

Determinants of Clusters in Indian Manufacturing: The Role of Infrastructure, Governance, Education, and Industrial Policy

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Motivation

- Significant economic benefits from agglomeration on productivity and regional growth
 - Ciccone and Hall (1996), Schivardi (2004), Brulhart and Sbergami (2009)
- Entrepreneurship is a key contributor to job creation and economic growth at aggregate and regional levels
 - Acs et al. (2008), Audretsch (2007), Klapper and Love (2011), Audretsch and Keilbach, (2005), Dejardin (2011), Samila and Sorenson (2011)
- Understanding the process of spatial concentration and new firm entry in manufacturing is relevant for economic development
- To attract manufacturing and promote formation of industrial clusters, policy-makers need to know which factors correlate with local employment dynamism

Why India?

- Manufacturing is much more concentrated in India than in other developing and developed countries
 - Largest 5 states account for 60% of employment (but just 47% of population) *table*
 - Fernandes and Sharma (2012) calculate a spatial GINI coefficient of 0.6 (compare with 0.25 for China)
- Industrial policy in India was explicitly used to nudge manufacturing into government-approved (often backward) areas
- Recently there has been increasing competition between Indian states to attract manufacturing industries

Evidence of spatial concentration of manufacturing in India

State	State Share of Manufacturing Employment (%)					Average Population Share (%)	Employment in 2007 (in hundred thousands)
	1985	1989	1994	2000	2005		
Maharastra (MAH)	16.70	15.44	14.87	14.68	14.64	10.80	251
Tamil Nadu (TN)	12.14	12.13	13.83	13.26	14.34	7.32	224
Andra Pradesh (AP)	9.86	11.28	11.87	11.92	11.30	8.75	177
Gujarat (GUJ)	10.16	9.89	9.51	9.23	9.94	5.67	154
Uttar Pradesh (UP)	8.92	9.78	8.62	8.01	9.05	14.89	141
Top 5 sum	57.78	58.53	58.70	57.10	59.27	47.44	
West Bengal (WB)	10.53	8.83	8.09	7.55	5.77	9.12	126
Karnataka (KAR)	5.07	5.42	5.48	5.55	6.45	6.05	91
Punjab (PUN)	4.17	4.71	4.46	5.20	5.56	2.74	77
Madhya Pradesh (MP)	4.63	4.87	4.87	4.71	3.98	6.76	74
Haryana (HAR)	3.31	3.21	3.47	4.42	5.02	2.30	64
Top 10 sum	85.49	85.57	85.07	84.52	86.06	74.42	

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So it is natural to ask

- What are the determinants of industrial location within India?
 - Comparative advantage factors?
 - New Economic Geography (NEG) mechanisms and Marshallian economies?
 - Business environment factors?
- Are there complementarities between state and central government initiatives to boost manufacturing industry?
 - Do industrial policy reforms boost state-level comparative advantage and business environment?

..... this paper addresses these questions

- We use a panel of 180 industries spread across 16 major Indian states over 1985-2007 period to study role of comparative advantage factors, NEG mechanisms, and business environment factors in determining spatial concentration and new entry in manufacturing
 - We focus on effects of state characteristics interacted with characteristics making industries naturally more prone to locate in states of certain types

Our findings – part 1

- Skilled labor comparative advantage is an important determinant of spatial concentration and entry
- But unskilled labor comparative advantage has counter-intuitive negative effect
 - **Skilled labor is *least substitutable* input in production process so its abundance in a state is critical for firms' location choices**
- Different types of infrastructure have different effects on spatial concentration and entry
 - **Transport infrastructure which is *less substitutable* by firms has a strong positive effect whereas electricity infrastructure which is *more substitutable* (large Indian firms have electricity generators) has a negative effect**
- Governance quality is important determinant of concentration and entry

Our findings – part 2

- Did 1990s policy reforms change determinants of location?
 - Negative effect of unskilled labor comparative advantage verified only post-1991 and driven by industries exposed to stronger tariff declines (more capital-intensive)
 - Skilled labor comparative advantage factor has stronger positive effect in fostering new entry in FDI-liberalized industries
 - States' distance to foreign markets and presence of input-output linkages matter in different ways: tariff-liberalized and FDI-liberalized industries tend to locate in states with more ports but also in states with lower manufacturing base suggesting weakening of domestic input-output linkages and stronger role of access to imported inputs post-1991

