Análisis Económico, Vol. 1, Nº 1, pp. 3-16 (Noviembre 1986)

MEASUREMENT OF WELFARE GAINS AND LOSSES ARISING FROM TAX RESTRICTIONS ON TRADE FOREIGN INVESTMENT* **

ALEJANDRO JADRESIC
Departamento de Ingeniería Industrial
Universidad de Chile

Abstract:

In this paper welfare measures are derived to represent the welfare gains and losses which result from tax restrictions on trade and foreign investment in a small country that produces n commodities and uses m factors. Analytical and graphical measures are first derived under the assumption that the stock of foreign owned factor is given. Similar measures are then obtained assuming that foreign investment is endogeneously determined. Finally, measures are derived to evaluate the benefits associated to tariffs and investment taxes when used as second best policy instruments.

1. Introduction

Consumer and producer surplus measures have been used to represent the welfare losses that result from trade tariffs and subsidies in the n-commodity case (see Helpman (1978)). Similar measures are derived in this paper to evaluate the effects that tax restrictions and subsidies on trade and foreign investment have on the national welfare of a price taking country when foreign owned factors are used in domestic production. In Section 2 the analysis is performed within a "short run" framework in which the stock of foreign investment in the host country is taken as given. In Section 3 the analysis is restated within a "long run" framework in which foreign-owned factors are perfectly mobile across countries. In Section 4 welfare measures are derived to analyze

* Este artículo fue el ganador del Premio Análisis Económico, instituido con motivo del primer número de esta revista. / This article was awarded the Análisis Económico Special Prize organized for the first issue of this journal.

** This paper is based on Chapter 2 of my doctoral dissertation, submitted to Harvard University. I thank the members of my thesis committee, Richard Caves and Elhanan Helpman, and an anonymous referee for helpful comments. Financial support was provided by the Fondo Nacional de Desarrollo Científico y Tecnológico.

the benefits that result from tariffs and investment taxes when used as second best policy instruments.

2. The short run case

It is well known that when a given amount of factors used in domestic production is owned by foreigners, tariffs may improve national welfare of a small country over the welfare level it achieves with free trade (see, for example, Brecher and Bhagwati (1981) and Svensson (1981)): income redistribution toward national factors, resulting from the utilization of tariffs as an indirect foreign income taxation mechanism, may outweight the immiserizing effects of trade distortions. Welfare measures which formalize this idea are here derived.

Assume that all goods are tradeables and let $R(P^* + S, V + F)$, the GDP function (see Helpman and Razin (1983)), denote the maximum level of revenues –production evaluated at national prices, $(P^* + S)$– domestic producers can achieve given the international prices, P^* ($P^* \in R_+^n$), the tariffs, S ($S \in R^n$ and $P^* + S \in R_+^n$), the domestic owned factors, V, and the foreign owned factors, F. V and F are nonnegative m-dimensional vectors. It is assumed that a tariff is not levied on good 1 (*i.e.*, $S_1 = 0$) which is chosen to be the numeraire both in the host country and abroad.

Let $P = P^* + S$ be the vector of domestic prices. $R(.)$ satisfies:

$$R(P, V + F) = P . X(P) \tag{1}$$

where $X(P)$, the ouput vector, is the solution to the problem:

$$\mathrm{Max}_X \, [P . X \,/\, (X, -(V + F)) \in A \subset R^{n+m}]$$

A is a convex set of feasible input/output production vectors. $X(P)$ may but need not be unique. If it is not unique, it may be chosen arbitrarily from the GDP-maximing set.

The demand side of the economy is represented by a unique consumer with a strictly quasi-concave utility function, $u(C)$. Let $E(P, U)$ denote the minimum level of expenses required by the consumer to achieve the utility level U given the prices P. It satisfies:

$$E(P, U) = P . C(P, U) \tag{2}$$

where $C(P, U)$, the consumption vector, is the unique solution to the problem:

$$\mathrm{Min}_C \, [P . C \,/\, u(C) \geqslant U; C \in R_+^n]$$

Let W denote factor rewards in the host country ($W \in R_+^n$). Differentiability provided, W equals the gradient of $R(.)$ with respect to V ($W = R_V(.)$). Foreign factors earn these rewards minus the specific taxes, T, charged on foreign income ($T \in R^m$ and $W\text{-}T \in R_+^m$). For simplicity it is assumed that foreign investors repatriate all their earnings using the numeraire good as mean of exchange[1].

The government transfers to the domestic consumer both tariff and foreign income taxation revenues. Hence, the utility level of the consumer can be obtained from the condition:

$$E(P, U) = R(P, V + F) - (W\text{-}T) . F + S . (C(P, U) - X(P)) \tag{3}$$

In the particular case when there is free trade and foreign investors are not taxed, this relation becomes:

$$E(P^*, U^*) = R(P^*, V + F) - W^* . F \tag{4}$$

where U^* and W^* respectively denote the utility level and factor rewards that prevail in such case.

Let $Q(S, T)$ be the income that would have to be taken away in the free trade and investment situation to leave the domestic consumer at the utility level achieved if trade tariffs were S and investment taxes were T. $Q(S, T)$ satisfies:

$$Q(S, T) = E(P^*, U^*) - E(P^*, U) \tag{5}$$

$Q(S, T)$ is positive if $U^* > U$ and negative otherwise[2].

