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ANALYSING TRADE FLOWS AND INDUSTRIAL STRUCTURE OF INDIA: THE QUESTION OF DATA HARMONISATION

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ABSTRACT

An important requirement for the analysis of trade flows in relation to domestic industrial structure is the availability of a database covering information on trade flows, industry and firm characteristics. Such a database, as yet, does not exist in India. Thus, one is left to opt for the second best solution of compiling data from different sources to produce a harmonised database. This paper is an attempt to provide guidance in that direction. It raises certain relevant research issues on international trade in relation to domestic industrial structure, attempts a critical assessment of various available data sources for empirical analysis and highlights the advantages of choosing certain specific sources: (i) publications of the Directorate General of Commercial Intelligence and Statistics (DGCI&S) which provide data on India's foreign trade, (ii) Annual Survey of Industries (ASI), which provides data on industry characteristics, and (iii) the electronic data base 'Prowess', which provides data on firm characteristics. Following this, the data on trade flows, industry and firm characteristics are sought to be harmonised. First, the DGCI&S data are matched with 3-digit level National Industrial Classification (NIC) in the ASI, using the concordance table prepared by Debroy and Santhanam (1993). Second, we have constructed a concordance table for selected manufacturing sectors wherein the 3-digit items of NIC are matched with the industry categories in Prowess. Its appropriateness is evaluated by comparing data on value of output and total emoluments to employees as reported in ASI with that in Prowess. By and large, it appears that our concordance table is consistent and effective.

At one level, the "data" are the world that we want to explain, the basic facts that economists purport to elucidate. At the other level, they are the source of all our trouble. Their imperfections makes our job difficult and often impossible…We tend to forget that these imperfections are what gives us our legitimacy in the first place.

Zvi Griliches [1986], Handbook of Econometrics, Vol III

Introduction

A general thrust given to greater international integration, particularly of developing countries, is one of the most pronounced developments during the last two decades or so. India is no exception to this trend. Economic liberalisation was initiated in India in the early 1980s and intensified since the early 1990s. In this context, as one attempts to analyse India's trade flows in relation to domestic industrial structure, some specific issues emerge which are related to the suitability of the relevant data. The present paper discusses some of these issues with the focus on the features of various available data sources on India's international trade and industrial sector and on the problem of harmonisation one confronts while using them. It may be mentioned, at the outset, that our emphasise is on highlighting how to make the best use of available data rather than endeavouring to make suggestions for improvements.

The need for a comprehensive data system related to industry, trade and private corporate sector, both in a planned and in a liberalised economy, has been well recognised[1]. The economic liberalisation measures introduced in India have significant implications for the growth and behaviour of industrial production and international trade. The most important pre-requisite for any serious analysis of the underlying dynamics is the existence of a consistent and accessible database. Further, the nature and content of data requirements in a liberalised regime is different from that in a regulated regime. This is because of the greater integration of the Indian economy with the rest of the world and the consequent strengthening of linkages between different aspects related to domestic and external sectors of the economy.

Though, the important need for harmonising the data on industrial production and international trade has been understood unequivocally, no attempt has been made towards operationalising this requirement. Thus, one is compelled to assemble the relevant data from various sources and make required adjustments/matchings to suit the purpose. In this regard, Debroy and Santhanam (1993) made an important contribution by preparing a concordance table, wherein India's trade and industrial classifications are matched. They matched each of the 3-digit codes of National Industrial Classification (NIC) -1987 with the codes of Indian Trade Classification (ITC). However, the information available to the researchers from the Annual Survey of Industries (ASI) which follow

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1   See for example Rao (1972);; EPW Research Foundation (1988); Sastry (1998); Ministry of Commerce (1998); Ghosh (1998); Maulik (1998);; Pradan and Saluja (1998); Department of Company Affairs (1998); Shetty (1998); Venkateswaran (1998); Vyas (1998); Nagaraj (1999); Jacob (1999); Shanta and Raja Kumar (1999); Sinha Roy (2001); Chandrasekhar and Tilak (2001). Also see *Journal of Indian School of Political Economy* (Vol XIII, No. 1, January-March 2001) which contains 'Workshop on Modernization of The Statistical System in India, Compendium of the Workshop Materials', Department of Statistics, Ministry of Planning and Program Implementation, 1998, New Delhi.

the NIC is limited in two major respects. First, the ASI does not provide data to construct variables representing certain crucial elements of industrial structure such as, advertising intensity, extent of foreign collaboration, R&D intensity, concentration ratios, minimum efficient plant scale etc. Second, the ASI does not provide data related to individual firms within the industry[2].

Firm level data are crucial because different manufacturing units within the same industry are likely to be heterogeneous in terms of some important characteristics. The electronic database 'Prowess' supplied by the Centre for Monitoring Indian Economy (CMIE) provides comprehensive data for about 6000 companies listed in Bombay Stock Exchange (BSE). This database contains information on all the major financial variables. In the present paper, we present a concordance table for selected manufacturing sectors, wherein NIC items are matched with the industry categories in Prowess. We hope that this concordance table, complemented with the one prepared by Debroy and Santhanam (1993) will serve constructive purpose in empirical work on trade flows in relation to industrial structure. The appropriateness of the concordance table is evaluated by comparing industry wise data on value of output and total emoluments to employees as reported in ASI and in Prowess.

The paper is organised in 4 sections. Section I raises certain research issues pertaining to international trade in relation to domestic industrial structure in the context of liberalisation. The discussion is not comprehensive but essentially meant to be illustrative. Section II attempts a critical assessment of the various data sources available on India's international trade and industrial sector. Section III deals with the

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2   The Collection of Statistics Act prohibits disclosure of data relating to individual factories.

harmonisation of data related to trade, industry and firm characteristics. Section IV provides a summary.

