Washington DC, 12 November 2014

The allocative efficiency of land and other factors of production in India

Gilles Duranton
Wharton

Ejaz Ghani
World Bank

Arti Grover Goswami
World Bank

William Kerr
Harvard Business School

Objectives

- Explore the extent of factor misallocation among districts in India

- Explore the production consequences of misallocation

- Explore the determinants of misallocation (policy and contextual)

Why this matters

- Economic development is not only about higher productivity and factor accumulation, it is also about more efficient allocations of factors across firms

- The approach we develop allows us to assess the effects of 'frictions' on economic development

- It allows us to focus attention on a specific factor (land)

Two challenges

- Appropriate data
    - Establishment production function
    - Fine factor disaggregation
    - Enough districts
    - Enough establishments in each industry and district

    Use India's ASI and NSSO since 1898 (5 waves)

- Develop a new methodology

Existing approaches

- Restuccia and Rogerson (2008), Hsieh and Klenow (2009)

    - Assume a model of monopolitistic competition

    - An efficient factor allocation involves equalising the marginal revenue product of factors across firms

    - In turn, TFP (revenue) should be equalised

    - Idiosyncratic distortions will break this

    - Misallocation can be measured by the variance of measured TFP

    - Usual application: compute the variance of TFP in a country and perform some counterfactuals

    - Issues: limited output, need faith in the model, we don't know what drives misallocation

- Olley and Pakes (1996)

  - Share-weighted aggregate productivity:
    $\Phi_g = \sum_{i=1}^{n} s_i \varphi_i$

  - Unweighted productivity: $\overline{\varphi}_g = \frac{1}{n} \sum_{i=1}^{n} \varphi_i$

  - Misallocation in a group (eg, local industry):
    $M_g = -(\Phi_g - \overline{\varphi}_g) = -n \operatorname{cov}_g(s_i, \varphi_i)$

  - Aggregate misallocation: $M_d = \sum_{g \in d} S_g M_g$

  - Usual application: measure shares with output and look at an industry over time, comparison across industries, comparison across countries

Two observations

- The shares in the OP index need not be measured with output. They can also be factor shares (employment, land and buildings, other fixed assets)

- Aggregation need not be computed at the country level for both OP and HK.
  It can be computed at the district level
  (total misallocation = sum of district misallocation +
  cross district misallocation)

Step 1: Estimate establishment productivity

- Needed to compute misallocation

- Issue: factor endogeneity

- Our preferred approach corrects for local demand/productivity shocks (LP-Sivadasan)

- 22 industries in organised and unorganised sectors (with different factor shares)

- 5 cross-sections of data over 1989-2010 (same factor shares over time)

- Robustness checks: OLS TFP, etc

Step 2: Compute misallocation

- For each district and each year of data

- Compute first by district-industry and then aggregate across industries by district using local weights (Alternate aggregation approaches used to assess robustness)

- OP misallocation for output, value added, employment, land and buildings, other fixed assets, HK misallocation

