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India's global trade potential: The gravity model approach

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INDIA'S GLOBAL TRADE POTENTIAL: THE GRAVITY MODEL APPROACH

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DECEMBER 2004

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Contents

FOREWORD ..... **I**

ABSTRACT ..... **II**

I INTRODUCTION **1**

I THE GRAVITY MODEL **2**

II SURVEY OF LITERATURE **5**

III OUR APPROACH **6**

III.1 METHODOLOGY 9

III.1.1 Econometric Issues *10*

III.2 DATA SAMPLE 11

IV ESTIMATION RESULTS **12**

V INDIA'S TRADE POTENTIAL **15**

V.1 REGIONAL DISTRIBUTION OF INDIA'S TRADE POTENTIAL 16

V.2 INDIA'S TRADE POTENTIAL WITH REGIONAL GROUPINGS IN ASIA 17

V.2.1 India-SAARC *17*

V.2.2 India-ASEAN *18*

V.2.3 India-GCC *18*

V.2.4 India-China *19*

VI CONCLUSIONS **19**

REFERENCES **21**

APPENDIX **24**

ANNEX **37**

Foreword

The comprehensive programme of trade liberalization initiated in India in July 1991 has no doubt, led to a perceptible change in the performance of the external sector. Current account deficits have fallen sharply and reserves are accumulating. Though our share of world trade has almost doubled as the base was small it is still not commensurate with our position as the 11th largest economy in terms of the current exchange rate (4th in terms of GDP at PPP). Similarly, though our trade to GDP ratio has increased it is still far below other large economies such as China and Brazil. Clearly, therefore India needs to enhance its volume of trade with the rest of the world. This paper undertakes an estimation of India's global trade potential and is therefore topical.

To estimate the global trade potential for India this paper has used an augmented gravity model equation with maximum possible geographical coverage of world trade flows. Bilateral trade in the model has been explained using variables that are representative of geographical, cultural and historical proximity of bilateral trade pairs along with their economic size. In the process the model estimates the most natural trading partners for India. The paper identifies countries, regions and regional groupings in Asia with maximum potential for expansion of trade with India.

The estimates obtained using the augmented gravity model specification in this paper indicate a huge potential, of the order of US $ 6.5 billion, with Pakistan. The model also shows that there is tremendous potential with China and trade can more than double if barriers and constraints are removed.

The potential direction of trade indicated by the findings in this paper assumes great importance in the context of India's ongoing efforts of bilateral and regional integration. I am confident that this paper will provide an important contribution in shaping India's policy of country specific trade promotion and bilateral integration.

Arvind Virmani
Director & Chief Executive
ICRIER

December 2004

India's Global Trade Potential: The Gravity Model Approach

Amita Batra*

Abstract

In this paper we have attempted to estimate trade potential for India using the gravity model approach. We have used an augmented gravity model to first analyze the world trade flows and the coefficients thus obtained are then used to predict trade potential for India.

The gravity model has been estimated using the OLS technique with cross - section data for the year 2000. The dependent variable in all our tests is total merchandise trade (exports plus imports in US dollars), in log form, between pairs of countries.

Our estimation results show that the gravity equation fits the data and delivers precise and plausible income and distance elasticities and estimates for other geographical, cultural and historical characteristics. All three of the traditional "gravity" effects are intuitively reasonable, with statistically significant t-statistic. Alternative measures of GNP in terms of current dollar value and purchasing power parity do not alter either the sign or significance of different explanatory variables.

The magnitude of India's trade potential is highest with the Asia-Pacific region followed by Western Europe and North America. Countries like China, United Kingdom, Italy and France reveal maximum potential for expansion of trade with India. Among specific country groupings/trade arrangements, India's trade potential is revealed to be highest with Pakistan in SAARC and with Philippines and Cambodia in the ASEAN.

Key Words*: Gravity Model, Trade Potential*

JEL Classification: *F10, F13, F15*

* The idea of estimating India's global trade potential using the Gravity Model by ICRIER was first thought of by Prof. Arvind Virmani. I am indeed thankful for his giving me the opportunity to undertake this work. The paper as finalized reflects also Prof. Arvind Virmani's valuable suggestions at various stages. My sincere thanks to the participants at the ICRIER seminar for giving useful comments. Ms. Zeba Khan worked hard to assist me in finalizing this paper for which I offer my deep appreciation.

I Introduction

Trade reforms formed an integral part of the comprehensive programme of structural reforms initiated in India in 1991-92. These reforms have led to a perceptible change in the performance of the external sector in India. This is evident from the increase in trade to GDP ratio in India. From a pre -reform ratio (1980-1991) of 14 per cent, trade to GDP ratio increased to 23 per cent in the period of reforms (1991-2003). India's exports as a percentage of world exports improved to .56 per cent during 1991-96 and further to .65 per cent during 1996-2002 from .48 per cent in the 1980s. The ratio was .71 per cent in 2001-2002, the highest achieved so far since the 1970s. However, India's share in world trade is still very low and appears unimpressive when compared with other Asian countries such as China, Malaysia, Korea and Thailand[1]. India's share in world trade is less than one per cent. In comparison, China corners about 5 per cent of world trade and Korea has a 2.5 per cent share in total world trade There is, therefore, a clear need to enhance the volume of India's trade with the rest of the world. In this context an estimation of India's trade potential is appropriate.

This paper aims to estimate trade potential for India using the gravity model approach. Gravity model is one of the most popular empirical tools for modeling bilateral trade flows. We use the gravity model to first analyze the world trade flows for the year 2000. The coefficients thus obtained from the gravity model estimation are then used to predict trade potential for India.

Untapped trade potential is indicated in case India's trade with any country is less than that predicted by the gravity model. The policy implications associated with the findings of untapped trade potential would extend from the necessity of country specific trade promotion and bilateral integration to the need to anticipate relevant distributional changes due to the effect of the expansion in bilateral trade flows in the near future.

[1] Share of select East Asian countries in World exports and trade is presented in Annex Table I.

The remainder of the paper is organized as follows. In the next section an introduction to the gravity model and its theoretical foundations are presented. Section three briefly reviews the existing literature on the application of gravity model to international trade flows. In section four we present an outline of our approach, methodology, main econometric issues and data sample for estimation of the gravity model. Results are analyzed in section five. In section six we discuss India's trade potential with countries in SAARC, ASEAN and GCC. Section seven concludes.

I The Gravity Model

The gravity equation is a simple empirical model for analyzing bilateral trade flows between geographical entities. The gravity model for trade is analogous to the Newtonian physics function that describes the force of gravity. The model explains the flow of trade between a pair of countries as being proportional to their economic "mass" (national income) and inversely proportional to the distance between them. The model has a lineage that goes back to Tinbergen (1962) and Poyhonen (1963), who specified the gravity model equation as follows:

$$Trade_{ij} = \alpha . \frac{GDP_i . GDP_j}{Distance_{ij}} \qquad (1)$$

where $Trade_{ij}$ is the value of the bilateral trade between country i and j, GDP_i and GDP_j are country i and j's respective national incomes. $Distance_{ij}$ is a measure of the bilateral distance between the two countries and α is a constant of proportionality.

Taking logarithms of the gravity model equation as in (1) we get the linear form of the model and the corresponding estimable equation as:

$$Log\ (Trade_{ij}) = \alpha + \beta_1 \log (GDP_i . GDP_j) + \beta_2 \log(distance_{ij}) + u_{ij} \qquad (2)$$

Where α, β_1 and β_2 are coefficients to be estimated. The error term captures any other shocks and chance events that may effect bilateral trade between the two countries. Equation (2) is the core gravity model equation where bilateral trade is predicted to be a positive function of income and negative function of distance.

Theoretical Foundations

While the core gravity equation has been used for empirical analysis since the econometric studies of trade by Tinbergen (1962) and Poyhonen (1963), the theoretical foundations to the model are of more recent origin. The most classic and early application of the model to international trade was perhaps by Linnemann (1966).

Trade theorists have found the model to be consistent with theories of trade based upon models of imperfect competition and with the Hecksher – Ohlin model. Frankel (1997) credits Helpman and Krugman (1985) for the standard gravity model. The derivation of a proportionate relationship between trade flows and country size as given by Helpman do not include a role for distance. There are several reasons, though, for the inclusion of distance as an explanatory variable. Some of these explanations are as follows:

- Distance is a proxy for transport costs
- Distance is an indicator of the time elapsed during shipment. For perishable goods the probability of surviving intact is a decreasing function of time in transit
- Synchronization costs: when factories combine multiple inputs, the timing of these needs to be synchronized so as to prevent emergence of bottlenecks. Synchronization costs increase with increasing distance.
- Transaction costs: distance may be correlated with the costs of searching for trading opportunities and the establishment of trust between potential trading partners.
- Cultural distance: It is possible that greater geographical distance is correlated with larger cultural differences. Cultural differences can impede trade in many ways such as inhibiting communication, clashes in negotiating styles etc.

