Robotics and Reshoring: Case Studies of the Apparel and Footwear and Electronics Industries

Fernanda Bárcia de Mattos
David Kucera
ILO Employment Policy Dept.

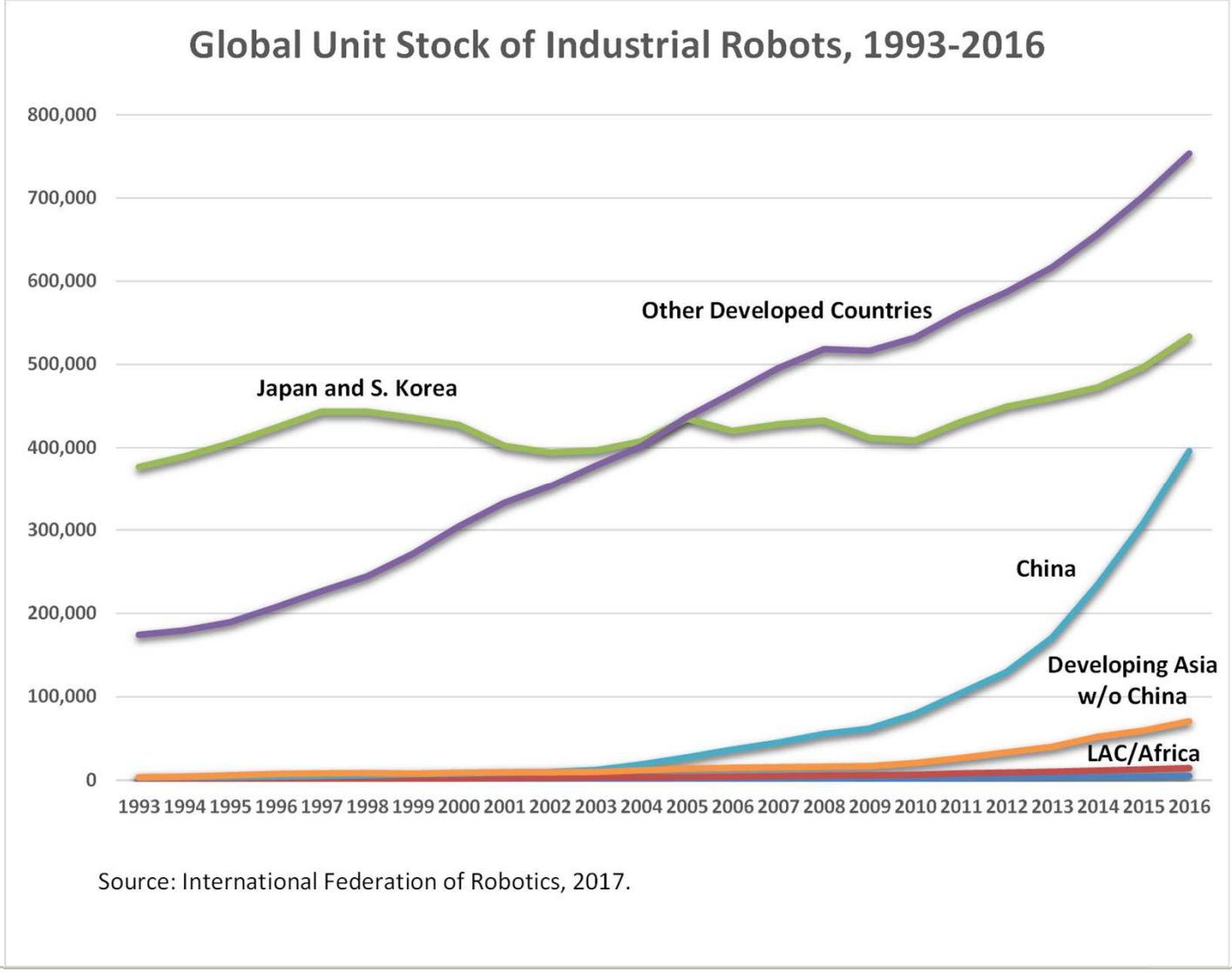
Technological feasibility and routine work

- Many studies of the risk of potential automation by robots (computer-controlled equipment) are based on Frey and Osborne's method (2013)
- This method focuses on technological feasibility of potential automation based on the extent of routine work for 700 occupations
- Useful in that it provides overall country-level estimates
- Because developing countries have a higher share of routine work, the method leads to systematically higher estimates of the risk of potential automation in these countries

Technological feasibility and the geography of robotics

- E.g., estimated 47 percent of jobs at high risk in the US compared to around 80 percent in Cambodia, Nepal and Ethiopia
- Yet the higher share of routine work in developing countries is not new and neither are robots
- If technological feasibility were the decisive consideration, developing countries would have more robots than developed countries
- Robots are rather highly concentrated in developed countries and China and this does not correspond with share of routine work in countries

Technological feasibility and the geography of robotics



Source: International Federation of Robotics, 2017.

