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Free trade zones and employment in a structuralist macro model

Abstract

This paper examines the employment effects of creating Free Trade Zones (FTZs) for an economy with a demand constrained industrial sector and a supply constrained agricultural sector. Also, as protection of real wages of workers, indexed wages is considered. The results depict the interaction between neoclassical factor substitutability and effective demand constraints. The sources of expansionary effects and contractionary effects of creating FTZs are identified and separated. Our results suggest that formation of FTZs may not necessarily lead to increase in aggregate output and employment, even with overall unemployment in the economy. It is further shown that creation of FTZs does not necessarily lead to increase in employment there. Even if we assume that the FTZ expands, the rest of the economy can contract through reduction in effective demand arising out of reduced export competitiveness and also reduction in effective demand originating from the workers.

Keywords: free trade zones, second best, supply constraints, indexed wages, tariffs.

Introduction

The SEZ Act 2005 has generated a lot of discussion in India, in particular, on land acquisition issues and on whether the investment in such SEZs (Special Economic Zones) would be treated as exposure to the infrastructure sector for tax purposes. Reserve Bank of India Annual Report 2004-2005 explains the need for such SEZs and states "it is expected to facilitate large flow of foreign and domestic investment into the SEZs and contribute to improvements in infrastructure and productive capacity, generation of additional economic activity and creation of employment opportunities. The Act provides several incentives to reduce transaction costs and improve the competitiveness of exports. The Act, inter alia, provides for i) full income tax exemption to SEZ units for the first consecutive five years, and 50 per cent exemption for the next five years, and ii) exemption of SEZ units and developers from payment of customs duty on all imported inputs and excise duty on products sourced from the domestic market."

The existing literature on Special Economic Zones (SEZs) or Free Trade Zones (FTZs) has concentrated primarily on the second-best properties of creating such zones. That is, in the presence of distortions, both in the domestic (rigid wages) as well as in the trade (tariffs) fronts, creation of FTZs has been interpreted to be equivalent to a reduction in overall distortions. Economic welfare has been measured in terms of national income and creation of FTZs involves reduction in tariffs on intermediate input imports into this zone. Young (1987) showed that such an expansion reduces economic welfare. On the other hand, Young and Miyagiwa (1987) show, that in the presence of Harris-Todaro type of unemployment, such expansion in FTZs is necessarily welfare improving. Datta Chaudhuri and Adhikari (1993) generalize this result by showing that if domestic capital is mobile between the rural and the urban sectors, then such expansion is not necessarily welfare improving. Beladi and Marjit (1992a, 1992b) show that expansion of export processing zones through increased inflow of foreign capital to these zones may not be welfare improving for an economy following a protectionist policy, both in the presence of full-employment and unemployment. Adhikari and Datta Chaudhuri (2000) analyze the effects of creating free trade zones on the intensity of the foreign exchange constraint and employment and welfare for an economy that is demand constrained at home and faces adverse export demand elasticities for its traditional exports.

A recent book by Bhaduri (2006) brings together some of his papers on unemployment and strategies for growth of developing economies. He employs the Keynes-Kalecki framework of analysis to demonstrate the impact of macroeconomic policies on income and unemployment and goes on to show the problems such economies could face if certain structural characteristics of these economies are not taken into consideration. These papers bring out the role of the government vis-à-vis the market, the importance of the national market over the international market and the role of agriculture vis-à-vis industry in the development process.

The book mentions that one of the major arguments raised against the Keynesian framework is that it is defined for a closed economy. The option of economic expansion through accessing the foreign markets was not explored. Many developing economies, in particular the South Asian ones, have shown that export led growth is indeed possible. However, Bhaduri argues that attempts towards export competitiveness might lead to labor displacement and contraction in the domestic market size. The depressing effects may outweigh the expansionary effects.

The present paper tries to formalize the Bhaduri line of reasoning to examine the effects on aggregate employment of an economy trying to boost export

earnings through the formation of FTZs, which faces a demand constrained industrial sector and a supply constrained agricultural sector. As protection of real wages of workers, indexed wages is considered. The sources of the expansionary effects and contractionary effects of creating FTZs are identified and separated. Accordingly, the plan of the paper is as follows. Section 1 develops the model. The effects of creating FTZs on domestic employment are examined in Section 2. Section 3 concludes the paper.

