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Contribution to Overall Employment by the Auto Industry: Jobs and Skills

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Contribution to Overall Employment by the Auto Industry: Jobs and Skills

March 2022

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The findings, interpretations, and conclusions expressed are those of the authors and do not necessarily reflect the views of the Governing Body of NCAER.

Contents

List of Tables

List of Figures

Executive Summary

India's structural transformation directly from agriculture to the services sector without going through the intermediate step of agriculture to manufacturing to services has opened up policy challenges. While manufacturing can potentially create low-skilled labour-intensive jobs, it is the services sector that has proved to be the most dynamic. The debate between manufacturing and services has been going for long in India. We illustrate here that both manufacturing and services are inter-dependent on each other. The auto sector, one of the largest sub-sectors in the manufacturing sector is a case in point.

The automobile industry has a significant presence in India with the sector making a major contribution to the manufacturing sector, in particular, and the overall economy, in general. India is the largest manufacturer of two-wheelers & three-wheelers and the fourth largest manufacturer of passenger vehicles in the world.

Apart from its direct contribution to the economy, the sector also contributes significantly to the economy through its linkages with other sectors, be it through use of inputs from other sectors (backward linkages) and supply of its output to other sectors (forward linkages). The Input-Output analysis best captures the overall contribution of a sector through economic activities within the sector and in other sectors through backward and forward linkages. In this way, the sector contributes to the national GVO, which percolates into the creation of jobs. The total number of direct jobs created in the auto sector went up from 3.5 million to 4.2 million between 2015–16 and 2019–20. Out of that more than 60 per cent of jobs are generated from vehicle 'parc'. However, the total number of jobs (direct and indirect) created through activities in this sector went up from 24.3 million to 30.7 million.

Details of the total number of jobs (direct+ indirect) created by the automobile sector in various years are summarised in the table below.

Employment Generated by the Auto Sector: Direct and Indirect (million)			
Parameter	**FY 2015–16**	**FY 2018–19**	**FY 2019–20**
Direct employment (A)	3.5	3.6	4.2
Indirect employment (B)	20.8	24.7	26.5
Total employment (A+B)	24.3	28.3	30.7

Source: NCAER computations.

Further, details of the creation of jobs due to backward and forward linkages have been summarised in the following table.

Employment Generated by the Auto Sector: Backward and Forward Linkage Sectors (million)			
Parameter	**FY 2015–16**	**FY 2018–19**	**FY 2019–20**
Backward-linked employment (A)	15.7	19.4	20.4
Forward-linked employment (B)	8.6	8.9	10.3
Total employment (A+B)	**24.3**	**28.3**	**30.7**

Source: NCAER computations.

I.   Introduction

I.1   *Motivation*

India's structural transformation directly from agriculture to the services sector without going through the intermediate step of agriculture to manufacturing to services has opened up policy challenges. While manufacturing can potentially create low-skilled labour-intensive jobs, it is the services sector that has proved to be the most dynamic. The debate between manufacturing and services has been going for long in India. We illustrate here that both manufacturing and services are inter-dependent on each other. The auto sector, one of the largest sub-sectors in the manufacturing sector is a case in point.

 In 2019–20, agriculture, comprised of 16.7 per cent of total Indian Gross Domestic Product (GDP), manufacturing, 13.5 per cent, non-manufacturing, 11.1 per cent and services 50 per cent[1]. In contrast, agriculture employed 45.6 per cent of the workforce in that year, manufacturing, 11.2 per cent, non-manufacturing industry, 12.5 per cent and services, 30.7 per cent[2]. While the above GDP and employment numbers would suggest that the services sector was (and is) the most dynamic sector in India, Bhadury, Narayanan and Pratap (2021) show that not to be necessarily true[3]. They find increased prevalence of informal job contracts in the services sector which could potentially weaken the positive relationship between labour quality and labour productivity. Further, they find that India's labour force seemed to be rapidly shifting towards services sub-sectors with lower productivity.

Agriculture, industry (manufacturing and non-manufacturing) and services are interdependent on each other. Taking in account direct and indirect requirements due to change in economic activities in various sectors, an increase of Rs 1 in the final demand for manufacturing goods results in an increase in output of agriculture by Rs 0.20, of non-manufacturing industry by Rs 0.27 and of services by Rs 0.38 in 2015–16[4]. Similarly, an increase of Rs 1 in the final demand for services results in an increase in output of agriculture by Rs 0.08, of manufacturing by Rs 0.24, of non-manufacturing by Rs 0.10. Thus, a rupee increase in final demand of manufacturing has a greater effect on services output than a rupee increase in the final demand of services impacting manufacturing output. Even estimates of jobs suggest that manufacturing has a larger impact on services than vice-versa[5].

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[1] Ministry of Statistics and Programme Implementation (MoSPI), National Statistical Office (NSO), Government of India (GoI). 2023. Press Note on Second Advance Estimates of National Income 2022-23,
Quarterly Estimates of Gross Domestic Product for the Third Quarter (Q3) of 2022-23 and First Revised Estimates of National Income, Consumption Expenditure, Saving And Capital Formation for 2021–22. February 28.

[2] MoSPI, NSO, GoI. 2021. Annual Report: Periodic Labour Force Survey (July 2019-June 2020). July.

[3] Bhadury, S., Narayanan, A. and Pratap, B. 2021. "Structural Transformation of Jobs from Manufacturing to Services: Will It Work for India?". *Margin: The Journal of Applied Economic Research*. 15(1): 22–49.

[4] NCAER computations from I-O matrix for 2015–16 computed from Supply-Use table given by MoSPI.

[5] Preliminary estimates from an aggregate 2015–16 model comprising of four sectors (agriculture, manufacturing, non-manufacturing industry and services) show that one direct job in manufacturing sector creates 7.5 jobs in the economy. The corresponding numbers for agriculture, non-manufacturing industry and services are 2.8, 3.8 and 4.2 respectively. This indicates that the manufacturing sector creates relatively more indirect jobs in the economy compared to other sectors.

Further, there are service sector jobs which are critically dependent or driven by the manufacturing sector. A case in point is the auto sector. While one may think that the auto sector solely comprises of the manufacturing of all types of vehicles. However, there are other service sectors which are driven either wholly or partially by the auto manufacturing sector namely wholesale & retail trade of vehicles, repair & maintenance, renting & leasing of vehicles, vehicle insurance, advertising & market research and engineering activities including technical testing & analysis etc. One could do a similar exercise for other manufacturing sectors to make the point that manufacturing is equally important as the services sector for the robustness of an equitable & sustainable Indian growth story.

The report highlights the importance of the automobile sector and its interlinkages with the rest of the economy.

I.2   Research Objectives

India produces all categories of vehicles, such as two-wheelers (2Ws), three-wheelers (3Ws), passenger vehicles (PVs), and commercial vehicles (CVs) including light commercial vehicles, trucks, buses, tractors, and heavy CVs, among others.[6] It is the largest manufacturer of 2Ws & 3Ws and the fourth largest manufacturer of PVs in the world. Apart from the manufacturing sector, the Indian automobile (henceforth 'auto') sector is linked to the rest of the economy through backward and forward linkages.

This report fulfils three research objectives, as follows:

- It estimates the contribution of both direct employment in the manufacturing sector and indirect employment in the supporting sectors for the years 2015–16, 2018–19 and 2019–20. For this purpose, it estimates both the generation of a total number of jobs from the auto industry and the generation of jobs per vehicle. As mentioned earlier, the Indian auto industry manufactures four types of vehicles, catering to both domestic and foreign markets.
- It disaggregates the impact of the auto industry on jobs across four segments—PVs, CVs, 2Ws, and 3Ws.
- Analyse the distribution of workers across various levels of skills based on combining general, technical & vocational educational levels. Rapid automation in this sector has affected employment and is expected to have a concomitant impact on the demand for particular types of skills.

This report is divided into eight sections. The second section defines the constituents of the auto sector and highlights the share of jobs in it. In the third section we delineate the methodology. We use the Input-Output (IO) methodology to estimate the total (direct + indirect) output and employment contribution of the auto sector. The IO-based multiplier analysis is an analytical tool for estimating the total (direct + indirect) requirements in the economy to meet one unit of final demand in the sector, say, ''the auto sector''. This is explained with the help of backward and forward linkages. The importance of the contribution of a sector to the economy may be assessed in terms of both direct output and the employment generated by it.

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[6] Ministry of Heavy Industries and Public Enterprises, Government of India. 2020. Annual Report 2019-20. https://dhi.nic.in/writereaddata/UploadFile/AR2019_20E.pdf, New Delhi, India.

Further, it may have a larger multiplier impact through inter-sectoral linkages in the economy.

The fourth section briefly outlines the methodology used in the study. The fifth and sixth sections present the estimates of the contribution of the auto sector to output and employment. It is found that after accounting for both direct and indirect impact, the auto sector has a large multiplier impact on the economy in terms of both output and employment. The seventh section analyses the skills required for the auto sector. The eighth section presents the key conclusions.

II.   What Constitutes the Auto Sector?

As per the National Industrial Classification (NIC) code of 2008, four sectors are associated with the auto sector (Table 1).   On average (2017–18 to 2019–20), the four activities listed under 'Motor Vehicles' in Tables 1 and 2 together account for 1.2 per cent of the total jobs in the Indian economy. On disaggregation, the auto maintenance and repair sub-sector has the largest share in the number of jobs generated (Table 2). There are differences between the shares of motor vehicles and motor cycles & scooters (Table 2). Further, volatile growth patterns are observed in terms of employment across various sub-sectors (Table 3).

Table 1: NIC Codes for the Auto Sector	
NIC Code	*Item*
Motor Vehicles	
29[1]	Manufacturing of motor vehicles and their parts
45101+45102	Wholesale and retail sale of new and used motor vehicles
45200	Maintenance and repair
77100	Renting and leasing of motor vehicles
Motor Cycles and Scooters	
30911+30912+30913[2]	Manufacturing of motorcycles & scooters and their parts
45401+45402	Wholesale and retail sale
45403	Maintenance and repair

Source: Central Statistical Organisation. 2008. "National Industrial Classification [All Economic Activities)". Ministry of Statistics and Programme Implementation, Government of India, New Delhi, India.
Notes: 1. This includes manufacturing of motor vehicles and bodies (coachwork) for motor vehicles; trailers and semi-trailers; and parts and accessories for motor vehicles.
2. This includes the manufacturing of: motorcycles, scooters, and mopeds and their engines; three-wheelers and their engines; and parts and accessories for three-wheelers and motorcycles, including sidecars.

