APPENDIX 1

GENERATION OF INPUT FLOW MATRIX, MAKE MATRIX AND ASSOCIATED MATRICES

Input flow Matrix

A1.1 The Input and output flows for different sectors have been identified in terms of commodities, using the ASICC codes for the manufacturing sectors and the IOTT sector codes for other sectors. For the sectors for which the ASICC codes have been used to code the input commodities, the same have been converted to the IOTT sector codes using the ASICC-IOTT concordance, specially developed for the purpose. The coding structure adopted for the industries is the NIC, 1998.

A1.2 The input and output flows relating to registered and unregistered manufacturing industries have been generated separately on the basis of detailed coded (ASICC) input data available from the survey results. For the registered manufacturing sector, the item directory of the detailed results of ASI, 1998-99, are available according to the ASICC. The data records are aggregated to the IOTT-sector codes for both the industries and the commodities, using the concordance of (i) NIC Industries-IOTT sectors and (ii) ASICC commodities-IOTT sectors, respectively, keeping in view the coverage of IOTT sectors.

A1.3 Input flows from registered manufacturing segments has been generated by combining the input data for each of the input data Blocks I, H & F of ASI and for each of the industry sub-groups. Similarly output flow has been generated from the data of block J & G (output Blocks). Within the industry sub-groups, commodities are grouped to conform to IOTT sectors and similarly the industry sub-groups are merged to conform to IOTT sectors. It may be noted that in each of industry sectors besides the identified inputs, there are several unidentified input items of the categories of 'other basic materials', 'other chemicals', 'other packing materials', 'others', etc. The treatment of these unidentified inputs is given in para A1.6, below.

A1.4 Specially tabulated data for input and output (commodity-wise) have been used for preparing the input/output flows of the unregistered manufacturing. Once the data tapes of unregistered manufacturing are available according to the ASICC codes for the input and output commodities, the data records are assigned the IOTT-sector codes for both the industries and the commodities, using the concordance tables mentioned above. Treatment of unidentified items appearing in the above mentioned tables are same as those of registered manufacturing, except for those items which were not given ASICC codes at the time of the survey. These uncoded commodities have also been converted into IOTT sector codes. Since the survey on unorganised manufacturing sector relates to 2000-01, proper adjustments have been done to convert the data for the year 1998-99. Input/output flows thus arrived at separately for registered and unregistered manufacturing are combined to arrive at the total flows of the manufacturing sectors.

A1.5 The single input flow matrix representing the complete manufacturing sector has then been combined with the input flow matrices relating to primary and service sectors of the economy and aggregated to 115 sector classification adopted. The final demand

vectors are outside the 115 columns relating to inter-industry transactions. The final demand vectors give the row totals of utilisation of commodities in the final demand column. Thus, the input flow at purchasers' price has been obtained by depicting the inter-industry flows and final uses of the commodities in rows. The sectoral estimates of gross value added have then been introduced as a row at the bottom next to the row showing the total inputs by industries. The unbalanced input-output transactions table at purchasers' price is thus obtained, where the individual row and column totals show the first results of the exercise in terms of commodity utilisation and input structures of industries. The sum of the entries in a column of this table shows the output of the industry at ex-factory price. The sum of the entries along any row shows the total of the inter-industry and the final use of the commodity. Since the table is *commodity x industry* transaction presentation, the row totals do not tally with the column totals even after final balancing though the column and row headings are similar. The balancing in this case, therefore, refers to an exercise with reference to independent *industry x commodity* classification of output.

A1.6 In the combined input flow, there are a number of unidentified inputs, such as, other raw materials, other chemicals, other packing materials, consumable stores, materials consumed for repairs and maintenance of buildings, machinery and equipment and others, other fuels etc. The entries corresponding to 'other chemicals' row have been transferred to the rows of "inorganic heavy chemicals", "organic heavy chemicals" and "other chemicals", in proportion to the existing entries of these three sectors of chemical industries. The materials used for the repairs and maintenance of buildings have been treated as the purchase from the construction sector. The materials consumed for the repairs and maintenance of machinery and equipment have been identified to the components of the machinery used in the industries and transfers made to the relevant producing sectors. The values of remaining unidentified items in different industries have been transferred to relevant sectors in the course of manual balancing.

Output Matrix

A1.7 For balancing the table, it is necessary to have an *industry x commodity* classification of outputs, i.e., a Make matrix. Similar to the procedure followed for the generation of combined input flow, the output flows relating to registered and unregistered manufacturing industries have been generated separately on the basis of detailed coded output data and finally merged into a single output flow matrix representing the complete manufacturing sector. The sources of data for the industry-wise details of output on products and by-products are the same as those utilised for the input flows. These output data are tabulated to obtain the *industry x commodity* matrix (Make matrix) by merging the output flows from registered, and unregistered manufacturing sectors and the output flows from primary and service sectors.

A1.8 The IOTT at purchasers' price thus obtained is, to begin with, balanced manually, leaving not more than 5 per cent gaps between generated and estimated row and column totals. The Make matrix is used for the purpose. This matrix provides the commodity outputs at ex-factory price. The estimated row totals are obtained by adding distributive margins comprising of trade, transport and net indirect taxes to the commodity outputs obtained from the Make matrix, while the estimated column totals are the outputs of the industries at factor cost. While undertaking the manual balancing, the gaps between estimated and generated totals are reconciled to an appreciable extent by allocating the unidentified items of inputs and outputs.