Determinants of concentration and new entry

- Location choice made by comparing profitability across locations:
 - Cost factors: availability and cost of inputs
 - Demand factors/market access factors: size of local consumer market or distance to markets
 - Cost and demand can be influenced by existing industrial structure (agglomeration economies) and by location characteristics related to availability of public goods and services/general business environment
- Comparative/natural advantages (resource/labor endowments or transportation costs): Ellison and Glaeser (1999), Sanguinetti and Martincus (2009)
- Agglomeration economies: presence of input suppliers by Jofre-Monseny et al. (2011), Glaeser and Kerr (2009), Amiti and Javorcik (2008) and of similar types of labor by Jofre-Monseny et al. (2011), Glaeser and Kerr (2009), market access by Amiti and Javorcik (2008)

Determinants of concentration and new entry

- Business environment (availability/quality of infrastructure governance): Amiti and Javorcik (2008), Michielsen (2011), Rothenberg (2011)
- Some evidence focusing on India
 - Lall and Chakravorty (2005) find new investments are biased towards coastal districts and existing industrial clusters after 1991 reforms
 - Ghani et al. (2011) show that entry of new firms at industry-district level is positively linked to education, agglomeration economies (presence of incumbent firms, labor pooling, and presence of small suppliers) but is negatively linked to high population density
 - Mukim and Nunnenkamp (2010) show that foreign investors in India prefer to locate where other foreign investors are already present, in industrially diverse locations and in Indian districts with better infrastructure

Our Approach - Motivation

- We follow approach proposed by Midelfart-Knarvik, Overman and Venables (2000) and Ellison and Glaeser (1999) whereby location characteristics complement industry characteristics in explaining spatial distribution of manufacturing
 - Model combines comparative advantage cost factors and geographical forces from NEG theory
 - Locations differ in endowments & trade among locations is costly (transport costs vary with distance)
 - Industries use intermediate factors to produce differentiated final goods
 - In presence of transport costs, supply and demand (for final or intermediate goods) considerations influence location choice
 - Both location characteristics and industry characteristics can influence costs and demand patterns
 - Effects will vary across industries by considering characteristics that lead industries to concentrate in locations of different types

Our Approach - Details

- Our empirical specifications examine determinants of spatial concentration and entry in Indian manufacturing over time: interactions between location characteristics (endowments or geography) and industry characteristics (factor intensity or transport costs)
 - Example of conjecture that can be tested: industries relying on energy-intensive techniques tend to concentrate in locations rich in sources of electricity
- Such specifications are appropriate to explain manufacturing location in India given country's spatial dimension and high transport costs across states
 - Similar specifications used to examine spatial concentration of industries in Argentina by Sanguinetti and Martincus (2009) and in Brazil by Martincus (2010)

Econometric Specification

*Concentration*_{jst} or *Entry*_{jst}

$$= \alpha_o + \alpha * INDUSTRY_{jt} * STATE_{st} + I^j + I^s + I^t + \xi_{jst}$$

Elements in vector $INDUSTRY_{jt} * STATE_{st}$ capture comparative advantage of location s for industry j

- If location s has a desirable characteristic A , this would in principle make all industries locate entirely there
- But given physical constraints and congestion costs, not all industries will locate entirely in that location
- Industries will take constraints and costs into account in choosing their location and only those that benefit most from desirable characteristic A will locate in s

Industry and state fixed effects imply that coefficients on interaction terms are identified *within* industries and locations

Measures of spatial concentration and new entry & data sources

- India's Annual Survey of Industries (ASI) manufacturing plant-level data from 1985/1986 to 2007/2008
 - Covers all factories registered under Factories Act of 1948 (units employing 20 or more workers) & frame combines a 'census sector' and 'sample sector'
 - Caveats: (a) repeated cross-sections (no plant identifier), (b) 3-digit NIC is most disaggregate industry level possible, (c) state is most disaggregated location level possible, (d) data is noisy in some years (Bollard, Klenow, and Sharma, 2013)
- Measures of spatial concentration and entry based on employment for industry-state-year cells aggregated up from plant level:
 - $Concentration_{jst} = \frac{L_{jst}}{\sum_s L_{jst}}$ (denominator is total employment industry j in year t)
'Net' measure covering expansion/contraction of incumbent firms & firm entry/exit in industry-state
 - $Entry_{jst} = \frac{\sum_{i=1}^N I(age_{ijst} \leq 3) * l_{ijst}}{\sum_{i=1}^N l_{ijst}}$ (denominator is total employment industry j in state s in year t)
Measure capturing more directly entry of new firms in industry-state

