

## **Export Processing Zones, Backward Linkages and Unemployment**

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### **Abstract**

*This paper investigates the effects of export processing zones (EPZs) on factor rewards, national income and the output of the domestic intermediate good producing sector (backward linkage effect) in surplus-labor developing countries. It is shown that if the intermediate good is internationally traded, an increase in foreign capital investment in the EPZs will not change factor rewards and then national income irrespective of the existence of unemployment. It is also shown that, contrary to the conventional wisdom, an increase in foreign capital investment decreases production of the intermediate good and increases unemployment. The effects of factor accumulation on outputs and unemployment are also examined.*

- **JEL Classifications:** F22, O12
- **Key words:** Export processing zone, Backward linkage, Unemployment

### **I. Introduction**

Many emerging economies have intensively employed

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export processing zones (EPZs) or duty free zones (DFZs) to accelerate their development. These policies show considerable success as development strategies in those countries which include Kaohsiung (Taiwan), Masan (South Korea) and Maquiladoras (Mexico). The advantages of these policy options are as follows: (1) they introduce foreign capital which is scarce in those countries, (2) they introduce advanced technology in the host country, (3) they stimulate domestic sectors through (inter-industry) linkage effects, (4) they mitigate the balance of payment problem by increasing export earnings, and (5) they alleviate the problem of unemployment. On the other hand, advanced countries invest their capital in developing countries to enjoy their low wage rates, to circumvent the protective barriers of the invested countries, and to enjoy various fringe benefits which include a capital tax reduction, production and wage subsidies. Various aspects of DFZs and EPZs have been discussed by several trade theorists such as Hamada (1974), Rodriguez (1976), Hamilton and Svensson (1982), Young (1987, 1992), Young (1992), Young and Miyagiwa (1987), Beladi and Marjit (1992), Miyagiwa (1993) and Yabuuchi (1997).

Recently, Din (1994) presented an ingenious model which incorporates EPZs and an intermediate good-producing sector. He remarked that one of the major objectives for forming EPZs is to stimulate the domestic (primary) sectors through backward linkages. These linkages are established through the input-output relations between EPZs and domestic good-producing sectors. Din showed that if the intermediate good is internationally traded, then an increase in foreign capital investment in the EPZs (i.e., an establishment or an increase in the activity of the EPZs) has no effect on factor rewards and then national income, and it has harmful

(respectively beneficial) effect on the intermediate good-producing activities if the intermediate good sector is labor (respectively capital)-intensive.

By the way, EPZs are employed mainly by developing countries which are characterized by abundant labor and unemployment. Thus in this paper we focus our attention on another important objective of forming EPZs by incorporating urban unemployment into Din's full-employment model. We analyze the effects of EPZs on factor rewards, national income, unemployment and outputs. Our main findings are as follows. Suppose that all goods including the intermediate good are internationally tradable. An increase in foreign capital investment will not change factor rewards and then national income even if unemployment exists. Furthermore, it decreases the output of the intermediate good and increases unemployment. It is interesting that urban unemployment decreases if and only if employment in urban sectors (the domestic manufacturing sector and the EPZ) decreases. The effects of factor accumulation on the outputs and unemployment are also investigated.

The rest of the paper is organized as follows. Section 2 presents the model and basic assumptions. Section 3 examines the effects of EPZs on factor rewards, national income, the output of intermediate good and unemployment. Section 4 is devoted to the analysis of the relation between factor accumulation and unemployment. Finally, concluding remarks can be found in section 5.

## II. The Model and Assumptions

Let us consider a small open economy in which there are two zones: the domestic zone and the EPZ. The domestic zone: produces two goods,  $X_1$  and  $X_2$ , while the



$$P_3 = a_{L3}w_3 + a_{V3}s + a_{X3}P_1 \quad (6)$$

where  $a_{ij}$  is the amount of the  $i$ th factor used in the  $j$ th industry to produce one unit of the output,  $w_j$  is wage in the  $j$ th sector,  $r$  is rental of domestic capital,  $s$  is rental of foreign capital, and  $p_j$  is the price of the  $j$ th good ( $j=1,2,3$ ). We assume that all goods are tradable and then their prices are exogenously given.

