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Technology and Employment: The Indian Scenario

Pankaj Vashisht

Scheme of Presentation

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- *Global debate on Technology and Job*
- *Changing Demand and Supply of Labour in India*
- *Technology and Jobs in India*

Technology and The End of Work?

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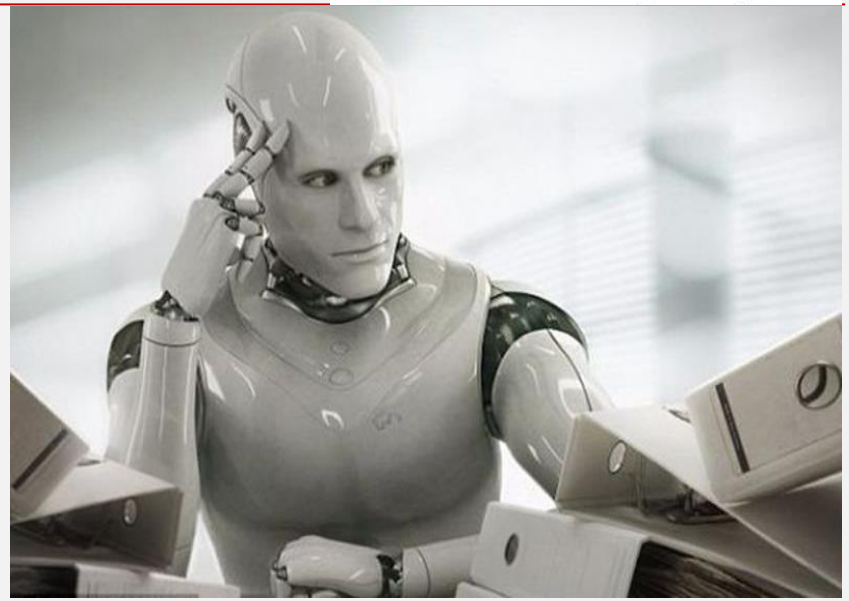

"The factory of the future will have only two employees, a man and a dog. The man will be there to feed the dog. The dog will be there to keep the man from touching the equipment."
Warren Bennis

1. Artificial Intelligence
2. Quantum computers
3. Blockchain technology
4. 3D printing
5. New generation robotics include Sewbots, Baxter, and LBR iiwa

History tells us a Different Story

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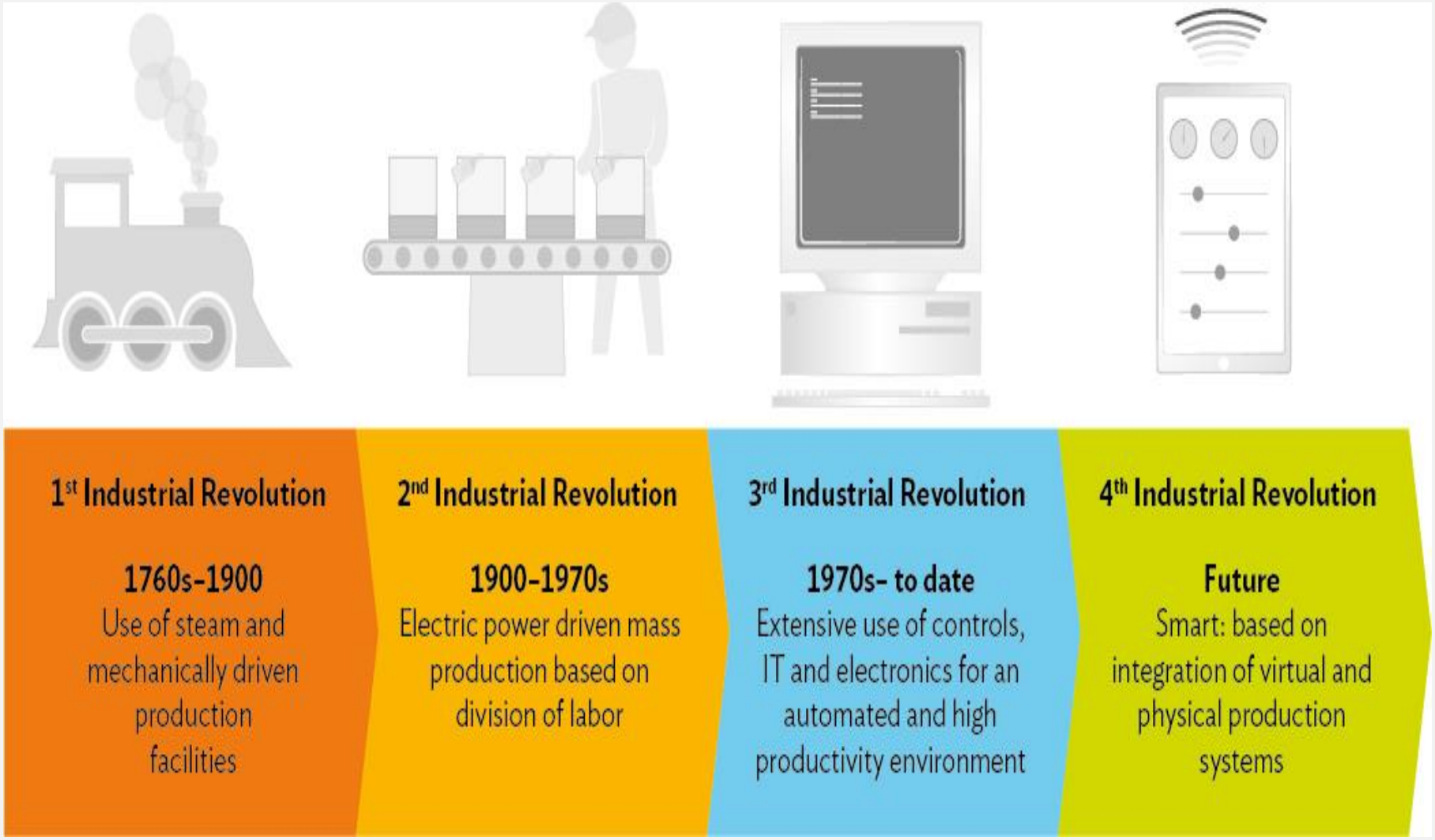

