INDIA-BANGLADESH BILATERAL TRADE IN THE CONTEXT OF GLOBALIZATION- A GENERAL EQUILIBRIUM APPROACH

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ABSTRACT

India and Bangladesh had adverse balance of trade, throughout the last two decades. The government of both these countries pursued policies of trade liberalization since the beginning of the 1990's. This has enabled the economies to gradually emerge from inward-looking, protected perspectives into open, globally integrated ones.

There have been various attempts to promote greater trade between India and Bangladesh under the provision of SAPTA (South Asian Preferential Trading Agreement) and SAFTA (South Asian Free Trade Area). Given the importance attributed to free trade as a policy to boost bilateral trade between the countries in this paper we present a theoretical framework, which helps to identify the pattern of trade flows between the two economies in a perfectly competitive world characterized by free trade.

The paper presents a neoclassical model of international trade, which assumes that each economy has fixed domestic endowments, with tradable and non-tradable commodities that are used for intermediate as well as final consumption. Leontief functions are used to represent technologies and preferences. The efficient allocation of resources is obtained by maximizing the level of domestic final demand (including consumption and investment) in one economy, subject to a given proportion of final consumption in the other. Thus, the model proposes a new way to locate the comparative advantages of the two economies linked by international trade. It constructs a competitive benchmark based only on the fundamentals of the two economies: endowments, preferences and technologies. No statistics or constructs beyond the fundamentals of the economies are used in the model. In particular, it employs no price statistics. Nor does it admit of any artificial limitations on the direction of trade. This theoretical framework, which provides a general equilibrium determination of the commodity pattern of trade, is a general equilibrium version of Raa and Mohnen (2000). The empirical implementation of the model considers trade in twenty five sectors comparable in the I-O tables of India and Bangladesh. The basic findings are: India enjoys comparative advantage in almost all the commodities excepting Rice, Fishing and Services, which it finds suitable to import from her neighbouring country Bangladesh. On the other hand, in a free trade set up Bangladesh's comparative advantage rests in these three goods. The study isolates the gains from free trade accruing to either economy. Though Bangladesh gains significantly from this bilateral trading arrangement with India, but such an arrangement ends up making Bangladesh too much dependent on India for the supply of several essential goods. So to make Bangladesh self reliant to some extent, we carry out two simulations in the paper where we make Bangladesh produce on its own some important goods of its

consumptions and lower the volume of its import of that good from India. But such an attempt lowers the extent of gains for Bangladesh.

The paper also explores the possibility of Bangladesh producing some of its important consumption items on its own by utilizing the Indian technology for production. To show how this could be done the paper proposes the super free trade model of India and Bangladesh. By holding technology in production and consumption constant across the two economies this model enables one 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. The gains from such a super free trade arrangement is also obtained .With super free trade, Bangladesh becomes relatively self reliant as it can produce many goods on its own by freely employing the India technology of production. However, such an attempt also ends up lowering the country's gains from free trade with India. This model, not only gives idea about the relative importance of the determinants of the pattern of comparative advantage, but also throws considerable light on the contemporary issue of technology transfer associated with international trade. The paper concludes with policy options.

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INTRODUCTION

Way back in 1947, Jawaharlal Nehru (Parthasarathi, 1990) envisioned the great many advantages of political and economic cooperation among the countries of Asia. This spirit of Asian cooperation on a continental scale became manifest in the functioning of the Association of South East Asian Nations (ASEAN) since 1967 and in the emergence of the South Asian Association for Regional Cooperation (SAARC), comprising the seven countries - Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka since 1985 as regional groupings of cooperation.

Having begun with non-economic areas the member countries of the SAARC gradually extended the scope of cooperation to the economic fields. The SAARC Secretariat initiated the programme of conducting detailed analytical studies for identifying the areas of cooperation in the spheres of production, trade, manufactures and services, and thereby suggesting ways and means of eliminating the constraints impeding the process of cooperation. The most obvious measure of cooperation between the member states of any regional grouping is the level of trade taking place. But unfortunately the performance of the SAARC members on the trade front can hardly be termed as moderate when benchmarked with many other countries in Asia. In particular, the SAARC states are plagued with trade imbalances among themselves. This urged the member states to undertake a concrete step when a study on SAARC Trade, Manufactures and Services was commissioned at the Islamabad summit in 1998. An Inter-Governmental Group set up by the Colombo summit in 1991 to formulate and seek agreement on an institutional framework for trade liberalization among the members finalized a draft agreement on SAARC Preferential Trading Agreement (SAPTA). Finally, the agreement on SAPTA was signed at the Dhaka summit in 1993. Thereafter, in December 1995, being ratified by the member states it came into force with an attempt to integrate and strengthen the regional trade links in South Asia. The agreement on SAPTA aims at track expansion among the members through exchanging concessions relating to tariffs, para-tariffs, non-tariffs measures and direct trade measures. The agreement on SAPTA allows for various

approaches to trade liberalization such as product-by-product, across the board tariff reductions, sectoral approach and direct trade measures.

However, the ultimate aim of this region is not to stop at preferential trading arrangements rather to take SAPTA towards a new vision of free flowing trade in the region under the arrangement of South Asian Free Trade Area (SAFTA). Accordingly, at the end of the 12th SAARC summit at Islamabad, Pakistan on January 6, 2004 the foreign ministers of the seven member states signed a framework pact on the Free Trade Area in the region paving the way for the regional integration of the economies. As per the terms of this pact the developing countries of the region – India and Pakistan - will have to bring down their custom tariffs to between zero and five percent within seven years of the beginning of the agreement. Sri Lanka has been given eight years for the same whereas the rest of the Least Developed Countries (LDCs) – Nepal, Bhutan, Bangladesh and Maldives – will have ten years to do that. As such, the South Asian Free Trade Area (SAFTA) treaty will come into force on January 1, 2006 and will be fully implemented by December 31, 2015 (Poudel, 2004). This emphasis given to free trade in the SAARC agenda led to several attempts to foster growth of bilateral trade between the two member countries of SAARC, namely, India and Bangladesh.

India and Bangladesh offer natural markets for each other's export products. In their mutual trade, they enjoy the advantages of reduced transaction costs and quicker delivery due to geographical proximity, common language and a heritage of common physical infrastructures. That is why soon after the launching of liberalization in Bangladesh in 1982, India's comparative advantage in the Bangladesh market started asserting itself and Indian exports registered unprecedented growth. The rate of growth of these bilateral exports of India to Bangladesh reached new dimensions, particularly since 1992-93. The total export of India to Bangladesh during 1980 was US $ 94.58 million. By 1990 it was US $ 305.07 million and very recently in 2000 this figure stood at US $ 934.99 million. Thus, during the last two decades India’s exports to Bangladesh have gone up by almost 10 times (table1). India tops the list of exporters to Bangladesh. India's share in the total import of Bangladesh was 3.6 % in 1980, which rose to 9.37% in 1995 and in 2000 to 11.1 %. On the other hand, Bangladesh's exports to India have also increased, but not at a commensurate rate. The total import of India from Bangladesh in 1985 was US $ 12.91

million. After a crest and fall, the import in 1995 was US $ 85.86 million and by 2000 this rose to US $ 74.12 million. For the entire last decade, India's share of import from Bangladesh in its total import remained less than 1%. Consequently, the trade gap between India and Bangladesh was staggering. In 1980, the gap was US $ 88 million, which increased to US $ 860.87 million in 2000. In this span of 20 years the rate of increase of Bangladesh's trade gap with India was enormous. India's share in the total trade gap of Bangladesh increased to as much as 37.4% in the year 2000 starting from a very small share of 4.84% in 1980 (figure1)

Thus, throughout the last decade both India and Bangladesh have liberalized and opened up to global competition, yet both did so with differential speeds. Bangladesh in its own wisdom and under the terms of the structural adjustment programmes (launched with the assistance of the International Monetary Fund and the World Bank and supported by other donors of the bilateral aid) has very promptly and rapidly lowered its tariff and non-tariff barriers and moved much faster towards private sector led and market driven economic policy reforms as compared to India. This difference in economic policy regime of the two countries has enabled India to gain greater access to the markets of Bangladesh for its exports since the past five years. This explains why Indian exports to Bangladesh for these years have grown at a rate of over 30% per annum while the exporters from Bangladesh, who sent their products to the Indian markets had to remain content with comparatively modest gains. As a consequence Bangladesh's bilateral trade deficit with India widened substantially during the nineties (table 1)

TABLE 1

TRADE BALANCES, EXPORT-IMPORT RATIOS AND TOTAL TRADE OF INDIA'S BILATERAL TRADE WITH BANGLADESH (1980-2000)
(MILLION US DOLLARS)

YEAR	EXPORTS	IMPORTS	TRADE BALANCE	EXPORT–IMPORT RATIO	TOTAL TRADE
(1)	(2)	(3)	(4) = (2) - (3)	(5) = (2) / (3)	(6) = (2) + (3)
1980	94.58	6.45	88.13	14.7	101.03
1985	105.19	12.91	92.28	8.15	118.10
1990	305.07	17.39	287.68	17.5	322.46
1995	605.11	85.86	519.25	7.05	690.97
2000	934.99	74.12	860.87	12.6	1009.11

Source: Statistics of the Foreign Trade of India by Countries, different issues

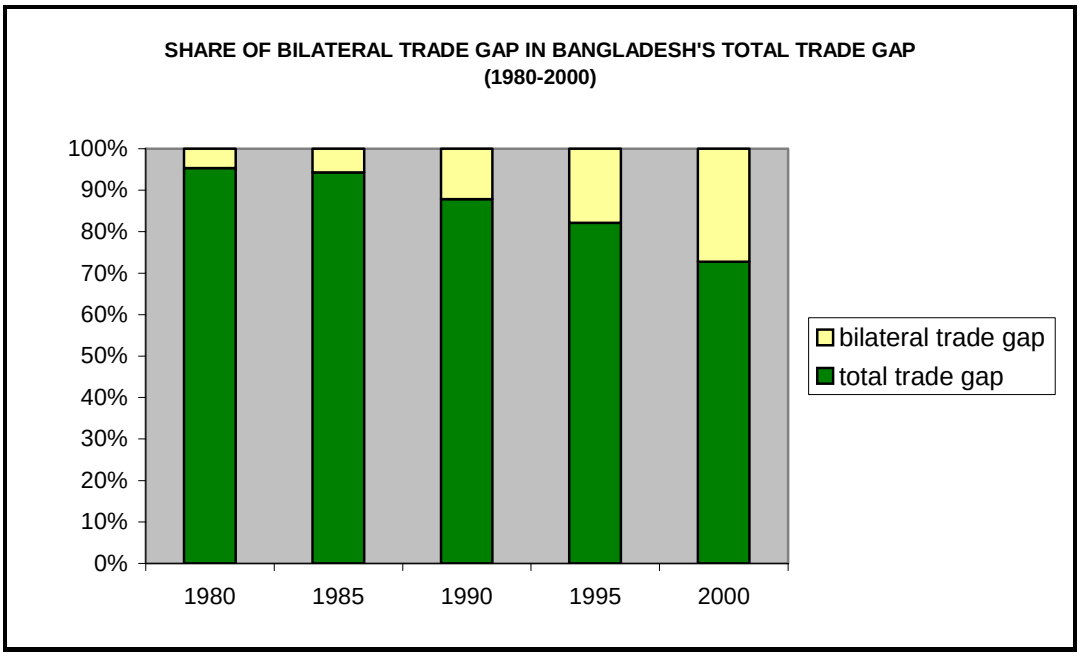
Moreover, the existing bilateral trade pattern was such that it kept exports from Bangladesh at a much lower level, especially in case of few consumer goods like shoes and other leather products, readymade garments, textiles etc. This is explained by the prevalence of the relatively higher tariff and non-tariff barriers applicable to the import of consumer goods into India under its global trade policy. However, this policy on part of India resulted in the denial of the benefits of higher exports for some of the more competitive products of Bangladesh (for instance ready-made garments) into the Indian market. This has inevitably led to the ballooning of the official trade deficit of Bangladesh with India over the past few years (US $ 92.28 million in 1985 to US $ 860.87 million in 2000). This growing bilateral trade deficit of Bangladesh has created and aggravated the economic and the political tensions between the economies.

