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A Note on the Employment Effects of an Export Boom**

Bharat R. Hazari
and
Pasquale M. Sgro *

Abstract

This paper utilizes the Heckscher-Ohlin type model with unemployment and non-traded goods to examine the effect of an export boom on the real exchange rate, sectoral outputs, unemployment, factor incomes and welfare. It is demonstrated that in the presence of unemployment 'Dutch Disease' type results critically depend on the relative factor intensities of the export and import-competing sectors. In a distortionary setting the issue of 'Dutch Disease' needs to be explored empircally via the use of computable general equilibrium models so that the ambiguities can be resolved case by case.

I. Introduction

In recent years trade theory has been extended to include a treatment of unemployment. This has been accomplished by introducing a uniform minimum real wage constraint in the Heckscher-Ohlin framework.[1] The consequences of such a wage distortion have been analysed by several authors notably : Brecher(1974), Batra and Seth (1977) and Sgro and Takayama (1981). A significant omission from these treatments is the presence of non-traded goods which have been extensively analyzed in real models

* La Trobe University and Deakin University, respectively.

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1. Unemployment in trade models has also been analyzed in cases where the binding minimum wage constraint is non-uniform. An example of this type of modelling is the Harris-Todaro (1970) model and its extensions.

of trade.[2] The object of this paper is not to fill this gap in the literature as it will only reinforce known results, but utilize the framework of Batra and Seth (1977) to incorporate non-traded goods and examine Dutch Disease type phenomenon in the presence of unemployment.[3] We utilize the above model as it avoids the problems of linearity and corner solutions associated with the Brecher (1974) type treatment of uniform minimum real wage.

We are concerned with examining the effects of an export boom on the relative price of non-traded goods (real appreciation of the exchange rate), sectoral outputs and factor incomes. We examine all these issues in the context of economies with unemployment.[4] This enquiry is conducted on the basis of a model in which the country produces three goods : an exportable, an importable and a non-traded good. An essential feature of this model is the specificity of a factor in the non-traded goods sector. Labour is completely mobile between the three sectors while capital is quasi-mobile among the traded goods sector.[5] We obtain the following interesting result from out analysis. All the important Dutch Disease type results are valid in this more general framework provided that the import sector is more capital intensive than the exporting sector. In this particular case the export boom also reduces unemployment. However, if the importing sector is labour-intensive then the Dutch Disease results do not *necessarily* follow. In a distortionary setting the issue of Dutch Disease needs to be explored empirically via the use of computable general equilibrium models so that the ambiguities can be resolved case by case.

II. Model

In this sector we present the model from which we derive our main results. In the model presented below it is assumed that the country is small and hence takes the terms of trade as given.

It is assumed that the real wage is rigid and that this rigidity causes unemploy-

2. A comprehensive treatment of non-traded goods in international trade is available in Hazari, Sgro and Suh (1981).
3. See Corden's (1982) survey for an extensive list of references.
4. Several countries have experienced sectoral booms in the traded goods sector ; for example Indonesia, Japan, Australia, and, of course, the Netherlands.
5. The first paper ; with specificity in the non-traded goods sector was by Hazari (1981). The same structure has since been used in a paper by Long (1983) and this type of specificity has been mentioned in the survey by Corden (1982).

ment. Following Batra and Seth (1977) we also relax the assumption of linear homogeneity and only assume that the production functions are concave. It is assumed that commodities X, Y the are produced where X is the exportable good, Y the importable good and N the non-traded good. The export boom is captured by introducing neutral technical progress which is represented by Θ. The production functions are given below :

$$X=\Theta X(K_x, L_x) \tag{1}$$
$$Y=Y(K_Y, L_Y) \tag{2}$$
$$N=N(L_N, S) \tag{3}$$

where $K_i(i=X,\ Y)$, $L_i(i=X,\ Y,\ N)$ represent the amounts of capital and labour allocations to the i th sector. Labour is the completely mobile factor, capital is quasi-mobile and S is sector specific to producing non-traded goods. All marginal products are assumed to be positive but diminishing, i.e. $X_L>0$, $X_{LL}<0$ and $X_{KL}>0$ and so on. Furthermore, concavity of these functions implies that for example $X_{LL}X_{KK}-X_{KL}^2>0$ and this proerty also holds for other functions.