- Do it for the organised sector, the unorganised, and both sectors taken together
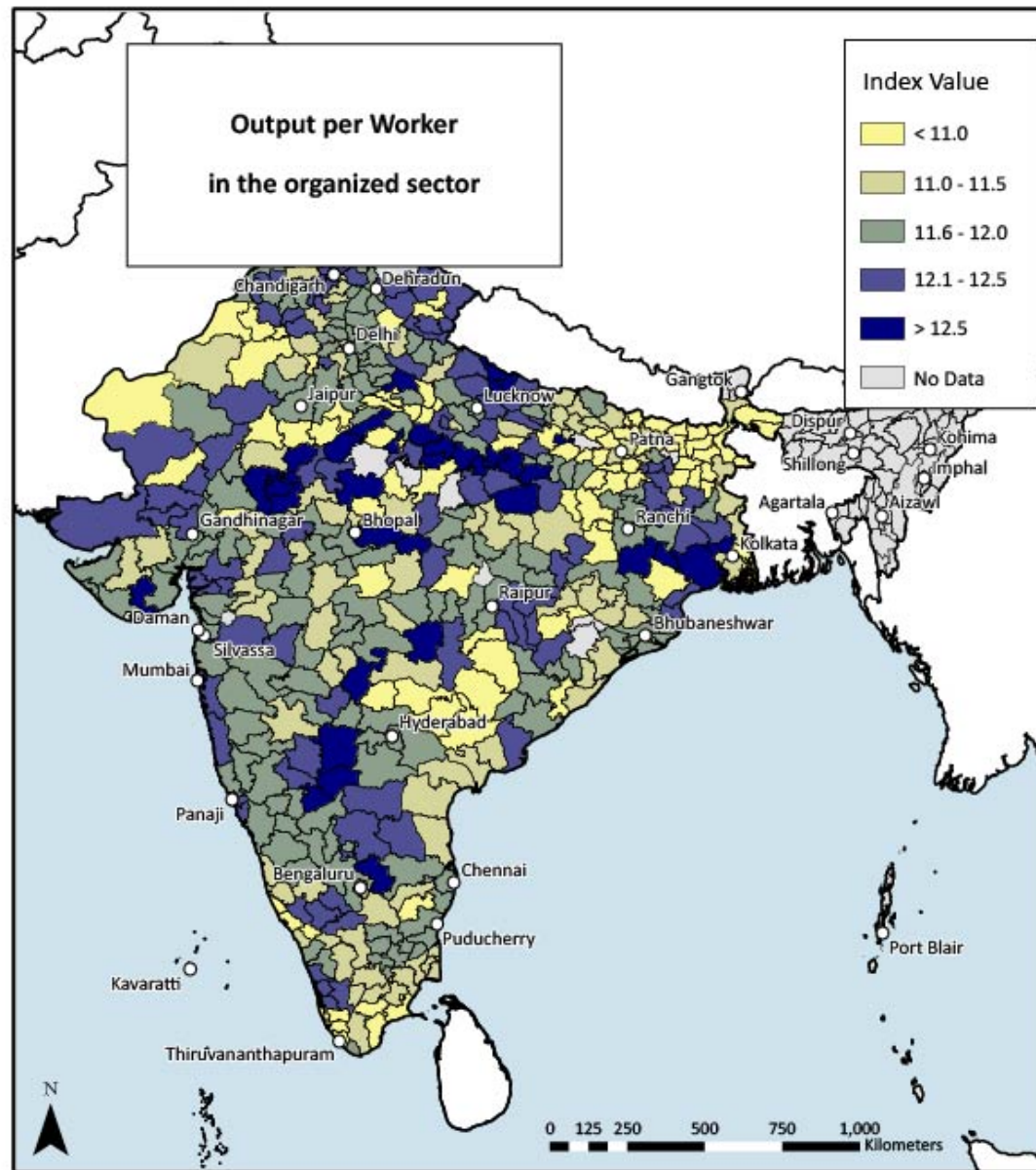
Potential issues with district misallocation

- Overestimated

  - TFP is estimated with noise

  Does not matter much provided the bias is constant and appropriate interpretations are given

