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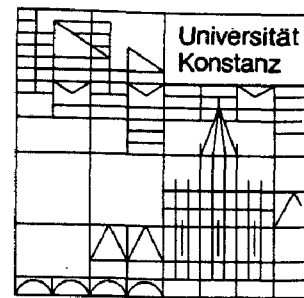
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**Sonderforschungsbereich 178**  
**„Internationalisierung der Wirtschaft“**

Diskussionsbeiträge



Juristische  
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Sugata Marjit

**International Capital Movement,  
Trade Policy and Unemployment**

**INTERNATIONAL CAPITAL MOVEMENT, TRADE POLICY  
AND UNEMPLOYMENT**

**Sugata Marjit**

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# International Capital Movement, Trade Policy and Unemployment

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## Abstract

This paper builds up a two country model of trade and unemployment allowing for perfect mobility of capital across the borders. Capital moves from the north to the south, which suffers from unemployment. A few basic policies related to lowering of unemployment are discussed. In particular it is shown that larger tariff as well as smaller tax on foreign capital may reduce employment in the south.

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## Introduction

The purpose of this paper is to reconsider the role of certain conventional policies in increasing employment in an open economy. In particular we shall focus on taxation of foreign capital, import tariff and export promotional measures in a typical less developed economy and find their impacts on unemployment. Recently Batra and Lahiri (1987) developed a model of intersectorally mobile capital and unemployment [ as a contribution to the literature popularized by Corden and Findlay (1975) ]. They consider welfare ranking of alternative trade policies and conclude that export promotional schemes undertaken by the LDCs should prove to be beneficial to them.

In this paper we consider a north-south trade model where north represents the advanced region and south indicates the group of LDCs lumped into one economy. The south has a fixed money wage rate and suffers from unemployment whereas labor force is fully employed in the north. We have an integrated production structure where the south not only imports capital from the north but also purchases intermediate input produced in the north. Actually one can think of a situation where the south assembles imported intermediates with its labor and sells the final good in the rest of the world. This is essentially trade with specialization in the stages of production. Such structures have been extensively discussed by Marjit (1987, 1988). Efficacy of policies pursued in the south will be shown to depend on the production structure of the north. A tax on foreign capital may be beneficial in terms of improving the employment situation if the intermediate input is capital-intensive. On the other hand, due to similar reasons tariff may fail to generate larger employment. In the literature on tariff and unemployment [ see Chan (1982), Sauernheimer (1986) ] labor intensities of contracting and expanding sectors are compared to find out the net impact of tariff. We shall show that even if the contracting sector in the south commands a larger share in total employment to start with, the expansionary effect, following an increase in capital-tax or a decline in tariff, may lead to larger employment.

Unlike the models in the literature, we emphasize on international capital mobility and structure of trade to discuss the policy impacts. To highlight the supply side effects we shall assume final goods prices to be fixed. One can think of our two economy globe as a 'small' part of the rest of the world. The paper will be divided into three sections. In the first section we describe the determination of equilibrium. In the second section we put forward the

basic propositions. In the last section we conclude the paper after suggesting some extensions and generalizations.

## SECTION - 1

## The Equilibrium

We assume two countries, north and south. North produces one intermediate good ( $I$ ) and a final good  $Y^*$ . Both goods are traded. Good  $I$  is used in the production of  $X$  – the export good of the south. South also has an enclave sector where northern capital uses southern labor, both skilled and unskilled, to produce a traded good  $Y$ . The final goods prices are given in the rest of the world. One can treat  $Y$  and  $Y^*$  to be similar goods. However, as long as their prices are given, physical distinctions do not matter. We assume that the south is an importer of  $Y$  such that the volume of domestic consumption outweighs the size of the enclave sector. Capital and labor in the north and skilled labor in the south are fully employed. The money wage rate of the unskilled labor can be thought to be a mark-up over the subsistence and is assumed to be fixed and there is unlimited supplies of unskilled workers at given money wage. Since commodity prices are fixed this amounts to saying that the real wage is also fixed.

