

Industry Specific Multipliers to Identify Key Industries of Indian Economy: An Application Of input Output Analysis

Priyanka Tariyal¹

¹ Kurukshetra University

Received: 7 December 2015 Accepted: 4 January 2016 Published: 15 January 2016

Abstract

Using the interindustry input output tables of Indian economy obtained from World Input Output Database (Timmer et al., 2015) for the period 1995-2009, the study attempts to estimate the industry specific multipliers of Indian economy and further identifies the key industries with greatest output and employment potential. The output and employment multipliers are analyzed after constituting a closed and open Leontief demand driven input output model. The open Leontief model gives type I multipliers of output and employment while closed Leontief model gives type II multipliers. These models are open and closed with respect to household sector. Thus, the study enables the comparative analysis of multiplier effects in terms of employment and output generation for each industry within the Indian economy. The results reveal that Agriculture, hunting, forestry and fishing output and employment, Food beverages and tobacco, Textiles and textile products, Retail trade, except of motor vehicles and motorcycles; repair of household goods, Private households with employed persons are important industries of Indian economy.

Index terms— key industries, input output analysis, interindustry tables, leontief model, output multiplier, employment multiplier, type i multiplier, type ii mult

1 Introduction

In the midst of gloom in the global economy with consequential impact on India, highly output and job oriented industries can give positive results in terms of increasing economic growth as they could be considered as the ones creating demand and employment for other segments of the economy and thus acting as leaders of economic growth (ASSOCHAM, 2016). The Indian economy is continuously evolving towards higher value added activities and employment generation has become a key area of concern. Thus, it is crucial to examine the employment and output linkages between the sectors. Using the input output tables, this paper generates a detailed breakdown of how a change in final demand in an industry creates output and employment within that industry and further effects production and employment in overall economy. The importance of a sector with respect to economic growth and development can be measured by determining the output and employment effects of that sector on the whole economy. But, the growth in gross domestic product does not always have the expected positive impact on employment (Ernst and Sarabia, 2008). Also, if the highly linkage sectors in terms of output are dependent on capital intensive intermediate products then, the policy thrust on boosting such sectors will not accomplish employment generating goals (Bhattacharya and Rajeev, 2014). Thus it is crucial to understand which sectors would have increased employment. Thus, the present study investigates the industry specific multipliers by using a symmetric input output tables of Indian economy with greatest output and employment potential. Using an interindustry approach in open as well as closed input output framework, enables us to measure not only the direct and indirect flows of output and job creation but also output and employment changes attributable to induced effects of interindustry connections.

Input output framework can be used to measure the significance of a sector in terms of its contribution to output and employment through economic impact or multiplier analysis that is the impact of a change in the sectoral final demand on production and employment and backward and forward linkage indices (Valadkhani, 2003). The multiplier analysis rests upon the difference between the initial effect of an exogenous change and total effects of that change. The open input output model with respect to household gives direct and indirect effects while closed input output model with respect to households gives direct, indirect and induced effects (Miller and Blaire, 2009). The extensive literature on input output analysis where most of the studies focusing on measuring linkages and multipliers to identify strategically important sectors of the economy, witnesses methodological improvements such as the direct linkages measured from the column sums of the technical coefficient matrix (Chenery and Watnabe, 1958) replaced with total linkages measured from column sums of the Leontief inverse matrix (Rasmussen, 1956). Further, replacement of the row sums of the Leontief-inverse (Rasmussen, 1956) to measure forward linkages with the row sums of the Ghosh-inverse (Beyers, 1976; Jones, 1976).

2 a) Objectives of the Study

The objective of the study is to identify the sectors with largest potential for employment and output generation in Indian economy. The specific objectives of the study are: Following the introduction, section 2 deals data sources followed by methodology in section 3. Section 4 discusses the results. The final section concludes the study.

II.

3 Data Sources

The goal is to build an Input output model based on detailed accounting of interindustry activity in an Indian economy in order to obtain output and employment multiplier effects and backward and forward linkage indices, mainly within the production system. The main data source for this study is World Input Output Database (Timmer et al., 2015) which contains annual time series of input output dataset for 27 European Union (EU) countries and 13 other major countries in the world including India for the period from 1995 to 2009. This database enables us to trace development overtime for an economy through benchmarking to time series of output, value added, trade and consumption from national accounts statistics. The comparison of total output and employment multipliers effects and linkages analysis are facilitated with the help of two wide datasets obtained from WIOD. National Input Output tables (NIOT) in current dollars at purchaser's prices for 35 industries for Indian economy. The classification of industries is based on ISIC Rev 3.1. Socioeconomic accounts (SEA) provides time series data on Indian economy for number of persons engaged (employees plus self-employed) and labour compensation at sectoral level. This data is denominated in national currency at current prices and thus need to be put on a common basis for the NIOT which is done by using official exchange rates from IMF.

III.