1. The model

We consider a small open economy producing three goods: two industrial goods *f* and *u*, and an agricultural good *r*. Goods *u* and *f* are traded and good *r* is non-traded. The entire output of good *f* is exported. Good *f* is produced in the FTZ with labor, foreign capital and an imported intermediate input *M*. Good *u* is produced with labor, domestic capital and *M*. Whereas labor and *M* are assumed to be perfectly mobile across sectors *u* and *f*, capital is assumed to be sector-specific. We assume that agricultural output is given for the period under consideration and the domestic industrial sector is demand constrained.

Since the country is small in *f*, the price of *f* is taken as unity. Further, the nominal exchange rate (e) is assumed to be fixed and also set at unity. Assuming constant returns to scale in production, we can then write down the zero profit condition in sector *f* as

$$1 = C_f(W, R^*, 1+T_f), \tag{1}$$

where W is the nominal wage rate, R^* is the return to foreign capital, T_f is the tariff rate on M in the FTZ, and C_f is the unit cost function.

Let C_{Kf}, C_{Lf} and C_{Mf} be the unit requirements of foreign capital, labor and M respectively in sector *f*. By the Shepherd-Samuelson relations, these can be obtained by differentiating the unit cost function with respect to the corresponding factor prices. As in Young (1987) we assume that there is an upward sloping supply curve $K^*(R^*)$ of foreign capital, i.e. $\delta K^*/\delta R^* > 0$. Full employment of foreign capital implies that

$$C_{Kf} X_f = K^*(R^*), \tag{2}$$

where X_f is the output of good *f*, entirely exported.

As sector *u* is demand-constrained, in the presence of excess capacity we assume that the price of good *u*, P_u, is fixed by applying a mark-up over unit costs, i.e.,

$$P_u = (1+q)\{WC_{Lu} + (1+T_u)C_{Mu}\}, \tag{3}$$

where q is the given mark-up rate, T_u is the tariff rate on M in u, C_{Lu} and C_{Mu} are the fixed unit requirements of labor and M in X_u respectively.

For simplicity we assume that all tariff revenues and profit incomes are saved and are immediately invested, and workers spend all their income on goods *u* and *r*. Let the workers' spend a fixed proportion, α, of their income on good *r*, i.e.,

$$P_r \bar{X}_r = \alpha WL, \tag{4}$$

where $\bar{X}_r$ is the output of good *r*, assumed to be fixed.

$$L = L_u + L_f \tag{5}$$

is the total employment of the economy, L_u (= $C_{Lu}X_u$) and L_f (= $C_{Lf}X_f$) being the employment in sectors *u* and *f* respectively.

Effective demand for good *u* comprises consumption demand of the workers, profit-earners and agricultural landlords, export-demand and autonomous investment demand for this good. Since workers do not save, they spend $(1-\alpha)WL$ on good *u*. Thus effective demand for good *u* is given by

$$X_u^d = (1-\alpha)WL/P_u + sR_u/P_u + P_rX_r/P_u + E_u + \bar{I}, \tag{6}$$

where R_u (= $q\{WC_{Lu} + (1+T_u)C_{Mu}\}X_u$) is the income of the profit-earners and s is their savings propensity, E_u is export demand, and $\bar{I}$ is real autonomous demand for good *u*. P_rX_r is the income of the landlords.

Market equilibrium in good *u* requires

$$X_u = X_u^d. \tag{7}$$

As argued by Bhaduri, no development process can ignore the welfare of workers, and in that context money wage rate is assumed to be indexed to the agricultural price and industrial price. That is

$$W = aP_r + bP_u, \tag{8}$$

where $0<a<1$ and $0<b<1$ are constants.

