Constraints and Opportunities in Rwanda’s Industrial Sector: Evidence from Firm level Data

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Background

  - Productivity differences across sectors in Africa are **large**
  - High-productivity sectors are **small**

- Suggests **structural change** can be a source of growth.

- Manufacturing (including agro proc) is a relatively small, high-productivity sector. (Rwanda: 6% of GDP)

- Hence, reallocation of resources from (say) traditional agriculture to manufacturing results in growth?
Manufacturing is heterogeneous

- For structural change to deliver growth, labor & capital must be reallocated to productive firms.

- The mfg sector includes firms with very different capabilities: small firms that cater for the local market and more modern large firms some of which export.

- What types of firms perform well?

- **Why** do such firms perform well?

- Very limited information on the features & characteristics of successful firms in Rwanda.
Questions

- How well do Rwandan mfg firms perform?
- How big are productivity diffs across Rwandan firms?
- What factors distinguish the top performing firms from other firms?
- How well do Rwandan firms perform compared to similar firms in the region?

- Questions such as these are at the center of several research programs at the IGC.
- This presentation contains preliminary results based on a recent industrial survey in Rwanda, which shed some light on these issues.
Finding answers

- Unique data for Rwandan firms with 10+ employees, collected & processed in August – October 2011 (NISR, RDB, BNR, MINICOM).

- Contains rich information on ownership, investment, managerial skills, sales, costs, exports etc.

- Enables us to construct simple measures of firm performance, such as value-added per worker.

- Comparison across different firms within Rwanda.
Cross-country firm-level benchmarking

- **Ethiopia**
  - Like Rwanda, a high growth economy with a small manufacturing sector (5% of GDP) and very little manufactured exports.
  - Census data on manufacturing firms with 10 or more employees. Year: 2008.

- **Kenya**
  - Larger & more diversified mfg sector than Rwanda; more exporting.
  - Survey data on Kenyan manufacturing firms for 2006.
Basic Facts:
Market structure and employment in Rwanda
93% of firms in mfg, mining & construction in Rwanda have less than 10 workers

Source: Establishment Census 2011
Most firms are in manufacturing...

Source: Establishment Census 2011
Firms with 10+ workers account for 72% of total employment

Total Employment: 33,488

Source: Establishment Census 2011
Evidence from the survey data: Productivity, exports, and investment
### Snapshot & Some Cross-Country Differences

<table>
<thead>
<tr>
<th></th>
<th>Rwanda</th>
<th></th>
<th></th>
<th>Ethiopia</th>
<th></th>
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<th>Kenya</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Manufacturing</td>
<td>Construction</td>
<td>Mining</td>
<td>Manufacturing</td>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td>Employees (median)</td>
<td>24</td>
<td>33</td>
<td>46</td>
<td>21</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value-added per worker (median; USD)</td>
<td>1,565</td>
<td></td>
<td></td>
<td>1,631</td>
<td></td>
<td>9,306</td>
<td></td>
</tr>
<tr>
<td>Capital stock per worker (median; USD)</td>
<td>1,912</td>
<td></td>
<td></td>
<td>643</td>
<td>6,616</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm age (years in operation)</td>
<td>8.5</td>
<td>10.8</td>
<td>3.8</td>
<td>11.3</td>
<td>22.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any exporting?</td>
<td>15%</td>
<td>0%</td>
<td>23%</td>
<td>4%</td>
<td></td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>Any investment in new equipment?</td>
<td>68%</td>
<td>76%</td>
<td>80%</td>
<td>47%</td>
<td></td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>Any foreign ownership?</td>
<td>8%</td>
<td>10%</td>
<td>24%</td>
<td>6%</td>
<td></td>
<td>52%</td>
<td></td>
</tr>
</tbody>
</table>

| Number of firms | 262 | 24 | 31 | 1682 | 389 |
| Year            | 2010 | 2007/08 | 2006 |
| Source          | Rwanda Industrial Survey | CSA census | IC survey |

Note: The Kenyan survey is a sample.
Why higher productivity may improve the lives of ordinary Rwandans

![Graph showing the relationship between log average wage and log value added per worker.](image)

- Bandwidth = 0.8
- USD 2,000

\[ \Delta VAD/L \ 10\% \ \Leftrightarrow \ \Delta \text{wage} \ 6\% \]
**Differences in Value-Added and Capital-Intensity across Small & Large Firms**

<table>
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<tr>
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<th>Rwanda</th>
<th>Ethiopia</th>
<th>Kenya</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Small firms (emp &lt;= 30)</td>
<td>Large firms (emp &gt; 30)</td>
<td>Difference</td>
</tr>
<tr>
<td>Value-added per worker (median; USD)</td>
<td>1,307</td>
<td>2,844</td>
<td>118%</td>
</tr>
<tr>
<td>Capital stock per worker (median; USD)</td>
<td>1,462</td>
<td>4,237</td>
<td>190%</td>
</tr>
</tbody>
</table>

- Large firms (30+ emp) more than twice as productive as small firms in Rwanda
- In Ethiopia this difference is even bigger
- But in Kenya, the productivity differences across differing size are much smaller
  - Small Kenyan firms 630% more productive than small Rwandan firms
  - Large Kenyan firms 360% more productive than large Rwandan firms
Differences in Exports, Investment & Ownership: Small & Large Firms

- Strong association between firm size and exporting
- Large proportion of the Rwandan firms are investing in new equipment.
- This is true for the small Rwandan firms also
Correlates of Total Factor Productivity

Simple model:

\[
\text{Value Added} = \text{TFP} \cdot (\text{Labor})^\alpha \cdot (\text{Capital})^\beta
\]

\[
\log \text{Value Added} = \log \text{TFP} + \alpha \cdot \log(\text{Labor}) + \beta \cdot (\text{Capital})
\]

where \(\log \text{TFP}\) correlates with exports, ownership, firm age etc.