Economics of Innovation and Employment

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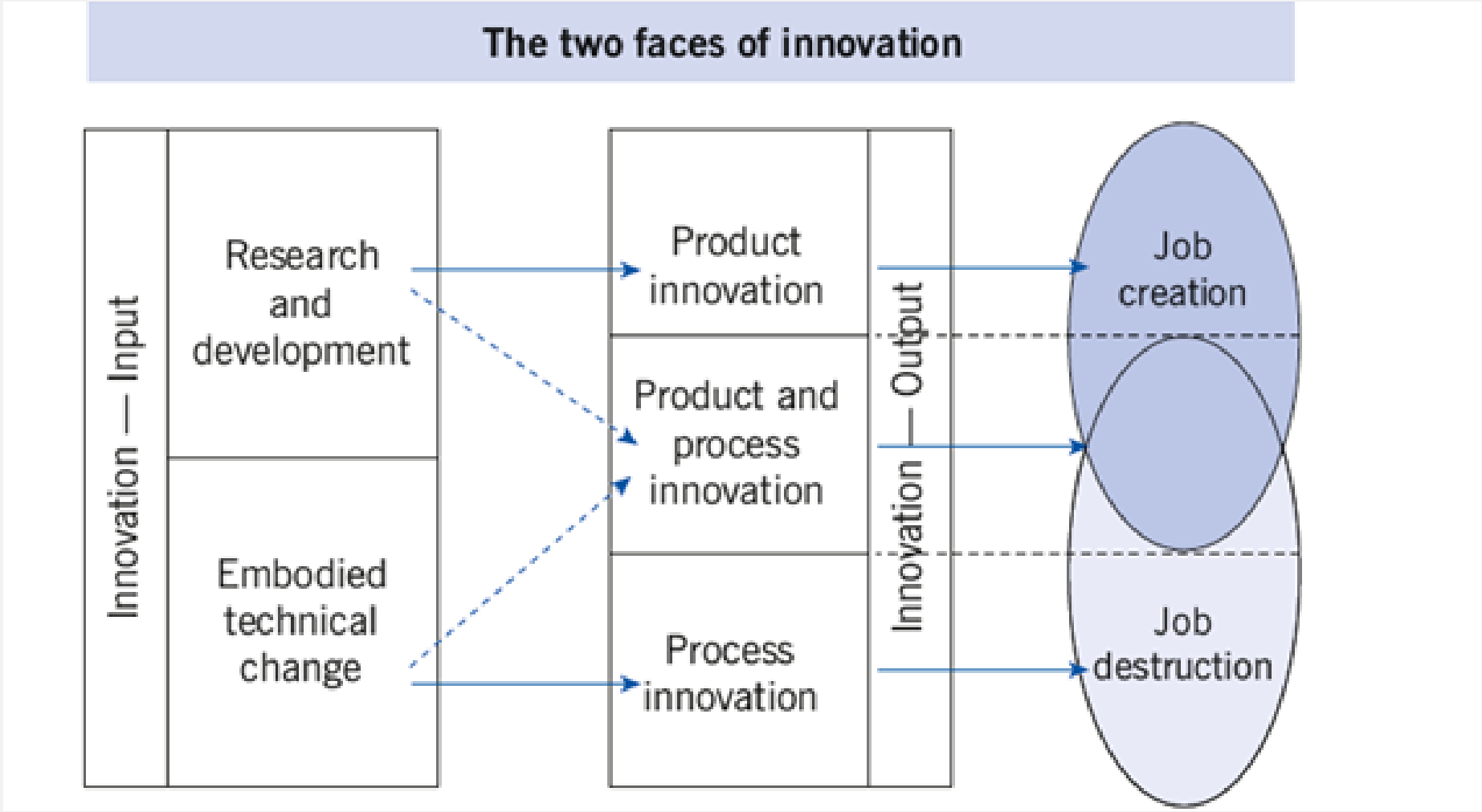

Source: Viverali 2012

Economic Rationale behind Optimism

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- Compensation Framework - Labour saving technology not a problem in long run
- Job creation through new products: Expansion of capital goods sector and emergence of new products
- Reduction in unit cost and increase in demand: **Efficiency Vs. Scale Effect**
  - What about imperfect market
- Increase in investment
- Decrease in Wage and end of labour saving innovations
- Trade union and increase in income: Keynsian Kaldorian tradition
- Job Creation through higher consumption
  - What if benefits of productivity gain not shared with workers

This time its Different?

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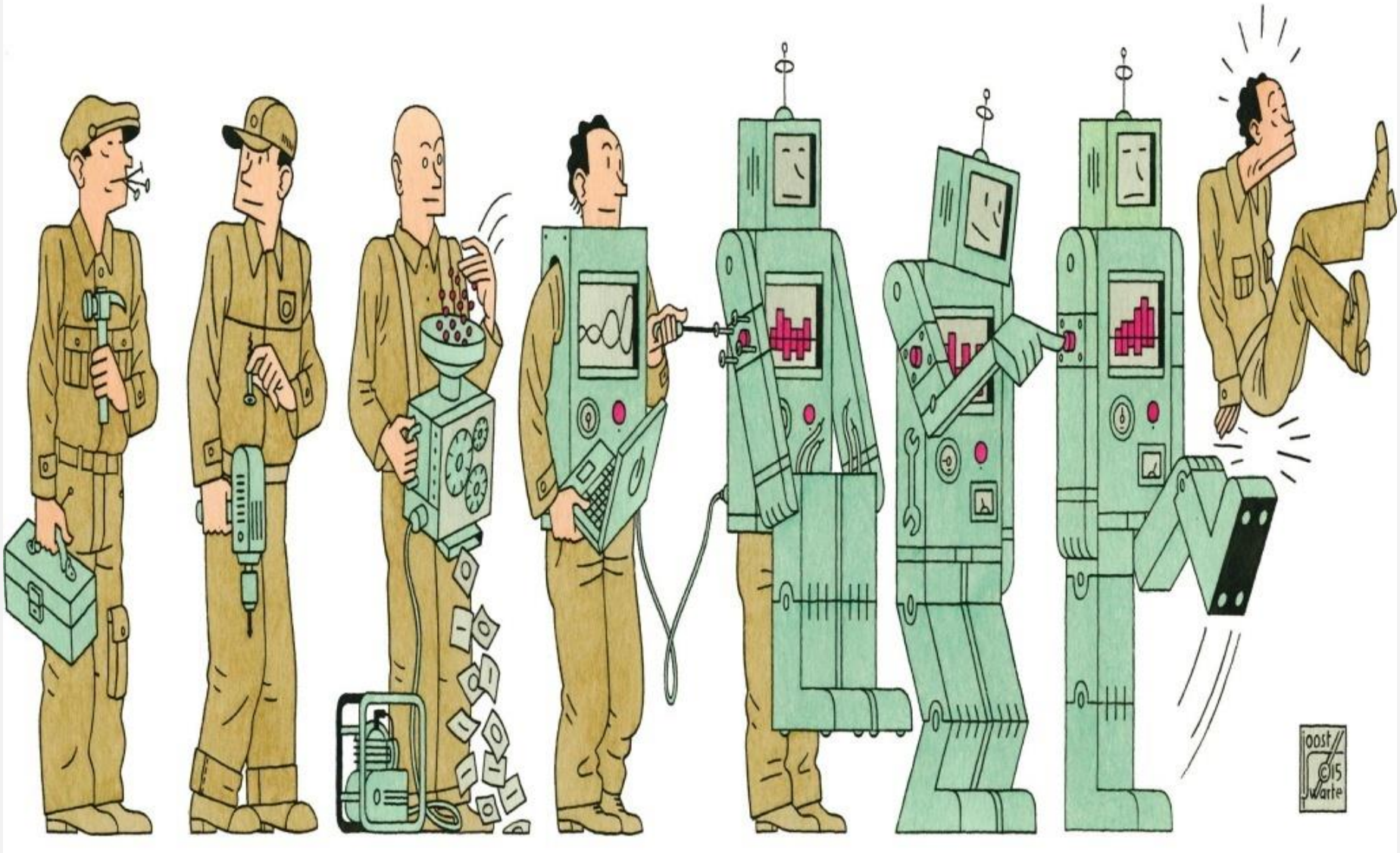