Table 2: Size of the Sector in Terms of Jobs in the Auto Sector				
Sector	**2015–16**	**2017–18**	**2018–19**	**2019–20**
Motor Vehicles (% Share)				
Manufacturing[1]	28.1	30.3	25.9	28.3
Wholesale and retail sale of new and used motor vehicles	20.9	22.3	19.4	23.2
Maintenance and repair	47.5	44.3	50.9	45.1
Renting and leasing of motor vehicles	3.5	3.1	3.8	3.4
Total	100.0	100.0	100.0	100.0
Share of employment due to vehicle 'parc'*	60	57	62	60
Motor Cycles and Scooters (% Share)				
Manufacturing	7.8	7.7	7.8	13.4
Wholesale and retail sale	37.7	34.3	40.9	32.9
Maintenance and repair	54.5	58.0	51.3	53.7
Total	100.0	100.0	100.0	100.0
Share of employment due to vehicle 'parc'*	65	66	64	62
Total (% Share)				
Manufacturing	23.3	25.2	21.5	25.2
Wholesale and retail sale	24.9	25.0	24.7	25.3
Maintenance and repair	49.2	47.4	51.0	46.9
Renting and leasing of motor vehicles	2.6	2.4	2.9	2.7
Total	100.0	100.0	100.0	100.0

Source: Compiled from data from the National Sample Survey Organisation. Ministry of Statistics and Programme Implementation, Government of India. 2014. "Employment and Unemployment Situation in India". http://mospi.nic.in/sites/default/files/publication_reports/nss_report_554_31jan14.pdf. January and Unit Level Data of Periodic Labour Force Survey (PLFS), July 2019-June 2020 and various issues.
Notes: The years refer to the period July to June. * Employment generated due to vehicle 'parc' have been estimated using industry assumptions. Vehicle parc refers to total number of vehicles on the road at a particular moment in time.

Table 3: Growth of Jobs in the Auto Sector and Its Various Sub-sectors				
Sector	**2015–16[1]**	**2017–18[2]**	**2018–19**	**2019–20**
Motor Vehicles (%)				
Manufacturing	1.9	5.82	(−)16.4	34.2
Wholesale and retail sale of new and used motor vehicles	6.5	5.46	(−)15.2	47.0
Maintenance and repair	(−)2.6	(−)1.56	12.3	8.8
Renting and leasing of motor vehicles	51.9	(−)3.58	21.3	8.3
Motor Cycles and Scooters (%)				
Manufacturing	(−)18.3	(−)1.0	10.1	70.6
Wholesale and retail sale	23.7	(−)5.4	30.0	(−)19.6
Maintenance and repair	2.4	2.3	(−)3.6	4.5
Total (%)				
Manufacturing	(−)0.74	5.3	(−)14.6	37.5
Wholesale and retail sale	11.3	1.7	(−)1.2	19.9
Maintenance and repair	(−)1.4	(−)0.5	7.9	7.7
Renting and leasing of motor vehicles	51.9	(−)3.6	21.3	8.3

Source: Compiled from data from the National Sample Survey Organisation. Ministry of Statistics and Programme Implementation, Government of India. 2014. "Employment and Unemployment Situation in India". http://mospi.nic.in/sites/default/files/publication_reports/nss_report_554_31jan14.pdf. January and Unit Level Data of Periodic Labour Force Survey (PLFS), July 2019-June 2020 and various issues. *Notes*: 1, 2- These are compound average annual growth rates.

The IO Table of 2015–16 for 131 x 131 sectors prepared by Chadha, Saluja, and Sivamani (2020)[7] has been used in this report to estimate the direct and indirect contributions of the auto sector. The IO Table of 2015–16 has been transformed from the Supply Use Table 2015–16 prepared by the Ministry of Statistics and Programme Implementation (MoSPI). **In the IO Table, the manufacturing and maintenance & repair sub-sectors are clubbed together to form the auto sector.** In 2019–20, these two sectors accounted for 72 per cent of the jobs generated by all the four sectors related to the auto sector. This report continues with the same definition.

The auto sector (manufacturing and maintenance & repair) has been disaggregated across three sub-sectors—PVs, CVs, and 2Ws and 3Ws.[8]

III.   Methodology

In order to estimate the total (direct and indirect) contribution of the auto sector to output and employment, we use the IO methodology, schematically presented graphically in Figure 1 (explained in detail in Annexure 1).

Figure 1: Methodology
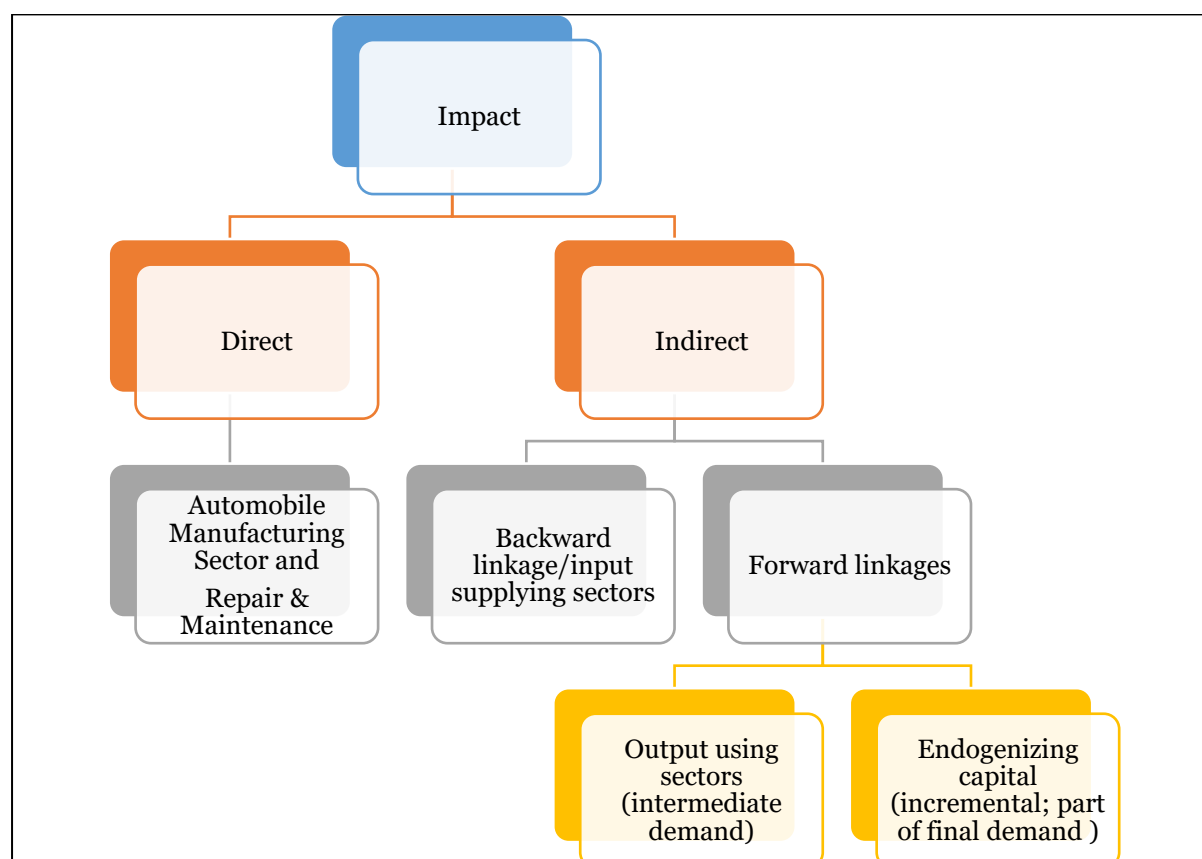
Source: NCAER conceptualisation.

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[7] Chadha, R., M.R. Saluja, and G. Sivamani. 2020. "Input Output Transaction Table: India", *Discussion Note*. January 2020|012020. https://www.brookings.edu/wp-content/uploads/2020/01/Input-Output-Transactions-Table.pdf.
[8] As explained later, two-wheelers and three-wheelers have been clubbed together because the former accounted for 96.3 per cent of the jobs in this sub-sector for 2015–16.

The direct estimation involves estimating the number of jobs generated in the automobile manufacturing and repair & maintenance sectors (as explained earlier in Section 2 about the definition of the auto sector used in the IO methodology). For the remaining part of the report, we refer to them as the "auto" sector. The indirect estimation pertains to the number of jobs generated in other sectors due to their linkages with the auto sector. The backward linkage involves estimating the number of jobs generated when the outputs of the other sectors are used as inputs in the auto sector. Forward linkage has two parts. First, the outputs of the auto sector are used as intermediate inputs in the other sectors. The second part of the forward linkage involves estimating the number of jobs generated due to the output of the auto sector being used as investment goods, which forms part of the final demand of the sector (refer to Annexure 1).

The steps involved in the estimation are delineated below.

SIAM 42 Sectors

- Using the IO table 2015–16 of 131 x 131 sectors (Chadha, Saluja, and Sivamani, 2020), we aggregated the sectors into a total of 41 sectors.[9] These have also been mapped with the NIC 2008. The 41 sectors included the combined motor vehicles sector.
- Consequently, we disaggregated the motor vehicles sector into PVs and CVs. The disaggregation was done using GVO and GVA estimates from both the organised (Annual Survey of Industries) and unorganised (NSS 73rd Round) sectors,[10] henceforth referred to as the Society of Indian Automobiles Manufacturing (SIAM) 42 sectors (Annexure 2).[11] The 2Ws sub-sector constituted 96 per cent of both the GVO and jobs in the combined 2W and 3W sectors. Therefore, we did not further split the sector. The interpretation of the results will apply to both the sub-sectors together.

Output Multiplier

- We first computed the Leontief Inverse matrix by using the IO table for the year 2015–16 to estimate the backward and forward linkages.
- Further, we estimated the GVO and GVA for 2018–19 and 2019–20.

Direct Employment

- We used labour inputs or the 'number of jobs" for estimating direct employment (Annexure 3). The concept entails adding multiple workers into the National Sample Survey (NSS) definition of Usual Status workers (Usual Principal Status (UPS) and Usual Subsidiary Status (USS).[12] The methodology

[9] Chadha, R., Saluja, M.R. and Sivamani, G. 2020. "Input Output Transaction Table: India", *Discussion Note*. January 2020|012020. https://www.brookings.edu/wp-content/uploads/2020/01/Input-Output-Transactions-Table.pdf.

