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FOUR ALTERNATIVE POLICIES TO RESTORE BALANCE OF PAYMENTS EQUILIBRIUM—A COMMENT AND AN EXTENSION

By J. Tinbergen and H. M. A. van der Werff

The article published by one of the authors[1] on alternative policies to restore balance of payments equilibrium needs some correction and may be somewhat generalized.

1. A first correction has to be made with respect to the conditions,[2] which, in the case of discriminatory (positive) duties, $\bar{D}^1$, $\bar{D}^2$, and $\bar{D}^3$ have to satisfy in order that positive duties are found.

It was stated that $(\lambda_1 - \lambda_2)$, $(\lambda_1 - \lambda_3)$, and $(\lambda_2 - \lambda_3)$ had to be positive, from which was deduced the condition: $\bar{D}^3 > -5\bar{D}^2$. It will, however, be clear that only the signs of the t^{ij}'s matter. If we express these t's in $\bar{D}^1$, $\bar{D}^2$, and $\bar{D}^3$ with the help of (5.3), (5.4), (5.7), and (5.8), we find: $t^{13} = (\bar{D}^2 + 5\bar{D}^3)/12$; $t^{23} = (-\bar{D}^2 + \bar{D}^3)/3$; $t^{12} = -\bar{D}^1/4$.

It will be evident that t^{12} and t^{23} are always positive since $\bar{D}^2 < \bar{D}^3$ and $\bar{D}^1 < 0$, whereas t^{13} is only positive if $\bar{D}^3 > -\bar{D}^2/5$, a condition less stringent than the one mentioned in the article.

2. On the same page we find a computation of t^{ji} for the case where, for every country i, $t^{mi} = 0$ $(i \neq m)$. Since in the set of equations,

$$\begin{aligned}
s^{1n} - as^{2n} \cdots - as^{n-1,n} - as^{n+1,n} \cdots - as^{m-1,n} &= a(-\lambda_m + \lambda_n),\\
-as^{1n} + s^{2n} \cdots - as^{n-1,n} - as^{n+1,n} \cdots - as^{m-1,n} &= a(-\lambda_m + \lambda_n),\\
-as^{1n} - as^{2n} \cdots - as^{n-1,n} - as^{n+1,n} \cdots + s^{m-1,n} &= a(-\lambda_m + \lambda_n),
\end{aligned}$$

where $s^{jn} = t^{jn} - \lambda_j + \lambda_n$ and $a = 1/(m-1)$, no terms with s^{nn} occur, we have $s^{jn} = a(-\lambda_m + \lambda_n)/[1 - (m-3)a]$. Hence $t^{ji} = \lambda_j - (\lambda_i/2) - (\lambda_m/2)$ (and not $t^{ji} = \lambda_j - \lambda_m$, as was stated in the article).

3. Similarly, we find in the case of both $t^{m-1,i}$ and $t^{m,i}$ equal to zero $(i \neq m-1, m)$:

$$t^{ji} = \lambda_j - \frac{\lambda_i}{3} - \frac{\lambda_{m-1}}{3} - \frac{\lambda_m}{3}$$

$$\left(\text{and not } t^{ji} = \lambda_j - \frac{\lambda_{m-1}}{2} - \frac{\lambda_m}{2}\right).$$

4. A generalization may be given with respect to the *welfare function* used. This was supposed to be the unweighted sum of the welfare func-

[1] J. Tinbergen, "Four Alternative Policies to Restore Balance of Payments Equilibrium," Econometrica, Vol. 20, July, 1952, pp. 372–390.

[2] Loc. cit., p. 384.

tions W^i of the individual countries. We may introduce instead a somewhat more general formula by taking a weighted sum: $W = \sum^i \omega_i W^i$.

By means of an analysis similar to the one used in the article we find, in the case of *discriminatory import duties and subsidies* (Section 4), the following set of equations for the macro-model:

$$\begin{aligned}(4.16') \quad & \{\omega_j t^{ij} - (\lambda_i + \omega_i) + (\lambda_j + \omega_j)\} + \frac{1}{m-1} \sum_{h \neq i,j} \{\omega_j t^{hj} - \\ & (\lambda_h + \omega_h) + (\lambda_j + \omega_j)\} = 0 \qquad (i, j = 1, \cdots, m;\ i \neq j),\end{aligned}$$

from which we deduce

$$(4.17') \qquad t^{ij} = \frac{(\lambda_i + \omega_i) - (\lambda_j + \omega_j)}{\omega_j}.$$

As in the article, we can divide the equations into m groups (each of $m - 1$ equations), in each of which only the duties levied by one country appear.

Equations (4.20) (the side conditions) remain unchanged. There appears to be *no loss in international trade*, whereas the change in consumption C^i is likewise equal to the initial balance of payments deficit $\bar{D}^i$.

Considering the micro-model we find:

$$(4.28') \qquad t_k^{ji} = \frac{(\lambda_j + \omega_j) - (\lambda_i + \omega_i)}{\omega_i}.$$

Thus, the value of t_k^{ji} appears to be independent of k, a result similar to the one found in the article.

