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Where Are the Jobs? Estimating Skill-based Employment Linkages across Sectors for the Indian Economy: An Input-Output Analysis

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WHERE ARE THE JOBS? ESTIMATING SKILL-BASED EMPLOYMENT LINKAGES ACROSS SECTORS FOR THE INDIAN ECONOMY: AN INPUT-OUTPUT ANALYSIS

NCAER Skilling India Working Paper

Tulika Bhattacharya¹ and Bornali Bhandari*

Abstract The Economic Surveys (2014–15 and 2015–16) have, over the years, stressed on the need to create jobs to meet the needs of a burgeoning population. However, the question as to which sector has the most potential to create jobs and at what level have often been left unanswered. The objective of this paper is to identify the sectors of the Indian economy that are able to generate different types of skilled employment, both directly as well indirectly, by estimating their employment linkage effects with varying levels of skills using the Input–Output technique. The contribution of this paper is that it re-defines skills by combining three types of education, including general, vocational and technical education, and thus defines four types of skilled employment categories—low skilled, low-medium skilled, medium-high skilled, and high skilled employment. The paper incorporates these four types of skilled employment within the Input–Output framework, using the World Input–Output Database (WIOD), and estimates the forward and backward linkage effects related to employment with respect to four different skill types for India. The estimation of these employment linkage effects is critical to identify the key employment-generating sectors in the Indian economy with varying levels of skill.

The study also urges policymakers to boost some select sectors in order to enhance different types of employment, thus proposing a way to take forward the ‘Skill India Mission’.

Keywords: Employment, India, Jobs, Input-output model, Skills

JEL Codes: C67, I29, J21, J23, J24, O1, O53

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1. Introduction

1.1. Motivation and Objectives

The Ministry of Finance (2016) says that “to exploit its demographic dividend, India must create millions of “good”—safe, productive, well-paying—jobs.” Keeping in view this argument, the Government of India introduced the Skilling India initiative two years ago. The primary aim of the ‘Skilling India’ initiative is to impart different skills to the workforce in the country through the introduction of vocational training facilities, and certificate courses, among others. Thus, the Skilling India initiative is largely analysing the issue from the supply side, that is, by addressing the question, “What skilling facilities are available for making the workforce in India skilled? However, it is also important to look at the skilling issue from the demand side, that is, to answer the following questions: Where are the jobs? Which are the sectors that create a demand for a skilled workforce? And at what level of skills has this demand been created? Therefore, apart from imparting different types of skill training, it is also important to identify the sectors wherein there is demand for different types of skilled employment. As a first step towards addressing this issue, the Ministry of Skill Development and Entrepreneurship [(MSDE) (2015)], in its identified 24 priority sectors as part of its national policy, and subsequently projected the demand for skilled manpower in these sectors for the year 2022. However, the projections are completely based on the demand for workers directly within the sectors, whereas in an interdependent economy characterised by production and consumption linkages across sectors, it is important to identify both direct and indirect employment creation. For instance, the National Skills Development Corporation (NSDC) and the IT-ITeS Sector Skills Council NASSCOM (2013) reveal that the Indian Information Technology (IT) industry created three million jobs directly and 9.5 million jobs indirectly in 2012–13. The indirect effect may be larger than the direct one. However, the report does not distinguish between skills levels measured on any rigorous basis (economic definitions) but it does differentiate between the number of years of experience: entry (0–2 years), middle (2–12 years), and leaders (12+ years). Thus, integrating rigorous analysis with policy needs may help all stakeholders in planning better for the future. Clearly, this necessitates the estimation of direct and indirect employment generation by Indian economic sectors with respect to varying skill types.

The present paper, which stems from this motivation, has two parts. First, the paper defines a skilled worker based on different forms of educational attainment, viz., through general education, along with other forms of technical and vocational education. This is a major point of departure from the existing studies that mostly consider only general education while defining a skilled worker. Second, the paper attempts to identify the sectors that can create different types of employment both within itself as well as in other sectors (direct and indirect) with varying levels of skill. For this purpose, the paper uses the Input–Output framework to estimate their employment linkage effects with different levels of skills.¹

¹ It is also important to consider the induced effect of employment creation, but that is beyond the scope of the current paper. However, this paper calculates the number of different types of jobs created across sectors, both directly as well as indirectly.

1.2. Defining ‘Skill’

While the word ‘skill’ has been used quite liberally in the above section, it is important to decide how to actually define it? First, the definition of skill has evolved over time and second a lot depends on data availability. A larger discussion on the process of defining skills has been done in the first part of this paper. In this section, educational attainment has been used as a measure of skill despite the caveat mentioned by Pertold-Gebicka (2010) that this requires a strong assumption that the employment structure of occupations correctly reflects their skill requirements.

The objective here is to assess employment as a function of all types of labour or the demand for all types of employment and not just to identify the skill-intensive nature of a particular sector. More precisely, if the output of sector X rises, by implication, employment in the sector also increases through the direct effect. In addition, employment in the sectors that supply inputs to X would also rise due to higher input demands; and the same process of employment generation, in turn, carries on for the sectors that supply inputs to the first set of input-supplying sectors and so on. Similar effects can be seen for sectors that demand the output of sector X as their input, and therefore, the final picture needs to be evaluated by considering all the linkage effects. Given that, as a first step, in this paper, educational attainment is used as a measure of skill.

In addition, this paper assesses other measures of educational attainment, including technical and vocational. The reasons are two-fold. First, the International Labour Office (2010), in its G-20 Training Strategy, stresses that education is considered to be one of the most important determinants for defining skilled people. The report argues that a proper facilitation of general education, in combination with technical and vocational education, would, in turn, increase the average productivity of the worker and make them skilled, thus enhancing the overall productivity of the economy and also encouraging workers to optimise their working capacities. Thus, the report suggests that the creation of a workforce endowed with different levels of skills, including access to general as well as technical and vocational education, is one of the major ingredients that all G-20 economies should possess to ensure growth and development in the long run.

Second, the recent policy changes and the emphasis being placed on the ‘Skilling India’ initiative and the evolution of the National Skills Quality Framework (NSQF) could imply that skills may no longer be associated with general educational attainment alone (Ministry of Finance, 2016). Further, it is evident from the NSQF levels of different sector skills councils that apart from general education, it is also important to examine other factors such as the knowledge–skill ratio, and the experience levels of the workers, while defining a skilled worker. Although we are aware that use of slightly old data may not completely reflect changes in the past two years since the introduction of the skilling agenda, as a first step we are establishing a baseline. And the number of workers who have acquired vocational training (2.2 per cent with formal training and 8.9 per cent with informal training) and technical training (2.4 per cent) constitute a very small proportion of the workers, which means that not including them in the analysis may not change the results significantly. However, it is important to widen the scope of the analysis.

Based on the current literature on the skills spectrum in India and the corresponding gaps identified in the literature, the present paper attempts to bridge these gaps by considering three types of education, viz., general, technical, and vocational education, and then defines a skilled worker who acquires a combination of these three types of education. Thus, four types of employment have been defined in this paper based on four skill levels –low skilled, low-medium skilled, medium-high skilled, and high skilled. It must be noted here that in order to arrive at a macro picture of any economy, it is difficult to combine the above-mentioned three forms of education, given the vast diversity among different sector skill councils regarding their work structure and also corresponding NSQF levels. For instance, if we consider two sector skill councils, viz., those in the construction and IT sectors, we find vast diversity among two sectors in terms of a worker getting employed at the same level. Table 1 shows that in the construction sector, the minimum qualification for getting a Mason Tilling job at the NSQF level 4.0 is preferably the 5th standard. However, at the same NSQF level 4.0, a Domestic IT Helpdesk Attendant needs at least a Master’s degree in order to get employed in the IT sector. Therefore, in view of the vast diversity of several sectors of the Indian economy as also the vast majority of informal workers, it is really difficult to capture all the sectors in one globe and thereafter define a skilled worker based on a unified definition. This paper thus attempts to define a skilled worker in a much broader sense by combining three types of education, while offering a macro picture of the Indian economy by considering the vast diversity across different sectors.

Table 1: Illustration of Skills

Construction Sector Skill Council		IT Sector Skill Council	
Programme Name	Mason Tilling	Job Role	Domestic IT Helpdesk Attendant
Level	4.0	Level	4.0
Qualification Pack Name and Reference ID	CON/No103	Code	SSC/Q110
Version Number	1.0	Minimum Education Qualification	Master’s Degree in any Discipline
Version Update	30.12.2015	Experience	0-1 year of Work Experience/ Internship in a Related Area
Pre-requisites to Training	Preferably 5 th Standard		
Experience	Minimum Experience of 1 year of Level 3		

Source: Partial adaptations from the Construction Skill Council and IT Sector Skill Councils.

1.3. Contribution to Policy

The paper examines the employment generation potential with varying skill levels of major sectors of the Indian economy using both the direct and indirect employment linkage effects of these sectors by estimating their employment multiplier.

The paper begins by considering the share of different types of employment in each sector of the Indian economy. However, this exercise is followed by the calculation of employment linkage effects with different skill types, which actually signifies the direct and indirect employment generation by a sector. Subsequently, the paper presents a list of sectors that have the potential to create different types of employment through direct and indirect employment linkages, which helps in identifying different sectors with different levels of skill.

The empirical results show that the services sector is mainly engaged in creating medium-high and high skilled employment within itself and in other sectors, while most of the manufacturing sectors create direct and indirect low-medium skilled employment. The results show that the manufacturing sectors such as 'textiles' and 'wood and wood products, furniture and fixtures' create low-medium skilled employment both directly as well as indirectly through their employment linkage effects, while a number of services sectors such as 'communication', 'trade', 'financing, real estate and business activities' and 'other services' create direct and indirect medium-high and high skilled employment. The evidence indicates that in both the manufacturing and services sectors of the economy, we still need a combination of skills; as Kochhar, et al. (2006) point out, managers are needed to supervise workers. Sectors such as 'textiles', 'food and beverages' and 'hotels and restaurants' may generate employment for a spectrum of skills in India; in contrast, the 'construction' sector mainly generates employment for the low-skilled.

Unlike the differentiated skilled data available in South Africa 10 years ago, which was used by Alleyne and Subramanian (2001), such data is not yet available in India. Distinguishing between various types of employment by combining three different types of educational attainment in an input–output framework to estimate employment by sector and skill may help policymakers plan better in terms of creating jobs. Further, it establishes a baseline to broaden our measures of skilling. Last but not the least, the paper indicates where the jobs are generated and at what level of skills.

1.4. Organisation of the Paper

Section 2 details the methodology for defining skilled employment by combining general, technical, and vocational education. It also presents the methodology used to estimate the employment multiplier along with employment linkage effects for different skill types and describes the underlying data sources used to accomplish this objective. Section 3 first presents the share of different types of employment in each sector of the Indian economy, and then highlights the employment linkage effects for different skill types using the Input–Output (I-O) tables. Section 4 concludes the paper.

2. Methodology and Data Sources

2.1. Defining Skilled Employment Based on General, Technical and Vocational Education

This paper covers three types of educational attainment, viz., general, technical, and vocational education, which are sourced from the Employment–Unemployment Survey conducted by the National Sample Survey Office in its 68th Round for the year 2011–12 and 66th Round for the year 2009–10 (Appendix A.1). Based on these codes, we define four types of employment for both these years, viz., low skilled employment, low-medium skilled employment, medium-high skilled employment and high skilled employment (Box 1).² Appendix A.2 also presents these four types of employment with their respective NSSO education codes.

Box 1: Four Types of Employment Based on NSSO (2013) Education Codes

- **Low Skilled Employment:** Not literate to below primary and no technical education and/or did not receive any vocational training; missing values in the respective codes.
- **Low-Medium Skilled Employment:** Attained secondary education and no technical education and/or received vocational training; missing values in the respective codes.
- **Medium-High Skilled Employment:** General education with higher secondary or diploma/ certificate course and/or technical education with diploma/certificate course below graduate level and/or received vocational training; missing values in the respective codes.
- **High Skilled Employment:** Graduate, post-graduate and above and/or technical education with diploma/certificate course for graduate and above level and/or received vocational training; missing values in the respective codes.

Source: Authors' computations using 68th (2011–12) and 66th (2009-10) Employment–Unemployment Survey by National Sample Survey Office (NSSO, 2013; 2011).

The process of combining the three-dimensional measure of skills was done in two steps. In the first step, we combined the general and technical education codes, which led to four types of employment (Table 2 shows the matrix). In the second step, we considered one variable as a combination of general and technical education, and related that variable with vocational education (Table 3). The second step provided the final skill variable, which is a combination of general, technical and vocational education (Figure 1). These four types of employment are defined as follows based on the education codes from NSSO (2013).³ It is to be noted here that Tables 2 and 3, and Figure 1 provide figures for employment pertaining to three

² These four types of skilled employment have been classified from the total employed workforce in the Indian economy.

³ These four types of employment have been defined from the total workforce of the Indian economy, that is, employed. Note that we have not specified any age group while defining these four types of employment. This is because we have to integrate these employment numbers into our WIOD I-O table, which does not provide information across different age groups.

categories of education for the year 2011–12, using the NSSO 68th Round Employment–Unemployment Survey. However, a similar exercise has been carried out for the year 2009–10 (NSSO 66th Round Employment–Unemployment Survey) also, and we got qualitatively similar results.

Table 2: Combining General and Technical Education, 2011–12 (Number of Workers by Usual Principal and Subsidiary Status) (million)

GE	TE												MC
	1	2	3	4	5	6	7	8	9	10	11	12	
1	129 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2	0.94 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0.17 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4	0.9 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	43.9 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
6	56.1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
7	69.1 (99.99)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.01 (0.01)
8	49.6 (99.97)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.01 (0.03)
10	27.7 (99.97)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.01 (0.03)
11	1.2 (23.2)	0 (0)	0.1 (1.7)	2.7 (45.7)	0.4 (6.1)	0.1 (1.0)	1.3 (22.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
12	21.8 (81.1)	1.5 (5.5)	0.02 (0.1)	0.9 (3.5)	0.1 (0.5)	0.02 (0.1)	0.7 (2.4)	0.02 (0.1)	0.8 (2.96)	0.3 (0.9)	0.02 (0.1)	0.7 (2.8)	0.01 (0.1)
13	7.5 (74.4)	0.6 (5.9)	0.01 (0.1)	0.3 (2.5)	0.1 (0.7)	0 (0)	0.3 (2.7)	0.02 (0.2)	0.47 (4.7)	0.3 (2.5)	0.01 (0.1)	0.6 (6.1)	0 (0.04)
MC	0.02 (52.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.01 (47.5)

Notes:

1. Figures in parentheses show the percentages.⁴

2. GE = General Education; TE = Technical Education; MC = Missing Cases.

3. The colour codes for the table are as follows:

Yellow: Low Skilled; Purple: Low-Medium Skilled; Green: Medium-High Skilled; Blue: High Skilled; Red: Missing cases; Black: Case does not exist.

Source: Authors' computations using the 68th Round (2011–12) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2013).

⁴ These percentages show how many workers out of specific general educational attainment (viz., specific codes in general education) have different types of technical education (viz., different codes in technical education). For instance, in Table 2.2, cell (1,1) implies that 100 per cent of the workers (129 million of the total employed workforce) who are illiterate (with general education code 1) have no technical education (with code 1). Similarly, cell (12,1) implies that 81.1 per cent of the workers (21.8 million of the total employed workforce) who are graduates (having general education code 12) have no technical education (with technical education code 1). Similar interpretations are true for the whole matrix.