Location determinants & data sources

State Characteristics (larger value=more attractive)	Industry Characteristics (larger value=more intensive/dependent)	Interpretation of Interaction
Unskilled Worker Abundance (UNSKABUN) Avg. wage per production worker in India/Avg. wage per production worker in state based on ASI data	Unskilled Worker Intensity (UNSKILLED INTENSITY) Avg. production labor costs/value of output in industry based on ASI data	<i>Industries that use more unskilled workers will locate in states with more unskilled workers</i>
Skilled Worker Abundance (SKABUN) Share of manufacturing non-production workers in state in manufacturing non-production workers in India based on ASI data	Skill Worker Intensity (SKILL INTENSITY) Avg. employment share non-production workers in industry based on ASI data	<i>Industries that use more skilled workers will locate in states with more skilled workers</i>
Market Potential (MKT) GDP per capita in state based on SDP Dataset (EPW Foundation)	Returns to Scale (IRS) Avg. real capital per plant in industry based on ASI data	<i>Industries with increasing returns to scale will locate in states with greater market size/potential</i>
Industrial Base (BASE) Share of GDP per capita in state originating in manufacturing based on SDP Dataset (EPW Foundation)	Intensity of Interm. Input Use (MATS) Manufacturing intermediate inputs/gross sales in industry based on ASI data	<i>Industries that are more dependent on intermediate inputs will locate in states with larger industrial base</i>

Location determinants & data sources

State Characteristics (larger value=more attractive)	Industry Characteristics (larger value=more intensive/dependent)	Interpretation of Interaction
Transport Infrastructure (TRANSPORT or HIGHWAY) State expenditures on transport, communications and storage based on SDP Dataset (EPW Foundation) or Length of highways in state based on Sen and Jamasb (2010)	Intensity of Transport Usage (TRANSPORT INTENSITY) Avg. ratio of inventories to sales in industry based on ASI data	<i>Industries that depend more on transportation will locate in states with more/better transport infrastructure</i>
Electric Infrastructure (TRANSMISSION) Length of electricity transmission lines in state based on Sen and Jamasb (2010)	Intensity of Electricity Usage (ELECTRIC) Avg. ratio of electricity consumption to gross sales in industry based on ASI data	<i>Industries that depend more on electricity will locate in states with more/better electricity infrastructure</i>
Governance Quality (GOVERN) (-1)*Murder rate per capita in state based on National Crime Records Bureau Annual Publications	Intensity of Intermediate Input Use (MATS) Manufacturing intermediate inputs/gross sales in industry based on ASI data	<i>Industries with greater contract intensity (need to interact with more suppliers and engage in more contracts) will locate in states with better governance</i>

Data limitations and econometric challenges

- Data on state characteristics
 - Extremely hard to collect for full time span 1985-2007
 - Focus on 16 main states which account for 94% of manufacturing employment and 92% of manufacturing output
- Zeros in dependent variable and choice of estimating sample
 - Concentration and entry measures are calculated based on unbalanced panel of 41429 observations based on 180 industries, 16 states, and 22 years
 - But not all industries locate in all states in all years (out of 63360 potential cells only 40%-60% are full) and problem is even greater for entry rates
 - Empty industry-state-year cells may be due to (i) absence of industry in state or (ii) to ASI data capturing just formal manufacturing
 - Zeros in our dependent variables contain relevant information: some industries choose to not locate in certain states

To address potential biases introduced by censoring our preferred specifications we include cells with zeros in estimating sample

Not all industries are located in all states in all years ...