The Great Decoupling

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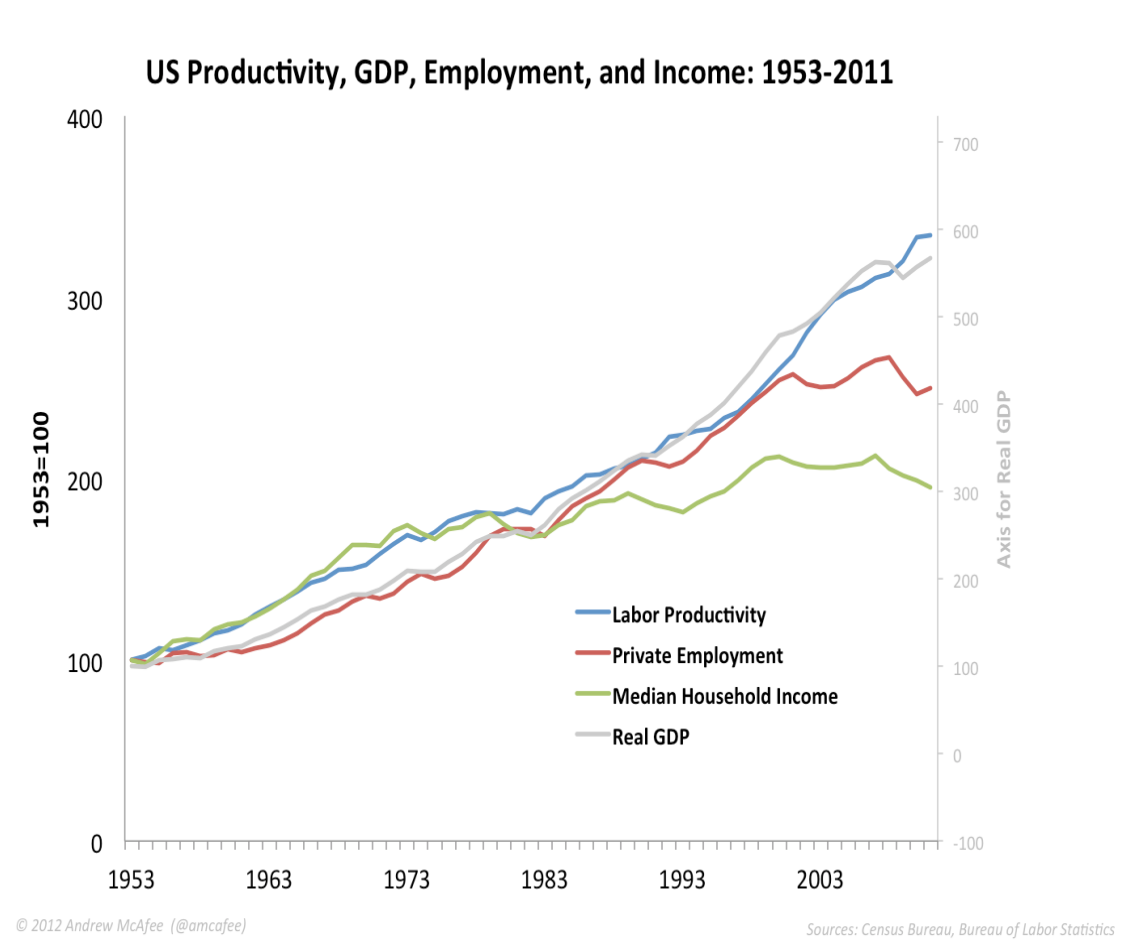
- Productivity growth not increasing the wage income

- Decoupling: Not Really (Stansbury and Summers 2017)



Source: Brynjolfsson and McAfee 2014

Job Polarization

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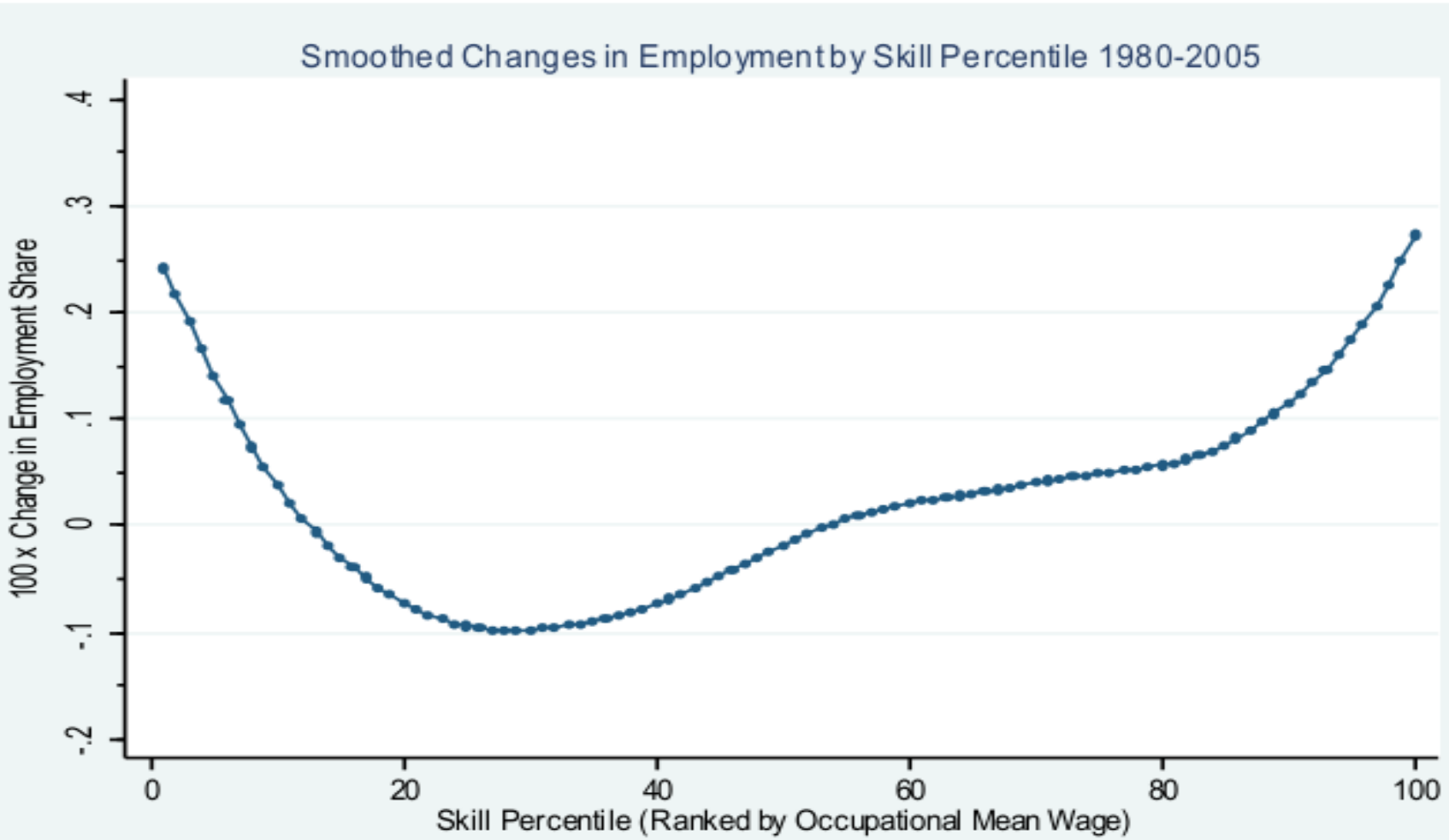