- Classical measurement error

  - TFP is estimated with noise

  - Sampling issues within each sector-district

  - Aggregation across sectors

  The coefficients will likely be downward-biased

Output per Worker

in the organized sector

Index Value

- < 11.0
- 11.0 - 11.5
- 11.6 - 12.0
- 12.1 - 12.5
- > 12.5
- No Data

Productivity in the organized sector

Index Value
- < 3.0
- 3.0 - 3.5
- 3.6 - 4.0
- 4.1 - 4.5
- > 4.5
- No Data

Land and Building Misallocation in the organized sector

Index Value
- < -1.0
- -1.0 - -0.5
- -0.4 - 0.0
- 0.1 - 0.5
- > 0.5
- No Data
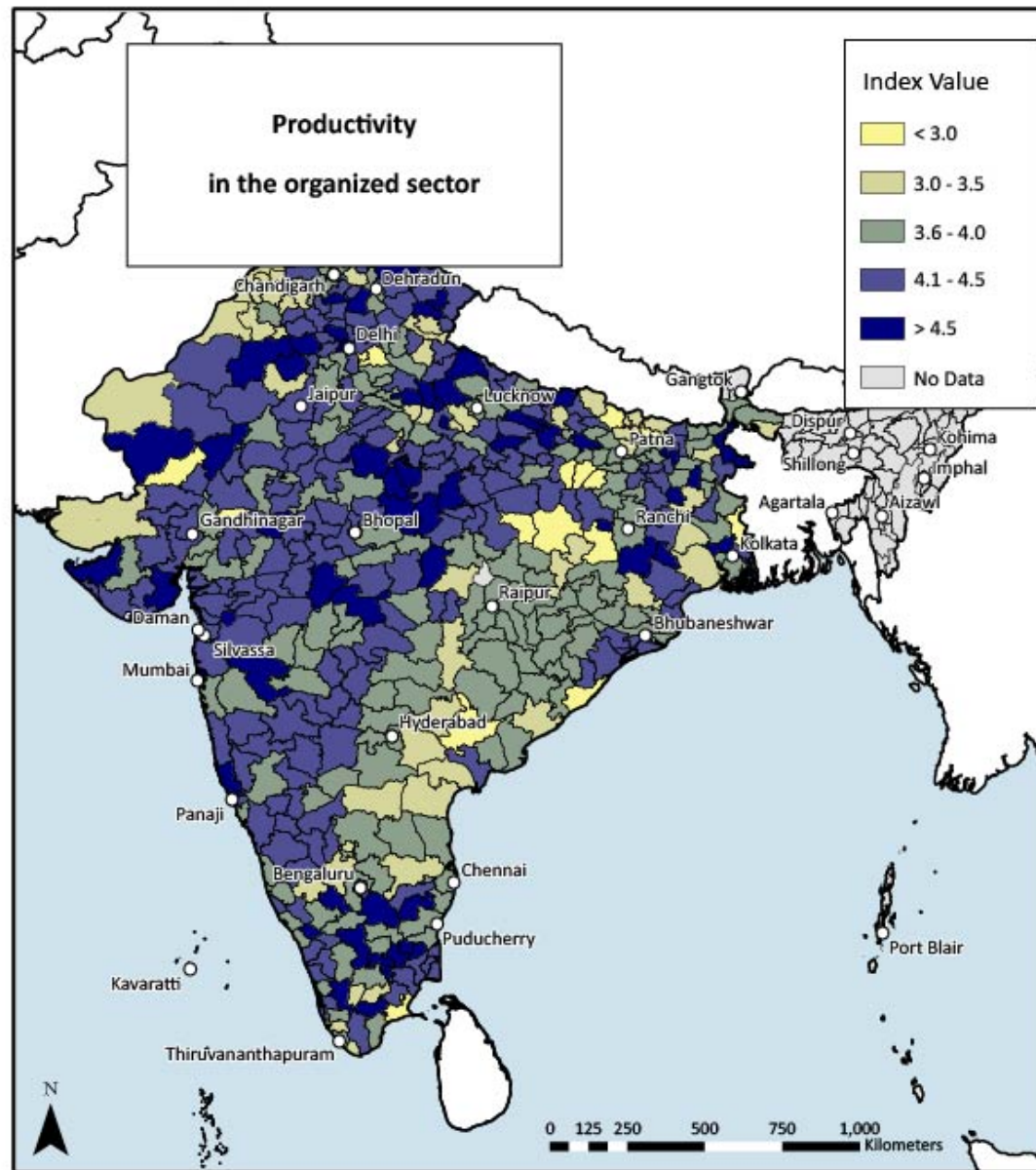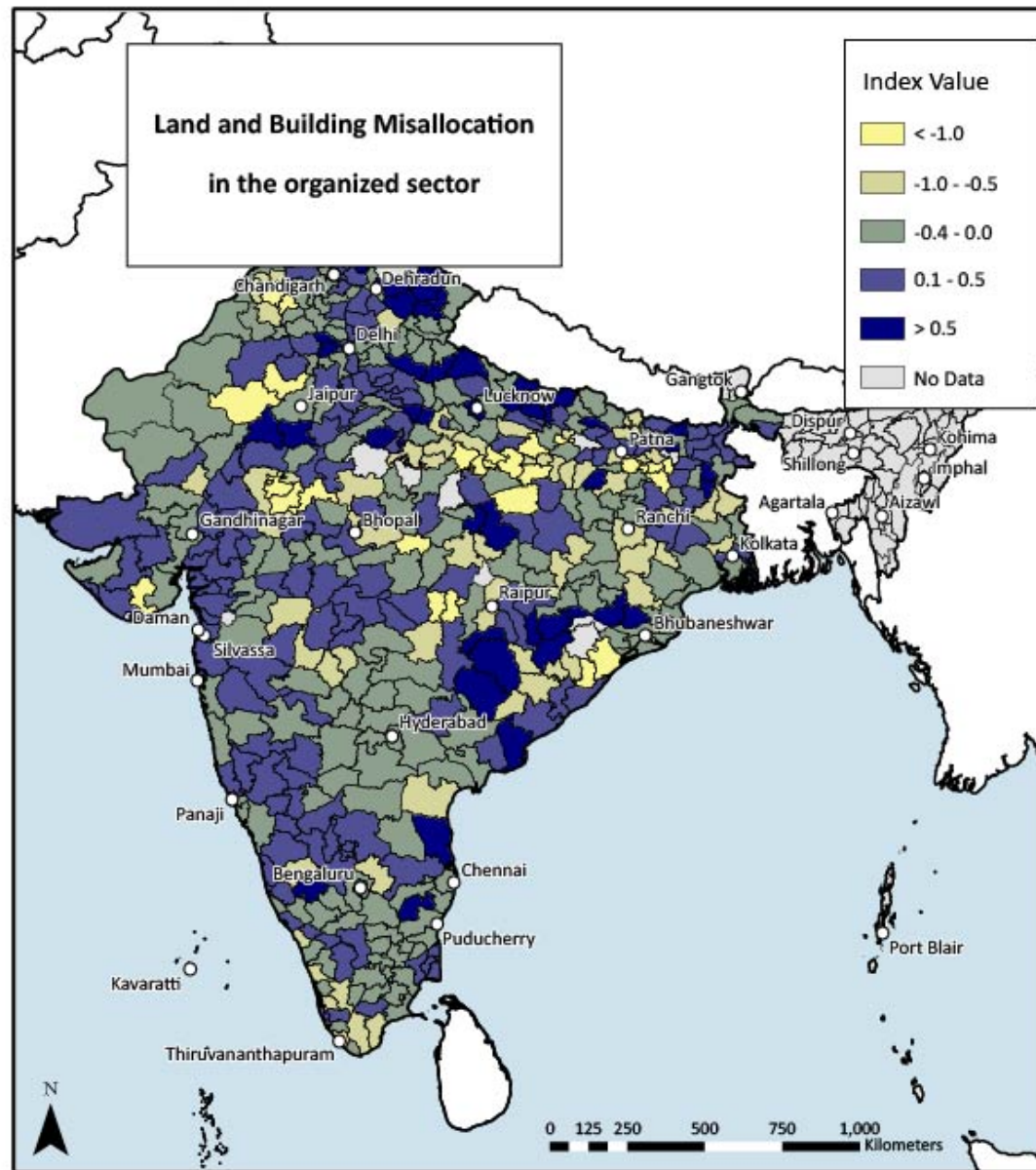
Table 3: Misallocation indices across districts