Table 3: Combining Technical Education, General Education and Vocational Education, 2011-12 (Number of Workers by Usual Principal and Subsidiary Status) (million)

Combination of General and Technical Education	Vocational Education							
	RFVT	FVT	NFVH	NFVSL	NFVLOJ	NFVO	None	MC
LS	0.1 (0.1)	0.3 (0.2)	8.2 (4.7)	3.0 (1.7)	6.9 (4.0)	0.4 (0.2)	131 (74.9)	24.9 (14.2)
LMS	0.7 (0.4)	3.2 (1.8)	9.1 (5.2)	5.0 (2.9)	12.4 (7.1)	1.1 (0.7)	134 (76.6)	9.4 (5.4)
MHS	0.8 (2.5)	3.1 (9.1)	0.9 (2.8)	0.8 (2.4)	1.8 (5.4)	0.2 (0.7)	25.03 (74.3)	1 (2.97)
HS	1.1 (2.9)	3.6 (9.7)	0.5 (1.2)	0.5 (1.4)	1.4 (3.7)	0.1 (0.3)	28.6 (77.5)	1.24 (3.4)
MC	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.01 (64.6)	0.01 (35.4)

Notes:

1. Figures in parentheses show the percentages.⁵

2. The colour codes for the table are as follows:

Yellow: Low Skilled; Purple: Low-Medium Skilled; Green: Medium-High Skilled; Blue: High Skilled; Red: Missing cases; Black: Cases do not exist.

3. The expansions of the acronyms used in the table are as follows:

LS = Low skilled, LMS = Low-Medium Skilled, MHS = Medium-High Skilled and HS = High-Skilled.

RFVT = Receiving Formal Vocational Training; FVT = Received Vocational Training: Formal; NFVH = Received Non-Formal Hereditary Vocational Training; NFVSL = Received Non-Formal Vocational Training by Self-learning; NFVLOJ = Received Non-Formal Vocational Training by Learning on the Job; NFVO = Received Non-Formal Vocational Training by Other Means; and None = Did Not Receive Any Vocational Training.

Source: Authors' computations using the 68th Round (2011–12) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2013).

Thus, four types of skill employment are obtained after combining three types of educational attainment, depicted in Box 1.⁶ The exact NSS codes used to compute various types of skill employment are presented in Appendix A.2.

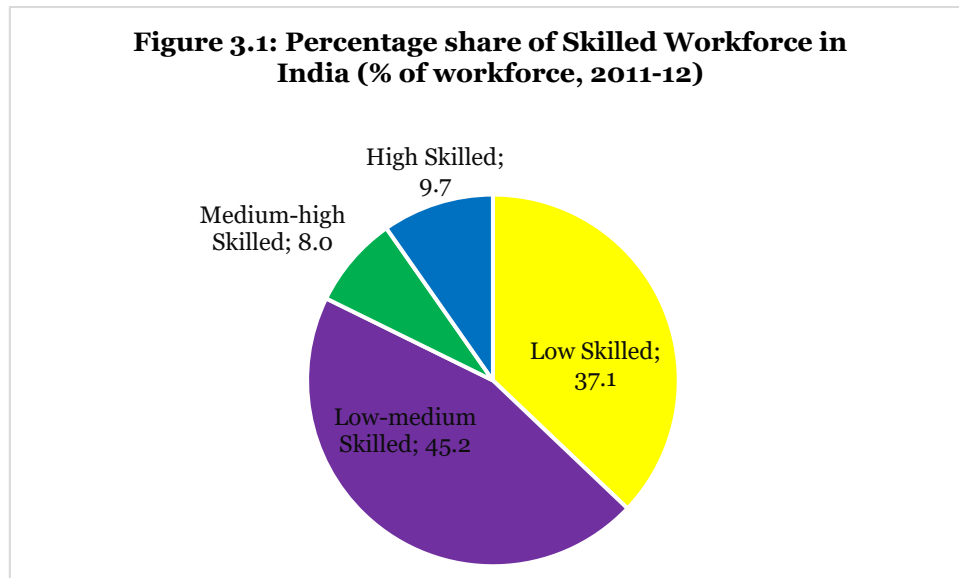
Figure 1 shows that 37.1 per cent of our workforce was low skilled, whereas 45.2 per cent of our workforce was low-medium skilled (Table A.1 in the Appendix

⁵ These percentages show how many workers out of general and technical educational attainment have different types of vocational education (viz., different codes in vocational education). For instance, in Table 3, cell (LS, RFVT) implies that 0.1 per cent of the workers (0.1 million of the total employed workforce) who are low skilled in terms of general and technical education are actually receiving formal vocational training. Similarly, cell (LS, NONE) implies that 74.9 per cent of the workers (131 million of the total employed workforce) who are low skilled in terms of general and technical education did not receive any vocational training. Similar interpretations are true for the whole matrix.

⁶ While defining skills, these four types of skilled employment categories can be expanded with respect to more detailed categories of educational attainment. This expansion is presented in Table A.4 in the Appendix, where employment has been classified into eight types while defining skilled employment. However, using these definitions, we get qualitatively similar results to our current exercise.

gives the detailed frequency distribution). Only 9.7 per cent of our workforce falls in the high-skilled category.

Figure 1: Percentage Share of Skilled Workforce in India (% of Workforce, 2011–12)



Source: Authors’ computations using the 68th Round (2011–12) Employment–Unemployment Survey by the National Sample Survey Office (NSSO, 2013).

2.1.1. Input-Output Framework for Different Types of Employment with Respect to Different Types of Skills

This section presents the steps employed in estimating the employment multiplier as well as employment linkage effects (both forward and backward) with respect to different skill types.

We start with the assumption of a fixed employment coefficient. We assume that with each output change, there will be an associated change in employment. Also following the dual-sector Lewis (1954) model, we have assumed that a change in output is linked to a fixed proportional change in employment, that is, the proportion of labour used per unit of output remains the same irrespective of the scale of production (Pradhan, Saluja and Singh, 2006; Bulmer-Thomas, 1982). This constant return to scale assumption is considered standard with respect to an I-O framework.⁷ Following this assumption, we get the fixed employment coefficients for each sector as follows:

$$E_i = L_i / X_i \text{ --- (1), } (i = 1, 2, \dots, n)^{8(1)}$$

where, L_i is the employment in sector ‘i’, X_i is the gross output and E_i is the

⁷ However, this fixed-coefficient type of production function is quite restrictive.

⁸ Unlike the standard production function, capital cannot be directly incorporated in the I–O model. In the I-O model, capital has been incorporated as past investment (Gross Fixed Capital Formation) and Gross Value Added, which does not provide any information regarding capital stock across sectors. In order to do that, a capital coefficient matrix needs to be constructed, which gives some idea of the distribution of capital across sectors in terms of their intermediate inputs, which is beyond the scope of the current research. However, some attempts have been made in this area through

fixed employment coefficient. In other words, E_{i3} is the labour requirement per unit of gross output, X_i .

However, in the previous equation, L_i is the total employment in sector 'i'. Thus, considering L_i as the total employment, we consider labour as homogeneous. In reality, labour is not all homogeneous. To capture the heterogeneity in the labour force, we considered different types of employment based on their different types of skill. Following this, L_i can be written as the summation of different types of employment. Thus,

$$L_i = LSi + LMSi + MHSi + HSi \quad (2)$$

where, L_i is the total employment in sector 'i', LS_i is low-skilled employment in sector 'i', LMS_i is the low-medium skilled employment in sector 'i', MHS_i is the medium-high skilled employment in sector 'i' and HS_i is the high skilled employment in sector 'i'. It should be noted here that the different types of skilled employment have been calculated by combining information on general, technical and vocational education published by the National Sample Survey Office (NSSO, 2013).⁹

Based on these different types of skilled employment, we can calculate the fixed employment coefficient with respect to each type of employment. Therefore, we write four types of fixed employment as follows:

$$E_{i1} = LSi / X_i \quad (3)$$

E_{i1} is the low skilled labour requirement per unit of gross output, X_i .

$E_{i2} = LMS_i / X_i$ ----- (4), ($i = 1,2,\dots,n$), E_{i2} is the low-medium skilled labour requirement per unit of gross output, X_i .

$E_{i3} = MHS_i / X_i$ ----- (5), ($i = 1,2,\dots,n$), E_{i3} is the medium-high skilled labour requirement per unit of gross output, X_i .

$E_{i4} = HSi / X_i$ ----- (6), ($i = 1,2,\dots,n$), E_{i4} is the high skilled labour requirement per unit of gross output, X_i .

Thus, for each type of employment, diagonalised matrices, formed with the elements of the fixed employment coefficients (viz., from Equations 3, 4, 5 and 6), have been constructed. We can represent them as follows in equations:

$$LSi = \hat{E}_{i1} * X_i \quad (3a)$$

$$LMSi = \hat{E}_{i2} * X_i \quad (4a)$$

$$MHSi = \hat{E}_{i3} * X_i \quad (5a)$$

constructing capital coefficient matrix for India in the study by Chadha et al. (2009), Koti (1967; 1969), and others.

⁹ From NSSO (2013), we obtained information on three types of education, which has been further combined to generate four types of skilled employment across sectors. Note that while defining these four types of employment, we have considered the workforce of the Indian economy, that is, those who are employed.

$$HS_i = \hat{E}_{i4} * X_i \text{ --- (6a)}$$

where, $\hat{E}_{i1}, \hat{E}_{i2}, \hat{E}_{i3}, \hat{E}_{i4}$, are the diagonalised matrices formed from the vector 'E', whose elements are defined by Equations 3, 4, 5, and 6, respectively. As previously mentioned, these diagonalised matrices clearly show the labour requirement for each sector with respect to per unit of gross output.

Now, as is well known from our conventional I–O model, we have

$X = (I - A)^{-1} F$ (7), where X is the vector of output, $(I - A)^{-1}$ is the Leontief Inverse matrix, F is the vector comprising final demand, A is the technical coefficient matrix which implies the direct input requirement from i^{th} sector in order to produce one unit of output in the j^{th} sector. The equation thus represents the amount of output created directly as well as indirectly for one unit change in final demand. This is the standard definition in the conventional I–O model.

Substituting this relation of X from (7) in Equations (3a), (4a), (5a) and (6a), we have the following labour equations with respect to each type of labour (viz., low skilled, low-medium skilled, medium-high skilled and high skilled):

$$LS_i = \hat{E}_{i1} * (I-A)^{-1} F = K_1 F \text{ --- (8a)}$$

$$LMS_i = \hat{E}_{i2} * (I-A)^{-1} F = K_2 F \text{ --- (9a)}$$

$$MHS_i = \hat{E}_{i3} * (I-A)^{-1} F = K_3 F \text{ --- (10a)}$$

$$HS_i = \hat{E}_{i4} * (I-A)^{-1} F = K_4 F \text{ --- (11a)}$$

where $(I - A)^{-1}$ is the Leontief Inverse matrix, F is the vector comprising final demand, and $K = [k_{ij}]$, the i, j^{th} element of K, which measures employment created directly and indirectly in the i^{th} sector when the j^{th} final demand changes by one unit. Again, $\sum_i k_{ij}$ gives the employment multiplier, thus measuring the total direct and indirect employment created throughout the economy when the j^{th} sector final demand increases by one unit (Bulmer-Thomas, 1982; Pradhan, Saluja and Singh, 2006).

After estimating the employment multiplier $\sum_i k_{ij}$, it is appropriate to calculate the indices to capture the forward and backward linkages for employment with varying levels of skill, which, in turn, helps to identify a key employment-generating sector.

The employment backward linkage measures how much employment in one sector can create jobs in other sectors, when final demand within that sector increases by unity. Thus, employment backward linkage generally takes into account outside sector employment while employment forward linkage measures how much employment in one sector can create jobs within itself, when the final demand from rest of the economy increases by unity. Hence, the employment forward linkage considers the within sector employment.

These employment linkage indices with respect to each type of employment are as follows:

Employment Backward Linkage with respect to **low skilled employment**,

$$(EBLLS) = [(1/n)\sum ik1ij] / [(1/n^2) \sum i \sum j k1ij], (i, j = 1, 2, \dots, n)$$

Employment Forward Linkage with respect to **low skilled employment**,

$$(EFLLS) = [(1/n)\sum j k1ij] / [(1/n^2) \sum i \sum j k1ij], (i, j = 1, 2, \dots, n)$$

Employment Backward Linkage with respect to **low-medium skilled employment**(EBLLMS) = [(1/n)\sum ik2ij] / [(1/n^2) \sum i \sum j k2ij], (i, j = 1, 2, \dots, n)

Employment Forward Linkage with respect to **low-medium skilled employment**

$$(EFLMS) = [(1/n)\sum j k2ij] / [(1/n^2) \sum i \sum j k2ij], (i, j = 1, 2, \dots, n)$$

Employment Backward Linkage with respect to **medium-high skilled employment**(EBLMHS) = [(1/n)\sum ik3ij] / [(1/n^2) \sum i \sum j k3ij], (i, j = 1, 2, \dots, n)

Employment Forward Linkage with respect to **medium-high skilled employment**

$$(EFLMHS) = [(1/n)\sum j k3ij] / [(1/n^2) \sum i \sum j k3ij], (i, j = 1, 2, \dots, n)$$

Employment Backward Linkage with respect to **high skilled employment**

$$(EBLHS) = [(1/n)\sum ik4ij] / [(1/n^2) \sum i \sum j k4ij], (i, j = 1, 2, \dots, n)$$

Employment Forward Linkage with respect to **high skilled employment**

$$(EFLHS) = [(1/n)\sum j k4ij] / [(1/n^2) \sum i \sum j k4ij], (i, j = 1, 2, \dots, n)$$

Note that for calculating the employment backward linkage coefficients for different skill types, the demand-driven Leontief input inverse matrix $((I - A)^{-1})$ is considered (Leontief, 1936; 1941), whereas the Ghoshian allocation coefficient matrix (Ghosh, 1958), more specifically, the output inverse matrix $((I - B)^{-1})^{10}$ is considered while calculating the employment forward linkage coefficients with respect to different skill types. Based on these linkage coefficients, we can identify the key employment-generating sectors of an economy (Bulmer-Thomas, 1982) that can

¹⁰ B is the allocation coefficient matrix, where, $b_{ij} = X_{ij} / X_i$ ----- (i), where b_{ij} = allocation coefficient, X_{ij} = i^{th} commodity going to j^{th} sector as inputs and X_i = i^{th} sector's output. Thus, it is evident from Equation (i) that the amount of i^{th} commodity going to j^{th} sector in turn depends on i^{th} sector's output only, that is, on its own output production.

create different types of employment, both directly as well as indirectly, with the help of their strong linkage effects.

2.2. Data Sources

The first important data sources we used are the 68th and 66th Rounds Employment–Unemployment Surveys conducted by the National Sample Survey Office (NSSO) for the years 2011–12 and 2009–10, respectively. The NSSO provides large sample, unit-level data on the employment–unemployment situation for the Indian economy for the corresponding years. From that unit-level data, we used the usual principal as well as subsidiary status (UPSS) of the sample observations as their employment status. The definition of “usual activity status relates to the activity status of a person during the reference period of 365 days preceding the date of survey. The activity status on which a person spent relatively longer time (i.e. major time criterion) during the 365 days preceding the date of survey is considered as the usual principal activity status of the person.” Besides, “a person whose usual principal status was determined on the basis of the major time criterion could have pursued some economic activity for a shorter time throughout the reference year of 365 days preceding the date of survey or for a minor period, which is not less than 30 days, during the reference year. The status in which such economic activity was pursued was the usual subsidiary economic activity status of that person” (NSSO, 2013; 2011). The main focus of the NSSO is to estimate the number of persons getting employment in different sectors in order to arrive at the employment/unemployment rate. Thus, as per the NSSO, if a person belongs to both categories of principal and subsidiary status, he/she is counted only once (according to their principal status) in order to avoid the problem of double counting. On the other hand, in the present exercise, our primary objective is to measure different types of total employment generation capabilities (both through principal and subsidiary status) of the major sectors. The NSSO also provides data on three types of educational attainment levels of the workers, which we have used to formulate four types of employment across various sectors of the Indian economy.