In the case of *discriminatory* (*positive*) *duties* (Section 5) we can try to find a solution in the same way as in the article, by supposing that $\lambda_i + \omega_i$ fulfills the condition $(\lambda_1 + \omega_1) \geqq (\lambda_2 + \omega_2) \geqq \cdots \geqq (\lambda_m + \omega_m)$ and by putting equal to zero all t^{ij}'s with "falling" indices ($i > j$).

For the nth country we find the following set of $n - 1$ equations:

$$(5.1') \qquad \begin{array}{rl} u^{1n} - au^{2n} - au^{3n} \cdots - au^{n-1,n} &= A_n, \\ -au^{1n} + u^{2n} - au^{3n} \cdots - au^{n-1,n} &= A_n, \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots & \\ -au^{1n} - au^{2n} - au^{3n} \cdots + u^{n-1,n} &= A_n, \end{array}$$

where $u^{in} = \omega^n t^{in} - (\lambda_i + \omega_i) + (\lambda_n + \omega_n)$ and

$$A_n = \frac{1}{m-1} \sum_{h=n+1}^{m} \{-(\lambda_h + \omega_n) + (\lambda_n + \omega_n)\}.$$

From this we deduce

$$(5.2')\quad t^{in} = \frac{(\lambda_i + \omega_i) - (\lambda_n + \omega_n)}{\omega_n} + \frac{(m - n)(\lambda_n + \omega_n) - \sum_{n+1}^{m} (\lambda_h + \omega_h)}{(m - n + 1)\omega_n} \qquad (i < n).$$

It can easily be shown with the help of equations (4.20) and (4.21) that the *loss L in international trade* is equal to $\bar{D}^m$ and that the burden C^i on country i is again equal to $\bar{D}^i$.

If we compute the t's for the special case $m = 3$, we get

$$(5.3')\quad t^{13} = \frac{(\lambda_1 + \omega_1) - (\lambda_3 + \omega_3)}{\omega_3}, \qquad t^{23} = \frac{(\lambda_2 + \omega_2) - (\lambda_3 + \omega_3)}{\omega_3},$$

$$(5.4')\quad t^{12} = \frac{(\lambda_1 + \omega_1) - (\lambda_2 + \omega_2)}{\omega_2} + \frac{(\lambda_2 + \omega_2) - (\lambda_3 + \omega_3)}{2\omega_3}.$$

Substituting these values in the side conditions (5.5), we have

$$(\lambda_1 + \omega_1) - (\lambda_2 + \omega_2) = \omega_3 \frac{(4\omega_2 + \omega_3)\bar{D}^2 + (2\omega_2 - \omega_3)\bar{D}^3}{6(\omega_2 + \omega_3)},$$

$$(\lambda_1 + \omega_1) - (\lambda_3 + \omega_3) = \omega_3 \frac{(2\omega_2 - \omega_3)\bar{D}^2 + (4\omega_2 + \omega_3)\bar{D}^3}{6(\omega_2 + \omega_3)},$$

$$(\lambda_2 + \omega_2) - (\lambda_3 + \omega_3) = \omega_3 \frac{-\bar{D}^2 + \bar{D}^3}{3}.$$

Therefore,

$$t^{12} = \frac{-\omega_3\bar{D}^1}{2(\omega_2 + \omega_3)}, \qquad t^{23} = \frac{-\bar{D}^2 + \bar{D}^3}{3}, \qquad \text{and}$$

$$t^{13} = \frac{(2\omega_2 - \omega_3)\bar{D}^2 + (4\omega_2 + \omega_3)\bar{D}^3}{6(\omega_2 + \omega_3)}.$$

If we consider the signs of the t's, it appears that t^{13} is positive under the condition

$$\bar{D}^3 > -\frac{2\omega_2 - \omega_3}{4\omega_2 + \omega_3}\bar{D}^2,$$

while t^{12} and t^{23} are always positive ($\bar{D}^1 < 0$ and $\bar{D}^2 < \bar{D}^3$).

The loss in international trade is here also equal to $\bar{D}^3$, whereas $C^i = \bar{D}^i$.

In the cases of *nondiscriminatory import duties* and *devaluation* (Sections 6 and 7, respectively) the results of the article are not changed by the introduction of the ω's, since the $m - 1$ side conditions are sufficient to determine the $m - 1$ variables, there being no room for maximizing W.

As a check on our generalized formulae we may put $\omega = 1$, which in fact leads us back to the old formulae.

Concluding, we may state that the introduction of the ω's does not profoundly change the results of the article: the criteria proposed in Section 3 (the loss in international trade, the burden on the countries, and the stability conditions) retain the same values as before.

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[Footnotes]

[1] **Four Alternative Policies to Restore Balance of Payments Equilibrium**
J. Tinbergen
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[2] **Four Alternative Policies to Restore Balance of Payments Equilibrium**
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