I. Some Emerging Research Issues

Greater international integration is expected to bring about some fundamental changes in world industry. Two of the more important of these are the internationalisation of markets and the growing opportunities for firms to specialise. Foreign buyers of products or suppliers of raw materials and other inputs now constitute a significant part of any large firm's network for the exchange of factors and goods. Firms compete with truly global strategies, involving selling world wide, sourcing components and materials world wide, embarking on collaborative form of R&D, sharing out of production facilities and distribution systems, locating activities in many nations to take advantage of low cost of factors of production and engaging in many other forms of cross border co-operation. Simultaneously, greater market integration has brought more opportunities for specialisation in particular product lines and to compete on the basis of non-price attributes (such as product differentiation).

It is clear that the dynamics mentioned above have implications on the market structures of domestic industries and hence on the structure of a country's international trade[3]. To illustrate, the opportunities and challenges emanating from greater international integration necessitate exploitation of economies of scale and narrow specialisation in production. Thus, production and export of all varieties in a specific product spectrum become impossible if economies of scale in production are to be reaped. In this context, it becomes important to analyse the structure of exports in its relation to imports within an industry. For

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3   It is held that the structure of international trade in the import substitution regime is shaped largely by the nature and bias of the protection policy.

understanding this dimension of trade pattern, trade theorists have evolved the concept of intra-industry trade (IIT), which means the simultaneous occurrence of exports and imports within the same industry. Studies have shown that the phenomenon of IIT is gaining significance for India and trade liberalisation biases trade expansion towards IIT (Veeramani 1998, 2001). While it is relevant to analyse the significance of such trade in a liberalised economy, empirical research on the bearing of different elements of market structure on exports and imports separately is also important.

The analytical interest on the above issues is not just empirically oriented, for there has been a proliferation of theoretical attempts to integrate the elements of international trade and industrial organisation. It may be noted that, according to the conventional wisdom, difference between countries in terms of resources and technology is the main reason for trade. Thus, the influence of domestic industrial structure on the pattern of international trade was overlooked. Trade theorists began to realise this lacunae as empirical studies tended to underline the impact of a set of factors representing the key elements of market structure upon IIT, export and import. Thus, the last three decades witnessed significant theoretical attempts to analyse the relationship that runs from domestic market structure to international trade[4]. This literature put forward specific propositions relating the various elements of market structure (such as, economies of scale, product differentiation, seller concentration, price discrimination, foreign collaboration, technological content in production, size of firms etc) on IIT, export and import.

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4   See Helpman and Krugman (1985) and Greenaway and Milner (1986) for a synthesis of the theoretical literature on IIT. White (1974) demonstrated that there are theoretical reasons to expect a relationship that runs from domestic market structure to export and import performance. See also Auquier (1980); and Glejser et al (1980) which are specifically related to export and domestic market structure.

Empirical testing of such propositions is highly demanding in terms of the requisites of data to measure the relevant variables at the levels of firms and industries. Specifically we require data on (i) the value and quantum of trade flows at the industry level, (ii) the industry characteristics, and (iii) the firm characteristics. Further, this information needs to be harmonised to produce a comprehensive database. One reason for the state of scanty literature, in the Indian context, related to the research issues raised above is probably that the kind of data they demand was non-existent till a few years back. The above mentioned issues apart, the proposed type of data base is also useful for analysing a number of other research questions which assume relevance in the context of liberalisation. To mention a few, such questions include the relationships that runs from domestic market structure to foreign direct investment, from external orientation to domestic industrial performance, and from market structure to technology behaviour. Also, the suggested database is useful for the conventional analysis of industry in the structure-conduct-performance paradigm.

II. Major Sources of Data

This section attempts a critical assessment of the various available data sources on trade (export and import) flows, industry characteristics and firm characteristics. Available data sources on each of these will be assessed in terms of levels of aggregation, variables for which information are given, time periods for which data are available, coverage of the sectors, time lag involved in making the data available etc. The emphasis of our discussion is to highlight the advantageous of choosing the following specific data sources: (i) publications of the Directorate General of Commercial Intelligence and Statistics (DGCI&S), which provide disaggregated data on India's foreign trade, (ii) 'Annual Survey of Industries' published by the Central Statistical Organisation (CSO), which provides data on industry characteristics and (iii) an electronic data base

'Prowess' supplied by the Centre for Monitoring Indian Economy (CMIE), which provides data on firm characteristics.

II.1. Data on Trade Flows

Regarding trade flows, industry level data on value and quantum of exports/imports are required for both multilateral (India versus the rest of the world) and bilateral (India versus each trading partner) cases on an annual basis. Further, any such database should possess the following features. First, the commodity classification system of trade statistics needs to be comparable so that analysis of changes across time will be easier. Second, it should be possible to match the trade classification system with the classification system of statistics on industry and firm characteristics. Major sources of official data on trade flows are the publications of (i) United Nations (UN), (ii) Reserve Bank of India (RBI), and (iii) DGCI&S.

The UN data on trade flows are available from two different volumes of its publications titled "International Trade Statistics Yearbook"[5] . The quantity and value in US dollars of imports and exports of commodities by countries are given in Volume 2. The data, for majority of countries from 1962, are also available in machine-readable form. The major limitations of the UN data are: (i) it does not report exports or imports for those commodities whose share in the total is less than 0.3 per cent, and (ii) considerable time lag is involved in making the data available.