To this if we add the fast growing "informal trade" (including the legitimate traditional border trade and the illegal trade more popularly known as smuggling), Bangladesh's trade deficit on her bilateral trade account with India will further widen. The annual value of informal exports to Bangladesh from India in the year 2000 is estimated at between US $ 1 billion and US $ 1.5 billion compared to the official trade turnover of US $ 500 million in the same year (Sobhan, 2002). Consumer goods of daily use which are originating in India and internationally relatively cheaper and better in terms of quality are being increasingly used by an average person in Bangladesh even living in areas which are quite far off from the Indian border. As a consequence goods of Indian origin are now almost flooding the shops in Bangladesh and thereby hurting the indigenous manufacturers of similar goods.

Thus, Bangladesh had a trade deficit on its bilateral trade account with India throughout the twenty years period from 1980-2000. This deficit not only kept mounting over the years but its share in Bangladesh's total trade gap also went up steadily during the same time. However, for a developing country the ever-increasing trade gap is not always an indication of adversity on its way of development. In fact, the target of a developing country should be to strengthen economic development by increasing import from comparatively cheap sources. The trend of its economic development and its weak areas

are, however, a matter of in-depth study primarily by the government and the people at the policy level of Bangladesh. The ever-increasing trade gap with India is, however, likely to create a hurdle to the establishment of a sound economic cooperation between the two countries and hence may be an issue of major concern for Bangladesh. Thus, in recent years, issues concerning India-Bangladesh bilateral trade have come to occupy an increasingly important place in the discourse on the evolving nature of economic relationship between these two neighbouring countries. This importance and urgency is not only underwritten by the concern for the widening deficit in the bilateral trade between the two economies as mentioned above, but also by other concerns, like, the issue of regional integration amongst countries of South Asia and its potential impact on, and implications for the economies of individual countries of the region and the need to design an appropriate strategy for the purpose of steering South Asia's integration into the global economy from a position of strength.

FIGURE 1



Against this backdrop, it has been held by many at various levels of policy making in both the countries that promotion of free trade between the two economies is imperative as this will go a long way in enhancing the trade and hence economic cooperation

between the two countries. However, evaluation of indices, like, Trade intensity index, Revealed Comparative Advantage and Trade complementarity index reveal that while India has some potential to meet Bangladesh's import demand, there is a major lack of such potential on part of Bangladesh. This applies to goods in which the individual economy is endowed with revealed comparative advantage. Similarly for overall trade also, as reflected by trade complementarity indices, while India's exports match Bangladesh's import fairly well, there is a clear lack of such complementarity in exports of Bangladesh to India. Hence, there exists a situation of partial trade complementarity. Thus, in spite of several attempts to promote Indo-Bangladesh bilateral trade under the provisions of SAPTA and SAFTA the prospects and possibilities of expansion of bilateral trade between the two economies of India and Bangladesh seem to have a rather limited scope. However, given the importance attributed to free trade as a policy to boost bilateral trade between these two countries and thereby widening the scope of greater economic cooperation between the them, building a theoretical and empirical model of bilateral trade involoving these two South Asian countries seems quite relevant.

In recent times contemporary researchers have shown considerable interest in promoting free trade in the world including the SAARC region and also free bilateral trade among its members. This concern has seen the development of a substantial volume of literature on this topic in recent years. However, very little work has been done regarding the bilateral trade relations between the two neighbouring countries of India and Bangladesh. The present thesis aims to provide a theoretical and empirical analysis of this bilateral trade between the two countries. However, the few researchers, who have made some significant contributions in this area are - Sen (1972); Rahman (1997); Rahman (2000); Pramanik (2000); Mukherjee (2000); Roy and Chakraborty (2000); Eusufzai (2001); Pohit and Taneja (2000); Waheeduzzaman (2002); Sobhan (2002).

Though these works relate to the promotion of bilateral trade between India and Bangladesh, yet none of these are based on theoretical model building that help to analyze the prospects and possibilities of trade between the two countries. Though such theoretical exercises have been attempted for few countries of the world, there does not exist one in the context of India and Bangladesh to the best of the knowledge of the

present researcher. In this context a mention may be made of a preliminary work by Roy and Chakraborty (2000).

Roy and Chakraborty (2000) locate the comparative advantages of India vis-à-vis Bangladesh. In their paper, they have developed three linear programming models, which maximize foreign earnings of India and Bangladesh at given world prices subject to material balance and factor endowments of the economies. This is in the same line of thought as Raa and Chakraborty's (1991). But though Roy et al. have made some humble attempts, yet a more comprehensive approach towards the analysis of the possibilities of bilateral trade between India and Bangladesh is still lacking. The present thesis aims at filling this gap by contributing to this area.

This paper is organized as follows. Section 1 introduces a model. Section 1.2 provides the theoretical background to the model. Section 1.3 presents the model that describes the pattern of bilateral trade in a perfectly competitive world characterized by free bilateral trade. Section 1.4 discusses the results of the model. The gains from free trade accruing to either country are discussed in section 1.5. Two simulations are done in the following section (1.6). Section 2.1 presents the model which explains the pattern of super free trade between India and Bangladesh. The results of this model are discussed in section 2.2. The super free trade model points out the relative importance of the determinants (endowments or technology) of the pattern of comparative advantages, which is explained in section 2.3. Section 2.4 reports the gains accruing to either economy from such a super free trading arrangement. The paper finally concludes with a summary of the theoretical models that it proposes along with the policy implications. The data required for the model are discussed in Appendix A.

1.2 THEORETICAL BACKGROUND OF THE MODEL

One of the basic issues in international trade theory is the determination of the sources of comparative advantages of nations and hence trade between nations. As early as the nineteenth century Ricardo (1817) came up with his theory of Comparative Advantage or as it is sometimes called, the theory of Comparative Costs. He postulated a two-country, two-commodity and one-factor (labour) model. The assumptions of the labour theory of value and constant returns to scale technology being true for each country, Ricardo's conclusion is that the pre-trade commodity price ratio and hence the flow of trade is

determined solely by international differences in relative labour costs. This is the essence of the comparative cost doctrine. It asserts that if free trade prevails, each country in the long run tends to specialize in the production of and the export of those commodities in whose production it enjoys a comparative advantage in terms of real costs, and to obtain by importation those commodities which could be produced domestically only at a comparative disadvantage in terms of real costs, and that such specialization is mutually beneficial for the trading countries.

Thus, in the Ricardian model each country has access to a different technology and this difference in technology explains why a country trades with other countries. But difference in labour productivity is not the only factor that gives rise to comparative advantage. Later on, with the advent of the neoclassical school of thought more sophisticated trade models were developed which explained comparative advantage in different ways. The best known is the Heckscher-Ohlin model of international trade (Heckscher, 1919; Ohlin, 1933). Heckscher-Ohlin shows that comparative advantage is influenced by the interaction between the resources of nations (relative abundance) and the technology of production (relative intensity). In a two-country, two-commodity and two-factor model the explanation of comparative advantage, as developed by these two economists, is as follows: A country tends to specialize in the production of, and exports, those commodities which require for their production relatively larger amounts of those factors which it has in relative abundance and which thus are relatively cheap before trade. However, this explanation is based upon following assumptions: there is perfect competition in both countries; there are no trade barriers and transport costs; each economy has fixed domestic endowments of the factors which are homogenous, fully employed and are completely mobile within the geographical boundary of the country; production functions are different for different commodities, but identical for each commodity in the two countries and the production function is subject to constant returns to scale.

An important corollary derivable from the Heckscher-Ohlin model is the famous Factor Price Equalization Theorem (Samuelson, 1949). The corollary simply says that international goods movement tends to act as substitute for factor movements. To put the matter another way: Free movement of labour and capital between countries will tend to

equalize wages and factor prices; but, even without any movements of productive factors across national boundaries, a tendency towards equalization of relative and absolute factor prices will often result from the free movements of goods in international trade. This is because the relative scarcity of some factors in different countries will be alleviated through trade; products produced primarily from scarce factors will tend to be imported, and thus some of the pressure on such resources will be lessened.

Based on this simple model of international factor price equalization or what is more precisely termed as "integrated equilibrium" [Helpman and Krugman (1985)], Vanek (1968) developed the concept of factor content of trade (Helpman, 1984). Given perfect competition in the goods and factor markets, free international arbitrage, technology subject to constant returns to scale and adequate restrictions on the distribution of world endowments, both goods and factor prices will be equalized internationally. Under these conditions, a good traded will embody fixed amounts of the services of the productive factors, independently of where it is produced. Hence trade can be conceived in two ways as

- the overt of exchange of goods
- the international exchange of services of factors embodied in the goods traded

The traditional theories of international trade as developed by Ricardo, Heckscher-Ohlin and others conceived of trade in the former sense, while, Vanek's contribution (Davis & Weinstein, 1997) was to recognize that we could equally think of trade as the international exchange of the services of factors embodied in the traded goods. Vanek's formulation of the problem allowed an extension of the logic of the Heckscher-Ohlin theory to settings in which the pattern of trade may be indeterminate but in which the net factor content of trade may nonetheless be determinate. This is the Heckscher-Ohlin-Vanek (HOV) model. Expression of the theory in this form also highlights the deep logic of the Heckscher-Ohlin theory in its focus on the relative availability of factors.