Year	Output	Value-added	Labour	Buildings	Land	Other K
A. Mean for for the organised sector						
1989	-0.40	-0.50	-0.10	-0.15	-0.05	-0.16
1994	-0.34	-0.47	-0.08	-0.12	-0.01	-0.07
2000	-0.33	-0.49	-0.08	-0.09	-0.02	-0.11
2005	-0.32	-0.46	-0.09	-0.13	-0.08	-0.11
2010	-0.24	-0.40	-0.02	-0.05	0.02	-0.03
B. Standard deviation for the organised sector						
1989	0.38	0.44	0.29	0.38	0.37	0.55
1994	0.36	0.43	0.25	0.35	0.43	0.46
2000	0.39	0.42	0.27	0.39	0.44	0.45
2005	0.34	0.43	0.23	0.35	0.39	0.38
2010	0.37	0.43	0.28	0.38	0.41	0.46
C. Mean for for the unorganised sector						
1989	-0.60	-0.60	-0.01	-0.05		-0.02
1994	-0.53	-0.58	0.01	-0.06		-0.28
2000	-0.65	-0.60	-0.10	-0.13		-0.19
2005	-0.76	-0.71	-0.15	-0.13		-0.30
2010	-0.51	-0.49	-0.05	-0.08		-0.16
D. Standard deviation for the unorganised sector						
1989	0.30	0.27	0.09	0.18		0.26
1994	0.33	0.30	0.11	0.20		1.16
2000	0.34	0.30	0.12	0.18		0.32
2005	0.41	0.36	0.16	0.28		0.37
2010	0.26	0.25	0.11	0.16		0.32