The second most important data source for estimating direct and indirect employment generation by the sectors through their linkage effects is the Input-Output (I-O) table for India. In this paper, we used the I–O tables from two sources, including one from the Central Statistics Office (CSO) and the other being the World Input-Output Database (WIOD) (Timmer, 2012). Using these two databases, we provide a comparative picture using the 2009–10 I–O table (which is provided by CSO) and the I–O table for the year 2011 (provided by WIOD).¹¹

Finally, it should be mentioned that we incorporated four types of employment in the 2011 as well as 2009–10 Indian I-O tables. In order to

¹¹ This is for the information that the WIOD provides I-O tables for 40 different countries of the world including India across 35 economic sectors for continuous years from 1995 to 2011. Moreover, the WIOD constructed the I-O tables for continuous years by extrapolating the intermittent national I-O tables for respective countries, along with information from other sources such as National Accounts Statistics (NAS) and International Trade Statistics (ITS). Although I-O tables provided by the CSO are also available from 1983–84 to 2007–08, we use the latest I-O table provided by the CSO, which is for the year 2009–10. Therefore, for this objective of identifying the employment-generating sectors for India, we have used the WIOD 2011 I-O table and CSO 2009-10 I-O table. (See Timmer, 2012.)

incorporate those employment figures in the I–O table, it is important to match the sectors in the I–O table with those in the NSSO Employment–Unemployment Survey. For that purpose, we used the National Industrial Classification (NIC-2008, 2004) codes published by the CSO (2008; 2004) to classify various sectors of the Indian economy. The matching of the sectors in the I–O table with the NIC codes has been delineated in the next section. Finally, by incorporating those employment figures across various sectors in the I–O table, the employment linkage effects with varying levels of skill were estimated, which were used to identify the key employment-generating sectors responsible for creating different types of direct and indirect employment.

3. Empirical Analysis

Before presenting the employment forward and backward linkages for different skill levels, we present the share of each type of employment across sectors of the Indian economy, which shows the employment generation within an industry. As a first step, we describe the sector classification used in this analysis.

3.1. Classification of Sectors

We start with the more disaggregated sectors in the CSO 2009–10 and 2011 WIOD I–O table. The CSO provides the I–O table for 130 sectors of Indian economy, while WIOD provides the Indian I–O table for 35 sectors. After consolidating similar sectors in the CSO and WIOD I–O tables, we finally arrive at 23 sectors.¹² These 23 sectors provide a complete macro picture of the Indian economy consisting of the primary sector, manufacturing sector, non-manufacturing sector, and tertiary or services sector. More specifically, among these 23 sectors, ‘agriculture’ appears as the primary sector, 13 sectors appear as secondary or the manufacturing sector (‘food, beverages and tobacco’ to ‘other manufacturing’), 3 sectors appear as non-manufacturing (‘mining and quarrying’, ‘construction’ and ‘electricity, gas and water supply’) and finally 6 sectors are tertiary or the services sectors (‘transport’, ‘communication’, ‘trade’, ‘hotels and restaurants’, ‘financing, real estate and business activities’ and ‘other services’). This detailed division of sectors as well as the merging procedure is shown in Appendix Table A.3.

While classifying these sectors, we also considered 24 key sectors as mentioned by the National Policy for Skill Development and Entrepreneurship, 2015, (Ministry of Skill Development and Entrepreneurship, 2015) wherein skilled employment has been projected for the year 2022. However, the issue of which sector is important for creating which type of employment has not been examined. Our study attempts to fill this gap and thus presents one concordance table (in Appendix Table A.2), which shows the match between the sectors in WIOD (2011), the NIC codes (Central Statistics Office, 2008) and the National Policy for Skill Development and Entrepreneurship (Ministry of Skill Development and Entrepreneurship, 2015). This concordance table is critical for estimating the share

¹² It should be noted here that the analysis of skill-based employment linkages has also been carried out for 130 sectors using the CSO 2009–10 I–O table and is presented in detail in Table A.5 in the Appendix to this paper. However, in order to obtain a more comprehensive and aggregated picture, the analysis for 23 sectors has been presented using the I–O tables for 2009–10 and 2011.

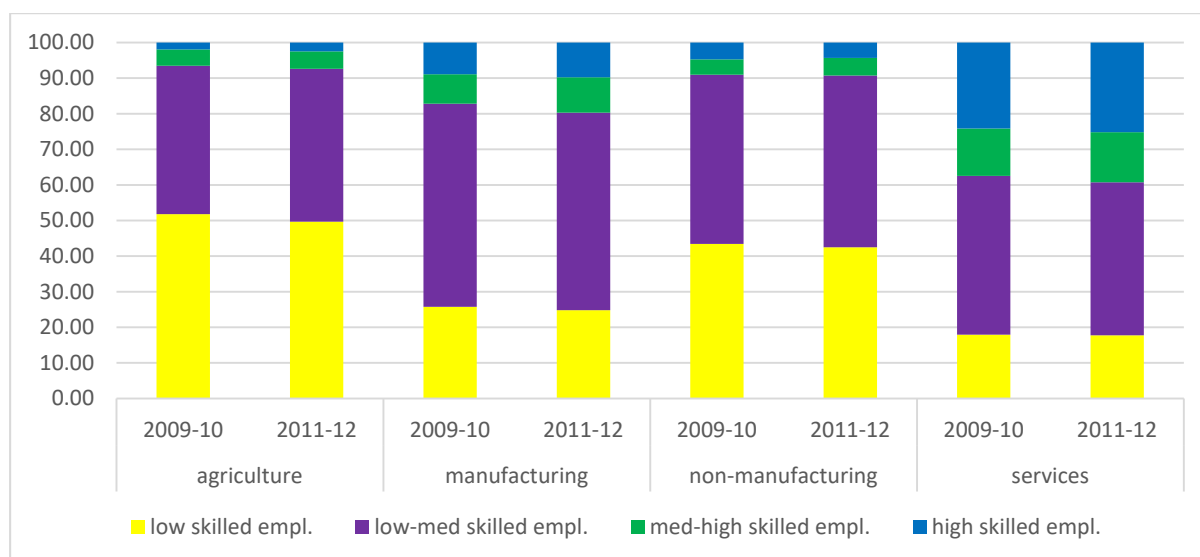
of different types of employment and the employment linkage effects across these sectors for the Indian economy.

3.2. Employment Share for Different Skill Types for India

This section examines the share of each type of employment across 23 sectors for India. The analysis starts with the percentage share of different types of employment in broad sectors of the Indian economy (viz., agriculture, manufacturing, non-manufacturing and services), followed by the percentage share of each type of employment within these broad sectors for the year 2011. Thus, it shows the employment distribution across different sectors of the Indian economy. However, this employment share only details the in-house employment creation within an industry.

Figure 2 provides the overall picture of the shares of different types of employment in the Indian economy for the years 2009–10 and 2011–12. The figure shows that most of the low skilled workers were absorbed in the agriculture sector followed by the non-manufacturing sector for both the years. This is mainly because the Indian agriculture sector represents much of the disguised unemployment in the Indian economy. Again, the non-manufacturing sector shows a large number of low skilled workers because of the high proportion of low-skilled informal workers in the construction sector. Interestingly, the share of low-medium skilled workers is also the highest in the non-manufacturing sector, followed by those in the manufacturing and services sectors. Also, the share of high-skilled workers is higher in the services sector during both the years.

Figure 2: Share of Employment by Skill Type in Broad Sectors of the Indian Economy (2009–10 and 2011–12)



Notes: The share is taken as a percentage share of each type of employment in the total employment.

The colour codes for the table are as follows:

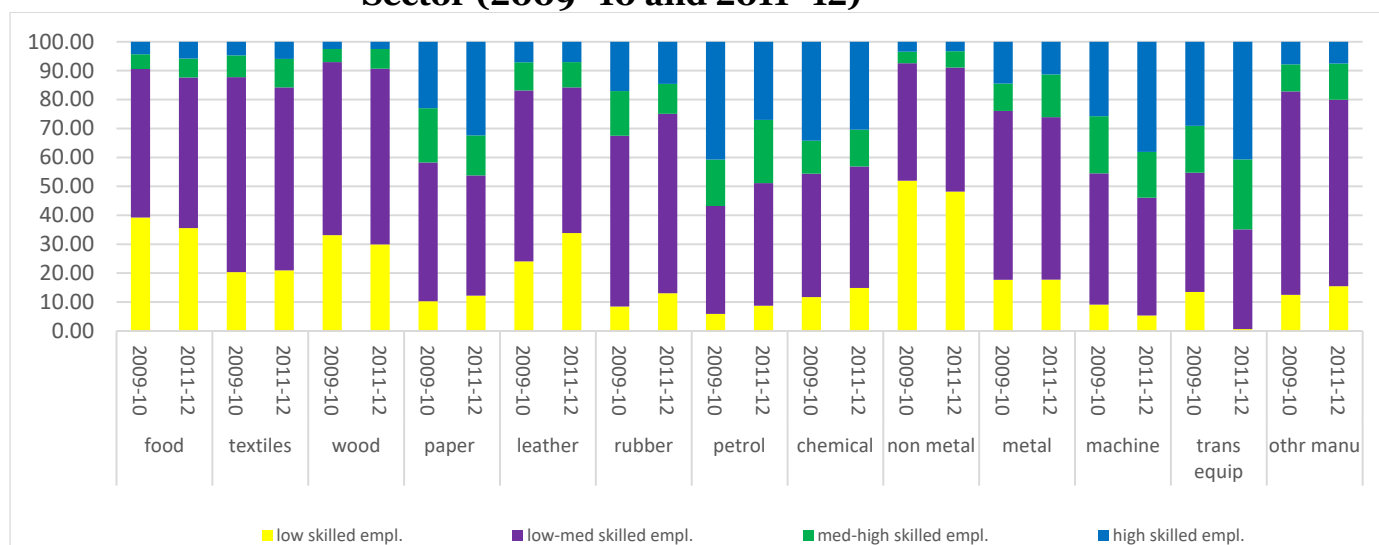
Yellow: Low Skilled. Purple: Low-Medium Skilled. Green: Medium-High Skilled.

Blue: High Skilled.

Source: Authors' estimation using the NSSO (2011–12) Employment–Unemployment Survey (NSSO, 2013).

It is evident from Figure 3 that the dominant employment within different manufacturing sectors is low-medium skilled employment for both the years, 2009–10 and 2011–12. The share of this type of employment is significant in all sub-sectors within the manufacturing sector. However, the concentration of low skilled employment is much higher in sectors like food, beverages and tobacco, non-metallic mineral products, and leather products, among others.

Figure 3: Share of Employment by Skill Type within the Manufacturing Sector (2009–10 and 2011–12)



Notes: The share is taken as a percentage share of each type of employment in the total employment.

The colour codes for the table are as follows:

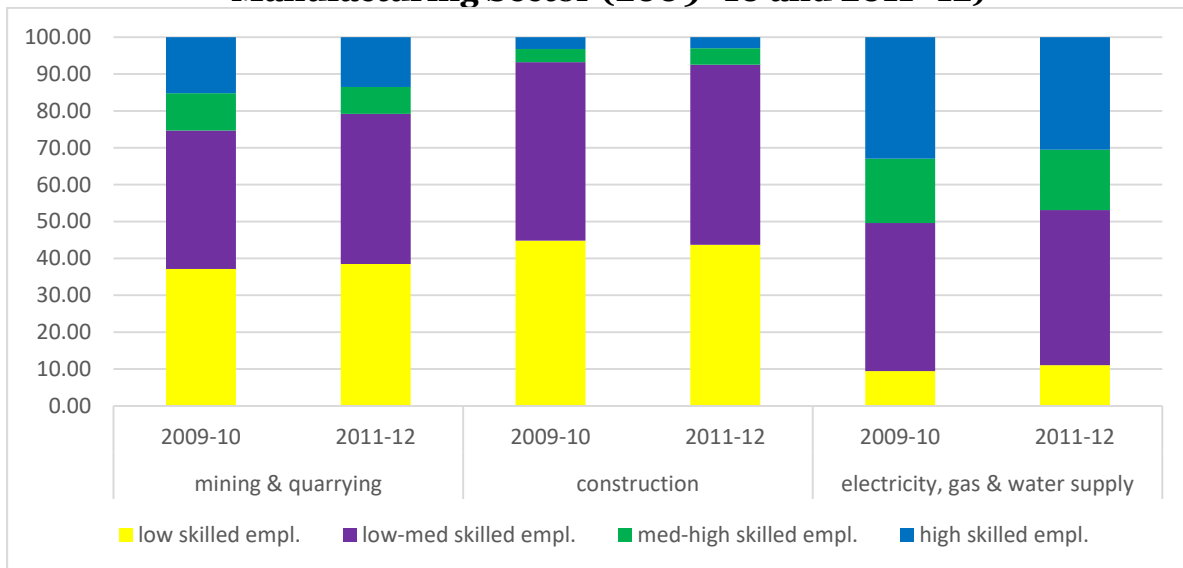
Yellow: Low Skilled. Purple: Low-Medium Skilled. Green: Medium-High Skilled.

Blue: High Skilled.

Source: Authors' estimation using the NSSO (2009-10) Employment–Unemployment Survey (NSSO, 2011) and NSSO (2011–12) Employment–Unemployment Survey (NSSO, 2013).

Within non-manufacturing, the share of low-skilled workers is the highest in the construction sector, followed by that in 'mining and quarrying'. This is because a large number of informal workers, mainly dropouts, are engaged as construction workers. However, the share of low-medium skilled employment is also higher in the construction sector because of the number of engineers engaged in construction utility projects, and building construction, among other activities. As regards high-skilled employment, the 'electricity, gas and water supply' sector engaged 32.97 per cent and 30.54 per cent of the workers during the years 2009–10 and 2011–12 respectively, followed by the 'mining and quarrying' sector.

Figure 4: Share of Employment by Skill Type within the Non-Manufacturing Sector (2009–10 and 2011–12)



Notes: The share is taken as a percentage share of each type of employment in the total employment.

The colour codes for the table are as follows:

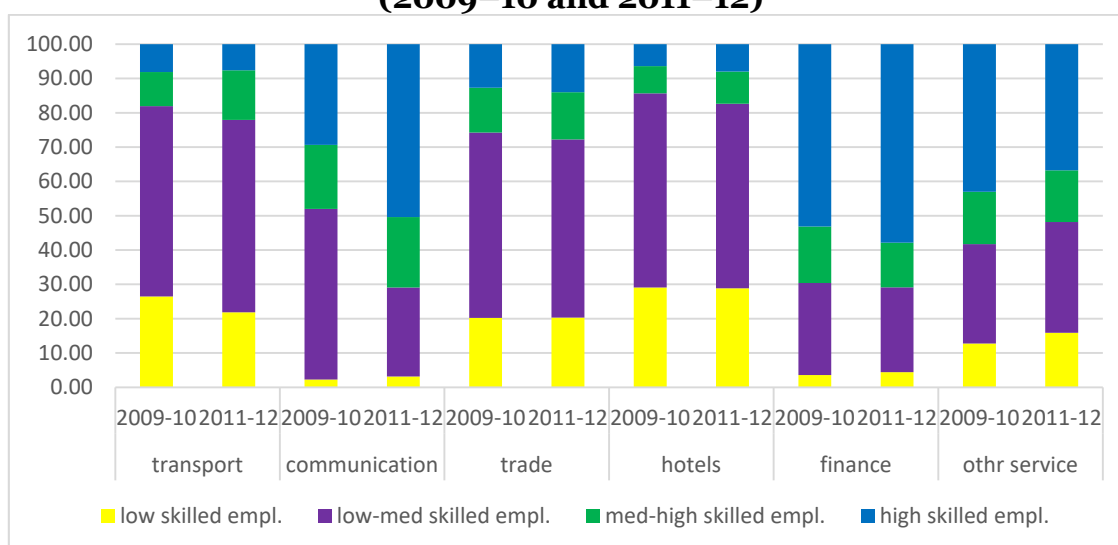
Yellow: Low Skilled. Purple: Low-Medium Skilled. Green: Medium-High Skilled.

