# Sources of technological capabilities in low-tech sectors in developing countries: a cross-country firm-level study

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# Background

- Rising knowledge-intensity in production and distribution of products from traditional industries:

  food production, textiles, clothing, footwear, wood products…

- Firms build up technological capabilities in many ways:
  - ✓ Technology transfer : capital goods, licensing, FDI
  - ✓ Absorptive capacity: R&D, human capital

- How important are these activities for productivity (TFP)

  in traditional industries ?

  in countries at different level of development ?

# Empirical approach

- Empirical evidence using firm level cross-section data

- Industries:
  - ✓ Food processing (food, beverages)
  - ✓ Textiles
  - ✓ Garments
  - ✓ Leather products

- Countries:
  Brazil, Ecuador, South Africa, Tanzania, Bangladesh

- Firm performance: TFP

| | Brazil | Ecuador | South Africa | Tanzania | Bangladesh |
|---|---|---|---|---|---|
| GDP/Capita (in constant 1995 US$) [a.] | 4642 | 1796 | 4020 | 207 | 396 |
| Population | 174 | 13 | 45 | 35 | 135 |
| MVA (%GDP) [a.] | 13 | 11 | 19 | 8 | 16 |
| % manuf. employment | | | | | |
| Food processing | 20.9 | 45.0 | 15.2 | 34.4 | 6.8 |
| Textiles | 5.0 | 6.0 | 4.9 | 25.8 | 29.9 |
| Garments | 7.8 | 4.8 | 7.1 | 1.5 | 47.0 |
| Leather products | 7.3 | 2.0 | 1.6 | 2.9 | 2.3 |
| Export performance (RCA) | | | | | |
| Fresh food | 3.88 | 8.96 | 2.25 | 19.56 | 1.44 |
| Processed food | 3.11 | 2.65 | 0.97 | 0.74 | n.a. |
| Textiles | 0.55 | 0.29 | 0.28 | 0.30 | 2.56 |
| Garments | n.a. | 0.12 | 0.66 | 0.21 | 22.95 |
| Leather products | 3.09 | n.a. | 0.41 | 0.39 | 2.95 |

# Innovation in food processing

- Variety of products: fish (fillets), meat, poultry, coffee, tea, juices, beer, wine, flour and bread…
- Issue: quality standards, both international trade and local market
- Need: testing, standard setting, knowledge on markets, standards, packing and transportation support, certification
- Importance of managerial capacities to absorp information and manage linkages

# Innovation in textiles, garments, leather products

- Textiles: Capital-intensive production
  Investment in modern machinery
  Need for finance

- Garments: low-skill labour intensive assembly of components;
  high-skill intensive design and marketing;
  role of large retailers, active in manufacturing through licensing, subcontracting, international division of labour;
  time factor, role of supportive infrastructure

- Leather products: see garments

# Econometric model

- Cobb-Douglas production function:

$$Y_i = A(Z_i, I_i) K_i^{\alpha} L_i^{\beta} e^{\varepsilon_i}$$

- A(.) characterises TFP
- In terms of labour productivity, in logarithmic terms, and controlling for country differences (D) and capacity utilisation (u):

$$\ln(Y_i / L_i) = \sum_{j=1}^{n-1} \delta_j D_{ij} + \ln A(Z_i, I_i)$$

$$+ \alpha \ln(K_i / L_i) + (\alpha + \beta - 1) \ln L_i + \gamma u_i + \varepsilon_i$$

$$\ln(Y_i / L_i) =$$

$$\sum_{j=1}^{n-1} \delta_j D_{ij} + \ln A(Z_i, Z_i * LDC_i, I_i, I_i * LDC_i)$$

$$+ \alpha \ln(K_i / L_i) + (\alpha + \beta - 1) \ln L_i + \gamma u_i + \varepsilon_i$$

# Data and variables

- World Bank Investment Climate Survey
- Covering period 2000-2002
- Stratified random samples, by industry, size and location

| | *Food* | *Textiles* | *Garments* |
|---|---|---|---|
| Brazil | 111 | 93 | 529 |
| Ecuador | 49 | 20 | 23 |
| South Africa | 36 | 12 | 25 |
| Tanzania | 61 | 7 | 10 |
| Bangladesh | 142 | 238 | 378 |
| *Total* | *399* | *370* | *965* |

| *variable:* | *Definition* | *food* | *text* | *garm* |
|---|---|---|---|---|
| CAPUT | [0,1] capacity utilisation | 0.73 | 0.77 | 0.76 |
| FOREIGN | =1 if foreign owned | 7.7 | 7.7 | 1.7 |
| LICENSE | =1 if license from foreign company | 8.5 | 4.9 | 4.7 |
| IMPMAC | =1 if invested in new imported machinery in 2000-02 | 24.7 | 39.2 | 32.2 |
| EDUCGM | =1 if manager with higher education | 71.5 | 63.6 | 61.9 |
| RD | =1 if spent on R&D or Design in 2000 | 36.0 | 38.1 | 46.2 |
| CREDIT | =1 if firm has overdraft facility | 61.7 | 75.9 | 69.6 |
| REGULATION | % of management's time spent in dealing with regulations | 8.79 | 6.88 | 6.19 |

Results of OLS

| | Food | Textiles | Garm&leath |
|---|---|---|---|
| Constant | 5.601*** | 6.947*** | 5.627*** |
| L(CAP/LABOUR) | 0.293*** | 0.245*** | 0.295*** |
| L(LABOUR) | 0.005 | -0.008 | 0.016 |
| CAPUT | 0.877*** | 0.401 | 0.442** |
| Ecuador | -1.392*** | -0.234 | 1.372 |
| South Africa | 0.224 | -0.229 | 0.094 |
| Tanzania | -1.118*** | -1.673*** | -1.687*** |
| Bangladesh | -1.279*** | -1.681*** | -0.790*** |

Results of OLS

| | Food | Textiles | Garm&leath |
|---|---|---|---|
| RD | 0.109 | 0.393*** | 0.115* |
| EDUCGM | 0.497*** | -0.022 | 0.246*** |
| LICENSE | 0.302 | 0.101 | 0.333*** |
| IMPMAC | 0.202 | 0.327*** | 0.012 |
| ECUIMPMAC | 0.684 | -0.162 | -1.632 |
| FOREIGN | 0.624*** | 0.104 | 0.349 |
| REGULATION | -0.007 | -0.010* | -0.010** |
| CREDIT | 0.229* | 0.017 | 0.198*** |
| $R^2$ | 0.49 | 0.54 | 0.34 |

# Interactions with LDC dummy

| | Food | | Textiles | | Garm&leath | |
|---|---|---|---|---|---|---|
| RD | 0.109 | 0.208 | 0.393*** | 0.451** | **0.115*** | **0.221**** |
| LDC*RD | | -0.242 | | -0.079 | | **-0.288**** |
| CREDIT | 0.229* | 0.052 | **0.017** | **-0.487** | 0.198*** | 0.247** |
| LDC* CREDIT | | 0.316 | | **0.744**** | | -0.163 |
| $R^2$ | 0.49 | 0.50 | 0.54 | 0.55 | 0.34 | 0.35 |

# Conclusion

- Sources of technological capabilities differ by industry:

- Food: managerial quality, foreign ownership
- Textiles: R&D&D, capital goods imports
- Garments and leather products:
  R&D&D, managerial quality, licensing

- Institutional influences: access to credit and regulation