

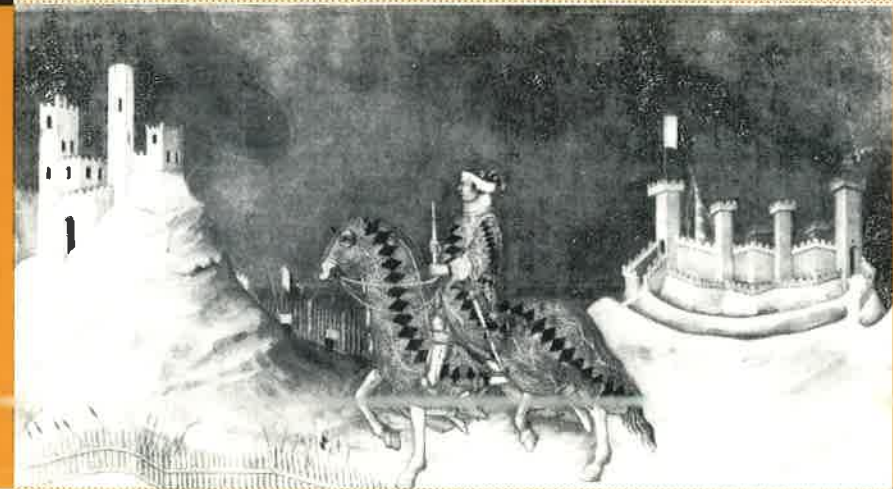
UNIVERSITA' DEGLI STUDI DI SIENA



QUADERNI DEL DIPARTIMENTO
DI ECONOMIA POLITICA

Massimo Di Matteo

**FORMS OF TRADE CONTROL IN
AN EQUILIBRIUM NORTH-SOUTH MODEL:
A COMPARATIVE EVALUATION**



**QUADERNI DEL DIPARTIMENTO
DI ECONOMIA POLITICA**

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SOUTH MODEL: A COMPARATIVE EVALUATION**



Siena, Febbraio 1992

FORMS OF TRADE CONTROL IN AN EQUILIBRIUM NORTH-SOUTH
MODEL: A COMPARATIVE EVALUATION.*

Some years ago G. Chichilnisky (1981,1984) presented a general equilibrium model of North-South trade where she criticized the adoption of export led policies by the South. It was shown that, under suitable conditions, a higher level of exports of the labour intensive (basic) good could result in a fall in the terms of trade and in a lower level of consumption in the South.

The model used was a rather standard 2x2x2 model with fixed coefficients and variable factor supplies. Sufficient conditions to obtain the result were two, both concerning the South: labour is "abundant" with a meaning similar to that used by Arthur Lewis (1954); technology is "dual", namely the labour-capital ratio is much higher in the basic than in the industrial sector.

These assumptions seem to represent a fairly good description of the conditions prevailing in a large part of the underdeveloped countries, so that the results need

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to be taken seriously by policy makers. They refer to structural features of the economy so that a long period of time is needed before these conditions can be altered.

In the meantime is useful to look at the choices open to policy makers in the South with the minimum end of mitigating the effects of this unfavourable state of affairs or the more ambitious task of altering it completely.

It is interesting to note that in the model proposed by Chichilnisky a movement in the South's terms of trade can be due to changes in the pattern of economic behaviour in the North. As an example an increase in the North's demand for industrial goods leads to a fall in the terms of trade of the South.

The question therefore arises whether the South has any policy measure in order to reduce or to annul the loss in welfare. And granted that there are many options is there a most preferred action?

The aim of the paper is to review some of the measures that could be employed by the policy makers and to compare their effectiveness in achieving the goal. I will briefly present the model that I will use throughout the paper (section 1). I will then modify it to the effect of incorporating various kinds of policy measures, present the results that follow and whenever feasible evaluate their effects on the economy of the South (sections 2 and 3). Some of the results will not be standard and will be briefly commented on together with remarks on the limitations of the analysis (section 4).