In the standard Harris-Todaro (hereafter, H-T) model, it is assumed that the wage rate in (domestic manufacturing) sector 2 ( $w_2$ ) is rigid due to some political and/or institutional considerations while wage rate in (domestic primary) sector 1 ( $w_1$ ) is flexible. In this case, the rural-urban labor allocation mechanism is shown as

$$w_1 = w_2 L_2 / (L_2 + L_u) \quad \text{or} \quad w_1(1 + \lambda) = w_2 \quad , \quad (7)$$

where  $L_2$  and  $L_u$  are employed and unemployed labor in the urban area, respectively, and  $\lambda = L_u / L_2$ . In the labor market equilibrium, therefore, the rural wage rate ( $w_1$ ) equals the expected wage income in the urban manufacturing sector which equals the manufacturing wage rate ( $w_2$ ) times the probability of finding a job in the urban manufacturing sector ( $L_2 / (L_2 + L_u)$ ).

In the present model, we introduce EPZ in the rural area. The local government may induce foreign firms to the rural area where labor force is abundant and the wage rate is relatively cheap. However, this does not necessarily mean that the EPZ is located actually in the rural area. The important thing is that foreign firms in the EPZ can use domestic labor at the flexible rural wage since minimum wage laws are relaxed and labor union activities are restricted there. In this case, the labor allocation between the sectors is shown in Figure 1. The

figure incorporates the EPZ into the standard H-T labor allocation mechanism. In the figure,  $00'$  measures the endowment of labor,  $mm$ ,  $ee$ , and  $aa$  show the marginal value products of labor in the manufacturing sector, the EPZ and the primary sector, respectively, and  $qq$  is a rectangular hyperbola. Note that  $0\bar{w}_2AL_2$  equals  $OCDE$ . This shows the rural-urban labor allocation shown in (7). Thus, the standard H-T labor allocation mechanism holds between the rural and the urban areas also in the present set-up. The manufacturing sector employs  $0L_2$  at the fixed urban wage rate ( $\bar{w}_2$ ).  $EF$  is unemployed in the urban area. In the rural area,  $0L_1$  and  $EG$  are employed in the primary sector and the EPZ, respectively, at the rural equilibrium wage rate .

Exogenously given endowments impose the resource constraints,

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 + L_u = L \quad (8)$$

$$a_{k1}X_1 + a_{k2}X_2 = K \quad (9)$$

$$a_{v3}X_3 = V \quad (10)$$

where  $L$  and  $K$  are the endowments of labor and capital, respectively. This completes the specification of our model with the fixed endowment of factors and the internationally determined prices. We have seven unknown variables  $w_1$ ,  $r$ ,  $s$ ,  $X_1$ ,  $X_2$ ,  $X_3$  and  $L_u$  which are solved by seven equations (4)-(6) and (7)-(10) for given parameters,  $w_2$ ,  $P_1$ ,  $P_2$ ,  $P_3$ ,  $L$ ,  $K$  and  $V$ .

Following Khan (1980) and Neary (1981), I make the following assumption. The assumption is known as the stability condition in the mobile-capital H-T model.

**Assumption 1 (Stability).** Manufacturing sector 2 is capital-intensive relative to primary sector 1 in the value sense, i.e.,

$$rK_2/w_2L_2 > rK_1/w_1L_1 \text{ and } k_2 > (1+\lambda)k_1,$$

where  $k_j = K_j/L_j$ , ( $j=1,2$ ).

The assumption is not unrealistic and well known in the literature. This implies that the manufacturing sector 2 is capital-intensive relative to the primary sector 1 also in the physical sense, i.e.,

$$K_2/L_2 > K_1/L_1 \text{ and } \Lambda = \lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1} > 0$$

where the allocative share of the  $i$ th factor in the  $j$ th industry (e.g.,  $\lambda_{K2} = a_{K2}X_2/K$ ).