Routine Biased Technological Change

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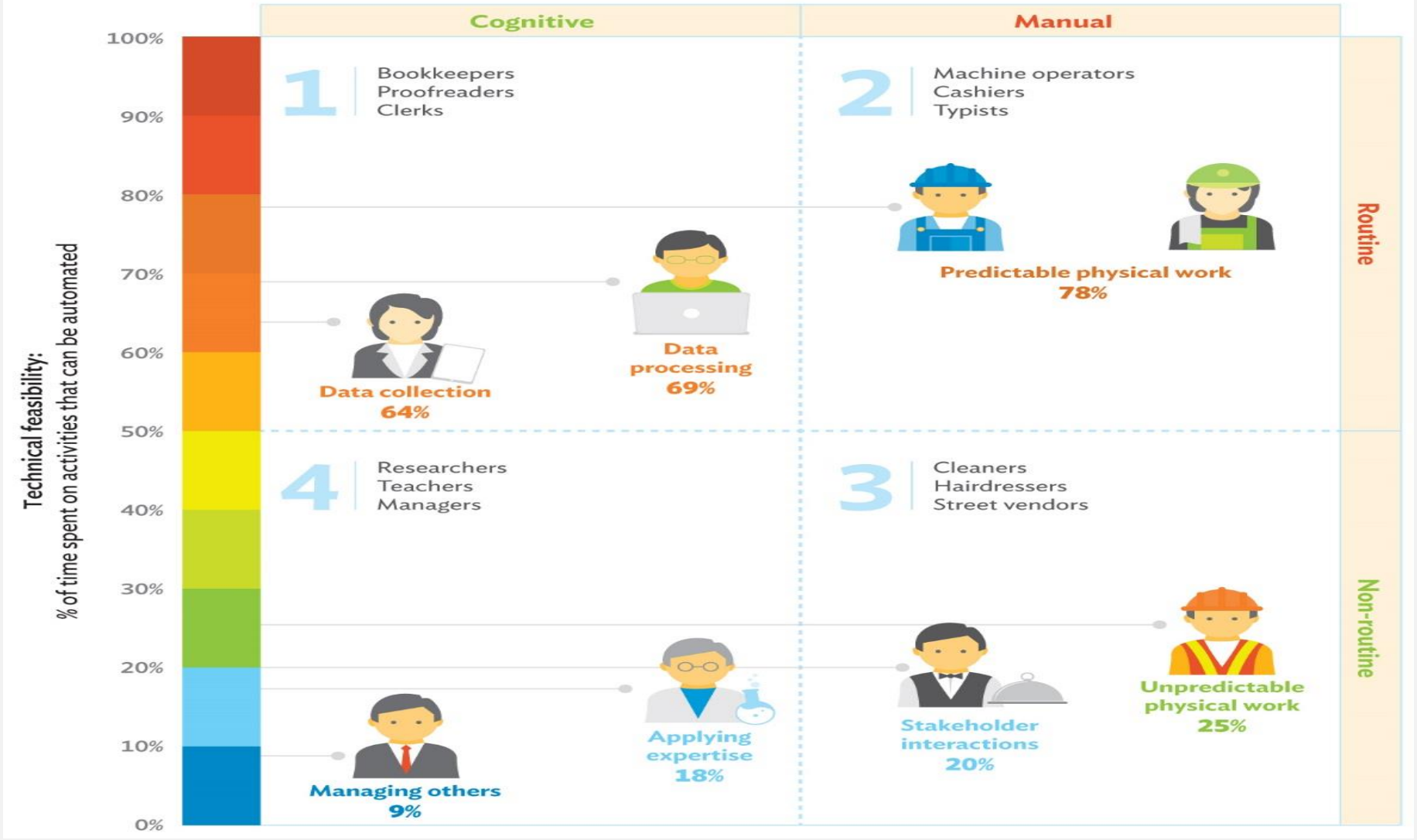