[10] Central Statistics Office (Industrial Statistics Wing), Ministry of Statistics and Programme Implementation, Government of India.2018. *Annual Survey of Industries*. http://microdata.gov.in/nada43/index.php/catalog/143.

National Sample Survey Office, Ministry of Statistics and Programme Implementation (MoSPI), Government of India (GoI). 2018. India - Unincorporated Non-Agricultural Enterprises (Excluding Construction) - JULY 2015 - JUNE 2016, 73rd Round. http://microdata.gov.in/nada43/index.php/catalog/139.

[11] Annexure 2 shows the concordance map among the 42 SIAM sectors, 131 sectors I-O table 2015-16 and NIC 2008 5-digit numbers.

[12] The concept of usual activity status refers to the activity status of a person during the last 365 days preceding the date of survey. The activity status on which a person spent a relatively longer time (183

for estimating the number of jobs/labour inputs is explained in Kolli, Sharma and Sinharay (2008).[13]

- The estimates include NSS employment status [Usual Principal Status (UPS) and Usual Subsidiary Status (USS)] data, including multiple workers, which becomes the total number of jobs.
- We interpolated the number of jobs for 2015–16 by using PLFS data for two rounds of 2017–18 and 2018–19 (Box 1).
- We have also estimated the number of jobs for 2018–19 and 2019–20 from the PLFS.
- We estimated the number of jobs for three desired sectors, namely, PVs, CVs, and 2Ws & 3Ws.
- We estimated the employment multiplier for 2015–16 using the Leontief Inverse computed earlier. Using Leontief Inverse 2015–16, we further estimated the employment multipliers for 2018–19 and 2019–20.

Box 1: Labour Force Estimates

For explaining the employment contribution of the automobile sector, unit-level data from the *Periodic Labour Force Survey (PLFS)* for various years were analysed. PLFS is a representative survey of households (representative at the district level) undertaken by the National Sample Survey Office (NSSO) of the Ministry of Statistics & Programme Implementation, Government of India. It captures the activity status of all the members of the households surveyed and enlists the industry that each member of the household is engaged in (as per the National Industrial Classification (NIC) 5-digit level). Thus, the number of workers in each industry is estimated from the survey by using the weight of each surveyed individual. Apart from the industry of engagement, other details about the workers like their education level (general, technical, and vocational), the quality of jobs like written job contracts, and access to social security benefits, are also captured in the survey. Since 2015–16 was the latest year for which the IO was available, the first task was to estimate the employment numbers for that year. Since no PLFS was carried out in 2015–16, the numbers for that year were estimated by interpolating the employment figures for 2017–18 and 2018–19, and using suitable population weights. The PLFS is carried out between July of one year and June of next year. This is carried out on an annual basis. There are quarterly reports available too but that was not used here in this work.

Sources: MoSPI and NCAER.

Indirect Employment

- The Leontief Inverse, along with the direct employment coefficient, that is, the ratio of the number of jobs to the GVO was further used to arrive at the total (direct and indirect) employment numbers. Direct jobs are the ones that are created in the sector itself due to the economic activities in that sector. Indirect jobs are those that are created in the upstream (backward) and downstream (forward) sectors through their linkages with the sector

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days or more) in years is called his/her UPS. Similarly, if a person has engaged in economic activity for a period of 30 days or more and less than 183 days during the last 365 days preceding the date of survey, it is called his/her usual subsidiary status (USS).

[13] Kolli, R., Sharma, S. and Sinharay, A. 2008. "Estimates of Workforce from the NSS-61st Round, 2004–05". *Journal of Income and Wealth*. 30(1): 34–58.

concerned. The Leontief Inverse provides both backward and forward indirect employment estimates.

- We also considered the incremental multiplier effect of investment by endogenising the sectoral gross fixed investment for the PVs and CVs sectors. This was done by taking the ratio of Gross Fixed Capital Formation (GFCF) to intermediate input use and allocating the same into the forward linked sector.[14]

    Both PVs and CVs are capital goods-producing sectors whose outputs are used over a period (and thus are employment creating over a period of time) and not just used up in a particular year. This becomes clearer from the IO matrix for 2015–16, where around 60 per cent of the GVO of both PVs & CVs are shown as GFCF and only around 12 per cent go in for intermediate use for the production of goods and services of all the sectors. This necessitates endogenising the incremental effect of capital formation on employment creation in order to get the complete contribution of the sub-sectors to job creation. While the entire CVs sub-sector has been used for estimating the impact of incremental job creation,[15] only a share of the PVs sub-sector has been used. This is because only the transport component of PVs (cars used as public transport vehicles like taxis, cabs, and so on) are employment-creating over a period of time.

    In contrast, the sector comprising 2Ws and 3Ws is mainly a consumer goods sector whose output is used over a period of time and is therefore not employment-creating.

- Using Leontief Inverse for the year 2015–16 and employment-to-output coefficients for 2018–19 and 2019–20 each, we estimated the total number (direct and indirect) jobs for these years as well.

- The total number of jobs created in a sector is estimated by multiplying the same year's GVO and employment multiplier (estimated by using IO analysis). This is done separately for backward, forward, and incremental multipliers. The general formula is the following:

Jobs created (million) = GVO (rupees lakh)*employment multiplier/1000000

IV. Output Multiplier

The output multiplier for a particular sector refers to addition to the GVO of the entire economy due to one unit of output generated in the said sector. In all the three automobile sectors, GVO multipliers were amongst the top ten in the 42 sectors, representing the entire economy (Annexure 4). For example, the GVO multiplier for 2Ws & 3Ws is interpreted as follows: Rs 1 lakh of output in that sub-sector creates Rs 2.75 lakh of output in the entire economy.[16] This shows that this

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[14] "Gross Capital Formation (GCF) refers to the aggregate of gross additions to fixed assets (that is, fixed capital formation), increase in stocks of inventories, hereinafter referred to as change in stocks during a period of account, and net acquisition of valuables".
Ministry of Statistics and Programme Implementation website:
http://mospi.nic.in/sites/default/files/reports_and_publication/statistical_manual/Chapter%2025.pdf.
[15] Commercial Vehicles (CVs) are used to transport goods and therefore, the whole sector is accounted for in incremental capital formation.
[16] We are using the unit of Rs lakh only for illustration purposes. This can be any units.

sector is highly interlinked with the rest of the economy. Thus, any change in activities in this sector will have a significant impact on the economy.

The income (GVA) multiplier of a sector refers to the addition to the GVA of the entire economy due to generation of Rs 1 lakh of output in the said sector. Similarly, the employment multiplier refers to the employment generated in the economy due to generation of Rs 1 lakh of output in the said sector.

V.   Employment Multiplier

The employment multiplier and the number of jobs created for 2015−16, 2018−19, and 2019−20 are reported in Table 4. The total number of (direct and indirect) jobs created by the automobile sector in 2015−16 was 24.3 million, which increased to 28.3 million in 2018−19, and then to 30.7 million in 2019−20. The number of jobs created due to economic activities in the PVs, CVs, and 2Ws and 3Ws sectors in 2015−16 were 14.8 million, 5.8 million, and 3.6 million, respectively. The corresponding figures in 2018−19 were 17 million, 6.4 million, and 4.8 million, respectively, and in 2019−20, they were 18.6 million, 7 million, and 5.1 million, respectively.

Table 4: Employment Multiplier and Job Creation over the Years												
	2015−16				2018−19				2019−20			
	PVs	CVs	2Ws & 3Ws	Total	PVs	CVs	2Ws & 3Ws	Total	PVs	CVs	2Ws & 3Ws	Total
Employment Multiplier												
Backward	0.211	0.191	0.211	--	0.171	0.155	0.157	--	0.183	0.164	0.167	--
Forward	0.059	0.044	0.062	--	0.041	0.031	0.033	--	0.049	0.034	0.038	--
Capital Adjusted	0.279	0.208	--	--	0.195	0.145	--	--	0.234	0.163	--	--
Employment (million jobs)												
Backward	10.3	2.5	2.8	15.7	12.4	3.0	3.9	19.4	13.1	3.2	4.1	20.4
Forward	2.9	0.6	0.8	4.3	3.0	0.6	0.8	4.4	3.5	0.7	1.0	5.2
Capital Adjusted	1.6	2.7	--	4.3	1.7	2.8	--	4.5	2.0	3.1	--	5.1
Total	**14.8**	**5.8**	**3.6[1]**	**24.3**	**17.0**	**6.4**	**4.8[1]**	**28.3**	**18.6**	**7.0**	**5.1[1]**	**30.7**
Vehicles produced (millions)	2.5	0.8	18.8	22.1	2.7	1.1	24.5	28.3	2.2	0.8	21.0	24.0
Jobs per vehicle produced[2]	**5.9**	**7.4**	**0.2[3]**		**6.2**	**5.8**	**0.2[3]**		**8.5**	**9.3**	**0.2[3]**	

Source: NCAER calculations, Data on the number of vehicles produced has been taken from MoSPI.

Notes: 1. Total number of jobs created in 2Ws were 3.5 million in 2015−16, 4.6 million in 2018−19, and 4.9 million in 2019−20. The corresponding figures for 3Ws were 0.1 million, 0.2 million, and 0.2 million, respectively.

2. Jobs per vehicle is arrived at by dividing the total number of jobs by the total number of vehicles produced in each category.

3. For 2Ws, the number of jobs per vehicle is 0.2 for all the three years. For 3Ws, the number of jobs per vehicle was 0.2 in 2015−16, and 0.3 in both 2018−19 and 2019−20.

Jobs per Vehicle Produced

In 2019–20, a total of 8.5 jobs were produced per passenger vehicle, 9.3 jobs per commercial vehicle, and 0.2 jobs per 2Ws and 0.3 jobs per 3Ws. These figures have increased since 2015–16.

Overall Jobs Created per Unit of Direct Jobs

The number of overall jobs created in the entire economy (direct + indirect) for every unit of jobs (direct) created in the automobile sector, 6.9 in 2015–16, 7.9 in 2018–19, and 7.3 in 2019–20. The corresponding numbers for PVs were 6.7, 7.4, and 6.9, respectively. In the CVs sector, these figures were relatively higher, at 11.6, 10.7, and 11.7, respectively. Similarly, the figures for 2Ws & 3Ws were 5.1, 6.9, and 6.4 in 2015–16, 2018–19, and 2019–20, respectively. The relatively higher figures for CVs denote that this sector has relatively larger inter-linkages with the rest of the economy through backward multipliers, forward multipliers, and incremental forward multipliers after endogenising capital formation in the sector (Table 5).