% of Empty Cells in Each State (Maximum Possible = 180)																
Year	AP	ASS	BIH	GUJ	HAR	HP	KAR	KER	MAH	MP	ORS	PUN	RAJ	TN	UP	WB
1984	26.78	68.31	41.53	30.05	45.90	71.04	27.32	47.54	22.95	38.80	57.38	45.90	44.26	28.42	30.05	28.42
1985	26.23	63.93	40.44	27.87	41.53	68.31	28.96	40.44	21.86	38.80	52.46	44.81	44.26	24.04	28.96	28.42
1986	28.96	68.85	42.62	28.96	41.53	69.40	28.96	46.99	24.59	40.44	54.10	48.63	45.36	26.78	29.51	32.79
1987	26.23	64.48	40.98	26.78	40.44	67.76	27.87	38.25	21.31	33.33	46.99	43.72	35.52	22.40	25.68	26.23
1988	25.68	62.30	40.44	28.96	39.89	66.12	27.32	37.16	24.04	33.88	42.62	42.08	39.34	25.68	27.32	26.23
1989	23.50	59.02	37.16	23.50	38.80	62.30	22.40	36.61	20.22	32.79	42.62	39.89	34.43	22.40	21.31	22.40
1990	22.95	63.39	40.44	23.50	37.70	60.66	25.68	33.88	20.77	32.79	44.26	40.44	33.33	22.95	21.31	25.14
1991	24.59	60.11	39.34	21.86	36.61	58.47	24.04	34.97	20.22	32.79	42.62	37.70	32.79	24.04	19.67	24.59
Avg. 1984-1991	25.61	63.80	40.37	26.43	40.30	65.51	26.57	39.48	21.99	35.45	47.88	42.90	38.66	24.59	25.48	26.78
1992	21.86	62.30	39.89	23.50	35.52	63.39	25.14	34.43	20.22	29.51	43.72	38.80	34.43	20.77	19.67	24.59
1993	22.40	59.56	36.07	24.59	36.07	61.20	22.40	34.97	18.58	30.60	42.08	38.25	36.07	21.86	20.77	24.04
1994	20.22	57.92	38.80	24.59	33.33	61.20	25.14	31.15	19.13	32.24	40.98	37.16	30.60	20.77	21.31	23.50
1996	15.30	56.28	39.89	16.94	29.51	57.92	19.67	29.51	12.57	26.78	40.98	32.79	26.78	15.30	18.58	22.95
1997	16.94	62.30	43.17	21.31	37.16	56.28	22.95	29.51	16.39	31.69	48.09	38.80	31.15	18.58	20.22	27.32
1998	32.79	71.58	55.74	38.80	43.72	69.95	36.61	45.90	31.69	40.44	55.74	46.45	39.34	30.60	35.52	41.53
1999	40.44	77.05	57.92	43.72	52.46	71.58	43.17	55.19	36.07	50.27	60.66	54.10	47.54	40.98	38.80	43.72
2000	40.98	76.50	57.38	42.08	48.09	68.31	39.34	52.46	32.79	53.01	65.03	55.19	46.45	38.80	38.25	48.63
Avg. 1992-2000	26.37	65.44	46.11	29.44	39.48	63.73	29.30	39.14	23.43	36.82	49.66	42.69	36.54	25.96	26.64	32.04
2001	38.25	73.77	56.83	43.17	47.54	68.31	39.34	53.01	31.15	45.90	61.75	52.46	52.46	34.97	36.61	42.62
2002	26.78	63.39	42.08	30.60	37.70	53.55	28.42	40.98	25.14	33.33	49.18	43.72	34.43	27.32	26.23	32.24
2003	38.80	72.13	56.28	39.34	44.26	66.67	37.70	53.01	32.79	43.72	60.66	51.91	45.36	34.43	34.97	42.08
2004	32.79	71.04	55.19	31.15	45.36	64.48	34.97	49.73	29.51	42.08	60.11	46.45	42.62	30.05	32.79	38.80
2005	30.05	57.38	42.62	26.78	35.52	47.54	24.04	38.80	23.50	31.69	49.18	39.34	32.79	25.14	26.23	32.24
2006	27.32	55.74	44.26	30.60	33.88	51.37	28.42	39.34	22.95	33.33	49.73	36.61	31.69	26.78	22.95	29.51
2007	26.23	56.83	45.90	30.05	28.96	44.26	26.78	41.53	26.78	31.15	49.73	38.80	33.88	30.05	22.40	29.51
Avg. 2001-2007	31.46	64.32	49.02	33.10	39.03	56.60	31.38	45.20	27.40	37.31	54.33	44.18	39.03	29.82	28.88	35.28

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Further econometric challenges

- Dependent variables are fractional in nature
 - Use Tobit estimation
- Adding-up problem in dependent variable
 - Both dependent variables add up to 1 when summed across states
 - Errors may have a structure within each industry which could affect inference - but this is an unidentified/unaddressed problem in the literature!
 - Solutions:
 - Drop one state per industry:
 - We are implicitly doing that by focusing on 16 states for which data on location characteristics is available but calculating employment shares based on all states
 - Standard errors clustered by industry in all specifications
 - Use also employment levels (instead of shares)
- Noisy data
 - Use winsoring techniques