To describe the model formally, we shall use the following symbols

$P_x, P_y, P_y^*$  - denote prices of the final goods

$\bar{w}_u$  - fixed money wage rate of unskilled labor in the south

$w_S$  - money wage rate of skilled labor

$w^*$  - money wage rate in the north

$a_{Ix}$  - per unit requirement of  $I$  for  $X$

$a_{Lx}$  - per unit requirement of unskilled labor for  $X$

$a_{Ky}$  - per unit requirement of capital for  $Y$

$a_{Sy}$  - per unit requirement of skilled labor for  $Y$

$a_{Ly}$  - per unit requirement of unskilled labor for  $Y$

$a_{LI}^*$  - per unit requirement of labor for  $I$

$a_{KI}$  - per unit requirement of capital for  $I$

$$a_{Sy}Y = S \quad (7)$$

$$a_{Ix}X = I \quad (8)$$

Total employment is given by

$$L_e = a_{Lx}X + a_{Ly}Y \quad (9)$$

We have nine equations to determine,  $P_I$ ,  $r$ ,  $w_S$ ,  $w^*$ ,  $X$ ,  $Y$ ,  $Y^*$ ,  $I$ ,  $L_e$  given  $P_x$ ,  $P_y$ ,  $P_y^*$ ,  $\bar{w}_u$ ,  $K$ ,  $L^*$  and  $S$ . In this system price and quantity equations are separable<sup>1</sup>. Given the assumption on production technology, equations (1) – (4) can determine  $P_I$ ,  $w_S$ ,  $w^*$  and  $r^2$ . Once we know the factor prices, we automatically know the input–output coefficients with  $a_{Ly}$  given exogeneously (by assumption). Now equations (5) – (7) will determine  $X$ ,  $Y$  and  $Y^*$ . With these informations  $L_e$  can be easily determined. It is evident that the north has a typical Heckscher–Ohlin structure. We should note that the south does not have any capital of its own. However,  $S$  can be interpreted as stock of human capital available to the south.

Until now we have not mentioned anything about the capital intensity of  $I$  or  $Y$ . This specification will have a lot to do with the subsequent results of the paper. We shall keep the issue open right now and shall talk about alternative assumptions and their influence on the outcome of a policy.

## SECTION - 2

## Policy

In this model, any policy that affects the southern import good sector, has to affect the production structure of the north through the movement of capital. This in turn affects  $I$  and the export sector of the south. To understand the basic mechanism we may consider equations (5) and (6). Since  $a_{Ky}$  and  $\hat{Y}$  are determined in the south, these can be treated as exogenous to the Northern subsystem. It is easy to show that,

$$\hat{I} = - \frac{\lambda_{Ly}^* \lambda_{Ky} (\hat{a}_{Ky} + \hat{Y})}{|\lambda|} \quad (10)$$

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<sup>1</sup>This type of production structure has the properties of the specific-factor as well as the Heckscher–Ohlin model. For a general equilibrium analysis of such structures one may refer to Marjit (1990a, 1990b) and Jones and Marjit (1990).

<sup>2</sup>Even if  $a_{Ly}$  is fixed, fixity of  $\bar{w}_u$  is needed for the absence of unemployment in the south as  $L$  and  $I$  are substitutes in the production of  $Y$ .

$|\lambda|$  is the intensity matrix and  $\lambda$ s denote the commodity shares of productive resources. These interpretations are exactly similar to Jones (1965). Equation (10) is sufficient to understand the direction of impact on  $I$  following changes in the production of  $Y$ . However, change in total employment can be computed only when we know what exactly happens to the sector producing  $X$ . In fact from (9) we get,

$$\hat{L}_e = \delta_1 \hat{X} + \delta_2 \hat{Y} \quad \left[ \delta_1 = \frac{a_{Lx}X}{L_e}, \delta_2 = 1 - \delta_1 \right] \quad (11)$$

Given  $P_x$  and  $\bar{w}_u$ ,  $P_I$  is automatically determined and that in turn determines  $a_{Ix}$ . As long as any policy does not disturb sector  $X$  directly, substitution margins remain unaffected. Therefore,  $\hat{X} = \hat{I}$ . This is typically the case when we consider policies that directly affect the  $Y$  sector.