Bergstrand's (1985) version of the imperfect substitutes theory incorporated a role for shipping costs, proxied in practice by distance. More recently, Deardorff (1995) has derived the gravity model from Hecksher-Ohlin theory. Deardorff shows that the gravity model can be derived from two extreme cases of the classical framework of the Hecksher-Ohlin model. The first case is frictionless trade, in which the absence of all impediments to trade in homogenous products causes producers and consumers to be indifferent among trading partners. Resolving this indifference randomly expected trade flows correspond exactly to the simple frictionless gravity equation if preferences are identical and homothetic or if demands are uncorrelated with supply and they depart from that equation systematically when there are such correlations. The second case is that different countries produce distinct goods, as in the H-O model with complete specialization. Expression for bilateral trade are derived, first with Cobb-Douglas preferences and then with CES preferences. Distance is included in the second of the two models.

Trade theories based upon imperfect competition and the Hecksher-Ohlin model justify the inclusion of the core variables –income and distance. Most studies have however, included additional variables to control for differences in geographic factors, historical ties and at times economic factors like the overall trade policy and exchange rate risk.

The particular theoretical model that best describes the empirical findings of the gravity model is a matter of contention. The main point, however, is that it seems possible to derive the gravity model equation from a variety of leading theories. The equation, it is often said, has gone from an amazing poverty of theoretical foundations to an embarrassment of riches!

The gravity model of international trade has a remarkably consistent history of success as an empirical tool. The elasticities of trade with respect to both income and distance are consistently high, signed correctly and statistically significant in an equation that explains a reasonable proportion of the cross-country variation in trade. It is to be noted however, that, in analyzing trade between country A and B, the gravity model

makes no provision for third party effects i.e. the model does not take into account the conditions and opportunities that prevail between A and C and B and C.

II Survey of Literature

Among the many studies using the gravity framework, a high percentage shares the research task of predicting trade potentials. Rahman (2003) has estimated trade potential for Bangladesh using panel data approach with economic factors like openness, exchange rates etc rather than natural factors. Christie (2002) estimates trade potential for Southeast Europe using ordinary least square estimation on cross section data from 1996-99. Kalbasi (2001) has analyzed the volume and direction of trade for Iran in a 76 country sample. The group of countries has been divided into developing and industrial countries and trade flows have been examined to determine the impact, if any, of the stage of development on bilateral trade.

Several studies have analyzed the trade enhancing impact of preferential trading arrangements. These studies predict the additional bilateral trade that would be a consequence of the economic integration of a set of economies. Both the cross section and panel data approach has been used by these studies. The cross-section as also the panel data approach is mainly static and refers to a long run relationship. Frankel (1997) has used the gravity model to investigate a host of issues like the estimates of trading blocs, role of currency links etc using cross-section and panel data. Frankel and Wei (1993) have examined bilateral trade patterns throughout the world and analyzed the impact of currency blocs and exchange rate stability on trade.

The most recently developed gravity model, by UNCTAD-WTO Trade Centre is *TradeSim*. This is being used for the estimation of trade potentials for countries with limited trade relations in the past, in particular transition economies. The model is in general being used to analyze the bilateral trade flows of developing countries with their trading partners.

III Our Approach

In addition to the basic gravity model equation we estimate an augmented gravity model equation to first analyze international trade flows and then estimate the trade potential for India with its trading partners. The model is "augmented" in that, several conditioning variables that account for other factors that may affect trade have been included over and above the (the natural logarithms of) income and distance. The models-basic and augmented as formulated for estimation are as follows:

Basic Gravity Model

As stated in section II, the gravity model in its most basic form explains bilateral trade (T_{ij}) as being proportional to the product of GDPiand GDP_j and inversely related to the distance between them.

$$\text{Log (Tij)} = \alpha + \beta_1 \log (GDP_i GDP_j) + \beta_2 \log(GDP/pop_i . GDP/pop_j) + \beta_3 \log(Dist_{ij}) \ldots\ldots(3)$$

To account for other factors that may influence trade levels, dummy variables have been added to the basic model. The augmented gravity equation is thus expressed as follows:

Augmented gravity model:

$$\text{Log (Tij)} = \alpha + \beta_1 \log (Y_i Y_j) + \beta_2 \log(Y_i/pop_i . Y_j/pop_j) + \beta_3 \log(D_{ij}) + \beta_4 (Border_{ij}) + \beta_5 (Lang_{ij}) + \gamma_1(Regl) + \gamma_2 (Comcol) + \gamma_3 (Col) + \gamma_4 (landlocked) + \gamma_5 (Island) + u_{ij} \ldots\ldots\ldots(4)$$

Where i and j denotes countries and Tij denotes the value of bilateral trade between i and j. The explanatory variables in the gravity model are defined as follows:

GNP (Y)/Population (Pop)**:** There are two standard ways of measuring the size of countries in the gravity model: GNP (output) or population. We have also attempted to supplement the size variables with a measure of land area. This however does not add any

significant value to our analysis. The focus in this paper is thus on GNP as a measure of size and self- sufficiency with an alternative tests using population.

As regards GNP, the model is estimated using nominal GNP in US dollars and also GNP in terms of purchasing power parity (PPP). The main assumption is that trade usually happens at international prices, and so GNP at PPP has no bearing on trade levels. At the same time, given the strong under-valuation of certain countries' GNP, importantly for India, it is tempting to estimate the model with GNP at PPP and observe if the corresponding coefficients change in any significant fashion.

Per Capita Income: Y/POP: While mathematically, it is precisely equivalent, whether we express the explanatory variables as GNP and per capita GNP, or as GNP and population, we choose the former. In particular the specification with GNP per capita allows us to explore the link between a country's trade and its stage of development. Several explanations have been provided in the literature for inclusion of GNP per capita as an independent variable in addition to GNP. One possible explanation for the independent effect of per capita income is that exotic foreign varieties of goods are superior in consumption. Other possibilities arise out of the literature on endogenous growth. For e.g. the process of development may be led by the innovation or invention of new products that are then demanded as exports by other countries.

It is also instructive to focus explicitly on GNP per capita as a determinant of trade. The standard gravity model predicts that countries with similar levels of output per capita will trade more than countries with dissimilar levels. This is true of the Helpman-Krugman sort of theory also, as it predicts that the volume of trade should increase with increasingly equal distribution of national income. This however contradicts the traditional Hecksher-Ohlin theories of trade that predict that countries with dissimilar levels of output will trade more than countries with similar levels. In addition, the Linder hypothesis says that countries with similar levels of per capita income will have similar preferences and similar but differentiated products, and thus will trade more with each other. This hypothesis is often viewed as similar to the Krugman-Helpman theory in its predictions. While the Krugman – Helpman hypothesis predicts that the sum of the logs

of (GNP/popi) and (GNP/popj) will have a positive effect on the log of trade, the Linder hypothesis is associated with the prediction that the absolute value of the difference of the two variables will have a negative effect on trade. A positive value of this falls in the category of Hecksher – Ohlin theories.

To distinguish among these influences - Hecksher-Ohlin style factor endowments differences, Linder –style taste differences, and the effect of development on trade and in an attempt to capture the distinctive features of each, we add a term for the difference in per capita GNP in the standard formulation of the gravity model. A negative sign on this term would support the Linder hypothesis, while a positive sign would support the Hecksher-Ohlin hypothesis. We test for both the hypotheses.

Distance: D is the distance between country i and country j measured "as the crow flies"-technically called the great-circle distance measured between the two latitude-longitude combinations. A major proportion of trade today goes by air (and not by sea or land) and therefore the air routes provide the most convenient justification for using the straight – line or great -circle measure of distance. The ultimate justification is of course given by the fact that this measure seems to be a reasonable measure of averaging across different modes of transportation and works well in practice.

To capture the impact of geographical factors and historical ties between countries on bilateral trade we include dummy variables. These are explained as follows:

Border/ Adjacency: A dummy variable to identify a pair of countries that are adjacent or contiguous or share a border. This dummy is in addition to the inclusion of the distance variable to account for the possibility of centre- to-centre distance overstating the effective distance between neighboring countries that may often engage in large volumes of border trade. The dummy variable is unity if countries i and j share a common border and 0 when they do not.

Common language: $Lang_{ij}$: is equal to one when two countries share a common language (official or commercial): Common language is expected to reduce transaction costs as speaking the same language helps facilitate trade negotiations.

Colonial links: Shared history is expected to reduce transaction costs caused by cultural differences.

- *Comcol.:* is equal to one if i and j were colonies after 1945 with the same colonizer
- *Col.:* is equal to one if i colonized j or vice versa

Landlocked: number of landlocked countries in the pair

Island: number of countries in the pair that are islands

Regional trading arrangements: Regl: Countries often enter into regional trading agreements with the intention of facilitating bilateral trade. The dummy variable is equal to one when both countries in a given pair belong to the same regional group and 0 otherwise. The estimated coefficient will then tell us how much of the trade can be attributed to a special regional effect. On an average it has been found that FTAs impact positively on trade with a study by Frankel and Rose indicating a tripling of trade between partners on account of membership of RTAs. A list of the regional groups considered for our analysis with their member countries is presented in the Annex –Table III.

Uij is a log-normally distributed error term and represents the myriad other influences on bilateral trade. E (ln Uij) = 0.

III.1 Methodology

In the first stage we have estimated (equation 4) for world trade flows. Gravity model Equation (4) has been estimated using the OLS technique with cross - section data for the year 2000. The dependent variable is total merchandise trade (exports plus imports in US dollar thousands), in log form, between pairs of countries. All estimates are checked for heteroscedasticity.