Step 3: Does factor misallocation breed output misallocation?

- Typical regression:
$$M_{i,t}^Y = a_0 + a_1 M_{i,t}^L + a_2 M_{i,t}^{T\&B} + a_3 M_{i,t}^{OA} + b_t + \epsilon_{i,t}$$

- Simple OLS, with state effects, with district effects

Table 4: Output and value added misallocation as a function of factor misallocation

Dependent variable -- misallocation index for:	Organised sector		Unorganised sector		Combined	
	VA	VA	VA	VA	VA	VA
Explanatory variables -- misallocation index for:						
Employment	0.586+++	0.512+++	0.943+++	0.858+++	0.518+++	0.398+++
	(0.074)	(0.067)	(0.070)	(0.072)	(0.043)	(0.053)
Total fixed assets	0.300+++		0.379+++		0.493+++	
	(0.045)		(0.035)		(0.031)	
Land and buildings		0.287+++		0.498+++		0.623+++
		(0.066)		(0.046)		(0.041)
Other fixed assets		0.122++		0.034++		0.000+++
		(0.053)		(0.017)		(0.000)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1739	1739	1807	1807	1816	1816
Adjusted R-squared	0.362	0.377	0.401	0.419	0.638	0.626

16

- All forms of misallocation matter

- Land and building misallocation is of particular importance

- Employment misallocation is also important, other fixed assets less so

- 1 sd of misallocation of land and buildings is associated with 0.62 sd of valued added misallocation with a factor share of 0.13

- Same results with districts FE and alternative measures of misallocation

- To be done: estimation from counterfactual distributions of factors to bolster identification

Step 4: Does factor misallocation lower output per worker?

- Typical regression:
$$Y_{i,t} = a_0 + a_1 M_{i,t}^L + a_2 M_{i,t}^{T\&B} + a_3 M_{i,t}^{OA} + b_t + \epsilon_{i,t}$$

- Simple OLS, with state effects, with district effects

- No other control variables to be included

Table 6: Output per worker as a function of factor misallocation

Dependent variable: log output per worker	Organised sector		Unorganised sector		Combined	
Explanatory variables -- misallocation index for:						
Employment	-0.393+++	-0.308+++	-1.938+++	-1.971+++	-0.165	-0.103
	(0.104)	(0.102)	(0.208)	(0.219)	(0.136)	(0.147)
Total fixed assets	-0.205+++		-0.344+++		-0.584+++	
	(0.064)		(0.089)		(0.064)	
Land and buildings		-0.428+++		-0.166		-0.645+++
		(0.097)		(0.113)		(0.088)
Other fixed assets		0.083		-0.159+++		-0.001+++
		(0.062)		(0.051)		(0.000)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1739	1739	1807	1807	1816	1816
Adjusted R-squared	0.113	0.119	0.445	0.449	0.169	0.154