Replacing (4) in (5) and using (3) we get:

$$Q(S, T) = [E(P, U) - E(P^*, U)] - [R(P, V + F) - R(P^*, V + F) - S . [C(P, U) - X(P)] + (W - W^*) . F - T . F \tag{6}$$

Using conditions (1) and (2) we can finally obtain:

$$Q(S, T) = P^* . [C(P, U) - C(P^*, U)] + P^* . [X(P^*) - X(P)] + (W - W^*) . F - T . F \tag{7}$$

The first term in (7) represents the consumption loss associated to the tariffs S, evaluated at international prices. It is nonnegative due to the definition of $E(.)$. The second term represents the production loss evaluated at international prices; it is also nonnegative due to the definition of $R(.)$. The third term represents the pre-tax additional cost of using foreign owned factors in the restricted trade and investment case; this term need not be positive. The fourth term represents the income transferred to foreigners when taxes T are charged. If subsidies are ruled out, then $-T.F$ is negative.

If F were equal to zero we would be in the case analyzed by Helpman (1978). Welfare losses from trade restrictions would always be nonnegative and could be measured in two alternative ways. According to (7) they could be obtained as the sum of consumption and production losses valued at international prices. According to (6) they could be measured graphically in terms of areas under compensated demand curves and supply curves. In fact, assume that for the range of prices considered here $E(.)$ and $R(.)$ are twice differentiable, so that $E_p = C$, $R_p = X$ (and therefore, X is unique), and the Hessians of $E(.)$ and $R(.)$ are well defined and symmetric; with sectorial production functions which are homogeneous of degree one, this asumption makes sence if the number of produced goods is less or equal than the numbers of factors fully employed (*i.e.*, if $n \leqslant m$; see Dixit and Norman (1980), ch. 2). It follows that the first two terms in (6) can be calculated by means of line integrals which are invariant to the path of integration, with integration limits equal to P and P^*, or equivalently, as the sum of areas under demand and supply curves, provided that such curves are defined along the path of integration. The third term in (6), which equals tariff revenues, can also be calculated in terms of graphical areas[3].

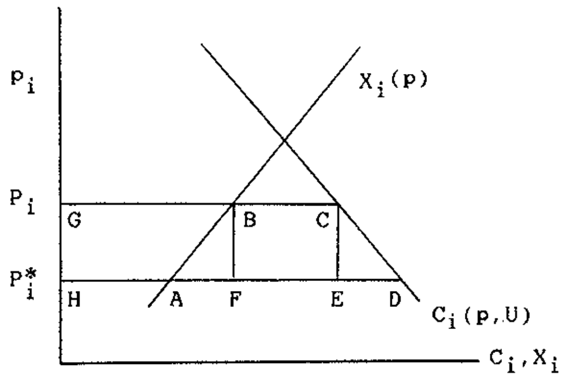

Figure 1

To clarify this further, consider Figure 1 which is a reproduction of Helpman's Figure 1. Demand and supply curves for good i have been drawn along a path of integration. The first term in (6) equals the sum (over all i) of areas such as GCDH, the second term equals the sum (over all i) of areas such as GBAH with a negative sign; hence, the sum of the first two terms in (6) equals the sum (over all i) of areas such as ABCD. If the integration path is appropriately chosen, so that for all goods demand and supply functions at the final graphical integration limit are valued at the restricted-trade prices, P, the tariff revenues can be calculated as the sum (over all i) of areas such as BCEF[4]. In such case, total welfare losses resulting from trade tariffs can be calculated by substracting the sum of areas such as BCEF from the sum of areas such as ABCD or, equivalently, by adding (over all i) triangles such as ABF + CDE.

When F = 0, welfare loss meausres need to be corrected to take into account the existence of foreign owned factors. As reflected in the last two terms in (6) and (7), there can be gains –tax revenues– resulting from direct taxation on foreign income and gains or losses resulting from tariff-induced changes in the rental carnings of foreign investors. Grafically these gains or losses can be represented by the sum (over all j) of areas such as KLMN and IJKL in Figure 2, where supply and demand curves for factor j have been drawn both for the free trade and restricted trade cases. It has been assumed in Figure 2 that the demand function for factor j is well defined and that tariffs S bring about a reduction in the rental wage of factor j. If factor demand functions are not defined because domestic factor rewards are left unchanged with factor inflows, as may occur if n = m and constant returns to scale prevails (for example, in the Heckscher-Ohlin model), the analysis for Figure 2 remains valid, except that factor demand functions have to be drawn as horizontal lines. If the return of factor j increased with the tariffs, a welfare loss would obtain and area IJKL would have to be added with a negative sign.

Overall, then, total welfare losses resulting from tax restrictions on trade and foreign investment can be calculated as the sum (over all i) of triangles such as ABC and CDE in Figure 1, minus the sum (over all j) of areas such as IJNM in Figure 2.

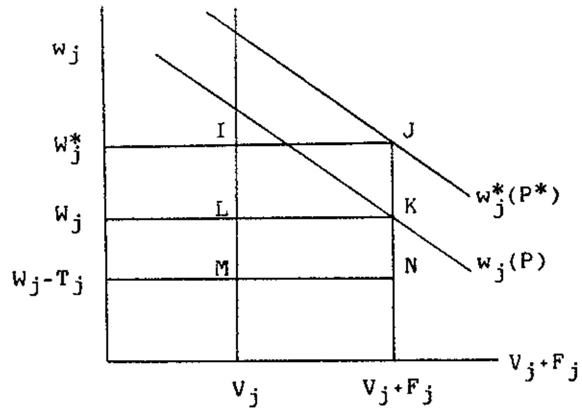

Figure 2

When F = 0 (and F fixed) total welfare losses need not be positive. Of course, if taxes could be levied at no cost the host country could always improve its welfare level by remaining at free trade and increasing taxes on foreign income. The benefits of such policy would be reflected in Q (0, T) being negative and its absolute value equal to revenues obtained from foreign income taxation. If feasible, free trade and 100% taxation (or more, if possible) would be optimal.