Deroutinesation of Jobs

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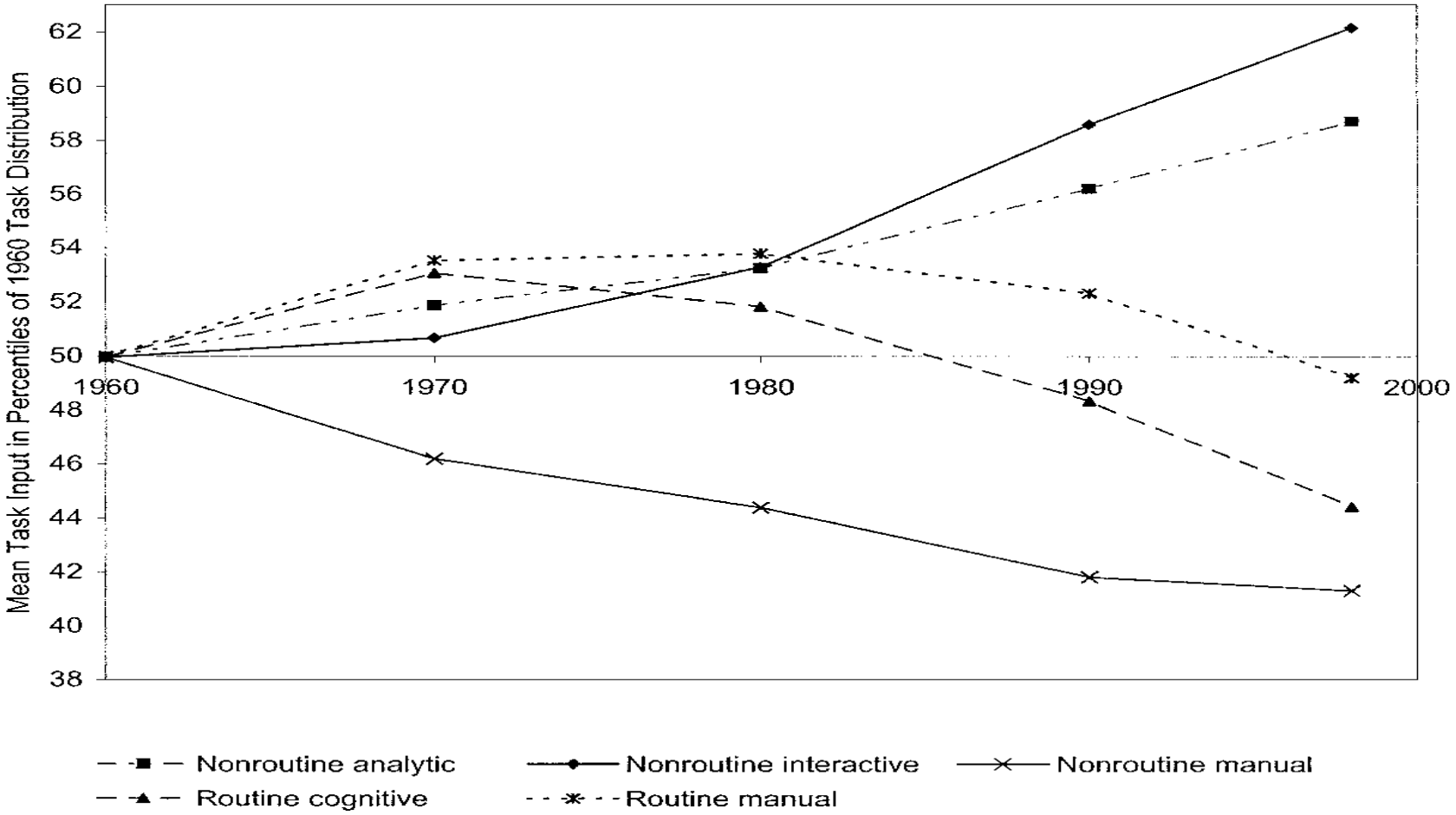

Source: Autor et al 2003

Changing task content and its drivers

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- Routine task content declined in the developed countries (Michaels et al. 2014)
- Transition economies following the same trend (Hardy et al. 2015)
- What explains changing task content
  - Technology (Autor et al 2003, Goos 2009)
  - Up-skilling: Increase in supply graduates (Salvatori 2015; Hardy et al. 2015)
  - Structural change (Barany and Siegel 2015)

Technology up-gradation

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- Capital imports
- R&D expenditure
- Share of ICT capital

Channing Profile of Indian Labour Force

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- Size and Shape of labour supply changing rapidly
- 9 million workers joining labour force annually
- Impressive improvement in the quality of the labour supply
- Supply of workers with college degree growing phenomenally
- Increase in supply of vocationally trained workers remained less impressive

		1983-84		2017-18	
		Million	**Share**	**Million**	**Share**
1	Not Literate	167.72	57.38	116.96	24.22
2	Literate Without Formal Schooling	6.02	2.06	1.60	0.33
3	Below Primary	26.84	9.18	27.61	5.72
4	Primary	36.81	12.59	61.78	12.79
5	Middle	26.91	9.21	101.40	21.00
6	Secondary	20.32	6.95	59.19	12.26
7	Above Secondary	7.67	2.62	114.40	23.69
7.1	Higher Secondary			42.07	8.71
7.2	Diploma/Certificate Course			7.93	1.64
7.3	Graduate			47.51	9.84
7.4	Postgraduate And Above			16.89	3.50
8	**Total**	**292**		**483**	

Source: Compiled from NSS unit-level data

Increasing Demand for High Skills

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- Noticeable change in occupation structure
- High skill occupations gained share in employment
- But no sign of polarisation, at least at aggregate level
- High Skill occupations gained at the cost of agriculture workers

	1983-84	2017-18
Legislator, Senior Officers and Managers	1.12	7.65
Professionals	1.44	4.25
Technical and Associate Professionals	2.19	4.09
Clerks	1.64	2.04
Services, Shop and Market Sales Workers	6.34	9.42
Skilled Agriculture and Fishery Workers	44.93	30.12
Craft Related Trade Workers	9.46	12.06
Plant and Machine Operator	2.94	5.92
Elementary Occupations	29.94	24.44