Blue: High Skilled.

Source: Author’s estimation using the NSSO (2011-12) Employment–Unemployment Survey (NSSO, 2013) and NSSO (2009–10) Employment–Unemployment Survey (NSSO, 2011).

Finally, within the services sector, the percentage share of high-skilled employment is higher than in other types of employment (Figure 4). More specifically, the share of high-skilled employment is the highest in ‘financing, real estate and business activities’ during both the years, which further increased to 57.85 per cent in 2011–12 from 53.14 per cent in 2009–10. The ‘other services’ sector also engages a much higher share (recorded as 43.02 per cent in 2009–10) of high skilled workers. Apart from high skilled employment, the percentage share of low-medium skilled employment is higher in the services sectors like ‘transport’, followed by that in ‘hotels and restaurants’, and ‘trade’, among others. Figure 4 also shows that this share increased during the year 2011–12 as compared to 2009–10.

Figure 5: Share of Employment by Skill Type within the Services Sector (2009–10 and 2011–12)



Notes: The share is taken as a percentage share of each type of employment in the total employment.

The colour codes for the table are as follows:

Yellow: Low Skilled. Purple: Low-Medium Skilled. Green: Medium-High Skilled. Blue: High Skilled.

Source: Authors' estimation using the NSSO (2009–10) Employment–Unemployment Survey (NSSO, 2011) and NSSO (2011–12) Employment–Unemployment Survey (NSSO, 2013).

3.3. Employment Linkages with Respect to Different Skill Levels for India

The previous sub-section presented the share of different types of employment across sectors for the years 2009–10 and 2011–12, respectively. However, these figures provide only the concentration of employment within a sector. In an interdependent economy, it is also important to capture how one sector is able to generate employment in other sectors through their linkage effects.

In order to consider this aspect, this section uses the I-O table of India for the year 2009–10 published by the CSO and the 2011 Indian I-O table from the World Input-Output Database (Timmer, 2012), and then estimates the employment forward and backward linkages for different skill types across the 23 sectors for both these years.

We used the 66th and 68th Rounds Employment–Unemployment Surveys conducted by the NSSO (2013; 2011) in order to obtain the employment numbers by different skill types across sectors. Based on the data on general, technical and vocational education from the NSSO (2013; 2011), we estimated different types of employment with varying skill types across sectors. By juxtaposing those employment numbers in the I-O table, we estimated different skill-based employment linkages across the 23 sectors. Tables 4 and 5 present the skill-based employment forward and backward linkages across sectors for the Indian economy for the years 2009–10 and 2011, respectively. It should be mentioned here that, for

comparing the employment linkages for these two time periods, the values of output as well as inter-industry transactions should be deflated in order to account for the change in price levels between these two time periods. For that purpose, we have deflated the values using the implicit price deflator provided by the National Accounts Statistics for the years 2011 and 2014 in the price and quantum indices.

Table 4: Skill-Based Employment Linkages across Sectors for India (2009–10)

Sectors	EBL for Low Skill	EFL for Low Skill	EBL for Low-Medium Skill	EFL for Low-Medium Skill	EBL for Medium-High Skill	EFL for Medium-High Skill	EBL for High Skill	EFL for High Skill
Agriculture	5.41	10.85	3.65	6.52	2.52	4.10	1.17	1.55
Mining and Quarrying	0.39	2.87	0.37	2.21	0.56	3.48	0.74	4.41
Food, Beverages and Tobacco	2.64	0.66	2.04	0.64	1.52	0.37	0.98	0.28
Textiles	1.24	0.59	1.82	1.46	1.38	0.80	1.12	0.46
Wood and Wood Products, Furniture and Fixtures	2.17	1.98	2.24	2.67	1.39	1.13	0.89	0.61
Pulp, Paper, Printing and Publishing	0.96	0.20	1.11	0.71	1.54	1.59	1.55	1.65
Leather Products	0.93	0.46	1.21	0.84	1.24	0.82	1.03	0.55
Rubber and Plastics	0.69	0.04	0.76	0.23	0.84	0.35	0.87	0.31
Petroleum Products	0.31	0.001	0.31	0.01	0.45	0.02	0.60	0.03
Chemicals	0.58	0.08	0.61	0.21	0.69	0.32	0.92	0.88
Non-metallic Mineral Products	0.86	1.41	0.72	0.83	0.65	0.46	0.65	0.35
Metals	0.34	0.16	0.52	0.40	0.66	0.42	0.76	0.45
Machinery	0.31	0.05	0.49	0.18	0.83	0.59	0.84	0.37
Transport Equipment	0.32	0.050	0.48	0.11	0.83	0.37	0.97	0.43
Other Manufacturing	0.39	0.10	0.70	0.41	0.79	0.33	0.85	0.22
Construction	1.23	1.06	1.15	0.85	0.86	0.39	0.75	0.26
Electricity, Gas and Water Supply	0.17	0.05	0.24	0.17	0.44	0.54	0.50	0.56
Transport	0.62	0.41	0.71	0.64	0.74	0.66	0.61	0.43
Communication	0.10	0.02	0.31	0.35	0.61	0.75	0.90	1.12
Trade	0.46	0.92	0.87	1.85	1.27	2.65	1.24	2.34
Hotels and Restaurants	2.43	0.76	2.03	1.10	1.59	0.91	1.00	0.67
Financing, Real Estate and Business Activities	0.15	0.03	0.21	0.17	0.47	0.69	1.07	1.74
Other Services	0.30	0.24	0.45	0.43	1.12	1.26	3.00	3.34

Notes: EBL = employment backward linkage, EFL = employment forward linkage

The colour codes for the table are as follows:

Red: Both employment forward and backward linkage coefficients with varying levels of skill having greater than unitary value

Green: Either one of the linkage coefficients (either forward or backward) with varying levels of skill having greater than unitary value.

Sources: Authors' computation using the I-O table for India for the year 2009-10 provided by the Central Statistics Office and the 66th Round (2009–10) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2011).

**Table 5: Skill-Based Employment Linkages across Sectors for India
(2011)**

Sectors	EBL for low skill	EFL for low skill	EBL for low-medium skill	EFL for low-medium skill	EBL for medium-high skill	EFL for medium-high skill	EBL for high skill	EFL for high skill
Agriculture	6.20	9.10	3.96	5.25	2.63	3.48	1.28	1.57
Mining and Quarrying	0.44	0.89	0.39	0.63	0.43	0.66	0.64	1.09
Food, Beverages and Tobacco	2.25	0.45	1.74	0.44	1.34	0.32	0.93	0.26
Textiles	1.15	0.66	1.72	1.32	1.59	1.19	1.10	0.65
Wood and Wood Products, Furniture and Fixtures	2.85	4.70	3.57	6.36	2.44	4.14	1.10	1.36
Pulp, Paper, Printing and Publishing	0.54	0.26	0.77	0.59	1.09	1.13	1.73	2.38
Leather Products	1.69	0.91	1.51	0.90	1.40	0.91	1.06	0.65
Rubber and Plastics	0.59	0.12	0.75	0.39	0.80	0.38	0.84	0.47
Petroleum Products	0.20	0.00	0.29	0.01	0.41	0.03	0.44	0.03
Chemicals	0.33	0.08	0.45	0.15	0.58	0.27	0.76	0.57
Non-Metallic Mineral Products	1.01	1.81	0.81	1.07	0.75	0.82	0.59	0.42
Metals	0.24	0.12	0.39	0.25	0.56	0.39	0.54	0.26
Machinery	0.20	0.02	0.35	0.09	0.54	0.20	0.79	0.43
Transport Equipment	0.17	0.00	0.31	0.07	0.58	0.28	0.82	0.42
Other Manufacturing	0.21	0.13	0.46	0.37	0.54	0.42	0.45	0.23
Construction	1.20	1.15	1.08	0.86	0.80	0.45	0.64	0.27
Electricity, Gas and Water Supply	0.18	0.08	0.28	0.20	0.45	0.44	0.66	0.74
Transport	0.32	0.29	0.46	0.49	0.64	0.73	0.49	0.35
Communication	0.10	0.05	0.22	0.26	0.66	1.20	1.34	2.64
Trade	0.49	0.99	0.89	1.69	1.34	2.61	1.28	2.37
Hotels and Restaurants	2.10	0.71	1.84	0.88	1.59	0.90	1.12	0.68
Financing, Real Estate and Business Activities	0.10	0.03	0.17	0.13	0.35	0.39	1.13	1.53
Other Services	0.42	0.45	0.60	0.61	1.51	1.66	3.27	3.62

Notes: EBL = employment backward linkage, EFL = employment forward linkage

Red: Both employment forward and backward linkage coefficients with varying levels of skill having greater than unitary value

Green: Either one of the linkage coefficients (either forward or backward) with varying levels of skill having greater than unitary value.

Sources: Authors' computation using World Input-Output tables for India for the year 2011 using the World Input-Output Database (Timmer, 2012) and 68th Round (2011–12) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2013).

With respect to four types of employment, Tables 4 and 5 present the employment backward and forward linkage coefficients for the respective types of skills for the years 2009–10 and 2011. These employment linkage coefficients portray the shares of different types of employment generated by the sectors both within the sector as well as in other sectors through their corresponding employment linkage coefficients. Note that sectors having more than unitary employment backward linkage with a specific type of skill are capable of creating more than one unit (above

average) of that type of employment in other sectors when the final demand within that sector increases by unity. In contrast, the sectors that have more than unitary employment forward linkage with a specific skill are capable of creating above average of that type of employment within the sector itself when the final demand from the rest of the economy increases by unity. Thus, these skill-based employment linkages capture additional employment generation capabilities of the sectors, which are not captured by considering only the employment share (as discussed in sub-section 3.2), because different types of employment shares represent the creation of only direct employment of that type within the sector, while an employment linkage analysis covers the creation of different types of employment not only within the sector, but also in the other sectors.¹³

Based on this interpretation, Tables 4 and 5 show that for the ‘agriculture’ sector, the employment forward and backward linkages with respect to low, low-medium and medium-high skilled are greater than unity for both the years, which implies that the ‘agriculture’ sector is capable of generating these four types of employment both within itself as well as in the other sectors. While Figure 2 shows employment concentration within ‘agriculture’, Tables 4 and 5 show its ability to create employment in other sectors too with the help of its linkage effects. As previously mentioned, the analysis of employment linkages has also been carried out with the more disaggregated 130 sectors in the 2009–10 I-O table. The detailed table is presented in Appendix Table A.5.

Thus, the results show that within the ‘agriculture’ sector, most of the sub-sectors like ‘paddy’, ‘wheat’ and other food grains are creating direct and indirect low, low-medium and medium-high employment. Within the manufacturing sector, the sub-sector ‘wood and wood products, furniture and fixtures’ are found to have all four types of employment linkages having greater than unity; hence, this sector is able to create all these four types of employment both within itself as well as in the other sectors. Again, if we compare this sector’s direct and indirect employment creation with the simple employment share of this sector (Figure 3), the share does not portray the real picture. For instance, Figure 3 shows that the shares of medium-high skilled and high skilled employment in the ‘wood and wood products, furniture and fixtures’ sub-sector were only 6.81 per cent and 2.49 per cent, respectively in 2011–12, although the employment linkage analysis in Table 5 shows that this sector has greater than unitary employment linkage coefficients with varying levels of skill. This again verifies the importance of employment linkage analysis. Further, two of the most important manufacturing sectors, viz., ‘food, beverages and tobacco’ and ‘textiles’, have above unitary employment backward linkages with respect to low, low-medium and medium-high skilled for both the years. Further, if we focus on detailed disaggregation within these two broad sectors, the results from Appendix Table A.5 show that within the ‘food, beverages and tobacco’ sub-sector, ‘miscellaneous food products’ is creating most of the indirect employment with varying levels of skill. Also, the sub-sectors ‘edible oil’ and ‘hydrogenated oil’ are creating the bulk of indirect employment. Again, within the broad ‘textiles’ sector, the sub-sector ‘cotton textiles’ is creating most of the indirect employment followed by the sub-sector, ‘jute, hemp, and mesta textiles’. Thus, from the disaggregated as

¹³ The construction sector is very interesting. It has both strong forward and backward linkages for low-skilled labour.

well as aggregated analysis, it is clear that these two sectors are able to create sufficient skilled employment indirectly in other sectors when the final demand within these sectors increases by unity. The disaggregated table in Appendix Table A.5 also shows that one of the most important sub-sectors within the manufacturing sector, viz., 'other transport equipment' is creating low-medium and medium-high employment, which implies that the 'automobile' industry within the sub-sector, 'other transport equipment' is creating sufficient employment. Again, the sub-sector 'aircraft and spacecraft' within 'other transport equipment' is creating mostly medium-high and high skilled employment. Finally, within the services sector, the sub-sector 'hotels and restaurants' are able to create sufficient indirect employment in the other sectors by generating above unitary employment backward linkages during both the years with varying levels of skill, which is evident from both the aggregated (covering 23 sectors) as well as disaggregated (covering 130 sectors) analysis. Interestingly within the 'transport' sector, the sub-sectors 'air transport' and 'supporting and auxiliary transport activities' are engaging to create most of the high skilled employment. Also, the sub-sectors 'financing, real estate and business activities' and 'other services' show above unitary employment linkages, especially with respect to the high skilled category for both the years. Even as the disaggregated Appendix Table A.5 shows that within the 'financing, real estate and business activities' sector, sub-sectors like 'banking', 'insurance', 'business services' and others are creating most of the high skilled employment. Moreover, within the 'other services' sector, the dominant employment-creating sub-sectors are 'education and research', 'medical and health', 'computer and related activities', and others.

3.3.1. Key Employment-Generating Sectors with Respect to Different Skill Levels for India

After presenting the employment linkage effects with varying levels of skill, it is important to identify the key employment-generating sectors with their corresponding types of employment. In order to identify the *key* employment-generating sectors, it is useful to rank them in terms of their high employment forward as well as backward linkage coefficients with different skill types. According to the specification in Bulmer-Thomas (1982) and the approach given by Diamond (1975), a key employment-generating sector is one that has high employment forward as well as backward linkages, or more precisely, one which has both employment forward as well as backward linkage coefficients greater than unity with respect to a specific type of skill. Based on this criterion, the key employment-generating sectors for varying skill levels for India have been identified for the years 2009–10 and 2011, respectively, in Tables 6 and 7. Note that these two tables rank the sectors in descending order, and also distinguish between the sectors in terms of outward versus within sector employment creation.