- Do exporters have higher TFP than non-exporters?
- Do foreign owned firms have higher TFP than domestically owned firms?
- Do firms improve TFP as they grow older?
Correlates of TFP: Summary of OLS Estimates

<table>
<thead>
<tr>
<th>Question</th>
<th>Rwanda</th>
<th>Ethiopia</th>
<th>Kenya</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do exporters have higher TFP?</td>
<td>Yes: 2.4 times higher</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Do foreign owned firms have higher TFP?</td>
<td>Yes: 4.5 times higher</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Are older firms more productive?</td>
<td>Yes: 4% per year</td>
<td>Yes: 0.7% per year</td>
<td>No</td>
</tr>
<tr>
<td>Are firms in the capital city more productive?</td>
<td>Yes: 1.5 times higher</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

- Very large differences across different types of firms in Rwanda
- These results are conditional on firm size.
Why do most Rwandan firms not export?

Which firms invest?
85% of firms did not export in the year 2010. Why?

- Could not find financing: 39%
- Lack of information on potential destinations: 29%
- Could not find clients: 22%
- Insufficient production volume: 20%
- Transport costs: 17%
- Other: 17%
- Too high quality standards in country of destination: 16%
- Problems with certification of product: 15%
- Unfavourable exchange rate: 6%

Source: Rwanda Industrial Survey 2011
Modeling the decision to export: Summary of regression results

- 14% of the firms exported in 2010
- Strong association between firm size & exporting
- Some (weak) evidence that foreign owned firms tend to export more
- Some (weak) evidence that young firms tend to export more than older firms
Modeling the decision to invest:
Summary of regression results

- 71% of firms made an investment in 2010
- Investment more common amongst young firms (true for all countries)
- Firms with high labor productivity (VAD/worker) record more investment...
  .... which leads to even higher labor productivity through the increase in the capital labor ratio
- Access to credit has a surprisingly small & insignificant effect on investment. Self-finance.
Questions and (preliminary) answers

How well do Rwandan mfg firms perform?

- A small number of firms perform well.
- On average, however, labor productivity is lower than in the comparison countries.
- Especially small firms seem to lag far behind comparable firms in Ethiopia & Kenya. Why is unclear.

How big are productivity differences across Rwandan firms?

- Quite big! Exporters, foreign owned firms and older firms have much higher TFP.
- We don’t find such big differences within the other countries
Questions and (preliminary) answers

What factors distinguish the top performing firms from other firms?

- They are large
- They export
- They have been operating for some time
- They are relatively capital-intensive, highlighting the importance of investment.
Preliminary Conclusions

- The results **suggest** the following:
  - International influences are (very) beneficial for firm performance in Rwanda
  - Very hard for small mfg firms to export – because of high transport costs, lack of information about distribution channels / markets, and lack of credit(?)
  - Rwandan firms are gaining much from experience (4% per year TFP) - building capabilities.
  - Demand may be a stronger determinant of investment than credit.
Thank you for your attention.
### Cross Country Benchmarking

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<tr>
<td><strong>Year</strong></td>
<td>2010</td>
<td>2007/08</td>
<td>2006</td>
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<tr>
<td><strong>Sector</strong></td>
<td>Manufacturing</td>
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<tr>
<td><strong>Firm size</strong></td>
<td>Employing more than 10 people</td>
<td>Large and Medium Scale Firms</td>
<td>Small, Medium and Large firms</td>
</tr>
<tr>
<td><strong>Sample Size</strong></td>
<td>262</td>
<td>1734</td>
<td>453</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>Rwanda Industrial Survey</td>
<td>Survey of Large and Medium Scale</td>
<td>Productivity and Investment Climate</td>
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<tr>
<td></td>
<td></td>
<td>Manufacturing Industries</td>
<td>Survey</td>
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Exports: Manufacturing

Kenya: 41.3%
Rwanda: 14.0%
Ethiopia: 3.6%
Investment: Manufacturing firms

Rwanda: 69.0%
Kenya: 53.9%
Ethiopia: 46.2%
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<td>8%</td>
<td>10%</td>
<td>24%</td>
</tr>
<tr>
<td>Male owner / manager</td>
<td>83%</td>
<td>100%</td>
<td>97%</td>
</tr>
<tr>
<td>Owner / manager has at least secondary schooling</td>
<td>65%</td>
<td>95%</td>
<td>57%</td>
</tr>
<tr>
<td>Located in Kigali province (Addis)</td>
<td>32%</td>
<td>86%</td>
<td>13%</td>
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A Case Study of Rwanda

- High overall growth in the last decade.
- 85% of employment in agriculture.
- Compared to most other African countries, manufacturing in Rwanda is small.
- Share of manufacturing falling – from 12% in 1997 to 6% in 2009.
- Is the “deindustrialization” a cause for concern?