With little effort it can be shown that in this situation,

$$\hat{L}_e > 0 \quad \text{iff} \quad -\frac{\delta_1 \lambda_{Ly}^* \lambda_{Ky} \hat{a}_{Ky}}{|\lambda|} - \hat{Y} \left[ \frac{\delta_1 \lambda_{Ly}^* \lambda_{Ky}}{|\lambda|} - \delta_2 \right] > 0 \quad (12)$$

## 2.1 A Tax on Foreign Capital

Consider a tax imposed on use of  $K$  in sector  $Y$ . This will reduce  $Y$  by increasing the cost of production and will also reduce  $a_{Ky}$  since  $K$  becomes relatively more expensive. Therefore, from (12), since  $\hat{a}_{Ky} < 0$  and  $\hat{Y} < 0$ , a sufficient condition for increase in the total employment will be given by,

$$\frac{\delta_1 \lambda_{Ly}^* \lambda_{Ky}}{|\lambda|} > \delta_2 \quad (13)$$

We shall derive the necessary conditions explicitly, in the appendix. Here we discuss only the possibility of increase in employment following tax on capital. It can be easily checked that for  $\delta_1 = \delta_2$ ,  $\lambda_{Ly}^* = \frac{3}{4}$ ,  $\lambda_{Ky} = \frac{1}{2}$ ,  $\lambda K I = \frac{1}{3}$ , (13) will hold. In fact it is possible that (13) will hold even with  $\delta_1 > \delta_2$  i.e. even if the employment intensity of the contraction sector is high relative to that of the expanding sector, employment still may improve. The intuition is simple. If  $|\lambda| > 0$ , which must be true for (13) to hold, it will mean that  $I$  is capital intensive. As capital backtracks home,  $I$  increases by a magnified amount a la Rybczynski theorem. So does  $X$  and hence there is a strong possibility that employment in fact will tend to grow.



## 2.2 A Tariff on Imports of $Y$

This will have similar type of impact on employment, but exactly in the opposite direction. As effective price of  $Y$  goes up,  $w$ , must go up implying an increase in  $a_{Ky}$ . This makes the first term of (12) negative. Since production of  $Y$  goes up, the second term in (12) will be negative provided (13) holds. Following a similar type of reasoning as in case of taxing the foreign capital, one may argue that the tariff may reduce the aggregate volume of employment contrary to the usual belief.

If  $I$  is labor intensive, we shall always have the usual result. As  $Y$  goes up (down) capital flows in (out) leading to increase (decrease) in  $I$  if  $I$  is labor intensive. This will mean  $X$  will increase (decrease). Then, a tax on foreign capital will reduce both  $Y$  and  $X$  and tariff will improve both  $Y$  and  $X$ .

One may criticize the fact that though we have ruled out substitution between unskilled labor and other resources in  $Y$ , we have allowed it in  $X$ . However, for the above results to be valid we are not taking help through the adjustments in the substitution margins which remain unaffected in sector  $X$  through fixing the price of  $X$  and  $P_I$ .

## 2.3 An Export Subsidy on $X$

Suppose the government in the south subsidizes production of  $X$ . This will increase in  $P_I$ . Given  $P_Y$ , north moves along its production possibility frontier producing more of  $I$  and less of  $Y$ . If  $I$  is capital intensive, such a change draws capital from the south leading to a contraction in sector  $Y^*$ . Interestingly even in this case the sufficient condition for improvement in employment turns out to be (13). Explicit derivation of results is given in the appendix.

If  $I$  is labor intensive, an export subsidy leads to import-substitution. Increase in production of  $X$  requires increased amount of  $I$  which increases the flow of capital into the south by raising  $w$  and lowering  $r$  in the north. As capital flows into the south,  $Y$  expands. Similarly a policy of import-substitution will automatically lead to an increase in the production of  $X$  in the south.

## SECTION - 3

## Conclusion

In a very simple framework we have tried to analyse the impact of conventional trade policies on aggregate unemployment in a typical LDC. The main results are that a tax on foreign capital may improve employment if the imported intermediate input in the south is capital intensive. Due to similar reasons import tariff on the final good may fail to push up total employment. One policy that we did not discuss in the paper may be an interesting extension of this model. Suppose the government gives a wage subsidy in the southern import good sector. This infact may lead to loss in total employment through a decline in the production of  $I$  if  $I$  is capital intensive. On the other hand a wage-subsidy in sector  $X$  will tend to boost up total employment. It is also to be noted that the north may have a specific factor type structure as developed by Jones (1971) in which  $I$  and  $Y$  use different capital input along with labor. Same type of results should be obtained if the capital which is used in  $I$  is also internationally mobile.