But this latter policy prescription does not sound very realistic. For instance, factor outflows, retaliation by foreigners, or tax treaties –all of which have been assumed away– could make such policy undesirable, even for a very short run looking country. Given the assumptions of the model, indirect tariff-induced taxation may sound more realistic. Suppose then that T = 0. According to (7) tariffs could be beneficial, but only if the reduction induced in foreign income were larger than the sum of the welfare losses created in consumption and production, measured at international prices, or equivalently, according to (6), if the sum of areas such as IJKL were larger than the sum of triangles such as ABF + CDE[5].

3. The long run case

The analysis in the preceding section relies decisively upon the assumption that the stock of foreign owned factors is fixed and, therefore, independent of domestic policy. This assumption explains why taxes or tariffs could be used in the model to extract income from foreign investors and improve national welfare. If instead foreign investors had been allowed to withdraw their factors instantaneously in respponse to policy attempting to reduce their planned earnings, taxes or tariffs could not have been relied upon in order to improve national welfare. In fact, with perfect mobility of foreign investment it is optimal for a price taking country not to charge tariffs or investment taxes (*eg.*, Kemp (1966)). Equivalently, tariff-induced or subsidy-induced inflows or outflows of foreign investment cannot improve national welfare of a small country over its free trade and investment welfare level (*eg.*, Bhagwati (1973)) and Brecher and Findlay (1983)).

In order to derive a measure of welfare losses resulting from tax restrictions on trade and foreign investment in the perfect factor mobility case, it is here assumed that there is an infinitely elastic supply of foreign factors at the rental price $\bar{W}$ ($\bar{W} \in R_+^n$). For simplicity, investment abroad of factors owned by the host country is not allowed; hence, $F \geqslant 0$. For factors j such that $W_j < \bar{W}_j + T_j$, the level of foreign investment equals zero. A strictly positive level of foreign investment requires $W_j = \bar{W}_j + T_j$. As in the preceding section, it is here assumed that factors owned by the host country are inelastically supplied at an amount V.

Define $\bar{R}$ (P, V, $\bar{W}$ + T) as follows:

$$\bar{R}(P, V, \bar{W}+T) = \mathrm{Max}_{X,\,F}\,[P.X - (\bar{W}+T).F/(X, -(V+F)) \in A] \quad (8)$$
$$\text{s.t. } F \geqslant 0$$

$\bar{R}$ (.), the "GNP function", indicates the maximum revenues net of pretax payments to foreign investors, that the host country can achieve given the prices P and $\bar{W}$ + T. It is assumed that $\bar{R}$ (.) has a finite value. The levels of output, X (P, $\bar{W}$ + T), and foreign investment, F (P, $\bar{W}$ + T), which solve (8) may but need not be unique. If the latter is the case, they may be chosen arbitrarily from the set of solutions to (8)[6]. Differentiability provided, domestic factor rewards can be calculated as $W = \bar{R}_V$. Given standard regularity conditions for the set A, Kuhn-Tucker conditions ensure that $W_j = \bar{W}_j + T_j$ is satisfied when $F_j > 0$ and $F_j = 0$ is satisfied when $W_j < \bar{W}_j + T_j$.

$\bar{R}$ (.) satisfies:

$$\bar{R}(P, V, \bar{W}+T) = P.X(P, \bar{W}+T) - (\bar{W}+T).F(P, \bar{W}+T) \quad (9)$$

The utility level of the national consumer is given by the condition:

$$E(P, U) = \bar{R}(P, V, \bar{W}+T) + T.F(P, \bar{W}+T) + S.[C(P, U) - X(P, \bar{W}+T)] \quad (10)$$

In the particular case in which tax restrictions on trade and factor inflows do not exist, (10) becomes:

$$E(P^*, U^*) = \bar{R}(P, V, \bar{W}+T) \quad (11)$$

Recall the definition of Q (S, T) in (5). Replacing (11) in (5) and using (10) we get, after rearranging:

$$Q(S, T) = [E(P, U) - E(P^*, U)] - [\bar{R}(P, V, \bar{W}+T) - \bar{R}(P^*, V, \bar{W})]$$
$$- T.F(P, \bar{W}+T) - S.[C(P, U) - X(P, \bar{W}+T)] \quad (12)$$

Using conditions (2) and (9) we can finally get:

$$Q(S, T) = P^*.[C(P, U) - C(P^*, U)] +$$
$$[(P^*.X(P^*, \bar{W}) - \bar{W}.F(P^*, \bar{W})) - (P^*.X(P, \bar{W}+T) - \bar{W}.F(P, \bar{W}+T))] \quad (13)$$

The first term in (13) represents the consumption loss resulting from trade and investment restrictions, evaluated at internatinal prices. It is nonnegative due to the definition

of E (.). The second term represents the net production loss which is also nonnegative due to the definition of $\bar{R}$ (.). Since Q (S, T) cannot be negative, it inmmediately follows that optimality for a price taking country requires the elimination of all barriers to trade and foreign investment.