Trade statistics are obtained as a by-product of administrative activity in India. The Director General of Foreign Trade (DGFT) is responsible for licensing statistics; the RBI for the balance of payments

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5   Volume 1 is subtitled as 'Trade by Country' and Volume 2 as 'Trade by Commodity'.

statistics and the DGCI&S for the balance of trade statistics. The RBI statistics is based on merchandise transactions taking place in the economy which are valued at the actual price paid through the banking channel, where export figures are on the basis of declarations and imports are on the basis of realisations rather than on landed merchandise. As the major purpose of the RBI data is to provide information on the balance of payment situation in the country, it is not available at desired levels of disaggregation.

The DGCI&S provides the most comprehensive and up-to-date data on India's foreign trade. The data include information on value, quantum and unit values of exports and imports, both country and commodity wise. This statistics is based on customs clearance of merchandise transactions at major ports in the country. Export statistics are based on declarations made by exporters in shipping bills and import statistics are based on declarations made by importers in bills of entry, both being subsequently checked by customs authority[6]. Customs authorities, in turn, furnish these data to DGCI&S. From the point view of our purpose, the two major publications of the DGCI&S are: (i) Monthly Statistics of Foreign Trade of India - Volume-I (Exports and Re-Exports) and Volume-II (Imports); (ii) Statistics of Foreign Trade of India by Countries -Volume-I (Exports and Re-Exports) and Volume-II (Imports) (Quarterly)[7]. While the former contains commodity by country

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6   These shipping bills and bills of entry for each item of export and import contain all the relevant details of the transactions, such as (i) code number of the commodity; (ii) description of the codes; (iii) licence particulars of the goods in case of imports; (iv) value of exports/imports, (v) quantity (gross and net); (vi) amount of duty; (vii) name of exporter/importer; and (viii) country of consignment/origin and destination.

7   Other publications of the DGCI&S are: (i) Monthly Press Note on India's Foreign Trade; (ii) Foreign Trade Statistics of India (Principle Commodities and Countries) (Monthly); (iii) Selected Statistics of Foreign Trade of India (Annual).

details, the latter contains country by commodity details and the March issues of these publications provide data for the corresponding financial year.

Unlike the RBI, the DGCI&S provides data at a highly disaggregate level[8]. The DGCI&S has adopted a new commodity classification system known as the 'Harmonised System (HS)' from April 1987[9]. The classification consists of 99 chapters (including chapter 77 reserved for future use) represented by 2-digit codes, 1253 H.S headings represented by 4-digit codes and 5062 H.S subheadings represented by 6-digit codes. The 8-digit codes of H.S, nearly 11035 in number, have been derived by further subdivision of the 5062 HS sub-headings to capture data on commodities of national importance. Manual handling of such a vast body of data is laborious. The DGCI&S data pertaining to the above two publications for the latest three financial years (since 1995) is available in an electronic database 'India Trades' supplied by the CMIE. The DGCI&S data appears to be the preferred one among the available sources, because of the following considerations. First, it is the most comprehensive and up-to-date official statistics on India's trade flows. Second, this data are available to the users with a reasonable time lag, particularly so with the introduction of the electronic database. Third, it is possible to match the trade classification system followed by the DGCI&S with the NIC and a concordance table is provided by Debroy and Santhanam (1993).

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8   Figures given in the publications of the DGCI&S differ from the exchange control data compiled by the RBI owing to differences in reference period, coverage and valuation. See RBI (1995) and Sinha Roy (2001) for details.

9   Thus, time series analysis of specific products, which cover years prior to 1987, is difficult.

II.2 Data on Industrial Characteristics

For the purpose of collection of data on manufacturing, the entire gamut of industrial activities in the country is divided into factory (registered or organised) and non-factory (unregistered or unorganised) sectors[10] . The most comprehensive official data source on production statistics of the factory sector is the Annual Survey of Industries (ASI), brought out annually by the Central Statistical Organisation (CSO)[11] . The ASI have been conducted since 1959 at the authority of Collection of Statistics Act, 1953. The primary unit of enumeration is the factory and the reference period is the accounting year of the factory ending on any day during the financial year. Particulars about installed capacity, output, employment, earnings and raw materials consumed, and reasons for spare capacity etc. are collected under the survey. From ASI 1987-88 and onwards, a new sampling design has been adopted, according to which, factories employing 100 or more workers whether using power or not constitute the census sector. The remaining factories constitute the non-census (sample) sector. Also, from 1987-88, a stratified uni-

10   The factory sector covers units registered under the Factories Act, 1948. The non-factory sector consists of household and non-household industrial units, which are not registered under the said act.

11   The ASI replaced both the Census of Manufacturing Industries (CMI) and the Sample Survey of Manufacturing Industries (SSMI) which were the main official sources of industrial statistics till 1958. The ASI covers all the factories registered under section 2m(i) and 2(mii) of the Indian Factories Act 1948, employing 10 or more workers using power and those employing 20 or more workers but not using power on any day of the preceding 12 months. It also covers all the electricity undertakings, gas and water supply establishments and bidi and cigar units registered under the Bidi and Cigar Workers (Conditions of Employment) Act, 1966.It may be noted that industry level data are also available from the publications of other agencies, such as (i) RBI; (ii) Industrial Credit and Investment Corporation of India (ICICI); (iii) Industrial Development Bank of India (IDBI); (iv) Centre for Monitoring Indian Economy etc. Most of these databases, however, provide information only on financial variables. Further, the coverage of firms and industries is limited and in most cases data are available only at a relatively aggregate level.

stage sampling design has been adopted for the sample sector and the coverage of the census sector has been reduced[12].