1. As I said we will employ a $2 \times 2 \times 2$ model: two commodities (basic and industrial goods are produced and traded), two resources (labour and capital are employed to produce the commodities), and two (group of) countries

are involved in trade (the North and the South). The structure of the model is simple and can be illustrated with reference to one country only. Features specific to each country are discussed below at appropriate places. Constant returns to scale are assumed to prevail in each sector, with a fixed coefficients technology. There are no intermediate goods. In equilibrium prices equal costs:

$$[1.1] \quad p_B = a_1 w + c_1 r p_I$$

$$[1.2] \quad p_I = a_2 w + c_2 r p_I$$

where

p_B (p_I) is the price of basic (industrial) good, w is the wage rate and r the rate of return and a_i (c_i) are the labour and capital coefficients in the i -th industry.

$D = a_1 c_2 - a_2 c_1 > 0$: this implies that the basic sector is more labour intensive than the industrial.

Labour supply (L^S) is an increasing function of the real wage:

$$[1.3] \quad L^S = \alpha w / p_B + L_0 \quad \text{where } L_0 > 0.$$

Following Chichilnisky's original analysis "perverse" cases whereby labour supply actually decreases when the real wage increases are ruled out. It can be assumed that the values for which the latter case will be true, are not feasible in the present model (e.g. they could imply that the rate of return is zero or negative).

We also define a supply of capital (K^S) as an increasing function of the rate of interest:

$$[1.4] \quad K^S = \beta r + K_0 \quad \text{where } K_0 > 0.$$

This assumption is less palatable in so far as there is no other use for capital. However most of the results are valid in the case where $\beta = 0$.

Then we have the demand functions for capital and labour:

$$[1.5] \quad K^D = B^S c_1 + I^S c_2$$

$$[1.6] \quad L^D = B^S a_1 + I^S a_2$$

where B^S (I^S) is the supply of basic (industrial) goods.

Full employment of resources requires

$$[1.7] L^D = L^S$$

$$[1.8] K^D = K^S.$$

Let us now specifically consider the economy in the South. It is assumed that it will export (import) the basic (industrial) good: for an analysis of why it is so see Di Matteo 1992). We have a definition of exports,

(S):

$$[1.9] B^S(S) - B^D(S) = X_B^S(S)$$

and of imports, $X_I^D(S)$:

$$[1.10] I^D(S) - I^S(S) = X_I^D(S)$$

where $I^D(S)$ [$B^D(S)$] is the demand for industrial (basic) goods in the South.

We now come to the trade balance condition, the value of exports equals the value of imports:

$$[1.11] p_B X_B^S(S) = p_I X_I^D(S).$$

Equations for the North are the same except for different parameters and different values of the exogenous variables and for the fact that the North exports (imports) industrial (basic) goods. Finally there are other self explanatory conditions to be fulfilled in the international equilibrium:

$$[1.12] p_I(S) = p_I(N)$$

$$[1.13] p_B(S) = p_B(N)$$

$$[1.14] X_B^S(S) = X_B^D(N)$$

$$[1.15] X_I^D(S) = X_I^S(N).$$

One among the latter two however, is not independent of the other equations of the system.

Finally we have to choose the numeraire:

$$[1.16] p_I = 1.$$

Therefore in the equation defining the supply of labour, w/p_B is a measure of the real wage. The model need to be supplemented by two more equations representing demand conditions. Following Chichilnisky we choose to close the model by assuming:

$$[1.17] I^D(S) = I_0^D(S)$$

$$[1.18] I^D(N) = I_0^D(N)$$

It is also true that in equilibrium Walras's Law holds in the South in the following form:

$$p_B B^D + p_I I^S = p_B (B^S - X_B^S) + p_I (I^S + X_I^D) = p_B B^S + p_I I^S$$

In this way the model has 26 equations: 11 for each country, the 3 international equations (one among [1.14] and [1.15] is redundant) and the numeraire equation. It turns out that the model can be reduced to one quadratic equation:

$$[A + A(N)] p_B^2 + g p_B - [V + V(N)] = 0$$

where

$$A = \beta a_1 a_2 / D^2 > 0$$

$$V = \alpha c_1^2 / D^2 > 0$$

$$g = I_0^D(S) + I_0^D(N) + C + C(N)$$

$$C = [1/D] \{c_1 L_0 - a_1 K_0 + [\alpha c_1 c_2 - \beta a_1^2] / D\} > 0 \quad [\text{when } \alpha(S) \text{ is very large}]$$

are for the South (the corresponding for the North are with the (N)).

