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TRADE LIBERALISATION, MULTINATIONAL INVOLVEMENT, AND INTRA-INDUSTRY TRADE IN MANUFACTURING

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Foreword

One of the important developments of 20th century was the fragmentation of the industry and globalisation of the trade in manufacturing. The initial effect of fragmentation was for companies in the advanced countries to start outsourcing within the country those parts of the manufacturing process that could be better done by specialist firms. Outsourcing gradually spread to other advanced countries, giving rise to the phenomenon of the intra-industry trade in intermediate goods. In the last 25 years of the 20th century, outsourcing and intra-industry trade have spread to the emerging economies. E&SE Asia has benefited enormously from the Globalisation of Manufacturing processed. Because of the drastic controls on imports, this phenomenon had largely bypassed India until the dramatic economic reforms in 1991-92.

An earlier ICRIER paper was perhaps one of the first to show how intra-industry had expanded in India after the import liberalisation of the 1990s. The current paper investigates the determinant of intra-industry trade in the Indian context. It demonstrates the removal of QRs and the decline in tariff rates has given a great boost to intra-industry trade. As intra-industry trade is closely linked to specialisation and gains from trade this will eventually translate into measurable improvements in productivity in the manufacturing sector.

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1. Introduction[1]

India's trade and investment regime was one of the most restrictive in the world, during the long spell of import substitution since the mid 1950s, due to the very complex nature and the wide number of tools used as policy instruments. Disillusioned with the import substitution policy, a process of reorientation of the policy framework began in the early 1980s in India, which gained momentum during the 1990s. The policy reforms during the 1980s focussed more on domestic industrial liberalisation while import liberalisation was more selective. The policy of a total ban on the imports of manufactured consumer goods continued as well as the requirement of obtaining license to import most items of capital goods, raw materials and intermediates. Only selected items, where domestic substitutes were not being produced, could be imported without license. Despite the reforms in the 1980s, India was indeed the most autarkic non-communist country in the world in 1991 (Joshi and Little 1996)

Since 1991, however, the country has been undertaking significant liberalization measures, which includes *inter alia* dismantling of quantitative restrictions (QRs) on imports, reduction of import tariff rates, industrial de-licensing, and opening up of a number of industries for direct foreign investment. A synoptic account of these developments in the 1990s is presented in Section 2.

The emerging patterns of specialization in a country, pursuant upon the initiation of trade liberalization, is a question of considerable academic interest and policy relevance. The conventional wisdom, based on the Heckscher-Ohlin-Samuelson (H-O-S) model, is that trade liberalisation would lead to a restructuring in which productive resources are reallocated from import competing industries to those industries where the country has comparative advantages. Viewed thus, an expansion of inter-industry trade – export

[1] I am grateful to Arvind Virmani, B N Goldar, K L Krishna (Indian Council for Research on International Economic Relations) D Narayana, and K J Joseph (Centre for Development Studies, Thiruvanthapuram) for comments and/or suggestions. The study would not have been possible without data on tariff and non-tariff barriers in Indian industry, which have been kindly provided by Deb Kusum Das.

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increase from one set of industries and import increase in another - is a natural consequence of trade liberalisation.

Historical experiences from different parts of the world, however, are not in conformity with the above viewpoint, at least with respect to the manufacturing industries. On the contrary, studies indicate a process of greater intra-industry reallocation of productive resources when a country opens up its manufacturing industries for external competition. Evidently, this is because that trade liberalisation gives rise to specialisation opportunities within the narrowly defined industries. To elucidate, if the product lines in an industry are differentiated and each is manufactured with increasing returns to scale, then a country may specialise in manufacturing a subset of the lines for meeting home demand and export, while those product lines not supplied domestically are imported. Thus, trade liberalisation generally gives rise to the simultaneous occurrence of exports and imports within the same industry. This phenomenon is called intra-industry trade (henceforth IIT)[2]. If the intensity of IIT is indeed found to be growing after liberalisation in a large number of industries, an important implication is that the apprehension of domestic industries going out of business, because of greater import competition, is untenable.

The 1990s is the period when it became imperative for the firms in Indian industry, which have been operating under protective umbrellas, to rationalise the choice of their product lines. Suggesting that the rationalisation process is indeed on track, a previous study showed considerable growth of IIT during the post liberalisation period in India's manufacturing sector (Veeramani, 2002). The positive link between trade liberalisation and the intensity of IIT, however, is not established rigorously in a panel regression framework employing the measures of tariff and QRs in the industries along with other explanatory factors.

Concomitant with the trade liberalisation in the 1990s, the Indian government has been undertaking policy initiatives to attract direct foreign investment in manufacturing

[2] See Globerman and Dean (1990) for references to the studies, which find out that trade liberalization biases trade expansion towards IIT.

industries. A large number of industries have been opened for investment from multinational enterprises and the approval procedures have been made simpler. This is an important issue in the present context, as the intensity of IIT is likely to be influenced by the extent of multinational involvement in the industry under consideration. Interestingly, recent theoretical literature indicates that the extent of multinational involvement interacts with trade barriers in determining the intensity of IIT in the industry (e.g. Markusan and Venables 1998). The interactive effect, to be explicated later in this paper, has not been examined empirically as yet.

The present study focuses to investigate the effects of trade liberalisation (measured by tariffs and QRs) and the extent of multinational presence on IIT in a panel of India's manufacturing industries. To the best of our knowledge, there are very few empirical studies in the context of developing countries concerned with the industry-specific determinants of IIT. The existing studies, in the context of developed countries, are primarily concerned with the analysis of the effects of product differentiation and economies of scale in the industries on IIT. We make an attempt to examine the importance of such factors in the present context too[3].