A number of studies in recent times have tried to test the various theories of trade mentioned above (Leamer & Levinsohn, 1995). Most of these tests have rejected the Heckscher-Ohlin-Vanek model. The problems with these studies are—independent data on trade, endowments and technologies are not used. This has resulted in the rejection of the Heckscher-Ohlin-Vanek model. Moreover, these studies often assume common

technologies and preferences. However, Bowen (1987) and Trefler (1993, 1995) gave an empirical support for a modified HOV model where preferences and technology were allowed to be different from those prevailing in the United States. Davis et al. (1997) made use of the regional data for Japan and showed that geographical differences in direct factor requirements may be sufficient to restore the HOV predictions on the factor content of trade.

The model developed in this paper (section 1.3) goes a step ahead by letting country specific endowments, preferences and technologies which are the fundamentals of an economy according to the neoclassical theory of trade and on the basis of these fundamentals a competitive benchmark is constructed by solving a linear programme and this linear programme then is used for locating the comparative advantages of the economies and assessing their gains from free trade. All patterns of specialization are admitted and therefore international trade theoretic assumption of a common cone of diversification is not made. Thus, to check the Heckscher-Ohlin model, the observed factor contents of net trade as well as those predicted by theory is not confronted and the model checks whether the endowments alone determine factor movements of free trade; i.e. the endogenous trade within the model, controlling for taste and technology. This model is a general equilibrium version of Raa and Mohnen (2000).

Thus, the model that is set up in the following section with the purpose of locating the comparative advantages of the economy of India vis-à-vis that of Bangladesh in a perfectly competitive world with free bilateral trade, is a neoclassical model of international trade. It begins with the assumption that each economy has fixed domestic endowments, with tradable and non-tradable commodities, which are used for intermediate as well as final consumption. Leontief functions are used to represent technologies and preferences i.e., there are fixed input coefficients and fixed proportions of final consumption and investment in each economy. The efficient allocation of resources is obtained by maximizing the level of domestic final demand (including consumption and investment) in one economy, subject to a given proportion of final consumption in the other. The novelty of this model lays in the fact that it proposes a new way to locate the comparative advantages of the two economies of the SAARC region linked by international trade. It constructs a competitive benchmark based only on the

fundamentals of the two economies: endowments, preferences and technologies. No statistics or constructs beyond the fundamentals of the economies are used in the model. In particular, it employs no price statistics. Nor does it admit of any artificial limitations on the direction of trade. This model provides a truly general equilibrium determination of the commodity pattern of trade. In addition, one important point about the model which is worth noting is that though the model is worked out for the two economies of India and Bangladesh, yet, since it is based on fundamentals with all prices endogenous, the incorporation of rest of the world as a third economy would be a straightforward extension of the model.

1.3 THE MODEL

The model may be formally stated as follows:

Let 'c' denote the level of final consumption in India and 'c*' the same for Bangladesh and let c*= γc i.e. 'γ' is Bangladesh-Indian final consumption ratio, γ being chosen such that the actual bilateral balance of payments is maintained.

The linear programme is

$$\underset{x,x^*,c}{\text{Max}}\ e^T (y+y^*\gamma)c$$

subject to

$$(I-A)\,x+(I-A^*)\,x^* \geq (y+y^*\gamma)\,c+z+z^* \quad \text{.....for tradable commodities... (1)}$$

$$(I-A)\,x \geq yc, \quad (I-A^*)\,x^* \geq y^*\gamma\, c \quad \text{.....for non-tradable commodities.....(2)}$$

$$kx \leq K, \quad lx \leq L \quad \text{..... for factor inputs in India.....(3)}$$

$$k^*x^* \leq K^*, \quad l^*x^* \leq L^* \quad \text{..... for factor inputs in Bangladesh .....(4)}$$

where, e^T = (1.....1)

y, y* = domestic final demand vector (including consumption and investment, excluding trade) in India and Bangladesh respectively

z, z* = net exports vector (except for bilateral trade) in India and Bangladesh respectively

A, A* = input-output coefficients matrix in India and Bangladesh respectively

K, K* = capital stock in India and Bangladesh respectively

L, L* = labour force in India and Bangladesh respectively

k, k* = capital input coefficients row vector in India and Bangladesh respectively

l, l* = labour input coefficients row vector in India and Bangladesh respectively

For every value of the final consumption ratio, 'γ', we denote the optimum (Indian) consumption level by $c(\gamma)$ and the outputs in the two countries by $x(\gamma)$ and $x^*(\gamma)$, respectively. For low values of 'γ', consumption of Bangladesh is not important and the bulk of the net output is exported to India. Similarly, for high values of 'γ' the trade balance shows an Indian surplus.

For tradable commodities, Indian net exports to Bangladesh are given by the vector:

$$\mathbf{(I-A)\, x\, (\gamma) - y\, c\, (\gamma) - z} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

In a general equilibrium framework, the supporting competitive prices are given by the shadow prices of the linear programme. Let us denote those for tradable commodities by $p(\gamma)$. Indian surplus on bilateral trade account is equal to the product of $p(\gamma)$ and (5) and is denoted by $s(\gamma)$.

For 'γ' low, $s(\gamma)$ is negative, and for 'γ' high, $s(\gamma)$ is positive. For some intermediate value, $s(\gamma)$ matches the observed surplus on the bilateral trade account,

$$\mathbf{S^0 = e\,(x^0 - Ax^o - y - z)} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

where x^0 is the observed value of the gross output vector x. We shall find the intermediate value of 'γ' by the Newton-Raphson algorithm,

$$\gamma_{n+1} = [\{s(\gamma_n) - s^0\}\, \gamma_{n-1} - \{s(\gamma_{n-1}) - s^0\}\gamma_n\,] \,/\, [s(\gamma_n) - s(\gamma_{n-1})] \ldots\ldots\ldots\ldots\ldots\ldots (7),$$

given initial values $\gamma_0 = 0$ and $\gamma_1 = 1$

The limit process (7) solves $s(\gamma) = s^0$ and this gives the general equilibrium value of the Indo-Bangladesh final consumption expansion ratio, $\boldsymbol{\gamma = c^*/c}$

For this value, the linear programme determines the levels, $c(\gamma)$ and $c^*(\gamma)$, the allocations, $x(\gamma)$ and $x^*(\gamma)$ and the bilateral trade vector, (5). The comparative advantages of the two economies are located on the basis of the sign pattern of the bilateral trade. This is done solely on the basis of the parameters or fundamentals of the two economies – taste (y, y*),

technology (A, A*; k, k*; l, l*) and endowments (K, K* and L, L*), and the rest of the world (z, z*) which is fixed. Thus, the model determines the comparative advantages of the two economies on the basis of their fundamentals only without recourse to any exogenous prices. In fact, all prices in the model– prices of tradables (shadow prices corresponding to constraint 1), prices of non-tradables (shadow prices corresponding to constraint 2), and factor prices (shadow prices corresponding to constraints 3 and 4) are endogenous.

A comparison of the expansion of final demand of the two economies under autarky and free trade scenarios enables one to find out the gains accruing from free trade to either economy. By making technology and taste represent input proportions and consumption respectively we make a short cut. In a strict sense, technology is a blue book of techniques and the relative prices chosen decide the choice of technique. The observed input-output coefficients reflect the techniques prevailing in each economy under observed prices. Thus, if prices change to the general equilibrium values then the choice of technique as also the input-output coefficients may be different. Thus, any induced change of techniques within the technology blue book is likely to prompt further reallocations of endowments and gains to specialization. A similar analysis holds for consumption also. Taste is a blue book of consumption coefficients and these consumption coefficients may adjust. However, the model proposed in this section restricts the blue book of technology as also that of consumption to a single page for each economy and thereby ignores the further reallocations. Hence the results of this model are likely to be conservative to some extent. However, this may not be treated as a serious limitation of this model. This is because the purpose of this paper is to primarily demonstrate how endogenous patterns of productive activity can create significant gains to free trade. Hence ignoring such reallocations may well be allowed in the context of the Leontief framework that underlines the proposed model.

1.4 RESULTS AND DISCUSSION

In this section we present the results of the above model. The results are shown in tables 2 and 3. The gross output figures, (table 2) show the commodities which each of the economy would produce under perfect competition and free bilateral trade. Though the

actual trade or observed trade figures show that both countries have positive outputs of all the twenty-five commodities mentioned in table 2, but in a perfectly competitive world with free bilateral trade as postulated by the model presented in section 1.3, India produces all commodities other than Fishing. On the other hand, Bangladesh in a world of free trade characterized by perfect competition would specialize in the production of Rice, Fishing and Services and will obtain all the remaining twenty-one tradable commodities from India. However, both countries have positive outputs of Construction since it is assumed to be a non-tradable good.

TABLE 2

ACTUAL AND FREE TRADE GROSS OUTPUT FIGURES FOR INDIA AND BANGLADESH (1992)

(MILLION US DOLLARS)

Sl. No	SECTORS	INDIA		BANGLADESH	
		ACTUAL TRADE	FREE TRADE	ACTUAL TRADE	FREE TRADE
1.	Rice	14995.71	12973.82	4218.951	18817.66
2.	Wheat	7877.38	13369.26	174.9694	0
3.	Jute	342.7719	745.6738	212.5766	0
4.	Sugarcane	3528.026	6180.254	216.7566	0
5.	Cotton	1835.499	2754.578	10.30481	0
6.	Tea	581.842	1238.147	114.4398	0
7.	Other Agricuture	33135.41	58549.22	1508.425	0
8.	Livestock	18384.82	33985.34	2207.261	0
9.	Fishing	2000.899	0	1687.669	6043.266
10.	Forestry	3788.796	9749.475	2051.581	0
11.	Beverages	20939.65	38132.05	1995.583	0
12.	Jute textile	1223.584	2474.303	369.3757	0
13.	Other textile	27110.77	44589.58	2547.957	0
14.	Wood & products	1901.565	3275.143	123.3758	0
15.	Paper & products	3491.252	4120.11	156.9788	0
16.	Leather	2482.43	3399.335	299.8897	0
17.	Chemicals	28190.3	55413.95	2807.526	0
18.	Non-metallicminerals	4905.778	8331.31	20.84661	0
19.	Iron & steel	14996.15	30356.39	566.0987	0
20.	Machinery	16734.04	32910.09	150.6415	0
21.	Mining & miscellaneous manufacturing	17054.19	37019.23	2001.553	0
22.	Communication & transport	13765.09	24351.04	73.92335	0
23.	Construction	28847.34	47248.44	3389.838	6810.225
24.	Electricity & gas	11151.14	21589.6	1252.586	0
25.	Services	128153.4	197251.3	13276.89	36407.63

The respective comparative advantages of the two economies are located on the basis of the sign pattern of bilateral trade. The effect of perfect competition and free bilateral trade on the pattern of trade between India and Bangladesh would be as given in table 3.