To the above quadratic equation there is one positive solution. Once the latter is known all the others endogenous variables can be computed.

Chichilnisky argues that the South is characterized by two features: unlimited supply of labour and dual technology. The first implies that the elasticity of

labour supply with respect to the real wage is nearly infinite: in the model this is captured by a very large value of α . It is precisely to accomodate this feature that the model has variable factor supplies. With the second assumption we describe a situation where the labour/capital ratio is much higher in the basic than in the industrial sector: in the model this is reflected in a high value of $D(S)$.

We briefly summarize one chain of deductions that can be derived from the model. An increase in the demand for industrial goods in the North is associated with a fall in the terms of trade for the South, an increase in its exports, and a fall in its overall consumption. Therefore the South is worse off. At the same time the North is better off since a fall in p_B induces an increase in the demand for basic goods. In this way we see that there is a clear conflict of interests between North and South.

2. If the above situation presents itself, are there policy measures that can be implemented by the South, to alter or mitigate the results? We can imagine two different types, "micro" and "macro" measures. Among the first we include consumption subsidy, production tax, and export duty. If it is assumed that the government in the South can control $I^D(S)$ we have a "macro" weapon: a change in the demand for industrial goods.

2.1. Let us start from the case of a consumption tax levied on the basic good in the South. In this way a wedge is created between the price paid by the consumer and that obtained by the producer. The following relation holds true:

$$p_B^C - p_B^P$$

where p_B^C is the price paid by the consumer, p_B^P is the price obtained by the producer and $T=1+t$ is the tax (subsidy is a negative tax).

Following the magisterial analysis by Meade (1955, ch.X) it is assumed in the paper that the proceeds (outlays) of the tax (subsidy) are given back to (are taken from) the consumers. In this way we isolate the "direct" effects of the tax (subsidy) from the "indirect" effects due to the way in which the government spends the proceeds or changes other taxes to cover the outlays. We assume also that:

$$p_B^P = p_B$$

where p_B is the world price. It is clear that in the North p_B indicates the consumer's and the producer's prices.

Which equations of the model need to be modified? Labour supply will be affected by the consumer's price; on the other hand the price equations will determine the producer's price to which taxation is subsequently added. The supply of capital will be a function of p_B , via the relation of the latter with the rate of interest. All other equations remain unaltered. We solve the model starting from:

$$X_I^D(S) = X_I^S(N)$$

and substituting where appropriate we get the final quadratic equation as follows:

$$p_B^2 [A + A(N)] + p_B g' - [V/T + V(N)] = 0.$$

This is equal to the expression we arrive at in the original model save for the term V/T instead of V and for g' which is equal to g except that one positive term within it is multiplied by $1/T$.

In other words the introduction of a consumption tax leads to a fall in V and g : to ascertain the effect on the terms of trade we now compute (using the implicit function theorem):

$$dp_B/dV = 1/\{2p_B[A+A(N)]+g\} > 0$$

and

$$dp_B/dg = -p_B/\{2p_B[A+A(N)]+g\} < 0.$$

Therefore the result is ambiguous depending on the relative strength of the two effects. We have a decrease in the terms of trade if $1-p_B > 0$.

If this is the case a consumption subsidy (i.e. $T=1-t$) will increase the terms of trade.

The rationale for the result is as follows. A consumption tax makes the consumer's price of basics higher than the producer's price. The supply of labour will be lower and this will decrease the supply of industrial goods. With a given demand for the latter the price of basics will increase. This however (via the cost/price equation) will increase the real wage in terms of producer's price and since the latter is linked to the consumer's price will also increase the latter and the supply of labour. Therefore there will be two contrasting influences on the terms of trade: the net outcome is uncertain.