The solution of the system proceeds as follows. For a given value of P_r, equations (3) and (8) simultaneously solve for W and P_u. Equation (1) then solves for R^*. Since factor prices are known, techniques are known and from equation (2) we get X_f and hence L_f. Substituting equations (5) and (7) in equation (6), along with equation (4), solve for P_r and X_u. The model brings out the simultaneity of the economic forces as domestic considerations determine the returns to foreign capital, which in turn determines capital inflow. This capital inflow determines the size of the FTZ and the level of employment in that sector, which have a bearing on the levels of output, employment and prices in the rest of the economy.

2. The employment effects of creating FTZs

In this section we shall examine the employment effects of creating an FTZ. This is done in four steps. First, the effect of reducing tariffs on the imported input entering the FTZ, on FTZ output, is derived. Given the structure of our model, the results will depend on neo-classical factor substitutability conditions. Second, the effect of the above policy measure, on agricultural prices, is determined. This is required to determine the wage effects of such expansion in the FTZ, as workers wage protection has been assumed and agriculture is supply constrained. Third, the impact of reduction in tariffs and consequent change in agricultural and industrial prices on wages is estimated and the combined effect on employment in the FTZ is determined. In the last step, the effects on output of the traditional domestic demand constrained industrial sector, is determined. This will depend on both expansion/contraction in the FTZ and also on wage-price movements, as both domestic effective demand and export demand, will be affected.

From the model laid in Section II, given P_r,

$$P_u = \alpha_1 P_r + \alpha_2, \tag{9}$$

where $\alpha_1 = (1+q)aC_{Lu}/\{1-(1+q)bC_{Lu}\}$ and $\alpha_2 = (1+q)\times$ $\times C_{Mu}(1+T_u)/\{1-(1+q)bC_{Lu}\}$,

$$W = \beta_1 P_r + \beta_2, \tag{10}$$

where $\beta_1 = a/\{1-(1+q)bC_{Lu}\}$ and $\beta_2 = b(1+q)\times$ $\times C_{Mu}(1+T_u)/\{1-(1+q)bC_{Lu}\}$.

Substituting equations (5), (9) and (10) in equation (4) we get

$$P_r X_r = \alpha(\beta_1 P_r + \beta_2)(C_{Lu}X_u + C_{Lf}X_f). \tag{11}$$

Again, substituting equations (4), (5), (9), (10) in (6) and (7) and multiplying throughout by P_u yields

$$\begin{aligned}&(\alpha_1 P_r + \alpha_2)(X_u - I - E_u) - (\beta_1 P_r + \beta_2)\times\\ &\times(C_{Lu}X_u + C_{Lf}X_f) - (1-s)q\times\\ &\times\{WC_{Lu} + (1+T_u)C_{Mu}\}X_u = 0.\end{aligned} \tag{12}$$

Total differentiation of equation (1) yields

$\theta_{Lf}\hat{W} + \theta_{Kf}\hat{R}^* + \theta_{Mf}\hat{T}_f = 0$, where $\hat{x} = dx/x$ for any variable $\hat{x}$, $T_f = dT_f/(1+T_f)$ and θ_{if} is the share of the i^{th} factor in total cost of sector f.

Since

$$\hat{W} = \frac{\beta_1 P_r \hat{P}_r}{W}$$

$$\hat{R}^* = -(\theta_{Lf}\hat{W} + \theta_{Mf}\hat{T}_f)/\theta_{Kf} = -(\frac{\theta_{Lf}\beta_1 P_r \hat{P}_r}{W} + \theta_{Mf}\hat{T}_f)/\theta_{Kf}.$$

We thus have three equations (2), (11) and (12) in three unknowns P_r, X_f, X_u, total differentiation of which yields

$$\begin{pmatrix} A_{11} & 1 & 0 \\ A_{21} & -\mathrm{WL_f} & A_{23} \\ A_{31} & \mathrm{WL_f} & \mathrm{WL_u} \end{pmatrix}\begin{pmatrix} \hat{P}_r \\ \hat{X}_f \\ \hat{X}_u \end{pmatrix} = \theta_{Mf}\begin{pmatrix} B \\ WL_f(S_{ML} - S_{KL}) \\ -WL_f(S_{ML} - S_{KL}) \end{pmatrix}\hat{T}_f$$

or $Ax = Z$, $A_{11} = \dfrac{\theta_{Lf}\beta_1 P_r}{\theta_{Kf}W}\left\{(1-\theta_{Mf})S_{KL} + \theta_{Mf}S_{MK} + e_k\right\}$,

and $e_k = = dK^*/dR^*.R^*/K^*$ is positive.