4 Methodology

The methodology undertaken in this study to accomplish the above mentioned objectives is as follows:

In the beginning, Leontief (1936) An input output framework with n industries for an economy can be expressed as a system of linear equations by the following expressions: $X_i = \sum_{j=1}^n X_{ij} + Y_i, i=1,2,3,\dots,n$ (1)

$$a_{Lij} = X_{ij} / X_j, j = 1, n \quad (2)$$

Thus, above mentioned equation (1) can now be formulated with equation (2) as so called Leontief production function Equation (3): $X_i = \sum_{j=1}^n a_{Lij} X_j + Y_i, i=1, n$ (3) $X = A L X + F$ (4) (E)

Global Journal of Human Social Science

5 -Year 2016

Industry Specific Multipliers to Identify Key Industries of Indian Economy: An Application Of input Output Analysis

6 Volume XVI Issue IV Version I

where, X_{ij} is the output of sector i consumed by sector j , to all types of consumption and for final consumption denoted as Y_i . Further the proportion of each input to the output of sector j is denoted by a_{Lij} 's are called input or technical coefficients and give the direct input requirement of the i th sector for producing one unit of output of j th sector excluding the indirect effects involved in production process.

where, X is endogenous and the column final demand, Y is exogenous. In matrix notation equation (3) can be written as where, $A L$ is the $n \times n$ coefficient matrix consisting of standardized elements of a_{Lij} , obtained by dividing each element of the column of the flow matrix by the total input of the buying sector. This equation is a fundamental equation of the open Leontief model.

where, $(I - A L)^{-1}$ known as Leontief Inverse or matrix multiplier, gives both direct and indirect requirements of inputs. While direct inputs are those purchased by the sector under consideration, indirect inputs are those purchased by all other sectors in which production has to adjust in order to supply inputs to specific sector.

7 b) Closed Leontief Model

The household sector receives wages for the work done in production process and spends some or all of this wage income on goods and services. Thus, it is necessary to include household consumption as a new column in the coefficient matrix and including the analogous income as an additional row. Household income is represented, as a proxy by total labour compensation defined as payment for labour services of wage employees and self-employed. The household income coefficient is nothing but the division of labour compensation by total output at basic prices, whereas, household consumption coefficient is obtained by dividing the private household consumption expenditure by total household consumption expenditure. The closed Leontief model for household augmented coefficient matrix would generate a Leontief inverse matrix of dimension $(n+1) \times (n+1)$. $X = (I_{n+1} - \tilde{A} L)^{-1} * Y(6)$

Where, $(I_{n+1} - \tilde{A} L)^{-1}$ is Leontief inverse matrix for closed Leontief model. This closed Leontief model describes the total amount of output induced by the requirement from all industries to produce output to satisfy the demand from an extra unit of output from an industry, and by the spending of the extra wages and salaries earned (from producing the additional output) by households (McLennan, 2006).

8 c) Multiplier analysis

Using the demand side input output model, output and employment multipliers are generated following the methodology given with Miller and Blaire (2009).

9 ? Output Multipliers

The output multipliers for an industry j , is defined as the impact on the production of all industries of the economy due to increase in the final demand of industry j by one unit. This impact can be analyzed in terms of three effects. The direct effects are the production changes required to produce the product. This generates the further production changes in industries supplying the increased demand for intermediate goods and services known as indirect effects. Finally, the induced effects occur as households

The direct and indirect effects of can be derived via summation of column elements of Leontief inverse matrix obtained from equation (??) of open model. $\text{Direct} + \text{indirect} = \sum_{i=1}^n (I - A L)^{-1} = \text{Type I Output Multipliers (7)}$

Finally the direct, indirect and induced effects of output multiplier can be derived from the column sum of the Leontief inverse matrix from equation (6) closed model $\text{Direct} + \text{Indirect} + \text{Induced effects} = \sum_{i=1}^{n+1} (I_{n+1} - \tilde{A} L)^{-1} = \text{Type II Output Multipliers (8)}$

? Employment Multiplier

The employment multiplier of industry j , is the employment generated in all the industries due to increase in the final demand of industry j by one unit. The study takes into account, the direct and indirect employment change in industry j indicated by input output model plus the induced changes in employment resulting from household sector. The first step to calculate employment multiplier is to obtain the fixed labour coefficients for each industry. $e_{ij} = L_j / X_j$ if $i = j$ (9)

where, L_j is number of persons engaged (wage employees plus self-employed) and X_j is gross output of industry j . (14) The direct plus indirect multiplier effects matrix can be obtained by multiplying labour coefficient, e_{ij} for each industry and Leontief inverse matrix from equation (??) of open Leontief model. $E(j) = e_{ij} * (I - A L)^{-1} = L_{ij}$ (10) Thus, the column sum of the matrix gives the direct and indirect employment changes in industry j due to change in its final demand.

10 Direct plus indirect effects

$= \sum_{i=1}^n L_{ij} = \text{Type 1 Employment Multipliers (11)}$

Finally, the direct, indirect as well as induced multiplier effects matrix of industry j can be obtained by multiplying labour coefficient, e_{ij} with Leontief inverse of closed Leontief model from equation (6) $E(j) = e_{ij} * (I_{n+1} - \tilde{A} L)^{-1} = L * ij$ (12)

Similarly, the columnsum of the matrix give total employment multiplier effects of industry j . $\text{Direct} + \text{Indirect} + \text{Induced effects} = \sum_{i=1}^n L_{ij} * = \text{Type II Employment Multipliers (13)}$ spend their additional income on final goods and services. $X = (I - A L)^{-1} * Y$ (5)

IV.