Table 6: Key Employment-Generating Sectors for Different Skill Levels for India for 2009–10 (with Both Linkage Coefficients Greater Than Unity Following Strict Specification of Linkage Coefficients)

Key Employment Generating Sectors for Creating Outward Sector Employment: Employment Backward Linkage Greater Than Unity			
Low-Skill	Low-Medium Skill	Medium-High Skill	High-Skill
Agriculture	Agriculture	Agriculture	Other Services
Wood and Wood Products, Furniture And Fixtures	Wood and Wood Products, Furniture and Fixtures	Pulp, Paper, Printing and Publishing	Pulp, Paper, Printing and Publishing
Construction	Hotels and Restaurants	Wood and Wood Products, Furniture and Fixtures	Trade
	Textiles	Trade	Agriculture
		Other Services	Financing, Real Estate and Business Activities
Key Employment Generating Sectors for creating Within Sector Employment: Employment Forward Linkage Greater Than Unity			
Low-Skill	Low-Medium Skill	Medium-High Skill	High-Skill
Agriculture	Agriculture	Agriculture	Other Services
Wood and Wood Products, Furniture and Fixtures	Wood and Wood Products, Furniture and Fixtures	Trade	Trade
Construction	Textiles	Pulp, Paper, Printing and Publishing	Financing, Real Estate and Business Activities
	Hotels and Restaurants	Other Services	Pulp, Paper, Printing and Publishing
		Wood and Wood Products, Furniture and Fixtures	Agriculture

Note: The sectors are listed in terms of their ranking. Also, the ranking is in descending order.
Sources: Authors' computation using the I-O table for India for the year 2009–10 provided by the Central Statistics Office and the 66th Round (2009–10) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2011).

Table 7: Key Employment-Generating Sectors for Different Skill Levels for India for 2011 (with Both Linkage Coefficients Greater Than Unity Following Strict Specification of Linkage Coefficients)

Key Employment Generating Sectors for creating Outward Sector Employment: Employment Backward Linkage Greater Than Unity			
<i>Low-Skill</i>	<i>Low-Medium Skill</i>	<i>Medium-High Skill</i>	<i>High-Skill</i>
Agriculture	Agriculture	Agriculture	Other Services
Wood and Wood Products, Furniture and Fixtures	Wood and Wood Products, Furniture and Fixtures	Wood and Wood Products, Furniture and Fixtures	Pulp, Paper, Printing and Publishing
Construction	Textiles	Textiles	Communication
Non-Metallic Mineral Products		Other Services	Agriculture
		Trade	Trade
		Pulp, Paper, Printing and Publishing	Financing, Real Estate and Business Activities
			Wood and Wood Products, Furniture and Fixtures
Key Employment Generating Sectors for Creating Inward Sector Employment: Employment Forward Linkage Greater Than Unity			
<i>Low-Skill</i>	<i>Low-Medium Skill</i>	<i>Medium-High Skill</i>	<i>High-Skill</i>
Agriculture	Wood and Wood Products, Furniture and Fixtures	Wood and Wood Products, Furniture and Fixtures	Other Services
Wood and Wood Products, Furniture and Fixtures	Agriculture	Agriculture	Communication
Non-Metallic Mineral Products	Textiles	Trade	Pulp, Paper, Printing and Publishing
Construction		Other Services	Trade
		Textiles	Agriculture
		Pulp, Paper, Printing and Publishing	Financing, Real Estate and Business Activities
			Wood and Wood Products, Furniture and Fixtures

Note: The sectors are listed in terms of their ranking. Also, the ranking is in descending order.
Sources: Authors' computation using World Input-Output tables for India for the year 2011 using World Input-Output Database (Timmer, 2012) and 68th Round (2011–12) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2013).

Based on the criterion stated above, Table 7 identifies a number of sectors that create outward and within sector employment having employment backward and forward employment linkages greater than unity. Interestingly, the rank has been changing across different levels of skills across different sectors. For instance, Table 6 shows that the sector 'other services' holds the fifth rank in the creation of outward sector employment creation with respect to medium-high skill, while the sector actually improves its rank (1st rank) by creating outward employment with respect to high skill. Also, the sector 'agriculture' holds the first rank in creating outward sector employment with respect to low, and low-medium skilled, though with its rank deteriorating in terms of creating high skilled employment. Tables 6 and 7 also show that sectors like 'wood and wood products, furniture and fixtures' are able to create a

wide spectrum of skills, thus creating low, low-medium and medium-high skilled employment for both the years. In contrast, within the manufacturing sector, sub-sectors like ‘pulp, paper, printing and publishing’ create mostly medium-high and high skilled employment. Moreover, a number of services sectors such as ‘communications’, ‘trade’, ‘financing, real estate and business activities’ and ‘other services’ were especially engaged in creating direct and indirect medium-high and high skilled employment in 2009–10 and 2011 by having greater than unitary linkage coefficients corresponding to these two types of employment. In contrast, one of the most important services sector, namely ‘hotels and restaurants’ has been found to be creating direct and indirect low, low-medium and medium-high employment. This makes intuitive sense because, for example, people work in *dhabas* and five-star hotels. Thus, these sectors are termed as key employment-generating sectors for creating a specific type of direct and indirect employment having both linkage coefficients greater than unity.

However, Diamond’s specification imposes a strict restriction on employment linkage effects because, according to him, both employment forward and backward linkages have to be greater than unity for a sector to qualify as a key sector with respect to different types of employment. Thus, if we marginally relax this strict assumption to consider sectors that have at least one of the employment linkage coefficients (either employment forward or backward) greater than unity, we can arrive at a number of sectors with moderately high linkage effects corresponding to each type of employment. Based on this specification, the employment linkage analysis for 2009–10 and 2011 shows that sectors like ‘mining and quarrying’ have greater than unitary employment forward linkages but less than unitary employment backward linkage. Thus, it can create more inward sector employment. Besides sectors like ‘food, beverages and tobacco’, ‘textiles’, ‘leather products’, and ‘hotels and restaurants’ are creating more outward sector employment having greater than unity employment backward linkage with less than unity employment forward linkage with respect to different types of skills.

The disaggregated analysis in Appendix Table A.5 shows that within the broad sector ‘leather products’, there is a sector named ‘leather footwear’, which is actually responsible for creating most of the employment with varying skill levels.

Now based on different skill-based employment linkages presented in Tables 4 and 5, we calculate the number of jobs that are created within the same sector (Table 8) and indirectly, that is, across other sectors (Table 9) for the years 2009–10 and 2011. However, they cannot be summed up due to double counting. It should be noted here that the number of jobs created directly and indirectly by 130 sectors is also presented in Appendix Table A.6.

Table 8: Creation of Jobs within Sector (million), 2009–10 and 2011

Sectors	Low-Skilled Employment		Low-Medium Skilled Employment		Medium-High Skilled Employment		High-Skilled Employment	
	2009-10	2011	2009-10	2011	2009-10	2011	2009-10	2011
Agriculture	110.2	102.2	88.7	88.3	9.7	10.1	4.2	5.1
Mining and Quarrying	1.0	0.9	1.0	0.9	0.3	0.2	0.4	0.3
Food, Beverages and Tobacco	3.3	3.6	4.3	5.2	0.4	0.7	0.4	0.6
Textiles	2.8	3.5	9.2	10.6	1.0	1.6	0.6	1.0
Wood and Wood Products, Furniture and Fixtures	1.5	1.7	2.8	3.4	0.2	0.4	0.1	0.1
Pulp, Paper, Printing and Publishing	0.1	0.2	0.6	0.6	0.3	0.2	0.3	0.5
Leather Products	0.2	0.4	0.5	0.6	0.1	0.1	0.1	0.1
Rubber and Plastics	0.1	0.1	0.4	0.6	0.1	0.1	0.1	0.1
Petroleum Products	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Chemicals	0.2	0.3	0.6	0.7	0.2	0.2	0.5	0.5
Non-Metallic Mineral Products	1.9	2.1	1.5	1.9	0.1	0.2	0.1	0.1
Metals	0.6	0.7	1.9	2.2	0.3	0.6	0.5	0.4
Machinery	0.2	0.1	1.1	0.9	0.5	0.3	0.6	0.8
Transport Equipment	0.2	0.0	0.5	0.5	0.2	0.3	0.4	0.5
Other Manufacturing, nec	0.3	0.6	1.7	2.4	0.2	0.5	0.2	0.3
Construction	17.2	19.5	18.5	21.8	1.4	2.0	1.2	1.3
Electricity, Gas and Water Supply	0.1	0.2	0.4	0.6	0.2	0.2	0.4	0.4
Transport	4.2	3.6	8.8	9.3	1.6	2.4	1.3	1.3
Communication	0.0	0.1	0.8	0.5	0.3	0.4	0.5	1.0
Trade	7.6	8.0	20.4	20.3	4.9	5.4	4.8	5.5
Hotels and Restaurants	1.6	2.0	3.0	3.7	0.4	0.6	0.3	0.6
Financing, Real Estate and Business Activities	0.2	0.5	1.8	2.7	1.1	1.4	3.6	6.4
Other Services	3.9	6.0	8.9	12.1	4.7	5.7	13.2	13.8

Sources: Authors' computation using the I-O table for India for the year 2009–10 provided by the Central Statistics Office, World Input-Output tables for India for the year 2011 using the World Input-Output Database (Timmer, 2012) and 66th Round (2009–10) 68th Round (2011–12) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2011; 2013).

Table 9: Indirect Creation of Different Types of Employment across Sectors (million), 2009–10 and 2011

Sectors	Low-Skilled Employment		Low-Medium Skilled Employment		Medium-High Skilled Employment		High-Skilled Employment	
	2009-10	2011	2009-10	2011	2009-10	2011	2009-10	2011
Agriculture	37.0	42.0	28.2	32.7	3.1	3.9	1.7	2.3
Mining and Quarrying	2.7	3.0	2.9	3.2	0.7	0.6	1.1	1.1
Food, Beverages and Tobacco	18.1	15.3	15.8	14.3	1.9	2.0	1.4	1.7
Textiles	8.5	7.8	14.0	14.2	1.7	2.3	1.6	1.9
Wood and Wood Products, Furniture and Fixtures	14.9	19.4	17.3	29.5	1.7	3.6	1.3	2.0
Pulp, Paper, Printing and Publishing	6.6	3.7	8.6	6.3	1.9	1.6	2.3	3.1
Leather Products	6.4	11.5	9.3	12.5	1.5	2.1	1.5	1.9
Rubber and Plastics	4.7	4.0	5.8	6.2	1.0	1.2	1.3	1.5
Petroleum Products	2.1	1.4	2.4	2.4	0.6	0.6	0.9	0.8
Chemicals	4.0	2.3	4.7	3.7	0.8	0.9	1.4	1.4
Non-Metallic Mineral Products	5.9	6.9	5.5	6.7	0.8	1.1	1.0	1.1
Metals	2.3	1.6	4.0	3.2	0.8	0.8	1.1	1.0
Machinery	2.1	1.4	3.8	2.9	1.0	0.8	1.2	1.4
Transport Equipment	2.2	1.2	3.7	2.5	1.0	0.9	1.4	1.5
Other Manufacturing, nec	2.7	1.4	5.4	3.8	1.0	0.8	1.2	0.8
Construction	8.4	8.2	8.9	8.9	1.1	1.2	1.1	1.1
Electricity, Gas and Water Supply	1.1	1.2	1.8	2.3	0.5	0.7	0.7	1.2
Transport	4.3	2.2	5.4	3.8	0.9	0.9	0.9	0.9
Communication	0.7	0.7	2.4	1.8	0.7	1.0	1.3	2.4
Trade	3.2	3.3	6.7	7.3	1.6	2.0	1.8	2.3
Hotels and Restaurants	16.7	14.3	15.6	15.2	1.9	2.3	1.5	2.0
Financing, Real Estate and Business Activities	1.0	0.7	1.7	1.4	0.6	0.5	1.6	2.0
Other Services	2.0	2.9	3.5	5.0	1.4	2.2	4.4	5.8

Sources: Authors' computation using I-O table for India for the year 2009–10 provided by the Central Statistics Office, World Input-Output tables for India for the year 2011 using the World Input-Output Database (Timmer, 2012) and the 66th Round (2009–10) and 68th Round (2011–12) Employment–Unemployment Surveys conducted by the National Sample Survey Office (NSSO, 2011; 2013).

It is evident from Tables 8 and 9 that the number of jobs created indirectly by the sectors is much higher than the direct employment generation within sectors. Also, this creates a distinction between the manufacturing and the services sectors in terms of their employment creation. It is clear that the sub-sectors within the services sector are mainly engaged in creating medium-high and high skilled employment within the sector itself and in the other sectors, whereas most of the manufacturing sectors are creating direct and indirect low-medium skilled employment. However, some manufacturing sectors such as 'wood and wood products, furniture and fixtures' and 'pulp, paper, printing and publishing' are also able to create direct and indirect medium-high and high skilled employment.

4. Conclusion

The paper defines four types of employment based on general, technical and vocational education: low skilled, low-medium skilled, medium-high skilled and high skilled employment. By examining the share of each type of employment, the paper shows that most of the low skilled workers are absorbed in the agriculture sector, followed by the construction sub-sector within the non-manufacturing sector. Interestingly, the share of low-medium skilled workers is also the highest in the non-manufacturing sector, followed by that in the manufacturing and services sectors. Besides, the share of high-skilled workers is higher in the services sector. However, this employment share indicates the creation of employment only within a sector. Employment creation outside a sector is also crucial, which has been captured by estimating the employment linkages with respect to the different types of skills.

The linkage analysis shows that manufacturing sectors such as ‘textiles’ and ‘wood and wood products, furniture and fixtures’ create low-medium skilled employment, both directly as well as indirectly, through their employment linkage effects, whereas the services sectors such as ‘communication’, ‘trade’, ‘financing, real estate and business activities’ and ‘other services’ are creating direct and indirect medium-high and high skilled employment by having greater than unitary linkage coefficients corresponding to these two types of employment. Thus, these sectors are key employment-generating sectors for creating a specific type of direct and indirect employment, with both linkage coefficients being greater than unity.

However, relaxing the strict specification given by Diamond (1975), we found that manufacturing sectors such as ‘food, beverages and tobacco’, ‘leather products’, ‘non-metallic mineral products’ and ‘textiles’ can create direct and indirect low-medium and medium-high employment with one of the linkage coefficients being greater than unity.

In addition, if we want to identify the sectors which are important in terms of creating direct versus indirect jobs, the results show that based on 2011–12 data, sub-sectors like ‘food, beverages and tobacco’, ‘textiles’, and ‘hotels and restaurants’ are mostly creating a majority of the indirect jobs, while the sub-sectors ‘construction’, and ‘financing, real estate and business activities’ create jobs within themselves.

However, as evidence indicates, whether in the manufacturing or services sectors, we still need a combination of skills in the economy; as Kochhar et al. (2006) point out, managers are needed to supervise workers. Our results also reveal that certain sub-sectors such as ‘textiles’, ‘food and beverages’, ‘wood and wood products’ and ‘hotels and restaurants’ may generate employment for a spectrum of skills in India, whereas in contrast, the ‘construction’ sector mainly generates employment for the low skilled.

Based on 2009–10 data, the empirical results at the more granular level show that the following sectors are important in terms of employment creation both directly and indirectly with respect to different levels of skill:

- a. Within the sub-sector ‘food, beverages and tobacco’: edible oil, hydrogenated oil, miscellaneous food products;
- b. Within the sub-sector ‘textiles’: cotton textiles, jute textiles, hemp and mesta textiles;
- c. Within the sub-sector ‘transport equipment’: automobile, aircraft and spacecraft;

- d. Within the sub-sector 'transport': air transport, supporting and auxiliary transport activities;
- e. Within the sub-sector 'financing, real estate and business activities': banking, insurance, business services; and
- f. Within 'other services': education and research, medical and health, computer and related activities.