If all factors of production are substitutes in the FTZ, then $A_{11} > 0$.

$A_{21} = \beta_1 P_r\{L_f(K\text{-}1) - (1+q)C_{Lu}E_u(1+\zeta)\}$, where $\zeta = E_u' P_u/E_u$ (< 0) is price-elasticity of demand for exports of good u, and $K = (1-\theta_{Mf})S_{KL} + \theta_{Mf}S_{ML}$,

$A_{23} = sqWL_u + (1+sq)M_u(1+T_u) > 0$, $A_{31} = -\{\beta_2 L + + \beta_1 L_f P_r K\} < 0$, $B = -\{(1-\theta_{Lf})S_{MK} + \theta_{Lf}S_K + e_k\}/\theta_{Kf}$.

It can be checked that $|A| < 0$ if A_{21} is positive. A rise in W increases wage income of the workers in the FTZ given L_f. This increase in W also leads to a substitution away from labor reducing wage income given W and X_f. Further, a rise in W raises P_u and export earnings for good u increases when export demand is inelastic. $A_{21} > 0$ implies that when W rises (falls), the rise (fall) in wage income for increase (decrease) in W and increase (decrease) in export earnings is less than decrease (increase) in wage income for substitution away from (towards) labor. We shall assume that $A_{21} > 0$.

Equation (1) shows that given W, a reduction in T_f raises R^* and C_{Kf} falls. But supply of capital, K^* increases with increase in R^*. For both reasons X_f would increase (equation (2). Now, for a given W, a reduction in T_f decreases C_{Lf}. Since $L_f = C_{Lf}X_f$, L_f can increase or decrease.

If L_f increases then the demand for the agricultural good increases and since this sector is supply constrained, price of good r will increase. The rise in P_r increases W through indexation and P_u through the mark-up rule. This rise in P_u again exerts upward pressure on W through wage indexation. This will exert contractionary force on X_f as C_{Kf} will increase. If L_f decreases, then demand for and hence price of good r decreases. As a result W, and P_u, and again W will fall. This will exert expansionary force on X_f as C_{Kf} will be reduced. The final impact on X_f depends on the extent of substitutability among different factors of production in the FTZ.

The effect of reduction in T_f on X_f is given by

$$\hat{X}_f / \hat{T}_f = \frac{\theta_{Mf}}{|A|}\left[A_{11}WL_f(S_{ML} - S_{KL})(1+sq)P_u X_u / (1+q) + B\{A_{31}A_{23} - A_{21}WL_u\}\right].$$

We thus have

Proposition 1

1. *A move towards FTZ increases output there if* $S_{KL} < S_{ML}$ *or if* $S_{KL} > S_{ML}$ *and* $A_{11}WL_f \left|S_{ML} - S_{KL}\right| (1+sq)P_u/(1+q) < \left|B\right| \{A_{31}A_{23} - A_{21}WL_u\}$.
2. *A move towards FTZ decreases output there if* $S_{KL} > S_{ML}$ *and* $A_{11}WL_f \left|S_{ML} - S_{KL}\right| (1+sq)P_u/(1+q) > \left|B\right| \{A_{31}A_{23} - A_{21}WL_u\}$.

The effects of reduction in T_f on X_f comprises the following effects: First, increase in K^* due to increase in R^* given W; second, decrease in C_{Kf} due to substitution of M and L for Capital given W; third, further decrease in C_{Kf} as substitution of M for L leads to fall in employment in the FTZ to some extent and reduces demand for and hence price of good r to fall which reduces W; and fourth, increase in C_{Kf} as increase in employment caused by increase in output of the FTZ increases demand for and hence price of good r, which raises W and leads to substitution of K for L. Now if the extent of substitutability between M and L is greater than that between K and L (third effect dominates over the fourth) then X_f increases; if the expansionary effects (first, second, third) dominate over (are dominated by) the contractionary effect (fourth) then X_f increases (decreases) [Proposition1].

