The linear program, which we now have to solve to find India's domestic expansion factor is

max $e\ y\ d$

subject to

(9) $(I - A)x = yd + z$

(10) $kx = K,\ lx = L$

where d is the level of final consumption in India and z the full net exports vector of India.

The solution to this linear program yields

(11) $d = 1.37$

We likewise solve a linear program to obtain the domestic expansion factor for Bangladesh. The linear program is, with * denoting Bangladesh,

max $e\ y^*\ d^*$

subject to

(12) $(I - A^*)x^* = y^*d^* + z^*$

(13) $k^*x^* = K^*,\ l^*x^* = L^*$

From the solution we obtain

(14) $d^* = 1.37$

Given the results in (11) and (14) we obtain that the efficiency gains of India and Bangladesh due to the elimination of domestic waste of resources are 37% for both the economies.

Given (8), (11) and (14), it follows that out of 43% of efficiency gains of India 6% can be ascribed to its free trade with Bangladesh while for Bangladesh out of 97% of efficiency gains 60% is due to free trade with India. Hence, while the extent of India's gains from bilateral trade with Bangladesh is just 6% that of Bangladesh due to bilateral trade with India is as large as 60%.

Thus, we have obtained the comparative advantages of the two economies on the basis of their endowments, technology and preferences-the fundamentals of an economy according to the neoclassical school of thought. However, having developed this model, it is also possible to find out how far endowments alone are important in

deciding the comparative advantages of the economies and hence test for the Heckscher-Ohlin line of thought. This can be done by holding technology and tastes constant across the economies. Let, for the time being the assumption be that each economy has free access to the other economy's technology and there is substitutability in the mean consumption vector of either economy. Given these new set of assumptions the model presented is now modified, with each economy being endowed with a free access to each other's technology in production and consumption in taste. This yields the model of super free trade, which is developed in the following section.

6. The Super-Free Trade Model

The modifications in the original model of Section 3 that will yield the super free trade model are as follows:

- the Indian net output **(I-A) x** in equations (1) and (3) in the Section 3 is replaced by **(I-A) x + (I-A*) χ**, so that any gross output component can be generated by activity $\mathbf{x}_i$ i.e. by a column of Indian input-output coefficient matrix **A** or activity χ i.e. by a column of Bangladesh's input-output coefficient **A***
- similarly, net output vector of Bangladesh **(I-A*) x*** is replaced by **(I-A*) x*+ (I-A) χ***
- the Indian capital requirements are bounded by **kx + k*χ < K** instead of **kx < K**
- similarly, Bangladesh's capital requirements are bounded by **k*x* + k χ* < K*** instead of by **k*x* < K***
- the Indian labour requirement is bounded by **lx +l* χ < L** instead of **lx < L** and that for Bangladesh is modified as **l* x* + l χ* < L***
- variable **c** in equation (1) is replaced by **c + c**
- Indian consumers are now, indifferent between Indian final consumption **y** and Bangladeshi **($e^T y$/ $e^T y^*$) y^*** where the latter is scaled up to the Indian level, while, the Bangladeshi's are now indifferent between

Bangladesh's final consumption y^* and **($e^T y^*$/ $e^T y$) y** $\hat{c}^*$. Thus, **yc** and **y*c*** in equation (2) and (3) is replaced by **{yc + ($e^T y$/ $e^T y^*$) y^* $\hat{c}$ }** and **{ y^*c^* + ($e^T y^*$/ $e^T y$) y $\hat{c}^*$ }** respectively.

- The scanning variable **γ = (c^*+ $\hat{c}^*$)/ (c + $\hat{c}$)** now instead **of γ = c^*/ c** as before.