Producers maximize profits subject to a given rigid real wage where all nominal variables are expressed in terms of any product price, hence :

$$w=\Theta P_X X_L(K_X, L_X) \tag{4}$$
$$w=P_Y Y_L(K_Y, L_Y) \tag{5}$$
$$w=P_N N_L(L_N, \bar{S}) \tag{6}$$
$$r=\Theta P_X X_K(K_X, L_X) \tag{7}$$
$$r=P_Y Y_K(K_Y, L_Y) \tag{8}$$
$$\Pi_s=P_N N_S(L_N, \bar{S}) \tag{9}$$

where X_i, Y_i, $N_i(i=L,\ K)$ denote the marginal physical product of capital and labour in the i th sector. The term N_S denotes the marginal physical product of the specific factor in the non-traded goods sector. The term $P_i(i=X,\ Y,\ N)$ represents the price of the i th good, r the rental on capital, w the real wage rate and Π_S the rental on the specific factor. The term Θ represents the expansion factor (export boom).

The factor endowment conditions require that :

$$K_X+K_Y=\bar{K} \tag{10}$$
$$L_X+L_Y+L_N=L<\bar{L} \tag{11}$$

Note that L denotes the actual level of employment.

The aggregate utility function, U, is assumed to be strictly concave and depends on the consumption of goods X, Y and N :

$$U=U(D_X, D_Y, D_N) \tag{12}$$

where $D_i(i=X, Y, N)$ denotes the consumption of the i th good. The utility is assumed to possess both behavioural and welfare significance. The national income equation for the above system is as follows :

$$I=P_XD_X+P_YD_Y+P_ND_N=P_XX+P_YY+P_NN \tag{12'}$$

where I denotes national income. This is useful in using the demand equation for the non-traded good.

Utility maximization requires that :

$$U_X/P_X=U_Y/P_Y=U_N/P_N \tag{13}$$

where $U_i(i=X, Y, N)$ are positive marginal utilities.

Market clearing conditions require that

$$D_N=N \tag{14}$$

$$D_X=X-E \tag{15}$$

$$D_Y=Y+M \tag{16}$$

$$P_XE=P_MM \tag{17}$$

when E and M denote exports and imports respectively and (17) the blance of payment equilibrium condition. This completes the specification of the model.

Ⅲ. Results

In this section we present the implications of the export boom on several variables. These variables are : the relative price of the non-traded good (real appreciation), employment, sectoral outputs, factor incomes and welfare. The formal expressions for the change in the relative price of the non-traded good as a consequence of an export boom :

$$\frac{dP_N}{d\Theta}=\frac{-P_NN_{LL}\,m_N(w\,P_N(Q+Q')+X)}{D'} \tag{18}$$

where m_N is the marginal propensity to consume the non-traded good. The above expression is derived by using equations (4), (6) and (11) as shown in the appendix.

$$D' = w\,N_L(1-m_N)+P_N N_{LL}\frac{\partial D_N}{\partial P_N}>0$$

$$\begin{aligned} Q+Q' = \frac{-1}{D}\Bigg(& X_L(Y_{LL}Y_{KK}-Y_{KL}^2)+Y_L\left\{\frac{(\alpha_X-1)(\alpha_Y-1)X_K Y_L}{K_X L_Y}-\frac{X_{KL}(\alpha_Y-1)Y_L}{L_Y}\right. \\ & \left.+(\frac{k_Y-k_X}{k_X})X_{KL}Y_{KL}\right\}+Y_K\left\{(k_Y-k_X)Y_{KL}X_{KL}-\frac{(\alpha_Y-1)Y_L X_{KL}}{L_Y}\right\} \\ & +X_L X_K(\alpha_X-1)Y_{KL}\left(\frac{k_X-k_Y}{k_X}\right)\Bigg) \end{aligned} \tag{18'}$$

where $D=\Theta[X_{LL}(N_{LL}N_{KK}-N_{KL}^2)+N_{LL}(X_{LL}X_{KK}-X_{KL}^2)]<0$

We now proceed to show that $(Q+Q'))>o$ for $k_Y>k_X$. This property plays an important role in our Theorem 1. The sign of D is negative as shown above. So we proceed to analyse the sign of the bracketed expression in square brackets. From the concavity of the production function we know that the following are positive :

$X_L>0,\ (Y_{LL}Y_{KK}-Y_{KL}^2)>o,\ Y_L>0,\ X_K>0,$
$L_Y>0,\ X_{KL}>0,\ k_y>0,\ k_x>0,\ Y_{KL}>0,\ Y_K>0.$

From the homogenity properties of the production functions we know that :