This is not a surprising result. If inputs owned by foreigners are regarded as negative outputs and investment taxes as tariffs on such outputs, it follows directly from the superiority of free trade for a price taking country. With such interpretation, the first two terms in (12) and (13) are respectively equivalent to the first two terms in (6) and (7). The investment tax revenues term in (12) can be interpreted as part of the term measuring tariff revenues in (6). The two terms representing "extraction" of foreign income do not appear in (12) and (13) because, just as domestic producers are not required to supply a fixed amount of goods regardless of prices, in this "long run" framework foreign investors are not required to supply a fixed amount of factors regardless of factor rewards.

Hence, as in Helpman's analysis, there are two alternative ways of measuring welfare losses resulting from tax restrictions. According to (13) a measure can be obtained by adding consumption and net production losses valued at international prices. According to (12) the welfare losses can be measured in terms of areas under demand and supply curves. In fact, assume that for our range of prices, E (.) and $\bar{R}$ (.) are twice differentiable, so that $E_p = C$, $\bar{R}_{(P\bar{W})} = (X, -F)$ (hence, (X, −F) is unique) and the Hessians of E (.) and $\bar{R}$ (.) are well defined and symmetric; with sectoral production functions which are homogeneous of degree one, this assumption is likely to be satisfied if the number of produced goods is less than or equal to the number of factors for which there is zero level of foreign investment[7]. Then, the firs two terms in (12) can be calculated as line integrals which are invariant to the path of integration or by measuring areas under demand and supply curves, provided they are defined along the integration path. The remaining two terms in (12), investment tax revenues and tariff revenues, can also be measured graphically.

Thus, assume an appropriate integration path has been chosen, with integration limits equal to (P*, W) and (P* + S, W + T), so that for all goods and factors we can carefully draw demand and supply functions which at the final integration limit are valued at the restricted trade and investment prices. Total welfare losses associated to taxes (T, S) can then be calculated as the sum over all goods and factors of conventional triangles, which represent welfare losses in each market. For goods, triangles such ABF + CED in Figure 1 have to be added (over all i) except that "long run" supply and demand curves have to be considered. With regard to factors, consider Figure 3 where the demand curve for foreign factor j has been drawn along the path of integration; the supply curve for foreign factor j has also been drawn: it is an horizontal line at the level $\bar{W}_j + T_j$. The sum (over all j) of areas such as SOPR is what factor markets contribute to the second term in (12). To this we need to substract tax revenues, which are given by the sum (over all j) of areas such as SOQR, since at the final integration limits factor demand functions are valued at prices (P* + S, $\bar{W}$ + T). Hence, the sum (over all j) of triangles such as OPQ measures the welfare losses arising in factor markets. Finally, total welfare losses can be calculated by adding losses from good markets plus losses from factor markets; they cannot be negative.

It is important to bear in mind that the decomposition of total welfare losses among factor and good markets which is implicit in the graphical analysis, depends on the specific path of integration that is chosen; different paths yield different welfare loss allocations among markets. Therefore, in general it is not correct to interpret the triangles measured in a specific graph as the welfare losses arising from the tax imposed in the market represented by the graph. On the other hand, as will be seen in the next section, the choice of specific paths of integration do allow interesting economic interpretation of the resulting welfare loss partitions.

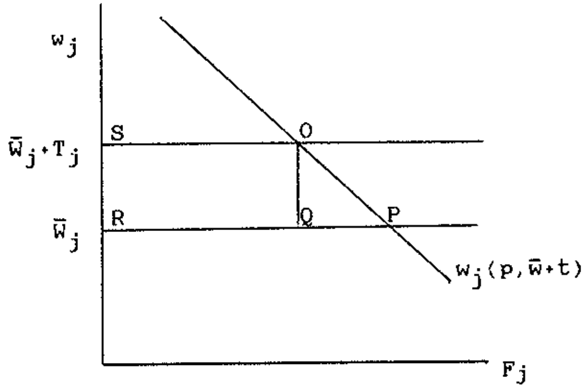

Figure 3

4. Second Best Analysis

The analysis in the preceding section has corroborated the orthodox belief that a that a small country cannont benefit from trade or investment taxes. However, in a second best world in which price constraints have to be taken as given national welfare can in general be improved by relying on tariffs or investment taxes. For instance, if non zero investment taxes cannot be modified, national utility can in general be increased by imposing tariffs or trade subsidies to induce factor movements[8]. Similarly, factor movements induced by investment taxes or subsidies can help it non-zero trade tariffs cannot be modified[9]. Welfare measures are derived in this section to analyze these two particular cases.

To analyze the benefits of using tariffs when investment taxes are given, note that:

$$Q(S,T) = [Q(0,T) - Q(0,0)] + [Q(S,T) - Q(0,T)] \quad (14)$$

where $Q(0,0) = 0$. Total welfare losses due to (S, T) equals the loss due to taxes, T, which is non negative, plus the loss associated to the utilization of tariffs as a second best policy tool. The second term in (14) with a negative sign, provides a welfare measure of the benefits of using tariffs; if $[Q(S,T) - Q(0,T)]$ is negative, then tariffts are partly neutralizing the immiserizing effects of investment taxes.