## Appendix

### A.1 Effect of a Tax on Foreign Capital

A positive tax is denoted by  $dt > 0$ . From equation (2) in the text we get,

$$\theta_{Ky}(\hat{r} + dt) + \theta_{sy}\hat{w}_s = 0 \quad (14)$$

Since  $r$  is determined by (3) and (4), from (14) we derive

$$\hat{w}_s = -dt \frac{\theta_{Ky}}{\theta_{sy}} \quad (15)$$

Now by the envelope property

$$\theta_{Ky}\hat{a}_{Ky} + \theta_{sy}\hat{a}_{sy} = 0 \quad (16)$$

and by CRS,

$$\hat{a}_{sy} - \hat{a}_{Ky} = -\sigma_y(\hat{w}_s - dt) \quad (17)$$

where  $\sigma_y$  is the elasticity of substitution between skilled labor and foreign capital.

From (16) and (17) we get,

$$\hat{a}_{Ky} = -\sigma_y dt \quad (18)$$

From (5) and (6) at given commodity prices,

$$\lambda_{KI}\hat{I} + \lambda_{Ky}^*\hat{Y}^* = -\lambda_{Ky}(\hat{a}_{Ky} + \hat{Y}) \quad (19)$$

$$\lambda_{LI}\hat{I} + \lambda_{Ly}^*\hat{Y}^* = 0 \quad (20)$$

Using (18), (7) in the text, (19) and (20) we get

$$\hat{I} = \frac{\lambda_{Ly}^*\lambda_{Ky}\sigma_y dt(\theta_{Ky} + \theta_{Sy})}{\theta_{Sy}|\lambda|} \quad (21)$$

From the fact that  $I$  has to be absorbed in  $X$  we get,

$$\hat{I} = \hat{X} \quad (22)$$

Following the text it is easy to show that

$$\begin{aligned} \hat{L}_c > 0 \quad \text{iff} \quad & \left[ \delta_1 \frac{\lambda_{Ly}^*\lambda_{Ky}\sigma_y dt(\theta_{Ky} + \theta_{Sy})}{\theta_{Sy}|\lambda|} - \delta_2 \frac{\theta_{Ky}}{\theta_{Sy}} \sigma_y dt \right] > 0 \\ \text{or,} \quad & \sigma_y dt \left[ \frac{\theta_{Ky}}{\theta_{Sy}} \left( \delta_1 \frac{\lambda_{Ly}^*\lambda_{Ky}}{|\lambda|} - \delta_2 \right) + \delta_1 \frac{\lambda_{Ly}^*\lambda_{Ky}}{|\lambda|} \right] > 0 \end{aligned} \quad (23)$$

Compare (23) with (13) in the text. (13) is a sufficient condition while (23) is a necessary condition. Since  $|\lambda| > 0$ , once (13) holds, (23) will automatically hold. Due to a tax at a given output of  $Y$ , a part of capital flies home as more of skilled labor is used in the south.

## A.2 A Tariff on $Y$

Follow exactly the same way as in A.1 except that the beginning change in price will favourably affect  $w_S$ .

## A.3 A Subsidy on $X$

Consider equation (1) in the text. Let  $ds > 0$  be the amount of per unit subsidy on  $X$ .

$$\text{Therefore,} \quad \hat{P}_I = \frac{ds}{\theta_{Ix}} \quad (24)$$

$$\text{Now, } \hat{a}_{Ix} = -\frac{\sigma_x \theta_{Lx}}{\theta_{Ix}} ds \quad (25)$$

where  $\sigma_x$  is the elasticity of substitution in sector  $X$  and  $\theta_s$  have usual interpretations. From (19), (20) and (24) we get,

$$\hat{I} = \frac{(\lambda_{Ly}^* \delta_K + \lambda_{Ky}^* \delta_L) \frac{ds}{\theta_{Ix} |\theta|} - \lambda_{Ky} \lambda_{Ly}^* \hat{Y}}{|\lambda|} \quad (26)$$

where  $\delta_K, \delta_L$  have similar interpretations as in Jones (1965). Since,

$$\hat{r} = \frac{\frac{ds}{\theta_{Ix}} \theta_{Ly}^*}{|\theta|}.$$

from (7), we get,

$$\hat{Y} = -\hat{a}_{Sy} = -\sigma_y \frac{ds}{\theta_{Ix} |\theta|} \theta_{Ly}^* \frac{(\theta_{Ky} + \theta_{Sy})}{\theta_{Sy}} \quad (27)$$