Source: Compiled from NSS unit-level data

Technology and Jobs in India: What we know

Risk of Automation and Job Apocalypse

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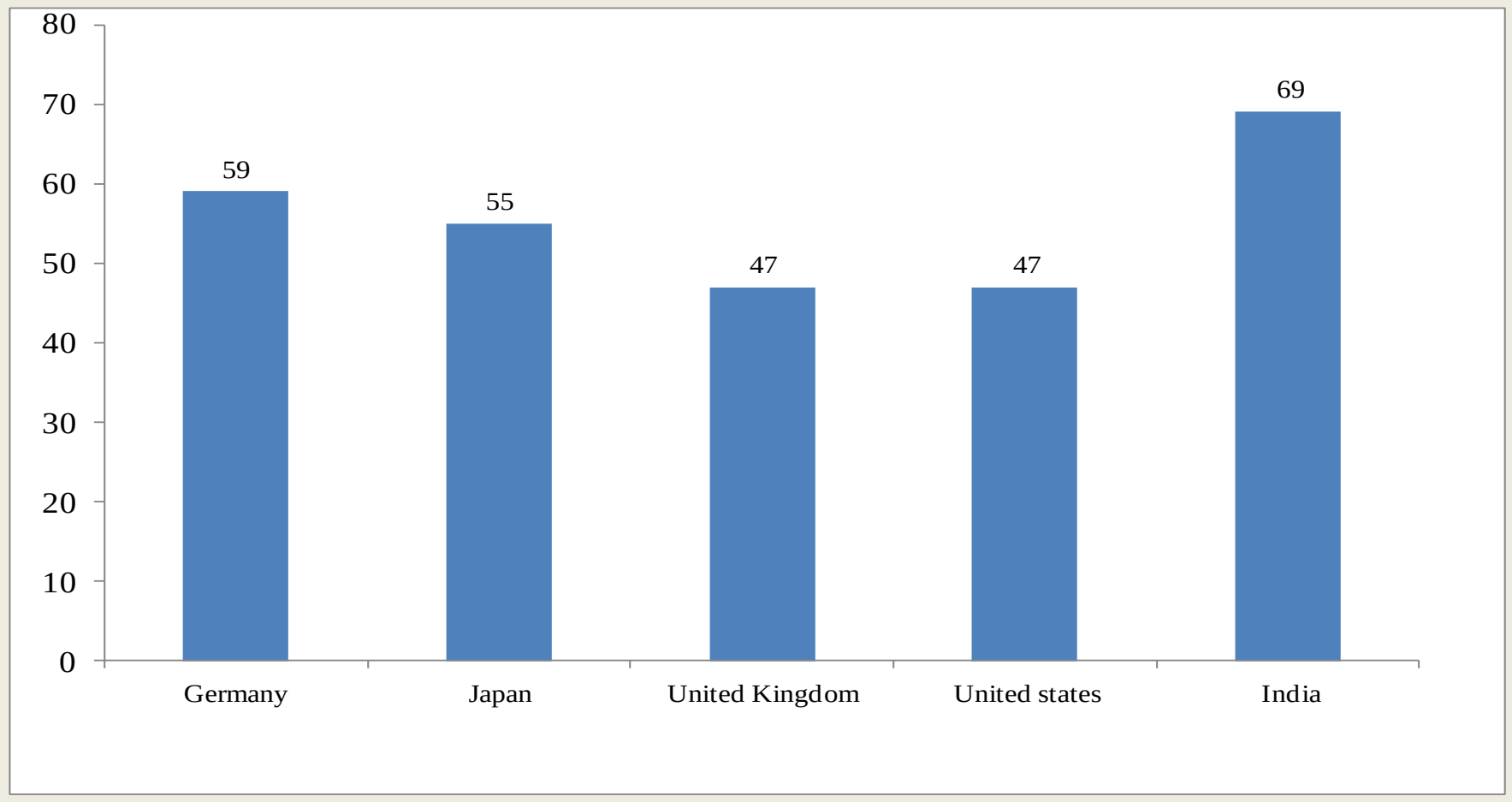

Source: World Bank 2013

Proportion of jobs at Risk of Automation

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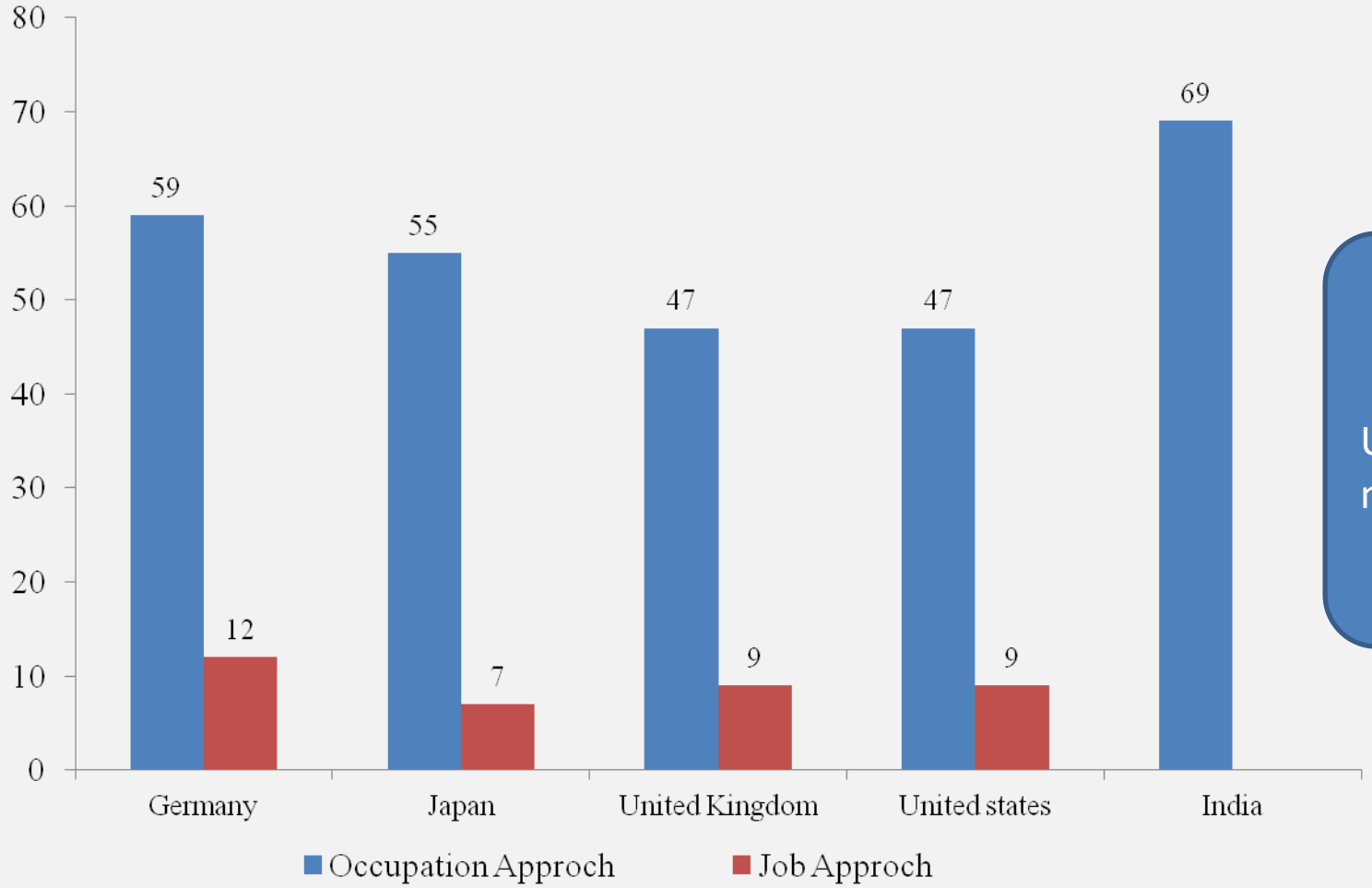