TABLE 3

FREE BILATERAL TRADE FROM INDIA TO BANGLADESH CONTRASTED WITH ACTUAL TRADE FIGURES (1992)

(MILLION US DOLLARS)

Sl. No.	SECTORS	ACTUAL EXPORTS OF INDIA TO BANGLADESH	FREE NET EXPORTS OF INDIA TO BANGLADESH
1.	Rice	0.014097	-10206.4
2.	Wheat	0.02615	353.7464
3.	Jute	0.000695	38.97524
4.	Sugarcane	0	83.82038
5.	Cotton	101.5367	6.189017
6.	Tea	0	369.78
7.	Other Agricuture	51.11138	1774.815
8	Livestock	0.459263	4392.197
9.	Fishing	0.000245	-3458.09
10.	Forestry	0.207159	4622.535
11.	Beverages	7.36741	2855.478
12.	Jute textile	-8.6E-05	308.1356
13.	Other textile	147.584	2089.184
14.	Wood & products	-3.1323	80.152
15.	Paper & products	1009.144	10.58797
16.	Leather	-3.66103	336.1363
17.	Chemicals	25.8887	4301.717
18.	Non-metallic minerals	6.634388	151.8256
19.	Iron & steel	12.64771	1081.363
20.	Machinery	33.56092	924.1248
21.	Mining & miscellaneous manufacturing	98.89515	3203.838
22.	Communication & transport	10.2329	412.5991
23.	Construction	0	0
24.	Electricity & gas	0.020512	2335.823
25.	Services	0.037795	-14570.1
	TOTAL	**1498.58**	**1498.46**

The figures in table 3 reveal that in a competitive set up with free bilateral trade as postulated by the model in section 1.3 India enjoys comparative advantage in almost all

the commodities mentioned in table 2 and table 3 excepting Rice, Fishing and Services which it finds suitable to import from her neighbouring country Bangladesh. However, India's observed trade figures suggest that she actually exports all goods barring Jute textile, Wood products and Leather. On the other hand, in a free trade set up Bangladesh's comparative advantage rests on Rice, Fishing and Services though her observed trade pattern suggests that she is more competitive in producing Jute textile, Wood products and Leather.

Thus, it is seen that the comparative advantages of the economies as obtained by solving the linear programme are close to the observed pattern for most of the goods mentioned in table 2. However, there also arise few contrasts of the free trade figures with the actual trade figures of the countries. As observed from the actual trade figures in table 3 Rice is exported from India to Bangladesh. But the free trade figures suggest the same to be an item of export for the economy of Bangladesh. This seems to be justified to some extent by the fact that Bangladesh has a significant edge in the value added per worker in this sector compared to India ($ 693.3 million versus $ 606.2 million per worker), whereas the value added per unit of capital in this sector is very little different in the two countries. Thus, Bangladesh which happens to be a relatively labour abundant country adopts the production of this labour intensive good. The small figure of Indian exports of Other Agriculture to Bangladesh as revealed by the actual or observed trade figures in contrast to the free trade figures can be explained in terms of the existence of high tariff on Indian fruits and vegetables imposed by Bangladesh (at over 40 percent level) (Sobhan, 2002). Similar such import restrictions also applied to Livestock exported from India. Thus, with free trade Livestock exported from India to Bangladesh will obviously record a manifold increase. This is, however, desirable in view of the fact that currently 1.5 million Indian cattle per annum were informally imported into Bangladesh (Sobhan, 2002). Such informal imports of cattle from India also provides hides and skins for manufacturing export quality finished leather in Bangladesh's more modern slaughter houses and tanneries. This sizeable component of the informal trade clearly provides a strong basis for Bangladesh's revealed comparative advantage in exporting leather products not only to India (as revealed by the actual trade figures in table 3) but also to the rest of the world. Thus, removal of all trade restrictions and making trade between the two countries

completely free would go a long way to reduce the incidence of informal trade with respect to cattle and livestock and a possible consequence of this may be the comparative advantage of India in Leather production rather than Bangladesh. However, goods like Jute textile, Wood products, etc feature as export items of Bangladesh in reality but here we see that these goods appear as export items for the economy of India. Similarly, for India also, the actual export figures are sometimes different from the competitive figures. For example, the observed trade figures show that India has been an exporter of Services, which comprises items like transport services, medical and educational services etc to Bangladesh during the entire last decade. But free trade with Bangladesh as postulated by the present model ends up in Services being an export item for Bangladesh. As far as Tea is concerned both the countries have proven expertise (as suggested by the observed output figures of the two countries in table 2) and as such there is no observed trade in Tea between the two countries. But the free trade figure shows a flow of this good from India to Bangladesh. Thus, the pattern of comparative advantage resulting from the model often departs from the observed trade pattern. As explained, this contrast arises due to numerous distortions existing in the real world, which cause the private cost of production of a good to diverge from its social cost in which case the free trade pattern do not confirm the observed pattern of trade. Examples of such distortions are monopoly power, externalities, tariffs and other impediments. The model assumes away all such market imperfections and departures from a simple perfectly competitive model.

However, there are some departures from the competitive benchmark that cannot be separated from the fundamentals, but are embedded in the physical structure of the economies. Particularly, worth mentioning are the phenomena of product differentiation and scale economies. Our model assumes away the possibility of two-way trade, which is the consequence of product differentiation existing in the real world. For instance, in Mining and Miscellaneous manufacturing the dominant item of Bangladesh is the Ready-made garment, which is a major export item for the country. Thus, given free trade Bangladesh is likely to export ready-made garments to India. But this in turn is likely to be countered by Indian exports of minerals to the country. This may end up in export of Mining and Miscellaneous manufacturing from India to Bangladesh. Moreover, the quality of clothing accessories and footwear (included in Miscellaneous manufacturing)

of Bangladesh is often different from the same product of Indian origin. Such differences in product quality are ignored in this model and any product considered here is taken to be the same in quality irrespective of its place of origin. However, since the purpose of this model is the determination of comparative advantages on the basis of the fundamentals of the economies we selected the most disaggregated classification of products that we could reconcile given the available input-output tables of the two economies. As such the possibility of product differentiation and hence two way trade is not considered in this model. As has already been pointed out, it is true that goods like clothing accessories (for instance zamdani sarees) being produced in Bangladesh are different from those being produced in India. Hence even at this level of disaggregation trade must be two way. This is no doubt true but in our opinion the only correct way of modeling this is to go in for further disaggregation of the data. Our view deviates from the view dominant in literature, where product differentiation is imposed by taking into account the origin of commodities (the so-called Armington assumption, Harris, 1984 and Srinivasan & Whalley, 1986). Consideration of such two-way trade may be practical for obtaining a good approximation but it is not necessary for the location of comparative advantages, particularly when they are not assumed to be revealed by international trade statistics.

As far as scale economies are concerned, such scale induced changes in technical coefficients could be very much relevant for detecting comparative advantages of the economies, particularly, given the fact that monopoly power is a priori excluded from this model. But the effect of such scale economies is ignored by the model. Its inclusion would reinforce the gains to free trade. But one would find it interesting to note that significant gains to free trade can be explained (section 1.5) with the help of this model even without the use of scale economies. However, the inclusion of scale economies might alter the locational pattern of comparative advantages, but they may not be very high.

Thus, the model developed in section 1.3 of this paper provides with a new method of locating the comparative advantages of the economies of Bangladesh and India in a perfectly competitive world of free bilateral trade. Moreover, the model also enables one

to probe into the related issue of gains from such free trade. This is discussed in the following section.

1.5 GAINS FROM FREE TRADE

Theoretical Background

One can think of the gains from trade as consisting of two parts:

- One depending on specialization in production. This part of the gain is obtained by eliminating the domestic waste of resources due to misallocation and less than full utilization.
- The other depending on the possibility of exchange. This part of the gain is attributed to free trade only.

The solution to the linear programming model developed in section 1.3 yields $\gamma = c^*/ c$ and c. The consequent expansion factors for final consumption in India and Bangladesh are

c = 1.643 and c* = 1.889 ---------- (8)

Thus, free bilateral trade in a perfectly competitive world would fetch for the Indian economy a total gain of 64.3 % while for the economy of Bangladesh the total gains would be 88.9 %. Thus, both the economies gain from free bilateral trade but the magnitude of gain is more for Bangladesh than for India. This shows bilateral trade is relatively more important for Bangladesh than for India.

It is now possible to isolate the gains from free trade only. For this we have to solve yet another linear programme, which will enable us to determine the domestic efficiency gains (gains by eliminating the domestic waste of resources due to misallocation and less than full utilization of resources) that the economies can achieve without having departed from the bilateral trade pattern, which was obtained by solving the previous linear programme.

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

Max e y d …… (9)

subject to

(I – A)x ≥ yd + z ……..(10)

kx ≤ K, lx ≤ L ……..(11)

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

The solution to this linear programme yields

d = 1.633 ……. (12)

We likewise solve a linear programme to obtain the domestic expansion factor for Bangladesh. The linear programme is,

max e y* d* ……..(9')

subject to

(I – A*)x* ≥ y*d* + z* ……(10')

k*x* ≤ K*, l*x* ≤ L* .....(11')

From the solution we obtain

d* = 1.372 ……..(12')

Given the results in (12) and (12') we obtain that the efficiency gains of India due to the elimination of domestic waste of resources is 63.3% while that of Bangladesh is 37.2% (d = 1.633 & d* = 1.372).

Thus, given (8), (12) and (12') it follows that the total efficiency gains of India from bilateral free trade with Bangladesh is 64.3% while similar gains for Bangladesh is as much as 88.9%. However, out of this 64.3% of efficiency gains of India as much as 63.3% is due to specialization in production. Such gains from specialization in production obtained by eliminating domestic waste and misallocation of resources for Bangladesh are only 37.2%. Hence, while for India only 1% of total gains can be ascribed to its free trade with Bangladesh, for Bangladesh similar gains from exchange are as high as 51.7%. Thus, while the extent of India's gains from free bilateral trade only with Bangladesh is just 1% that of Bangladesh due to free bilateral trade with India is as large as 51.7%.

TABLE 4

GAINS FROM FREE TRADE ACCRUING TO INDIA AND BANGLADESH

Sl. No.	COUNTRIES	INDIA	BANGLADESH
1.	Total Gains from trade	64.3%	88.9%
2.	Gains by eliminating domestic waste of resources	63.3%	37.2%
3.	Gains from free trade only	1%	51.7%

Free bilateral trade as postulated by the model not only multiplies the volume of trade between the two economies of India and Bangladesh, but also enables the relatively smaller economy, Bangladesh to reap significant gains. But such a free bilateral trading arrangement allows Bangladesh to specialize only in three sectors (Rice, Fishing and Services). While for all the rest of the commodities (excepting Construction which is non-tradable), considered in this model it has to depend on its relatively bigger trading partner, India. Thus, absolute free trade between the two economies results in too much dependence of Bangladesh on India. To free Bangladesh from such over dependence we now try to work out if a little restriction rather than absolute free trade is better for Bangladesh. Such an exercise is attempted in the following section.