11 Results and Discussion

12 a) Results of output multipliers from open and closed model

The type I and type II output multipliers for all 35 industries for all the years are given in appendix table A and the table below shows top 10 industries with highest type I and type II multipliers. From both the tables, results reveal that type II output multipliers for all the industries are greater than type I output multipliers as the former contains the induced effects generated by household sector through payments for labour services and associated spending on goods produced by various sectors.

13 B) RESULTS OF EMPLOYMENT MULTIPLIERS FROM OPEN AND CLOSED MODEL

Food, Beverages and Tobacco, Textiles and Textile Products, Leather, Leather and Footwear, Rubber and Plastics, Machinery, Nec, have high type I output multipliers for all the years and the multiplier value of each industry contain only the direct and indirect requirement from all the sectors needed to supply to satisfy unit increase in final demand of an industry. Thus, type I output multiplier value of 2.24 for Food, Beverages and Tobacco, implies that every unit increase of final demand for this sector, through direct and indirect effects, the additional demand created for output in other sectors is 2.

13 b) Results of Employment multipliers from open and closed model

The type I and type II employment multipliers for all 35 industries for all the years are given in appendix table B and the table below shows industries with highest type I and type II employment multipliers. From both the tables, results reveal that type II employment multipliers are greater than type I multipliers for all the industries.

The type I employment multiplier for Agriculture, Hunting, Forestry and Fishing is 2.34, implies due to unit

S.No	Sectors	1995		1996		1997		1998		1999		2000		2001		2002	
		Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
3	Food, Beverages and Tobacco	√ (2.24)	√ (4.43)	√ (2.21)	√ (4.38)	√ (2.21)	√ (4.34)	√ (2.21)	√ (4.23)	√ (2.17)	√ (4.03)	√ (2.21)	√ (4.16)	√ (2.22)	√ (4.28)	√ (2.27)	√ (4.33)
4	Textiles and Textile Products	√ (2.17)	√ (4.34)	√ (2.20)	√ (4.27)	√ (2.18)	√ (4.35)	√ (2.22)	√ (4.26)	√ (2.20)	√ (4.11)	√ (2.19)	√ (4.23)	√ (2.19)	√ (4.31)	√ (2.16)	√ (4.20)
5	Leather, Leather and Footwear	√ (2.31)	√ (4.42)	√ (2.30)	√ (4.39)	√ (2.34)	√ (4.48)	√ (2.28)	√ (4.41)	√ (2.23)	√ (4.24)	√ (2.18)	√ (4.31)	√ (2.15)	√ (4.37)	√ (2.09)	√ (4.24)
6	Wood and Products of Wood and Cork		√ (4.13)				√ (4.17)		√ (4.10)		√ (3.85)		√ (3.98)		√ (4.02)		√ (3.99)
7	Pulp, Paper, Paper, Printing and Publishing	√ (2.17)		√ (2.15)		√ (2.31)		√ (2.17)		√ (2.17)		√ (2.16)		√ (2.17)		√ (2.17)	
9	Chemicals and Chemical Products	√ (2.18)				√ (2.27)		√ (2.18)		√ (2.11)		√ (2.13)		√ (2.17)		√ (2.14)	
10	Rubber and Plastics	√ (2.19)		√ (2.15)		√ (2.14)		√ (2.18)		√ (2.18)		√ (2.11)		√ (2.17)		√ (2.14)	
12	Basic Metals and Fabricated Metal	√ (2.16)		√ (2.29)		√ (2.14)		√ (2.23)		√ (2.12)		√ (2.11)				√ (2.09)	
13	Machinery, Nec	√ (2.32)		√ (2.28)		√ (2.31)		√ (2.25)		√ (2.15)		√ (2.15)		√ (2.13)		√ (2.15)	
14	Electrical and Optical Equipment											√ (2.11)		√ (2.11)		√ (2.05)	
15	Transport Equipment	√ (2.49)		√ (2.45)		√ (2.49)		√ (2.43)		√ (2.37)		√ (2.37)		√ (2.36)		√ (2.35)	
16	Manufacturing, Nec; Recycling	√ (2.52)	√ (4.18)	√ (2.49)	√ (4.13)	√ (2.49)		√ (2.40)		√ (2.16)				√ (2.10)			
18	Construction		√ (4.25)		√ (4.27)		√ (4.35)		√ (4.29)		√ (3.99)		√ (3.97)		√ (4.05)		√ (3.98)
21	Retail Trade, Except of Motor Vehicles and Motorcycles, Repair of Household Goods				√ (4.26)		√ (4.24)		√ (4.32)		√ (4.14)		√ (4.20)		√ (4.30)		√ (4.29)
22	Hotels and Restaurants																
20	Renting of M&Eq and Other Business Activities		√ (4.46)		√ (4.60)		√ (4.59)		√ (4.58)		√ (3.96)		√ (3.99)		√ (4.05)		√ (4.00)
31	Public Admin and Defence; Compulsory Social Security	√ (5.19)		√ (5.25)		√ (5.33)		√ (5.39)		√ (5.04)		√ (4.96)		√ (5.06)		√ (5.06)	
32	Education																
33	Health and Social Work		√ (4.14)		√ (4.22)		√ (4.29)		√ (4.28)		√ (4.09)		√ (4.03)		√ (4.00)		
34	Other Community, Social and Personal Services		√ (4.59)		√ (4.66)		√ (4.80)		√ (4.94)		√ (4.75)		√ (4.61)		√ (4.53)		√ (4.38)