It is also to be noted the effects on the demand for basics in the South. The latter is derived from the operation of the Walras's law which in the case of taxation takes on a slightly different form. We evaluate overall demand in the South at consumer's price and output at producer's price getting:

$$p_B^C B^D + p_I^D I^D = p_B(B^S - X_B^S) + I^D + X_I^D$$

hence:

$$B^D = [1/T][B^S + (I^S - I^D)/p_B].$$

The above expression differs from the one that is arrived at in the original model simply by the term $1/T$. Therefore, as in the original model, the demand for basics is a positive function of the terms of trade so that if there is a rise in the latter this will increase it.

2.2 Let us now move on and suppose that the South levies a production subsidy on the basic industry. This again opens a wedge between consumer's and producer's prices. In particular the following relation now holds true:

$$p_B^P = T p_B$$

where $T=1+t$ but now $p_B^C = p_B$ i.e. the consumer's price equals the world price. Again in the North there will be no difference between the world, the producer's and the consumer's prices.

In this case too cost/price relationships will be affected by producer's price and labour supply by consumer's price. To solve the model we start from:

$$X_I^D(S) = X_I^S(N)$$

and after performing the appropriate substitutions we get the final quadratic equation:

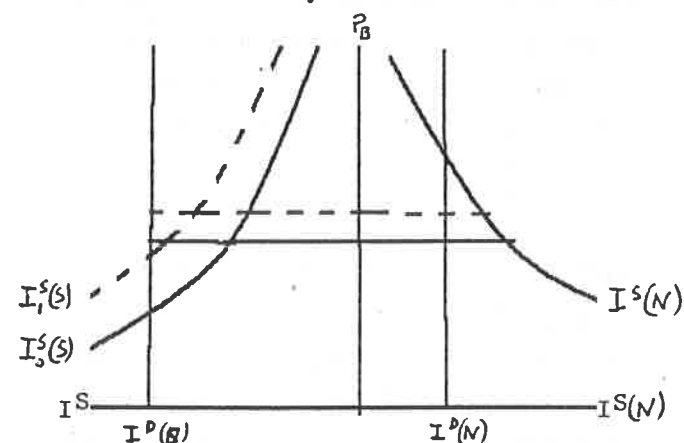
$$[AT+A(N)]p_B^2 + g p_B - [V+V(N)] = 0.$$

The only difference with the original model lies in AT instead of A . In other words a production subsidy on the basic commodity will increase A . In order to ascertain the effect on the terms of trade we use the implicit function theorem and compute:

$$dp_B/dA = -p_B^2/\{2p_B[A+A(N)]+g\} < 0.$$

In order to reach the goal of increasing the terms of trade, therefore the South needs a production tax,

namely $T=1-t$. The latter implies a lower level of production prices and therefore an increase in the interest rate and the supply of capital. This in turn will shift the supply of the capital intensive good, IS as in the diagram and the terms of trade will increase. This is in agreement with Meade's result that a production tax will depress exports. The latter in this model will carry an increase in the terms of trade.



We can check the value of the demand for basics in the South by resorting to Walras's Law evaluating as in 2.1 the demand at the consumer's and the output at the producer's price. From

$$p_B B^D + I^D = p_B^P (B^S - X_B^S) + IS + X_I^D$$

and making the appropriate rearrangements we get:

$$B^D = (1/T) [B^S + (IS - I^D)/p_B]$$

The only difference with the original expression is the term $1/T$ and therefore also in this case the demand for basics will increase with the terms of trade.

2.3 Only now we assume that the South levies an export duty on the exports of the basic commodity. In this way a wedge is created between the domestic price,

p_B^d (now equal for both the producer and the consumer) and the world price, p_B . The following relation holds true:

$$p_B^d T = p_B$$

where $T=1+t$. The domestic price is now less than the world price. In this case the domestic price will affect both the labour and the capital supply. Proceeding as usual i.e. starting from

$$X_I^D(S) = X_I^S(N)$$

we get the final equation:

$$[A/T + A(N)] p_B^2 + g p_B - [VT + V(N)] = 0.$$

We see immediately that the export duty affects both A and V . In particular it will increase V and lower A . We already know that

$$dp_B/dA < 0$$

and

$$dp_B/dV > 0$$

and we conclude that an export duty will increase the terms of trade.