Non-availability of apropos data is a major constraint to undertake a study of this type in the developing countries. Drawing upon different sources, we construct a new panel dataset on India's manufacturing industries from 1988 to 1999. India's foreign trade statistics from 1988 to 1999 are taken from the World Bank's "Production and Trade Database CD-ROM"[4]. The CD-ROM contains data on exports and imports in manufacturing industries at the 4-digit level (81 industries) of International Standard Industrial Classification (ISIC) for 24 countries including India. It reports data on India's trade flows with world total, with a number of regional groups and with particularly interesting markets such as European Union (EU), Japan, and United States of America (USA). Our data on tariffs and QRs are based on the recent estimations made by Das

[3] Like the majority of econometric studies on the topic, we do not test any specific theoretical model of IIT. Gray (1988) cautions the danger of following any specific model and explains the wisdom of adhering to a "looser paradigm" in the econometric analysis of IIT.
[4] See Nicita and Olarreaga (2001) for details.

(2003) and National Council for Applied Economic Research (2000). Other explanatory variables are constructed using an electronic database from the Centre for Monitoring Indian Economy (CMIE) called *Prowess* and the *Annual Survey of Industries* (ASI), brought out by the Central Statistical Organization (CSO).

The intensity of IIT, in this study, is measured by the well-known Grubel-Lloyd (1975) index[5]:

$$GL_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \times 100, \qquad (1)$$

where GL_i is the index of IIT in industry $_i$, and X_i, and M_i, are respectively the values of exports and imports in industry $_i$. The value of GL_i ranges from 0 to 100. If there is no IIT (i.e., one of X_i or M_i is zero) GL_i takes the value 0. If all trade is IIT (i.e., $X_i = M_i$), GL_i takes the value of 100. The dependent variable in our regression analysis is the GL_i measured for each of the 4-digit level industries from 1988 to 1999. The indices of IIT are measured using data on India's trade flows with world total, several regional groups of countries, EU, Japan and USA. Separate regression models with the same set of explanatory variables will be estimated for each of these partners.

The remainder of the paper is structured as follows. Section 2, provides a synoptic account of some of the major policy changes pertaining to trade and industry in India during the 1990s. Section 3 sets out the hypotheses to be tested and the variables used. Results of the regression analysis are discussed in Section 4. Some concluding remarks are provided in Section 5. The Appendix presents a detailed description of the data set used in the regression model.

[5] Vona (1991, pp. 690) examined the properties of various available measures of IIT and concluded that the Grubel Lloyd index (used in the present study) "….is the best available one and on the whole, possesses desirable properties".

2. Trade and Industrial Liberalisation in India during the 1990s

India adopted a development strategy centred on import substitution in the beginning of the Second Five-Year Plan (1956-61). Under this strategy, various aspects of production and international trade, at the level of specific products, were regulated by the government policy. Direct foreign investments were subjected to stringent approval process and were allowed only on a selective basis. A number of studies have suggested that the import substitution strategy led to resource misallocation and economic inefficiency in India[6]. Disillusioned with the import substitution policy, a process of reorientation of the policy framework began in the early 1980s. However, as already mentioned, the policy reforms during the 1980s focussed more on domestic industrial liberalisation while the import liberalisation was more selective. Serious and consistent attempts towards trade and investment liberalisation were undertaken since July 1991, in response to a severe macro economic crisis[7].

As part of the reforms during the early 1990s, the system of industrial licensing has been completely abolished (except for a small list of industries on strategic and environmental considerations) and the controls over investment and expansion by large industrial houses have been eliminated. Further, in a significant departure from the traditional outlook, direct foreign investment has been encouraged in all manufacturing industries (except in industries of strategic and environmental concerns) and the approval process has been made simple and transparent. Consequently, the inflow of direct foreign investment in India grew from a meagre 237 million dollars in 1990 to 3403 million dollars in 2001 (World Investment Report 2002).

The QRs on the import of capital goods and intermediates were completely removed in 1992. Whereas, the imports of manufactured consumer goods were continued to be banned till the mid 1990s, with the exception of a few items that could be imported under Special Import Licenses (SIL). Some progress towards the import liberalisation of

[6] Examples are Bhagwati and Desai (1970), Bhagwati and Srinivasan (1975), and Ahluwalia (1985).
[7] See, for example, Joshi and Little (1996) and Ahluwalia (2002) for a detailed account of the liberalization policies since 1991 in India.

consumer goods occurred in 1995 when certain items were allowed to import under Open General License (OGL) while the limit of items that could be imported under SIL scheme was broadened. Eventually, the major initiative towards the removal of QRs on the imports of consumer goods started in the late 1990s and completed in 2001.

Based on the detailed estimates provided by Das (2003), Figure 1 depicts the broad pattern of the changes in QRs across the 72 industries from 1988 to 1999. A significant reduction QRs during the 1990s, which were pervasive before 1991 is clear from the figure. Removal of QRs was accompanied by a gradual lowering of customs duties in the manufacturing industries. The import weighted average tariff rate for India's manufacturing sector for the year 1990 was 72%, which came down to 29% in 1997, and then showed some increase. Also the peak tariff rate came down significantly over the years (Table 1).

India's imports of non-oil manufactured commodities (in US dollars) grew at an average annual rate of 13% from 1991 to 1999, which is significantly higher than the 6% average annual growth from 1980 to 1990. Whereas, the average annual growth rate of manufactured exports remained at around 10% both in the 1980s and in the 1990s[8]. An earlier study, using data on 742 manufacturing industries at the 4-digit level of Indian Trade Classification, observed significant growth of IIT in India during the 1990s: the value of Grubel-Lloyd index (trade weighted average) increased steadily from 23% in 1987 to 38% in 1999 (Veeramani 2002). For the same set of industries, the present estimate of the trade weighted average Grubel-Lloyd index for the year 2000 is found to be as high as 44%, suggesting further increase of IIT in India's manufacturing sector (see Table 1). That the intensity of IIT shows a steady increase in Indian manufacturing is also evident from the estimated values of an index that measures the contribution of IIT in the *change* in trade flows or what is called marginal IIT (Table 1).