From ASI 1989-90 and onwards, NIC-1987 is followed for classification of industries. All the factories in the ASI are accordingly classified in their appropriate industry groups on the basis of value of the principle product manufactured by them. Therefore a unit gets classified in one and only one industry group even though it might be manufacturing products belonging to different industries. The NIC-1987 is based on the international system devised by UN in its International Standard Industrial Classification (ISIC) 1968 Rev. 2. The classification consists of 24 items at 2-digit level, 196 items at 3-digit level and 288 items at 4-digit level. The CSO will be following a new commodity classification system NIC 1998, which is based on the ISIC 1990 (which is also harmonised with the International Harmonised Commodity Description and Coding System [HS] 1996). Efforts have been made to structure every 4/5 digit category of revised NIC in such a manner so that one or more subheading of HS can be assigned, as a whole, to only one such category of NIC, to the extent possible. This will prove to be very useful for empirical research in future.

Major publications of the CSO relating to manufacturing statistics are: (i) Annual Survey of Industries - Summary Results for Factory Sector[13] and (ii) Annual Survey of Industries - Detailed Results for Factory Sector[14]. The former is published every year and presents summary results in respect of 32 selected characteristics. Data at 2 and

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12   See Pradhan and Saluja (1998) and Chandrasekhar (2001) for details.

13   In printed form, the latest year for which this is available is 1994-95 and on disk for the year 1997-98.

14   The latest year, for which it is available on disk, is 1997-98.

3-digit levels of disaggregation are given for all the states and for all-India. The important characteristics for which estimates are given in the reports are number of factories; capital (fixed, working, invested); number of workers, employees, total persons; mandays; wages; emoluments; outstanding loan; fuel and material consumed; input; products; gross output; depreciation; net value added; net income; profit; rent paid; interest paid, etc. Regarding the latter publication, from ASI 1993-94 onwards detailed tabulation is being undertaken on annual basis. These volumes provide detailed all India, statewise, as well as industry wise data at 4-digit level of industrial classification.

It may be reminded, at this juncture, that though trade data from the DGCI&S include the contribution from the unorganised sector as well, as regards the industrial and firm level data we will be compelled to confine to the organised sector. This is because comparable data on similar industrial characteristics pertaining to the non-factory sector is hard to come by.

II.3 Data on Firm Characteristics

As already mentioned, the ASI do not provide data related to individual firms within the industry. Thus, we need to look for alternative data sources. The following considerations are important while choosing an appropriate data source on firm characteristics. First, the database should be as comprehensive (mainly, in terms of number of firms covered and number of variables for which information are available) as possible. Second, it should be easy to match the NIC 1987 with the industrial categories under which firms are grouped. It may be noted, at the outset, that all the available firm level data sources are based on the financial statements of companies[15]. Comprehensive databases providing

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15   It is necessary to consider companies as a proxy for firm.

information on physical variables (such as number of employees, mandays worked etc) are not available.

The CMIE provide firm level statistics through its various publications and through the electronic database 'Prowess', which contains information on over 6,000 companies listed in BSE. In terms of number of variables for which information are available, this is the most comprehensive of the available databases. Also, the industrial classification followed is very disaggregate and the matching with the NIC 1987 can be done reasonably well. The industrial classification is based on the overall distribution of companies amongst industries and the distribution of sales turnover of companies. Selection of a set of industry groups is based on a 'reasonable' representation of companies. In some cases, companies belonging to a group of industries have been clubbed together, if they are closely related to each other. Regarding the sales turnover, as a general rule, if a company derives more than half of its sales from one of the industry classification heads, it gets classified under the particular industry, else it is classified as a diversified industry. The data are available from 1988-89 and onwards and are updated every month.

Other major sources of data on firm characteristics are the RBI, the BSE and the Department of Company Affairs (DCA)[16]. The RBI conducts quinquennal surveys on finances of small, medium and large public limited companies. The summary results of the survey are being published in the RBI Bulletin. The basic data file of the survey containing the company statistics is not being published, but it is possible to access

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16   The data available with the ICICI and the IDBI cover only those companies assisted by these organisations. See Vyas (1998) and Shanta and Raja Kumar (1999) for a comprehensive evaluation of various data sources on India's private corporate sector.

it on special request. The problem of access apart, the main limitation of this database is that it is essentially a sample data and thus the number of firms covered is comparatively less. Further, the matching of the industrial classification with the NIC 1987 is difficult because industries are grouped at a rather aggregated level as compared to Prowess. A major source of firm level data, which has been used extensively in applied work, is the 'Stock Exchange Official Directory' published by the BSE. Every issue contains data for 10 financial years. The DCA is another agency providing firm level data through its various publications. The DCA data on the financials of about 25,000 public limited companies are now available in an electronic database 'First Source' supplied by the CMIE. The limitation of the BSE and DCA data, from the point of view of our purpose is that they do not contain information on some crucial variables, (such as foreign trade, foreign equity share, R&D, import of technology etc).

III. Data Harmonisation

In a liberalised regime, international trade plays an important role in influencing the levels of output of various sectors. Further, the interrelationships between the variables related to domestic and external sectors of the economy would be strengthened. Thus arises, the pressing need of harmonising trade and production data. Nevertheless, as of now, no comprehensive database exists taking care of this aspect.

One possible suggestion to overcome this problem to a certain extent is to rely on 'Prowess'. It remedies the problem of non-harmonisation as it provides firm level (and industry level) information on production as well as foreign exchange transactions. The question of coverage apart, such a solution is handicapped because of the following major problems. First, the data on exports and imports from the 'Prowess' do not represent wholly the contribution from the corresponding

industry[17], because of the particular criteria followed in the industrial classification of firms. For example, using of these figures for measuring IIT do not go well with the understanding of the concept of IIT. Second, the scope of foreign trade data in 'Prowess' is limited, for, it does not provide data on quantity and unit values and there is no country wise break up.