$(\alpha_x-1)<0,\ (\alpha_Y-1)<0$

We assume that $k_Y>k_X$, hence the square bracketed expression in (18') is positive. Therefore $Q+Q'>0$ for $k_Y>k_X$ as $-1/D>0$. Note that if a production function is homogeneous of degree α then the marginal products are homogenous of degree $(\alpha-1)$. Thus α refers to the degree of homogenity. The expressions for the remaining variables are given below. Detailed derivations are shown in the appendix. The solutions for $dL_X/d\Theta$, $dK_X/d\Theta$, $dL_Y/d\Theta$ and $dr/d\Theta$ are obtained from equations (4), (5), (7) and (10). As far as the solutions for $dP_N/d\Theta$, $dL_N/d\Theta$, $dL/d\Theta$ and $dI/d\Theta$ are concerned, these are obtained from equations (4), (6), (11) and (12').

$$\frac{dL}{d\Theta}=\frac{N_L m_N X+[Q+Q'][N_L^2+P_L N_{LL}\frac{\partial D_N}{\partial P_N}]}{D'} \tag{19}$$

$$\frac{dX}{d\Theta}=X_K\frac{dK_X}{d\Theta}+X_L\frac{dL_X}{d\Theta}+X>0 \tag{20}$$

$$\frac{dY}{d\Theta}=Y_K\frac{dK_Y}{d\Theta}+Y_L\frac{dL_Y}{d\Theta}<0 \tag{21}$$

$$\frac{dN}{d\Theta}=N_L\frac{dL_N}{d\Theta}\gtreqless 0 \tag{22}$$

$$\frac{dL_N}{d\Theta}=\frac{m_N N_L[(Q+Q')wP_N+X]}{D'}$$

$$\frac{dr}{d\Theta}=\frac{[(Y_{LL}Y_{KK}-Y_{KL}^2)\ \Theta P_X^2(X_{LL}X_K-X_{KL}X_L]}{D} \tag{23}$$

$$\frac{d\prod_s}{d\Theta}=N_s\frac{dP_N}{d\Theta}+P_N N_{ss}\frac{dL_N}{d\Theta}\gtreqless 0 \tag{24}$$

$$\frac{dI}{d\Theta}=\frac{[X+wP_N(Q+Q')][N_L^2+P_N N_{LL}\frac{\partial D_N}{\partial P_N}]}{D'} \tag{25}$$

The following theorem emerges from the above equations :

Theorem 1 :

If $k_y>k_x$ then it necessarily follows that as a consequence of the export boom the real exchange rate appreciates $[(dP_N/d\Theta)>0]$, unemployment declines $((dL/d\Theta)>0)$, the output of the exportable (importable) good increases (declines), the output of the non-traded good increases $((dN/d\Theta)>0)$, the rental on both capital and the specific factor increase $((dr/d\Theta)>0,\ (d\prod_s/d\Theta)>0))$ and income or welfare always increases $((dI/d\Theta)>0)$.

Before offering an explanation of the above theorem it should be noted that for $K_x>K_y$ the above expressions *cannot be assigned unique signs.*

We offer proofs for the signs of some of the expressions in Theorem 1.

1. $\frac{dP_N}{d\Theta}>o$ for $k_y>k_x$

Proof : In equation (18) the denominator consists of $w>0$, $N_L>0$, $(1-m_n)>0$ as m_N is between zero and one, $P_N>0$, $N_{LL}<0$ and $\partial D_N/\partial P_N<0$, hence $D'>0$.
The top line consists of $P_N>0$, $N_{LL}<0$, $m_N>0$, $w>0$, $(Q+Q')>0$ and $X>0$. See equations (18') and ensuing discussion for the positivity of $(Q+Q')$. Therefore it follows that both the number and the denominator in equation (18) are positive. QED.

2. $\frac{dL}{d\Theta}>o$ for $k_y>k_x$

Note that D′ and (Q+Q′) in expression (19) are positive for reasons given above. The other terms in the numerator

$$N_L m_N X>0,\ N_L^2>0,\ P_N N_{LL}\frac{\partial D_N}{\partial P_N}>0.$$

Hence, both the numerator and the denominator are positive. Thus $dL/d\Theta>0$. QED. The proofs of the remaining results in Theorem 1 can be constructed in similar fashion.

