

\[ p^* M = \frac{[b^*/(p^* M)] M^* + dT / (p^* M)}{\epsilon \Delta \delta + \delta T} \]

and (2) as

\[ \dot{p} = \dot{t} + p^* \]

where \( \dot{t} \) is \( dt / (1 + t) \).

Substitute (3), (4) and (9) into (8) to yield

\[ \dot{p}^* = \frac{[1 - \epsilon s M^*/(p^* M) - \epsilon \Delta \delta + \delta T (1 - m^*)/p^* M]}{\Delta \Delta} \]

Rewrite (3), (6), (7) and (9) as

\[ 0 = \dot{p}^*[1 - \epsilon] + 2\epsilon + dT / (p^* M) + \delta \Delta \]

where \( \Delta = 1 + t - (1 - \epsilon) \).

Combine (10) and (11) to yield

\[ \dot{p}^* L = \dot{\epsilon} + dT / [k - (1 - m^*) / (\Delta + 1)p^* M] \]

where

\[ L = \epsilon + 1 + s M^*/[(1 + 1)p^* M]. \]

From (12) it is clear that the necessary and sufficient condition for an autonomous increase in the demand for the home importable to raise its price, i.e. the necessary and sufficient condition for stability (assuming that the tariff is endogenous) is that \( L > 0 \). In the absence of an initial transfer or tariff this is simply the Marshall-Lerner condition.

Substitute (12) into (5) and set \( \dot{t} = 0 \) to yield

\[ dy^* = -dT / [(p^* M)p^* M - m^* / (1 + t) L]. \]

Decomposing \( s \) along the lines of Caves-Jones (1985, 483) yields

\[ \dot{\epsilon} = \dot{\epsilon} + \frac{s^*}{\dot{s^*} + \dot{\epsilon} + \Delta} \]

where \( s^* = -[dC^*/(dL/p^*)] / [p^* M]^2 \).

The substituting term in foreign demand, \( C^* \) being foreign consumption of its importable, and \( p^* = -[dX^*/(dL/p^*)] / [p^* M]^2 \).

The foreign production response, and both of these terms are defined to be non-negative.

Substituting (13) into (14) and using the definition of a yields our major result:

\[ dy^* = -dT [s^* + \dot{\epsilon}] / [1 + (1 - \epsilon) M^* / [p^* M + (1 + t) L]]. \]

It is easy to show that the expression for the optimum tariff continues to be that reproduced in Caves-Jones (1985, 522), \( 1 / \dot{\epsilon} = 1 \) in this comment's notation, even in the presence of a nonzero transfer. Note that when the tariff is at its optimum level, any change in the transfer leaves foreign real income unchanged.
Finally, combining (11) and (12) while suppressing $\delta$ yields

$$i = -dT[\frac{S}{p^*}\frac{M}{L} (1 + i)]$$

where $S = (e - 1)[1 + i(1 - m^*)] + [p^*M^*/(p^*L)]$, which for stability (holding the tariff and transfer constant) must be positive.

At the maximum revenue tariff, incremental tariff changes have no effect on revenue. Thus when the initial tariff is at the maximum revenue level, a change in the transfer, holding total revenue constant, will induce an infinite change in the tariff relative to the change in the transfer (because tariff revenue changes only due to second order effects). Thus when the tariff is at this level the ratio of the change in foreign real income to the change in the transfer is infinite. Therefore from (16) and (17), the condition for the tariff to be at the maximum revenue level is $1 = 0$.

To recapitulate the conclusions of section 2 in different words and using the results of this section, an increased transfer to the home economy will raise foreign welfare if and only if $[1 + (1 - 1)/L]$ is less than zero. Assuming stability of the system (holding the tariff constant) the numerator is negative if and only if foreign welfare is a decreasing function of the tariff (holding home revenue constant) [i.e. if and only if the tariff exceeds the optimum foreign level]. Similarly, $L$ is positive if and only if tariff revenue is an increasing function of the tariff (i.e. if and only if the tariff is below the maximum revenue level).

NOTES

1. For other analyses of donor-enriching and recipient-depleting transfers see the symposium in the Journal of International Economics (1983, 197-252) and the references cited there.
2. For related analyses which considers tariff welfare when at least one country's goal is revenue maximization see Weymark (1978).
3. More precisely, when we say that the tariff is below the revenue or welfare maximizing level we mean that revenue or welfare is an increasing function of the tariff at that point. When revenue and welfare are single peaked functions of the tariff there is no difference between the two sets of statements.

BIBLIOGRAPHY


Pigovian Taxes and "Full" Property Rights

John A. Bishop*

Two divergent theories of social cost currently exist—the traditional Pigovian analysis and the more recent property-rights approach. In spite of their differences, both would require agents to internalize the effects of their actions. This paper summarizes the current debate and then presents three propositions to suggest that the Pigovian analysis is a special case of the more general property-rights approach. The first shows that the Pigovian approach is consistent with Coase's Theorem in that it allows no a priori assignment of rights or liabilities. The second proposition implies that when property rights are fully defined to include the income derivable from the property, the Pigovian tax involves the assignment of property rights. The third proposition states that other proposed solutions to externalities (such as pollution standards) imply the assignment of property rights, and that the choice of the property right to be assigned depends on relative costs. This paper will conclude with a generalization based on Turvey (1972), that no general prescription is available to handle all external effects other than cost minimization.

THE CURRENT DEBATE

While earlier writers had observed the possibility of divergence between private and net social product, A. C. Pigou (1928) is usually credited with the identification of the concept of social cost. He suggested that a tax (subsidy) on the negative (positive) effects of private economic acts is the proper way to force equilibration of private and social costs, in order to reach a Pareto-optimal allocation. This policy forms the basis for what Coase (1960, p. 39) calls the Pigovian tradition.

It is Pigou's failure to consider transaction costs that leads Coase to suggest that the tax (subsidy) schemes of Pigou "proceed in terms of a comparison between a state of laissez-faire and some kind of ideal [zero transaction cost] world" (1960, p. 43). Coase shows that in the absence of transaction costs, the same allocation of resources results no matter to which of the parties liability is assigned (1960, pp. 42-44). While this is an important conclusion, the primary significance of Coase's paper is that it motivated the discussion of transaction costs and their implications for theories of social cost.

Whereas Coase points out that the existence of transaction costs undermines the simple tax-subsidy schemes, Dahlman (1979) argues that transaction costs cannot possibly generate any Pareto-relevant externalities. He describes two general equilibrium models: one without externalities (Model I) and another into which externalities are introduced (Model II). The Pigovian conclusion that private markets will not internalize all the effects of production

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