Data harmonisation, entailing two stages, needs to be attempted in order to produce a comprehensive and consistent database. First, trade data at various levels of disaggregation from the DGCI&S have to be matched with data on industrial characteristics at 3-digit level of NIC. Second, firm level data from Prowess at various levels of disaggregation need to be matched with NIC 3-digits. As regards the first stage, one may depend on the concordance table prepared by Debroy and Santhanam (1993). They matched the industrial codes (NIC 3-digits), item by item, with the ITC (HS)[18]. Trade codes at 4, 6 and 8 digit levels of disaggregations were clubbed together under each NIC 3-digit codes.

In the second stage, we adopted the following steps. First, we selected the ITC 2-digit codes for preparing the concordance table. The selected codes are: Chemicals (06)); Plastics and Rubber (07); Paper (10); Stone and Cement (13); Gems and Jewellery (14); Base Metals (15); Machinery (16); Transport Equipments (17); Instruments and Apparatus (18); and Miscellaneous Manufactures (20). The specific significance of analysing trade dynamics in these sections is provided in

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17   This problem, which is a consequence of the classification procedure and the existence of multi product firms, do exist in the case of other variables taken from both the ASI and the 'Prowess'. However, in those cases, we do not have any alternative.

18   Matching was also done with ITC Rev-2, which was the trade code system till 1986-87.

a previous paper (Veeramani 2001)[19] . Second, the particular NIC 3-digit items, comprising of the selected ITC 2-digit items are identified from the concordance table of Debroy and Santhanam (1993). This resulted in the selection of eighty-two NIC 3-digit items (for which, matching trade codes are available). Third, we prepared a concordance table, wherein NIC 3-digit items are matched with the industrial categories in Prowess. In those cases, where the matching of individual NIC items with the prowess codes are ambiguous we aggregated two or more NIC items. The resultant concordance table on 66 items is shown in the Appendix (Table 1).

Table 2 and Table 3 in the Appendix are constructed with the objective of evaluating the appropriateness of our concordance table by comparing industry wise data on value of output and total emoluments to employees calculated from Prowess with that reported in ASI. First, we calculated the industry wise total by summing up the figures pertaining to individual firms in Prowess categories. Second, these values are expressed as a percentage of the total reported in ASI, in order to find out the extent of industry coverage in the Prowess. It is clear from the table that the coverage of Prowess in terms of the selected indicators is impressive in a number of industry groups. This is expected, because by virtue of their larger size, companies listed in the stock exchanges account for significant shares of total value of output in a given industry. In a few cases, the figures showing the coverage appears to be erroneous, as they cross the maximum defined limit of 100 per cent. It is difficult to

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19   The selected sections of commodities consist of predominantly manufactures, where the influence of industrial structure on trade flows is expected to be important. Also, in the recent years, these sections are found to be recording relatively high intensity of IIT, high growth of export and a rising share in the export basket of India.

attribute such inconsistencies to inappropriate matching of Prowess categories with the NIC items, as our concordance table does not suggest any particular ambiguities in the matching of those cases, where the inconsistencies are observed. Rather, we firmly believe that the probable reasons for the erroneous figures may be found elsewhere. It could arise because of inadequate coverage of the ASI and non-response by the units[20]. In fact, some commentators recently pointed out the seriousness of these problems in the ASI data (Ghosh 1998; Maulik 1998; Nagaraj 1999). Thus, omission of certain large firms from the ASI, which are actually included in the Prowess, can give rise to higher value added figures in the latter[21].

Table 3 in the Appendix provides separate lists of industrial categories, which appear on the higher and lower ends of the coverage scale, in terms of both value of output and total emoluments. Ten categories are shown under each head. It may be seen from the table that majority of the industrial categories which have higher (lower) coverage in terms of value of output also have higher (lower) coverage in terms of total emoluments. For example, eight out of ten industrial categories appear in both the columns, which show higher coverage (in terms of value of output and total emoluments), while the similar figure for the low coverage categories is nine. In fact, the rank correlation coefficient (i.e., 0.855) between the coverage in terms of value of output and total emoluments is found to be very high and statistically significant, providing credence to our concordance table.

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20   While presenting data in the ASI, only the reporting factories are taken into account.

21   The CMIE (2000) also pointed out the problem of underestimation of total production statistics in the official estimates.

Why is it that we observe higher coverage in certain groups and low coverage in others? Casual examination of Table 3 would indicate that the industrial categories which record higher coverage (in terms of both value of output and total emoluments) share a common feature which is distinct from that shared by the lower coverage groups. In general, those categories with high coverage seem to be the ones in which the scopes for small-scale operation are limited. On the contrary, by their very nature, categories, which fall on the lower end of the coverage scale, appear to be the ones with greater scope for small-scale operation. Thus, one may expect greater levels of market concentration in the former as compared to the latter. To test whether this indeed is the case, we worked out 3-firm concentration ratios using firm level data from the Prowess and industry level data from the ASI[22]. Rank correlation coefficients between concentration ratios on the one hand and the coverage in terms of value of output and total emoluments on the other are estimated. As expected, the coefficients (i.e., 0.837 and 0.687 for value of output and total emoluments, respectively) are positive and significant. Thus, industries with higher coverage in Prowess are characterised by high concentration ratios and vice versa. This suggests that the coverage in the Prowess is intimately related to the very nature of the corresponding industry group. By definition, industry groups dominated by smaller firms will be poorly represented in the Prowess, which give rise to lower coverage in those groups. On the other hand, industry groups dominated by larger firms will be greatly represented in the Prowess, which give rise to higher coverage. Hence, the differences in coverage are not due to any classification error, which provides further credence to the

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22   The publication of the CMIE, 'Industry: Market Size and Shares' provide Herfindahl index of concentration for around 250 products. However, matching of these product categories with the NIC items is difficult owing to the limited coverage and rather aggregated levels of classification followed.

concordance table. In sum, not withstanding certain inescapable limitations, our concordance table seems to be consistent and effective.