### III. EPZs and Linkages with Unemployment

#### A. Factor prices and national income

We analyze the effects of EPZ on factor prices and national income in the presence of urban unemployment. For the purpose, we will consider the change in foreign capital investment ( $V$ ). Note that our model is completely decomposable between the price side, eqs.(4)-(6), and the quantity side, eqs.(7)-(10). Therefore, factor prices are not affected by an increase in foreign capital investment because commodity prices and the urban manufacturing wage are fixed. This also implies that all input coefficients are fixed since they depend on factor prices. Thus the following result is immediate.

**Proposition 1.** An increase in foreign capital investment does not change the rural wage and rentals of domestic and foreign capital.

All good prices are constant because the goods are tradable and this country is small. Since the domestic manufacturing wage rate is fixed, the rental of

domestic capital is constant from (5). Then, the rural wage rate is also given through (4). Finally, (6) determines the rental of foreign capital. Therefore, an increase in foreign capital investment does not change the rural wage and rentals of domestic and foreign capital. This confirms the Din's result obtained in the model without unemployment.

Consider now the welfare effect of an increase in the activity of the EPZ. National income of the host country,  $y$ , is given by

$$y = w_1(L_1+L_3)+w_2L_2+rK, \quad (11)$$

where  $L_j = a_{Lj}X_j$ . Using the relation (7), (11) can be written as

$$y = w_1(L_1+L_2+L_3+L_u)+rK=w_1L+rK. \quad (12)$$

Since factor prices are not affected due to the increase in foreign investment, we have the following proposition.

**Proposition 2.** An increase in foreign capital investment does not change national income in the presence of unemployment.

This result holds even if unemployment changes. Under the assumption of H-T labor allocation mechanism, unemployed labor gets its subsistence income from relatives or friends, or they get their job by lottery every morning. Thus, each urban laborer obtains the expected wage on the average. Since the expected wage in the urban area is the same as the rural wage, every laborer obtains the same fixed wage rate in the economy as a whole. Therefore, national income does not change even if unemployment exists and changes due to the increase in foreign capital investment.

## B. Backward linkage effect

Now let us examine the effect of foreign capital inflow on the output of the intermediate good, that is, the backward linkage effect. Differentiating (7) - (10), we obtain

$$\begin{bmatrix} \lambda_{L1} & \lambda_{L2} & \lambda_{L3} & \lambda_u \\ \lambda_{K1} & \lambda_{K2} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & -\lambda w_1 \lambda_{L2} & 0 & w_1 \lambda_u \end{bmatrix} \begin{bmatrix} \hat{X}_1 \\ \hat{X}_2 \\ \hat{X}_3 \\ \hat{L}_u \end{bmatrix} = \begin{bmatrix} \hat{L} \\ \hat{K} \\ \hat{V} \\ 0 \end{bmatrix}. \quad (13)$$

Solving (13) for  $\hat{X}_1$  with respect to  $\hat{V}$ , we have

$$\hat{X}_1 / \hat{V} = -w_1 \lambda_u \lambda_{K2} \lambda_{L3} / \Delta, \quad (14)$$

where  $\Delta$  is the value of the determinant of the coefficient matrix of (13),

$$\Delta = \lambda_u (w_1 \lambda_{L1} \lambda_{K2} - w_2 \lambda_{K1} \lambda_{L2}) = w_1 \lambda_u \lambda_{L1} \lambda_{L2} (L/K) \{k_2 - (1 + \lambda)k_1\}.$$

It can be shown that  $\Delta$  is positive if the manufacturing sector is capital-intensive relative to the primary sector in the value sense (Assumption 1). Thus, the following proposition is immediate.

**Proposition 3.** An increase in foreign capital inflow decreases the output of the intermediate good.

Under the stability condition, the manufacturing good sector is capital-intensive relative to the primary (intermediate) good sector. An increase in foreign capital investment into the EPZ attracts labor from the domestic sectors. Therefore, the labor allocation reduces the output of the intermediate good sector and increases the output of the manufacturing sector through the Rybczynski effect. Thus, an increase in

foreign capital has a negative backward linkage effect in the present model.