Table 1; Tariff rates and Intra-Industry Trade in India

Year	Tariff rates (Import weighted average)			*IIT* index in manufacturing Industries (Trade weighted average) [cd]
	All Commodities [a]	Manufacturing industries [b]	Peak tariff [a]	
1987		-	-	23.08
1990	-	72.28	-	-
1991	72.5	-	150	-
1992	60.6	54.53	110	-
1993	46.8	-	85	-
1994	38.2	-	65	30.7 (29.9)
1995	25.9	-	50	31.2
1996	24.6	-	52	32.1
1997	25.4	28.85	45	36.2
1998	29.2	-	45	36.1
1999	31.4	33.15	40	37.8 (37.2)
2000	35.7	-	38.5	44.3 (42.8)

Source: [a] Ahluwalia (2002). – [b] Estimated from the World Bank's "Production and Trade Data CD-ROM. – [c] *GL* index from 1987 to 1999 is from Veeramani (2002). An updated index for the year 2000 is estimated for the same set of industries.- [d] Values in parentheses are the index of marginal IIT suggested by Brülhart (1994).

3. Hypotheses and Variables

Theoretical interest on IIT arose from the viewpoint that the H-O-S model, which predicts the pattern of inter-industry trade on the basis of factor endowment differences of countries, is inadequate to reconcile the phenomenon of IIT. To generate a pattern of both intra-industry and inter-industry trade, it was felt important to incorporate the elements of increasing returns to scale, imperfect competition and product differentiation into the formal trade theory. The most elegant exposition of this approach is found in Helpman and Krugman (1985) (henceforth H - K). The H-K model assumes that product differentiation is horizontal in nature – that is, final consumer products are similar in terms of quality but differentiated by other attributes. Another assumption of the model is that the extent of scale economies, which is internal to the firm, depends upon the volume of the particular variety produced. Under these assumptions, IIT occurs as a result of each firm in the "integrated economy" tending to specialise in the production of

[8] Growth rates are estimated using data from the World Bank's "Production and Trade Database CD-ROM"

distinct varieties within the manufacturing industry while consumers demand the entire spectrum of varieties produced[9].

A more generalised treatment of the H-K framework can be seen in Markusen and Venables (1998), who incorporate tariffs (or trade costs) and endogenous multinational firms into the model. While the standard H-K model deals with only the national firms, the new approach allows the co-existence of both national and multinational firms in the differentiated-products sector: the former operates a single plant and supply the foreign market by exports while the latter operate plants in both countries. This assumes that the multinational performs essentially the same range of production activities in both its plants, so captures the idea of horizontal multinational activity, rather than vertical. The incentive to undertake horizontal investment arises if the saving on trade costs (direct and indirect) associated with exporting the goods exceeds any fixed costs involved in setting up the new plant.

Despite considerable trade liberalisation since 1991, India's tariff rates in manufacturing remain as one of the highest in the world even today. Thus, it is likely that the bulk of the multinational activities in India have been horizontal in nature, undertaken with the motive of escaping the high tariff and non-tariff barriers associated with the exporting of the goods[10]. As horizontal investment displaces the export sales of differentiated products, it follows that a greater extent of multinational involvement will adversely affect the intensity of IIT in the industry under consideration. It is, however, important to note that the incentive to undertake horizontal investment is particularly high in the industries that face high trade barriers. Viewed thus, the extent of multinational involvement interacts with the height of trade barriers in determining the intensity of IIT in the industry. The variables used in the regression analysis are:

[9] The term "integrated economy" represents to mean two or more fully open economies combined.

[10] This is also evident from the fact that the affiliates of multinationals in India contribute only less than 5% of the country's total exports, while the affiliates contribute nearly half of the total exports in China and Malaysia (World Investment Report, 2002).

FOR	Share of output by the foreign firms in the industry.
TAR	Average nominal tariff rate in the industry
QR	Quantitative restrictions on imports

The interaction term (*FOR×TAR* and *FOR×QR*), which relates the extent of multinational involvement with trade barriers in the industry, is expected to yield a negative coefficient. In addition to the interactive effect, the variables representing trade barriers and multinational involvement are likely to exert own effects on IIT. First, as greater import competition forces firms in differentiated industries to rationalise their product lines by specialising in distinct varieties, we expect low trade barriers to cause higher IIT. Secondly, after controlling for the interactive effect with trade barriers, the own effect of multinational involvement on the industry's IIT may well be positive, reflecting the occurrence of greater product rationalisation due to the entry of multinational firms.

That larger markets permits greater division of labour is particularly true in the case of those industries, where the potential for the global integration of production process is high. In such industries, trade liberalisation may allow the country to embrace gains from specialisation in distinct parts, components and accessories of a particular product. The theoretical model of Ethier (1982) visualises IIT as an outcome of such specialisation. The potential for the global dispersion of production process, however, is severely limited in industries characterised by extensive plant level scale economies. In such industries, the effect of trade liberalisation is to organise the entire spectrum of production activities in few locations best suited to the exploitation of such economies[11]. We construct a measure of minimum efficient plant scale, as suggested by Caves et al (1975):

[11] The notion of scale economies relevant to the theoretical analysis of IIT corresponds to horizontal specialisation or vertical specialisation (Balassa 1986). The former happens when individual plants specialise in the production of finer product varieties [as in the horizontal models of IIT]. The latter occurs when individual plants in different countries specialise in the production of distinct parts, components and accessories of a particular product [as in the theory of IIT in intermediate goods developed by Wilfred Ethier). The direct empirical counterparts of economies of scale associated with horizontal and vertical specialisation are hard to construct. Most empirical studies use a proxy for minimum efficient plant scale. This indirect measure is hypothesised to have a negative relationship with the index of IIT, as industry production would be confined to a few locations when there are extensive plant level scale economies (Caves, 1981)

MES The average size (value of output) of the largest firms in an industry accounting for (approximately) one-half of industry output divided by total industry output

The avenues for specialization in narrow product lines and intra-industry restructuring pursuant upon trade liberalisation would be larger if an industry is characterised by relatively greater degree of product differentiation. Moreover, product differentiation in final consumer products is an important element in the models of IIT that deal with horizontally differentiated commodities. Thus, a number of empirical studies test the hypothesis that IIT is positively related to the degree of product differentiation in the industries[12.] To capture the effect of promotional differentiation of products, we consider the following variable.