Thus, formally the super free trade model may be presented as,

$$Max\ e^T y\ (c + \hat{c}) + e^T y^*\ \gamma\ (c + \hat{c})$$

$$x, \chi, x^*, \chi^*, c, \hat{c}, c^* >= 0$$

subject to the following constraints. For tradable commodities:

$$(I\text{-}A)\ x + (I\text{-}A^*)\ \chi + (I\text{-}A^*)\ x^* + (I\text{-}A)\ \chi^* >=$$

$$yc + (e^T y/\ e^T y^*)\ y^*\ \hat{c} + y^*c^* + (e^T y^*/\ e^T y)\ y\ \hat{c}^* + z + z^* \quad (15)$$

with $\hat{c}^*$ being determined by

$$(c^* + \hat{c}^*) = \gamma(c + \hat{c}) \quad (16)$$

for non-tradable commodities:

$$(I\text{-}A)\ x + (I\text{-}A^*)\ \chi \geq yc + (e^T y/\ e^T y^*)\ y^*\ c \quad (17)$$

$$(I\text{-}A^*)\ x^* + (I\text{-}A)\ \chi^* \geq y^*c^* + (e^T y^*/\ e^T y)\ y\ c^*$$

and for factor inputs:

$$kx + k^*\chi \leq K,$$

$$lx + l^*\chi < L \quad (18)$$

$$k^*x^* + k\chi^* < K^*$$

$$l^*x^* + l\chi^* < L^*$$

The linear program presented here yields a model of so called super free trade between India and Bangladesh with each economy having free access to each other's technology in production and consumption.

The pattern of trade obtained from this super free trade model is presented in the table below. The table also contains figures for observed trade and free trade in order to facilitate the comparison of the trade patterns between the two economics of India and Bangladesh in the three different situations.

As noted from Table 6.4 below the comparative advantages of India in Manufacturing, Chemicals, Machinery and Services persist when technology differences in production and consumption are eliminated, but now with technology being the same across the two economies India gains comparative advantage on some additional goods. They are—Livestock, fishing and forestry; Other food; Electricity and gas. All of these three goods were produced by Bangladesh under free trade. Though Bangladesh loses its comparative advantage on these goods given a uniform technology for the two economies, it gains advantage in the production of Agriculture and Textile which otherwise with free trade were being produced by India.

TABLE- 6.4

SUPER FREE TRADE FROM INDIA TO BANGLADESH CONTRASTED WITH ACTUAL AND FREE TRADE FIGLIRES.

(RS. MILLION)

Sectors	Actual net exports of India to Bangladesh	Free net exports of India to Bangladesh	Net super free exports of India to Bangladesh
1. Agriculture	169	148965	-526904.39
2. Livestock, fishing and forestry	1284	-499413	75672.31
3. Other food	1410	-550696	21536.67
4. Textile	59	43396	-359779.1
5. Manufacturing	889	185408	194328.06
6. Chemicals	-64369	52667	55505.21
7. Machinery	943	17248	36117.96
8. Construction	0	0	0

(Continued to page 188)

Sectors	Actual net exports of India to Bangladesh	Free net exports of India to Bangladesh	Net super free exports of India to Bangladesh
9. Electricity & gas	-434528	-328174	35236.84
10. Services	-481	435901	231512.71

Note: Actual Net Exports are at observed prices and Free and Super free Net Exports are at endogenous prices.

Thus, the comparative advantage of the economy of Bangladesh for all of Livestock, fishing and forestry; Other food & Electricity and gas are determined by technology. However, since there is no good for which Bangladesh retains its comparative advantage under super free trade as under free trade, there is no good for which endowment determines the economy's comparative advantage.

On the other hand, India's comparative advantage in Agriculture and Textile whose production are now picked up by Bangladesh is due to technology while endowments are responsible for India's comparative advantage in the goods, like Manufacturing, Chemicals, Machinery and Services, in which the country retains its advantage even when technology differences are leveled out. Hence, being endowed with the scope to adopt India's technology Bangladesh picks up the production of the two goods-Agriculture and Textile for which India's comparative advantage is solely due to its technology while India will pick up the production of three goods- Livestock, fishing and forestry; Other food & Electricity and gas from Bangladesh under super free trade.

7. Concluding Remarks

Given the present global scenario it is absolutely necessary for the countries of South Asia to build up economic cooperation for the sake of their own economic development and survival. This is a historical necessity.

However, as regards the two neighboring countries of India and Bangladesh the need for fostering bilateral economic cooperation between the two nations is far greater. Efforts for sub regional cooperation and integration seem more pragmatic for fast track development as this will increase the economic lot of the people in general.