**C. Unemployment**

Consider now the effect of EPZ on urban unemployment. Solving (13) for  $\hat{L}_u$  with respect to  $\hat{V}$ , we have

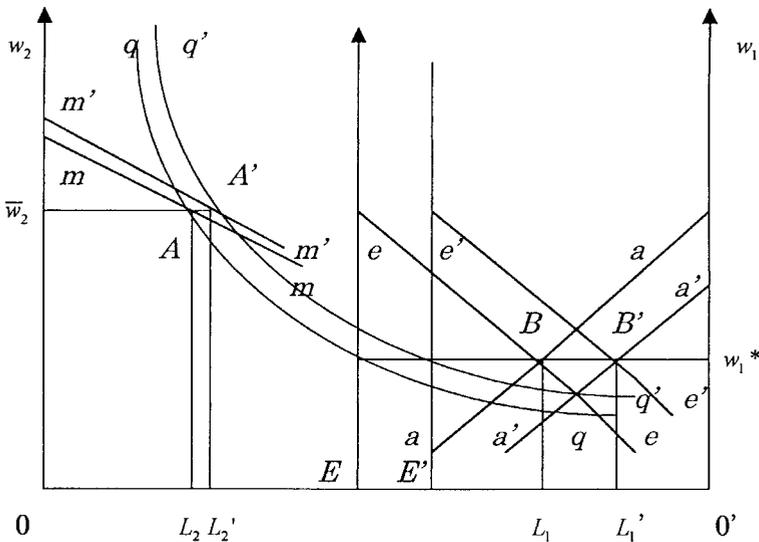
$$\hat{L}_u/\hat{V} = \lambda_{w_1}\lambda_{K1}\lambda_{L2}\lambda_{L3}/\Delta. \tag{15}$$

This suggests the following proposition.

**Proposition 4.** An increase in foreign capital investment increases unemployment.

This result is pessimistic contrary to the conventional wisdom that an inflow of foreign capital creates employment opportunity and alleviates the problem of unemployment. As shown in the previous proposition, foreign investment expands the manufacturing production, hence employment in the

**Figure 2.** The Effect of Capital Accumulation



manufacturing sector increases. This increase in urban employment increases the expected wage through the increase in the probability to get a job in the urban area, and attract labor from the rural area. If the rural wage increases owing to the withdrawal of labor, the labor movement will be limited to some extent. Since the rural wage does not change in the present situation, however, a large amount of rural labor moves into the city. As a result, some of the migrants cannot get their jobs and will be unemployed there, though total employment in the urban area increases. Thus, both employment and unemployment increase in the urban area. This can be seen also by differentiating (7).

$$(w_2 - w_1)dL_2 = w_1 dL_u. \quad (16)$$

Thus, this implies the following proposition.

**Proposition 5.** If employment in the urban manufacturing sector increases, urban unemployment increases, and vice versa.

This proposition has important policy implication for the policy makers of developing countries. They cannot reduce unemployment by increasing employment opportunity in the EPZ. Though foreign investment itself creates jobs in the EPZ, the harmful side effect is larger than the direct effect. Therefore, in order to alleviate the problem of unemployment, some other policies to keep labor in the agricultural sector must be considered.

#### IV. Factor Accumulation

Finally, let us examine the effects of factor accumulation on outputs and unemployment. From (13), we have the following results of comparative statics.

$$\hat{X}_1/\hat{L} = w_1\lambda_u\lambda_{K2}/\Delta > 0, \quad \hat{X}_2/\hat{L} = -w_1\lambda_u\lambda_{K1}/\Delta < 0. \quad (17)$$

and

$$\hat{X}_1/\hat{K} = -w_2\lambda_u\lambda_{L2}/\Delta < 0, \quad \hat{X}_2/\hat{K} = w_1\lambda_u\lambda_{L1}/\Delta > 0. \quad (18)$$

Thus, labor growth increases the output of the labor-intensive agricultural sector and decreases the output of the capital-intensive manufacturing sector. On the other hand, capital accumulation increases the output of the manufacturing sector and decreases the output of the agricultural sector. Therefore, the following proposition summarizes the results.