1.6 SIMULATIONS

We have noted from table 3 that Bangladesh imports large volumes of Tea, Other agriculture, Other textile, Chemicals and Machinery from India in a perfectly competitive set up with free bilateral trade. Large imports of such essential goods indicate that Bangladesh is too much dependent on India for the supply of these essential goods. Of these Tea also happens to constitute a large part of the country's total consumption. However, the actual or observed trade figure suggests that Bangladesh imports no tea from India. Thus, while with free trade Bangladesh imports substantial volumes of tea from India, in the real world with trade restrictions prevailing Bangladesh does not import any tea from its neighbour. Thus, the trade restriction in the real world may be the factor operating towards lowering this import. Hence, if Bangladesh seeks to reduce its dependence on India, then one possible way to achieve this is to continue with some restrictions on tea imports from India while allowing free trade to prevail for the rest of the goods. This is the first simulation that is done where Bangladesh is made to produce 50% of the amount of tea that it consumes.

We also go in for a second simulation where, the imports of the other goods featuring as top import items from India under free trade conditions (but not in case of observed trade) are subject to some import restrictions. These are, namely, Other agriculture, Other

textile, Chemicals and Machinery. We have performed a separate simulation for these goods because for all these goods the observed figures on net imports from India are not zero unlike that of tea, but the free trade figures show substantially higher net import figures than the observed figures. Besides, Bangladesh has expertise in tea production and as such we have assumed that it will produce a particular volume of this good all by itself and thereby it will try to lower its dependence on India. For the other goods (considered in the second simulation) we have not fixed the volume of domestic production but have only tried to lower the extent of imports from India. We have attempted to restrict these imports with the same aim (as in case of tea) to reduce Bangladesh's dependence on India to some extent.

Therefore, we now turn to incorporate some restrictions in the absolute free trade model that we proposed in section 1.3 and try to locate if Bangladesh's dependence on imports from India comes down.

Simulation 1

- Bangladesh produces itself at least 50% of the amount of Tea consumed by its residents

The incorporation of this condition will bring about a small change in the list of the constraints of the original model developed in section 1.3. The original model had four sets of restrictions (equations 1 to 4 in section 1.3). Now there is one additional restriction---

TEA = $ 99.1 million

Where, TEA denotes the domestic production of Tea in Bangladesh. The value assigned to the output of Tea is obtained by observing the figure for Bangladesh's consumption of this good from the country's input output table. The figure for the domestic production of Tea is fixed at 50 % of what the Bangladeshi's are observed to consume. The rest of the model works as it does in section 1.3 maintaining the actual bilateral balance of payments.

Simulation 2

- Bangladesh restricts the imports of some important commodities from India to 70% of its actual imports, the commodities being Other Agriculture, Other textile, Chemicals and Machinery.

As a result of incorporating this condition there are now four additional restrictions in the original model of section 1.3. The additional set of four restrictions is of the form:

(I-A) $\mathbf{x - yc - z + M_B \leq}$ 70% of Bangladesh's actual/observed import from India.

Where, M_B denotes the export of Bangladesh to India.

Here, also inclusion of these additional constraints does not affect the balance of payments position in any way.

We now analyze the results obtained with these restrictions imposed.

Results of simulation 1

The export pattern remains the same as in the original model. But now Bangladesh produces more commodities than it did before. In addition to Rice, Fish, Construction (non-tradable) and Services as before it now produces Tea also (Table 5). As a result the total volume of Bangladesh's import from India comes down as it is desired. But in this case, where Bangladesh produces tea and in the production of which it is not as efficient as India is, the gain of Bangladesh from such bilateral trading arrangement goes down as compared to the gains that it was reaping when there was no such restriction. While the extent of its gain under complete free trade was as much as 51.7%, with restrictions the same gain comes down by 1% to 50.7%.

Results of simulation 2

In addition to Rice, Fish and Services Bangladesh now also exports Chemicals to India (Table 6). This once again lowers Bangladesh's dependence on India by reducing the volume of its imports from the latter. But as in case of simulation 1, Bangladesh's gains from trade are lower this time also. In fact, it is even lower than is observed in case of simulation 1. Gains from trade to Bangladesh now are only 41.7%, i.e, 10% lower than the gain accruing from absolute free trade.

Thus, any attempt to lower the volume of Bangladesh's import from India with an aim to reduce its dependence on the latter ends up in affecting its gains from trade with India. Hence absolute free trade, though it may make Bangladesh too much dependent on India for the supply of majority of its goods of demand, yet as far as the country's gains from trade is concerned, such free trade fetches immense benefit to the country. Therefore, to sum up we may say that by solving a linear programme we have obtained the pattern of bilateral trade between India and Bangladesh in a world of free and perfectly competitive trade. The comparative advantages of the two economies are obtained from the sign pattern of the bilateral trade and this is done solely on the basis of the parameters of the two economies ---- taste (y and y*), technology (A,A*, k,k* ,l,l*) and endowments (K,K* , L,L*), the rest of the world trade being fixed and represented by vector 'z'. Thus comparative advantages of the two economies of India and Bangladesh are located absolutely on the basis of their fundamentals without recourse to exogenous prices. The resulting bilateral trade between the economies increases the volume of trade between them and allows both the countries to gain.

Thus, we have obtained the comparative advantages of the two economies on the basis of the fundamentals of an economy, namely, endowments, technology and preferences. However, the model developed in section 1.3 of this paper, which helps to locate the pattern of this comparative advantage between the two economies, does not shed any light on the relative importance of the determinants of comparative advantage. Following the conventions in literature this can be done by holding technology and taste constant across the economies in which case the role of endowment (the factor responsible for international trade between nations according to Hecksher- Ohlin) will get focused. This, in turn, can be implemented in a neo-classical fashion by assuming free access of each economy to the other's technology and that there is substitutability in the mean consumption vector of either economy. If the model in section 1.3 is modified so as to include these new assumptions then one comes up with a new trade model involving the economies of India and Bangladesh. This is the so-called super free trade model. Such a model is developed in section 2.1.

TABLE 5

RESULTS OF SIMULATION 1
(MILLION US DOLLARS)

SL. NO	SECTORS	GROSS OUTPUT		NET EXPORTS OF INDIA TO BANGLADESH UNDER FREE TRADE
		INDIA	BANGLA DESH	
1.	Rice	12968.26	19005.97	-10381.30
2.	Wheat	13370.32	0	312.79
3.	Jute	740.16	0	56.44
4.	Sugarcane	6180.60	0	66.27
5.	Cotton	2774.52	0	28.59
6.	Tea	1238.04	99.06	178.47
7.	Other Agricuture	58551.63	0	2342.59
8.	Livestock	33986.24	0	4105.57
9.	Fishing	0	6025.99	-2980.50
10.	Forestry	9747.95	0	3278.81
11.	Beverages	38132.38	0	3377.01
12.	Jute textile	2474.29	0	422.89
13.	Other textile	44591.96	0	2428.92
14.	Wood & products	3275.38	0	90.04
15.	Paper & products	4120.85	0	11.13
16.	Leather	3398.86	0	315.11
17.	Chemicals	55413.75	0	4628.00
18.	Non-metallicminerals	8331.92	0	152.64
19.	Iron & steel	30358.11	0	987.87
20.	Machinery	32913.55	0	897.70
21.	Mining & miscellaneous manufacturing	37018.80	0	3141.59
22.	Communication & transport	24353.54	0	401.59
23.	Construction	47253.73	6762.21	0
24.	Electricity & gas	21588.98	0	1769.15
25.	Services	197250.37	35759.78	-14132.99
	TOTAL			**1498.45**

TABLE 6

RESULTS OF SIMULATION 2

(MILLION US DOLLARS)

SL. NO	SECTORS	GROSS OUTPUT		NET EXPORTS OF INDIA TO BANGLADESH UNDER FREE TRADE
		INDIA	BANGLA DESH	
1.	Rice	13860.75	17537.83	-9574.44
2.	Wheat	13349.62	0	288.11
3.	Jute	731.73	0	64.40
4.	Sugarcane	6158.95	0	62.81
5.	Cotton	2754.32	0	189.55
6.	Tea	1224.57	0	171.10
7.	Other Agricuture	56125.23	2218.80	36.05
8.	Livestock	34191.37	0	4400.12
9.	Fishing	0	5890.28	-2984.11
10.	Forestry	9687.86	0	3229.09
11.	Beverages	37912.85	0	3208.32
12.	Jute textile	2424.24	0	535.68
13.	Other textile	41405.89	4267.48	107.35
14.	Wood & products	3289.39	0	118.25
15.	Paper & products	4325.75	0	243.80
16.	Leather	3389.80	0	308.96
17.	Chemicals	48738.74	6303.06	-261.96
18.	Non-metallicminerals	8268.37	0	129.23
19.	Iron & steel	29932.30	0	1436.49
20.	Machinery	31806.53	1012.58	20.51
21.	Mining & miscellaneous manufacturing	35932.77	0	3589.28
22.	Communication & transport	24567.80	0	445.43
23.	Construction	47264.65	6330.32	0
24.	Electricity & gas	21299.70	0	2749.19
25.	Services	203371.82	29697.57	-7014.51
	TOTAL			**1498.79**

2. 1 SUPER FREE TRADE MODEL

The super free trade model of India and Bangladesh is set up by making certain modifications in the model developed in section 1.3. The model formed with such modifications is referred to as the super free trade model because here the trading partners do not only freely trade with each other but they are also endowed with the

freedom to use each other's technology and to substitute its mean consumption vector with that of the other economy.

The modifications in the original model (section 1.3) which bring out the super free trade model are as follows:

- the Indian net output **(I-A) x** in equations (2) and (3) in section 1.3 is replaced by **(I-A) x + (I-A*) χ**, so that any gross output component can be generated by activity **x** 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 matrix **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 **kx + k* χ ≤ K** instead of **kx ≤ K**
- similarly, Bangladesh's capital requirements are bounded by **k*x* + k χ* ≤ K*** instead of **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 + ĉ**
- 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**. Thus, **yc** and **y*c*** in equation (2) and (3) is replaced by **{ yc + ($e^T y/ e^T y^*$) y* ĉ }** and **{ y*c* + ($e^T y^*/ e^T y$) y ĉ* }** respectively.
- The scanning variable **γ = (c*+ ĉ*)/ (c+ ĉ)** now instead **of γ = c*/ c** as before.

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

$$\textbf{Max} \quad e^T y\,(c + \hat{c}) + e^T y^*\,\gamma\,(c + \hat{c}) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

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

subject to the following constraints. For tradable commodities:

$$(I-A)\,x + (I-A^*)\,\chi + (I-A^*)\,x^* + (I-A)\,\chi^* \geq$$

$$yc + (e^T y / e^T y^*)\,y^*\,\hat{c} + y^* c^* + (e^T y^* / e^T y)\,y\,\hat{c}^* + z + z^* \quad \text{……..(2)}$$

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

$$(c^* + \hat{c}^*) = \gamma\,(c + \hat{c}) \quad \text{…….(3)}$$

for non-tradable commodities:

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

…….…. (4)

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

and for factor inputs:

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

$$lx + l^*\chi \leq L \quad \text{…….(5)}$$

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

$$l^* x^* + l\,\chi^* \leq L^*$$

The linear programme 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.

