What Constrains Indian Manufacturing?

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Services has been the main engine of growth in India, not manufacturing.
Contribution to Growth, India

- Services
  - 1951-60
  - 1980-90
  - 1990-00
  - 2000-07

- Industry
  - 1951-60
  - 1980-90
  - 1990-00
  - 2000-07

- Agriculture
  - 1951-60
  - 1980-90
  - 1990-00
  - 2000-07
Surprising, because substantial Reforms in Indian Manufacturing.

E.g. Delicensing....

![Bar chart showing the percentage of industries delicensed from 1985 to 1997. The percentage increases from 27% in 1985 to 94% in 1997.](chart.png)
......and Trade Reforms

Average Tariff (%)


Tariff Values: 149, 149, 149, 149, 107, 85, 67, 50, 45, 39, 44
Table 1: Pre and Post Reforms Performance of Indian Manufacturing

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Value Added</td>
<td>0.0586***</td>
<td>0.0628***</td>
<td>0.0247***</td>
<td>0.0113***</td>
</tr>
<tr>
<td>Capital Stock</td>
<td></td>
<td>0.0628***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Factories</td>
<td></td>
<td>0.0247***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Employment</td>
<td></td>
<td></td>
<td>0.0113***</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.98</td>
<td>0.99</td>
<td>0.87</td>
<td>0.77</td>
</tr>
</tbody>
</table>

*Note: 
**p < 0.01, ***p < 0.001
Have these Payoffs been too Low?

Seem low when

• compared with Manufacturing growth in other countries—Korea, China

• Compared with the growth of services in India
Major Factors Constraining Growth in Manufacturing—Survey Data

• Infrastructure
• Financing constraints
• Labor regulations (Surprisingly not found to be as important in the surveys!)
• Availability and quality of labor
• Business environment
• Corruption
What do we do?

• We want to look at how important are these factors in constraining growth.

• To the extent that some of these factors are expected to affect industries differently, we can use this variation to see whether industries dependent on
  – Infrastructure
  – Financial sector
  – Labor intensive industries

Have performed differently post delicensing, as compared to the control group.
Defining Industry Characteristics

- **Labor Intensity**: ratio of total employment to capital stock.
- **Dependence on External Finance**: ratio of outstanding loans to invested capital.
- **Infrastructure Dependence of Industries**: ratio of expenses on distribution (i.e., storage and transportation) and power and fuel to gross value added.
## Preliminary Results

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure dependent</th>
<th></th>
<th>Dependent on External Finance</th>
<th></th>
<th>Labor Intensive</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Above Median</td>
<td>Below Median</td>
<td>Above Median</td>
<td>Below Median</td>
<td>Above Median</td>
<td>Below Median</td>
</tr>
<tr>
<td>Delicensing</td>
<td>-0.15***</td>
<td>0.33***</td>
<td>0.08</td>
<td>0.18***</td>
<td>-0.01</td>
<td>0.24***</td>
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<tr>
<td></td>
<td>[3.12]</td>
<td>[4.46]</td>
<td>[1.31]</td>
<td>[2.64]</td>
<td>[0.22]</td>
<td>[3.19]</td>
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<td>682</td>
<td>679</td>
<td>682</td>
<td>679</td>
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<td>679</td>
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<tr>
<td>Number of Industries</td>
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<td>22</td>
<td>22</td>
<td>22</td>
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<tr>
<td>Time FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.77</td>
<td>0.66</td>
<td>0.71</td>
<td>0.70</td>
<td>0.69</td>
<td>0.72</td>
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</tbody>
</table>
Methodology

\[ Y_{it} = \Sigma \alpha_i d_i + \Sigma \beta_t d_t + \gamma (\text{delicensing dummy}_{it}) + \delta (\text{characteristic of industry } i * \text{delicensing dummy}_{it}) + \epsilon_{it} \]

We estimate these regressions for dependent variables log value added, and no of factories. A slightly different specification for employment and capital stock.
Interpretation of the Interaction Term

<table>
<thead>
<tr>
<th>Term</th>
<th>Outcome Variable in Pre Reform period</th>
<th>Outcome variable in Post Reform period</th>
</tr>
</thead>
<tbody>
<tr>
<td>For More Labor Intensive (treatment group)</td>
<td>( \Theta_{L,\text{Pre}} )</td>
<td>( \Theta_{L,\text{Post}} )</td>
</tr>
<tr>
<td>For Less Labor Intensive (control group)</td>
<td>( \Theta_{C,\text{Pre}} )</td>
<td>( \Theta_{C,\text{Post}} )</td>
</tr>
</tbody>
</table>

And test the hypothesis that: \((\Theta_{L,\text{Post}} - \Theta_{L,\text{Pre}}) - (\Theta_{C,\text{Post}} - \Theta_{C,\text{Pre}})\) is significantly different from zero.
<table>
<thead>
<tr>
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<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>delicensing</td>
<td>0.12**</td>
<td>0.18***</td>
<td>0.26***</td>
<td>0.53***</td>
<td>0.93***</td>
<td>0.36***</td>
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<tr>
<td></td>
<td>[2.50]</td>
<td>[3.10]</td>
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<td>[4.65]</td>
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<td>[5.61]</td>
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<tr>
<td>Infrastructure Dep*</td>
<td>-0.17**</td>
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<td></td>
<td>-0.18***</td>
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<td></td>
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<tr>
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<td>[2.42]</td>
<td>[2.59]</td>
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<tr>
<td>Labor Intensity*</td>
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<td>External Finance Dep*</td>
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<td>-0.93***</td>
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<tr>
<td>Infrastructure Dummy*</td>
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<td>Labor Intensity Dummy*</td>
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<td>-0.19***</td>
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<td>-0.18***</td>
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<td></td>
<td></td>
<td>[3.40]</td>
<td></td>
</tr>
</tbody>
</table>
Quantitatively:
In post delicensing period

• Industries at 75th percentile of infrastructure dependence grew 6 percent less than the industries at the 25th percentile.

• Industries at 75th percentile of financial dependence grew 13 percent less than the industries at the 25th percentile.

• Industries at 75th percentile of labor intensity grew 12 percent less than the industries at 25th percentile.
Results....

• Post delicensing industries dependent on infrastructure, dependent on the financial sector and the labor intensive industries have grown less. Points to the fact that infrastructure, financial sector imperfections are emerging as bottlenecks on growth.

• Results on labor intensive industries also imply that they are facing bottlenecks: these could be due to labor market regulations; quality of labor or hysteresis (Kochhar et al).
Results....

• Factories: Results are similar to value added for financial dependent and labor intensive industries. We see fewer new factories opening post delicensing in these industries.
Results....

• Employment: employment elasticity of growth differs across industries.
• It is lower for infrastructure dependent and financial dependent industries and higher for labor intensive industries.
• No change post delicensing.
Results…

- Investment elasticity of growth is higher than the employment elasticity.
- Thus the production techniques overtime are becoming more capital intensive!
- It is higher for infrastructure dependent and financial dependent industries and lower for labor intensive industries.
- Investment elasticity has increased in labor intensive industries!
Robustness Tests

- Potential Outliers
- Autocorrelation in error terms
- Omitted industry characteristics
- Omitted Policy variables
Caveats

• Causality—can we imply causality?

• Especially interpreting the results for labor intensive industries...
What more can we do to establish causality?

If Indian states give adequate variation in
• Infrastructure quality
• Quality of financial sector
• Nature of labor regulations

Then we can address the causality issue even more strongly, by comparing the post delicensing performance of infrastructure dependent industries in states with better infrastructure with that of the control group.
Thank You!