Special case

If $S_{ML} = S_{KL}$ or $S_{KL} = 0$, then a move towards an FTZ necessarily increases output there.

As a special case if we assume that $S_{KL} = 0$, then due the increase in W, C_{Kf} would not increase. So output of the FTZ necessarily increases. Similarly, if the extent of substitutability between K and L is equal to that between M and L then the fall in C_{Kf} due to fall in W will be equivalent to the rise in C_{Kf} due to rise in W. Hence output of the FTZ will necessarily increase.

The effect of reduction in T_f on P_r is given by

$$\hat{P}_r / \hat{T}_f = \frac{\theta_{Mf}\theta_{Lf}X_f X_u(1+sq)P_u}{\theta_{Kf}(1+q)|A|}\{(1-\theta_{Lf})S_{MK} + \theta_{Lf}S_{Kl} + e_k + \theta_{Kf}(S_{KL} - S_{ML})\}.$$

We thus have

Proposition 2

1. *A move towards FTZ increases the price of the agricultural good if* $S_{ML} < S_{KL}$ *or* $(1-\theta_{Lf})S_{MK} + \theta_{Lf}S_{KL} + e_k + \theta_{Kf}(S_{KL} - S_{ML}) > 0$.
2. *A move towards FTZ decreases the price of the agricultural good if* $(1-\theta_{Lf})S_{MK} + \theta_{Lf}S_{KL} + e_k + \theta_{Kf}(S_{KL} - S_{ML}) < 0$.

Suppose that Proposition 1 holds. Then the effects of reduction in T_f on P_r are the following: first, increase in demand for good r due to increase in X_f and employment of the FTZ; second, increase in demand for good r due to substitution of L for K; third, decrease in demand for good r for substitution of M for L. If the expansionary forces dominate over (are dominated by) the contractionary force then P_r increases (decreases) [Proposition 2].

Special case

If $S_{ML} = S_{KL}$ or $S_{ML} = 0$, then a move towards an FTZ necessarily increases the price of the agricultural good.

If $S_{ML} = 0$, then P_r necessarily increases; if $S_{ML} = S_{KL}$ then the increase in demand for good r due to substitution of L for K will compensate the decrease in demand for good r for substitution of M for L. Therefore, P_r necessarily increases.

It is noted that when X_f increases, L_f can increase or decrease.

We have $\hat{L}_f / \hat{T}_f = \hat{C}_{Lf} / \hat{T}_f + \hat{X}_f / \hat{T}_f$, and

$$\hat{C}_{Lf} / \hat{T}_f = -\theta_{Kf} K\beta_1 P_r / W.\hat{P}_r / \hat{T}_f + \theta_{Mf}(S_{ML} - S_{KL}).$$

Suppose that Proposition 1 holds i.e., $\hat{X}_f / \hat{T}_f < 0$.

Now if $S_{ML} < S_{KL}$, then $\hat{P}_r / \hat{T}_f < 0$ and $\hat{C}_{Lf} / \hat{T}_f >$ or < 0. If $S_{ML} > S_{KL}$ and $\hat{P}_r / \hat{T}_f < 0$, then $\hat{C}_{Lf} / \hat{T}_f > 0$. So $\hat{L}_f / \hat{T}_f >$ or < 0.

Proposition 3

1. *A move towards an FTZ increases employment there if Proposition 1(1) holds and* $\hat{C}_{Lf} / \hat{T}_f < 0$.
2. *A move towards an FTZ decreases employment there if Proposition 1(2) holds and* $\hat{C}_{Lf} / \hat{T}_f > 0$.

When output of the FTZ increases due to fall in T_f, employment in the FTZ would increase; a rise in R^* leads to substitution of labor for capital, and the reduction in T_f would lead to substitution away from labor. Again, increase in employment would raise the price of the agricultural good and that would raise W through indexation. This would lead to further substitution away from labor. Therefore the

final impact on L_f is determined by the relative strengths of these effects.