- Again, importance of land and building misallocation

- Some instability caused by multicollinearity

- Stronger support for the importance of land and buildings districts FE and alternative computations of misallocation

- 1 sd of misallocation of land and buildings is associated with -24% of output per worker

- 1 sd of misallocation of all factors is associated with -19% of output per worker in the organised sector, -32% in the unorganised sector, and -28% in the combined sample

- Moving from the bottom to the top factor misallocation decile $\Rightarrow$ 20th to 50th decile of output per worker

- Strong effect of HK misallocation on output per worker

- Larger than their theory counterfactuals

- 1 sd deviation improvement in misallocation of land and buildings is equivalent to a fivefold increase in supply

Step 4: The determinants of misallocation

- Three policies

  – Repeal of ULCRA

  – Stamp duty

  – Land and labour reforms before 1990 (Besley and Burgess)

- Local characteristics

Table 7: Changes in misallocation following the repeal of ULCRA, 2000-2010

Dependent variable --		Combined		
Change in misallocation for:	value added	value added	land&build	land&build
Explanatory variables:				
Dependent variable initial level	-0.704+++	-0.706+++	-0.696+++	-0.705+++
	(0.089)	(0.086)	(0.118)	(0.114)
ULCRA repeal	-0.127+	-0.136++	-0.059+	-0.057+
	(0.059)	(0.059)	(0.030)	(0.028)
Controls	Basic	Extended	Basic	Extended
Observations	252	252	252	252
Adjusted R-squared	0.481	0.477	0.382	0.378

Table 9: Misallocation and stamp duty, 1989-2003

Dependent variable -- Index of misallocation for:	Combined			
	value added	value added	land&build	land&build
Explanatory variables:				
Stamp duty	0.078+++	0.071++	0.054+++	0.050+++
	(0.022)	(0.025)	(0.012)	(0.014)
Controls	1	2	1	2
State fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	889	776	889	776
Adjusted R-squared	0.136	0.117	0.146	0.151

Table 8c: Misallocation and land and labour refrom, combined sample 1989

Dependent variable -- Index of allocation efficiency for:	value added	value added	land & buildings	land & buildings	Employ-ment	Employ-ment
Explanatory variables:						
1977 Unionisation rate	20.497++	20.297++	16.144++	16.347++	8.900+	8.575++
	(6.821)	(6.651)	(6.320)	(6.318)	(4.382)	(3.947)
Cumulative labour reform to 1990	-0.005	-0.004	-0.011	-0.010	-0.007	-0.007
	(0.008)	(0.008)	(0.009)	(0.009)	(0.007)	(0.008)
Cumulative land reform to 1990	0.006	0.002	0.018	0.020+	0.014	0.013
	(0.011)	(0.011)	(0.011)	(0.010)	(0.012)	(0.011)
Controls	1	2	1	2	1	2
Observations	296	296	296	296	296	296
Adjusted R-squared	0.076	0.068	0.087	0.085	0.054	0.047

- Good evidence from the repeal of ULCRA

- Large effects: the decline in misallocation implies +3.7% output per worker

- Evidence from stamp duty points at even larger effects

- Weak evidence regarding land and labour reform

- Strong association with unionisation

- Analysis of local characteristics point at correlates of development and infrastructure

Conclusion

- Extremely poor factor allocation in India

- But a lot of variation across districts

- Large effects of factor misallocation on output misallocation

- Large effects of factor misallocation on output per worker

- Misallocation of land and buildings plays a uniquely important role

- Policies can have a large effects on misallocation