IV. Summing Up

The policy liberalisation calls for systematic analysis of a number of research questions related to trade flows and industrial structure. Some of these questions may be appropriately analysed within the framework of detailed case studies based on primary surveys. However, the analysis of certain other questions, like the ones raised in the present paper, requires the availability of comprehensive and consistent secondary data. Importantly, the nature and scope of the database required in the liberalised policy regime seems to be different. An important requirement is the availability of a harmonised database covering information on trade flows, industry and firm characteristics. Such a database, as yet, does not exist. Thus, one is left to opt for a second best solution of compiling data from different sources to construct a harmonised database to suit the purpose.

We have attempted a critical assessment of various available data sources on trade (export and import) flows, industry characteristics and firm characteristics. The discussion highlighted the advantages of choosing the following specific data sources: (i) publications of the DGCI&S which provide industry level data on India's foreign trade, (ii) the ASI, published by the CSO which provide data on industry characteristics, and (iii) and an electronic data base 'Prowess' supplied by the CMIE which provide data on firm characteristics. Harmonisation of these data from various sources and at various levels is a difficult procedure and a certain degree of subjectivity can not be avoided. Nevertheless, so long as a 'ready-to-use' database is not available, such a procedure is imperative for a meaningful analysis of micro level foreign trade dynamics under liberalisation.

Data harmonisation, entailing two stages, need to be attempted in order to produce a comprehensive and consistent database. First, trade data at various levels of disaggregation from the DGCI&S have to be matched with data on industrial characteristics at 3-digit level of NIC. Regarding this, one may depend on the concordance table prepared by Debroy and Santhanam (1993). In the second stage, Prowess data at various levels of disaggregation need to be matched with NIC 3-digits. An attempt was made in the present paper to present a concordance table (for selected manufacturing sectors), wherein the NIC items are matched with the industry categories in Prowess. The appropriateness of the concordance table was evaluated by comparing industry wise data on value of output and total emoluments as reported in ASI and in Prowess. It was shown that the extent of data coverage in the Prowess is quite good, excepting in those industries where the small-scale operations are dominant. The exercise provided some evidence to establish the credence of the concordance table. We hope that the discussion in this paper will provide useful guidance for undertaking empirical research in the area of India's international trade and industrial sector.

Appendix

Table 1: Matching of NIC codes with Prowess Categories: The Concordance Table

NIC code[a] and Description	Prowess Categories
271: Veneer sheets, plywood and their products.	Veneer sheets & sheets of plywood+ Plywood.
276+277+279: Wooden furniture and fixtures + Bamboo and cane furniture + Products of wood, bamboo, cane, etc.	Wood Products (excluding those under NIC 271 and Cork)
280+282+283: Pulp, paper and paperboard, newsprint + Paper and paperboard articles and pulp articles + Special purpose paper.	Pulp, waste etc + Paper, newsprint & paperboard (excluding those under NIC 281).
281: Containers, boxes, etc., of paper and paperboard	Cartons, boxes, cares etc
284+85/87/88+89: Newspaper + Periodicals, books, journals etc., block making, binding, etc + Other printed material	Printed books, newspapers etc
286: Currency notes, stamps, stamp papers etc.	N.A
300: Industrial, organic and inorganic chemicals	Inorganic chemicals + Organic chemicals
301: Fertilizers and pesticides	Fertilizers + Pesticides

cont'd....

NIC code[a] and Description	Prowess Categories
302: Plastic in primary forms, synthetic rubber	Plastic in primary forms + Synthetic rubber
303: Paints, varnishes, dyes and related products, artists colors and ink	Paints, dyes etc
304: Drugs, medicines and allied products	Drugs, medicines and allied products
305: Perfumes, cosmetics, soaps, toiletries, etc.	Cosmetics and toilet preparations + Soap, washing preparations, waxes
307+308: Matches + Explosives, ammunition and fireworks	Explosives
309: Chemical Products n.e.c	Photographic or cinemotographic goods + Starches modified, adhesives etc + Miscellaneous chemicals
310: Tyres and tubes	Tyres and tubes + Solid rubber tyres
312: Rubber products n.e.c	Rubber and rubber products (excluding Synthetic rubber and those under NIC 310)
313: Plastic products n.e.c	Plastic Products
314/16: Refined petroleum and products	Petroleum products
317: Nuclear Fuels	N.A

NIC code[a] and Description	Prowess Categories
320: Refractory and structural clay products	Refractory bricks + Bricks blocks and other ceramic products + Other ceramic products
321: Glass and glass products	Glass and Glassware
322/23: Earthen and plastic products and non-structural ceramic ware	Earthen wares and plaster products
325: Mica Products	Mica Products
326: Stone goods and stoneware	Pumice stone + Granite + Sandstone etc + Limestone, Mill stone, grindstone etc + Stones nec.
327: Asbestos cement and other cement products	Asbestos - cement Products
329: Mis.non metallic mineral products	N.A
330+331/337/338+340+341+ 342+343+346+349: Iron and steel in primary/semi finished forms + Semi finished iron and steel products + Castings of metals + Metal scrap products + Fabricated structural metal products + Fabricated metal products n.e.c + Furniture and	Primary materials (excluding Ferro alloys) + Steel, semi finished + Castings + Finished steel + Stainless steel + Alloy steel nec + Articles of iron and steel.