Technological feasibility versus economic feasibility

- Technological feasibility is clearly not the decisive factor
- Yet Frey and Osborne's estimates of risk of potential automation based on technological feasibility are themselves questionable:
  - **Sewing machine operators:** 89 percent risk
  - **Shoe machine operators and tenders:** 97 percent
  - **Electrical and electronic equipment assemblers:** 95 percent
- Technological bottlenecks
  - **Sewing:** Accurately aligning pliable fabrics in sewing machines, exacerbated by wide range of fabrics, products and sizes
  - **3D printing:** Developing materials of comparable softness, breathability and durability as conventional fabrics
  - **Electronics assembly:** Inserting small, delicate, often flexible parts into tightly-packed consumer electronics, exacerbated by short product cycles

Strategic industries: Technological and economic bottlenecks

- Our method: In-depth case studies for strategic industries, based on desk research and interviews of key informants

- Strategic industries because:

  - Employ large numbers of workers
  - Labour-intensive and female-intensive
  - Important in export-led development and global supply chains
  - Experienced significant offshoring of production

- Also looking at warehousing and BPOs

Offshoring versus reshoring (and nearshoring)

- **Hypothesis:** For most developing countries – with notable exceptions like China – the main risk of job loss from automation will not be automation within those countries but rather automation *in or near* developed countries and associated reshoring of production

- To this day, offshoring dominates reshoring

- **Path dependence:** Reshoring has resulted in lack of skilled operatives in developed countries and strong industrial clusters in developing countries

- Yet, labour costs are rising in many developing countries and benefits from reshoring can be substantial:

  - Closer proximity to customers, meaning reduced transport costs and delivery times
  - Less surplus inventory sold at discounts as production becomes more just-in-time
  - Closer proximity to designers
  - Improved product quality
  - Improved brand image
  - Reduced corporate social responsibility risk

Tianyuan Garments and SoftWear Automation

- Tianyuan a large Chinese contract manufacturer producing primarily for Adidas
- SoftWear Automation an apparel robotics firm using sensors to count threads and align fabrics in its "Sewbots" with explicit reshoring objective:

"SoftWear's fully automated Sewbots allow manufacturers to SEWLOCAL™, moving their supply chains closer to the customer while creating higher quality products at a lower cost."

- Tianyuan invested 20 million USD in a T-shirt factory in Arkansas, using 21 fully automated SoftWear Automation production lines, to open in 2018 and create 400 ancillary jobs
- Reported to be able to produce T-shirts at the same unit costs as lowest cost countries such as Bangladesh
- But reports of output vary wildly, from 800,000 units/day to 1.2 million units/year; true unit costs unclear
- T-shirts not the obvious candidate to benefit from "fast fashion," JIT and reshoring, being a standardized, low-cost product