ADV Advertising expenses as a percentage of sales

Defying the hypothesis on the relationship between promotional differentiation and IIT, the co-efficient of *ADV* showed a negative sign, in some of the previous studies [Caves (1981) Marvel and Ray (1987)]. An interesting explanation to this result can be seen in Caves (1981, pp.208), who notes that ".... styling the advertising to local tastes seems complementary with styling the product itself, so that *the production of heavily advertised goods tends* (other things, such as scale economies and comparative advantage, permitting) *to take place on the same national territory as does their consumption*" [emphasis added]. Viewed thus, it may be appropriate to hypothesise that *ADV* is related to the measure of IIT in a non-linear fashion, an inverted U relationship. A positive relationship is anticipated over some unspecified range while a reverse relationship may be anticipated beyond that.

It is important to emphasize that ADV is generally considered as an indicator of promotional differentiation of products, rather than product differentiation in a general sense. Thus, in the regression analysis, it may be appropriate to treat consumer goods industries separately from other industries. In addition, let us also note that a separate

[12] Ethier (1982), however, cautions that although the existence of product differentiation is essential to the theory, the degree of product differentiation need not be an essential determinant of the intensity of IIT.

analysis of consumer goods industries is truly in the spirit of the H-K model and its generalisation by Murkusen and Venables (1998). However, the majority of studies that attempt to test the hypotheses drawn from the H-K model do not make this distinction very explicit.

4. Regression Results

To investigate the empirical validity of the hypotheses specified above, panel-data regression models are estimated separately for India's IIT with World Total and with various trading partners, namely USA, EU, Japan, East Asia & Pacific. We will first discuss the results of the regression analysis for all industries (i.e., consumer goods industries and other industries pooled) and then proceed to discuss the results of the separate regressions for consumer goods industries and other industries. As expected, the two variables representing trade barriers are highly correlated (r = 0.57). Thus, we do not include both these variables in a single specification.

The estimation results for all industries are shown in Table A1. It is clear that both TAR and QR, the variables representing the extent of trade barriers in the industries, are negatively related to the intensity of India's overall IIT (i.e., with World Total): these variables attain statistically significant negative co-efficient even when the year dummies are included in the specification[13]. As far as the individual country partners are concerned, TAR and QR do not yield statistically significant co-efficient when the year dummies are included in estimation, except for QR in the case of East Asia and Pacific. Whereas, if the year dummies are excluded, both these variables attain statistically significant negative co-efficient for all partners, excepting TAR in the case of Japan. In short, not withstanding some differences in the robustness of the results for individual

[13] To control for the effect of possible year-specific factors (other than trade liberalization) on IIT, we created 12 year dummies to represent each year from 1988 to 1999 and are considered as independent variables (after treating the year 1988 as the base) in addition to the trade liberalization variables, TAR and QR. While the inclusion of the year dummies should provide much robustness to the results pertaining to the trade liberalization variables, it is also likely that the year dummies end up capturing the effect of trade liberalization better, and hence statistical insignificance of TAR and QR. Thus, wherever TAR and QR show statistically insignificant co-efficient, we will re-estimate the equation after dropping the year dummies. To save space, the co-efficient and t values of the 11 year dummies are not shown in the tables.

country partners, trade liberalization of the 1990s undoubtedly led to an increase in the intensity of India's overall IIT.

That multinational involvement interacts with trade barriers in determining the intensity of IIT is also evident from the results shown in the table. The interaction terms generally yield negative signs with statistical significance and the results are generally not much sensitive to the inclusion or exclusion of the year dummies. Thus, direct foreign investments in industries characterised by high trade barriers are indeed trade replacing in nature[14]. However, the own effect of multinational involvement is generally positive, indicating that the entry of multinationals induces some pro-competitive effects in the industry such as greater product rationalisation and hence IIT.

The coefficient of *MES*, the variable capturing plant level scale economies, yields statistically significant negative sign for India's overall IIT and for India's IIT with East Asia and Pacific. Trade liberalisation is unlikely to bring about intra-industry specialization if it pays to organise the spectrum of production activities in one or few locales because of substantial plant level scale economies in the industry under consideration. On the other hand, liberalisation will promote IIT in those industries where the global dispersion of production process is gainful. The relationship, however, is not very strong in India's IIT with Japan and does not hold at all in the case of USA and EU. Probably, the above result is because that production process in Indian industry is more integrated with that in East Asia and Pacific than with other countries.

The effect of product differentiation on IIT is captured by the variable *ADV,* and its quadratic term (ADV^2). These variables, though show the correct signs, for the most part, fail to achieve statistical significance at the acceptable level. The lack of robustness in the results could well be because that ADV is an indicator of promotional differentiation of products, rather than product differentiation in a general sense. We should expect

[14] Horizontal investment in a given industry will negatively affect exports, not only of the home country that undertakes the investment but also of other countries that supply substitutable products of the same industry. Detailed industry-wise information on the source of multinationals in India is not available. hus, it is not possible to differentiate the effect of multinational investment on IIT by the source of investment.

robust results for the group of consumer goods industries, while we should not expect any significant effect of ADV on the intensity of IIT in intermediate and capital goods industries.