NIC code[a] and Description	Prowess Categories
fixtures of metal + Handtools, weights and measures and general hardware + Metal cutlery, utensils and kitchenware + Metal products n.e.c.	
332: Ferro alloys	Ferro alloys
333+334: Copper in basic forms and semi finished copper products + Brass in basic forms and semi finished brass products.	Copper
335: Aluminium in basic forms and semi-finished aluminium products	Aluminium
336: Zinc in basic forms and semi finished zinc products	Zinc
339: Other non ferrous metals in basic forms and semi finished products	Other Base materials
350: Agriculture machinery and parts	Agricultural machinery
351: Mining and Construction machinery equipment and parts	Mining machinery + Construction machinery + Material handling equipment + Lifts and elevators

NIC code[a] and Description	Prowess Categories
352: Prime movers, boilers, steam generating plants and nuclear reactors	Prime movers
353: Food and textile machinery	Machinery used in food and beverage industries +Textile including jute machinery
354 +359:Industrial Machinery (other than food and textile machinery) + Special purpose machinery, equipment, components and accessories	Industrial Machinery (excluding those under NIC 353)
355: Refrigerators, air conditioners & fire fighting equipment and parts and accessories	Refrigerators, air conditioners etc.
356: General purpose non-electrical machinery, equipment, components, accessories	General purpose machinery
357: Machine tools, accessories and parts	Machine tools
358: Office computing and accounting machinery and parts	Office equipment

NIC code[a] and Description	Prowess Categories
360: Electrical machinery and parts	Motors and generators + Transformers + Converters and rectifiers + Switching apparatus + Electric signaling apparatus + Amplifiers and power supplies + Industrial furnaces and ovens + Elecrical machinery nec.
361: Insulated wires and cables	Wires and cable insulated
362: Accumulators, primary cells and primary batteries	Primary cells and accumulators
363: Electric lamps	Electric filament or discharge lamps + Radiation lamps +LED lamps + Indicating lamps
364/88: Electric fans, electro thermic domestic appliances and parts and appliances based on solar energy	Fans and blowers + Domestic appliances (electro mechanical) + Solar appliances
365: Apparatus for radio broad casting and television Transmission, radar telephony/ telegraphy video recording apparatus	Communication and broadcasting equipments + Strategic electronics equipment + Electronic cameras + CCTV cameras + Electronic relays + Recorders
366: Television receivers, reception apparatus for radio	Television receivers + Video systems (excluding video camera)

NIC code[a] and Description	Prowess Categories
broadcasting, radio telephony/ telegraphy radio recording apparatus	+ Audio equipment + Audio visual equipment + Cassettes + Loud speakers
367: Computers and computer based systems	Educational computers + Computer systems + Computer peripherals
368: Electronic valves and tubes and other electronic components nec	N. A
369: Radio graphic X-ray apparatus, X-ray tubes and parts	X-ray filims and plates + X-ray machine + X-ray machine (dental) + Ultra sound scanners + X-analysis equipment + X-ray tubes.
370: Ships and Boats	Ships and boats etc
371/72: Locomotives and parts, railway/tramway coaches, wagons and other railroad equipment	Railway and tramway equipments
373/74/79: Heavy motor vehicles, motor cars and other transport equipment and parts	Commercial vehicles + Passenger cars & jeeps + Automobile ancillaries + Transport equipments n.e.c
375: Motor cycles, scooters, three-wheelers and parts	Two and three wheelers

NIC code[a] and Description	Prowess Categories
376: Bicycles, cycle rickshaw and parts	Bicycles, cycle rickshaws etc
377: Aircraft, Spacecraft and parts	Aircrafts
378: Bullock carts, push carts and hard carts	Bullock carts, push carts etc
380: Medical, surgical, scientific and measuring equipment (except optical equipment)	Medical electronics equipments
381: Photographic, cinemato-graphic and optical goods	Optical Instruments + Cameras and other photographic instruments
382: Watches and Clocks	Clocks and watches + Electronic watches and clocks
383: Jewellery and related articles	Pearls and precious stones
384: Currency and coins	N.A
385: Sports and athletic goods	Canvas and sports shoes + Sports goods
386: Musical instruments	Musical instruments
387: Stationary articles n.e.c :	N.A

[a] - the symbol'/' represents that the particular aggregation of NIC codes is done by Debroy and Santhanam (1993) and the symbol '+' represents that the aggregation is done for the present exercise.

Table 2: Coverage of Prowess Database

NIC Codes	Value of Output (Rs. Crores)		Wages and Salaries (Rs. Crores)		Coverage of Prowess (%)	
	ASI	Prowess	ASI	Prowess	Value of Output	Wages and Salaries
271	1054.18	512.36	82.55	30.61	48.60	37.08
276+77+79	385.49	143.09	43.94	16.44	37.12	37.41
280+82+83	9056.05	1853.58	845.78	172.36	20.47	20.38
281	2561.95	256.22	191.27	24.05	10.00	12.57
284	6850.19	1015.03	110505	105.87	14.82	0.10
300	18839.01	8187.22	1448.88	555.97	43.46	38.37
301	25855.88	27652.1	1429.95	1612.95	106.95	112.80
302	16950.23	7726.21	530.26	588.89	45.58	111.06
303	9767.03	5009.84	495.41	392.98	51.29	79.32
304	21833.17	15585.94	1495.91	1439.77	71.39	96.25
305	9261.79	5628.3	330.82	287.55	60.77	86.92
307+08	1494.95	338.29	191.68	51.09	22.63	26.65
309	8099.2	1427.08	386.52	108.72	17.62	28.13
310	9277.74	7840.11	535.98	570.61	84.50	106.46
312	3549.3	217.35	315.97	20.44	6.12	6.47