While panel data has advantages in terms of being able to capture the relevant relationships over time and panels monitor unobservable trading-partner-pairs' individual effects, classical gravity models have used cross-section data to estimate trade effects and trade relationship for a particular time period, which is invariably one particular year. Further gravity model has been estimated upto the year 1996 and it has been observed that aggregation over time does not really add any value to the estimations. We have therefore followed the classical tradition of estimation with cross-section data.

In the second stage the estimated coefficients from the first stage have been used to analyze India's trade pattern in general and with some regional groupings in particular. The latter have been selected keeping in mind the prospective preferential trading arrangements that are in offing in the near future or are already operational. The regional groupings that have been analyzed for trade potential with India are SAARC, ASEAN and GCC. India-China trade potential finds a special mention in view of the ongoing efforts for expansion of bilateral trade between the two countries.

III.1.1 Econometric Issues

Multicollinearity:

Klein's thumb rule as well as simple correlations have been used to test for multicollinearity[2] in our specification. Simple correlations are small (refer Appendix-Table 2) and the auxiliary regressions for Klein's rule do not indicate multicollinearity. Multicollinearity is thus not a problem in our specification of the gravity model.

Endogeneity

Both economic size and income per capita are treated as exogenous variables in the gravity equation. There is, however empirical and theoretical support for the impact that trade can have on income. The possibility of endogeneity of these variables therefore cannot be denied and the apparently significant effect of income on trade may be

[2] According to *Klein's rule of thumb,* multicollinearity is a problem if max $R_j^2 > R^2$ where R_j^2 is the statistic from the OLS estimation of the auxiliary regression of the jth regressor on the other regressors and the intercept term. Several auxilliary regressions were estimated and this condition did not hold true for any of the regressors, as all R^2_j were less than .2.

spurious. To resolve this problem we have attempted alternative instrumental variables (IV) estimations using instruments like population and land area for size[3]. The use of instrumental variable technique does not alter the coefficients on any of the variables to any significant extent[4], implying thereby that the endogeneity of income does not lead to any significant distortion of the initially postulated relationship in the gravity model.

Country Pairs with Zero data:

For some country pairs the data entry is zero, normally due to levels of trade that are too small to be recorded. These are generally countries that, by virtue of their small size and remoteness, would be expected to have little trade with each other. It is not always possible, though, to ascertain whether their trade is actually zero or is very small and has in the process of being rounded off appeared as zero value. In any case, these pairs with zero trade values present a problem for estimation of the gravity model in the log linear form. We have tried to resolve this problem by estimating the model using three different techniques:

- Omission of the zero pairs from the data set
- Estimation of a restricted model, that is, estimate the gravity model for all countries that have income above US $15 million[5].
- A semi-log formulation of the gravity model. The reformulated gravity equation is then estimated using Tobit technique[6].

No significant changes in coefficient values are however found.

III.2 Data Sample

The dependent variable in our analysis is the natural log of total bilateral trade (exports plus imports) measured in current international prices (dollar value). Our analysis is based on the maximum possible geographical coverage of world trade flows. Our data source is the PC TAS. PC TAS is derived from the trade database of the United

[3] Correlation between population and GNP and land area and GNP is greater than .5, thereby indicating the strength of these variables as instruments for GNP/size.

[4] Results are not reported here, but are available on request from the author.

[5] Model IX –Results presented in Appendix- Table 3

[6] Model XI and XII –Results presented in Appendix-Table 3

Nation's Statistics Division, and covers over 90 per cent of world trade. 146 countries[7] report their exports and imports with trading partners drawn from a set of 245 countries. There are 20531 observations in the sample. Observations for all variables are for the year 2000.

GNP is measured in current international prices (dollars) as well as in PPP terms. Population of all countries is measured in millions. The data source for population and GNP is the World Bank published World Development Indicators (CD-ROM, 2003).

Bilateral distance is measured, in kilometers, as the great circle distance between two capital cities of the trading partners.[8] Bilateral distance is from the data set developed by Haveman[9] and the CEPII[10]. For language, contiguity, colonial background and other such information we have used the CIA World Factbook.

As there are missing observations for some of the regressors, the usable sample may be much smaller for most estimations.

IV Estimation Results

Table 3 presents the OLS estimates of the basic and augmented gravity models[11]. We analyze the results of the augmented model for both GNP at current international US $(Model VII) and in terms of PPP (Model IV).

Gravity model estimation results using GDP at current international dollar:

The model for both the basic and augmented version fits the data well and explains 70 per cent of the variation in bilateral trade across our sample of countries. The

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7 A list of the sample countries is given in the Annex-Table-II.

8 Great circle distance is measured between any two latitude-longitude combinations-i.e. "as the crow flies" between two cities. Where distance between capital cities is not available, distance between major cities of the trading partners has been used.

9 www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/Data/Gravity/dist.txt

10 www.cepii.fr.

11 Some other variations of the gravity model that have been estimated are also reported with model descriptions in the Appendix.

standard features of the gravity model work well. Distance and income provide most of the explanatory power in all the regressions. The baseline variables (both GDP and distance) are very highly significant, have the expected signs and are of reasonable magnitude.

The coefficient on the GNP variable in our specification is positive, statistically significant and economically reasonable indicating that higher GDP (for the country pairing) increases trade. Given that the coefficient is less than one (.87), an increase in the size of the country (output) increases trade, though, less than proportionately.

The estimated coefficient on log distance has the anticipated negative sign and is slightly over one, indicating that trade between a pair of countries falls by a little over 1 per cent for every 1 percent increase in the distance between them[12]. On controlling for adjacency, i.e. inclusion of the variable for common border, the magnitude of the coefficient on distance is reduced slightly. The coefficient on the dummy variable for a common border itself is estimated to be .56. As trade is specified in logarithmic form, we interpret the coefficient on the dummy by taking the exponent. Two countries that share a common border are estimated to engage in 75 per cent more trade than two otherwise-similar countries.

We have also included an effect for landlockedness, which may add to transportation costs. The coefficient on the dummy for this effect is estimated at –0.26. This implies that, holding constant for other factors, the lack of ocean ports reduces trade by about 30 per cent.

Sharing a language increases trade by economically and statistically significant amounts. The estimated coefficient of the common language dummy is .55. The implication is that two countries sharing linguistic links tend to trade roughly 74 per cent

[12] When the adjacency variable is not included in the gravity equation, the estimated coefficient on the log distance is a little more than, when it is included. When we hold constant for common borders, the estimated coefficient on the distance variable is diminished by a very small magnitude. The adajcency variable is to be included however, as it has its own relevance, beyond distance, for bilateral trade.

more than they would otherwise. The effect of sharing a common language though positive, is not as much as the effect of sharing a common border.

Ex-colonies and their colonizers and countries with the same colonizer all have disproportionately intense trade, consistent with intuition and received wisdom. Coefficients on the dummy variables representing these effects are positive and significant.

Effects of RTAs:

We find that the dummy variable for intra-regional trade is highly significant statistically. The common membership of a RTA explains some amount of bilateral trade over and above that explained by the five basic variables - size, per capita income, bilateral distance, common borders, and common languages. The coefficient on the dummy variable for regional trading arrangements is .87, implying that the preferential trading arrangements can lead to over twice as much trade as is otherwise possible for a country pair[13]. However the regional dummy when dis-aggregated into individual RTA dummies does not seem to have the same impact. This is even more apparent when we separate out the trade creating and trade diversion effects of these preferential trading arrangements. Specifically when we consider the Bangkok Agreement (BA) and the SAARC PTA in our specification, the trade diversion effects of the latter stand out for being highly significant in comparison with the trade creation effects. In case of the BA, while substantial trade creation is possible, the estimates also show the arrangement to be more open vis a vis the rest of the world (Refer Appendix-Table 3).

Gravity Model estimation results using GNP at PPP

The results reported above are for GNP and per capita GNP at current exchange rates. Alternatively these variables are measured at purchasing power parity rates (PPP). In theory the PPP rates are preferable as large temporary swings in the nominal exchange rate can distort the comparison of incomes across countries. The usual disadvantage cited against measurement of PPP values is that they may be subject to large measurement

[13] The dummy for RTA in the gravity equation does not distinguish between trade creating and trade diversion effects. The impact as indicated by the estiamted coefficient for the dummy therefore should be taken as the upper bound on trade creation effects of the RTA.

errors. Considering, however, that India's income is significantly understated in current dollar terms, we estimate the gravity model using the PPP measure also.

Most of the coefficients are left largely unaffected in terms of sign and significance. The coefficient for GNP per capita was statistically significant and positive. This was in contrast with the model with income measured at the current exchange rate. In that case per capita income was insignificant and was later dropped on account of high multi-collinearity. (Refer Appendix - Table 2)

Linder vs. Hecksher-Ohlin hypothesis:

To test for the strength of the Linder hypothesis as against the H-O hypothesis we have included the log of absolute difference in GNP per capita for a country pair. As stated earlier this allows us to address the question-whether trade flows are large among similar countries or dissimilar countries. Our estimation results support the Linder hypothesis. Similar countries trade more than dissimilar ones. The log difference of PC incomes appears as negative and significant for the model with these variables expressed in current international dollars. In case of the PPP model the negative sign is retained even though the variable does not remain significant. The coefficient on the product of per capita incomes remains positive however, and is highly significant. This suggests that the trade and development relationship is the most powerful of all the three channels through which per capita income can impact upon trade.