2.2 RESULTS AND DISCUSSION

The gross output figures of the two economies of India and Bangladesh under a super free trading arrangement as postulated by the model developed in the last section is presented in table 7 while the pattern of the super free trade between them is reported in table 8.

As noted from table 7 India does not produce Wheat, Jute, Cotton, Wood, Paper, Leather, Machinery, Mining and miscellaneous goods. Its trading partner Bangladesh on the other hand, produces all these goods and India finds it suitable to import these goods from there. Given the scope to use both its own as well as Bangladesh's technology to produce goods, India uses its own technology to produce goods like Other agriculture, Forest products, Beverages, Chemicals, Communication and transport equipment, while it uses Bangladeshi technology to produce Rice, Sugarcane, Tea, Livestock, Fish, Jute textile, Non-metal mineral manufactures, Iron and steel, Construction (non-tradable), Electricity

and gas and Services. However, for Other textile India finds it best to make use of both the technologies.

Bangladesh, now being given free access to use Indian technology, uses it to produce only two goods, namely, Paper and paper products and Machinery. It uses its own technology to produce several other goods, like, Rice, Wheat, Jute, Cotton, Fish, Wood and wood products, Leather, Mining and miscellaneous manufacturing and Construction (non-tradable). Under this arrangement of super free trade Bangladesh does not produce Sugarcane, Tea, Other agriculture, Livestock, Forest products, Beverages, Jute textile, Other textile, Chemicals, Non-metal mineral manufactures, Iron and steel, Communication and transport equipment, Electricity and gas and service. The country finds it profitable to obtain these goods by the way of imports from India, who produces all these goods either by using its own technology or the technology used by Bangladesh.

Thus, while India produces sixteen out of the twenty four tradable goods (Construction being non-tradable) considered in this empirical implementation of the super free trade model, Bangladesh produces ten of them. Together they produce twenty-six tradable goods. Thus there are two goods which both the countries are producing. These are Rice and Fish. However, for producing both these goods both India and Bangladesh rely on the technology of Bangladesh, thereby revealing its superiority over the Indian technique of producing the same. Though there are such goods, which are produced by both the economies, the ultimate pattern of comparative advantage underlying this super free trade between India and Bangladesh is revealed by the sign of the net export vector. Table 8 shows this net export vector. This table also contains the figures to specify the trade flow under free trade arrangement between the two economies so as to facilitate comparison between the two different situations.

Table 8 reports that India now imports a larger number of goods from Bangladesh as compared to the free trade situation (discussed in section 1.4). It obtains from Bangladesh Rice, Wheat, Jute, Cotton, Fishing, Wood products, Paper and paper products, Leather, Machinery and Mining and miscellaneous manufacturings. Thus, though India produces both Rice and Fish using Bangladesh's technology, yet it also imports some of both these goods from Bangladesh. This indicates that the ultimate advantage in the production of these two goods rests with Bangladesh. As noted from tables 7 and 8 India produces as

much as US $ 68526.09 million worth of Rice and US $ 18985 million worth of Fish, yet its net imports of Rice from Bangladesh is to the tune of US $ 2313.85 million and that of

TABLE 7

GROSS OUTPUT FIGURES OF INDIA TO BANGLADESH (1992)
WITH SUPERFREE TRADE
(MILLION US DOLLARS)

Sl. No	SECTORS	GROSS OUTPUT OF INDIA		GROSS OUTPUT OF BANGLADESH	
		USING OWN TECHNOLOGY	USING BANGLADESHI TECHNOLOGY	USING OWN TECHNOLOGY	USING INDIAN TECHNOLOGY
1.	Rice	0	68526.09	9690.814	0
2.	Wheat	0	0	5163.098	0
3.	Jute	0	0	445.029	0
4.	Sugarcane	0	4050.785	0	0
5.	Cotton	0	0	2152.484	0
6.	Tea	0	2586.8	0	0
7.	Other Agriculture	35925.98	0	0	0
8.	Livestock	0	36386.35	0	0
9.	Fishing	0	18985.17	9582.282	0
10.	Forestry	35747.25	0	0	0
11.	Beverages	44276.63	0	0	0
12.	Jute textile	0	2278.88	0	0
13.	Other textile	14436.62	26806.14	0	0
14.	Wood & products	0	0	2947.351	0
15.	Paper & products	0	0	0	2816.224
16.	Leather	0	0	4076.558	0
17.	Chemicals	90649.3	0	0	0
18.	Non-metallic minerals	0	6257.521	0	0
19.	Iron & steel	0	23670.13	0	0
20.	Machinery	0	0	0	14084.52
21.	Mining & miscellaneous manufacturing	0	0	58452.89	0
22.	Communication & transport	5482.515	0	0	0
23.	Construction	0	58744.12	5261.132	0
24.	Electricity & gas	0	27934.36	0	0
25.	Services	0	263691.2	0	0

Fish is US $ 7083.03 million. This may be explained by the relatively higher demand of both these goods in this country compared to their supply. Supply of these goods depend on inputs like land, water which may be preoccupied in alternative use and hence additional quantities of these inputs cannot be brought in to increase the domestic supply of these goods within India. As such, though our country produces substantial amounts of both these goods, yet it has to depend on some imports of these from Bangladesh, who is

endowed with a comparatively better ability to produce them (as is apparent from the super free trade pattern in table 8).

2.3 RELATIVE IMPORTANCE OF THE DETERMINANTS OF THE PATTERN OF COMPARATIVE ADVANTAGE

The comparison of the super free trade figures with the free trade figures in table 3 reveals that the comparative advantages of Bangladesh vis-à-vis India in the production of Rice and Fish persist when technology differences in production and consumption are eliminated. However, now with technology being the same across the two economies Bangladesh gains comparative advantage in some additional goods. They are—

Wheat, Jute, Cotton, Wood and wood products, Paper and paper products, Leather, Machinery, Mining and miscellaneous manufacturing. But, with such super free trading conditions prevailing Bangladesh looses its comparative advantage to India in the production of Services (which includes trade, educational, medical etc services) which it otherwise produces under a free trade set up as postulated by the model developed in section 1.3 of this paper. India now enjoys advantage in the production and hence exports of this good to Bangladesh, which it otherwise imports in a free trade situation. This difference in the pattern of comparative advantage of the two economies in the two different trade situations leads one to a crucial inference. The comparative advantage of the economy of Bangladesh in the production of Rice and Fish is determined by endowments, while, technology determines the economy's comparative advantage in case of Services. Thus, it is the superior technology of the country in the production of Services which enables it to enjoy a comparative advantage in the production of this good. So the moment technology in production is equalized across the two countries the country loses comparative advantage in the production of this good. Hence, given an opportunity to adopt the trading partner's technology, India is likely to adopt the superior technology that Bangladesh uses to produce Services.

TABLE 8

SUPER FREE NET EXPORTS OF INDIA TO BANGLADESH CONTRASTED WITH THE FREE NET EXPORT FIGURES (1992)
(MILLION US DOLLARS)

Sl. No	SECTORS	FREE NET EXPORTS OF INDIA T0 BANGLADESH	NET SUPERFREE EXPORTS OF INDIA TO BANGLADESH
1.	Rice	-10206.4	-2313.85
2.	Wheat	353.7466	-5934.42
3.	Jute	38.97531	-340.339
4.	Sugarcane	83.82027	72.15103
5.	Cotton	6.189199	-1881.31
6.	Tea	169.7769	221.2025
7.	Other Agriculture	1774.815	2228.343
8.	Livestock	4592.197	6892.079
9.	Fishing	-3458.09	-7083.03
10.	Forestry	4622.535	11579.15
11.	Beverages	2855.479	2991.046
12.	Jute textile	308.1356	420.9091
13.	Other textile	2089.184	2490.041
14.	Wood & products	80.1518	-1245.76
15.	Paper & products	10.58813	-1456.72
16.	Leather	336.1362	-3017.35
17.	Chemicals	4301.717	18119.89
18.	Non-metallic minerals	151.8255	941.038
19.	Iron & steel	1081.363	4933.96
20.	Machinery	924.1248	-10858.2
21.	Mining & miscellaneous manufacturing	3203.838	-51538.9
22.	Communication & transport	412.5991	1320.283
23.	Construction	0	0
24.	Electricity & gas	2335.823	4522.343
25.	Services	-14570.1	30435.6
	TOTAL	**1498.46**	**1498.16**

An analysis on the similar lines can be made to explain the changes observed in the pattern of trade flow from India to Bangladesh when the free trade conditions are replaced by super free trade conditions. As noted, India's production of Wheat, Jute, Cotton, Wood and wood products, Paper and paper products, Leather, Machinery, Mining

and miscellaneous manufacturing is picked up by Bangladesh once the technology differences between the two economies are ironed out. But as in a free trade arrangement India continues to retain its comparative advantage in goods like- Sugarcane, Tea, Other agriculture, Livestock, Forestry, Beverages, Jute textile, Other textile, Chemicals, Non-metallic minerals, Iron and steel, Communication and transport equipment and Electricity and gas. Hence India's comparative advantage in the former set of goods whose production are now picked up by Bangladesh is due to technology while endowments are responsible for India's comparative advantage in the goods in which the country retains its advantage even when technology differences is leveled out. Hence, being endowed with the scope to adopt India's technology, Bangladesh picks up the production of the eight goods for which India's comparative advantage is solely due to its technology (table 9).

In short as table 9 indicates, Bangladesh's comparative advantage in production of Rice and Fish are due to the country's endowments while in case of India endowments of the country account for its comparative advantage in the production of as many as thirteen goods, namely, Sugarcane, Tea, Other agriculture, Livestock, Forestry, Beverages, Jute textile, Other textile, Chemicals, Non-metallic minerals, Iron and steel, Communication and transport equipment and Electricity and gas. This is an instance where our theoretical framework finds support for the Heckscher – Ohlin theory of international trade, which as mentioned in section 1.2 of assumes that differences in technologies and tastes are insignificant in determining a country's comparative advantage in any line of production.

Therefore, given the opportunity to adopt a foreign technology each country adopts the other country's technology for producing goods and uses it to its advantage. But the question that arises is does this change in the trade flows as a result of adopting new technology fetch any additional gains to the countries ? The issue of gains in case of super free trade between the two countries is discussed in the following section.