Therefore, these are the employment-generating sectors at the disaggregated level.

Moreover, the demand for medium-high skilled employment is relatively low in the economy, even within the services sector. Therefore, policies are needed to encourage this specific set of the workforce by providing additional training facilities like formal vocational training, and other courses. In addition, there is also a need to create appropriate jobs for them.

Thus, the analysis presents a distinction between the manufacturing versus services sectors in terms of their employment creation. The analysis clearly portrays that the services sectors are mainly engaged in creating medium-high and high skilled employment both within the sector itself and also in other sectors, while most of the manufacturing sectors are creating direct and indirect low-medium skilled employment. The exceptions are some manufacturing sectors such as 'wood and wood products, furniture and fixtures' and 'pulp, paper, printing and publishing', which are also able to create direct and indirect medium-high and high skilled employment.

Thus, this analysis helps policymakers understand the type of employment created by various sectors both directly and indirectly through their linkage effects, thereby enabling them to devise appropriate policies for each sector. The study also motivates policymakers to boost some select sectors in order to enhance different types of employment, thus proposing a way forward to join in the 'Skill India Mission'.

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Appendices

Appendix A.1: Education Codes

General Education Codes:
01- Not literate
02- Literate without formal schooling (EGS/NFEC/AEC)
03- TLC
04- Others
05- Literate: below primary
06- Primary
07- Middle
08- Secondary
10 - Higher secondary
11- Diploma/certificate course
12- Graduate
13- Post-graduate and above
Technical Education Codes:
01- No technical education
02- Technical degree in agriculture/engineering/technology/medicine, etc.
03- Diploma/certificate (below graduate level) in agriculture
04- Diploma/certificate (below graduate level) in engineering/technology
05- Diploma/certificate (below graduate level) in medicine
06- Diploma/certificate (below graduate level) in crafts
07- Diploma/certificate (below graduate level) in other subjects
08- Diploma/certificate (graduate and above level) in agriculture
09- Diploma/certificate (graduate and above level) in engineering/technology
10- Diploma/certificate (graduate and above level) in medicine
11- Diploma/certificate (graduate and above level) in crafts
12- Diploma/certificate (graduate and above level) in other subjects
Vocational Education Codes:
01- Yes: receiving formal vocational training
02- Received vocational training: formal
03- Received vocational training: non-formal: hereditary
04- Received vocational training: non-formal: self-learning
05- Received vocational training: non-formal: learning on the job
06- Received vocational training: non-formal: others
07- Did not receive any vocational training

Source: 68th (2011-12) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2013).

Appendix A.2: NSSO Codes Used for Computing Skills

- **Low Skilled Employment** = General education codes (01 to 05, that is, not literate to below primary) and/or technical education code (01, that is, no technical education) and/or vocational education code (7, that is, did not receive any vocational training); missing values in the respective codes.
- **Low–Medium Skilled Employment** = General education codes (06 to 08, that is, primary to secondary) and/or technical education code (01, that is, no technical education) and/or vocational education codes (1 to 6, that is, received vocational training); missing values in the respective codes.
- **Medium–High Skilled Employment** = General education codes (10, 11, that is, higher secondary and diploma/certificate course) and/or technical education codes (02 to 07, that is, diploma/certificate course below graduate level) and/or vocational education codes (1 to 6, that is, received vocational training); missing values in the respective codes.
- **High-skilled Employment** = General education codes (12, 13, that is, graduate, post-graduate & above) and/or technical education codes (08 to 12, that is, diploma/certificate course for graduate and above level) and/or vocational education codes (1 to 6, that is, received vocational training); missing values in the respective codes.

Table A.1: Share of Skilled Workforce (2011–12)

Skills	Frequency (Million)	Percentage	Cumulative Percentage
Low Skilled	156.0	37.1	37.1
Low-Medium Skilled	189.9	45.2	82.3
Medium-High Skilled	33.7	8.0	90.3
High Skilled	40.9	9.7	100.0
Missing cases	0.0	0.0	100.0
Total	420.5	100.0	

Notes: The colour codes in the table as follows:

Yellow: Low Skilled.

Purple: Low-Medium Skilled.

Green: Medium-High Skilled.

Blue: High Skilled.

Red: Missing cases.

Source: Authors' computations using the 68th (2011–12) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2013).

Table A.2: Concordance Table of Sectors in WIOD (2011), NIC (2008) and National Policy for Skill Development and Entrepreneurship (2015)

24 Sectors Listed by the National Policy for Skill Development and Entrepreneurship, 2015	35 Sectors in World I-O Table	23 Sectors in the Consolidated World I-O Table	Division of Sectors	Code of Sectors to Merge	NIC-2008 Codes¹⁴
Agriculture	AtB: Agriculture, Hunting, Forestry and Fishing	1. Agriculture	Primary Sector	AtB	01+02+03
	C: Mining and Quarrying	2. Mining and Quarrying	Non-manufacturing Sector	C	05+06+07+08+09
Food processing	15t16: Food, Beverages and Tobacco	3. Food, Beverages and Tobacco	Manufacturing Sector	15t16	10+11+12
Textile and Clothing, Handlooms	17t18: Textiles and Textile Products	4. Textiles		17t18	13+14
Furniture and Furnishing	20: Wood and Products of Wood and Cork	5. Wood and Wood Products, Furniture and Fixtures		20	16+31
	21t22: Pulp, Paper, Printing and Publishing	6. Pulp, Paper, Printing and Publishing		21t22	17+18+58+59
Leather and leather goods	19: Leather, Leather and Footwear	7. Leather products		19	15
	25: Rubber and Plastics	8. Rubber and plastics		25	22
	23: Coke, refined Petroleum and Nuclear Fuel	9. Coke, Refined Petroleum and Nuclear Fuel		23	19
Pharma	24: Chemicals and Chemical Products	10. Chemicals		24	20+21
	26: Other Non-Metallic Mineral	11. Other Non-Metallic Mineral Products		26	23
	27t28: Basic Metals and Fabricated Metal	12. Metals		27t28	24+25
	29: Machinery, nec	13. Machinery		29+30t33	26+27+28
	30t33: Electrical and Optical Equipment				
Auto and Auto Components	34t35: Transport Equipment	14. Transport Equipment		34t35	29+30

¹⁴ The detailed description of NIC-2008 codes is presented in Appendix Table A.3.

24 Sectors Listed by the National Policy for Skill Development and Entrepreneurship, 2015	35 Sectors in World I-O Table	23 Sectors in the Consolidated World I-O Table	Division of Sectors	Code of Sectors to Merge	NIC-2008 Codes¹⁴
Gems and Jewellery, Handicrafts	36t37: Manufacturing, nec; Recycling	15. Manufacturing, nec; Recycling		36t37	32+33
Construction	F: Construction	16. Construction	Non-manufacturing Sector	F	41+42+43
	E: Electricity, Gas and Water Supply	17. Electricity, Gas and water supply		E	35+36+37
Transportation	60: Inland Transport		Tertiary/Services sector	60+61+62+63	49+50+51+52
	61: Water Transport	18. Transport			
	62: Air Transport				
	63: Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies				
Telecommunications	64: Post and Telecommunications	19. Post and Telecommunications		64	53+60+61+63
	50: Sale, Maintenance and Repair of Motor Vehicles and Motor Cycles; Retail Sale of Fuel				45+46+47
	51: Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	20. Trade		50+51+52	
Retail	52: Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods				
Tourism, Hospitality and Travel, Logistics	H: Hotels and Restaurants	21. Hotels and restaurants		H	55+56
BFSI	J: Financial Intermediation				62+64+65+66+6
Building, Construction and Real Estate	70: Real Estate Activities	22. Financing, Real Estate and Business Activities		J+70+71t74	8+69+70+71+73+74+75+77+78+79+80+81+82

24 Sectors Listed by the National Policy for Skill Development and Entrepreneurship, 2015	35 Sectors in World I-O Table	23 Sectors in the Consolidated World I-O Table	Division of Sectors	Code of Sectors to Merge	NIC-2008 Codes¹⁴
Electronic & IT hardware	71t74: Renting of Machinery and Equipment and Other Business Activities				
	L: Public Administration and Defence; Compulsory Social Security				38+39+72+84+85+86+87+88+90+91+92+93+94+95+96+97
IT and ITES, Education/skill development	M: Education				
Healthcare	N: Health and Social Work				
Security, Media and Entertainment, Beauty and Wellness, Building Hardware	O: Other Community, Social and Personal Services	23. Other Services		L+M+N+O+P	
Domestic Help	P: Private Households with Employed Persons				

Sources: Authors' estimation using WIOD (2011), Timmer (2012), NIC (2008), and National Policy for Skill Development and Entrepreneurship (2015).

Table A.3: Detailed Description of NIC-2008 Codes and Merging Procedure of the Sectors

NIC-2008 Sectors	NIC-2008 Sector Codes	23 Sectors in the Consolidated World I-O Table	Codes to Merge from NIC-2008 Codes
Crop and Animal Production, Hunting and Related Service Activities	01	1. Agriculture	01+02+03
Forestry and Logging	02		
Fishing and Aquaculture	03		
Mining of Coal And Lignite	05	2. Mining and Quarrying	05+06+07+08+09
Extraction of Crude Petroleum and Natural Gas	06		
Mining of Metal Ores	07		
Other Mining and Quarrying	08		
Mining Support Service Activities	09		
Manufacture of Food Products	10	3. Food, Beverages and Tobacco	10+11+12
Manufacture of Beverages	11		
Manufacture of Tobacco Products	12		
Manufacture of Textiles	13	4. Textiles	13+14
Manufacture of Wearing Apparel	14		
Manufacture of Wood and of Products of Wood and Cork, Except Furniture; Manufacture of Articles of Straw and Plaiting Materials	16	5. Wood and Wood Products, Furniture and Fixture	16+31
Manufacture of Furniture	31		
Manufacture of Paper and Paper Products	17		
Printing and Reproduction of Recorded Media	18	6. Pulp, Paper, Printing and Publishing	17+18+58+59
Publishing Activities	58		
Motion Picture, Video and Television Programme Production, Sound Recording and Music Publishing Activities	59		
Manufacture of Leather and Related Products	15		
Manufacture of Rubber and Plastics Products	22	7. Leather products	15
Manufacture of Coke and Refined Petroleum Products	19	8. Rubber and Plastics	22
		9. Coke, Refined Petroleum and Nuclear Fuel	19
Manufacture of Chemicals and Chemical Products	20	10. Chemicals	20+21
Manufacture of Pharmaceuticals, Medicinal Chemical and Botanical Products	21		
Manufacture of Other Non-Metallic Mineral Products	23	11. Other Non-Metallic Mineral Products	23
Manufacture of Basic Metals	24	12. Metals	24+25
Manufacture of Fabricated Metal Products, Except Machinery and Equipment	25		

NIC-2008 Sectors	NIC-2008 Sector Codes	23 Sectors in the Consolidated World I-O Table	Codes to Merge from NIC-2008 Codes
Manufacture of Computer, Electronic and Optical Products	26		26+27+28
Manufacture of Electrical Equipment	27	13. Machinery	
Manufacture of Machinery and Equipment nec	28		
Manufacture of Motor Vehicles, Trailers and Semi-Trailers	29	14. Transport Equipment	29+30
Manufacture of Other Transport Equipment	30		
Other Manufacturing	32	15. Manufacturing, nec; Recycling	32+33
Repair and Installation of Machinery and Equipment	33		
Construction of Buildings	41	16. Construction	41+42+43
Civil Engineering	42		
Specialised Construction Activities	43		
Electricity, Gas, Steam and Air Condition Supply	35	17. Electricity, Gas and Water Supply	35+36+37
Water Collection, Treatment and Supply	36		
Sewerage	37		
Land Transport and Transport via Pipelines	49	18. Transport	49+50+51+52
Water Transport	50		
Air Transport	51		
Warehousing and Support Activities for Transportation	52		
Postal and Courier Activities	53	19. Post and Telecommunications	53+60+61+63
Programming and Broadcasting Activities	60		
Telecommunications	61		
Information Service Activities	63		
Wholesale and Retail Trade And Repair of Motor Vehicles And Motorcycles	45	20. Trade	45+46+47
Wholesale Trade, Except of Motor Vehicles and Motorcycles	46		
Retail Trade, Except Of Motor Vehicles and Motorcycles	47		
Accommodation	55	21. Hotels and Restaurants	55+56
Food and Beverage Service Activities	56		
Computer Programming, Consultancy and Related Activities			62+64+65+66+68+69+70+71+73+74+75+77+78+79+80+81+82
	62		
Financial Service Activities, Except Insurance and Pension Funding	64	22. Financing, Real Estate and Business Activities	
Insurance, Reinsurance and Pension Funding, Except Compulsory Social Security	65		
Other Financial Activities	66		
Real Estate Activities	68		

NIC-2008 Sectors	NIC-2008 Sector Codes	23 Sectors in the Consolidated World I-O Table	Codes to Merge from NIC-2008 Codes
Legal and Accounting Activities	69		
Activities of Head Offices; Management Consultancy Activities	70		
Architecture and Engineering Activities; Technical Testing and Analysis	71		
Advertising and Market Research	73		
Other Professional, Scientific and Technical Activities	74		
Veterinary Activities	75		
Rental and Leasing Activities	77		
Employment Activities	78		
Travel Agency, Tour Operator and Other Reservation Service Activities	79		
Security and Investigation Activities	80		
Services to Buildings and Landscape Activities	81		
Office Administrative, Office Support and Other Business Support Activities	82		
Waste Collection, Treatment and Disposal Activities; Materials Recovery			38+39+72+84+85+86+87+88+90+91+92+93+94+95+96+97
	38		
Remediation Activities and Other Waste Management Services	39		
Scientific Research and Development	72		
Public Administration and Defence; Compulsory Social Security	84		
Education	85		
Human Health Activities	86		
Residential Care Activities	87		
Social Work Activities without Accommodation	88	23. Other Services	
Creative, Arts and Entertainment Activities	90		
Libraries, Archives, Museums and Other Cultural Activities	91		
Gambling and Betting Activities	92		
Sports Activities and Amusement and Recreation Activities	93		
Activities of Membership Organisations	94		
Repair of Computers and Personal and Household Goods	95		
Other Personal Service Activities	96		
Activities of Households as Employers of Domestic Personnel	97		

Source: Authors' estimation using NIC (2008) published by the Central Statistics Office (2008).

Table A.4: Combining Technical Education, General Education and Vocational Education, 2011-12 (Number of Workers by Usual and Subsidiary Status) (figures in parentheses show percentages)

GE and TE	Vocational Education							Did Not Receive Any Vocational Training=7	MS
	Receiving Formal Vocational Training=1	Received Formal Vocational Training=2	Received Non-Formal Vocational Training: Hereditary=3	Received Non-Formal Vocational Training: Self-Learning=4	Received Non-Formal Vocational Training: Learning on the Job=5	Received Non-Formal Vocational Training: Others=6			
LS	0.1 (0.05)	0.3 (0.2)	8.2 (4.7)	3.0 (1.7)	6.95 (3.97)	0.4 (0.2)	131 (74.9)	24.9 (14.2)	
LMS	0.7 (0.4)	3.2 (1.8)	9.1 (5.2)	5.0 (2.9)	12.4 (7.1)	1.1 (0.7)	134 (76.6)	9.4 (5.4)	
MHS	0.8 (2.5)	3.1 (9.1)	0.9 (2.8)	0.8 (2.4)	1.8 (5.4)	0.2 (0.7)	25.0 (74.3)	1 (3.0)	
HS	1.1 (2.9)	3.6 (9.7)	0.5 (1.2)	0.5 (1.4)	1.4 (3.7)	0.1 (0.3)	28.6 (77.5)	1.2 (3.4)	
MS	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.01 (64.6)	0.01 (35.4)	

Notes: The colour codes for the table are as follows:

Yellow: Low Skilled in general and technical education without vocational training.