V India's Trade Potential

Having estimated the gravity model for bilateral trade flows in the world, we proceed to estimate trade potential for India. In this section the model estimates from the previous section are used to predict India's trade with all the countries in our sample. The ratio of trade potential (P) as predicted by the model and actual trade (A) i.e. (P/A) is then used to analyze the future direction of trade for India. If the value of P/A exceeds one, the implication is in terms of potential expansion of trade with the respective country. Depending on the value of P/A, India's trading partners have been divided into two categories-those with which potential for expansion of trade is foreseen and countries

with which India has already exceeded its trade potential. The absolute difference between the potential and actual level of trade i.e. the value of (P-A) has also been used to classify countries with potential for expansion of trade with India. A positive value indicates future possibilities of trade expansion while a negative value shows India has exceeded its trade potential with the particular partner country[14].

The magnitude of India's trade potential is maximum with countries like China, United Kingdom, Pakistan, Japan, Italy and France. Our estimates indicate that India can potentially attain ten times or more trade with countries like Georgia, Turkmenistan, and Uzbekistan. With countries like Lithuania, Tajikistan, Mongolia, Romania, Luxembourg and Norway, potential trade as predicted by our model is five times or more than the actual level of trade. Potential trade, that is more than twice the level of actual trade, is indicated for countries like China, Japan, Austria, Mexico, Qatar etc.

V.1 Regional Distribution of India's Trade Potential[15]

When India's trade potential is compared across different regions of the world, maximum potential is indicated for the Asia - Pacific region followed by western Europe, North America, Middle East, Central and Eastern Europe and Latin America. In Asia, Japan, Pakistan, China, Philippines and Korea reveal maximum potential for expansion of trade with India. Among the set of countries comprising the EU, India has trade potential with all except Belgium. In North America both the US and Canada reveal considerable potential for expanding trade. In Central and Eastern Europe, Poland, has the maximum potential for expansion of trade with India.

Most of the countries in the CIS region reveal possibilities of expanding trade with India. However, for the region as a whole, our findings show that India has exceeded its trade potential. This can be explained by the large magnitude of trade that India has with the Russian Federation. Russian Federation along with Ukraine and Belarus

[14] Refer Appendix -Table 4 (A-F) for countries with potential for expansion of trade with India. Refer Appendix - Table 5 (A-D) for countries where India has exceeded its trade potential.

constitute the group of countries in the CIS region, with which India has exceeded its trade potential.

V.2 India's Trade Potential with Regional Groupings in Asia[16]

In the paragraphs that follow we analyze India's trade potential with a set of countries defined by some preferential trading arrangements that are already operational or in offing in the near future using the estimates obtained from the model. In particular, we consider the group of countries constituting SAARC, ASEAN and the GCC. India's total trade with both SAARC and ASEAN has been increasing and the increase was 25 per cent in the period 2001-2002 –2002-2003. Currently the share of SAARC and ASEAN in total trade for India is small, about 8-9 per cent.

V.2.1 India-SAARC

Pakistan[1]
Maldives[1]
Nepal[1]
Sri lanka[3]
Bangladesh[2]
Bhutan[2]

1- potential, 2- no data available, 3- overtraded

Among the SAARC nations high trade potential according to both P/A as well as the magnitude of potential is indicated for Pakistan. In fact, among all SAARC member nations India's trade potential is indicated only for Pakistan. P/A ratio for Pakistan is very high. The magnitude of trade potential with India-Pakistan trade has thus far been restricted on account of political barriers and at present (2002-03) it accounts for only about 8 per cent of India's total trade with SAARC. In comparison Bangladesh, Sri Lanka and Nepal accounted for 38, 32 and 20 per cent respectively in the same period. For both Sri Lanka and Nepal our model yields a P/A ratio that is less than one indicating that

[15]Countries ranked according to the ratio of India's trade potential to actual trade and magnitude of trade potential in different regions is presented in the Appendix-Table 4(C and F).

16 In the respective groupings, countries ranked according to the ratio of India's potential to actual trade and magnitude of difference between potential and actual trade is presented in the Appendix-Table 6(A and B).

India has gone far beyond the level of trade predicted on the basis of natural factors with these two countries.

V.2.2 India-ASEAN

Philippines[1]
Cambodia[1]
Vietnam[1]
Thailand[3]
Indonesia[3]
Malaysia[3]
Singapore[3]
Laos[2]
Myanmar[2]
Brunei[2]

1- potential, 2- no data available, 3- overtraded

Among the ASEAN nations high trade potential is indicated for Philippines, Vietnam and Cambodia. At present Philippines has the lowest share in India's total trade with ASEAN. Philippines accounts for only six per cent of India's total trade with ASEAN in comparison with over 20 per cent share of countries like Singapore, Malaysia and Indonesia. Thailand also accounts for 11 per cent of India's trade with ASEAN. Our results indicate possibility of trade potential with Thailand, only with estimates of the model with GNPP at PPP. The value of the P/A ratio indicates that India has attained its potential with Vietnam. With countries like Malaysia, Indonesia and Singapore India seems to have exceeded its Trade potential.

V.2.3 India-GCC

Oman[1]
Qatar[1]
Kuwait[1]
Bahrain[3]
Saudi Arabia[3]
UAE[2]

1- potential, 2- no data available, 3- overtraded

Among the countries of the Gulf Cooperation Council, our model estimates yield a high trade potential for Oman, Kuwait and Qatar. With Oman, trade can be thrice as much as the actual trade while with Qatar the level of trade can be doubled. At present UAE ranks the highest and is followed by Saudi Arabia in terms of India's total trade with the GCC countries. For Saudi Arabia our model indicates a P/A ratio of less than one. This indicates that India's trade with Saudi Arabia has already crossed its potential.

V.2.4 India-China

Trade between India and China has been increasing in the recent years. Total trade increased by almost 46 per cent in 2003-04 over the previous year. However there is vast potential for expansion in India-China bilateral trade. The natural links between India and China, common border and their geographical proximity open vast opportunities for bilateral trade. The gravity model, when estimated with current GNP values in US $ yields a value of trade potential that is 2.5 times the actual trade between India and China.

Trade possibilities between India and China are further enhanced by access to an enlarged market owing to common membership of the Bangkok Agreement. China acceded to the Bangkok Agreement in 2001. The Bangkok Agreement is the largest PTA in terms of market potential. The size of the market and proximity of the two economies are thus indicative of a huge potential for trade between India and China.

VI Conclusions

In this paper we have estimated the trade potential for India using the augmented gravity model. Cross section data for the year 2000 has been analyzed using OLS estimation technique. Our analysis is based on maximum possible coverage of world trade flows.

The gravity equation fits the data and delivers precise and plausible income and distance elasticities and estimates for other geographical and historical characteristics. All

three of the traditional "gravity" effects are intuitively reasonable, with statistically significant t-statistic, often exceeding 50 in absolute value. As per received wisdom and intuition, higher economic size of a country pair and geographical proximity positively influence bilateral trade flows. Alternative measures of GNP in terms of current dollar value and purchasing power parity do not alter either the sign or significance of different explanatory variables. Historical and cultural similarities also impact positively upon bilateral trade.

Our estimates of India's global trade potential reveal that the magnitude of India's trade potential is maximum in the Asia-Pacific region followed by Western Europe and North America. Potential for expansion of trade is highest with countries like China, United Kingdom, Italy and France. Our estimates indicate that India can potentially attain ten times or more the level of the actual trade with countries like Georgia, Turkmenistan, and Uzbekistan. In fact, most of the countries in the CIS region reveal possibilities of expanding trade with India. For the region as a whole, however, our estimates show that India has exceeded its trade potential. This may be explained by the large magnitude of trade that India has with the Russian Federation. Among specific country groupings/trade arrangements India's trade potential is maximum with Pakistan in SAARC, with Philippines and Cambodia in the ASEAN region and with Oman, Qatar and Kuwait in the GCC.