Using (14), (13) can be rewritten as follows:

$$Q(S,T) = \left\{[P^*.X(P^*,\bar{W}) - \bar{W}.F(P^*,\bar{W})] - [P^*.X(P^*,\bar{W}+T) - \bar{W}.F(P^*,\bar{W}+T)]\right\} + \left\{[P^*.X(P^*,\bar{W}+T) - \bar{W}.F(P^*,\bar{W}+T)] - [P^*.X(P,\bar{W}+T) - \bar{W}.F(P,\bar{W}+T)] + P^*.[C(P,U) - C(P^*,U)]\right\} \quad (15)$$

Investment taxes cause a production loss, given by the nonnegative expression that appears on the first line of equation (15), which can be reduced by levying tariffs if and only if net production valued at international prices increases when both investment taxes and trade tariffs are charged or, equivalently, if the expression of the second line of (15) is negative. Tariffs, however, also create a consumption loss which is represented by the nonnegative expression of the third line of (15); hence, they would be beneficial only if they bring about an increase in net national production which is larger than the consumption loss that they generate.

Assume that E (.) and R (.) are twice differentiable and use (12) to derive the following identities:

$$Q(0,T) - Q(0,0) = -[\bar{R}(P^*,V,\bar{W}+T) - \bar{R}(P^*,V,\bar{W})] - T.F(P^*,V,\bar{W}+T) \quad (16)$$

and,

$$Q(S,T) - Q(0,T) = [E(P,U) - E(P^*,U)] - [\bar{R}(P,V,\bar{W}+T) - \bar{R}(P^*,V,\bar{W}+T)] - T.[F(P,\bar{W}+T) - F(P^*,\bar{W}+T)] - S.[C(P,U) - X(P,\bar{W}+T)] \quad (17)$$

According to (16) initial welfare losses due to taxes T can be calculated as the sum (over all j) of triangles such as OPQ in Figure 3, provided that for all factors integration limits are (P*, W) and (P*, W + T). According to (17) additional welfare losses due to tariffs S can be calculated as the sum (over all i) of triangles such as ABF + CED in Figure 1, except that for all goods "long run" supply and demand curves have to be considered with integration limits equal to $(P^*, \bar{W} + T)$ and $(P, \bar{W} + T)$, minus the difference between post-tariff an pre-tariff investment tax revenues, or equivalently, minus the sum (over all j) of rectangles such as TUVW in Figure 4, where pre-tariff and post-tariff demand curves for factor j have been drawn, assuming that tariffs increase the demand for this factor.

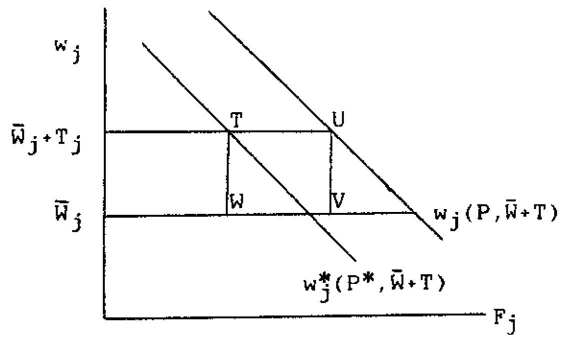

Figure 4

Therefore the host country would benefit from a tariff scheme if and only if it brougt about an increase in investment tax revenues that were larger than the welfare losses it would cause in goods markets, as measured by the sum of the conventional triangles described above. In such case, as explained in footnote 8, tariffs would on the average be inducing inflows (outflows) of factors subjected to positive (negative) investment tax restrictions without causing too much damage in goods markets. Tariffs would be undoing some of the damage caused by the investment taxes which by assumption could not be abolished.

To analyze the case where investment taxes or subsidies are used in the presence of a given tariff scheme, note that:

$$Q(S,T) = [Q(S,0) - Q(0,0)] + [Q(S,T) - Q(S,0)] \quad (18)$$

Total welfare losses due to (S, T) equals losses due to tariffs, S, plus losses from using investment taxes, T, as second best policy instrument. [Q (S, 0) – Q (S, T)] provides a measure of the benefits of using taxes. If Q (S, 0) > Q (S, T) then taxes are partly neutralizing the immiserizing effects of trade tariffs.

From (13) and (18) we get:

$$\begin{aligned} Q(S,T) = & \Big\{ P^*.[C(P,U^o) - C(P^*,U^o)] + \\ & [P^*.X(P^*,\bar{W}) - \bar{W}.F(P^*,\bar{W})] - [P^*.X(P,\bar{W}) - \bar{W}.F(P.\bar{W})] \Big\} \\ & + \Big\{ P^*.[C(P,U) - C(P^*,U)] - P^*.[C(P,U^o) - C(P^*,U^o)] + \\ & [P^*.X(P,\bar{W}) - \bar{W}.F(P,\bar{W})] - [P^*.X(P,\bar{W}+T) - \bar{W}.F(P,\bar{W}+T)] \Big\} \end{aligned} \quad (19)$$

where U^o is the utility level when taxes and tariffs are respectively equal to 0 and S. Tariffs cause both a consumption and a production loss. The production loss is reduced when investment taxes are levied if and only if net production valued at international prices is larger when both tariffs and taxes are charged. Because the utility level depends on T, taxes also affect the value of the consumption loss. It is possible that a certain tax scheme which reduces the production loss also increases the consumption loss. However, it can be shown that with minor assumptions on national preferences, it is the effect on production the one that prevails[10]. Thus, taxes are beneficial (detrimental) if they increase (reduce) net national production valued at international prices.