Job at Risk: Using revised methodology

Risk of Automation and Job Apocalypse

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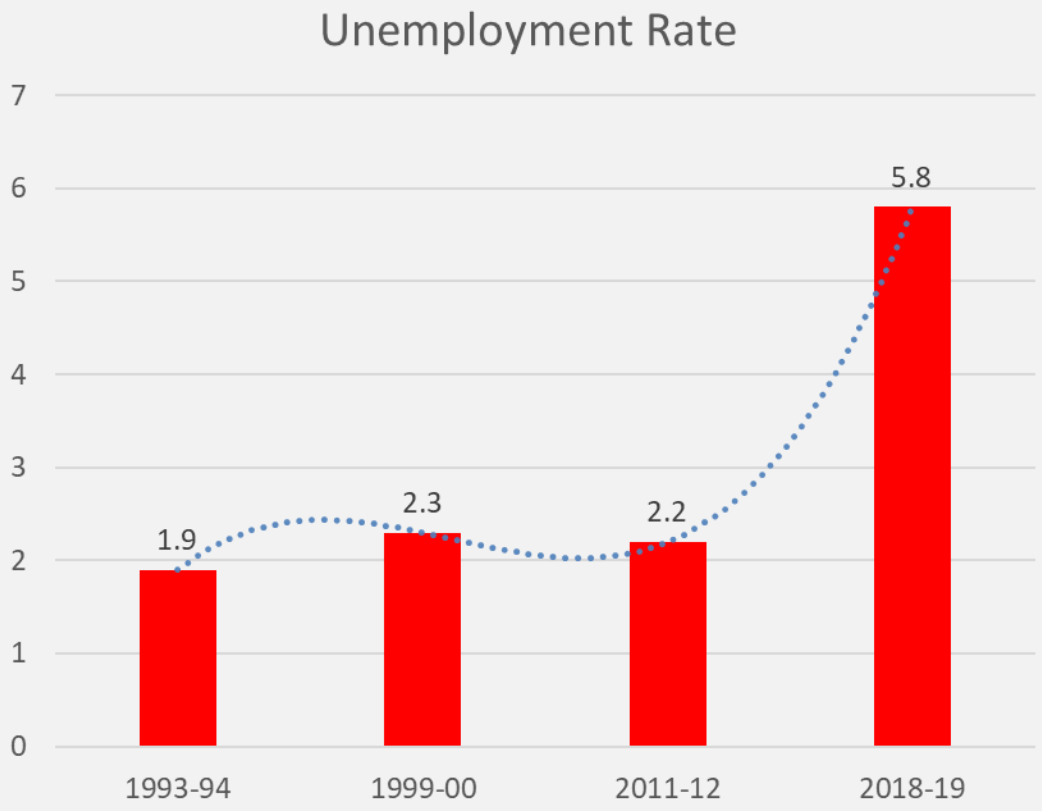
- No evidence to back hypothesis of negative impact of technology on labour demand (Vashisht 2018)
- Sectoral studies: Economic feasibility and pent-up demand (Vashisht and Rani 2029)



Task Content of Jobs has been Changing

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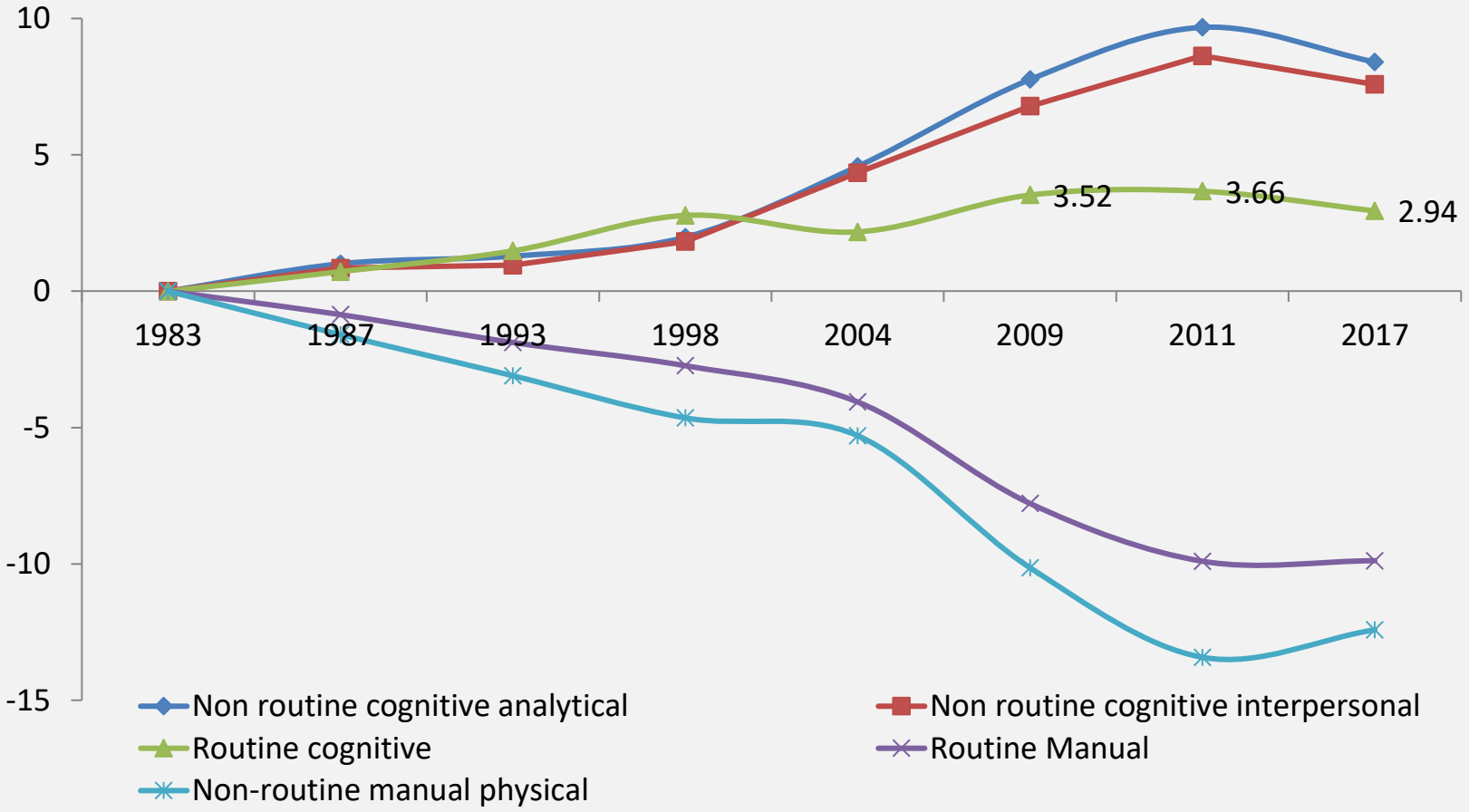