Figure 1:

1 2 3 4 5 6 7

¹© 2016 Global Journals Inc. (US) s 8

²© 2016 Global Journals Inc. (US) s

³© 2016 Global Journals Inc. (US)

⁴© 2016 Global Journals Inc. (US) s 12

⁵© 2016 Global Journals Inc. (US) s 14

⁶© 2016 Global Journals Inc. (US) s 16

⁷© 2016 Global Journals Inc. (US) s 18

S.no	Sectors	2003		2004		2005		2006		2007		2008		2009	
		Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
1	Agriculture, Hunting, Forestry and Fishing	√(2.31)	√(4.23)	√(2.28)	√(3.91)	√(2.24)	√(3.72)	√(2.22)	√(3.64)	√(2.23)	√(3.55)	√(2.25)	√(3.70)	√(2.24)	√(3.81)
2	Mining and Quarrying	√(2.19)	√(4.09)	√(2.16)	√(3.76)	√(2.14)	√(3.68)	√(2.18)	√(3.62)	√(2.17)	√(3.60)	√(2.15)	√(3.70)	√(2.17)	√(3.84)
3	Food, Beverages and Tobacco	√(2.14)	√(4.06)	√(2.12)	√(3.81)	√(2.15)	√(3.78)	√(2.14)	√(3.74)	√(2.19)	√(3.70)	√(2.16)	√(3.80)	√(2.19)	√(3.94)
4	Textiles and Textile Products		√(3.78)				√(3.42)		√(3.43)		√(3.34)		√(3.54)		√(3.81)
5	Leather, Leather and Footwear	√(2.23)		√(2.20)	√(3.43)	√(2.17)	√(3.37)	√(2.14)	√(3.32)	√(2.17)	√(3.27)	√(2.16)	√(3.38)	√(2.20)	√(3.65)
6	Wood and Products of Wood and Cork														
7	Pulp, Paper, Paper, Printing and Publishing	√(2.19)		√(2.15)		√(2.13)		√(2.08)		√(2.08)		√(2.06)		√(2.06)	
8	Coke, Refined Petroleum and Nuclear Fuel	√(2.40)	√(3.95)	√(2.36)	√(3.62)	√(2.32)	√(3.49)	√(2.26)	√(3.44)	√(2.26)	√(3.31)	√(2.24)	√(3.37)	√(2.34)	√(3.66)
9	Chemicals and Chemical Products														
10	Rubber and Plastics	√(2.14)		√(2.10)		√(2.14)		√(2.13)		√(2.14)		√(2.20)		√(2.19)	
11	Other Non-Metallic Mineral	√(2.18)		√(2.12)		√(2.10)		√(2.05)		√(2.07)		√(2.12)		√(2.11)	
12	Basic Metals and Fabricated Metal	√(2.09)		√(2.06)		√(2.07)				√(2.03)		√(2.10)		√(2.09)	
13	Machinery, Nec	√(2.38)		√(2.30)		√(2.14)		√(2.10)		√(2.10)		√(2.13)		√(2.12)	
	Transport Equipment														
15								√(1.99)							
16	Manufacturing, Nec; Recycling		√(3.99)		√(3.61)		√(3.54)		√(3.42)		√(3.31)		√(3.47)		√(3.66)
	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel		√(4.23)		√(3.12)		√(3.69)		√(3.61)		√(3.53)		√(3.74)		√(3.83)
20	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles				√(2.52)										√(3.43)
28	Financial Intermediation		√(3.76)												
29	Real Estate Activities		√(4.82)		√(4.32)		√(4.18)		√(4.17)		√(3.97)		√(3.76)		√(3.49)
32	Education		√(4.11)		√(3.53)		√(3.39)		√(3.30)		√(3.33)		√(3.14)		

Figure 2:

S.No	Sectors	1995		1996		1997		1998		1999		2000		2001		2002	
		Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
1	Agriculture, Hunting, Forestry and Fishing	√(2.34)	√(4.23)	√(2.23)	√(4.23)	√(2.14)	√(3.74)	√(2.13)	√(3.57)	√(2.03)	√(3.29)	√(2.17)	√(3.45)	√(2.16)		√(2.13)	√(3.48)
3	Food, Beverages and Tobacco	√(1.45)	√(2.97)	√(1.42)	√(2.97)	√(1.31)	√(2.64)	√(1.30)	√(2.57)	√(1.25)	√(2.37)	√(1.30)	√(2.48)	√(1.32)	√(4.28)	√(1.22)	√(2.36)
4	Textiles and Textile Products										√(1.91)		√(2.00)		√(4.31)		√(1.93)
5	Leather, Leather and Footwear												√(1.90)		√(4.37)		√(1.89)
6	Wood and Products of Wood and Cork	√(1.14)	√(2.56)	√(1.16)	√(2.56)	√(1.06)	√(2.36)	√(1.01)	√(2.28)	√(1.15)	√(2.34)	√(1.25)	√(2.52)	√(1.44)	√(4.02)	√(1.65)	√(2.84)
18	Construction														√(4.05)		
19	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel								√(1.68)								
21	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods		√(2.68)		√(2.68)		√(2.56)		√(2.69)		√(2.49)		√(2.52)		√(4.30)		√(2.36)
22	Hotels and Restaurants	√(1.23)	√(2.57)	√(1.17)	√(2.57)	√(1.10)	√(2.25)	√(1.10)	√(2.20)	√(1.06)	√(2.04)	√(1.10)	√(2.13)	√(1.11)		√(1.04)	√(2.08)
30	Renting of M&Eq and Other Business Activities		√(2.45)		√(2.45)		√(2.24)		√(2.24)						√(4.05)		
31	Public Admin and Defence; Compulsory Social Security		√(3.48)		√(3.48)		√(3.13)		√(3.13)		√(2.77)		√(2.71)		√(5.06)		√(2.54)
32	Education		√(2.40)		√(2.40)		√(2.13)				√(1.90)						
33	Health and Social Work														√(4.00)		
34	Other Community, Social and Personal Services	√(1.02)	√(3.00)		√(3.00)		√(2.88)		√(3.04)		√(2.92)		√(2.85)		√(4.53)		√(2.58)
35	Private Households with Employed Persons	√(2.90)	√(4.41)	√(2.64)	√(4.41)	√(2.32)	√(3.72)	√(2.12)	√(3.55)	√(1.86)	√(3.13)	√(2.34)	√(3.60)	√(2.84)		√(3.22)	√(4.37)