**Proposition 6.** In the presence of the EPZ and unemployment, the Rybczynski theorem holds under stability.

Equations (8) and (9) show that sectors 1 and 2 constitute a modified Hecksher-Ohlin world with the EPZ (sector 3) and unemployment. Therefore, the change in factor endowments has two effects on the outputs of the domestic sectors: the direct resource allocation effect and the indirect effect through the EPZ and unemployment. By the way, the change in factor endowment does not affect the employment in the EPZ ( $L_3$ ) when the wage rate is fixed. On the other hand, labor growth decreases unemployment and capital accumulation increases unemployment as shown below. Thus, the side effect through the change in unemployment enforces the direct effect of factor growth. If labor increases, available labor increases more than the initial increase in labor endowment since unemployment decreases. If capital increases, available labor decreases at the same time since unemployment increases. Therefore, the Rybczynski theorem holds *a fortiori*.

Solving (13) for  $\hat{L}_u$  with respect to factor changes, we have

$$\hat{L}_u/\hat{L} = (w_1 - w_2)\lambda_{K1}\lambda_{L2}/\Delta \quad (19)$$

and

$$\hat{L}_u/\hat{K} = (w_2 - w_1)\lambda_{L1}\lambda_{L2}/\Delta. \quad (20)$$

Thus we have the following proposition.

**Proposition 7.** Labor growth decreases unemployment and capital accumulation increases unemployment.

This result is rather paradoxical. It seems that, in labor-surplus developing countries, labor growth makes labor more redundant while capital accumulation creates more employment opportunity. In the present set-up, however, the results obtained are reversed. Labor growth expands the output of the labor-intensive (primary) sector 1 and reduces that of the capital-intensive (manufacturing) sector 2 through the Rybczynski effect. This attracts more labor into the rural sector than that released from the manufacturing sector since the primary sector is labor-intensive. Thus, labor growth reduces unemployment since some of the workers are supplied from the unemployment pool. On the other hand, capital accumulation increases the output of the capital-intensive manufacturing sector and decreases that of the labor-intensive primary sector. In the process, both labor and capital move from the agricultural sector to the manufacturing sector. A relatively large amount of labor is released from the primary sector owing to the difference in the factor intensity. This leads to an increase in unemployment.

Figure 2 shows the effect of capital accumulation. Capital accumulation shifts  $mm$  to  $m'm'$  and employment

in these sectors expand from  $0 L_2$  to  $0 L_2'$ . The marginal value product of labor in the primary sector decreases from  $aa$  to  $a'a'$  due to the reallocation of capital. The equilibrium is reestablished at point  $B'$ . Clearly,  $L_1L_1'$  is larger than  $L_2L_2'$ , hence unemployment increases as a result of capital accumulation and accompanying capital reallocation. The effect of labor growth is also explained similarly.

### **v. Concluding Remarks**

This paper has examined the effects of a formation or an expansion of EPZs on various aspects of developing countries in the presence of unemployment. We have shown that an increase in foreign capital investment leaves domestic factor rewards and then national income unchanged. Furthermore, it decreases the output of the intermediate good, and increases urban unemployment. It has also been shown that, contrary to the conventional wisdom, labor growth decreases unemployment while capital accumulation increases unemployment. Thus, in spite of favorable expectation by many developing countries, EPZs may have negative effects on national income, backward linkage and unemployment in an economy characterized by the EPZ and unemployment.

In this paper, we have focused our attention on the problem of unemployment in developing countries. It is noteworthy that both foreign capital investment and domestic capital accumulation increase unemployment in the present model with EPZ and unemployment. The important policy implication is that some other policies to expand the primary sector are required in order to alleviate the problem of unemployment.

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