Indeed, the results reported in Table A2 and A3 suggest that the econometric analysis of IIT can be made more instructive by distinguishing the consumer goods industries from other industries. The results concerning the promotional differentiation variables are now very much in the expected lines: these variables are relevant to explain IIT only in the consumer goods industries. In sharp contrast, but as expected, the product differentiation variables fail to yield significant result for the group of intermediate and capital goods industries.

Important differences in the results can also be noticed with respect to the variables representing multinational involvement and its interaction with trade barrier. The own effect of multinational involvement is a definite positive for the consumer goods industries while not so for other industries. Similarly, the effect of multinational involvement through its interaction with trade barriers is relatively strong for the consumer goods industries as compared to other industries. This is not surprising, as the consumer goods industries in India had been overly insulated from the threat of direct imports till recently. On the whole, the results of the regression analysis, especially in the case of consumer goods industries, lend credence to some of the postulates central to the H-K model of IIT and its recent generalisations by incorporating multinational firms and trade costs.

5. Conclusions

A number of developing countries have been undertaking policy initiatives to open up their economies for world competition since the early 1980s or so. The changes in the policies are indeed remarkable as reflected in the observation of Dornbusch (1992, p.69) that "[i]n a broad swing of the pendulum, developing countries have been shifting from severe and destructive protection to free trade fever". Though rather late to join the bandwagon, India

has also been undertaking significant policy initiatives to liberalise trade and foreign investment.

Liberalisation is likely to cause greater intra-industry trade (IIT) because of increased specialisation opportunities at the level of finer product varieties within the narrowly defined industries. Other factors, which can exert influence on the intensity of IIT, include the extent of multinational involvement in the industry and the degree of product differentiation and scale economies. Interestingly, recent theoretical literature indicates that the extent of multinational involvement interacts with trade liberalisation in determining the intensity of IIT in the industry. The present paper analyses the effects of trade liberalisation, multinational involvement and other industry-specific factors on IIT in a panel of 81 manufacturing industries in India for the period 1988 to 1999. The standard Grubel-Lloyd index is used to estimate the intensity of IIT in the industries.

To investigate the empirical validity of various hypotheses specified, panel-data regression models are estimated separately for India's IIT with World Total and with various trading partners, namely USA, EU, Japan and East Asia & Pacific. The regression analysis provides strong support to the hypothesis that trade liberalisation causes higher levels of IIT.

It is, however, important to keep in mind that despite considerable trade liberalisation since 1991, India's tariff rates remain as one of the highest in the world even today. This creates a powerful incentive for multinationals to undertake tariff jumping horizontal investment in India. Such investments are undertaken as an alternative to exporting the products, so as to save the costs on account of high tariffs in India. Thus, the extent of multinational involvement in industries characterised by high trade barriers is likely to exert a negative influence on the intensity of IIT. The results of the regression analysis are consistent with these viewpoints in that the interaction terms capturing the joint effect of multinational involvement and trade barriers yield statistically significant negative coefficient.

The own effect of multinational involvement on IIT, especially in the consumer goods industries, is positive, perhaps indicating that the entry of multinationals induces some pro-competitive effects in the industry such as greater product rationalisation and hence IIT.

Trade liberalisation should continue if multinationals have to augment the process of integrating the Indian industry with the fragmented structure of global production activities. Else, multinational activities in India will continue to be, predominantly, market seeking in nature.

Table A1: Determinates of India's Intra-Industry Trade: All Industries, 1988-2000 (Number of Observations = 900)												
	TAR	QR	FOR	FOR* TAR	FOR* QR	ADV	ADV^2	MES	C	Year Dummy	Hausman (Chi^2)	RE / FE
World total	-0.1031 (-2.21)**	-	0.6972 (2.65)***	-0.0051 (-3.31)***	-	1.8618 (0.93)	-0.1469 (-0.69)	-24.9846 (-2.13)**	54.34 (7.46)***	YES	8.73 (0.95)	RE
	-	-0.1032 (-2.89)***	0.4944 (1.95)**	-	-0.0061 (-2.64)***	2.8527 (1.43)	-0.2189 (-1.03)	-27.5190 (-2.39)***	50.62 (10.21)***	YES	17.65 (0.41)	RE
USA	-0.0806 (-1.55)	-	0.7436 (2.61)***	-0.0049 (-2.87)***	-	-0.3505 (-0.16)	-0.0248 (-0.11)	12.6571 (1.00)	37.10 (4.64)***	YES	9.59 (0.92)	RE
	-	-0.0582 (-1.46)	0.6298 (2.30)**	-	-0.0066 (-2.54)***	0.2029 (0.09)	-0.0681 (-0.29)	9.5069 (0.78)	32.33 (6.08)***	YES	15.31 (0.57)	RE
	-0.0971 (-4.98)***	-	0.7698 (2.72)***	-0.0048 (-2.85)***	-	-0.2576 (-0.12)	-0.0343 (-0.15)	10.3392 (0.83)	38.86 (9.30)***	NO	8.50 (0.20)	RE
	-	-0.0937 (-3.26)***	0.5176 (1.47)	-	-0.0060 (-2.21)**	5.4120 (2.34)**	-0.4098 (-1.68)*	11.9483 (0.74)	32.40 (9.29)***	NO	13.26 (0.04)**	FE
EU	0.0378 (0.82)	-	0.3227 (1.22)	-0.0030 (-1.99)**	-	2.5534 (1.28)	-0.2670 (-1.27)	-3.2487 (-0.28)	17.22 (2.37)**	YES	10.64 (0.87)	RE
	-	-0.0015 (-0.04)	0.2823 (1.11)	-	-0.0045 (-1.95)**	2.9331 (1.46)	-0.3063 (-1.46)	-4.6167 (-0.40)	22.71 (4.51)***	YES	15.42 (0.57)	RE
	-0.0761 (-4.19)***	-	-0.0445 (-0.14)	-0.0017 (-1.08)	-	6.7617 (3.11)***	-0.5622 (-2.57)***	-13.6204 (-0.95)	35.80 (10.90)***	NO	10.61 (0.10)*	FE
	-	-0.0860 (-3.43)***	-0.1102 (-0.36)	-	-0.0028 (-1.17)	9.1770 (4.56)***	-0.7166 (-3.37)***	-18.0602 (-1.28)	33.25 (10.94)***	NO	19.54 (0.00)***	FE
Japan	0.0248 (0.55)	-	0.1569 (0.67)	-0.0036 (-2.45)***	-	0.7002 (0.38)	-0.0464 (-0.23)	-14.1531 (-1.36)	10.72 (1.57)	YES	15.83 (0.54)	RE
	-	-0.0332 (-0.96)	-0.1034 (-0.44)	-	-0.0024 (-1.04)	1.3945 (0.75)	-0.1076 (-0.53)	-18.3215 (-1.77)*	17.22 (3.80)***	YES	16.42 (0.50)	RE
	-0.0178 (-0.98)	-	-0.2641 (-0.80)	-0.0031 (-1.96)**	-	4.9725 (2.28)**	-0.3522 (-1.60)*	-4.6337 (-0.32)	17.94 (5.45)***	NO	13.29 (0.04)**	FE
	-	-0.0490 (-1.95)**	-0.5891 (-1.91)**	-	-0.0019 (-0.82)	5.5530 (2.76)***	-0.3962 (-1.86)*	-7.8382 (-0.55)	20.24 (6.66)***	NO	17.54 (0.01)***	FE
East Asia & Pacific	0.0429 (0.83)	-	0.2877 (1.05)	-0.0032 (-1.87)*	-	0.1153 (0.05)	-0.0379 (-0.16)	-21.0573 (-1.74)*	24.30 (3.10)***	YES	15.31 (0.57)	RE
	-	-0.0744 (-1.90)**	0.2331 (0.87)	-	-0.0048 (-1.89)**	1.1664 (0.55)	-0.1290 (-0.56)	-22.84 (-1.91)**	37.11 (7.12)***	YES	16.24 (0.51)	RE
	-0.0330 (-1.60)*	-	-0.1515 (-0.41)	-0.0011 (-0.63)		4.7740 (1.93)**	-0.3607 (-1.45)	-46.6216 (-2.85)***	41.72 (11.15)***	NO	15.82 (0.01)***	FE