Special case

If $S_{ML} = S_{KL}$, then employment in the FTZ will increase (decrease) due to reduction in T_f when $\left|\hat{X}_f / \hat{T}_f\right|$ is greater (less) than $\hat{C}_{Lf} / \hat{T}_f$.

It is noted that if $S_{ML} = S_{KL}$, then a reduction in tariff in the FTZ raises the price of the agricultural good and hence the wage rate by indexation. Hence, there will be substitution away from labor. On the other hand, when $S_{ML} = S_{KL}$ output necessarily increases in the FTZ. Now employment will increase (decrease) if the effect of increase in output is greater (less) than the effect of substitution.

The effect of reduction in T_f on the output of the domestic sector, X_u is given by

$$\hat{X}_u / \hat{T}_f = \frac{-\theta_{Mf}}{\theta_{Kf}} WL_f \left[\left\{(1-\theta_{Lf})S_{MK} + \theta_{Lff} S_{KL} + e_k\right\} + \theta_{Kf} \times \right.$$
$$\left. \times (S_{KL} - S_{ML})\right]\left[WL_f + \beta_2 L_u + \beta_1 P_r (1+q) C_{Lu} E_u (1+\xi)\right] A.$$

We thus have

Proposition 4

1. *A move towards FTZ leads to expansion of the domestic sector if Proposition 3(1) holds and* $\zeta < 1$.
2. *A move towards FTZ leads to contraction of the domestic sector if Proposition 3(1) holds and* $\zeta < 1$.

Suppose that Proposition 3(1) holds. If P_r increases then W increases. This on the one hand leads to increase in income of workers in the FTZ given the level of employment and increase in export earnings for the domestic sector (as $\zeta < 1$); on the other, it leads to substitution away from labor and hence decrease in employment in the FTZ, given the level of output. But since we have assumed that the first effect will be dominated by the second ($A_{21} > 0$) effective demand and hence output (and hence employment) of domestic sector will decrease [Proposition 4 (2)].

Suppose that Proposition 3(2) holds. If P_r decreases then W falls. This on the one hand leads to decrease in income of workers in the FTZ given the level of employment and decrease in export earnings for the domestic sector (as $\zeta < 1$); on the other, it leads to substitution of labor and hence increase in employment in the FTZ. But since we have assumed that the first effect will be dominated by the second ($A_{21} > 0$) effective demand and hence output (and hence employment) of domestic sector will increase [Proposition 4 (1)]

Special case

If $S_{ML} = S_{KL}$ or $S_{ML} = 0$, then a move towards an FTZ leads to contraction of the domestic sector if $\zeta < 1$.

If $S_{ML} = S_{KL}$ or $S_{ML} = 0$, then a move towards an FTZ necessarily increases the price of the agricultural good. Then W increases by indexation. Since $A_{21} > 0$ domestic effective demand will decrease. Again a rise in W increases P_u. If $\zeta < 1$, then export revenue for good u will fall. So output of the domestic sector falls.

Concluding remarks

This paper examines the employment effects of creating a SEZ/FTZ in an economy, where the domestic industrial sector is demand constrained and agriculture is supply constrained. The terms of trade effects of creating such a zone are incorporated through wage indexation and the role of export demand elasticities is also examined. On the whole, a model is developed incorporating elements of the literature on second best and Keynesian macroeconomics. The philosophy behind setting up of SEZs is that they are supposed to compensate for the distortions generated by the structural constraints in the rest of the economy. However, our results suggest that formation of SEZs may not necessarily lead to increase in aggregate output and employment, even with unemployment in the economy. It is shown that, on one hand, creation of SEZs itself does not necessarily lead to increase in employment there. This is because of input substitutability and indexed wages. On the other hand, even if we assume that the SEZ expands, the rest of the economy can contract through reduction in effective demand arising out of reduced export competitiveness and also reduction in effective demand originating from the workers. Further, special cases on substitutability of factors in the FTZ show significant results. For example, if the imported input and labor are not substitutable or the extent of substitutability between imported input and labor, and that between capital and labor are equal, then the FTZ necessarily expands whereas the domestic sector necessarily contracts if export demand for the domestic sector is inelastic.

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