Hence in this paper we try to address the issue of formation of a sub-regional cooperation involving India and Bangladesh and to analyze it empirically which will help either economy to move a long way on the path of development.

We develop a model in an input-output linear programming framework. The solution to the model confirms that most trade directions between India and Bangladesh conform to the comparative advantages of the Indian economy vis-à-vis Bangladesh. This pertains to the Indian exports in Agriculture, Textile, Manufacturing and Machinery and to the Bangladesh exports in Electricity and gas. There are few reversals that might be expected under free trade. Chemicals and Services are exported by Bangladesh, but the comparative advantage rests in India. The model reveals that Bangladesh should rather export in Livestock, fishing and forestry, as well as in Other food, two of the three sectors where bilateral trade has not taken place. India should pick up the third: Services. We estimate the gains from free bilateral trade to the economy of Bangladesh due to free trade with India as high as 60%, while India would make only a small gain of 6%.

The model of super free trade developed in Section-6 further enables one to find out the relative importance of the determinants of comparative advantages of the two economies. By holding technology in production and consumption constant across the two economies we have been able to separate out those goods in whose production an economy has a comparative advantage solely due to its technology from those goods for which the comparative

advantage is brought about by endowments of the economy. While there is no good for which endowments determine comparative advantage for Bangladesh, its technology determines the comparative advantage in three goods-Livestock, fishing and forestry; Other food & Electricity and gas. For India, on the other hand, endowments are responsible for India's comparative advantage in the goods, like Manufacturing, Chemicals, Machinery and Services and technology determines that for Agriculture and Textile.

This model also helps to highlight the role of international trade as a medium of transferring technology between the nations. Here, the relatively less developed economy Bangladesh not only gains in terms of access to greater volume of goods and services by entering into free trade with its relatively developed partner India, but it also gets an opportunity to use India's technology to its advantage in a number of cases. As obtained from Table 6.4, given free access to technology Bangladesh gains comparative advantage in the production of even agricultural and textile goods which it otherwise could not have gained with its own technology under perfectly competitive free trade conditions.

APPENDIX: DATA

The data required for our empirical work was not available in the desired form and as such we had to adopt round about methods to obtain the statistics necessary for the model. We have used various sources—official, semiofficial, and studies of other researchers—to build a database for the empirical implementation of the model.

The application of the model requires data on the following:

1. Input-output coefficient matrices for India and Bangladesh (A, A^*);
2. Sectoral capital and labor coefficients (k, l, k^*, l^*);
3. Sectoral consumption coefficients (y, y^*);

4. Stocks of capital and labor for the two economies (K, L, K^*, L^*).

Since the data are not always available in these forms, we now describe the underlying data and their manipulation for each of the four categories.

Input-Output Coefficient Matrices

The basis of the data of this study are the two Input-Output Tables of the Indian Economy for the year 1991-92 (Government of India, Planning Commission, 1995) and of the economy of Bangladesh for the year 1992-93, (Centre on Integrated Rural Development for Asia and Pacific (CIRDAP), Bangladesh, June 1996). The Input-Output Table for the Indian economy consists of 60 sectors, while that of the economy of Bangladesh consists of 53 sectors. These two input-output tables have been aggregated into 10 sectors only in a way such that all sectors are common to India and Bangladesh. From the aggregated input-output table of each of the country, the input-output coefficient matrices have been computed (A for India and A^* for Bangladesh).

Labour and Capital Coefficients

In this study, sectoral labour coefficients for each sector have been computed from the sectoral employment and sectoral output data of the respective economies. While for the economy of Bangladesh the employment figures for the desired sectors were available for the year 1992-93 (CIRDAP, Bangladesh, June 1996), for the economy of India the employment figures for all the sectors desired were not available for the year 1991-92. We computed them using the employment figures of the year 1979-80 (ten Raa and Chakraborty, 1991) and the employment growth rate for the period from 1977-78 to 1987-88 (Government of India, Planning Commission, 1995).

To obtain the sectoral capital coefficients for the economies of India and Bangladesh, we made use of their sectoral values added at factor cost and their wage rates.