Baseline results

Industry Characteristic	State Characteristic	Industry-State Employment Share Including Zeros Tobit (2)	Industry-State Entry Rate Including Zeros Tobit (4)
IRS	MKT	-0.0067* (0.0040)	-0.0027 (0.0086)
MATS	BASE	-0.0008* (0.0004)	0.0009 (0.0013)
SKILL INTENSITY	SKABUN	0.0113*** (0.0024)	0.0066* (0.0039)
UNSKILLED INTENSITY	UNSKABUN	-0.0257*** (0.0037)	-0.0291** (0.0117)
TRANSPORT INTENSITY	TRANSPORT	0.0017** (0.0008)	0.0077** (0.0030)
MATS	GOVERN	0.0022** (0.0010)	0.0191*** (0.0019)
Industry Fixed Effects		Yes	Yes
State Fixed Effects		Yes	Yes
Year Fixed Effects		Yes	Yes
N. Observations		61305	61305

Counter-intuitive: states with large industrial base may suffer from congestion?

Counter-intuitive: average unskilled wage proxy for quality of unskilled labor?

Importance of comparative advantage factors related to skilled labor, infrastructure and governance for location

Results with electricity infrastructure

Industry Characteristic	State Characteristic	Industry-State Employment Share Including Zeros Tobit 1985-2005 (3)	Industry-State Entry Rate Including Zeros Tobit 1985-2005 (4)	Industry-State Employment Share Including Zeros Tobit 1991-2000 (9)	Industry-State Entry Rate Including Zeros Tobit 1991-2000 (10)
IRS	ELEC MKT	-0.0046** (0.0022)	-0.0074 (0.0050)	-0.0079** (0.0038)	-0.0106 (0.0086)
MATS	ELEC BASE	-0.0005** (0.0002)	0.0003 (0.0011)	-0.0006*** (0.0001)	-0.0007 (0.0007)
SKILL INTENSITY	SKABUN	0.0117*** (0.0026)	0.0067* (0.0039)	0.0111*** (0.0024)	0.0106** (0.0049)
UNSKILLED INTENSITY	UNSKABUN	-0.0203*** (0.0034)	-0.0196 (0.0121)	-0.0105*** (0.0040)	-0.0225 (0.0143)
MATS	GOVERN	0.0019* (0.0011)	0.0175*** (0.0018)	0.0022*** (0.0007)	0.0157*** (0.0018)
ELECTRIC	TRANSMISSION	-0.0119** (0.0052)	-0.0104 (0.0073)		
TRANSPORT INTENSITY	HIGHWAY			0.0040** (0.0017)	0.0068 (0.0042)
Industry Fixed Effects		Yes	Yes	Yes	Yes
State Fixed Effects		Yes	Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes	Yes
N. Observations		46162	46162	19215	19215

Counter-intuitive: due to unobserved quality of electricity or to congestion?