TABLE 9

DETERMINANTS OF COMPARATIVE ADVANTAGES OF INDIA AND BANGLADESH

Sl. No	SECTORS	DETERMINANT OF COMPARATIVE ADVANTAGE	
		INDIA	BANGLADESH
1.	Rice		Endowments
2.	Wheat	Technology	
3.	Jute	Technology	
4.	Sugarcane	Endowments	
5.	Cotton	Technology	
6.	Tea	Endowments	
7.	Other Agriculture	Endowments	
8.	Livestock	Endowments	
9.	Fishing		Endowments
10.	Forestry	Endowments	
11.	Beverages	Endowments	
12.	Jute textile	Endowments	
13.	Other textile	Endowments	
14.	Wood & products	Technology	
15.	Paper & products	Technology	
16.	Leather	Technology	
17.	Chemicals	Endowments	
18.	Non-metallic minerals	Endowments	
19.	Iron & steel	Endowments	
20.	Machinery	Technology	
21.	Mining & miscellaneous manufacturing	Technology	
22.	Communication & transport	Endowments	
23.	Construction		
24.	Electricity & gas	Endowments	
25.	Services		Technology

Note: Construction is non-tradable

2.4 GAINS FROM SUPER FREE TRADE

Gains accruing to either economy when technology differences in production and consumption are leveled out are reported in table 10. It is noted from table 10 that given a chance, though Bangladesh adopts Indian technology to produce a host of goods and thereby reduce its dependence on India, yet as far gains from trade is concerned,

Bangladesh loses a significant portion of its gains by adopting Indian technique of production. While the extent of its gains from free trade with India (technology being specific to each economy) is as much as 51.7%, with technology differences between the

TABLE 10

GAINS FROM SUPER FREE TRADE ACCRUING TO INDIA AND BANGLADESH CONTRASTED WITH GAINS FROM FREE TRADE

SL. NO	COUNTRIES	INDIA		BANGLADESH	
		FREE TRADE	SUPER FREE TRADE	FREE TRADE	SUPER FREE TRADE
1.	Total Gains	64.3%	95%	88.9%	74.1%
2.	Gains by eliminating domestic waste of resources	63.3%	63.3%	37.2%	37.2%
3.	Gains from free trade only	1%	31.7	51.7%	36.9%

economies being ruled out the percentage of gains accruing to it come down to only 36.9%. However, India gains substantially from this trading arrangement as compared to free trade. India's gains from super free trade with Bangladesh are recorded to be 31.7% while the gains to it from free trade are only 1%.

Thus, when technology in production and consumption is assumed to be the same across the two countries of India and Bangladesh, Bangladesh loses a large part of its gain from trade while India makes substantial additional gains. This reduction in the gains of Bangladesh, however, may be explained by the fact that our model does not consider natural resources, climate etc as factors which can also influence production of a good. Under super free trading arrangements with India, Bangladesh is shown to produce goods like Wheat and Cotton. The climatic condition suitable for the production of these goods is mostly found in the western part of India. Bangladesh, which lies on the eastern boundary of India, lacks the favourable climatic conditions required for the production of these goods. Thus, in so far as the Indian edge in Wheat or Cotton production is a reflection of the adequate climatic conditions prevailing in the country, the transfer of the Indian technology to Bangladesh to enable it to produce these goods are likely to lower Bangladesh's gains.

However, the bigger trading partner India experiences an increase in gains under super free trade than what it reaps in a free trading arrangement with the same country. One

factor which may explain this increase in gain to some extent is that, bilateral free trade results in India losing its comparative advantage in the production of Services (in the production of which India is found to have comparative advantage according to the observed trade figures). However, with super free trade India once again regains its advantage in this line of production. Besides, as suggested by the super free net trade figures (table 8) India now imports Wood and Leather from Bangladesh. This is in conformity with the country's observed trade figures. In case of bilateral free trade both these were items of export for India. This may also serve to provide some sort of an explanation for the rise in the extent of India's gains once the country enters into a super free trading arrangement with Bangladesh. Thus, the super free trade model redistributes the gains from trade in favour of India rather than Bangladesh.

The above discussion indicates that the super free trade model of India and Bangladesh developed in section 2.1 serves a very useful purpose of isolating the determinants of comparative advantages of each economy. By holding technology in production and consumption constant across the two economies the model enables one 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. The model also highlights the role of international trade as a medium of transferring technology between 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 in quite a substantial number of cases. As obtained from table 7, given free access to technology Bangladesh is able to produce many more goods on its own than it could when technologies were different in the two economies under perfectly competitive free trade.

3. SUMMARY AND CONCLUSION

The emphasis given to free trade in the SAARC agenda led to several attempts to foster growth of bilateral trade between the two member countries of SAARC, namely, India and Bangladesh. Moreover, in recent years issues concerning bilateral trade between

Bangladesh and India have received heightened interest and come under close scrutiny. This is because during the last decade while India's importance as a source of imports to Bangladesh registered a phenomenal increase, Bangladesh's role as an exporter to the Indian market has undergone further marginalization. As a result, Bangladesh's trade deficit with India has increased substantially. Such a state of affairs has given rise to concern both at the policy level as well as at the level of public perception. Against this backdrop this paper attempts to study bilateral free trade between these two countries by constructing a competitive benchmark, based only on the fundamentals of the two economies: endowments, preferences and technologies. A linear programme along with an input-output framework helps to determine endogenously the direction of trade taking place between the countries. The paper proposes a new way to locate the comparative advantages of the two economies linked by international trade. No statistics or constructs beyond the fundamentals of the economies are used in the model. In particular, it employs no price statistics. Nor does it admit of any artificial limitations on the direction of trade. This theoretical framework provides a truly general equilibrium determination of the commodity pattern of trade.

The gross output of commodities being produced by each economy as obtained by solving the above model show that in a perfectly competitive world with free bilateral trade India produces all commodities considered in the model other than Fishing. On the other hand, Bangladesh would specialize in the production of Rice, Fishing and Services and will obtain all the remaining twenty-one tradable commodities from India. However, both countries have positive outputs of Construction since it is assumed to be non-tradable. It is obtained that India enjoys comparative advantage in almost all the commodities excepting Rice, Fishing and Services, which it finds suitable to import from her neighbouring country Bangladesh. On the other hand, in a free trade set up Bangladesh's comparative advantage rests on Rice, Fishing and Services.

The extent of India's gains from such free bilateral trade with Bangladesh is just 1% while that of Bangladesh is as large as 51.7%. Though Bangladesh gains significantly from this bilateral trading arrangement with India, but such an arrangement ends up making Bangladesh too much dependent on India for the supply of several essential goods. So to make Bangladesh self reliant to some extent, we carry out two simulations

in the paper where we make Bangladesh produce on its own some important goods of its consumptions (Tea, Other Agriculture, Other textile, Chemicals and Machinery) and lower the volume of its import of that good from India. But such an attempt lowers the extent of gains for Bangladesh.

The paper also explores the possibility of Bangladesh producing some of its important consumption items on its own by utilizing the Indian technology for production. To show how this could be done the paper proposes the super free trade model of India and Bangladesh. The results of the model indicate that the comparative advantage of the economy of Bangladesh in the production of Rice and Fish is determined by endowments, while, technology determines the economy's comparative advantage in case of Services. Hence, given an opportunity to adopt the trading partner's technology, India is likely to adopt the superior technology that Bangladesh uses to produce Services. In case of India, the endowments of the country accounts for its comparative advantage in the production of as many as thirteen goods, namely, Sugarcane, Tea, Other agriculture, Livestock, Forestry, Beverages, Jute textile, Other textile, Chemicals, Non-metallic minerals, Iron and steel, Communication and transport equipment and Electricity and gas. While technology determines the country's comparative advantage in the production of - Wheat, Jute, Cotton, Wood and wood products, Paper and paper products, Leather, Machinery, Mining and miscellaneous manufacturings. This model, not only demonstrates the relative importance of the determinants of the pattern of comparative advantage, but also throws considerable light on the contemporary issue of technology transfer associated with international trade.

The paper concludes on the note that, given the present global economic scenario formation of an Indo-Bangladesh free trade area seems to be prospective. In particular, it notes that the ultimate aim of the SAARC region is not to stop at preferential trading arrangements rather SAPTA should eventually make way for a free trade area in the region. Accordingly, the signing of the agreement on SAFTA at the 12th SAARC summit, held in Pakisatn on 6th January, 2004 represents a 'historic' move of this region from 'preferential trade' to 'free trade'. Against this backdrop, a Free Trade Area (FTA) option, particularly between India and Bangladesh needs to be looked at seriously by the governments of the both these countries. Such a free trade arrangement is likely to go a

long way towards deeper integration of the two South Asian countries, such as freeing of trade in services, free flow of investment, trade facilitation, harmonization and mutual recognition of standards and coordination of macro-economic policies. In particular, it will fetch substantial gains for the economy of Bangladesh by improving its over-all competitiveness through access to the marketing network, skill and technology of Indian manufacturers and trading partners. Similar suggestion has not only come up from various policy making levels in the two countries, but has also been put forward by various contemporary researchers in their writings. However, any work, which is based on theoretical model building that helps to analyze the viability of free bilateral trade between these two countries, has not been attempted to the best of the knowledge of the present researcher. The present study thus makes a modest contribution to this area.

4. DATA

The data required for the empirical work of the model is not always available in the desired form and as such we have adopted 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:

- Input-output coefficient matrices for India and Bangladesh (A, A^*);
- Sectoral capital and labour coefficients (k, l, k*, l*);
- Sectoral consumption coefficients (y, y*);
- Stocks of capital and labour for the two economies (K, L, K*, L*).

The detailed description of this data underlying the model and their necessary adjustments are given in Appendix A.

A. APPENDIX

A.1 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 (Planning Commission, Government of India, 1995) and of the

economy of Bangladesh for the year 1992-93, (Centre on Integrated Rural Development for Asia and Pacific (CIRDAP), Bangladesh, 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 25 sectors only in a way such that all sectors are common to India and Bangladesh. The sectors are: (1) Rice, (2) Wheat, (3) Jute, (4) Sugarcane, (5) Cotton, (6) Tea, (7) Other agriculture, (8) Livestock, (9) Fishing, (10) Forestry, (11) Beverages, (12) Jute textile, (13) Other textile, (14) Wood and wood products, (15) Paper and paper products, (16) Leather, (17) Chemicals, (18) Non-metallic minerals, (19) Iron and steel, (20) Machinery, (21) Mining and miscellaneous manufacturing, (22) Communication and transport equipment, (23) Construction, (24) Electricity and gas and (25) Services.

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) using the standard input-output rule:

$$\mathbf{A = z\,x^{-1}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$\mathbf{A^{*} = z^{*}\,x^{*\,-1}} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Where z is the inter-industry transaction matrix of India (25x25) and x is the diagonal matrix representing its sectoral outputs while z^{*} is the inter-industry transaction matrix of Bangladesh (25x25) and x is the diagonal matrix representing the economy's sectoral outputs.