Table 5: Overall Jobs Created per Unit of Direct Jobs								
	Direct Jobs			Total (direct+ indirect) jobs			Total jobs per unit of direct jobs		
	2015 −16	2018 −19	2019 −20	2015 −16	2018 −19	2019 −20	2015 −16	2018 −19	2019 −20
PVs	2.2	2.3	2.7	14.8	17	18.6	6.7	7.4	6.9
CVs	0.5	0.6	0.6	5.8	6.4	7	11.6	10.7	11.7
2Ws & 3Ws	0.7	0.7	0.8	3.6	4.8	5.1	5.1	6.9	6.4
Combined Auto sector	**3.5**	**3.6**	**4.2**	**24.3**	**28.3**	**30.7**	**6.9**	**7.9**	**7.3**

Source: NCAER calculations.

Why Have Jobs Increased between 2015–16 and 2019–20?

Both the nominal and real GVO of the auto sector increased between 2015–16 and 2019–20 at a CAGR of 11.2 per cent and 10.3 per cent, respectively.[17] For the corresponding period, the CAGR of the nominal and real all-India GVO was 9.4 per cent and 6.4 per cent, respectively. Clearly, the auto sector grew at a faster pace than the overall economy. Given the positive albeit inelastic relationship between employment and output (Figure 1), direct employment in the auto sector grew at a CAGR of 4.97 per cent between 2015–16 and 2019–20. Overall, all-India employment had grown at a marginally slower CAGR of 4.45 per cent for the corresponding period. Given the differential pace in the growth of the auto sector and the rest of India, it is not surprising that the number of overall (direct plus indirect) jobs per direct job had come down in 2019–20 (refer to the above section).

While the nominal GVO virtually stood stagnant between 2018–19 and 2019–20, why did the number of direct jobs increase? Since the rise in total number of (direct + indirect) jobs critically depends upon direct jobs, it is important to carry out

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[17] The CAGR of auto WPI inflation rate between 2015–16 and 2019–20 was 0.8 per cent.

a more in-depth analysis of the sector. One partial answer lies in the data—while the number of direct jobs went up by 16.5 per cent, the number of man-days rose by a substantially slower rate of 3 per cent. This implies that workers were not being laid off but were used less intensely. This is confirmed by anecdotal evidence that the auto manufacturing companies were using non-working days during 2019–20 to manage the workforce in the face of falling production.[18]

Annexure 5 shows that if the auto sector nominal GVO had increased at a CAGR of 15 per cent between 2015–16 and 2019–20, a total of 36.3 million jobs would have been generated.

Jobs Creation across Skill Levels

Adapting the Bhattacharya, Bhandari, and Bairagya (2020) definition of categorising workers across skill levels by combining their general education, technical education, and vocational education attainment, workers have been grouped across four skill categories (Annexure 6).[19] The distribution of jobs across these four levels in various years has been given in Annexure 7.

Table 6 gives the total number of (direct and indirect) jobs created by the auto sector across the four skill levels. This shows that most of the jobs (direct and indirect) created through economic activities in the automobile sector were in the 'low-medium skilled' category. The percentage of jobs in this group was 54.3 per cent in 2015–16, which declined slightly to 49.6 per cent in 2019–20. In contrast, the share of high skilled jobs increased from 12.6 per cent to 16.3 per cent between the two periods.

Table 6: Total (Direct and Indirect) Jobs Created across Skill Levels							
Total Jobs (millions)							
	Low Skilled	Low-Medium Skilled	Medium-High Skilled	High Skilled	Low Skilled	Low-Medium Skilled	Medium-High Skilled	High Skilled
	2015–16				2019–20			
PVs	2.4	7.9	2.6	1.9	2.9	9.1	3.5	3.1
CVs	0.8	3.2	1.1	0.8	0.9	3.5	1.4	1.1
2Ws & 3Ws	0.6	2.2	0.5	0.4	0.9	2.6	0.8	0.7
Total Auto Sector	**3.8**	**13.2**	**4.2**	**3.1**	**4.7**	**15.2**	**5.7**	**5.0**

Source: NCAER calculations.

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[18] A non-working day is a holiday without pay. It affects workers who get a daily wage based on their contracts.
India Today. 2019. "Auto sector slowdown: What are non-working days?". https://www.indiatoday.in/business/story/auto-sector-slowdown-what-are-non-working-days-1597786-2019-09-11. September 11.
Narsimhan. 2020. "Slowdown pain spreads: Tata Motors, Ashok Leyland, Hero halt production". *Business Standard*. https://www.business-standard.com/article/companies/auto-slowdown-tata-motors-tvs-join-peers-in-applying-brakes-to-production-119081601884_1.html. January 5.
[19] Bhattacharya, T., Bhandari, B. and Bairagya, I. 2020. "Where are the jobs? Estimating skill-based employment linkages across sectors for the Indian economy: An input-output analysis". *Structural Change and Economic Dynamics*, 53: 292–308.

Relative Contribution of Various Sectors to Output Multiplier and Backward Employment Multiplier

Apart from the own sectors, the top ten contributing sectors (in terms of contribution to output multiplier) in each of the three automobile sectors have been shown in Table 7. The top ten contributors to output multiplier are almost common in each of the three automobile sectors. 'Ferrous and non-ferrous basic metal' is the most important sector in terms of its contribution to the output multiplier in all the three automobile sub-sectors. This includes steel, which is the major input in automobile manufacturing. Other major contributors to the output multiplier in each of the three sub-sectors were 'trade', 'mining and quarrying', and 'electricity'.

	Table 7: Top Ten Contributors to Output Multiplier (%) in 2015–16		
	PVs	*CVs*	*2Ws & 3Ws*
S. No.	*Sectors*	*Sectors*	*Sectors*
1	Ferrous and Non-ferrous Basic Metal	Ferrous and Non-ferrous Basic Metal	Ferrous and Non-Ferrous Basic Metal
2	Trade	Trade	Trade
3	Mining and Quarrying	Mining and Quarrying	Electricity
4	Hand Tools and Miscellaneous Metal Products	Hand Tools and Miscellaneous Metal Products	Mining and Quarrying
5	Rubber Products	Rubber Products	Hand Tools and Miscellaneous Metal Products
6	Electricity	Electricity	Petroleum Products
7	Land Transport	Land Transport	Basic Heavy Inorganic and Organic Chemicals
8	Real Estate, Ownership of Dwelling & Professional Services	Real Estate, Ownership of Dwelling & Professional Services	Land Transport
9	Basic Heavy Inorganic and Organic Chemicals	Basic Heavy Inorganic and Organic Chemicals	Real Estate, Ownership of Dwelling & Professional Services
10	Plastic Products	Plastic Products	Rubber Products

Source: NCAER computations.
Note: Sectors are arranged in descending order of contribution to output multiplier in each sector.

The individual sectors contributing to the output multiplier are based on various layers of interlinkages amongst different sectors in the economy. A sector may not directly contribute to the automobile sector. However, it may have been linked indirectly to the auto sector. For example, activities in the auto sector create demand for machinery and equipment, which in turn, generate, a demand for iron and steel industry. This, in turn, augments demand for mining & quarrying sector. While the mining & quarrying sector may not be directly contributing to the auto sector, it is indirectly contributing to the auto sector via other sectors. Therefore, we have delineated the top ten sectors contributing to the output multiplier but we are not giving any figure because of various layers of inter-linkages.

Apart from the own sectors, the top ten contributing sectors in terms of contribution to the backward employment multiplier in each of the three automobiles sectors are shown in Table 8. These have been derived from

contribution to the output multiplier, that is, production linkages.[20] As explained earlier, the individual sectors attributing to the total indirect (backward) employment in the auto sector may not be an input-using sector but indirectly it must be feeding into the output multiplier. For example, agriculture and forestry and fishing are large contributors to backward employment multipliers in the three auto sectors. This implies that this sector may not be directly linked to the auto sector but it may be linked via other sectors contributing to the auto sector through different layers of value chains.

	PVs	CVs	2Ws & 3Ws
Table 8: Top Ten Contributors to (Backward) Employment Multiplier (%) in 2015–16			
S. No.	**Sectors**	**Sectors**	**Sectors**
1	Agriculture, Forestry and Fishing	Trade	Trade
2	Trade	Agriculture, Forestry and Fishing	Agriculture, Forestry and Fishing
3	Land Transport	Land Transport	Land Transport
4	Ferrous and Non-Ferrous Basic Metal	Ferrous and Non-Ferrous Basic Metal	Ferrous and Non-Ferrous Basic Metal
5	Hand Tools and Miscellaneous Metal Products	Hand Tools and Miscellaneous Metal Products	Hand Tools and Miscellaneous Metal Products
6	Construction	Construction	Construction
7	Real Estate, Ownership of Dwelling and Professional Services	Real Estate, Ownership of Dwelling and Professional Services	Synthetic Fibres and Resins
8	Mining and Quarrying	Mining and Quarrying	Mining and Quarrying
9	Synthetic Fibres and Resins	Paper and Paper Products and Printing & Publishing	Real Estate, Ownership of Dwelling and Professional Services
10	Paper and Paper Products and Printing and Publishing	Synthetic Fibres and Resins	Other Miscellaneous Manufacturing

Source: NCAER computations.
Note: Sectors have been arranged in descending order of contribution to the backward employment multiplier in each sector.

VI.   Skills Needed in the Auto Sector[21]

NCAER (2018) defined skills as a combination of cognitive, socio-emotional, and technical and vocational skills.[22] Lack of data in this area prompts us to use educational attainment as an alternative measure of skills, howsoever imperfect. Vocational skilling schemes have also been the focus of recent initiatives by the Government of India. This is a sensible policy as only 7.1 per cent of auto workers

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[20] Total indirect employment multipliers are largely derived from the backward employment multiplier. Forward and incremental employment multipliers are less contributing.
[21] We also thank Mr Arindam Lahiri, CEO of Automotive Sector Skills Council for sharing his insights on the skilling needs for the sector.
[22] National Council of Applied Economic Research (NCAER). 2018. "Skilling India: No Time to Lose." http://www.ncaer.org/publication_details.php?pID=300. October. New Delhi, India.

were found to have acquired formal vocational training in 2019–20 and only 29 per cent of the workers had acquired non-formal vocational training (Table 9).