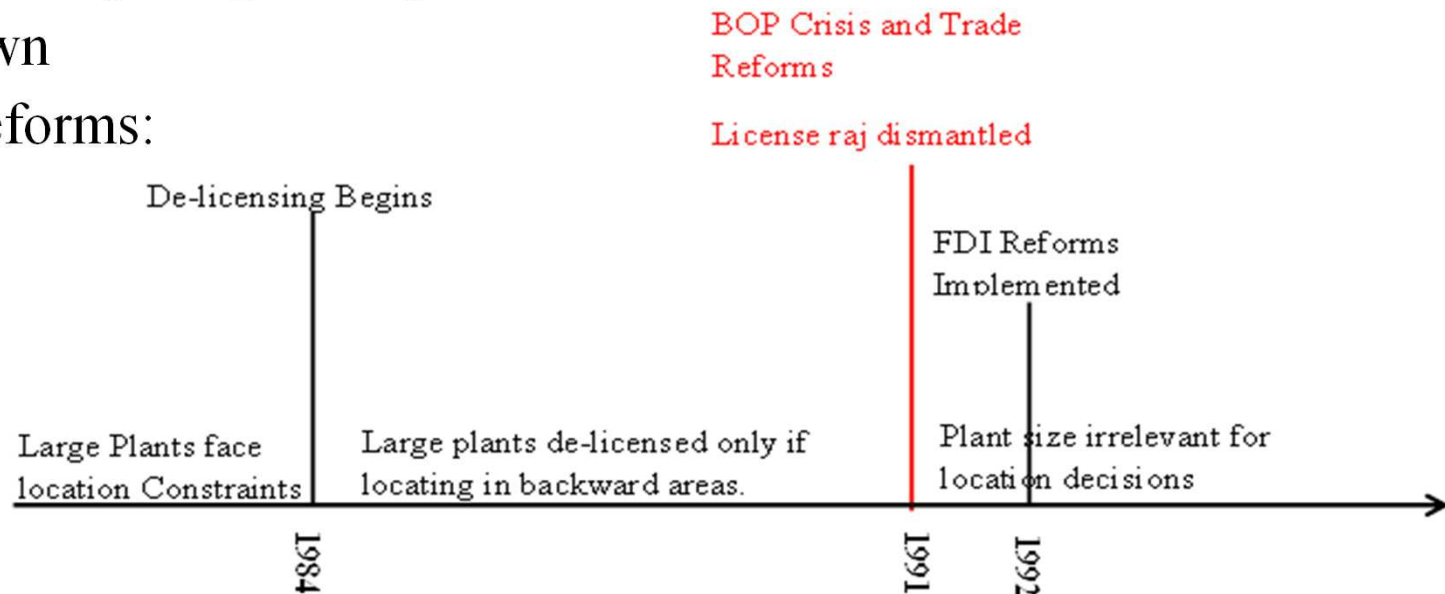
Location choices based on infrastructure that is less substitutable: firms can have electricity generators but cannot circumvent use of public roads/highways

Robustness & endogeneity

- Baseline results are maintained:
 - When levels of state characteristics and industry characteristics are included
 - When region trends are added (regions are geographic areas larger than states)
 - When industry-year and state-year fixed effects are included
- Our objective is to identify important correlates of spatial concentration and new entry in Indian manufacturing but not to claim causal links but still ...
 - One-year lagged values for all interaction terms $INDUSTRY_{jt} * STATE_{st}$ or 1980 values for either location or industry characteristics
 - All specifications include a rich set of industry, state, and year fixed effects
 - Employment in new firms in an industry-state is less likely to suffer from endogeneity with respect to location determinants: for a new firm, location attributes - including industrial structure - are exogenous at time of entry

India's policy reforms and determinants of location

- License “Raj”: controls on entry, output and location decisions of manufacturing plants
- Tariff-Quota “Raj”: high/complex trade barriers
- FDI lockdown
- Timing of reforms:



- De-licensing, trade and FDI liberalization may increase or decrease spatial concentration of manufacturing
- Reforms implemented differentially across industries/time not across states – but relevant to examine whether link between concentration or entry and state*industry characteristics was affected by reforms

Industry Characteristic	State Characteristic	Policy	Industry-State Employment Share Including Zeros Tobit (1)	Industry-State Entry Rate Including Zeros Tobit (2)
IRS	MKT		-0.0133** (0.0053)	0.0053 (0.0204)
MATS	BASE		-0.0044 (0.0366)	0.0235 (0.0607)
SKILL INTENSITY	SKABUN		0.0088** (0.0041)	0.0089 (0.0069)
UNSKILLED INTENSITY	UNSKABUN		0.0237* (0.0126)	0.3195*** (0.0274)
TRANSPORT INTENSITY	TRANSPORT		0.0090** (0.0037)	0.0413*** (0.0108)
MATS	GOVERN		-0.0078 (0.0068)	0.0075 (0.0201)
IRS	MKT	POST-1991	0.0085 (0.0059)	-0.0090 (0.0207)
MATS	BASE	POST-1991	0.0040 (0.0364)	-0.0225 (0.0605)
SKILL INTENSITY	SKABUN	POST-1991	0.0052 (0.0034)	0.0033 (0.0080)
UNSKILLED INTENSITY	UNSKABUN	POST-1991	0.0126 (0.0107)	-0.2835*** (0.0291)
TRANSPORT INTENSITY	TRANSPORT	POST-1991	-0.0126*** (0.0039)	-0.0427*** (0.0119)
MATS	GOVERN	POST-1991	0.0101 (0.0067)	0.0107 (0.0199)
Industry Fixed Effects			Yes	Yes
State Fixed Effects			Yes	Yes
Year Fixed Effects			Yes	Yes
N. Observations			61305	61305

A possible approach to consider role of reforms

Intuitive results on unskilled labor comparative advantage pre-1991
Similar results when using unskilled labor intensity in 1980 (pre-sample)