Figure 3: Table 1 :Table 1 :

13 B) RESULTS OF EMPLOYMENT MULTIPLIERS FROM OPEN AND CLOSED MODEL

S.No	Sectors	2003		2004		2005		2006		2007		2008		2009	
		Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
1	Agriculture, Hunting, Forestry and Fishing	√ (1.93)	√ (3.06)	√ (1.82)	√ (2.77)	√ (1.61)	√ (2.36)	√ (2.14)	√ (2.18)	√ (1.13)	√ (1.60)	√ (1.06)	√ (1.53)	√ (1.03)	√ (1.53)
3	Food, Beverages and Tobacco	√ (1.13)	√ (2.12)	√ (1.02)	√ (1.79)		√ (1.52)	√ (1.34)	√ (1.89)						
4	Textiles and Textile Products		√ (1.76)		√ (1.45)		√ (1.26)	√ (1.11)							
5	Leather, Leather and Footwear		√ (1.75)		√ (1.45)		√ (1.27)	√ (1.16)	√ (1.77)						
6	Wood and Products of Wood and Cork	√ (1.53)	√ (2.53)	√ (1.49)	√ (2.25)	√ (1.33)	√ (2.03)	√ (1.70)	√ (2.36)		√ (1.18)		√ (1.21)		√ (1.6)
18	Construction														
19	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel								√ (1.70)						
	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods		√ (2.16)		√ (1.78)		√ (1.51)	√ (1.32)	√ (2.25)		√ (1.01)				√ (1.00)
22	Hotels and Restaurants		√ (1.91)		√ (1.60)		√ (1.34)	√ (1.19)	√ (1.73)						
30	Renting of M&Eq and Other Business Activities														
31	Public Admin and Defence; Compulsory Social Security		√ (2.22)		√ (1.78)		√ (1.53)	√ (1.39)	√ (2.61)		√ (1.01)	√ (1.10)			
32	Education														
33	Health and Social Work														
34	Other Community, Social and Personal Services		√ (2.24)				√ (1.49)	√ (1.31)	√ (2.11)		√ (1.04)				
35	Private Households with Employed Persons	√ (3.33)	√ (4.32)	√ (3.29)		√ (2.98)	√ (3.59)	√ (3.31)	√ (3.85)	√ (2.46)	√ (2.89)	√ (2.35)	√ (2.75)	√ (2.24)	√ (2.62)

Figure 4:

S.No	Sectors	1995		1996		1997		1998		1999		2000		2001		2002	
		Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
1	Agriculture, Hunting, Forestry and Fishing	1.37	4.07	1.33	3.97	1.35	3.91	1.33	3.63	1.34	3.41	1.35	3.47	1.35	3.63	1.37	3.80
2	Mining and Quarrying	1.45	3.38	1.44	3.26	1.40	3.29	1.35	3.24	1.32	3.19	1.35	3.33	1.38	3.15	1.33	2.87
3	Food, Beverages and Tobacco	2.24	4.43	2.21	4.38	2.21	4.34	2.21	4.23	2.17	4.03	2.21	4.16	2.22	4.28	2.27	4.33
4	Textiles and Textile Products	2.27	4.34	2.20	4.27	2.28	4.35	2.22	4.26	2.20	4.11	2.19	4.23	2.19	4.31	2.16	4.20
5	Leather, Leather and Footwear	2.31	4.43	2.30	4.39	2.34	4.48	2.28	4.41	2.23	4.24	2.18	4.31	2.15	4.37	2.09	4.24
6	Wood and Products of Wood and Cork	2.08	4.13	2.06	4.13	2.09	4.17	2.08	4.10	1.89	3.85	1.88	3.98	1.85	4.02	1.85	3.99
7	Pulp, Paper, Paper, Printing and Publishing	2.27	3.80	2.25	3.78	2.31	3.91	2.27	3.87	2.17	3.68	2.16	3.75	2.17	3.82	2.17	3.77
8	Coke, Refined Petroleum and Nuclear Fuel	1.94	3.14	1.88	3.03	1.82	2.90	1.82	2.92	1.47	2.08	1.37	1.86	1.57	2.27	1.54	2.15
9	Chemicals and Chemical Products	2.18	3.62	2.17	3.60	2.27	3.76	2.18	3.62	2.11	3.38	2.13	3.42	2.17	3.52	2.14	3.39
10	Rubber and Plastics	2.39	4.04	2.35	3.99	2.34	3.98	2.38	4.03	2.28	3.77	2.31	3.89	2.32	3.98	2.33	3.93
11	Other Non-Metallic Mineral	1.94	3.57	1.88	3.47	1.94	3.59	1.92	3.59	1.83	3.33	1.84	3.42	1.93	3.58	1.91	3.44
12	Basic Metals and Fabricated Metal	2.36	3.93	2.29	3.86	2.34	3.92	2.23	3.79	2.12	3.55	2.11	3.59	2.10	3.56	2.09	3.44
13	Machinery, Nec	2.32	4.03	2.28	3.96	2.31	4.03	2.25	3.91	2.15	3.73	2.15	3.82	2.13	3.82	2.15	3.73
14	Electrical and Optical Equipment	1.91	3.71	1.88	3.63	1.92	3.65	1.80	3.57	2.10	3.55	2.11	3.65	2.11	3.68	2.05	3.55
15	Transport Equipment	2.49	3.95	2.45	3.91	2.49	3.97	2.43	3.91	2.37	3.70	2.37	3.75	2.36	3.74	2.35	3.64
16	Manufacturing, Nec; Recycling	2.52	4.18	2.49	4.13	2.49	4.15	2.40	4.00	2.16	3.64	2.10	3.65	2.10	3.66	1.97	3.38
17	Electricity, Gas and Water Supply	2.08	3.57	2.06	3.67	2.06	3.67	2.06	3.61	2.01	3.62	2.00	3.61	2.03	3.66	2.01	3.50
18	Construction	1.96	4.25	1.94	4.27	1.96	4.35	1.93	4.29	1.87	3.99	1.87	3.97	1.90	4.05	1.89	3.98
19	Motor Vehicles and Motorcycles; Retail Sale of Fuel	1.33	3.06	1.31	3.00	1.29	2.89	1.26	2.82	1.25	2.69	1.25	2.88	1.26	3.10	1.00	2.70
20	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	1.33	2.68	1.31	2.61	1.29	2.53	1.26	2.47	1.25	2.32	1.25	2.43	1.26	2.55	1.25	2.62
21	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods	1.33	4.11	1.31	4.26	1.29	4.24	1.26	4.32	1.25	4.14	1.25	4.20	1.26	4.30	1.25	4.29
22	Hotels and Restaurants	1.97	3.89	1.89	3.80	1.91	3.77	1.90	3.65	1.89	3.50	1.93	3.64	1.93	3.77	1.95	3.83
23	Inland Transport	1.90	3.87	1.90	3.92	1.92	3.96	1.93	4.00	1.85	3.57	1.86	3.51	1.92	3.61	1.90	3.47
24	Water Transport	1.61	3.81	1.60	3.88	1.61	3.92	1.60	3.97	1.60	3.58	1.63	3.59	1.67	3.66	1.67	3.53
25	Air Transport	1.84	3.81	1.82	3.86	1.83	3.90	1.83	3.94	1.78	3.55	1.80	3.53	1.85	3.62	1.81	3.46
26	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	1.70	3.81	1.68	3.87	1.69	3.91	1.69	3.96	1.67	3.62	1.71	3.67	1.76	3.79	1.78	3.73
27	Post and Telecommunications	1.24	2.79	1.23	2.77	1.21	2.95	1.22	3.00	1.27	2.95	1.33	3.16	1.31	3.13	1.32	3.50
28	Financial Intermediation	1.28	3.28	1.29	3.32	1.32	3.32	1.33	3.34	1.33	3.07	1.34	3.33	1.34	3.20	1.35	3.12
29	Real Estate Activities	1.14	2.46	1.14	2.52	1.15	2.54	1.14	2.54	1.12	2.38	1.13	2.30	1.13	2.31	1.14	2.31
30	Renting of M&Eq and Other Business Activities	1.57	4.46	1.56	4.60	1.59	4.59	1.57	4.58	1.50	3.96	1.51	3.99	1.53	4.05	1.52	4.00
31	Public Admin and Defence; Compulsory Social Security	1.00	5.19	1.00	5.25	1.00	5.33	1.00	5.39	1.00	5.04	1.00	4.96	1.00	5.06	1.00	5.06
32	Education	1.19	3.71	1.19	3.76	1.20	3.77	1.20	3.81	1.18	3.61	1.18	3.58	1.18	3.59	1.17	3.56
33	Health and Social Work	1.92	4.14	1.96	4.22	2.05	4.29	2.04	4.28	1.96	4.09	1.89	4.03	1.82	4.00	1.70	3.86
34	Other Community, Social and Personal Services	1.75	4.59	1.70	4.66	1.68	4.80	1.61	4.94	1.49	4.75	1.45	4.61	1.43	4.53	1.36	4.38
35	Private Households with Employed Persons	1.75	3.92	1.70	3.91	1.68	3.92	1.61	3.89	1.48	3.58	1.45	3.53	1.43	3.55	1.36	3.44