NIC Codes	Value of Output (Rs. Crores)		Wages and Salaries (Rs. Crores)		Coverage of Prowess (%)	
	ASI	Prowess	ASI	Prowess	Value of Output	Wages and Salaries
313	12096.82	6119.54	686.02	279.21	50.59	40.70
314+16	36467.6	100835.9	617	1472.66	276.51	238.68
320	3775.44	1255.33	486.79	145.21	33.25	29.83
321	2695.82	1538.86	255.63	155.73	57.08	60.92
326	1509.78	236.09	106.12	23.07	15.64	21.74
327	803.25	817.48	67.98	89.43	101.77	131.55
330+31+37+38+ 40+41+42+43+46 +49	93784.44	52866.87	6339.02	5113.63	56.37	80.67
332	2485.77	1366.16	132.02	108.23	54.96	81.98
333+34	1973.45	1440.15	90.93	41.74	72.98	45.90
335	8908.21	6026.13	522.11	488.15	67.65	93.50
336	1398.27	1305.18	133.71	180.57	93.34	135.05
339	443.9	160.33	24.48	15.98	36.12	65.28
350	6499.16	3811.23	512.62	270.97	58.64	52.86

NIC Codes	Value of Output (Rs. Crores)		Wages and Salaries (Rs. Crores)		Coverage of Prowess (%)	
	ASI	Prowess	ASI	Prowess	Value of Output	Wages and Salaries
351	1560.06	618.87	138.17	116.06	39.67	84.00
352	5605.62	1845.23	611.13	143.78	32.92	23.53
353	4307.23	1371.97	418.21	168.01	31.85	40.17
354+59	5739.36	2203.95	627.8	265.63	38.40	42.31
355	3020.26	2150.62	324.32	209.93	71.21	64.73
356	6843.61	3817.04	877.79	546.48	55.78	62.26
357	1996.73	1024.37	364.87	174.31	51.30	47.77
358	508.2	579.66	27.12	52.08	114.06	192.04
360	16747.52	4352.27	1916.53	559.75	25.99	29.21
361	5901.28	3603.49	332.33	269.55	61.06	81.11
362	1500.9	1904.41	117.61	232.25	126.88	197.47
363	1377.31	201.67	178.24	33.13	14.64	18.59
364+88	1367.81	1571.55	122.9	93.52	114.90	76.09
365	4606.92	3221.61	589.9	528.42	69.93	89.58
366	8733.61	5313.19	323.45	158.89	60.84	49.12
367	4127.51	3861.44	202.85	302.93	93.55	149.34

cont'd

NIC Codes	Value of Output (Rs. Crores)		Wages and Salaries (Rs. Crores)		Coverage of Prowess (%)	
	ASI	Prowess	ASI	Prowess	Value of Output	Wages and Salaries
369	875.99	43.33	104.86	11.37	4.95	10.84
370	1998.91	1885.57	258.94	364.02	94.33	140.58
371+72	3092.34	390.88	874.29	112.99	12.64	12.92
373+74+79	32617.59	28672.22	2854.04	2676.94	87.90	93.79
375	8040.64	7174.52	643.58	493.65	89.23	76.70
376	2633.89	1016.16	177.79	92.24	38.58	51.88
377	1047.76	1798.72	268.15	495.98	171.67	184.96
380	2337.79	151.16	277.21	25.39	6.47	9.16
381	886.01	767.67	63.78	50.28	86.64	78.83
382	323.85	462.56	113.57	64.53	142.83	56.82
383	4080.17	2379.48	228.12	47.38	58.32	20.77
385	342.87	89.77	27.64	10.87	26.18	39.33

Table 3: Lists of Industrial Categories with High and Low Coverages

High Coverage		Low Coverage	
Wages and Salaries	Value of output	Wages and Salaries	Value of output
314/16: Refined petroleum and products	314/16: Refined petroleum and products	284+85+89: Newspaper + Periodicals, books, journals etc., block making, binding, etc + Other printed material	369: Radio graphic X-ray apparatus, X-ray tubes and parts
362: Accumulators, primary cells and primary batteries	377:Aircrafts, spacecrafts and parts	312: Rubber products n.e.c	312: Rubber products n.e.c
358: Office computing and accounting machinery and parts	382: Watches and Clocks	380: Medical, surgical, cientific and measuring equipment (except optical equipment)	380: Medical, surgical, scientific and measuring equipment (except optical equipment)
377:Aircrafts, spacecrafts and parts	362: Accumulators, primary cells and primary batteries	369: Radio graphic X-ray apparatus, X-ray tubes and parts	281: Containers, boxes, etc.,of paper and paperboard

cont'd

High Coverage		Low Coverage	
Wages and Salaries	Value of output	Wages and Salaries	Value of output
367: Computers and computer based systems	364/88: Electric fans, electro thermic domestic appliances and parts and appliances based on solar energy.	281: Containers, boxes, etc. of paper and paperboard	371+72: Locomotives and parts, railway/tramway coaches, wagons and other railroad equipment
370: Ships and Boats	358: Office computing and accounting machinery and parts	371+72: Locomotives and parts, railway/tramway coaches, wagons and other railroad equipment	363: Electric lamps
336: Zinc in basic forms and semi finished zinc products	301: Fertilizers and pesticides	363: Electric lamps	284+85+89: Newspaper + Periodicals, books, journals etc., block making, binding, etc + Other printed material

High Coverage		Low Coverage	
Wages and Salaries	Value of output	Wages and Salaries	Value of output
327: Asbestos cement and other cement products	327: Asbestos cement and other cement products	280+82+83: Pulp, paper and paper board, newsprint + paper and paperboard articles and pulp articles + Special purpose paper.	326: Stone goods and stoneware
301: Fertilizers and pesticides	370: Ships and Boats	383: Jewellery and related articles.	309: Chemical Products n.e.c
302: Plastics in primary orms, synthetic rubber	367: Computers and computer based systems	326: Stone goods and stoneware	280+82+83: Pulp, paper and paper board, newsprint + paper and paperboard articles and pulp articles + Special purpose paper.

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