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Appendix

Table 1: Descriptive Statistics

	Obs.	Mean	Std.Dev	Min	Max
Trade	7249	863847.3	7695192	1	3.96e+08
Trmfg	5611	84469.6	6651419	4	2.54e+08
gdp1	20803	3.02e+11	9.06e+11	4.17e+08	9.58e+12
gdpc1	20972	2.04e+11	8.18e+11	4.3e+07	9.81e+12
pc1	20803	9507.19	9349.66	450	53410
cpc1	20972	6943.04	9528.98	95.27	43043.24
dist	20291	8111.32	4622.63	4.01	131866.8
area1	21294	861593.7	2152450	300	1.69e+07
pop1 (mn)	22231	4.03e+07	1.49e+08	44000	1.26e+09
dl	22603	.08	.27	0	1
dcomcol	22603	.03	.18	0	1
dlandlock	22603	.36	.55	0	2
dborder	22603	.01	.10	0	1
disland	22603	.50	.61	0	2
dcomctry	22603	.00	.04	0	1
dcolonial	22603	.00	.06	0	1
dregnl	22603	.01	.10	0	1

Table 2: Simple Correlations

	trade	area1	Pop1	gdp1	pc1	dist	dl	dcomcol	Dlandlock	dborder	disland	dcomctry	dcolonial	dregnl	cpc1	trmfg
trade	1															
area1	0.04	1														
pop1	0.04	0.48	1													
gdp1	0.08	0.51	0.63	1												
pc1	0.07	0.01	-0.23	0.21	1											
dist	-0.06	0.2	0.09	0.14	0.03	1										
dl	0.03	0.04	-0.02	0.02	-0.06	-0.10	1									
dcomcol	-0.02	-0.06	0.03	-0.05	-0.11	-0.08	0.25	1								
dlandlock	-0.05	-0.10	-0.07	-0.09	-0.01	-0.16	-0.10	-0.06	1							
dborder	0.17	0.02	0.04	0.00	-0.09	-0.20	0.15	0.08	0.02	1						
disland	0.01	0.00	-0.06	0.05	0.20	0.19	0.17	0.10	-0.22	-0.09	1					
dcomctry	0.01	0.00	0.02	0.03	0.05	0.00	0.13	-0.01	-0.03	-0.01	0.10	1				
dcolonial	0.00	-0.04	-0.02	0.00	0.02	-0.01	0.22	-0.02	-0.03	-0.02	0.12	0.11	1			
dregnl	0.14	-0.05	-0.04	-0.04	0.06	-0.16	0.17	0.14	-0.05	0.15	0.14	0.01	0.01	1		
cpc1	0.08	0.00	-0.18	0.28	0.95	0.06	-0.05	-0.10	-0.04	-0.08	0.23	0.05	0.03	0.06	1	
trmfg	0.98	0.03	0.04	0.08	0.07	-0.06	0.02	-0.02	-0.05	0.16	0.01	0.02	0.00	0.14	0.08	1

Table 3: Gravity Model Estimates

Dependent Variable: Log (trade between country pairs)

	GNP-PPP				GNP-Current US$					
Var/model	**I**	**II**	**III (L/H-O)**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX:<15**	**X (Li/HO)**
PGNP	0.92	0.84	0.86	0.86	0.87	0.87	0.87	0.92	0.87	0.89
Dist.	-1.16	-1.11	-1.04	-1.04	-1.17	-1.17	-1.11	-1.09	-1.11	-1.11
PGNPPC		0.39	.38	0.38		0.006*				
Border			0.71	0.72			0.56	0.40	0.56	0.46
Language			0.72	0.72			0.55	0.77	0.55	0.54
Comcol			0.61	0.61			0.51	0.31	0.51	0.48
Col			1.24	1.23			1.0	0.89	1.0	1.05
Comctry			1.37	1.39			1.53	-	1.53	1.56
Landlocked			-0.45	-0.45			-0.26	0.01*	-0.26	-0.24
Island			0.07	0.07			0.09	0.08	0.09	0.13
Regl.			1.11	1.12			0.87	0.55	0.87	0.84
crude1			-	-				-0.01		
crude2			-	-				-0.01		
LPC			-0.02*							-0.07
Int.	-26.57	-29.9	-31.12	-31.17	-22.43	-22.4	-23.18	-25.34	-23.18	-23.29
Adjusted R^2	.63	.67	.70	.70	.69		.71	.73	.73	.71
No. of Obs.	5801	5801	5798	5801	5986	5986	5986	2422	5986	5986

	Tobit Models		RTA Effects	
Var/model	**XI(PPP)**	**XII (Current)**	**BA**	**SAPTA**
PGNP	.86	.87	.87	.86
Dist.	-1.04	-1.11	-1.08	-1.04
PGNPPC	.38	-		
Border	.72	.56	.33	.38
Language	.72	.55	.52	.47
Comcol	.61	.51	.34	.44
Col	1.23	1.0	.92	.86
Comctry	1.39	1.53	1.67	1.85
Landloc.	-.45	-.26	-.08	-08
Island	.07	.09	.02	.04
Regl.	1.12	.87	.87	.85
ba_I			.61	
ba_{ij}			.86	
$SAPTA_I$				-.17
$SAPTA_{ij}$				.30
Int.	-31.17	-23.18	-23.41	-24.12
No. of Obs.	5801	5988	4796	4796

All variables except dummies are in logs
All results are checked for heteroscedasticity
*: not significant
LPC = log of the absolute difference in per capita incomes of country 1 and 2 in the bilateral pair.
PGNP = Log (Y1*Y2)
PGNPPC =Log (Y_1/pop_1* Y_2/pop_2)

Model Description

I. $\text{Log}(\text{Trade}_{ij}) = \alpha + \beta_1 \log(\text{GNP}_i.\text{GNP}_j) + \beta_2 \log(\text{distance}_{ij}) + u_{ij}$

II. $\text{Log}(\text{Trade}_{ij}) = \alpha + \beta_1 \log(\text{GNP}_i.\text{GNP}_j) + \beta_2 \log(\text{distance}_{ij}) + \text{Log}(\text{PciPcj})^* + u_{ij}$

III. IV with PC entered as absolute value of the difference of log per capita incomes

IV. II + All dummies

Models I to IV are estimated using GNP in terms of PPP.

V. I with GNP in current US $

VI. II with GNP in current US $

VII. VI + All Dummies**

VIII. VII+ Crude Oil Reserves[1]

IX. VIII for all reporter countries with GNP > 15 million

X. VII with PC income variable entered to test for Linder/H-O hypothesis

XI. Semi-log (Tobit) estimation of VII

XII. Semi-log (Tobit) estimation of IV

*: Alternative model:

II': $\text{Log}(\text{Trade}_{ij}) = \alpha + \beta_1 \log(\text{GNP}_i.\text{GNP}_j) + \beta_2 \log(\text{distance}_{ij}) + \text{Log}(\text{PopiPopj}) + u_{ij}$

** The variable for per capita income is dropped in this and all the subsequent models using current GNP figures.

[1] To account for natural resources of individual countries.

India's Trade Potential

Note:
For all Tables below:
p- trade potential using estimates of the augmented gravity model; a-actual trade;
ppp: trade potential indicates estimates using model IV(GNP at PPP)
c- trade potential indicates estimates using model VII(GNP at current exchange rate)
Countries where India has already attained its potential have not been included.

Table 4A:Countries with Potential for Expansion of Trade $(P/A)_{ppp}$

Country	$(P/A)_{ppp}$	Country	$(P/A)_{ppp}$
Bosnia and Herzegovina	3302.1	Hungary	3.2
Macao, China	77.7	Turkey	3.2
Pakistan	52.2	Guyana	3.1
Macedonia,TFYR	25.9	Belarus	2.9
Turkmenistan	25.7	Portugal	2.9
Georgia	22.8	Uganda	2.9
New Caledonia	17.3	Mexico	2.7
Uzbekistan	13.9	Austria	2.5
El Salvador	12.5	Canada	2.5
Lithuania	11.2	Japan	2.5
Malta	11.2	Peru	2.5
Papua New Guinea	10.7	Ukraine	2.5
Romania	10.7	Sudan	2.4
Tajikistan	9.4	Spain	2.3
Slovakia	9.2	Bolivia	2.2
Luxembourg	9.1	Denmark	2.2
Namibia	8.0	Samoa	2.2
Zaire	8.0	Syrian Arab Republic	2.2
Bulgaria	7.9	Venezuela	2.2
Cambodia	7.9	Czechoslovakia	2.1
Mongolia	7.8	Kuwait	2.1
Poland	7.8	Paraguay	2.1
Cyprus	7.3	Solomon.Islands	2.1
China	6.5	Suriname	2.1
Azerbaijan	6.2	Italy	2.0
Guatemala	6.2	Sweden	2.0
Iceland	6.0	Vietnam	2.0
Central African Republic	5.8	Brazil	1.9
Croatia	5.8	Thailand	1.9
Zimbabwe	5.8	USA	1.9
Ireland	5.5	Korea, Rep.	1.8
Philippines	5.5	Madagascar	1.8
Gambia	5.4	Russian Fed	1.8
Norway	5.3	Botswana	1.7
Algeria	5.1	Malawi	1.7
Kazakhstan	5.1	Finland	1.6
United Kingdom	4.9	France	1.6
Jamaica	4.8	Guinea	1.6
Greece	4.6	Sierra.Leone	1.6
Oman	4.4	Hong.Kong	1.5
Cameroon	4.2	Lebanon	1.4
Ecuador	4.1	Australia	1.3
Estonia	4.1	Bahrain	1.3
Iran	4.1	Germany	1.3
Slovenia	4.0	Nepal	1.3
Colombia	3.8	Kenya	1.2
Costa Rica	3.8	South.Africa	1.2
Latvia	3.7	Tunisia	1.2
Kyrgyzstan	3.6	Netherlands	1.1
New Zealand	3.6	Saudi Arabia	1.1
Ghana	3.3		