Table A2: Determinates of India's Intra-Industry Trade: Consumer Goods Industries, 1988-2000 (No. of Observations = 420)												
	TAR	QR	FOR	FOR* TAR	FOR* QR	ADV	ADV^2	MES	C	Year Dummy	Hausman (Chi2)	RE / FE
World total	-0.1933 (-2.62)***	-	1.0966 (3.35)***	-0.0061 (-2.99)***	-	8.3861 (2.92)***	-0.6119 (-2.25)**	-32.3575 (-1.74)*	53.18 (4.75)***	YES	18.45 (0.36)	RE
	-	-0.0806 (-1.11)	1.0781 (3.12)***	-	-0.0085 (-2.63)***	8.0712 (2.80)***	-0.6011 (-2.21)**	-43.9587 (-2.38)**	36.39 (4.09)***	YES	17.93 (0.39)	RE
USA	-0.0193 (-0.25)	-	0.9386 (2.58)***	-0.0036 (-1.67)*	-	4.2169 (1.36)	-0.3468 (-1.20)	-17.7890 (-0.88)	20.45 (1.70)*	YES	4.70 (0.99)	RE
	-	-0.1374 (-1.80)*	0.9016 (2.46)***	-	-0.0056 (-1.64)*	4.8738 (1.61)*	-0.4144 (-1.46)	-23.8799 (-1.22)	31.90 (3.38)***	YES	10.94 (0.86)	RE
	-0.0581 (-1.87)*	-	0.9506 (2.63)***	-0.0037 (-1.75)*	-	3.7908 (1.37)	-0.3001 (-1.11)	-16.1455 (-0.81)	26.46 (3.87)***	NO	4.28 (0.64)	RE
	-	-0.0716 (-1.27)	0.8631 (1.73)*	-	-0.0046 (-1.30)	6.6095 (2.23)**	-0.4551 (-1.63)*	-22.5173 (-0.91)	23.72 (3.39)***	NO	12.66 (0.05)**	FE
EU	-0.1218 (-1.63)*	-	0.6169 (1.77)*	0.0021 (-1.00)	-	6.1277 (2.06)**	-0.5496 (-1.98)**	-27.1546 (-1.39)	32.11 (2.79)***	YES	13.58 (0.70)	RE
	-	-0.0129 (-0.17)	0.2043 (0.43)	-	-0.0019 (-0.56)	8.6385 (2.54)***	-0.6854 (-2.32)**	-37.6354 (-1.54)	18.50 (2.03)**	YES	145.38 (0.00)***	FE
	-	-0.0812 (-1.51)	0.1684 (0.36)	-	-0.0014 (-0.42)	11.8502 (4.23)***	-0.8757 (-3.31)***	-48.0787 (-2.04)**	25.68 (3.88)	NO	66.37 (0.00)***	FE
Japan	0.0970 (1.46)	-	0.6286 (2.05)**	-0.0052 (-2.80)***	-	2.8235 (1.07)	-0.1694 (-0.69)	-28.9214 (-1.68)*	0.15 (-0.01)	YES	5.53 (0.99)	RE
	-	-0.0286 (-0.44)	0.3602 (1.14)	-	-0.0044 (-1.49)	3.6521 (1.40)	-0.2575 (-1.05)	-37.7225 (-2.25)**	16.14 (2.00)**	YES	9.94 (0.91)	RE
	0.0268 (1.01)	-	0.5852 (1.91)*	-0.0050 (-2.75)***	-	4.6229 (1.96)*	-0.2947 (-1.28)	-28.8840 (-1.71)*	7.49 (1.29)	NO	6.28 (0.39)	RE
	-	0.0108 (0.22)	-0.3085 (-0.71)	-	-0.0035 (-1.15)	6.4742 (2.53)***	-0.4138 (-1.71)*	-13.9974 (-0.65)	11.15 (1.85)*	NO	11.38 (0.07)*	FE
East Asia & Pacific	0.1461 (1.72)*	-	0.6644 (1.86)*	-0.0042 (-1.80)*	-	2.7413 (0.85)	-0.2156 (-0.70)	-37.2929 (-1.82)*	5.59 (0.44)	YES	21.32 (0.21)	RE
	-	-0.0202 (-0.23)	0.1273 (0.23)	-	-0.0062 (-1.61)*	5.6116 (1.43)	-0.3682 (-1.08)	-52.9856 (-1.88)*	31.68 (3.01)***	YES	26.06 (0.07)*	FE
	0.0217 (0.60)	-	-0.2336 (-0.41)	-0.0012 (-0.48)	-	6.8372 (1.97)**	-0.4206 (-1.34)	-57.8917 (-2.11)	29.53 (4.14)***	NO	19.97 (0.00)***	FE
	-	0.0064 (0.10)	0.0930 (0.17)	-	-0.0067 (-1.75)*	4.9629 (1.54)	-0.3057 (-1.01)	-46.7012 (-1.73)*	32.59 (4.29)***	NO	27.65 (0.00)***	FE