Table 9: Workers in Auto Sector with Vocational Training (%)		
	Formal Vocational Training	*Informal Vocational Training*
2015–16	6.0	28.7
2018–19	6.1	28.3
2019–20	7.1	29.0

Source: National Statistical Organisation.

We have analysed the skilling data being provided by the Automotive Skills Development Council (ASDC), the key agency involved in imparting vocational skills for the automotive sector.[23] We downloaded the total number of job roles in the ASDC as of 21 September 2021 and found that 29 per cent of the 211 job roles being offered for vocational skilling were in the manufacturing sub-sector (Figure 2).

Figure 2: Percentage Share of Sub-Sectors in ASDC Job Roles, 21st September 2021
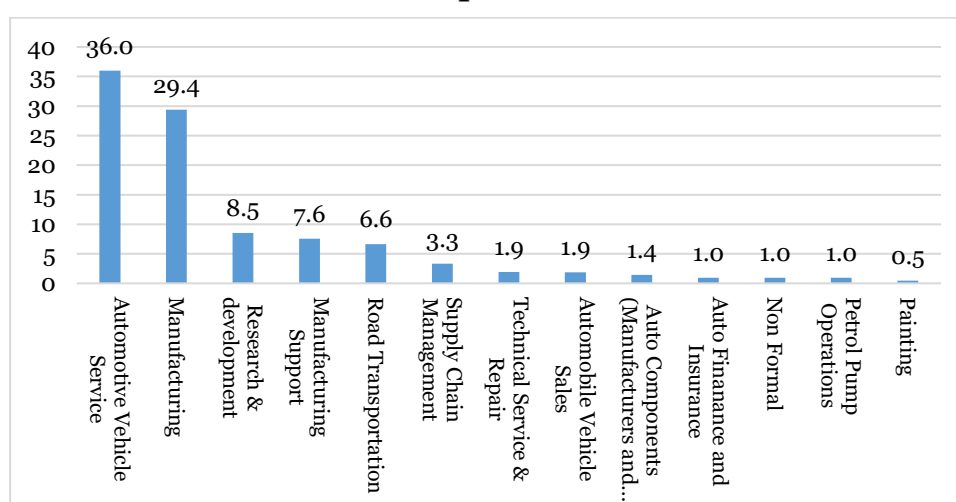
Source: Automotive Skills Development Corporation.

Further, approximately 80 per cent of the jobs fell between levels 3-6 of the National Skills Quality Framework (NSQF) levels 3 to 6 with 29 per cent being at level 4 (Figure 3).[24] For example, the skill category of an automotive electrician would be

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[23] "ASDC is the first Sector Skill Council of India, promoted by the Automobile Industry through SIAM, Automotive Component Manufacturers Association and Federation of Automobile Dealers Association and Government of India represented by Department of Heavy Industry and National Skill Development Corporation."
ASDC website. https://www.asdc.org.in/skilldevelopment.
[24] "The NSQF is a competency-based framework that organises qualifications according to a series of knowledge, skills and aptitude. The NSQF levels, graded from one to ten, are defined in terms of learning outcomes which the learner must possess regardless of whether they are obtained through formal, non-formal, or informal learning".

NSQF 4, with the pre-requisite being that they should have passed Class XII. If the Annexure 5 category were to be used, they would fall in the high-medium skilled category. However, the skill category of a maintenance technician employed in a service workshop would also be NSQF level 4 but the minimum pre-requisite is that they should have passed Class X. Press Shop Assistant Helpers are +placed at NSQF Level 2 and the minimum pre-requisite is that they should have passed Class 8.

The bulk of ASDC vocational training focuses on the low-medium and high-medium skilled workers, and justifiably so, as they comprise a majority of workers in the sector.

Figure 3: Percentage Share of ASDC Job Roles as per Levels of National Skills Quality Framework, 21st September, 2021
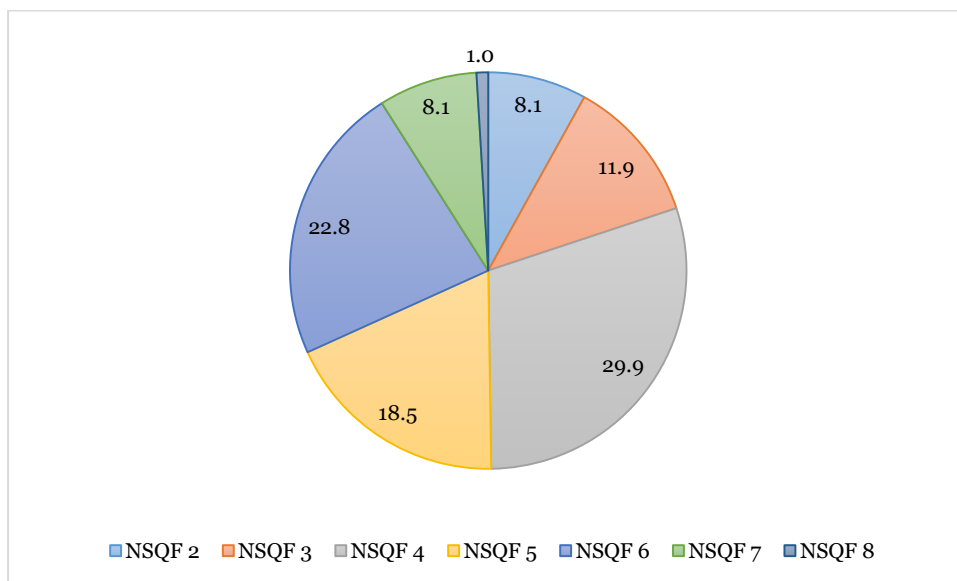
Source: Automotive Skills Development Corporation.

Unfortunately, this focus on vocational skills is not enough. What is important is not just the number of people that one is hiring or training but also the quality of their skills, that is, whether they have the skills that employers need. We had conducted a small online survey of SIAM members and specifically asked their Human Resource Managers (HRMs) these related questions: Are you able to hire the required numbers and is there any spatial mismatch? What skills do you find missing despite the workers having the right pedigree?

Six HRMs responded, saying that they did not face a problem in hiring workers. A majority of them also said that there was no spatial mismatch between quantity and quality during the process of hiring of workers. However, the workers lacked practical skills and presentation skills, and were not adequately trained in the new-age technical domains. Even engineering graduates (high-skilled workers, see Annexure 5) lacked practical skills, knowledge of automobiles/cars, and analytical, applied, and shop-floor management skills. One respondent said that "Interdisciplinary appreciation is missing, for example, a mechanical graduate often

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University Grants Commission website. https://www.ugc.ac.in/pdfnews/6556003_Guidelines-for-providing-Skill-Based-Education-under-NSQF.pdf.

has a low understanding of related electrical/electronic interfaces". The quality of students from both Industrial Training Institutes (ITIs) and second-tier engineering colleges was low and hence an area of concern.

We had asked the HRMs whether they provided on-the-job training to all the workers, and if yes, what type of training, for how many months, and whether they provided apprenticeship to workers. If so, what type of modules did the training have?

Almost all the firms responded that they provided training (technical, functional, simulation, etc.) to workers. They also provided apprenticeship training. The duration of the training could can run from one month to 12 months. One respondent said that they ran a two–year full term apprenticeship programme. They had also designed a three-year earn-and-learn programme leading to the award of a Diploma in Manufacturing. For graduate and post-graduate engineers, they ran a one-year structured training programme while for Diploma Engineers, they ran a two–year on-the-job training programme.

We also asked firms whether they offered career paths or lifelong learning to workers. Did they provide mentorship? Did they offer study leave or more training?

While automotive companies are providing mentorship, continuous training, and even encouragement to their workers to go in for higher studies, only one respondent said that they had tied up with leading polytechnics and engineering colleges. Their workers pursued Diploma and subsequently degree programmes, which were funded by the company. In essence, they got an opportunity to advance their careers post their education too.

We had also asked firms the following question: Since a majority of the workers in the auto sector are low-medium skilled workers, what type of common skills do you look for at various levels of NSQF, in order to help workers acquire the requisite skills to enter the automotive industry? The responses included dexterity skills, analytical skills, motor skills, knowledge of mathematics, basic knowledge of working on machines, advance courses in the Electrical and Electronics fields, paint, robotics, Industry 4.0, IOT, Machine Learning, Artificial Intelligence and Mechanical Engineering/Electrical Engineering/Die Maintenance. One respondent said that they were interested in NSQF Level 5 and above, which in our categorisation, would include the high-skilled workers.

VII. Key Conclusions

The automobile sector has an enormous impact on the Indian economy, that is, any upside or downside in the sector creates a multiplier impact in the economy. Amongst all the sectors, it has one of the highest output multipliers in the economy while the direct output-employment elasticity in the sector is very low. The sector created only 4.2 million jobs in the economy in 2019–20, but supported a total (including direct and indirect jobs) of 30.7 million jobs in the economy.

However, the sector faced challenges in hiring skilled workers at all levels. It is recommended that foundational skills need to be more attuned to measurement

and mathematical skills.[25] The pedagogy at schools too needs to change. The quality of education being imparted in the Industrial Training Institutes (ITIs) and second-tier engineering schools also needs to be upgraded to make it more adaptable for employability. Rapid changes in technology necessitate the imparting of more inter-disciplinary knowledge along with updated knowledge. The areas of problem-solving, creative thinking, and application of skills continue to seem neglected and need attention. Even auto companies need to adapt some best practices within their companies to upskill and re-skill their employees and to offer them viable career paths.

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[25] Bhandari (2021) has listed the full range of skills needed for employability. Focusing on reading and mathematical skills is not enough. One needs a 360-degree change in outlook, and concomitant changes in textbooks, pedagogy, teachers, the curriculum, and the examination system.
Bhandari, B. 2021. "Policy for the Full Range of Employability Skills". *NCAER Working Paper No. 123*. https://www.ncaer.org/publication_details.php?pID=353. New Delhi, India: NCAER.

Annexures

The theoretical structure of IO models comprising n sectors of a hypothetical economy is explained as follows. The supply of output into intermediate use and final use could be explained to satisfy the material balance of the economy in the following equation.

$$X_i = \sum_j X_{ij} + F_i \, i, j = 1,2,3,\ldots\ldots\ldots\ldots\ldots n$$

Where,

X_i is the total output of i_{th} sector

X_{ij} is the output of i_{th} sector consumed in j_{th} sector

F_i is the total final demand for i_{th} sector consisting of private consumption, Government consumption, Gross Fixed Capital Formation, change in stocks, and net exports (exports less imports).