Counter-intuitive: may be linked to result that over time industries on average concentrate more in backward states which happen to be those with poorer infrastructure (though this is not true for de-licensed industries)

Industry Characteristic	State Characteristic	Policy	Industry-State Employment Share Including Zeros Tobit (1)	Industry-State Entry Rate Including Zeros Tobit (2)
IRS	MKT		-0.0095** (0.0043)	-0.0106 (0.0194)
MATS	BASE		-0.0054 (0.0163)	-0.0037 (0.0389)
SKILL INTENSITY	SKABUN		0.0123*** (0.0037)	0.0090 (0.0074)
UNSKILLED INTENSITY	UNSKABUN		-0.0775*** (0.0109)	-0.0594** (0.0266)
TRANSPORT INTENSITY	TRANSPORT		0.0009 (0.0040)	0.0328*** (0.0107)
MATS	GOVERN		0.0020 (0.0063)	0.0385* (0.0223)
UNSKILLED INTENSITY	UNSKABUN	DEL	0.0625*** (0.0121)	0.0457 (0.0295)
TRANSPORT INTENSITY	TRANSPORT	DEL	0.0009 (0.0040)	-0.0299*** (0.0105)
IRS	MKT	FDI	0.0032*** (0.0012)	-0.0050 (0.0047)
MATS	BASE	FDI	0.0080** (0.0039)	0.0164*** (0.0061)
SKILL INTENSITY	SKABUN	FDI	0.0014 (0.0012)	0.0045* (0.0025)
UNSKILLED INTENSITY	UNSKABUN	FDI	0.0081*** (0.0028)	0.0137 (0.0083)
TRANSPORT INTENSITY	TRANSPORT	FDI	0.0005 (0.0010)	0.0110*** (0.0033)
MATS	BASE	TAR	-0.0058 (0.0062)	-0.0327* (0.0177)
UNSKILLED INTENSITY	UNSKABUN	TAR	-0.0182*** (0.0056)	-0.0711*** (0.0178)
Industry Fixed Effects			Yes	Yes
State Fixed Effects			Yes	Yes
Year Fixed Effects			Yes	Yes
N. Observations			58560	58560

Other possible approach to consider role of reforms

Intuitive results on unskilled labor comparative advantage for de-licensed or FDI-liberalized industries

Industries most affected by tariff declines were more capital-intensive not responsive to state unskilled labor abundance

Substantial input tariff declines may have weakened role of domestic IO linkages

Specifications include other interaction*policy terms not shown for brevity

Final approach to consider role of reforms

Industry Characteristic	State Characteristic	Policy	Industry-State Employment Share Including Zeros Tobit (1)	Industry-State Entry Rate Including Zeros Tobit (2)
	PORT	DEL	-0.0005** (0.0002)	0.0006 (0.0005)
	BASE	DEL	0.0092** (0.0045)	-0.0129 (0.0097)
	BACKWARD	DEL	-0.0101** (0.0041)	-0.0073 (0.0123)
	PORT	TAR	-0.0000 (0.0001)	0.0007* (0.0004)
	BASE	TAR	-0.0048* (0.0028)	-0.0182* (0.0103)
	PORT	FDI	0.0004** (0.0001)	0.0004** (0.0002)
	BASE	FDI	-0.0032** (0.0016)	-0.0043 (0.0036)
Industry Fixed Effects			Yes	Yes
State Fixed Effects			Yes	Yes
Year Fixed Effects			Yes	Yes
N. Observations			58560	58560

Lower concentration of de-licensed industries in backward states - expected once constraints to locate in such states are gone

For industries experiencing stronger tariff liberalization role of domestic IO linkages weakened as imported inputs gain importance

Importance of access to imported inputs for FDI-liberalized industries

Specifications include interaction and interaction*policy terms not shown for brevity

Conclusions

- We establish rigorous correlations between spatial concentration of manufacturing and its determinants in India
- Firms respond most to availability of *less* substitutable inputs
 - Skilled versus unskilled labor: skilled labor is a bottleneck
 - Transport versus electricity: most firms have own generators
 - Will greater provision of electricity by state make firms more productive?
- Governance matters particularly for contract-intensive industries
- Different market-oriented reforms have different effects
 - Mechanisms through which de-licensing, trade & FDI reforms affect concentration and entry are varied and nuanced
- Policy can affect spatial distribution of manufacturing in India