Table A3: Determinates of India's Intra-Industry Trade: Intermediate and Capital Goods Industries, 1988-2000 (No. of observations 480)												
	TAR	QR	FOR	FOR* TAR	FOR* QR	ADV	ADV^2	MES	C	Year Dummy	Hausman (Chi2)	RE / FE
World total	-0.0012 (-0.02)	-	-0.0001 (0.00)	-0.0042 (-1.56)	-	-4.6184 (-1.07)	0.0126 (0.02)	-19.8121 (-1.35)	50.37 (5.32)	YES	3.33 (0.99)	RE
	-	-0.1287 (-3.20)***	-0.2132 (-0.53)	-	-0.0020 (-0.50)	-4.3509 (-1.01)	0.0629 (0.09)	-20.3011 (-1.40)	62.43 (10.09)***	YES	2.68 (1.00)	RE
	-0.0242 (-1.11)	-	0.0921 (0.22)	-0.0039 (-1.44)	-	-4.8974 (-1.16)	0.0640 (0.10)	-22.3586 (-1.56)	55.51 (10.67)***	NO	2.80 (0.83)	RE
USA	-0.1138 (-1.55)	-	0.4854 (1.01)	-0.0096 (-2.89)	-	-2.1574 (-0.44)	-0.1644 (-0.20)	24.3820 (1.50)	48.06 (4.33)	YES	14.99 (0.60)	RE
	-	-0.0022 (-0.04)	0.1642 (0.36)	-	-0.0085 (-1.66)*	-2.8071 (-0.56)	0.1399 (0.17)	24.7117 (1.55)	32.79 (4.82)***	YES	17.23 (0.44)	RE
	-0.1112 (-4.00)***	-	0.5440 (0.91)	-0.0111 (-3.32)***	-	-1.8853 (-0.31)	-0.2894 (-0.32)	62.1191 (2.79)***	43.42 (8.83)	NO	11.65 (0.07)*	FE
	-	-0.0884 (-2.46)***	0.3206 (0.54)	-	-0.0124 (-2.37)**	7.3401 (1.24)	-1.1147 (-1.21)	44.4782 (1.96)**	35.34 (7.76)***	NO	12.19 (0.06)*	FE
EU	0.2063 (3.58)***	-	0.0571 (0.14)	-0.0065 (-2.50)***	-	-2.5450 (-0.60)	0.2401 (0.36)	22.9056 (1.57)	-0.93 (-0.10)	YES	2.23 (1.00)	RE
	-	0.0006 (0.02)	-0.2603 (-0.65)	-	-0.0044 (-1.11)	-2.2314 (-0.52)	0.1163 (0.17)	14.0480 (0.96)	26.49 (4.29)	YES	3.68 (0.99)	RE
	-0.0522 (-2.41)**	-	0.1032 (0.25)	-0.0057 (-2.14)**	-	0.8617 (0.20)	-0.2344 (-0.35)	6.0461 (0.42)	39.12 (7.23)	NO	1.47 (0.96)	RE
	-	-0.0939 (-3.42)***	-0.1620 (-0.41)	-	-0.0049 (-1.23)	2.0634 (0.50)	-0.2785 (-0.42)	6.5926 (0.46)	39.08 (7.65)	NO	4.57 (0.60)	RE
Japan	0.0075 (0.12)	-	-0.7031 (-1.74)*	-0.0027 (-0.89)	-	-1.1176 (-0.27)	0.0988 (0.14)	-8.0094 (-0.61)	14.21 (1.48)	YES	10.94 (0.86)	RE
	-	0.0180 (0.41)	-0.8462 (-2.23)**	-	-0.0009 (-0.19)	-1.7698 (-0.42)	0.2226 (0.32)	-9.5777 (-0.75)	13.45 (2.37)**	YES	13.88 (0.68)	RE
	-0.0651 (-2.76)***	-	-0.6016 (-149)	-0.0023 (-0.76)	-	-0.8184 (-0.20)	-0.0357 (-0.05)	-14.4152 (-1.13)	30.01 (6.86)***	NO	9.41 (0.15)	RE
	-	-0.0629 (-1.98)**	-0.9748 (-1.86)*	-	-0.0027 (-0.60)	10.0177 (1.92)**	-1.3056 (-1.60)	-5.8363 (-0.29)	23.36 (5.80)	NO	21.45 (0.00)	FE
East Asia & Pacific	-0.0504 (-0.78)	-	0.1207 (0.28)	-0.0017 (-0.59)	-	1.7621 (0.40)	-0.5341 (-0.74)	-11.2862 (-0.76)	36.56 (3.71)***	YES	6.74 (0.99)	RE
	-	-0.0979 (-2.25)	-0.1009 (-0.25)	-	0.0030 (0.69)	0.8783 (0.20)	-0.3036 (-0.42)	-11.5019 (-0.79)	38.23 (6.26)***	YES	11.08 (0.85)	RE
	-0.0851 (-3.60)***	-	0.2829 (0.65)	-0.0008 (-0.27)	-	1.5111 (0.34)	-0.4879 (-0.68)	-18.9388 (-1.30)	48.91 (9.63)***	NO	6.00 (0.42)	RE
	-	-0.1480 (-4.83)***	0.0371 (0.07)	-	0.0030 (0.67)	7.4401 (1.48)	-1.1040 (-1.41)	-21.3688 (-1.11)	46.92 (12.09)***	NO	14.25 (0.03)**	FE