Where $\sum_j X$ and F_i are total intermediate and final demand of the total output of sector i. In other words, output of i_{th} sector is equal to the total output consumed by other sectors including the sector itself) and different components of final demand. This could further be explained in the forms of coefficients form which are as follows

$$X_{ij} = a_{ij} X_j$$

Where a_{ij} is the output of sector i used as input by sector j for producing one unit of output.

The a_{ij} are also called as structural technical or coefficients. The above balance equation could be explained as follows.

$$X_i = a_{ij} X_j + F_i$$

The equation could further be explained in matrix form as follows:

$$(I - A)X = F$$

Where A_{nn} is coefficient matrix of input coefficients a_{ij} ; I is identity matrix where diagonal elements are equal to unity and off diagonal elements are equal to zero. X and F are vectors of total output and final demand. The input coefficients matrix (a_{ij}) gives the direct input requirement of the i_{th} sectors for producing one unit of output of j_{th} sector. However, it does not indicate the indirect (or second or higher round) effects of producing one unit of j_{th} sector. For an illustrative example, the production of one unit of a car requires the direct inputs of steel, other components and tyres, which in turn, requires inputs of the other sectors for their production and so on. Hence, with the help of the IO model, we can estimate the direct and indirect requirements of producing an additional unit of a sector. The equation could further be manipulated as follows:

$$X = (I - A)^{-1} F$$

$$X = R * F$$

Where $R = [r_{ij}]$ is called Leontief inverse or multiplier. Each coefficient of r_{ij} shows direct and indirect amount of i_{th} input required one unit of final demand in sector j. The underlying strict linearity assumption r_{ij} represents the partial assumption of derivative of x_i w.r.t f_i .

$$r_{ij} = dx_i / df_i$$

The total direct and indirect output effect could further be analysed in terms of employment multipliers by assuming fixed labour to output ratio each sector as computed below.

$$E_i = L_i/X_i$$

Both L_i and X_i represent the employment and output ratio for the sector of the economy. The total employment multipliers are estimated as follows:

$$L = \hat{E} * (I - A)^{-1} * F$$

The total direct and indirect multipliers are compiled for both the backward and forward linked sectors by taking the column and row sums of the L_{ij} matrix.

The PVs and CVs are capital goods sectors, which accounts for a large share of Gross Fixed Capital Formation in total output. The intermediate usage largely captures machinery equipment and parts but not the capital used in the production process. This higher capital allocation in final use has a further effect, which is captured by scaling up of the forward linked multiplier. This endogenising of the capital effect has been captured in an incremental sense. This is computed by taking the share of the GFCF in the total intermediate input use. The share has further been used to scale up the forward linked multiplier. As mentioned earlier, only the incremental value has been used.

The Leontief Inverse matrix, as computed from the IO Table, presents the total (direct and indirect) requirement table. The total direct and indirect multiplier explains the total direct and indirect requirement of the economy in order to meet one unit of final demand in a specific sector. These two concepts, namely backward and forward multipliers, are important techniques for tracing the effect of a change in final demand in the i_{th} sector of the economy. The multipliers have considerable bearing upon looking at inputs using and output supply of a specific sector. The indices for the linkages are further important in terms of assessing the indirect requirement of inputs of specific sector. In a nutshell, the backward linkages show relative strength of final demand on production whereas forward linkages shows the strength of a particular industry's link to the final demand changes.

As explained earlier, the multiplier evaluates the impact of one unit of final demand in a sector on the total output, valued added. The linkages or multiplier analysis is specifically useful in understanding the impact assessment of a new project, construction of an airport, or metro line, or other mega projects like the construction of a refinery, among other things. Another important consideration with regard to the multipliers aspects is in terms of assessing the economy-wide contribution of a sector, accounting for both direct and indirect contributions.

The present analysis has been carried out in terms of understanding the output and employment contribution of the 'automobile sector'. The relevance of a sector could further be viewed in terms of the likely slowdown of the automobile sector and its implications on the sectors indirectly linked to it.

The automobile sector qualifies as an ideal case for the study of multiplier analysis. The automobile sector comprises: (i) passenger vehicles; (ii) commercial vehicles, and (iii) two/three wheelers. We disaggregate the automotive sector industries into three sub-sectors.

The backward and forward linkages have further been subjected to its implications of the total (direct and indirect) employment, which is explained below. The indirect employment effects are critically linked to employment activities enabled through the backward and forward supplier effects. The total (direct and indirect) effects are important in terms of gauging the job creation or job destruction effect with regard to the boom/burst cycle of a sector or industry.

The employment multiplier has been captured using the labour-output ratios, which have been computed from the first IO table for 2015–16. The employment multipliers have been used for estimating the total employment in the three sub-sectors of the 'Automobile Sector". The total employment has also been estimated for 2018–19, and 2019–20 using the Leontief Inverse. We have estimated the labour-output ratios for two later years by using the Periodic Labour Force Survey GVO for the disaggregated manufacturing sectors corresponding to 42 IO sectors. The necessary ASI and Unincorporated Survey have been used for the disaggregated automobile sector.

Another major contribution of this study lies in bifurcating the Motor Vehicles Sectors into PVs and CVs. After the creation of two separate sectors, the IO table has further been balanced. The 42 sector IO table is finally used for multiplier analysis. The motor cycles and scooters sector has not been bifurcated in the 42 IO sector.

Table A1.1: Share (%) of Major Constituents of Two Automobile Sectors in GVO and GVA, 2015–16		
Sectors	*GVO*	*GVA*
Motor Vehicles		
i) Passengers Cars	0.79	0.67
ii) Commercial Vehicles	0.21	0.33
	1.00	1.00
Motor cycles and Scooters		
i) Two Wheelers	0.96	0.96
ii) Three Wheelers	0.04	0.04
	1.00	1.00

Source: Authors' computation based on Annual Survey of Industry (ASI) and NSSO 73rd Round Data on Unincorporated Non-Agricultural Enterprises (Excluding Construction) Data for 2015–16.

Sl. No.	SIAM Sectors	131 IO Sectors	NIC codes and descriptions
	Annexure 2: Mapping of SIAM Model Sectors (42) with 131 IO Sectors and NIC 5-digit sectors		
1	Agriculture, Forestry and Fishery	Crops, dairy, fishing, livestock (1-26)	Crop and animal production, hunting and related service activities, Forestry and logging, Fishing and aquaculture (011-032)
2	Mining and Quarrying	mineral products (27-37)	Mining and quarrying (051-099)
3	Food Beverage and Tobacco	Food Beverage and Tobacco (38-46)	Manufacture of food products, beverages and tobacco products (101-120)
4	Textiles and Garments	Khadi, cotton textiles(handlooms) (47), Cotton textiles (48), Woollen textiles (49), Silk textiles (50), Art silk, synthetic fibre textiles (51), Jute, hemp, Mesta textiles (52), Carpet weaving (53), Miscellaneous textile products (54), Readymade garments (55)	Manufacture of textiles, Manufacture of wearing apparel, (131-143)
5	Paper and Paper Products; Printing & Publishing	Wood and wood products except for furniture (56), Paper, Paper products and newsprint (57); Publishing, printing and allied activities (58)	Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials, Manufacture of paper and paper products, Printing and reproduction of recorded media (161-182)
6	Leather and Leather Footwear	leather & footwear (60), leather & products (61)	Manufacture of leather and related products (151-152)
7	Rubber Products	rubber products (62),	Manufacture of rubber products (221)
8	Plastic Products	plastic products (63)	Manufacture of plastics products (222)
9	Petroleum Products	Petroleum Products	Manufacture of refined petroleum products (192)
10	Coke and Coal Tar products	Coal tar products	Manufacture of coke oven products (191)
11	Basic Heavy Inorganic and Organic Chemicals	Organic heavy chemicals (67), Inorganic heavy chemicals (66)	Organic heavy chemicals (20114-20118,20123), Inorganic heavy chemicals (20111 to 20113)
12	Paints, varnishes and lacquers	Paints, varnishes and lacquers (70)	Paints, varnishes and lacquers (20221 to 20229)
13	Other Chemicals and Chemical Products	Fertilizers (68),Pesticides (69), Soaps, cosmetics & glycerine (71),	Fertilizers (2012, 20122, 20129), Pesticides (20211 to 20219), Soaps, cosmetics & glycerine (20231 to 20239), Other chemicals (20291 to 20299), Drugs and medicine (21001 to 21009)

Sl. No.	SIAM Sectors	131 IO Sectors	NIC codes and descriptions
		Other chemicals (73), Drugs and medicine (74)	
14	Synthetic fibres, resin	Synthetic fibres, resin (72)	Synthetic fibres, resin (20132 to 20133, 20301 to 20304)
15	Non-Metallic Mineral Products	Structural clay products (75), Cement (76), Other non-metallic mineral prods. (77)	Structural clay products (23921 to 23929, 23931 to 23939), Cement (23941 to 23943, 23949, 23952), Other non-metallic mineral prods.(23101 to 23919, 23944, 23945, 23951, 23953 to 23999)
16	Ferrous and Non-Ferrous Basic Metal	Iron, steel and Ferro alloys (78), Iron and steel casting & forging (79), Iron and steel foundries (80), Non-ferrous basic metals (including alloys) (81)	Iron, steel and Ferro alloys (24101 to 24109), Iron and steel casting & forging (24311 to 24319, 25910), Iron and steel foundries (25111 to 25119), Non-ferrous basic metals (including alloys) (24201 to 24209, 24320)
17	Hand Tools and Miscellaneous Metal Products	Hand tools, hardware (82), Miscellaneous metal products (83)	Hand tools, hardware (25932, 25933, 25939), Miscellaneous metal products (25121 to 25129, 25131, 25920, 25931, 25991 to 25999, 31003, 33111 to 33119)
18	Non-Electrical Machinery & Parts	Tractors and agri. Implements (84) Industrial machinery (F & T) (85), Industrial machinery(others) (86) Machine tools (87) Other non-electrical machinery (88)	Tractors and agri. Implements (28211 to 28219, 33124), Industrial machinery (Food & Textiles) (28251 to 28259, 28261 to 28269, 33126, 33127), Industrial machinery(others) (28230, 28241 to 28249, 28291 to 28299, 33125, 33129, 33200), Machine tools (28221 to 28229, 33123), Other non-electrical machinery (25200, 28110 to 28199, 30400, 33122)
19	Electrical industrial Machinery	Electrical industrial Machinery (89)	Electrical industrial Machinery (27101 to 27104, 33121)
20	Electrical wires & cables	Electrical wires & cables (90)	Electrical wires & cables (27310, 27320, 27331 to 27339)
21	Batteries	Batteries (91)	Batteries (27201 to 27202)
22	Other electrical Machinery	Other electrical Machinery (92)	Other electrical Machinery (27400, 27900)
23	Electrical, electronic & communication equipments	Electrical appliances (93), Electronic equipments (including TV) (94), Communication equipment (96)	Electrical appliances (27501 to 27509, 95221, 95222), Electronic equipments(incl.TV) (26101 to 26209, 26401 to 26409, 95210), Communication equipment (26301 to 26309, 95120)