Purple: Low skilled in general and technical education with vocational training.

Light blue: low-medium skilled in general and technical education with vocational training.

Orange: low-medium skilled in general and technical education without vocational training.

Deep Green: medium-high skilled in general and technical education with vocational training.

Light Green: medium-high skilled in general and technical education without vocational training.

Deep Blue: High Skilled in general and technical education with vocational training.

Gray: High Skilled in general and technical education without vocational training.

Red: Missing cases.

LS is low-skilled.

LMS is for low-medium skilled.

MHS is for medium-high skilled.

HS is for high-skilled.

MS is for missing cases.

Source: Authors' computations using the 68th Round (2011–12) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2013).

Table A.5: Skill-Based Employment Linkages across 130 Sectors for India (2009-10)

SC	Sectors	EBL for Low Skill	EFL for Low Skill	EBL for Low-Med Skill	EFL for Low-Med Skill	EBL for Med-High Skill	EFL for Med-High Skill	EBL for High Skill	EFL for High Skill
1	Paddy	3.85	2.67	2.93	0.83	2.21	0.33	1.07	0.11
2	Wheat	3.23	2.26	2.44	0.71	1.83	0.28	0.87	0.09
3	Jowar	3.70	2.32	2.81	0.73	2.13	0.28	1.04	0.09
4	Bajra	2.63	2.28	1.97	0.71	1.44	0.28	0.65	0.09
5	Maize	3.12	2.04	2.35	0.64	1.74	0.25	0.80	0.08
6	Gram	3.14	4.07	2.36	1.27	1.75	0.50	0.80	0.16
7	Pulses	4.01	3.62	3.05	1.13	2.29	0.44	1.09	0.15
8	Sugarcane	2.80	2.65	2.10	0.83	1.56	0.32	0.72	0.11
9	Groundnut	3.23	3.20	2.42	1.00	1.79	0.39	0.81	0.13
10	Coconut	2.94	2.46	2.21	0.77	1.64	0.30	0.75	0.10
11	Other Oilseeds	3.24	3.74	2.45	1.17	1.83	0.46	0.86	0.15
12	Jute	3.24	4.89	2.46	1.53	1.87	0.60	0.92	0.20
13	Cotton	3.20	3.79	2.42	1.18	1.81	0.46	0.86	0.15
14	Tea	2.82	3.17	2.11	0.99	1.55	0.39	0.68	0.13
15	Coffee	3.11	2.87	2.37	0.89	1.78	0.35	0.86	0.12
16	Rubber	2.76	5.04	2.07	1.57	1.54	0.61	0.71	0.20
17	Tobacco	2.99	2.10	2.27	0.65	1.71	0.26	0.83	0.08
18	Fruits	2.65	2.60	1.98	0.81	1.44	0.32	0.63	0.10
19	Vegetables	2.78	3.47	2.08	1.08	1.53	0.42	0.68	0.14
20	Other Crops	3.09	4.06	2.34	1.27	1.75	0.50	0.82	0.16
21	Milk and Milk Products	2.82	1.72	2.12	0.54	1.56	0.21	0.69	0.07
22	Animal Services (Agricultural)	4.68	4.68	3.67	1.46	2.88	0.57	1.48	0.19
23	Poultry and Eggs	3.19	3.39	2.41	1.06	1.78	0.41	0.79	0.14
24	Other Livestock Production	3.33	2.48	2.54	0.77	1.92	0.30	0.90	0.10
25	Forestry and Logging	0.19	0.14	0.17	0.04	0.13	0.00	0.14	0.00
26	Fishing	0.37	0.19	0.54	0.12	0.27	0.02	0.22	0.01

SC	Sectors	EBL for Low Skill	EFL for Low Skill	EBL for Low-Med Skill	EFL for Low-Med Skill	EBL for Med-High Skill	EFL for Med-High Skill	EBL for High Skill	EFL for High Skill
27	Coal and Lignite	0.11	0.19	0.17	0.12	0.47	0.26	1.05	0.52
28	Natural Gas	0.03	0.01	0.03	0.00	0.11	0.06	0.12	0.05
29	Crude Petroleum	0.09	0.02	0.12	0.03	0.20	0.17	0.30	0.28
30	Iron Ore	0.09	0.14	0.18	0.12	0.14	0.04	0.20	0.05
31	Manganese Ore	0.10	0.39	0.18	0.35	0.10	0.00	0.13	0.00
32	Bauxite	1.31	5.51	0.71	1.10	0.98	0.86	1.25	0.94
33	Copper Ore	0.24	21.02	1.46	88.13	3.15	106.78	4.00	109.83
34	Other Metallic Minerals	0.15	0.26	0.16	0.10	0.28	0.11	0.40	0.12
35	Limestone	0.39	0.60	0.41	0.23	0.39	0.10	0.32	0.04
36	Mica	0.27	10.84	0.29	4.26	0.50	4.07	0.90	4.76
37	Other Non-Metallic Minerals	1.06	1.54	0.96	0.49	1.10	0.28	0.69	0.04
38	Sugar	1.21	0.03	1.13	0.04	1.09	0.03	0.86	0.01
39	Khandsari, Boora	1.19	0.01	1.07	0.02	0.93	0.00	0.81	0.01
40	Hydrogenated Oil (Vanaspati)	1.74	0.00	1.44	0.00	1.58	0.10	0.90	0.04
41	Edible Oils Other Than Vanaspati	2.01	0.01	1.63	0.01	1.35	0.01	0.78	0.01
42	Tea and Coffee Processing	1.34	0.04	1.18	0.02	1.01	0.00	0.77	0.00
43	Miscellaneous Food Products	2.48	0.19	2.17	0.14	1.72	0.06	1.07	0.04
44	Beverages	1.22	0.06	1.19	0.06	1.02	0.02	0.78	0.02
45	Tobacco Products	2.83	1.33	2.21	0.42	0.98	0.06	0.60	0.02
46	Khadi, Cotton Textiles (Handlooms)	0.79	0.27	1.36	0.35	1.15	0.14	0.83	0.07
47	Cotton Textiles	1.42	0.19	1.86	0.25	1.56	0.10	1.09	0.05
48	Woolen Textiles	0.90	0.23	1.55	0.30	1.34	0.12	1.01	0.06
49	Silk Textiles	0.70	0.24	1.42	0.31	1.26	0.12	1.07	0.06
50	Art Silk, Synthetic Fibre Textiles	0.79	0.25	1.41	0.32	1.25	0.13	1.02	0.06
51	Jute, Hemp, Mesta Textiles	1.37	0.35	1.72	0.45	1.42	0.18	0.95	0.09

SC	Sectors	EBL for Low Skill	EFL for Low Skill	EBL for Low-Med Skill	EFL for Low-Med Skill	EBL for Med-High Skill	EFL for Med-High Skill	EBL for High Skill	EFL for High Skill
52	Carpet Weaving	0.76	0.14	1.41	0.18	1.22	0.07	0.94	0.04
53	Readymade Garments	0.70	0.16	1.39	0.21	1.20	0.08	0.96	0.04
54	Miscellaneous Textile Products	0.85	0.21	1.47	0.27	1.29	0.11	1.02	0.05
55	Furniture and Fixtures—Wooden	0.81	0.64	1.29	0.45	0.82	0.12	0.64	0.05
56	Wood and Wood Products	1.39	1.58	1.60	0.76	0.81	0.16	0.55	0.06
57	Paper, Paper Products and Newsprint	0.37	0.07	0.55	0.09	0.76	0.10	0.89	0.11
58	Printing and Publishing	0.37	0.05	0.78	0.12	1.55	0.18	1.74	0.17
59	Leather Footwear	0.84	0.20	1.26	0.17	1.14	0.06	1.07	0.05
60	Leather and Leather Products	0.60	0.10	0.85	0.11	1.04	0.09	0.79	0.04
61	Rubber Products	0.49	0.01	0.58	0.03	0.67	0.03	0.65	0.02
62	Plastic Products	0.42	0.02	0.58	0.05	0.71	0.05	0.77	0.04
63	Petroleum Products	0.09	0.00	0.13	0.00	0.21	0.00	0.30	0.00
64	Coal Tar Products	0.17	0.02	0.27	0.03	0.41	0.03	0.67	0.07
65	Inorganic Heavy Chemicals	0.40	0.04	0.50	0.05	0.61	0.05	0.82	0.11
66	Organic Heavy Chemicals	0.41	0.04	0.49	0.05	0.58	0.05	0.76	0.11
67	Fertilizers	0.33	0.02	0.43	0.02	0.61	0.05	0.82	0.09
68	Pesticides	0.35	0.00	0.45	0.03	0.56	0.03	0.64	0.04
69	Paints, Varnishes and Lacquers	0.32	0.00	0.39	0.01	0.50	0.02	0.60	0.03
70	Drugs and Medicines	0.49	0.01	0.56	0.02	0.73	0.04	1.34	0.14
71	Soaps, Cosmetics and Glycerin	0.49	0.03	0.66	0.05	0.60	0.01	0.70	0.01
72	Synthetic Fibres, Resin	0.32	0.00	0.40	0.00	0.47	0.00	0.53	0.00
73	Other Chemicals	0.55	0.12	0.60	0.08	0.62	0.04	0.71	0.09
74	Structural Clay Products	1.22	1.23	0.79	0.26	0.61	0.08	0.55	0.05
75	Cement	0.25	0.05	0.40	0.07	0.47	0.03	0.62	0.04

SC	Sectors	EBL for Low Skill	EFL for Low Skill	EBL for Low-Med Skill	EFL for Low-Med Skill	EBL for Med-High Skill	EFL for Med-High Skill	EBL for High Skill	EFL for High Skill
76	Other Non-Metallic Mineral Products	0.68	0.47	0.69	0.16	0.68	0.06	0.62	0.02
77	Iron, Steel and Ferro Alloys	0.19	0.03	0.36	0.02	0.59	0.03	0.82	0.05
78	Iron and Steel Casting and Forging	0.20	0.01	0.38	0.02	0.60	0.02	0.76	0.01
79	Iron and Steel foundries	0.22	0.04	0.46	0.06	0.69	0.03	0.91	0.04
80	Non-ferrous Basic Metals	0.24	0.10	0.59	0.13	1.02	0.08	1.31	0.07
81	Hand Tools, Hardware	0.35	0.21	0.66	0.18	0.81	0.09	0.81	0.02
82	Miscellaneous Metal Products	0.25	0.08	0.64	0.15	0.85	0.06	1.15	0.08
83	Tractors and Agricultural Implements	0.27	0.07	0.42	0.02	0.64	0.02	0.87	0.02
84	Industrial Machinery (F & T)	0.24	0.04	0.46	0.03	0.69	0.02	1.52	0.14
85	Industrial Machinery (Others)	0.20	0.00	0.39	0.02	0.64	0.03	0.78	0.01
86	Machine Tools	0.22	0.02	0.43	0.03	0.65	0.03	0.77	0.01
87	Other Non-Electrical Machinery	0.21	0.02	0.45	0.05	0.74	0.05	0.95	0.04
88	Electrical Industrial Machinery	0.22	0.01	0.43	0.02	0.74	0.04	0.98	0.04
89	Electrical Wires and Cables	0.23	0.02	0.48	0.03	0.81	0.05	1.02	0.05
90	Batteries	0.24	0.02	0.45	0.04	0.75	0.06	0.95	0.06
91	Electrical Appliances	0.21	0.01	0.41	0.02	0.70	0.02	0.94	0.02
92	Communication Equipments	0.20	0.02	0.41	0.04	0.72	0.06	0.97	0.06
93	Other Electrical Machinery	0.22	0.02	0.46	0.04	0.80	0.06	1.04	0.06
94	Electronic Equipment (including TV)	0.17	0.00	0.38	0.04	0.65	0.04	0.98	0.07
95	Ships and Boats	0.16	0.00	0.43	0.05	0.51	0.01	1.37	0.11
96	Rail Equipments	0.20	0.02	0.35	0.03	0.53	0.04	0.82	0.08
97	Motor Vehicles	0.22	0.01	0.40	0.01	0.67	0.02	0.97	0.03
98	Motorcycles and Scooters	0.19	0.01	0.37	0.01	0.74	0.04	0.89	0.03

SC	Sectors	EBL for Low Skill	EFL for Low Skill	EBL for Low-Med Skill	EFL for Low-Med Skill	EBL for Med-High Skill	EFL for Med-High Skill	EBL for High Skill	EFL for High Skill
99	Bicycles, Cycle-rickshaw	0.29	0.06	0.45	0.02	0.62	0.01	0.71	0.01
100	Other Transport Equipment	0.54	0.37	1.92	0.70	1.94	0.34	1.06	0.09
101	Watches and Clocks	0.14	0.00	0.31	0.05	0.33	0.01	0.36	0.00
102	Medical, Precision and Optical Instruments	0.29	0.01	0.45	0.01	0.70	0.03	1.10	0.06
103	Gems and Jewellery	0.38	0.01	0.71	0.06	0.81	0.02	0.82	0.01
104	Aircraft and Spacecraft	0.21	0.00	0.57	0.15	2.00	0.49	7.58	1.73
105	Miscellaneous Manufacturing	0.39	0.21	0.67	0.19	0.80	0.10	0.85	0.06
106	Construction	0.72	0.33	0.79	0.14	0.63	0.04	0.65	0.03
107	Electricity	0.12	0.02	0.21	0.03	0.40	0.05	0.66	0.08
108	Water Supply	0.10	0.04	0.22	0.06	0.41	0.07	0.37	0.05
109	Railway Transport Services	0.16	0.05	0.28	0.05	0.58	0.10	1.00	0.15
110	Land Transport including via Pipeline	0.61	0.20	0.78	0.16	0.82	0.09	0.59	0.03
111	Water transport	0.19	0.00	0.34	0.05	0.40	0.03	0.71	0.09
112	Air Transport	0.21	0.00	0.31	0.01	0.46	0.02	0.98	0.11
113	Supporting and Auxiliary Transport Activities	0.40	0.09	0.56	0.10	0.76	0.10	1.18	0.17
114	Storage and Warehousing	0.37	0.38	0.58	0.28	0.41	0.06	1.40	0.37
115	Communication	0.07	0.01	0.31	0.08	0.68	0.10	1.02	0.13
116	Trade	0.32	0.30	0.68	0.31	1.03	0.27	1.01	0.20
117	Hotels and Restaurants	1.66	0.25	1.55	0.19	1.30	0.09	0.80	0.06
118	Banking	0.08	0.01	0.14	0.03	0.29	0.06	1.13	0.26
119	Insurance	0.14	0.00	0.25	0.06	0.87	0.25	1.88	0.49
120	Ownership of Dwellings	0.03	0.00	0.04	0.00	0.06	0.00	0.10	0.01
121	Education and Research	0.12	0.03	0.27	0.05	1.46	0.20	5.21	0.62
122	Medical and Health	0.35	0.02	0.52	0.05	1.19	0.12	2.26	0.22
123	Business Services	0.29	0.04	0.45	0.08	1.05	0.22	1.90	0.37

SC	Sectors	EBL for Low Skill	EFL for Low Skill	EBL for Low-Med Skill	EFL for Low-Med Skill	EBL for Med-High Skill	EFL for Med-High Skill	EBL for High Skill	EFL for High Skill
124	Computer and Related Activities	0.09	0.00	0.13	0.00	0.34	0.02	1.47	0.13
125	Legal Services	0.07	0.01	0.16	0.04	0.70	0.18	3.43	0.80
126	Real Estate Activities	0.12	0.01	0.30	0.06	0.55	0.08	1.04	0.11
127	Renting of Machinery and Equipment	0.39	0.49	1.06	0.66	2.47	0.87	1.45	0.30
128	Other community, Social and Personal Services	0.21	0.13	0.38	0.11	0.51	0.08	0.94	0.13
129	Other Services	1.41	1.31	1.39	0.51	1.41	0.27	1.07	0.13
130	Public Administration	0.05	0.03	0.23	0.06	0.83	0.11	1.49	0.17

Notes: EBL = employment backward linkage, EFL = employment forward linkage.