*** significant at 1% level - ** significant at 5% level - * significant at 10% level – RE random effects model – FE fixed effects model

Data Appendix

India's trade data at the 4-digit level (81 industries) of ISIC are taken from the World Bank's "Production and Trade Database CD-ROM". This database also provides statistics pertaining to the value of industrial production, but only up to the year 1995. Thus, data on the value of total industry output (to measure *MES* and *FOR*) is taken from the Annual Survey of Industries (ASI), which is the most comprehensive official source on production statistics of the organized manufacturing sector in India. Data pertaining to individual factories within the industries, however, are not available in the ASI. Factory (or firm) level data on the value of output are required to construct minimum efficient plant scale (*MES*). Firm level information is also required to identify the foreign firms in the industries, which are defined as those reporting 25% or more of foreign equity participation in total equity. Thus, firm level data on value of output and the percentage of foreign equity collaboration required for the measurement of *MES* and *FOR*, respectively, are taken from the CMIE database, *Prowess*. In short, data on total industry output required for the measurement of *MES* and *FOR* are taken from the ASI, while the firm level data of the corresponding industries are taken from the *Prowess.* The ASI does not report data on advertising. Thus, advertising intensity (*ADV*) is measured using industrial level data from the *Prowess*, which is being constructed after tracking the same set of firms in a given industry from 1988 to 1999.

Prowess data is available according to the National Industrial Classification (NIC) -1998. However, the ASI data, except for 1998 and 1999, are available according to NIC–1987. For 1998 and 1999 we have made use of a special tabulation of ASI data according to NIC-1987, which was prepared by the Central Statistical Organization (CSO) for a research project undertaken at the Indian Council for Research on International Economic Relations (ICRIER). The classification codes followed to present the trade and industrial data (trade data according to ISIC Rev 2 and industrial data according to NIC 1987 and NIC 1998), are closely related. The table that establishes a concordance between the various classification codes is given below.

The variable MES is measured taking into account the entry of new firms in the industry. It is not appropriate to measure MES using data on the same set of firms tracked overtime, particularly in a context of large-scale entry of new firms under liberalization. With the entry of large and medium firms, the share of the incumbent can fall well below 50% of total industry output overtime. This would make the measurement of MES, with the time series dimension, difficult without considering the size of the new entrants. For obvious reason, the variable FOR too is measured taking into account the entry of new foreign firms in the industry.

However, as mentioned above, we tracked the same set of firms in a given industry from 1988 to 1999 to measure ADV. In order to get a reasonable number of firms that operate during the entire period in a given industry, ADV is measured at a relatively aggregate level of industrial classification – that is, after establishing a concordance with the 3-digit rather than the 4-digit level of ISIC.

Data on nominal tariffs and QRs are based on the estimations made by Das (2003) and National Council for Applied Economic Research (2000)[15]. The estimates of tariff rates and QRs by Das (2003) consist of 72 manufacturing industries at the 3-digit level of NIC-1987 for the period 1980-2000. Das (2003) estimated QRs or what is called import coverage ratio in 72 manufacturing industries in India from 1980 to 1999, using the following formula.

$$QR_j = \sum D_i M_i / \sum M_i$$

Where D_i = 1 if product line $_i$ within industry $_j$ falls under the restricted category of imports (that is, the imports are banned/ restricted/ limited permissible/ canalised), and D_i = 0 if import is free of QRs

[15] "Production and Trade Database CD-ROM" contains data on tariff rates at the 4-digit level industries in India, but only for some selected years.

As the estimates of Das (2003) exclude some of the manufacturing industries, we also used the estimates of tariff and QRs made by the National Council for Applied Economic Research (NCAER). The latter provides estimates after grouping the entire manufacturing sector into 64 industrial groups based on the classification system in the national Input-Output Table. Thus, in some industries, these estimates are used after mapping the 4-digit level industries with the sectoral classification in the Input-Output Table. The NCAER estimates of tariff rate, however, are not available for 1989, 1990 and 1999. Thus, in the case of the industries where we chose to use the NCAER data, the tariff rates for 1989 and 1990 were treated the same as the estimates available for 1988 while the 1999 estimates were applied to the year 1998 as well. As to QRs, the NCAER estimates are available for 1988, 1995, 1997, 1998 and 1999. Thus, as to the industries where the NCAER data are used, the estimates of QRs for the year 1988 were applied to the years 1989 and 1990 as well. Similarly, the estimates of QRs for 1995 were applied to1991, 1992, 1993 and 1994. The estimates of QRs in 1996 are the simple averages of the NCAER estimates available for 1995 and 1997. The above procedure, arose due to the non-availability of complete time series for some of the industries, is adopted keeping mind the broad trend in the levels of QRs during the period

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