The above theorem shows that if the import sector is capital intensive the relative price of the non-traded goods increases(in other words the real exchange rate appreciates). This is in accordance with the Dutch Disease phenomenon. The intuitive explanations of this appreciation runs along the following lines. An export boom at constant prices for the traded goods leads to an increase in income(despite the labour market distortion, only for the case $k_y>k_x$). This increase in income leads to increased demand for the non-traded good resulting in an unambiguous rise in its relative price.

An export boom necessarily raises total employment and income if the import sector is capital intensive relative to the exporting sector. A boom in the exporting sector results in an increase in its output and since income also rises the output of the non-trad ed goods also increases. The capital intensive sector Y contracts releasing capital and labour. However, sector X is labour-intensive and in general would require a greater amount of labour than that released from sector Y. This labour can be drawn from the pool of unemployed labour. Therefore, employment increases (unemployment falls) as a consequence of the export boom.

It should be noted that when $k_X>k_Y$ or the export sector is capital intensive then some of the expressions listed in Theorem 1 do not necessarily have unique signs. Since in this case the capital intensive sector expands and the labour intensive sector contracts it immediately follows that all the labour released from Y will not be absorbed by the capital intensive sector X. The output of the non-traded goods sector may rise or fall. Hence, the labour released from sector Y may increase the unemployed pool, thereby giving rise to results other than those associated with export booms in the standard framework. These expressions are important in Dutch Disease type phenomenon. Thus, the traditional conclusions about Dutch Disease depend critically on the relative factor intensity of the export and import sectors in a model that incorporates unemployment. It should be emphasized that in countries which import capital intensive commodities Dutch Disease type effects are more likely to occur with or without unemployment. Furthermore, in the case in which the import sector is labour intensive all the usual distortion type paradoxes re-emerge and need to be analysed empirically case by case.

Appendix

Detailed Derivations

From equations (4), (5), (7), (8) and (10) we obtain the following system :

$$\begin{pmatrix} \Theta P_X X_{LL} & \Theta P_X X_{KL} & 0 & 0 \\ 0 & -P_Y Y_{KL} & P_Y Y_{KL} & 0 \\ \Theta P_X X_{KL} & \Theta P_X X_{KK} & 0 & -1 \\ 0 & -P_X Y_{KK} & P_Y Y_{KL} & -1 \end{pmatrix} \begin{pmatrix} dL_X \\ dK_X \\ dL_Y \\ dr \end{pmatrix} = \begin{pmatrix} -P_X X_L d\Theta \\ 0 \\ -P_X X_K d\Theta \\ 0 \end{pmatrix}$$

It then follows that

$$\frac{dL_X}{d\Theta} = \frac{-X_L[\Theta P X_{LL} Y_{LL} + (Y_{LL} Y_{KK} - Y_{KL}^2)] + P X_K D_{KL} Y_{LL} \Theta}{D}$$

$$\frac{dK_X}{d\Theta} = -\frac{dK_Y}{d\Theta} = \frac{-P_Y \Theta Y_{LL}(X_L X_{LL} - X_L X_{KL}) P_X^2}{D}$$

$$\frac{dL_Y}{d\Theta} = \frac{\Theta P Y_{KL}(X_L X_{KL} - X_K X_{LL})}{D}$$

With $P_Y = 1$

$$D = \Theta P[X_{LL} Y_{KK} - Y_{KL}^2) + Y_{LL} (X_{LL} X_{KK} - X_{KL}^2)]$$

From equations (4), (6), (11) and (12′) we obtain the following system :

$$\begin{pmatrix} N_L & P_N N_{LL} & 0 & 0 \\ 0 & 1 & -1 & 0 \\ 0 & 0 & -W P_N & 1 \\ \frac{\partial P_N}{\partial \Theta} & -N_L & 0 & m_N \end{pmatrix} \begin{pmatrix} dP_N \\ dL_N \\ dL \\ dI \end{pmatrix} = \begin{pmatrix} 0 \\ -(Q+Q') \\ X \\ 0 \end{pmatrix}$$

$$\frac{dP_N}{d\Theta} = \frac{-P_N N_{LL}\, m_N(W P_N(Q+Q') + X)}{D'}$$

$$D' = W N_L(1 - m_N) + P_N N_{LL} \frac{\partial D_N}{\partial P_N} > 0$$

For $Q+Q'$ see the main text.