From (26) and (27)

$$\hat{I} = \left[ (\lambda_{Ly}^* \delta_K + \lambda_{Ky}^* \delta_L) + \lambda_{Ky} \lambda_{Ly}^* \sigma_y \theta_{Ly}^* \frac{(\theta_{Ky} + \theta_{Sy})}{\theta_{Sy}} \right] \frac{ds}{\theta_{Ix} |\lambda| |\theta|} \quad (28)$$

Note that as  $r$  goes up, capital flows out of the south. Therefore, beside the direct impact of an increase in  $P_I$ , there is also a Rybczynski type effect on the size of  $I$ .

Since,  $\hat{X} = \hat{I} - \hat{a}_{Ix}$  and  $\hat{a}_{Ix} = -\sigma_x \frac{ds}{\theta_{Ix}} \theta_{Lx}$

Where  $\sigma_x$  is the elasticity of substitution in sector  $X$ , one can write from (28)

$$\hat{X} = \left[ \frac{(\lambda_{Ly}^* \delta_K + \lambda_{Ky}^* \delta_L) + \lambda_{Ky} \lambda_{Ly}^* \sigma_y \theta_{Ly}^* \frac{(\theta_{Ky} + \theta_{Sy})}{\theta_{Sy}}}{|\lambda| |\theta|} + \sigma_x \theta_{Lx} \right] \frac{ds}{\theta_{Ix}} \quad (29)$$

Hence,

$$\hat{L}_e > 0 \quad \text{iff} \quad \delta_1 \hat{a}_{Lx} + \delta_1 \hat{X} - \delta_2 \sigma_y \frac{ds}{\theta_{Ix} |\theta|} \theta_{Ly}^* \frac{\theta_{Ky} + \theta_{Sy}}{\theta_{Sy}} \theta_{Ky} > 0$$

$$\begin{aligned}
\text{or, } \quad & \left[ \frac{\delta_1 (\lambda_{Ly}^* \delta_K + \lambda_{Ky}^* \delta_2)}{|\lambda| |\theta|} + \delta_1 \sigma_x \theta_{Lx} + \delta_1 \sigma_x \theta_{Ix} \right] \frac{ds}{\theta_{Ix}} \\
& + \sigma_y \frac{ds}{\theta_{Ix}} \theta_{Ly}^* \frac{\theta_{Ky} + \theta_{Sy}}{|\theta| \theta_{Sy}} \left[ \delta_1 \frac{\lambda_{Ky} \lambda_{Ly}^*}{|\lambda|} - \delta_2 \theta_{Ky} \right] > 0 \quad (30)
\end{aligned}$$

Note that (13) guarantees the validity of (30).

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$a_{Ly}^*$  - per unit requirement of labor for  $Y^*$   
 $a_{Ky}^*$  - per unit requirement of capital for  $Y^*$   
 $r$  - return to capital  
 $P_I$  - price of the intermediate input  
 $L_e$  - total employment in the south  
 $K$  - stock of capital  
 $S$  - given supply of skilled labor  
 $L^*$  - given supply of northern labor  
 $\hat{\cdot}$  - proportional change i.e.  $\hat{X} \equiv \frac{dX}{X}$

We assume that the production functions obey constant returns to scale and diminishing marginal returns to inputs. Markets are competitive. For simplicity we further assume that the foreign capital and skilled labor are substitutes in the production of  $Y$  and unskilled labor is required in fixed proportions. Though this is a simplifying assumption, it captures reality to some extent. Usually, highly unskilled human resource can only be poor substitute for more sophisticated inputs.

With these assumptions we can now describe the equations of the model.

Competitive equilibrium implies,

$$P_I a_{Ix} + \bar{w}_u a_{Lx} = P_x \quad (1)$$

$$r a_{Ky} + w_S a_{Sy} + \bar{w}_u a_{Ly} = P_y \quad (2)$$

$$r a_{Ky}^* + w^* a_{Ly}^* = P_y^* \quad (3)$$

$$r a_{KI} + w^* a_{LI}^* = P_I \quad (4)$$

Full employment conditions imply

$$a_{KI} I + a_{Ky} Y + a_{Ky}^* Y^* = K \quad (5)$$

$$a_{LI} I + a_{LI}^* Y^* = L^* \quad (6)$$