Sl. No.	SIAM Sectors	131 IO Sectors	NIC codes and descriptions
24	Passenger cars	part of Motor Vehicles (99)	Manufacture of passenger cars (29101), Manufacture of car seats(29303),part of remaining motor vehicles components ((29101-29304, 45200 less 29101, 29303, 29102, 29202)
25	Commercial vehicles	part of Motor Vehicles (99)	Manufacture of commercial vehicles such as vans, lorries, over-the-road tractors for semi-trailers etc.(29102), Manufacture of trailers and semi-trailers for transport of goods or passengers (29202), part of remaining motor vehicles components ((29101-29304, 45200 less 29101, 29303, 29102, 29202)
26	Motor Cycles and Scooter (30)	Motor Cycles and Scooter	Manufacture of motorcycles, scooters, mopeds etc. and their engine (30911), Manufacture of three-wheelers and their engine (30912), Manufacture of parts and accessories of three wheelers and motorcycles including side cars (30913), Maintenance and repair of motor cycles, mopeds, scooters and three wheelers (45403)
27	Other Transports & Equipments, nec.	Ships and boats (97), Rail equipments (98), Bicycles, cycle-rickshaw (101), Other transport equipments (102), Aircraft & spacecraft (103)	Ships and boats (30111 to 30120), Rail equipments (30201 to 30206, 33140), Bicycles, cycle-rickshaw (30921 to 30923, 95291), Other transport equipments (30991 to 30999, 33150, 33190), Aircraft & spacecraft (30301 to 30305)
28	Other Miscellaneous Manufacturing	Furniture & Fixtures (59), Watches and clocks (95), Gems & jewellery (105), Miscellaneous manufacturing (106), Medical, precision & optical instruments (104)	Furniture & Fixtures-wooden (31001, 31002, 95240), Watches and clocks (26521 to 26529, 95294), Gems & jewellery (32111 to 32120, 95293), Miscellaneous manufacturing (18200, 25132 to 25139, 26511 to 26519, 26600, 26800, 31009, 32201 to 32209, 32401 to 32403, 32409, 32901 to 32909, 33131, 33132, 95295, 95299), Medical, precision & optical instruments (26700, 32501 to 32509, 33133)
29	Construction	Construction and construction services	Construction and construction services (41001 to 43900)
30	Electricity	Electricity	Electricity (35101 to 35109)
31	Water Supply	Water Supply	Water Supply (36000, 37001 to 37003, 35301 to 35303)
32	Land Transport	Land transport	Land passenger services (49211 to 49219, 49221 to 49229), Land freight services (49231 to 49232, 49300)

Sl. No.	SIAM Sectors	131 IO Sectors	NIC codes and descriptions
33	Other Transport	rail transport (110), water transport (112), Air Transport (113)	rail transport (Railway passenger services (49110), Railway freight services (49120)), water transport (Water passenger services (50111 to 50119, 50211 to 50219), Water freight services (50120, 50220)), Air Transport (Air passenger services (51101 to 51109), Air freight services (51201 to 51202))
34	Supporting and Auxiliary transport Activities	Supportive and Auxiliary transport activities	Supportive and Auxiliary transport activities (Transport incidental services -passengers (52211 to 52232, 52291 to 52294, 79110, 79120, 79900), Transport incidental services -freight (52241 to 52243))
35	Trade	Trade	Trade (45101 to 47990, 92001, 92002) less 45200, 45403
36	Hotel and Restaurants	Hotels & Restaurant	Hotels & Restaurant (Hotels (55101 to 55902), Restaurants (56101 to 56304))
37	Storage, warehousing & communication	Storage and warehousing (115), Communication services (116)	Storage and warehousing (52101 to 52109), Communication services (53100, 53200, 61101 to 61900, 60100, 60200)
38	Financial & Insurance Services	Financial services (119), Insurance services (120)	Financial services (64110 to 64990, 66110 to 66190), Insurance services (65110 to 65300, 66210 to 66309)
39	Real Estate, Ownership of Dwelling & Professional Services	Ownership of dwellings (121), Legal services (124), Computer related services (125), Other Business services (126), Real estate services (127)	Ownership of dwellings, Legal services (69100), Computer related services (58201 to 58203, 62011 to 63999, 95111, 95112), Other Business services (69201 to 71200, 74101 to 74909, 80100 to 82990), Real estate services (68100 to 68200)
40	Education and research	Education and research (122)	Education and research (85101 to 85500, 72100 to 72200)
41	Renting of machinery & equipment	Renting of machinery & equipment (128),	Renting of machinery & equipment (Renting of transport equipment (77100),Renting of machinery and equipments (other than transport equipment) (77210 to 77400))
42	Rest of the Services	Medical and Health (123), Community, social and personal services(129), Other services (130), Public administration and defence (131)	Medical and Health (75000, 86100 to 86909, 87100 to 87900), Community, social and personal services (Cultural and religious services(91010 to 91030, 94910), Other Community and social services (88100, 88900, 94110 to 94200, 94920 to 94990, 96010 to 96908)), Other services (Sporting and recreational services(59111 to 59202, 90001 to 90009, 92009, 93110 to 93290), Other part of other services (38110 to 39000, 73100, 73200, 78100 to 78300, 97000 to 99000)), Public administration and defence (84111 to 84300)

Source: NSSO, MoSPI.

	2015-16	2017-18	2018-19	2019-20
Agriculture, Forestry and Fishery	214.4	220.7	220.3	268.0
Mining and Quarrying	1.9	1.9	2.0	1.6
Food Beverage and Tobacco	9.0	9.3	9.1	9.5
Textiles and Garments	17.4	18.0	17.8	18.2
Paper and Paper Products; Printing & Publishing	4.5	4.6	4.7	4.7
Leather and Leather Footwear	1.1	1.2	1.0	1.1
Rubber Products	0.4	0.3	0.4	0.4
Plastic Products	0.9	0.8	1.0	0.9
Petroleum Products	0.3	0.3	0.3	0.4
Coke and Coal Tar products	0.0	0.0	0.0	0.0
Basic Heavy Inorganic and Organic Chemicals	0.3	0.4	0.3	0.2
Paints, varnishes and lacquers	0.1	0.1	0.2	0.2
Other Chemicals and Chemical Products	1.5	1.4	1.7	2.0
Synthetic fibres, resin	0.0	0.0	0.0	0.0
Non-Metallic Mineral Products	4.1	4.2	4.2	4.4
Ferrous and Non-Ferrous Basic Metal	3.0	3.0	3.2	3.1
Hand Tools and Miscellaneous Metal Products	2.0	1.9	2.2	1.9
Non-Electrical Machinery & Parts	2.0	2.0	2.2	2.3
Electrical industrial Machinery	0.8	0.8	0.8	0.5
Electrical wires & cables	0.2	0.1	0.2	0.3
Batteries	0.1	0.1	0.1	0.1
Other electrical Machinery	0.2	0.3	0.2	0.3
Electrical, electronic & communication equipments	1.7	1.7	1.8	2.2
Passenger cars	**2.2**	**2.3**	**2.3**	**2.7**
Commercial vehicles	**0.5**	**0.5**	**0.6**	**0.6**
Motor Cycles and Scooter	**0.7**	**0.7**	**0.7**	**0.8**
Other Transports & Equipments, nec.	1.7	1.6	1.9	2.0
Other Miscellaneous Manufacturing	5.4	5.1	6.0	6.0
Construction	63.9	62.5	68.9	76.1
Electricity	1.3	1.4	1.3	1.5
Water Supply	0.5	0.5	0.5	0.8
Land Transport	19.8	20.2	20.4	21.4
Other Transport	1.0	1.1	1.1	1.1
Supporting and Auxiliary transport Activities	1.1	1.1	1.1	1.5
Trade	46.0	45.1	49.5	58.5
Hotel and Restaurants	8.7	8.8	9.0	9.1
Storage, warehousing & communication	2.1	2.1	2.3	1.9
Financial & Insurance Services	5.1	4.9	5.6	5.6
Real Estate, Ownership of Dwelling & Professional Services	11.6	11.8	12.0	12.2
Education and research	17.6	17.6	18.6	18.5
Renting of machinery & equipment	0.9	1.0	0.9	1.0
Rest of the Services	28.4	27.4	31.0	26.9

Annexure 3: Labour Inputs (Number of Jobs) in various years (millions)