Given below are the expressions used for simplifying $Q+Q'$ in the main text. These follow from Euler's theorem for homogeneous functions of degree α. The marginal products are of degree $(\alpha-1)$.

$$L_X X_{LL} + K_X X_{KL} = (\alpha_x - 1)\ X_L,$$
$$L_X X_{KL} + K_X X_{KK} = (\alpha_x - 1)\ X_K,$$
$$L_N N_{LL} + K_N N_{KL} = (\alpha_n - 1)\ N_L,$$
$$L_N N_{KL} + K_N N_{KK} = (\alpha_n - 1)\ N_K.$$

$$\frac{dX}{d\Theta} = X_K \frac{dK_x}{d\Theta} + X_L \frac{dL_x}{d\Theta} + X > 0$$

References

Batra, R.N. and Seth, A.C. (1977), "Unemployment, Tariffs and the Theory of International Trade", *Journal of International Economics*, 7 : 295-306.

Brecher, R.A. (1974), "Minimum Wages and the Theory of International Trade, *Quarterly Journal of Economics,* Vol. 88, 98-116.

Buiter, W.H. and Purvis, D.D. (1982), "Oil, Disinflation and Export Competitiveness : A Model of the Dutch Disease" in J. Bhandari and B. Putnam (eds.), *Economic Interdependence and Flexible Exchange Rates,* Cambridge. M.I.T. Press.

Corden, W.M. (1981), "The Exchange Rate, Monetary Policy and North Sea Oil : The Economic Theory of the Squeeze on Tradeables," *Oxford Economic Papers,* (July) : 23−46.

Corden, W.M. (1982), "Booming Sector and Dutch Disease Economics : A Survey," (Mimeographed)

Corden, W.M. and Neary, J.P. (1982), "Booming Sector and De-Industrialisation in a Small Open Economy" *Economic Journal,* 92(December) : 825-848.

Eastwood, R.K. and Venables, A.J. (1982), "The Macroeconomic Implications of a Resource Discovery in an Open Economy," *Economic Journal,* 92(June) : 285-99.

Gregory, R.C. (1976), "Some Implications of the Growth of the Mineral Sector." *Australian Journal of Agricultural Economics,* 20 (August) : 71-91.

Harris, J.R. and Todaro, M. (1970), "Migration, Unemployment and Development : A Two-Sector Analysis," *American Economic Review,* 60, 126-142.

Hazari, B.R. (1981), "On Secific Factors in the Non-Traded Goods Sector and Some Propositions in the Pure Theory of International Trade," *Greek Economic Review,* 3, 71-80.

Hazari, B.R. and Sgro, P.M. (1987), "A Note of Minimum Wages, Non-Traded Terms of Trade, Welfare and Unemployment," *Note Economiche,* 16, 100-106.

Hazari, B.R., Sgro, P.M. and Suh, D.C. (1981), *Non-Traded and Intermediate Goods and the Pure Theory of International Trade,* London : Croom Helm.

Jones, R.W. (1974), "Trade with Non-Traded Goods : the Anatomy of Interconnected Market," *Economica,* 41, 121-38.

Lapan, R.W. (1976), "International Trade, Factor Market Distortions, and the Optimal Dynamic Subsidy," *The American Economic Review,* 66(June) : 335-346.

Long, N.V. (1983), "On the Effects of a Booming Export Industry on the Rest of the Economy," *Economic Record,* 59, 57-60.

McKinnon, R.I. (1976), "International Transfers and Non-Traded Commodities : The Adjustment Problem," In D.M. Leipziger, (ed.), *The International Monetary System and the Developing Nations,* Washington, D.C. : Agency for International Development

Robinson, S. and De Melo, J. (1986), "The Treatment of Foreign Trade in Computable General Equilibrium Models of Small Economies,"(Mimeographed).

Sgro, P.M. and Takayama, A.K. (1981), "On the Long-run Growth Effects of a Minimum Wage for a Two-Sector Economy," *Economic Record* 180-5. Reprinted in Hazari, B.R. *International Trade : Theoretical Issues,* London : Croom Helm 1986, 352-362,

Snape, R.H. (1977), "Effects of Mineral Development on the Economy," *Australian Journal of Agricultural Economics.* 21(December) : 147-56.

van Wijnbergern, Sweder, (1982a), "Inflation, Employment and the Dutch Disease in Oil Exporting Countries : A Short Run Disequilibrium Analysis," *Quarterly Journal of Economics,* (March).