Source: Own estimates based NSS unit-level data and ONeT data

Decomposition of Change in Task Intensities

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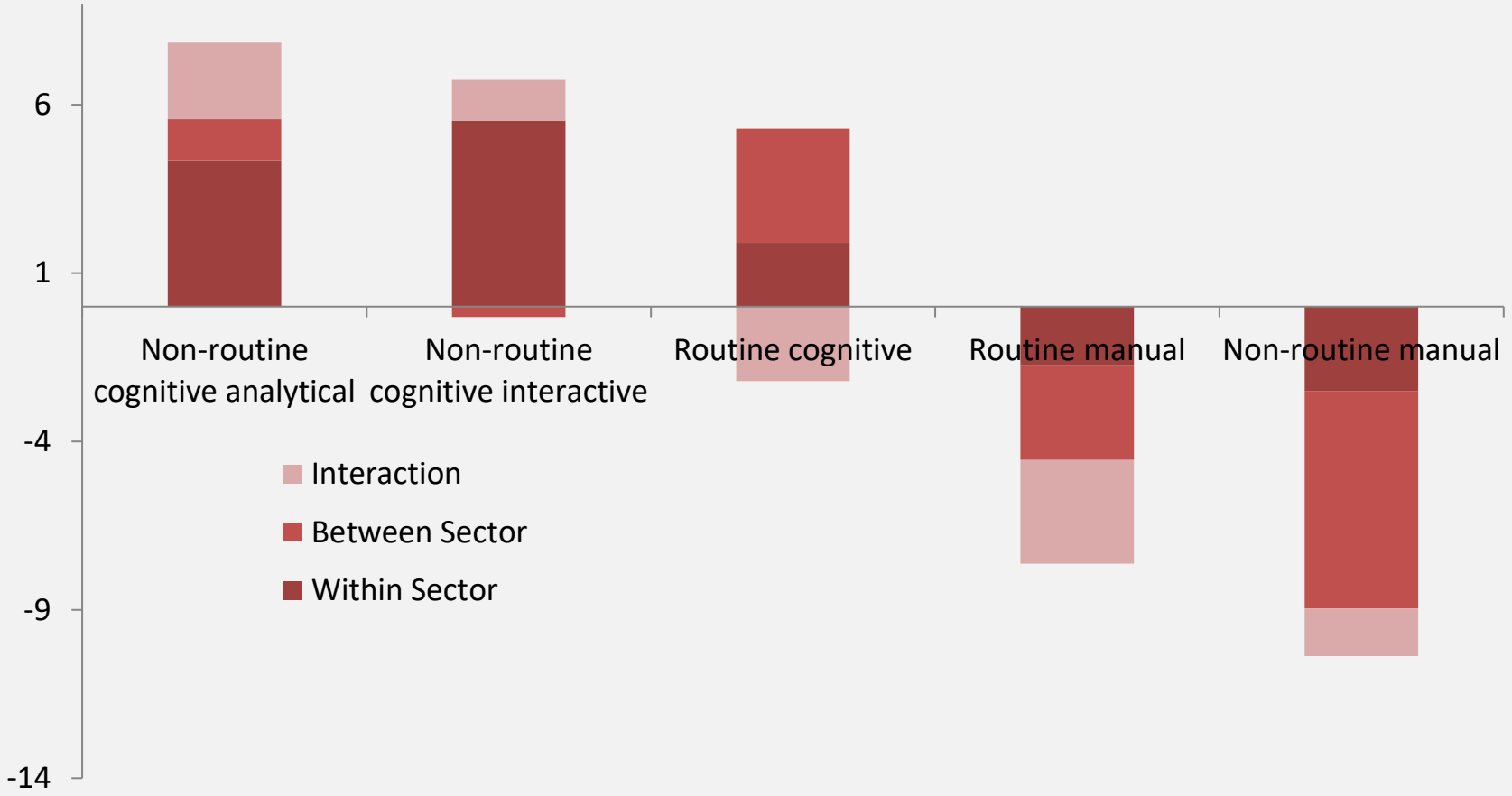

Fixed effect regression of task content measures

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	Non Routine Cognitive Analytical		Non Routine Cognitive Interactive	
	1	2	3	4
High Education Share	.029* (.003)	.004 (.005)	.029* (.004)	.005 (.006)
Medium Education Share	-.007 (.011)	.004 (.003)	-.007 (.012)	.003 (.002)
Total Factor Productivity		.013* (.002)		.012* (.003)
No. of Observations	42	42	42	42
Within R Square	.35	.62	.30	.55

*, **, *** significant at 1, 5 and 10 percent respectively. Estimation using Driscoll Kraay standard error.
Standard error in parenthesis

Fixed effect regression of task content measures

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	Routine Cognitive		Routine Manual		Non-Routine Manual Physical	
	5	6	7	8	9	10
High Education	.002 (.003)	.001 (.004)	-.049* (.005)	-.053* (.006)	-.042* (.004)	-.041* (.006)
Medium Education	.009*** (.004)	.009** (.002)	-.053* (.002)	-.052* (.003)	-.037* (.005)	-.038* (.004)
Total Factor Productivity		.000 (.000)		-.001 (.003)		-.001 (.002)
No. of Observations	42	42	42	42	42	42
Within R Square	.02	.02	.57	.58	.56	.57

*, **, *** significant at 1, 5 and 10 percent respectively. Estimation using Driscoll Kraay standard error.
Standard error in parenthesis

Social Dimension of Task Content

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	Scheduled Tribes	Scheduled Castes	Other
Non routine cognitive analytical	-2.29	-9.50	2.11
Non routine cognitive Personal	-0.97	-7.47	0.46
Routine cognitive	-4.65	-4.69	1.82
Routine Manual	3.43	7.41	-2.96
Non-routine manual physical	7.00	10.09	-5.51

Source: Own estimates based NSS unit-level data and ONeT data

Gender Dimension of Task Content

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	Male	Female
Non routine cognitive analytical	0.38	-1.57
Non routine cognitive Personal	-1.10	-0.56
Routine cognitive	1.97	-4.41
Routine Manual	-1.30	1.04
Non-routine manual physical	-2.88	1.36

Are weaker sections Falling behind?

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- Decomposed the change in task intensities to examine the movement of various groups across occupations
- Weaker Sections (SC and ST)
  - Upward mobility: moving from manual task intensive occupations to cognitive task intensive occupations
- Female
  - Results on the gender front are not that encouraging
  - Shrinking manual task is hurting female
  - Mobility from manual task intensive occupations to non-routine cognitive tasks intensive occupation is very slow
  - Reason for falling Labour force participation rate?

Summing up

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- India witnessing technology upgradation but no evidence of technological unemployment
- Significant change in task composition: Manual task content declining rapidly
- Changing task content may be contributing to growing gender divide
- Growing need for skilling and Human Capital formation:
  - Improve quality of education in public school
  - Focus on cognitive skills and STEM education
  - Increase technological proficiency
  - Potential de-routinization: Focus on reskilling and Life long learning

Thank You!