In order to derive graphical measures, assume that E (.) and $\bar{R}$ (.) are twice differentiable and use (12) to derive the following identities:

$$\begin{aligned} Q(S,0) - Q(0,0) = & [E(P,U^o) - E(P^*,U^o)] - [R(P,\bar{W}) - R(P^*,\bar{W})] \\ & - S.[C(P,U^o) - X(P,\bar{W})] \end{aligned} \quad (20)$$

and,

$$\begin{aligned} Q(S,T) - Q(S,0) = & -[R(P,V,\bar{W}+T) - R(P,V,\bar{W})] - T.F(P,\bar{W}+T) \\ & - \Big\{ S.[C(P,U) - X(P,\bar{W}+T)] - S.[C(P,U^o) - X(P,\bar{W})] \Big\} \\ & + [E(P,U) - E(P^*,U)] - [E(P,U^o) - E(P^*,U^o)] \end{aligned} \quad (21)$$

According to (20) initial welfare losses due to tariffs S can be calculated as the sum (over all j) of triangles such as ABF + CDE in Figure 1, provided that "long run" demand and supply curves are considered, demand functions are valued at the utility level U^o, and integration limits are (P*, $\bar{W}$) and (P, $\bar{W}$). According to (21) additional welfare losses due to taxes T can be obtained as follows. First we need to calculate the sum (over all j) of triangles such as OPQ in Figure 3 choosing prices (P, $\bar{W}$) and (P, $\bar{W}$ + T) as integration limits. Then we have to substract the difference between post-tax and pre-tax tariff revenues or, equivalently, substract the sum (over all i) of areas such as ABJK + CDHI in Figure 5, where supply and demand curves for good i have been drawn along a path of integration both for the pre-tax and post-tax situations. It has been assumed in Figure 5 that taxes bring about an increase in demand for good i and a reduction in the supply for good i. Finally we have to add a "price–correction" term which is given by the third line in (21) and can be calculated as the sum (over all i) of areas such as CDFG in Figure 5. Overall, then, additional welfare losses due to taxes T can be obtained as the sum (over all i) of triangles such as OPQ in Figure 3 minus the sum (over all i) of areas such as ABJK + CEHI-DFGE in Figure 5.

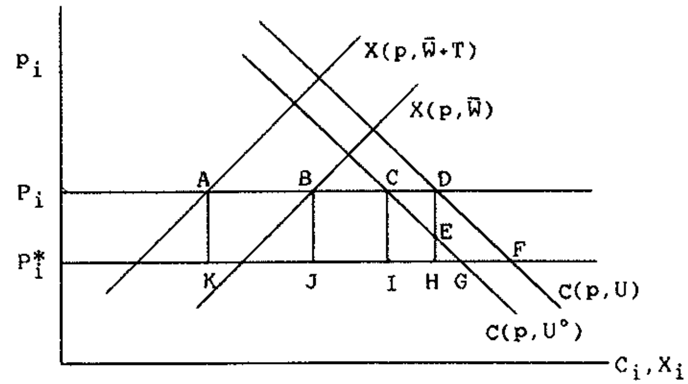

Figure 5

The need to add the "price-correction" term arises from the fact that welfare comparisons are being done at international prices rather than domestic prices. In fact, if instead of using the welfare index Q (S, T)-Q (S, 0) (which equals E (P*, U^o)-E (P*, U) in order to compare utility levels U^o and U, we had chosen the index E (P, U^o)-E (P, U), the third line in (21) would not appear and additional welfare losses from taxes T would be measured entirely by the first two lines in (21)[11]. Since these two alternative welfare indices preserve the same ranking of utility levels, it follows that the sign of Q (S, T)-Q (S, 0) is the same as the sign of the sum of the first and second lines in (21). The "price-correction" term just translates an index based on domestic prices into an index based on international prices.

Therefore, the host country would benefit from an investment tax scheme T if and only if it brought about an increase in tariff revenues that were larger than the welfare losses it would create in factor markets as measured by the sum of conventional triangles described before. In such case, as indicated in footnote 9, the tax scheme T would be inducing factor movements that would work to reduce the distortions that tariffs create in production, namely, to reduce production of protected goods and to shift resources and production into unprotected sectors. Indirectly, investment taxes would also be affecting the distortions that tariffs create in consumption; this should also show up on tariff revenues. Yet, if minor conditions are satisfied by domestic preferences, the effects on production are the ones that matter.

5. Conclusion

Analytical and graphical measures have been derived in this paper to represent the welfare gains and losses that result fromt tax restrictions on trade and foreign investment both for the case where the stock of foreign owned factors is given and the case where foreign investment is determined endogenously within the model.

With a given stock of foreign investment, it has been shown that welfare losses due to tariffs –which can either be measured as the sum of production losses and consumption losses or as the sum of conventional triangles under demand and supply curves of goods– have to be corrected to take into account changes in the earnings of foreigners induced by direct income taxation and by trade tariffs. If income of foreigners decreases with tariffs, the host country could eventually benefit not only from direct taxation but also from trade tariffs.

With perfect mobility of foreign owned factors, it has been shown that free trade and zero taxes on foreign investors are optimal for a small price taking country. Welfare losses due to tax restrictions on trade and/or foreign investment can be calculated as the sum of production and consumption losses or as the sum of conventional triangles measured under demand and supply curves of goods and factors.

With perfect mobility of foreign owned factors and exogen constraints on the values of trade tariffs (taxes on foreign investment), it has been shown that the host country can benefit from non-zero levels of investment taxes (tariffs). Investment taxes (tariffs) can then be used as policy instruments to partially offset the welfare losses associated to existing tariffs (investment taxes). The resulting welfare variations can be measured by indices based on consumption and production losses and on areas under supply and demand curves. Conditions required for tariff or tax schemes to improve or deteriorate national welfare have also been derived. Thus, with given taxes on foreign investment the host country would benefit from a certain tariff scheme if and only if it brought about an increment in revenues from foreign investment taxation that were larger than the welfare losses caused in goods markets, as measured by the sum of conventional triangles. Similary, with given trade tariffs the host country would benefit from a certain foreign investment taxation scheme if and only if it brought about and increase in tariff revenues that were greater than the welfare losses it would create in factor markets, as measured by the sum of conventional triangles.