Sectors	Output (GVO) multiplier	Income (GVA) multiplier	Employment Multiplier	
			Backward	Forward
Agriculture, Forestry and Fishery	1.53	1.01	0.88	3.64
Mining and Quarrying	1.82	0.95	0.12	0.24
Food Beverage and Tobacco	2.44	1.02	0.67	0.11
Textiles and Garments	2.32	0.95	0.50	0.39
Paper and Paper Products; Printing & Publishing	2.31	0.94	0.41	0.41
Leather and Leather Footwear	2.11	0.97	0.43	0.17
Rubber Products	2.36	0.93	0.24	0.04
Plastic Products	2.73	0.88	0.29	0.08
Petroleum Products	2.45	0.88	0.11	0.01
Coke and Coal Tar products	2.30	0.95	0.16	0.00
Basic Heavy Inorganic and Organic Chemicals	2.45	0.85	0.18	0.03
Paints, varnishes and lacquers	2.48	0.91	0.20	0.02
Synthetic fibres, resin	2.68	0.90	0.39	0.28
Other Chemical Products & Chemicals	2.47	0.93	0.19	0.00
Non-Metallic Mineral Products	2.20	0.92	0.24	0.19
Ferrous and Non-Ferrous Basic Metal	2.60	0.81	0.17	0.21
Hand Tools and Miscellaneous Metal Products	2.23	0.92	0.20	0.19
Non-Electrical Machinery & Parts	2.37	0.88	0.18	0.07
Electrical industrial Machinery	2.21	0.90	0.19	0.08
Electrical & Electronic Machinery	2.37	0.90	0.17	0.05
Electrical wires & cables	1.87	0.92	0.11	0.04
Batteries	1.15	0.99	0.09	0.09
Electrical, Electronic & Communication equipment	2.30	0.91	0.26	0.20
Passenger Cars	**2.70**	**0.91**	**0.21**	**0.06**
Commercial Vehicles	**2.49**	**0.87**	**0.19**	**0.04**
Motor Cycles and Scooter	**2.75**	**0.85**	**0.21**	**0.06**
Other Transports & Equipment, nec.	2.27	0.92	0.33	0.26
Other Miscellaneous Manufacturing	3.12	0.88	0.39	0.28
Construction	2.21	0.93	0.41	0.51
Electricity	2.22	0.94	0.15	0.06
Water Supply	2.37	0.97	0.24	0.06
Land Transport	2.05	0.93	0.33	0.82
Other Transport	2.01	0.96	0.15	0.07
Supporting and Auxiliary transport Activities	2.03	0.96	0.16	0.07
Trade	1.79	0.96	0.33	1.11
Hotel and Restaurants	2.08	0.99	0.71	0.32
Storage, warehousing & communication	2.07	0.94	0.14	0.08
Financial & Insurance Services	1.48	0.98	0.11	0.15
Education & Research	1.54	0.98	0.23	0.19
Real Estate, Ownership of Dwelling & Professional Services	1.41	0.98	0.12	0.28
Renting of machinery & equipment	1.90	0.95	0.53	0.47
Rest of the Services	1.68	0.97	0.27	0.16

Source: NCAER computations.

Annexure 5: Simulation Exercise for 2019–20 (number of million jobs)								
	Actual Scenario				**CAGR of 15% between 2015–16 and 2019–20**			
Type of Multiplier	**PVs**	**CVs**	**2Ws/ 3Ws**	**Total**	**PVs**	**CVs**	**2Ws/ 3Ws**	**Total**
Backward	13.1	3.2	4.1	20.4	15.7	3.8	4.7	24.2
Forward	3.5	0.7	1.0	5.2	4.2	0.8	1.1	6.1
Capital Adjusted	2.0	3.1	--	5.1	2.3	3.8	--	6.1
Total	18.6	7.0	5.1	30.7	22.2	8.3	5.8	36.3

Source: NCAER Computations.

Note: The CAGR of GVO of the auto sector between 2015–16 and 2019–20 was 11.2 per cent. We are assuming a higher CAGR of 15 per cent for the auto sector between 2015–16 and 2019–20.

Annexure 6: Skilled employment based on General, Technical and Vocational education	
Skill Level	**Description**
Low skilled	General education below primary, no technical and no vocational education
	General education below primary, no technical and some vocational education
Low medium skilled	General education primary to secondary, no technical and no vocational education
	General education primary to secondary, no technical and some vocational education
Medium high skilled	General education higher secondary, no technical and no vocational education
	General education higher secondary, no technical and some vocational education
	General education higher secondary, some technical and no vocational education
	General education diploma/certificate course, no technical and no vocational education
	General education diploma/certificate course, no technical and some vocational education
	General education diploma/certificate course, some technical and no vocational education
	General education diploma/certificate course, some technical and some vocational education
High skilled	General education graduate & above, no technical and no vocational education
	General education graduate & above, no technical and some vocational education
	General education graduate & above, some technical and no vocational education
	General education graduate & above, some technical and some vocational education

	2015−16				2017−18				2018−19			
	LS	**LMS**	**MHS**	**HS**	**LS**	**LMS**	**MHS**	**HS**	**LS**	**LMS**	**MHS**	**HS**
Agriculture, Forestry and Fishery	44.8	45.1	6.4	3.6	45.7	44.7	6.2	3.4	43.9	45.6	6.7	3.8
Mining and Quarrying	31.5	46.2	11.5	10.7	31.4	46.1	12.7	9.7	31.7	46.3	10.4	11.7
Food Beverage and Tobacco	32.6	51.5	8.4	7.4	35.2	49.0	8.5	7.2	30.0	54.2	8.4	7.5
Textiles and Garments	21.2	63.6	10.0	5.3	21.9	63.2	9.8	5.1	20.3	63.9	10.2	5.5
Paper and Paper Products; Printing & Publishing	27.3	49.7	10.7	12.3	30.4	45.9	12.3	11.4	24.1	53.5	9.1	13.2
Leather and Leather Footwear	22.1	57.5	12.1	8.3	24.5	56.2	10.5	8.7	19.1	59.0	14.1	7.8
Rubber Products	8.7	45.3	30.0	16.0	8.4	39.5	29.4	22.8	9.0	50.0	30.5	10.4
Plastic Products	16.4	54.0	14.3	15.4	17.2	54.2	11.0	17.6	15.8	53.8	16.8	13.5
Petroleum Products	3.1	53.7	15.3	27.9	1.6	52.4	12.6	33.4	4.5	54.9	17.9	22.7
Coke and Coal Tar products	21.0	47.3	7.0	24.7	26.1	34.8	8.6	30.6	0.0	100.0	0.0	0.0
Basic Heavy Inorganic and Organic Chemicals	12.9	31.0	27.1	28.9	18.2	27.6	25.3	28.9	5.8	35.6	29.7	29.0
Paints, varnishes and lacquers	17.1	57.6	9.1	16.1	20.0	58.7	9.7	11.6	15.1	56.9	8.7	19.3
Other Chemicals and Chemical Products	10.2	33.9	20.0	35.8	11.3	35.1	17.3	36.3	9.4	32.8	22.4	35.4
Synthetic fibres, resin	35.5	43.4	9.9	11.1	7.0	76.1	10.8	6.1	59.9	15.6	9.1	15.4
Non-Metallic Mineral Products	39.0	45.3	8.6	7.2	42.4	43.8	7.0	6.8	35.4	46.8	10.3	7.6
Ferrous and Non-Ferrous Basic Metal	11.6	56.5	18.7	13.2	9.9	59.6	15.6	14.9	13.1	53.6	21.7	11.6
Hand Tools and Miscellaneous Metal Products	16.4	55.8	17.9	10.0	17.0	55.4	16.0	11.7	15.9	56.1	19.6	8.4
Non-Electrical Machinery & Parts	12.2	50.4	21.7	15.7	15.7	50.8	17.9	15.6	8.9	50.0	25.3	15.8
Electrical industrial Machinery	8.1	50.1	27.7	14.1	7.8	51.2	29.2	11.8	8.3	49.1	26.2	16.5
Electrical wires & cables	4.7	40.0	32.2	23.1	0.8	48.7	31.1	19.3	8.0	32.6	33.1	26.3
Batteries	9.4	44.0	36.7	9.8	1.3	61.7	16.6	20.4	15.9	29.8	53.0	1.3
Other electrical Machinery	8.6	34.8	29.9	26.7	9.0	36.5	26.2	28.3	8.1	32.2	35.3	24.5
Electrical, electronic & communication equipment	4.6	45.0	28.9	21.5	4.3	43.9	29.0	22.8	4.9	46.0	28.9	20.2
Passenger cars	8.5	56.6	22.7	12.2	7.6	55.7	22.9	13.8	9.5	57.4	22.5	10.6
Commercial vehicles	8.5	56.4	22.7	12.4	7.1	54.4	23.8	14.8	10.0	58.5	21.6	9.9
Motorcycles and Scooter	10.2	72.5	12.5	4.9	12.7	75.1	9.1	3.1	7.7	69.7	16.0	6.7
Other Transports and Equipment, nec	13.3	59.0	17.2	10.5	14.4	61.4	13.8	10.3	12.3	56.9	20.1	10.7
Other Miscellaneous Manufacturing	15.0	67.3	10.7	7.0	12.9	70.4	9.3	7.4	16.8	64.6	11.8	6.7
Construction	37.9	53.2	6.1	2.8	38.4	52.7	6.0	2.8	37.5	53.6	6.1	2.8

	2015–16				2017–18				2018–19			
	LS	LMS	MHS	HS	LS	LMS	MHS	HS	LS	LMS	MHS	HS
Electricity	6.0	36.8	26.6	30.6	6.4	41.4	22.9	29.2	5.5	31.6	30.8	32.1
Water Supply	15.4	50.2	15.8	18.6	18.6	50.5	16.8	14.1	12.1	49.9	14.7	23.2
Land Transport	19.0	65.2	10.8	5.0	20.0	64.7	10.9	4.4	17.9	65.7	10.7	5.7
Other Transport	6.5	38.8	17.0	37.7	4.9	40.9	18.0	36.2	8.1	36.7	15.9	39.2
Supporting and Auxiliary transport Activities	12.6	42.2	17.4	27.8	11.5	47.7	16.0	24.9	13.7	36.6	18.9	30.8
Trade	16.4	52.4	15.5	15.7	17.8	52.6	14.3	15.3	15.2	52.2	16.6	16.0
Hotel and Restaurants	25.5	57.8	9.7	7.0	27.5	56.4	9.5	6.6	23.5	59.1	10.0	7.4
Storage, warehousing & communication	5.7	36.7	24.7	32.8	5.5	35.8	24.7	34.0	6.0	37.6	24.8	31.7
Financial & Insurance Services	1.3	16.7	15.0	66.9	0.9	18.0	14.7	66.4	1.7	15.6	15.4	67.3
Real Estate, Ownership of Dwelling & Professional Services	4.7	23.4	14.9	57.0	4.8	24.0	15.0	56.2	4.5	22.8	14.8	57.8
Education and research	3.3	15.8	15.0	65.8	3.4	15.2	15.9	65.5	3.3	16.4	14.1	66.1
Renting of machinery & equipment	15.1	63.7	11.1	10.1	19.4	61.9	9.2	9.5	10.2	65.8	13.3	10.7
Rest of the Services	20.6	40.2	15.2	23.9	21.3	39.6	15.6	23.6	20.1	40.8	14.9	24.2

Source: NCAER Computations from MoSPI.

Note: LS Low Skilled, LMS Low Medium Skilled, MHS Medium High Skilled, HS High Skilled.