Table 4B: Countries with Potential for Expansion of Trade $(P/A)_c$

Country	$(P/A)_c$	Country	$(P/A)_c$
Macao, China	43.7	Turkey	2.3
Bosnia and Herzegovina	43.4	Algeria	2.2
Pakistan	26.7	Kazakhstan	2.2
Turkmenistan	13.9	Bolivia	2.1
Macedonia,TFYR	12.6	Latvia	2.1
Georgia	11.9	Mexico	2.1
Uzbekistan	9.5	Slovenia	2.1
Libya	7.8	Austria	2.0
New Caledonia	7.4	Qatar	2.0
El Salvador	7.0	Estonia	1.9
Lithuania	5.9	Iran	1.9
Mongolia	5.5	Lebanon	1.9
Tajikistan	5.5	Madagascar	1.8
Malta	5.4	Costa Rica	1.7
Romania	5.2	Hungary	1.7
Luxembourg	5.0	New Zealand	1.7
Norway	4.5	Peru	1.7
Papua New Guinea	4.5	Suriname	1.7
Iceland	4.3	Sweden	1.7
Poland	4.2	Denmark	1.6
Slovakia	4.1	Kuwait	1.6
Yugoslavia	4.1	Portugal	1.6
Azerbaijan	3.7	Gambia	1.5
Central African Republic	3.7	Seychelles	1.5
Zaire	3.7	Colombia	1.4
Croatia	3.5	Spain	1.4
Guatemala	3.5	Syrian Arab Republic	1.4
Cambodia	3.3	Canada	1.3
Cyprus	3.3	Italy	1.3
Cameroon	3.1	Sierra.Leone	1.3
Namibia	3.0	Uganda	1.3
Oman	3.0	Finland	1.2
Japan	2.9	France	1.2
Bulgaria	2.8	Korea, Rep.	1.2
Greece	2.8	Malawi	1.2
Ireland	2.8	Botswana	1.1
United Kingdom	2.7	Brazil	1.1
China	2.6	Kyrgyzstan	1.1
Venezuela	2.5	USA	1.1
Zimbabwe	2.5		
Ecuador	2.4		
Philippines	2.3		

Table 4C:
Regional Distribution of Countries with Potential for Expansion of Trade* (P/A)

Country	$(P/A)_{ppp}$	$(P/A)_c$	Country	$(P/A)_{ppp}$	$(P/A)_c$
Latin America			**CIS**		
El Salvador	12.5	7.0	Turkmenistan	25.7	13.9
Guatemala	6.2	3.5	Georgia	22.8	11.9
Venezuela	2.2	2.5	Uzbekistan	13.9	9.5
Ecuador	4.1	2.4	Tajikistan	9.4	5.5
Bolivia	2.2	2.1	Azerbaijan	6.2	3.7
Mexico	2.7	2.1	Kazakhstan	5.1	2.2
Peru	2.5	1.7	Kyrgyz Republic[1]	3.6	1.1
Suriname	2.1	1.7	Belarus[1]	2.9	0.9
Colombia	3.8	1.4	Ukraine[1]	2.5	0.8
Brazil	1.9	1.1	Russian Federation[1]	1.8	0.7
Paraguay[2]	2.1	1.0	**North Africa**		
Guyana[1]	3.1	0.8	Libya	-	7.8
Jamaica[1]	4.8	-	Algeria	5.1	2.2
Western Europe			**Sub-Saharan Africa**		
Bosnia and Herzogovina	3302.1	43.4	Central African Republic	5.8	3.7
Macedonia	25.9	12.6	Zaire	8.0	3.7
Malta	11.2	5.4	Cameroon	4.2	3.1
Luxembourg	9.1	5.0	Namibia	8.0	3.0
Norway	5.3	4.5	Zimbabwe	5.8	2.5
Iceland	6.0	4.3	Madagascar	1.8	1.8
Croatia	5.8	3.5	Gambia	5.4	1.5
Cyprus	7.3	3.3	Seychelles	-	1.5
Greece	4.6	2.8	Sierra.Leone	1.6	1.3
Ireland	5.5	2.8	Uganda	2.9	1.3
UK	4.9	2.7	Malawi	1.7	1.2
Turkey	3.2	2.3	Botswana	1.7	1.1
Slovenia	4.0	2.1	Sudan[2]	2.4	1.0
Austria	2.5	2.0	Kenya[1]	1.2	0.9
Sweden	2.0	1.7	Guinea[1]	1.6	0.8
Denmark	2.2	1.6	Ghana[1]	3.3	0.7
Portugal	2.9	1.6	Tunisia[1]	1.2	0.6
Spain	2.3	1.4	South.Africa[1]	1.2	0.3
Italy	2.0	1.3	**Asia Pacific**		
Finland	1.6	1.2	Macao, China	77.7	43.7
France	1.6	1.2	Pakistan	52.2	26.7
Germany[2]	1.3	1.0	Mongolia	7.8	5.5
Netherlands[1]	1.1	0.7	Papua New Guinea	10.7	4.5
Middle-East			Cambodia	7.9	3.3
Oman	4.4	3.0	Japan	2.5	2.9
Qatar	-	2.0	China	6.5	2.6
Iran	4.1	1.9	Philippines	5.5	2.3
Lebanon	1.4	1.9	New Zealand	3.6	1.7
Kuwait	2.1	1.6	Korea, Rep.	1.8	1.2
Syrian Arab Republic	2.2	1.4	Solomon.Islands[2]	2.1	1.0
Bahrain[1]	1.3	0.9	Vietnam[2]	2.0	1.0
Saudi Arabia[1]	1.1	0.8	Thailand[1]	1.9	1.0
Central and Eastern Europe			Hong.Kong[1]	1.5	0.9
Lithuania	11.2	5.9	Nepal[1]	1.3	0.8
Romania	10.7	5.2	Australia[1]	1.3	0.7
Poland	7.8	4.2	Samoa[1]	2.2	-
Yugoslavia	-	4.1	**North America**		
Slovak Republic	9.2	4.1	Canada	2.5	1.3
Bulgaria	7.9	2.8	USA	1.9	1.1
Latvia	3.7	2.1			
Estonia	4.1	1.9			
Hungary	3.2	1.7			
Czech Republic[2]	2.1	1.0			

*-ranked within regions according to $(P/A)_c$;
1-potential according to $(P/A)_{ppp}$ but overtraded according to $(P/A)_c$
2-potential according to $(P/A)_{ppp}$ but 1 according to $(P/A)_c$

Table 4D: Countries with Potential for Expansion of Trade $(P\text{-}A)_{ppp}$

(US$ million)

Country	$(P\text{-}A)_{ppp}$	Country	$(P\text{-}A)_{ppp}$
United Kingdom	21600	Nepal	114.0
China	16200	Croatia	112.2
Pakistan	13100	Slovenia	111.6
USA	11800	Malta	109.5
Japan	5720.4	Belarus	106.5
Italy	2107.2	Lithuania	101.6
Bosnia and herzegovina	1799.1	Syrian.Arab.republic	97.9
Canada	1729.6	Turkmenistan	96.2
Germany	1439.8	Uganda	93.5
France	1406.8	Luxembourg	88.6
Iran	1384.0	Macao, China	85.5
Hong.kong	1370.7	Venezuela	71.5
Philippines	1221.7	Cambodia	64.6
Russian fed	1199.0	Azerbaijan	62.3
Spain	1098.6	Kyrgyzstan	58.4
Korea, rep.	1031.7	Peru	55.6
Poland	891.0	Bahrain	55.4
Turkey	861.4	Georgia	55.1
Thailand	804.5	Cameroon	51.4
Ireland	803.7	Latvia	49.4
Greece	559.9	Papua.new.guinea	47.4
Australia	528.0	Estonia	45.4
Oman	521.1	Guatemala	39.9
Norway	469.3	Costa rica	37.6
Mexico	443.1	Iceland	37.0
Sweden	440.2	Jamaica	35.8
Brazil	439.4	Tajikistan	35.2
New.Zealand	372.8	Zaire	33.5
Denmark	364.6	El.salvador	32.4
Kuwait	349.6	Macedonia, tfyr	31.7
Austria	348.7	Tunisia	27.7
Romania	332.4	Namibia	26.8
Portugal	311.3	Kenya	25.8
Ukraine	305.3	Ecuador	24.7
Algeria	305.1	Lebanon	21.0
Kazakhstan	270.0	N.Caledonia	18.8
Uzbekistan	262.6	Guyana	13.7
Viet nam	250.1	Gambia	13.5
Finland	232.8	Malawi	13.2
South.africa	206.7	Mongolia	10.4
Cyprus	200.4	Paraguay	9.9
Saudi arabia	190.8	Madagascar	9.4
Hungary	190.3	Botswana	8.8
Colombia	190.0	Guinea	6.8
Czechoslovakia	167.7	Bolivia	5.2
Bulgaria	157.5	Central African Republic	4.9
Ghana	152.6	Solomon.islands	4.0
Sudan	149.6	Sierra.Leone	3.3
Slovakia	132.9	Samoa	1.4
Netherlands	117.2	Suriname	1.3
Zimbabwe	114.8	Maldives	0.7

Table 4E: Countries with Potential for Expansion of Trade $(P\text{-}A)_c$

(US$ million)