The colour codes for the table are as follows:

Red: Both employment forward and backward linkage coefficients with varying levels of skill having greater than unitary value

Green: Either one of the linkage coefficients (either forward or backward) with varying levels of skill having greater than unitary value.

Sources: Authors' computation using I-O table for India for the year 2009–10 provided by the Central Statistics Office and the 66th Round (2009–10) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2011).

**Table A.6: Number of Direct and Indirect Creation of Jobs (million),
2009–10**

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium -High Skilled Employment	High Skilled Employment
		Creation of Jobs within the Sector (million)				Indirect Creation of jobs (million)			
1	Paddy	16.5	13.3	1.5	0.6	4.3	3.8	0.5	0.3
2	Wheat	9.6	7.8	0.9	0.4	3.6	3.2	0.4	0.2
3	Jowar	0.5	0.4	0.0	0.0	4.2	3.7	0.4	0.3
4	Bajra	0.5	0.4	0.0	0.0	3.0	2.6	0.3	0.2
5	Maize	1.2	1.0	0.1	0.0	3.5	3.1	0.4	0.2
6	Gram	1.3	1.0	0.1	0.0	3.5	3.1	0.4	0.2
7	Pulses	3.8	3.1	0.3	0.1	4.5	4.0	0.5	0.3
8	Sugarcane	3.4	2.7	0.3	0.1	3.1	2.7	0.3	0.2
9	Groundnut	1.2	1.0	0.1	0.0	3.6	3.2	0.4	0.2
10	Coconut	0.8	0.6	0.1	0.0	3.3	2.9	0.3	0.2
11	Other Oilseeds	4.1	3.3	0.4	0.2	3.6	3.2	0.4	0.2
12	Jute	0.3	0.2	0.0	0.0	3.6	3.2	0.4	0.2
13	Cotton	2.7	2.2	0.2	0.1	3.6	3.1	0.4	0.2
14	Tea	0.4	0.3	0.0	0.0	3.2	2.7	0.3	0.2
15	Coffee	0.3	0.3	0.0	0.0	3.5	3.1	0.4	0.2
16	Rubber	0.7	0.5	0.1	0.0	3.1	2.7	0.3	0.2
17	Tobacco	0.6	0.5	0.1	0.0	3.4	3.0	0.4	0.2
18	Fruits	6.1	4.9	0.5	0.2	3.0	2.6	0.3	0.2
19	Vegetables	8.2	6.6	0.7	0.3	3.1	2.7	0.3	0.2
20	Other Crops	10.9	8.8	1.0	0.4	3.5	3.0	0.4	0.2
21	Milk and Milk Products	14.1	11.3	1.2	0.5	3.2	2.8	0.3	0.2

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium -High Skilled Employment	High Skilled Employment
22	Animal Services (Agricultural)	3.0	2.4	0.3	0.1	5.3	4.8	0.6	0.4
23	Poultry and Eggs	2.3	1.9	0.2	0.1	3.6	3.1	0.4	0.2
24	Other Livestock Production	4.8	3.8	0.4	0.2	3.7	3.3	0.4	0.2
25	Forestry and Logging	0.3	0.2	0.0	0.0	0.2	0.2	0.0	0.0
26	Fishing	0.5	0.8	0.0	0.0	0.4	0.7	0.1	0.1
27	Coal and Lignite	0.1	0.2	0.1	0.3	0.1	0.2	0.1	0.3
28	Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	Crude Petroleum	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1
30	Iron Ore	0.0	0.1	0.0	0.0	0.1	0.2	0.0	0.1
31	Manganese Ore	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0
32	Bauxite	0.0	0.0	0.0	0.0	1.5	0.9	0.2	0.3
33	Copper Ore	0.0	0.0	0.0	0.0	0.3	1.9	0.7	1.0
34	Other Metallic Minerals	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1
35	Limestone	0.0	0.0	0.0	0.0	0.4	0.5	0.1	0.1
36	Mica	0.0	0.0	0.0	0.0	0.3	0.4	0.1	0.2
37	Other Non-Metallic Minerals	0.7	0.6	0.1	0.0	1.2	1.2	0.2	0.2
38	Sugar	0.0	0.2	0.0	0.0	1.4	1.5	0.2	0.2
39	Khandsari, Boora	0.0	0.0	0.0	0.0	1.3	1.4	0.2	0.2
40	Hydrogenated Oil (<i>Vanaspati</i>)	0.0	0.0	0.0	0.0	2.0	1.9	0.3	0.2

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment
41	Edible Oils Other Than Vanaspati	0.0	0.1	0.0	0.0	2.3	2.1	0.3	0.2
42	Tea and Coffee Processing	0.0	0.1	0.0	0.0	1.5	1.5	0.2	0.2
43	Miscellaneous Food Products	1.2	2.2	0.2	0.2	2.8	2.8	0.4	0.3
44	Beverages	0.1	0.2	0.0	0.0	1.4	1.5	0.2	0.2
45	Tobacco Products	1.9	1.6	0.1	0.0	3.2	2.9	0.2	0.2
46	Khadi, Cotton Textiles (Handlooms)	0.1	0.2	0.0	0.0	0.9	1.8	0.2	0.2
47	Cotton Textiles	0.7	2.3	0.3	0.2	1.6	2.4	0.3	0.3
48	Woollen Textiles	0.1	0.2	0.0	0.0	1.0	2.0	0.3	0.3
49	Silk Textiles	0.0	0.1	0.0	0.0	0.8	1.8	0.3	0.3
50	Art Silk, Synthetic Fibre Textiles	0.4	1.4	0.2	0.1	0.9	1.8	0.3	0.3
51	Jute, Hemp, Mesta Textiles	0.1	0.2	0.0	0.0	1.5	2.2	0.3	0.2
52	Carpet Weaving	0.1	0.2	0.0	0.0	0.9	1.8	0.3	0.2
53	Readymade Garments	0.9	3.0	0.3	0.2	0.8	1.8	0.3	0.2
54	Miscellaneous Textile Products	0.5	1.5	0.2	0.1	1.0	1.9	0.3	0.3
55	Furniture and Fixtures-Wooden	0.9	1.6	0.1	0.1	0.9	1.7	0.2	0.2

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium -High Skilled Employment	High Skilled Employment
56	Wood and Wood Products	1.4	1.7	0.1	0.1	1.6	2.1	0.2	0.1
57	Paper, Paper Products and Newsprint	0.1	0.2	0.1	0.1	0.4	0.7	0.2	0.2
58	Printing and Publishing	0.1	0.4	0.2	0.2	0.4	1.0	0.3	0.4
59	Leather Footwear	0.1	0.3	0.0	0.0	0.9	1.6	0.2	0.3
60	Leather and Leather Products	0.1	0.2	0.1	0.0	0.7	1.1	0.2	0.2
61	Rubber products	0.0	0.1	0.0	0.0	0.6	0.8	0.1	0.2
62	Plastic Products	0.0	0.3	0.1	0.1	0.5	0.8	0.1	0.2
63	Petroleum Products	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1
64	Coal tar Products	0.0	0.0	0.0	0.0	0.2	0.3	0.1	0.2
65	Inorganic Heavy Chemicals	0.0	0.1	0.0	0.1	0.5	0.7	0.1	0.2
66	Organic Heavy Chemicals	0.0	0.1	0.0	0.1	0.5	0.6	0.1	0.2
67	Fertilizers	0.0	0.0	0.0	0.0	0.4	0.6	0.1	0.2
68	Pesticides	0.0	0.0	0.0	0.0	0.4	0.6	0.1	0.2
69	Paints, Varnishes and Lacquers	0.0	0.0	0.0	0.0	0.4	0.5	0.1	0.2
70	Drugs and Medicines	0.0	0.1	0.1	0.3	0.6	0.7	0.2	0.3

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium -High Skilled Employment	High Skilled Employment
71	Soaps, Cosmetics and Glycerin	0.1	0.3	0.0	0.0	0.5	0.9	0.1	0.2
72	Synthetic Fibres, Resin	0.0	0.0	0.0	0.0	0.4	0.5	0.1	0.1
73	Other Chemicals	0.1	0.1	0.0	0.0	0.6	0.8	0.1	0.2
74	Structural Clay Products	1.1	0.6	0.1	0.0	1.4	1.0	0.1	0.1
75	Cement	0.1	0.3	0.0	0.1	0.3	0.5	0.1	0.2
76	Other Non-Metallic Mineral Products	0.7	0.6	0.1	0.0	0.8	0.9	0.1	0.2
77	Iron, Steel and Ferro Alloys	0.1	0.3	0.1	0.2	0.2	0.5	0.1	0.2
78	Iron and Steel Casting and Forging	0.0	0.1	0.0	0.0	0.2	0.5	0.1	0.2
79	Iron and Steel Foundries	0.1	0.3	0.0	0.1	0.2	0.6	0.1	0.2
80	Non-Ferrous Basic Metals	0.1	0.2	0.0	0.0	0.3	0.8	0.2	0.3
81	Hand Tools, Hardware	0.1	0.3	0.0	0.0	0.4	0.9	0.2	0.2
82	Miscellaneous Metal Products	0.2	1.0	0.1	0.2	0.3	0.8	0.2	0.3
83	Tractors and Agricultural Implements	0.1	0.1	0.0	0.0	0.3	0.5	0.1	0.2
84	Industrial Machinery (F & T)	0.0	0.0	0.0	0.1	0.3	0.6	0.1	0.4

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium -High Skilled Employment	High Skilled Employment
85	Industrial Machinery (Others)	0.0	0.0	0.0	0.0	0.2	0.5	0.1	0.2
86	Machine Tools	0.0	0.1	0.0	0.0	0.2	0.6	0.1	0.2
87	Other Non-Electrical Machinery	0.1	0.5	0.2	0.2	0.2	0.6	0.2	0.2
88	Electrical Industrial Machinery	0.0	0.1	0.1	0.1	0.2	0.6	0.2	0.3
89	Electrical Wires and Cables	0.0	0.0	0.0	0.0	0.3	0.6	0.2	0.3
90	Batteries	0.0	0.0	0.0	0.0	0.3	0.6	0.2	0.2
91	Electrical Appliances	0.0	0.0	0.0	0.0	0.2	0.5	0.1	0.2
92	Communication Equipment	0.0	0.1	0.0	0.0	0.2	0.5	0.2	0.2
93	Other Electrical Machinery	0.0	0.1	0.0	0.1	0.2	0.6	0.2	0.3
94	Electronic Equipment (including TV)	0.0	0.1	0.0	0.1	0.2	0.5	0.1	0.3
95	Ships and Boats	0.0	0.0	0.0	0.0	0.2	0.6	0.1	0.4
96	Rail Equipment	0.0	0.0	0.0	0.0	0.2	0.4	0.1	0.2
97	Motor Vehicles	0.1	0.2	0.1	0.2	0.2	0.5	0.1	0.2
98	Motorcycles and Scooters	0.0	0.1	0.1	0.1	0.2	0.5	0.2	0.2
99	Bicycles, Cycle-Rickshaw	0.0	0.0	0.0	0.0	0.3	0.6	0.1	0.2

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium -High Skilled Employment	High Skilled Employment
100	Other Transport Equipment	0.0	0.2	0.0	0.0	0.6	2.5	0.4	0.3
101	Watches and Clocks	0.0	0.0	0.0	0.0	0.2	0.4	0.1	0.1
102	Medical, Precision and Optical Instruments	0.0	0.0	0.0	0.1	0.3	0.6	0.1	0.3
103	Gems and Jewellery	0.1	1.1	0.1	0.1	0.4	0.9	0.2	0.2
104	Aircraft and Spacecraft	0.0	0.0	0.0	0.0	0.2	0.7	0.4	1.9
105	Miscellaneous Manufacturing	0.2	0.5	0.1	0.1	0.4	0.9	0.2	0.2
106	Construction	17.2	18.5	1.4	1.2	0.8	1.0	0.1	0.2
107	Electricity	0.1	0.4	0.2	0.3	0.1	0.3	0.1	0.2
108	Water supply	0.0	0.1	0.0	0.0	0.1	0.3	0.1	0.1
109	Railway Transport Services	0.1	0.3	0.2	0.3	0.2	0.4	0.1	0.3
110	Land Transport including via Pipeline	3.9	8.0	1.3	0.6	0.7	1.0	0.2	0.2
111	Water Transport	0.0	0.1	0.0	0.0	0.2	0.4	0.1	0.2
112	Air Transport	0.0	0.0	0.0	0.1	0.2	0.4	0.1	0.3
113	Supporting and Auxiliary Transport Activities	0.1	0.3	0.1	0.2	0.4	0.7	0.2	0.3

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium -High Skilled Employment	High Skilled Employment
114	Storage and Warehousing	0.0	0.1	0.0	0.0	0.4	0.8	0.1	0.4
115	Communication	0.0	0.8	0.3	0.5	0.1	0.4	0.1	0.3
116	Trade	7.6	20.4	4.9	4.8	0.4	0.9	0.2	0.3
117	Hotels and Restaurants	1.6	3.0	0.4	0.3	1.9	2.0	0.3	0.2
118	Banking	0.0	0.6	0.3	1.7	0.1	0.2	0.1	0.3
119	Insurance	0.0	0.1	0.2	0.4	0.2	0.3	0.2	0.5
120	Ownership of Dwellings	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0
121	Education and Research	0.4	1.5	1.7	6.7	0.1	0.3	0.3	1.3
122	Medical and Health	0.2	0.9	0.6	1.4	0.4	0.7	0.2	0.6
123	Business Services	0.1	0.5	0.4	0.8	0.3	0.6	0.2	0.5
124	Computer and Related Activities	0.0	0.1	0.2	1.3	0.1	0.2	0.1	0.4
125	Legal Services	0.0	0.1	0.1	0.4	0.1	0.2	0.1	0.9
126	Real Estate Activities	0.0	0.2	0.1	0.1	0.1	0.4	0.1	0.3
127	Renting of Machinery and Equipment	0.1	0.2	0.1	0.0	0.4	1.4	0.5	0.4
128	Other community, Social and Personal Services	0.5	1.1	0.2	0.5	0.2	0.5	0.1	0.2

SC	Sectors	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment	Low Skilled Employment	Low-Medium Skilled Employment	Medium-High Skilled Employment	High Skilled Employment
129	Other Services	2.3	2.3	0.3	0.2	1.6	1.8	0.3	0.3
130	Public Administration	0.6	3.0	1.6	3.1	0.1	0.3	0.2	0.4

Sources: Authors' computation using the I-O table for India for the year 2009–10 provided by the Central Statistics Office and 66th Round (2009–10) Employment–Unemployment Survey conducted by the National Sample Survey Office (NSSO, 2011).