Figure 5: Table 2 :Table 2 :

13 B) RESULTS OF EMPLOYMENT MULTIPLIERS FROM OPEN AND CLOSED MODEL

S.No	Sectors	2003		2004		2005		2006		2007		2008		2009	
		Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
1	Agriculture, Hunting, Forestry and Fishing	1.38	3.58	1.37	3.37	1.36	3.14	1.35	3.06	1.33	2.95	1.32	3.09	1.33	3.21
2	Mining and Quarrying	1.40	2.92	1.35	2.56	1.37	2.42	1.35	2.32	1.37	2.23	1.37	2.35	1.36	2.46
3	Food, Beverages and Tobacco	2.31	4.23	2.28	3.91	2.24	3.72	2.22	3.64	2.23	3.55	2.25	3.70	2.24	3.81
4	Textiles and Textile Products	2.19	4.09	2.16	3.76	2.14	3.68	2.18	3.62	2.17	3.60	2.15	3.70	2.17	3.84
5	Leather, Leather and Footwear	2.14	4.16	2.12	3.81	2.15	3.78	2.14	3.74	2.19	3.70	2.16	3.80	2.19	3.94
6	Wood and Products of Wood and Cork	1.84	3.78	1.78	3.38	1.77	3.42	1.74	3.43	1.75	3.34	1.76	3.54	1.80	3.81
7	Pulp, Paper, Paper, Printing and Publishing	2.23	3.74	2.20	3.43	2.17	3.37	2.14	3.32	2.17	3.27	2.16	3.38	2.20	3.65
8	Coke, Refined Petroleum and Nuclear Fuel	1.62	2.28	1.61	2.20	1.67	2.27	1.59	2.24	1.65	2.19	1.62	2.19	1.84	2.78
9	Chemicals and Chemical Products	2.19	3.41	2.15	3.13	2.13	3.03	2.08	2.97	2.08	2.86	2.06	2.90	2.06	3.06
10	Rubber and Plastics	2.40	3.95	2.36	3.62	2.32	3.49	2.26	3.44	2.26	3.31	2.24	3.37	2.34	3.66
11	Other Non-Metallic Mineral	2.02	3.53	1.99	3.18	1.98	3.14	1.93	3.09	1.95	2.98	1.98	3.15	1.99	3.35
12	Basic Metals and Fabricated Metal	2.14	3.39	2.10	3.09	2.14	3.07	2.13	3.01	2.14	2.92	2.20	3.09	2.19	3.20
13	Machinery, Nec	2.18	3.64	2.12	3.26	2.10	3.17	2.05	3.10	2.07	2.99	2.12	3.17	2.11	3.36
14	Electrical and Optical Equipment	2.09	3.47	2.06	3.14	2.07	3.09	1.00	3.01	2.03	2.90	2.10	3.10	2.09	3.18
15	Transport Equipment	2.38	3.58	2.30	3.27	2.14	3.05	2.10	3.00	2.10	2.90	2.13	3.02	2.12	3.09
16	Manufacturing, Nec; Recycling	1.91	3.14	1.66	2.54	1.54	2.30	1.66	2.27	1.68	2.49	1.55	2.31	1.47	2.20
17	Electricity, Gas and Water Supply	2.04	3.48	2.01	3.25	2.01	3.15	1.99	3.14	2.01	3.07	1.97	3.17	2.00	3.31
18	Construction	1.96	3.99	1.93	3.61	1.92	3.54	1.89	3.42	1.91	3.31	1.96	3.47	1.97	3.66
19	Repair of Motor Vehicles and Motorcycles; Retail	1.26	3.32	1.23	3.12	1.21	2.90	1.19	2.89	1.18	2.85	1.16	3.02	1.16	2.83
20	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	1.26	2.66	1.23	2.52	1.21	2.33	1.19	2.31	1.18	2.26	1.16	2.35	1.16	2.42
21	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods	1.26	4.23	1.23	3.87	1.21	3.69	1.19	3.61	1.18	3.53	1.16	3.74	1.16	3.83
22	Hotels and Restaurants	1.97	3.75	1.94	3.50	1.91	3.31	1.89	3.27	1.90	3.20	1.91	3.36	1.87	3.43
23	Inland Transport	1.92	3.39	1.89	3.09	1.88	3.02	1.86	2.94	1.87	2.86	1.87	2.93	1.92	3.16
24	Water Transport	1.70	3.36	1.67	3.04	1.64	2.96	1.61	2.86	1.61	2.75	1.61	2.84	1.64	3.00
25	Air Transport	1.82	3.30	1.72	2.91	1.66	2.77	1.69	2.69	1.70	2.70	1.63	2.67	1.61	2.79
26	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	1.82	3.59	1.79	3.26	1.78	3.18	1.74	3.07	1.75	2.95	1.76	3.07	1.77	3.23
27	Post and Telecommunications	1.34	3.19	1.31	2.96	1.41	2.94	1.36	2.89	1.43	2.86	1.48	3.05	1.43	3.05
28	Financial Intermediation	1.36	3.03	1.34	2.87	1.34	2.85	1.31	2.71	1.32	2.58	1.33	2.68	1.33	2.79
29	Real Estate Activities	1.15	2.26	1.15	2.07	1.15	1.98	1.14	1.91	1.14	1.83	1.14	1.85	1.14	1.90
30	Renting of M&Eq and Other Business Activities	1.53	3.76	1.46	3.21	1.42	2.98	1.35	2.86	1.36	2.62	1.38	2.67	1.39	2.72
31	Public Admin and Defence; Compulsory Social Security	1.00	4.82	1.00	4.32	1.00	4.18	1.00	4.17	1.00	3.97	1.00	3.76	1.00	3.49
32	Education	1.17	3.40	1.16	3.05	1.15	2.91	1.14	2.86	1.14	2.82	1.14	2.91	1.14	2.94
33	Health and Social Work	1.61	3.69	1.38	2.98	1.56	3.18	1.52	3.11	1.52	3.00	1.48	3.05	1.50	3.14
34	Other Community, Social and Personal Services	1.32	4.11	1.24	3.53	1.20	3.39	1.22	3.30	1.17	3.33	1.14	3.41	1.12	3.38
35	Private Households with Employed Persons	1.32	3.24	1.24	2.81	1.20	2.64	1.22	2.59	1.17	2.61	1.14	2.63	1.12	2.58