A.2 Labour 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. In other words,

$$\mathbf{l = L\,x^{-1}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

for India and

$$\mathbf{l^{*} = L^{*}\,x^{*\,-1}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

for Bangladesh,

where l is the row vector of labour coefficients of India

L is the row vector of labour employed in each sector in the Indian economy

l* is the row vector of labour coefficients of Bangladesh

L* is the row vector of labour employed in each sector in the Bangladesh economy

While for the economy of Bangladesh the employment figures for all the required sectors were available for the year 1992-93 (CIRDAP, Bangladesh, 1996), for the economy of India the employment figures for majority of the sectors were available for the year 1991-92 from the economic tables (Census, 1991). For some agricultural sectors like Rice, Wheat, Jute, Sugarcane, Cotton the employment figures were obtained from website indiaagristat.com. Employment figure for Tea was available from the website www.teauction.com.

A.3 Capital Coefficients

An indirect method has been used to derive the sectoral capital coefficients from the available information for the two economies of India and Bangladesh. The following formula is used:

$$\mathbf{k = (v - wL)\, x^{-1}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$\mathbf{k^* = (v^* - w^*L^*)\, x^{*\,-1}} \quad \ldots\ldots\ldots\ldots (6)$$

for India and Bangladesh respectively,

where k is the row vector of capital coefficients of the Indian economy

v denotes the row vector of value added at factor cost by sectors of the Indian economy

w is the wage rate of the sectors of the Indian economy

L is the row vector of labour employed in the Indian sectors

k* is the row vector of capital coefficients of the Bangladesh economy

v* denotes the row vector of value added at factor cost by sectors of the Bangladesh economy

w* is the wage rate of the sectors of the Bangladesh economy

L* is the row vector of labour employed in the Bangladesh sectors

For both economies of India and Bangladesh the figures for sectoral value added at factor cost (v and v*) were available from the input-output tables of the respective economies.

For the Indian economy the wage rate was available from the Indian Labour Year Book 1995. For the economy of Bangladesh we had the data on wage rates for all the sectors (CIRDAP, 1996).

Thus, given v, w, L and x for India and v*, w*, L*and x* for Bangladesh we obtain the sectoral capital coefficients (k and k*) for the two economies which are presented in table A.1

TABLE A.1
SECTORAL LABOUR, AND CAPITAL COEFFICIENTS IN INDIA AND BANGLADESH

SL. NO.	SECTORS	INDIA		BANGLADESH	
		LABOUR COEFFICIENT (l)	CAPITAL COEFFICIENT (k)	LABOUR COEFFICIENT (l*)	CAPITAL COEFFICIENT (k*)
1.	Rice	52.05	0.38	41.37	0.20
2.	Wheat	26.49	0.56	38.44	0.15
3.	Jute	86.18	0.32	48.77	0.15
4.	Sugarcane	28.67	0.63	21.10	0.47
5.	Cotton	61.62	0.17	39.89	0.34
6.	Tea	67.62	0.53	6.19	0.65
7.	Other Agricuture	42.15	0.34	22.82	0.55
8.	Livestock	3.91	0.42	25.58	0.51
9.	Fishing	19.17	0.72	27.84	0.37
10.	Forestry	8.40	0.83	4.78	0.81
11	Beverages	10.40	0.05	6.44	0.16
12.	Jute textile	16.25	0.08	10.66	0.02
13.	Other textile	6.67	0.16	21.48	0.07
14.	Wood & products	64.27	0.03	25.52	0.03
15.	Paper & products	8.29	0.22	1.87	0.09
16.	Leather	11.03	0.24	2.44	0.08
17.	Chemicals	1.51	0.18	0.89	0.21
18.	Non-metallic minerals	17.91	0.29	1.46	0.15
19.	Iron & steel	1.64	0.21	1.24	0.14
20.	Machinery	3.35	0.26	2.79	0.26
21.	Mining & miscellaneous manufacturing	11.93	0.37	4.09	0.15
22.	Communication & transport	1.92	0.34	1.96	0.29
23.	Construction	7.97	0.29	6.03	0.04
24.	Electricity & gas	3.70	0.45	1.76	0.48
25.	Services	18.53	0.49	13.51	0.41

A.4 Capital Stock and Labour Force

In order to estimate the total capital stock of an economy, we require data on the degree of capacity utilization of that economy. For India, we obtained the rate to be roughly around 60% from Raa and Chakraborty (1991). The declining trends in capacity utilization in major industries over the years, the low efficiency of the private sector companies in terms of capacity utilization and extensive system of industrial licensing and price controls which resulted in bureaucratic controls over foreign trade are some of the factors which explain the reasons for this low degree of capacity utilization in India. Given this rough estimate of capacity utilization, the total capital stock for the Indian economy is obtained by using the formula

$$K = kx / \sigma$$

where σ is the degree of capacity utilization in India.

Due to similar reasoning, the capacity utilization in Bangladesh is also assumed to be around 60% and the capital stock (K*) for the economy of Bangladesh is obtained by using the formula

$$K^* = k^* x^* / \sigma^*$$

where σ^* ($= \sigma$)is the degree of capacity utilization in India.

The figures for the total labor force for both the economies are the total economically active population, which includes persons employed, as well as those who are willing to supply labour. For India this figure is available from Planning Commission Government of India, 1995 and for Bangladesh it is available from the World Development Report (1995). The figures for the capital and labour stocks for the two economies are shown in table A2.6

TABLE A 2

CAPITAL STOCK AND LABOUR FORCE OF INDIA AND BANGLADESH

COUNTRY	CAPITAL STOCK (MILLION US $)	LABOUR (MILLION)
India	240120.17	521.33
Bangladesh	21302.61	54.86

REFERENCES

1. **Bowen, H., Leamer, E.E. & Sveikauskas, L.** [1987] 'Multicountry, multifactor tests of the factor abundance theory', *American Economic Review*, 77, pp. 791-809.
2. **Davis, D., Weinstein, D., Bradford, S. & Shinpo, K.** [1997] 'Using international and Japanese regional data to determine when the factor abundance theory of trade works', *American Economic Review*, 87, pp. 421-446.
3. **Eusufzai, Z.** [2001] *Liberalization in the Shadow of a Large Neighbour: A Case of Bangladesh- India Economic Relations*, Dhaka University Press, 2000.
4. **Harris, R.** [1984] 'Applied general equilibrium analysis of small open economies with scale economies and imperfect competition', *American Economic Review*, 74, pp.1016-1032.
5. **Heckscher, E.F.** [1919] 'The Effect of Foreign Trade on the Distribution of Income' in *Readings in the Theory of International Trade*, Clarendon Press, Oxford.
6. **Helpman, E.** [1984] 'The Factor Content of Foreign Trade', *Economic Journal,* 94, pp.84-94.
7. **Helpman, E. and Krugman, P.R.** [1985] *Market structure and Foreign Trade*, Cambrigde, MIT Press.
8. **Leamer, E. E & Levinsohn, J.** [1995] International trade theory: evidence, in: G. Grossman & K. Rogoff (eds), *Handbook of International Economics*, Vol. III, Amsterdam, North- Holland.
9. **Mukherjee, I. N.** [2000] 'India's Trade and Investment linkages with Bangladesh: Identifying the Potential', *International Seminar on Indo-Bangladesh Relations- The New Millennium,* organized by Centre for Research in Indo-Bangladesh Relations, Kolkata and held at the Indian Institute of Chemical Engineers, Jadavpur University, Kolkata, December 7 & 8, 2000.
10. **Ohlin, B.** [1933] *Interregional and International trade*, Cambridge, Mass: Harvard University Press.
11. **Parthasarathi, G.** [1990] *Economic Cooperation in the SAARC Region, Potential, Constraints and Policies,* Interest Publication, New Delhi.

12. **Pohit, S. and Taneja, N.** [2000] 'India's informal trade with Bangladesh and Nepal: A Qualitative Assessment', *Indian Council for Research on International Economic Relations, Working Paper* No. 58, July.

13. **Poudel, K.** [2004] *Coverstory, Spotlight,* vol. 23, No. 24, January 9-15, 2004, nepalnews.com

14. **Pramanik, B.** [2000] 'A profile of Bangladesh foreign trade and prospect of Indo-Bangladesh economic cooperation', *International Seminar on Indo-Bangladesh Relations- The New Millennium,* organized by the Centre for Research in Indo-Bangladesh Relations, Kolkata and held at the Indian Institute of Chemical Engineers, Jadavpur University, Kolkata, 7 & 8 December, 2000.

15. **Raa, T.T. and Chakraborty, D.** [1991] 'Indian comparative advantage vis-a-vis Europe as revealed by linear programming of the two economies', *Economic Systems Research*, 3, pp. 111-150.

16. **Raa, T.T. and Mohnen, P.** [2001] 'The location of comparative advantages on the basis of fundamentals only', Economic Systems Research, 13, pp.93–108.

17. **Rahman, M.** [2000] 'Bangaldesh-India Bilateral Trade, An Investigation into Trade in Services', *paper prepared under South Asia Network of Economic Research Institutes (SANEI) Study Programme,* August.

18. **Rahman, S.** [1997] 'Non-reciprocity in Bangladesh-India bilateral trade: a case for market access and domestic competitiveness', *Bangladesh Institute of International and Strategic Studies (BIISS) Journal*, 18, pp. 289-347.

19. **Ricardo, D.** [1817] "On Foreign Trade", *Principles of Political Economy and Taxation,* paperback, 2004, Dover Publications, Barnes and Nobles.

20. **Roy, C. and Chakraborty, D.** [2000] 'Location of Comparative Advantages in India and Bangladesh', *Journal of Applied Input-Output Analysis*, 6, pp. 17-35.

21. **Samuelson, P.** [1949] 'International Trade and Equalization of Factor Prices', *The Economic Journal*, 58, pp.163-184.

22. **Sen, S.** [1972] 'Indo-Bangladesh Trade: Problems and Prospects', *Foreign Trade/Bangladesh*, *Economic and Political Weekly*, Vol. 7, No.15.

23. **Sobhan, R.** (ed) [2002] *Bangladesh-India Relations, Perspective from civil society dialogues, Centre for Policy Dialogue*, The University Press limited, Dhaka, Bangladesh.

24. **Srinivasan, T.N. and Whalley, J**. [1986] *General Equilibrium Trade Policy Modeling*, Cambridge, MIT Press.

25. **Trefler, D.** [1993] 'International factor pricing differences: Leontief was right!' *Journal of Political Economy*, 101, pp. 961-987.

26. **Trefler, D.** [1995] 'The case of missing trade and other mysteries', *American Economic Review,* 85, pp.1029-1046.

27. **Vanek, J.** [1968] '*The Factor Proportions Theory: The N-Factor Case*,' Kyklos, 21, pp. 749-756.

28. **Waheeduzzaman, A.N.M.** [2002] 'Facilitation of Trade and Investment among Bangladesh, India and Nepal: Sub-regional Cooperation and Competitiveness' in *Forrest E. Cookson and A.K.M Shamsul Alam edited Towards Greater Sub-Regional Economic Cooperation: Limitations, Obstacles and Benefits,* University Press Limited, Dhaka.

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