The anslysis carried out in this paper has relied, among others, upon the asumption that there is a unique national consumer (or that there exists a community indifference curve), It can be shown, however, as Helpman (1978) did for the case without foreign investment, that the welfare measures derived above remain meaningful if the expenditure functions and compensated demand functions are respectively replaced by the sum of individual expenditure and individual compensated demand functions. This, provided that one is willing to weight equally dollars received by different consumers.

NOTES

1 For a discussión of the implications of using alternative assumptions regarding the way foreign investors repatriate or consume their earnings see Chapter 2 of my thesis.

2 Alternatively we could define an index Q' (S, T) as the income that would have to be provided in the tariff-tax case to allow the consumer achieve the free trade-zero taxation utility level. Q' (S, T) would satisfy the condition: Q' (S, T) = E (P, U*)-E (P, U); rather than being based on international prices, P*, Q' (.) would be based on domestic prices, P. Results would differ slightly from those derived below. Helpman (1978) uses both indices and calls them E_2 and and E_1. We choose just E_2 for lack of space and because it yields somewhat reatier results.

3 If R (.) is not differentiable, for instance because n > m causes X (.) not to be unique for a given set of prices, the unrestricted and tax-restricted equilibria may be non-unique. Moreover, as can be seen in (3), U could also be not unique for given values of S and T. It follows that even though (6) and (7) remain valid (except that Q (S, T) depends on the output maximizing level X (P) chosen) Q (S, T) and the tax-restricted welfare level of the host country may be non-unique. Hence, we could be unable to calculate Q (S, T) by means of line integrals which are invariant to the path of integration.

4 An appropriate integration path, Z, can be defined as follows. Let Z = Z (Θ), where $0 \leqslant \Theta \leqslant 1$, Z (0) = P*, and Z (1) = P. Provided that X (Z (Θ)) and C (Z (Θ), U) are well defined for all Θ, areas should be calculated by integrating parametrically between Θ = 0 and Θ = 1. Note that if this integration path is chosen, then supply and demand curves are not the standard supply and compensated demand functions.

5 That tariffs can generally improve national welfare can be shown easily by assuming differentiability so that $C = E_P$, $X = R_P$, and $W = R_V$, and differentiating (3) to get: $E_U dU = -F.R_{VP}dS + S.dM = -F.dW + S.dM$, where M = C (P, U) – X (P). When S = 0, this relation states that the host country would benefit from an infinitesimal tariff scheme that reduced the income of foreign investors. We thus have to choose tariffs dS that satisfy the condition: $-F.R_{VP}dS \geqslant 0$. Welfare gains would be warranted because production and consumption losses from tariffs do not exist at S = 0. First order conditions for (second best) optimal policy can be obtained by making dU = 0. For specific examples see my dissertation. See also Brecher and Bhagwati (1981).

6 For finiteness of $\bar{R}$ (.) we could impose standard "Inada conditions" in domestic production functions and require all goods to use at least one inmobile factor as input. Regarding uniqueness of X (.) and F (.) see footnote 7.

7 Let each good a production function with constant returns to scale and assume that all n goods are produced and all m factors are fully employed. We can then write the system of equations:

(a) A (W) . W = P
(b) A' (W) . X = V + F

where $W \leqslant \bar{W}$ and A (W) is a matrix with input/output requirements in domestic production. Let m' be the number of "mobile factors", for which the condition Wj = Wj is binding, which we assume we know a priori. The unknowns of the system are n output levels, m' levels of foreign investment of mobile factors, and n - m' wages of inmobile domestic factors. A first countdown tells us that the number of unknowns exactly matches the number of equations: n + m' + (m-m') = n + m. Assume n > m - m'. In general equations (a) would allow us to determine the values of the wage levels of inmobile (and mobile) factors as a function of P and $\bar{W}$. Replacing W = W (P, $\bar{W}$) in (b) only output levels and foreign investment would remain unknown. But since the number of unknowns would be greater than the number of equations (n + m' > m) we would not be able to solve for X and F. X and F would remain undeterminate. The reader can check that if $n \leqslant m - m'$ is satisfied, there should not be any problem with the uniqueness of X and F and with the differentiability of $\bar{R}$ (.). The reader can also check that if n < m - m', wage levels of immobile factors would in general depend not only on P and $\bar{W}$, but also on V.

8 Assume differentiability holds so that $\bar{R}_P = X$, $\bar{R}_{\bar{W}} = -F$, and $E_P = C$, and differentiate (10) with respect to S to get: $E_U dU = -T.\bar{R}_{\bar{W}P}dS + S.dM$, where M = C (P, U) – X (P, $\bar{W}$). If T = 0 this equation becomes: $E_U dU = -T.\bar{R}_{\bar{W}P}dS = -T.dF$. Thus the hos country would benefit from an infinitesimal tariff scheme that worked to offset the negative effects of investment taxes; namely, that on the average caused inflows (outflows) of factors subjected to positive (negative) investment taxes. For examples see Yabuuchi (1982) and my dissertation.