Figure 6:

-
- [Miller and Lahr ()] ‘A Taxonomy of Extractions’. R E Miller , M L Lahr . *Regional Science Perspectives in Economic Analysis: A Festschrift in Memory of Benjamin H. Stevens*, M L Lahr, R E Miller (ed.) (Amsterdam) 2001. Elsevier Science. p. .
- [Valadkhani ()] ‘An Empirical Analysis of Australian Labour Productivity’. A Valadkhani . *Australian Economic Papers* 2003. 42 (3) p. .
- [Timmer ()] ‘An Illustrator Guide to the World Input Output Database: The Case of Global Automotive Production’. Timmer . *Review of International Economics* 2015. 23 p. .
- [Appendix Table A: Output Multipliers: Type I and Type II] *Appendix Table A: Output Multipliers: Type I and Type II*,
- [Schultz ()] ‘Approaches to identify Key sectors Empirically by means of Input Output Analysis’. S Schultz . *Journal of Development Studies* 1977. 14 (1) p. .
- [Construction industry can help India cope up with global doom and gloom (2016)] *Construction industry can help India cope up with global doom and gloom*, <http://www.assochem.org/newsdetail.php?id=5465on6> sep. 2016.
- [Bhattacharya and Rajeev ()] *Identifying Employment Creating Sectors in India: An analysis of Input Output Linkages*, T Bhattacharya , M Rajeev . 2014. ICDD Working Papers.
- [McLennan ()] ‘Information Paper : Australian National Accounts: Introduction to Input Output Multipliers’. W McLennan . *Australian Bureau of Statistics* 2006. (5246) .
- [Miller and Blair ()] *Input-Output Analysis -Foundations and Extensions*, R Miller , P Blair . 1985. Prentice-Hall.
- [Ghosh ()] ‘Input-Output Approach to an Allocation System’. A Ghosh . *Economica* 1958. 25 (1) p. .
- [Drejer (2002)] ‘Input-Output Based Measures of Interindustry Linkages Revisited-A Survey and Discussion’. I Drejer . *the 14th International Conference on Input-Output Techniques*, (Montréal, Canada) 2002. October 10-15, 2002. (paper presented at)
- [Chenery and Watanabe ()] ‘International Comparison of the Structure of Production’. H B Chenery , T Watanabe . *Econometrica* 1958. 26 p. .
- [Mattas and Shreshtha ()] K Mattas , C M Shreshtha . *A New Approach to Determining Sectoral Priorities in an Economy: Input Output Elasticities*, 2006. 23 p. .
- [Miller and Blair ()] R Miller , P D Blair . *Input-Output Analysis-Foundations and Extensions*, (U.K. 2 nd Edition) 2009. Cambridge University Press.
- [Leontief ()] ‘Quantitative input and output relations in the economic system of the United States’. W Leontief . *Review of Economics and Statistics* 1936. 28 p. .
- [Rasmussen’s ()] P Rasmussen’s . *Studies in Intersectoral relations*, (North Holland, Amsterdam) 1958.
- [Leontief et al. ()] *Studies in the structure of the American economy*, W Leontief , W W Leontief , H B Chenery , P G Clark . 1953. New York: Oxford University Press. p. . (Interregional Theory)
- [Jones ()] ‘The measurement of Hirschman linkages’. L P Jones . *Quarterly Journal of Economics* 1970. 90 (2) p. .
- [Ernst and Sarabia ()] *The Role of Construction as employment provider: A world-wide input output analysis*, *Employment Policy Department, Employment Working Paper*, C Ernst , M Sarabia . 2015.
- [Hirschman ()] *The Strategy of Economic Development*, A O Hirschman . 1958. New Haven: Yale University Press.
- [Laumas ()] ‘The Weighting Problem in Testing the Linkage Hypothesis’. P S Laumas . *The Quarterly Journal of Economics* 1976. 90 (2) p. .
- [Yotopoulos and Nugent ()] P A Yotopoulos , J B Nugent . *Defence of a Test of the Linkage Hypothesis*, 1976. 90 p. .