The result reached by Meade that an export duty will depress exports is confirmed now in a general equilibrium analysis. Thanks to the latter we are able to reach more definite results and see that the effect of the export duty on the terms of trade is always as desired and superior to that of the production tax.

In conclusion we maintain first that in this model levying an export duty or a production tax enable the South to reach the desired goal of increasing the terms of trade whereas this is not always the case with a consumption tax (or subsidy). This asymmetry is not present in the standard results reached by Meade and depends on the endogeneity of labour supply.

Secondly it is clear that in this model the Lerner's case (Lerner 1936) can never happen, i.e. it is always the case that an export duty will increase the terms of trade.

3. Let us now discuss the "macro" policy. Suppose that in the South the government is the main element in determining the demand for industrial goods. This can happen for various reasons: there is a strong dirigistic policy or a sort of planning, the industrial sector is in large part devoted to produce goods bought by the government, etc. This being the case, can the government change the demand for industrial goods in such a way that the terms of trade can improve?

The answer is immediate by use of the implicit function theorem. Start once again from:

$$X_I^S(N) = X_I^D(S)$$

which in turn is

$$I^S(N) - I_0^D(N) = I_0^D(S) - I^S(S).$$

Therefore

$$dp_B/dI_0^D(S) = 1/([dI^S(S)/dp_B] + [dI^S(N)/dp_B]) < 0.$$

In other words a fall in the demand for industrial goods in the South will bring about an increase in the terms of trade. To complete the analysis we have to look at the effects on the demand for basics in the South:

$$dB^D(S)/dI^D(S) = [dB^D/dp_B][dp_B/dI^D] < 0.$$

Therefore the result of the "macro" policy has contrasting effects on the welfare of the South: on one hand the demand for industrial goods fall, on the other the demand for basics increases, since in the South the demand for basic good is positively correlated to its price (see Chichilnisky 1981). Therefore we cannot say

whether there is an improvement unless we have a way of evaluating the changes.

What we really need is a community indifference curve (CIC) that can weight the marginal changes in the quantity consumed of the two commodities. It is however well known that in general we cannot build such a curve unless we make drastic assumption. One sufficient condition to have a CIC is that each agent has the same income and tastes.

Suppose as is traditional in the pure theory of international trade that evaluates the gains from trade, that there exists such a utility function $V_S(I, B)$. Given the latter we can build a set of indifference curves in the plane (I, B) . Along one indifference curve pick a point with the combination I^*, B^* . Then we compare the MRS along the CIC at that point of an infinitesimal change in $I^D(S)$ (following the government's policy) with the actual change in B^D due to the same change in $I^D(S)$. If the latter is greater than the MRS it means that the change in B^D induced by the government action leads to a preferred position. This criterium has a local validity and the problem does not necessary have an optimum solution in general.

4. The purpose of the paper has been that of evaluating a set of instruments of economic policy to ameliorate the welfare of the South in the context of the general equilibrium model originally proposed by Chichilnisky (1981, 1984). The reason was that Chichilnisky showed that to an increase in the exports of the South is associated a loss of welfare of the South itself.

The answer as expressed in this paper is in the affirmative, namely there are at least two ways whereby

the South can certainly better its terms of trade and improve its welfare: it can levy a production tax or an export duty. The latter is the most efficacious one and is superior to the other. It is also shown that in the model under scrutiny the Lerner's case cannot happen.

Moreover it is shown that "macro" policy has an ambiguous effect on the welfare.

Finally it is important to stress that the paper has followed the tradition of the optimum tariff argument, namely retaliation is excluded. Indeed the study of a trade warfare is beyond the scope of the paper and calls for different tools of analysis.

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