9 Differentiating (10) with respect to T we get: $E_U dU = -T.\bar{R}_{\bar{W}\bar{W}}dT + S.dM$. If T = 0 this equation states that the host country would benefit from an infinitesimal taxation scheme which increased tariff revenues. Equivalently, if T = 0 we can write: $(1 - S.C_Y) E_U dU = P^*.C_Y E_U dU = -S.dX$ where C_Y is the vector of income derivatives of the market demand functions. Insofar $P^*.C_Y$ is positive, which is a very reasonable condition, the host country would benefit from an infinitesimal taxation scheme which on the average brought about an increase in the production of unprotected goods and a reduction on the production of protected goods. For examples see Brecher and Findlay (1983) and my thesis.

10 Note that the value of the production loss decreases with T as net production evaluated at international prices, $Z = P^*.X (P, \bar{W} + T) - \bar{W}.F (P, \bar{W} + T)$, gest larger. Z can be written as $Z = \bar{R} (P, \bar{W} + T) - S.X (P, \bar{W} + T) + T.F (P, \bar{W} + T)$. But then, according to (10), $Z = E (P, U) - S.E_p (P, U)$. Therefore, $dZ = (1 - S.C_Y) E_U dU = P^*.C_Y E_U dU$ Insofar $P^*.C_Y$ is positive, Z and U move in the same direction. This in turn implies that Z and Q (S, T) are negatively related. An interesting implication of this result is that in order to calculate the (second best) optimal taxes T for a given value of S (for which we have to make dZ = 0), we need to take into account only technological conditions. For an example see Brecher and Findlay (1983).

11 Using (10) to calculate $E (P, U^o) - E (P, U)$ we get the first two lines in (21). However if domestic prices were chosen to make welfare comparisons, the initial losses due to tariffs S would not be given by (20) and could not be calculated as the sum of triangles such as ABF + CDE in Figure 1 (see Helpman (1978)).

REFERENCES

BHAGWATI, J., 1973, "The theory of Immiserizing Growth: further apllications", in M. Conolly and A. Swoboda (eds.), "International trade and money" (Toronto: University of Toronto Press) 45-54.

BRECHER, R. and J. BHAGWATI, 1981, "Foreign ownership and the theory of trade and welfare", Journal of Political Economy 89, 497-511.

BRECHER, R. and R. FINDLAY, 1983, "Tariffs, foreign capital, and national welfare", Journal of International Economics 14, 277-288.

DIXIT, A. and V. NORMAN, 1980, "Theory of international trade" (Cambridge: Cambridge University Press).

HELPMAN, E., 1978, "The exact measurement of welfare losses which result from trade taxes", International Economic Review 19, 157-163.

HELPMAN, E. and A. RAZIN, 1983, "Increasing returns, monopolistic competition, and factor movements: A welfare analysis", Journal of International Economics 14, 263-276.

JADRESIC, A., 1984, "Foreign investment and national welfare in a small country", Ph.D. dissertation, Harvard University.

KEMP, M., 1966, "The gain from international trade and investment: a neo Heckscher-Ohlin approach", American Economic Review 56, 788-809.

SVENSSON, L., 1981, "National welfare in the presence of foreign owned factors of production. A note on the dual approach", Institute of international Economic Studies. Seminar Paper Nº 150.

YABUUCHI, S., 1982, "A note on tariff-induced capital inflow and immiserization in the presence of taxation of foreign profits", Journal of International Economics 12, 183-189.

Análisis Económico, Vol. 1, Nº 1, pp. 17-32 (Noviembre 1986)

PREANUNCIO DEL TIPO DE CAMBIO Y DESEMPLEO KEYNESIANO*

MARTIN RAMA **
Centro de Investigaciones Económicas (CINVE-Uruguay)

Abstract:

In 1978, Argentina, Chile and Uruguay adopted a stabilization policy based on exchange rate preannouncement. The aim of this paper is to study the consequences of such a policy from a analytical point of view. The paper stands on a two-sector disequilibrium model, in which there is a price level inertia in the labor market as well as in the non-traded goods market. The main stylized facts are reproduced. It is shown, particularly, that the exchange rate préannouncement had to give rise to an economic boom first, and a keynesian unemployment situation later.

En el correr de 1978 Argentina, Chile y Uruguay adoptan una política de estabilización basada en el preanuncio del tipo de cambio, con el objeto de combatir una inflación tradicionalmente elevada. Dicha política, conocida como *active crawling-peg*, se basa en la fijación del tipo de cambio que va a regir *cada día* durante los meses siguientes, con el compromiso, por parte de la autoridad monetaria, de vender (o comprar) la cantidad de divisas necesarias para satisfacer la demanda (u oferta) privada. El *active crawling-peg* es, entonces, un tipo de cambio "fijo" que se desliza de modo regular a lo largo de una trayectoria conocida de antemano.

A partir de entonces, en los tres países la tasa de devaluación anunciada es sensiblemente inferior a la tasa de promedio del período previo (llega a ser nula en el caso chileno). Y en los tres países las principales variables macroeconómicas evolucionan del mismo modo, lo que permite identificar un conjunto de "hechos estilizados" relacionados

* La primera versión de este trabajo fue escrita en el Laboratoire de Conjoncture et Analyse des Déséquilibres de la Universidad de París I (M. Rama, 1985, Cap. 9). Agradezco los comentarios y sugerencias de Alfredo F. Calcagno, Pierre-Yves Hénin, Phillipe Michel, Nelson Noya, André Zylberberg y un árbitro anónimo. Ninguno de ellos es responsable de los errores que pudieran subsistir.

** Las opiniones vertidas en este artículo sólo comprometen a su autor.