Country	(P-A)c	Country	(P-A)c
United Kingdom	9506.2	Malta	46.7
Japan	6888.5	Luxembourg	43.8
Pakistan	6550.2	Bulgaria	41.6
China	4575.5	Slovenia	39.4
USA	1634.1	Zimbabwe	35.9
Italy	534.3	Cameroon	34.7
France	498	Syrian.Arab.Republic	32.5
Turkey	488.8	Azerbaijan	32.3
Poland	424.4	Yugoslavia	31.6
Iran	404.1	Colombia	30.2
Norway	383.7	Georgia	27.5
Canada	364.3	Iceland	24.3
Spain	348.9	Peru	23.7
Philippines	346.1	Bosnia and Herzegovina	23.1
Ireland	312.9	Cambodia	21.7
Oman	304.8	Latvia	19.8
Sweden	301.6	Guatemala	19.6
Mexico	292.1	Tajikistan	18.9
Greece	278	Papua.new.guinea	17.1
Korea, rep.	244.7	El.salvador	16.9
Austria	235.6	Uganda	15.3
Denmark	194.1	Macedonia, tfyr	14.7
Kuwait	186.7	Estonia	13.8
Uzbekistan	172.5	Zaire	13.1
Romania	144.1	Ecuador	11.3
Qatar	140.2	Costa rica	9.8
Libya	109	Viet nam	9.4
New.zealand	102.2	Madagascar	8.7
Portugal	93.6	Namibia	7.6
Venezuela	89.2	N.caledonia	7.4
Algeria	87.7	Mongolia	6.8
Finland	82.3	Bolivia	5
Kazakhstan	80.2	Malawi	4.7
Cyprus	74.2	Seychelles	3.7
Brazil	73.3	Kyrgyzstan	3
Hungary	59.8	Central african republic	2.7
Croatia	58.4	Gambia	1.6
Turkmenistan	50.3	Sierra.leone	1.4
Lebanon	50.1	Botswana	1.2
Slovakia	49.9	Suriname	0.8
Lithuania	48.6	Paraguay	0.3
Macao, china	47.6		

Table 4F:
Regional Distribution of Countries with Potential for Expansion of Trade* (P-A)*(US$mn)*

Country	(P-A)ppp	(P-A)c	Country	(P-A)ppp	(P-A)c
North America			**CIS**		
USA	11800	1634.1	Uzbekistan	262.6	172.5
Canada	1729.6	364.3	Kazakhstan	270.0	80.2
Latin America			Turkmenistan	96.2	50.3
Mexico	443.1	292.1	Azerbaijan	62.3	32.3
Venezuela	71.5	89.2	Georgia	55.1	27.5
Brazil	439.4	73.3	Tajikistan	35.2	18.9
Colombia	190.0	30.2	Kyrgyzstan	58.4	3.0
Peru	55.6	23.7	Belarus[1]	106.5	-3.8
Guatemala	39.9	19.6	Ukraine[1]	305.3	-46.4
El Salvador	32.4	16.9	Russian Federation[1]	1199.0	-359.0
Ecuador	24.7	11.3	**North Africa**		
Costa Rica	37.6	9.8	Libya	-	109.0
Bolivia	5.2	5.0	Algeria	305.1	87.7
Suriname	1.3	0.8	**Sub-Saharan Africa**		
Paraguay	9.9	0.3	Zimbabwe	114.8	35.9
Jamaica	35.8	-	Cameroon	51.4	34.7
Guyana[1]	13.7	-1.6	Uganda	93.5	15.3
Western Europe			Zaire	33.5	13.1
UK	21600.0	9506.2	Madagascar	9.4	8.7
Italy	2107.2	534.3	Namibia	26.8	7.6
France	1406.8	498.0	Malawi	13.2	4.7
Turkey	861.4	488.8	Seychelles	-	3.7
Norway	469.3	383.7	Central African Republic	4.9	2.7
Spain	1098.6	348.9	Gambia	13.5	1.6
Ireland	803.7	312.9	Sierra.Leone	3.3	1.4
Sweden	440.2	301.6	Botswana	8.8	1.2
Greece	559.9	278.0	Guinea[1]	6.8	-2.8
Austria	348.7	235.6	Sudan[1]	149.6	-5.1
Denmark	364.6	194.1	Kenya[1]	25.8	-17.3
Portugal	311.3	93.6	Ghana[1]	152.6	-18.8
Finland	232.8	82.3	Tunisia[1]	27.7	-52.0
Cyprus	200.4	74.2	South.Africa[1]	206.7	-927.2
Croatia	112.2	58.4	**Asia -Pacific**		
Malta	109.5	46.7	Japan	5720.4	6888.5
Luxembourg	88.6	43.8	Pakistan	13100.0	6550.2
Slovenia	111.6	39.4	China	16200.0	4575.5
Yugoslavia	-	31.6	Philippines	1221.7	346.1
Iceland	37.0	24.3	Korea, Rep.	1031.7	244.7
Bosnia and Herzogovina	1799.1	23.1	New Zealand	372.8	102.2
Macedonia	31.7	14.8	Macao, China	85.5	47.6
Germany[1]	1439.8	-170.0	Cambodia	64.6	21.7
Netherlands[1]	117.2	-391.2	Papua New Guinea	47.4	17.1
Middle-East			Vietnam	250.1	9.4
Iran	1384.0	404.1	Mongolia	10.4	6.8
Oman	521.1	304.8	Solomon.Islands[2]	4.0	0.03
Kuwait	349.6	186.7	Maldives[1]	0.7	-8.4
Qatar	-	140.3	Thailand[1]	804.5	-37.3
Lebanon	21.0	50.1	Nepal[1]	114.0	-82.7
Syrian Arab Republic	97.9	32.5	Hong.Kong[1]	1370.7	-407.5
Bahrain[1]	55.4	-19.9	Australia[1]	528.0	-418.2
Saudi Arabia[1]	190.8	-279.4	Samoa	1.4	-
Central and Eastern Europe					
Poland	891.0	424.4			
Romania	332.4	144.1			
Hungary	190.3	59.8			
Slovak Republic	132.9	49.9			
Bulgaria	157.5	41.6			
Latvia	49.4	19.8			
Estonia	45.4	13.8			
Lithuania	101.6	48.6			
Czech Republic[1]	167.7	-5.6			

*-ranked within regions according to $(P\text{-}A)_c$;
1-potential according to $(P\text{-}A)_{ppp}$ but overtraded according to $(P\text{-}A)_c$
2-potential according to $(P\text{-}A)_{ppp}$ but insignificant according to $(P\text{-}A)_c$

Table 5A : Countries where India has Exceeded its Trade Potential (P/A)

Country	$(P/A)_{ppp}$	$(P/A)_c$
Argentina	0.7	0.5
Australia	-	0.7
Bahrain	-	0.9
Belarus	-	0.9
Belgium	0.2	0.1
Benin	0.1	0.1
Burkina Faso	0.6	0.4
Chile	0.7	0.4
Congo	0.1	0.3
Cote Divoire	0.3	0.3
Djibouti	0.3	0.2
Ethiopia	0.3	0.1
Gabon	0.5	0.5
Ghana	-	0.7
Guinea	-	0.8
Guyana	-	0.8
Hong Kong	-	0.9
Indonesia	0.8	0.4
Israel	0.8	0.6
Jordan	0.2	0.2
Kenya	-	0.9
Liberia	-	0.2
Malaysia	0.5	0.3
Maldives	-	0.7
Mali	0.2	0.2
Mauritania	0.6	0.3
Mauritius	0.9	0.3
Morocco	0.4	0.3
Mozambique	0.4	0.3
Nepal	-	0.8
Netherlands	-	0.7
Niger	0.3	0.2
Nigeria	0.8	0.7
Panama	0.2	0.2
Russian Fed	-	0.7
Saudi Arabia	-	0.8
Senegal	0.2	0.2
Singapore	0.5	0.3
South Africa	-	0.3
Sri Lanka	1.0	0.5
Switzerland	0.1	0.1
Tanzania	0.5	0.7
Togo	0.4	0.2
Tunisia	-	0.6
Ukraine	-	0.8
Uruguay	0.9	0.7
Vanuatu	0.1	0.04
Yemen	0.2	0.4
Zambia	0.7	0.9

Table 5B: Countries where India has Exceeded its Trade Potential (P-A)

(US$ million)

Country	(P-A)ppp	(P-A)c
Argentina	-154.9	-305.2
Belgium	-3874.4	-4169.1
Benin	-60.6	-60.3
Burkina faso	-7.7	-11.0
Chile	-65.1	-114.6
Congo	-44.0	-36.2
Cote divoire	-80.6	-81.4
Djibouti	-14.5	-16.3
Ethiopia	-53.5	-62.8
Gabon	-17.7	-20.6
Guinea.bissau	-75.7	-76.5
Indonesia	-234.5	-768.5
Israel	-160.5	-377.2
Jordan	-250.2	-268.1
Liberia	-	-14.7
Malaysia	-924.7	-1331.2
Mali	-24.6	-24.2
Mauritania	-6.2	-10.4
Mauritius	-19.2	-139.6
Morocco	-210.6	-269.4
Mozambique	-32.0	-40.0
Niger	-20.8	-22.7
Nigeria	-91.1	-147.0
Panama	-79.4	-84.3
Senegal	-52.9	-56.8
Singapore	-1283.9	-1624.0
Sri.lanka	-5.6	-367.2
Switzerland	-3162.2	-3149.1
Tanzania	-76.4	-41.3
Togo	-31.1	-45.1
Uruguay	-2.4	-10.9
Vanuatu	-33.0	-34.8
Yemen	-141.2	-108.2
Zambia	-9.2	-5.1

Table 5C:
Regional Distribution of Countries where India has Exceeded its Trade Potential (P/A)