A1.9 The overall distributive margins by commodities are obtained as the sum of trade margin, transport margin and net indirect tax for each of the commodities. The commodity-wise trade margins have been estimated using the results of the DTE, 1990-91 Survey and Non-Directory Trading Establishments and Own Account Trading Enterprises, Survey, 1990-91 covered in the 46th round of NSSO. The results of these surveys have been specially tabulated to provide (i) estimated value of expenses and receipts of DE by trade activity group, (ii) estimated value of sales and gross profit by commodity groups and by enterprises type and (iii) expenses on items in enterprises by industry group and enterprises type. The transport margins have been estimated separately for railways, road, water and air transport. The railway transport margins have been estimated from the detailed commodity-wise "Goods Revenue Statistics of Government Railways, 1998-99, Railway Board, Ministry of Railways". Commodity-wise road transport margins are estimated on the basis of the results of the special study on" Commodity-wise tonnes carried by railways and highways and respective percentage share in total, within and between modes and average lead, 1986-87" conducted by Rail India Technical & Economic Services Ltd. (RITES) for Planning Commission. The commodity-wise water and air transport margins are obtained using the norms obtained from the (i) Economic Statistics on Indian Coastal Shipping, 1993-94, (ii) Statistics of Inland Water Transport, 1993-94 and (iii) Indian Airlines Cargo. The source materials used for estimating the commodity-wise net indirect taxes have already been described in Chapter 2. The commodity-wise trade and transport margins are adjusted so as to tally at the aggregate level with trade and goods transport earnings estimated independently for the estimation of domestic income.

A1.10 An exercise to determine the price differentials of commodities appearing both as inputs and outputs in the ASI, DME, NDME data was also undertaken. The exercise provided for some commodities an independent set of overall margins (price differentials) covering all the factors, i.e., trade and transport margins and net indirect taxes. The results of this exercise were utilised to adjust the estimated commodity-wise distributive margins in the course of manual balancing.

Input-Output Transactions Table at Producers' Price

A1.11 After the manual balancing, trade, railway transport and other transport margins which are in vector form are converted into matrices making use of the proportions of the input flow matrix at purchasers' price. While preparing these matrices, the CIS and imports columns are not considered. The trade margin, railway transport margin and other transport margin matrices are consolidated to obtain the combined trade-transport margin matrix. This combined margin matrix is subtracted from the input flow matrix at purchasers' price to arrive at input flow matrix at producers' price. Since the input flows at purchasers' price include the margins in the input values, the corresponding rows have no entries except for traveling cost in case of transport. For the input flow matrix at producers' price, values of the margins (trade, railway and other transport) are added to the entries against these services.

A1.12 The row and column gaps remaining after manual balancing are absorbed in the inter-industry flow (115x115 matrix) using the RAS technique. Before applying the RAS technique, it is checked that the aggregated row control totals tally with the aggregated column control totals. These row control totals are the commodity-wise intermediate uses and the column control totals are the industry-wise total inputs. Thus, the balanced input flow matrix at producers' price is obtained.

Input-Output Transactions Table at Factor Cost

A1.13 IOTT at factor cost is finally obtained by subtracting the matrix of net indirect taxes from the balanced input flow matrix at producers' price and introducing the net indirect taxes as a new row. These indirect taxes are taxes on inputs consumed by the respective industries.

A1.14 The matrix of net indirect taxes is obtained by adding the individual matrices of import duty, excise duty, export duty, sales tax and other taxes and subtracting the matrix of subsidies. To obtain these tax matrices, an import flow matrix has been prepared making use of the information on imported materials used in manufacturing industries collected in the ASI. Import duty matrix is based on the import flow matrix. The import duties are allocated to the different cells in a row of the import flow matrix in proportion to their magnitudes in the total import of the corresponding commodity sector. In this allocation, change in stocks, exports and of course the imports have been excluded. Export duties on exports are allocated to export column under final use. Excise duty has been allocated to different consuming industry sectors and final uses (excluding imports and change in stocks) on the basis of domestic flow matrix, obtained by subtracting the import flow matrix from the balanced input flow matrix at producers' price. Sales tax matrix is obtained on the basis of the input flow (domestic and imported combined) matrix at producers' price. Other indirect taxes have been appropriately allocated taking into account the nature of taxes. Subsidies are allocated to different consuming industry sectors and final use in proportion to the flow of relevant domestic indirect taxes (excluding import duties). Where subsidies are related to specific purpose, they are allocated to the respective cells of the domestic flow matrix.

Generation of Associated Matrices

A1.15 The Absorption (*commodity x industry*) and Make (*industry x commodity*) matrices provide the basic information for an input-output system. From these basic matrices, the *commodity x commodity* or *industry x industry* tables under different technology assumptions can be easily constructed. The usual associated matrices are: (i) *input-output coefficient* matrix derived from the *commodity x industry* matrix by dividing the column entries by the respective industry outputs (ii) *product mix* matrix derived from the make matrix by dividing the row entries by the respective industry outputs (presented as a transpose of this matrix, named 'C' (iii) *market share* matrix also derived from the make matrix by dividing column entries by the respective commodity outputs, named 'D' (iv) *commodity x commodity* matrices under *industry technology* and *commodity technology* assumption (v) *industry x industry* matrices under *industry technology* and *commodity technology* assumptions and (vi) *Leontief inverse* matrix which is used in the popular open static models for the projection purposes.

A1.16 In this Publication, only commodity x commodity matrix under the industry technology assumption has been included (Table 6). The input-output coefficient, product mix and market share matrices are given as Matrix 3, 4 and 5 respectively. The Leontief Inverse for commodities is given as Matrix 7. In the presented Leontief Inverse, the coefficient matrix used related to *commodity x commodity* matrix generated under industry technology assumption. All the above matrices are presented at 115-sector classification.

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