	$(P/A)_{ppp}$	$(P/A)_c$		$(P/A)_{ppp}$	$(P/A)_c$
Latin America			**Sub-Saharan**		
Uruguay	0.9	0.7	Benin	0.1	0.1
Argentina	0.7	0.5	Burkina Faso	0.6	0.4
Chile	0.7	0.4	Congo	0.1	0.3
Panama	0.2	0.2	Cote divoire	0.3	0.3
Northern Africa			Djibouti	0.3	0.2
Morocco	0.4	0.3	Ethiopia	0.3	0.1
Western Europe			Gabon	0.5	0.5
Belgium	0.2	0.1	Mauritania	0.6	0.3
Switzerland	0.1	0.1	Mali	0.2	0.2
Asia			Mauritius	0.9	0.3
Indonesia	0.8	0.4	Mozambique	0.4	0.3
Malaysia	0.5	0.3	Niger	0.3	0.2
Singapore	0.5	0.3	Nigeria	0.8	0.7
Sri Lanka *	1.0	0.5	Senegal	0.2	0.2
Maldives*	1.0	0.7	Tanzania	0.5	0.7
Vanuatu	0.1	0.04	Togo	0.4	0.2
Middle-East			Uruguay	0.9	0.7
Israel	0.8	0.6	Zambia	0.7	0.9
Jordan	0.2	0.2	Liberia	-	0.2
Yemen	0.2	0.4			

*-P/A_{ppp} =1

Table 5D:
Regional Distribution of Countries where India has Exceeded its Trade Potential (P- A)

(US$ million)

	(P-A)ppp	(P-A)c		(P-A)ppp	(P-A)c
Western Europe			**Sub-Saharan Africa**		
Belgium	-3874.4	-4169.1	Benin	-60.6	-60.3
Switzerland	-3162.2	-3149.1	Burkina Faso	-7.7	-11.0
Middle-East			Congo	-44.0	-36.2
Israel	-160.5	-377.2	Cote Divoire	-80.6	-81.4
Jordan	-250.2	-268.1	Djibouti	-14.5	-16.3
Yemen	-141.2	-108.2	Ethiopia	-53.5	-62.8
Latin America			Gabon	-17.7	-20.6
Argentina	-154.9	-305.2	Mauritania	-6.2	-10.4
Uruguay	-2.4	-10.9	Mali	-24.6	-24.2
Chile	-65.1	-114.6	Mauritius	-19.2	-139.6
Panama	-79.4	-84.3	Mozambique	-32.0	-40.1
Asia Pacific			Niger	-20.8	-22.7
Indonesia	-234.5	-768.5	Nigeria	-91.1	-147.0
Singapore	-1283.9	-1624.0	Senegal	-52.9	-56.8
Malaysia	-924.7	-1331.2	Tanzania	-76.4	-41.3
Sri.Lanka	-5.6	-367.2	Togo	-31.1	-45.1
Vanuatu	-33.0	-34.8	Zambia	-9.2	-5.1
Northern Africa			Guinea.bissau	-75.7	-76.5
Morocco	-210.6	-269.4	Liberia	-	-14.7

Table 6A: Trade Potential: With Regional Groupings in Asia * (P/A)

GCC

Country	(P/A)ppp	$(P/A)_C$
Oman	4.4	3.0
Qatar	-	2.0
Kuwait	2.1	1.6
Bahrain	1.3	0.9
Saudi Arabia	1.1	0.8
UAE	-	-

ASEAN

Country	(P/A)ppp	$(P/A)_C$
Cambodia	7.9	3.3
Philippines	5.5	2.3
Vietnam	2.0	1.0
Thailand	1.9	1.0
Indonesia	0.8	0.4
Malaysia	0.5	0.3
Singapore	0.5	0.3
Laos	-	-
Myanmar	-	-
Brunei	-	-

SAARC

Country	(P/A)ppp	$(P/A)_C$
Pakistan	52.2	26.7
Nepal	1.3	0.8
Maldives	1.0	0.7
Sri Lanka	1.0	0.5
Bangladesh	-	-
Bhutan	-	-

*- ranked according to $(P/A)_c$

Table 6B: Trade Potential: With Regional Groupings in Asia * (P-A)

(US$ million)

GCC

Country	(P-A)ppp	(P-A)c
Oman	521.1	304.8
Kuwait	349.6	186.7
Qatar	-	140.2
Bahrain	55.4	-19.9
Saudi Arabia	190.8	-279.4
UAE	-	-

ASEAN

Country	(P-A)ppp	(P-A)c
Philippines	1221.7	346.1
Cambodia	64.6	21.7
Vietnam	250.1	9.4
Thailand	804.5	-37.3
Indonesia	-234.5	-768.5
Malaysia	-924.7	-1331.2
Singapore	-1283.9	-1624.0
Laos	-	-
Myanmar	-	-
Brunei	-	-

SAARC

Country	(P-A)ppp	(P-A)c
Pakistan	13100	6550.2
Maldives	0.7	-8.4
Nepal	114.0	-82.7
Sri Lanka	-5.6	-367.2
Bangladesh	-	-
Bhutan	-	-

*- ranked according to $(P/A)_c$

Annex

Table I: Share of India and Selected East Asian Countries in World Trade

Country	Exports	Trade
India	0.8	0.8
China	5.1	4.8
Indonesia	0.6	0.5
Korea	2.5	2.4
Malaysia	1.5	1.3
Thailand	1.1	1.0

Table II: List of sample countries:

Albania	Czechoslovakia	Kazakastan	Qatar
Algeria	Denmark	Kenya	Romania
Andorra	Dominica	Kiribati	Russian Fed
Antigua and Barbuda	Dominican Republic	Korea Rep	Saudi Arabia
Argentina	Ecuador	Latvia	Senegal
Armenia	Egypt	Lebanon	Singapore
Australia	El Slavador	Lithuania	Slovakia
Austria	Estonia	Luxembourg	Slovenia
Azerbaijan	Ethiopia	Macau	South Africa
Bahamas	Fiji	Macedonia	South Africa C.U
Bahrain	Finland	Madagascar	Spain
Bangladesh	France	Malaysia	Sri Lanka
Barbados	Gabon	Maldives	St. Kitts and Nevis
Belarus	Gambia	Mali	St. Vct and Grenadines
Belgium	Georgia	Malta	Sudan
Belgium-luxembourg	Germany	Mauritius	Suriname
Belize	Ghana	Mexico	Swaziland
Benin	Greece	Moldova	Sweden
Bhutan	Greenland	Mongolia	Switzerland
Bolivia	Grenada	Morocco	Tajikistan
Botswana	Guatemala	Mozambique	Tanzania
Brazil	Guinea	Nepal	Thailand
Brunei Dar.	Haiti	Netherlands	Togo
Bulgaria	Honduras	New Zealand	Tonga
Burundi	Hong Kong	Nicaragua	Trinidad and Tobago
Cameroon	Hungary	Niger	Tunisia
Canada	Iceland	Nigeria	Turkey
Cape Verde	India	Norway	Turkmenistan
Chile	Indonesia	Oman	U.K
China	Iran	Panama	U.S.A
Colombia	Ireland	Papua New Guinea	UAE
Comoros	Israel	Paraguay	Uganda
Costa Rica	Italy	Peru	Uruguay
Cote divoire	Jamaica	Philippines	Vanautu
Croatia	Japan	Poland	Venezuela
Cyprus	Jordan	Portugal	Yugoslavia
			Zambia
			Zimbabwe

Table III: Regional Trading Arrangements

APEC	NAFTA	EEA	AFTA	SAPTA	Sparteca	EFTA
Australia	Canada	Austria	Brunei	Bangladesh	Australia	Iceland
Brunei	Mexico	Belgium	Indonesia	Bhutan	Cook Island	Liechtenstein
Canada	US	Denmark	Malaysia	India	Fiji	Norway
Chile		Finland	Philippines	Maldives	Kiribati	Switzerland
China		France	Thailand	Nepal	Marshall Islands	
Hong Kong		Greece	Singapore	Pakistan	Micronesia	
Indonesia		Luxembourg	Vietnam	Sri Lanka	Nauru	
Japan		Iceland			New Zealand	
Korea		Italy			Niue	
Malaysia		Ireland			Papua New Guinea	
Mexico		Netherlands			Solomon Island	
N. Zealand		Norway			Tonga	
P.N Guinea		Portugal			Tuvalu	
Peru		Spain			Vanuatu	
Philippines		Sweden			Western Samoa	
Russia		Germany				
Singapore		UK				
Thailand						
US						
Vietnam						

ANZ CER	GCC	CEFTA	ANDEAN	ECOWAS	BA
Australia	Bahrain	Bulgaria	Bolivia	Benin	Bangladesh
N.Zealand	Kuwait	Czechoslovakia	Colombia	Burkina Faso	China
	Oman	Hungary	Ecuador	Cape Verde	India
	Qatar	Poland	Peru	Cote Divoire	Korea
	S.Arabia	Romania	Venezuela	Gambia	Laos
	UAE	Slovak		Ghana	Philippines
		Slovenia		Guinea	Sri Lanka
				Guinea Bissau	Thailand
				Liberia	
				Mali	
				Mauritania	
				Niger	
				Nigeria	
				Senegal	
				Sierra Leone	
				Togo	