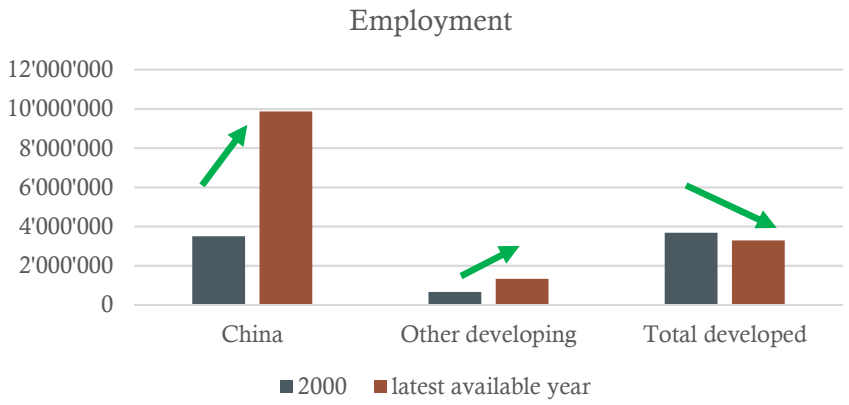
3D Printing

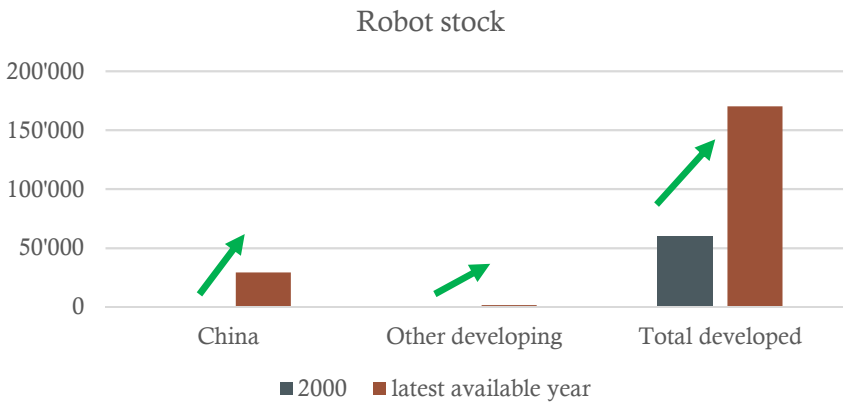
"Anything with reliable rigidity is a target for 3D prototyping…but it's the inherent flexibility, drape, hand and so on that make a garment actually wearable. Unforeseen advancements aside, I do not personally believe that the 3D printing of soft garments is likely any time soon." – Lydia Hansen, Industry Analyst, 2015

- Recent technological and commercial firsts
  - **Continuum:** Markets 3D printed apparel made to customers' specifications
  - **Materialise:** Produces 3D printable material both pliable and durable
  - **Stratasys:** Combines two materials, hard and soft, in a single 3D printed garment
  - **XYZ Workshop:** Produces a 3D printed dress made from a recyclable bioplastic
  - **Electroloom:** Develops a 3D printer producing prototype T-shirts
  - **Prospective developments:** Bio-printing (simulations of natural fibers) and incorporating cotton and other natural fibers into 3D printing processes
- More headway in footwear than apparel, with an online store specializing in 3D printed footwear and new Adidas' Speedfactory as part of its *Made for Germany* (MFG) initiative (with plans for US, UK and France)
- To what extent will 3D printing remain for a high-end niche market, focusing on prototyping and expensive, customized apparel and footwear?

The electronics industry

- Top 10 exporters in 2015 accounted for 95.6% of world total:
  - EU-28; U.S.; Japan, S. Korea, Singapore
  - China, Mexico, Malaysia, Thailand and Viet Nam
- Within-industry automation not even: components vs. assembly
- Fears of automation-enabled reshoring but we have seen increases in both robots and employment in emerging countries
- Small number of large contract manufacturers may have incentives to automate





Source: UNIDO INDSTAT2, 2017; IFR, 2017.

Foxconn: leading both automation and offshoring?

- Largest electronics contract manufacturer globally, 1.4 million workers
- In 2016, announced plans to fully automate Chinese factories
  - Produces own cobots, FoxBots
  - 40,000 FoxBots in operation
- Early 2016: 60,000 layoffs in one plant in Jiangsu, China
- July 2016: signed MoU with the government of Wisconsin: $10 billion + 13,000 jobs
- Yet, Foxconn has also announced investments (and plans to create jobs) in emerging countries. E.g. Indonesia, 2014; India, 2015, 2016 and 2017
- At the same time, many previous MoU's have not come to fruition

Concluding remarks

- Economic feasibility dominates technological feasibility
- Technological feasibility is itself often overstated, at least in apparel and electronics
- Risk of job loss in developing countries more likely from automation *in or near* developed countries and associated reshoring of *production*, if not *employment*
- Reshoring may also take place among developing countries, given the market potential of large developing countries
- Though offshoring continues to dominate reshoring, benefits from reshoring are compelling
- Depends on availability of skilled operatives and strength of industrial cluster effects

Concluding remarks

- *Industry-level employment impacts* from automation remain uncertain and depend on overcoming technological and economic bottlenecks and the extent to which products are for niche versus mass markets
- Developments currently underway will soon provide some clarity
- *Overall employment impacts* from automation depend on a range of potentially offsetting effects at task, enterprise, industry and economy-wide levels
    - Substitution effects
    - Complementarity effects (collaborative robots)
    - Market expansion effects
    - Income effects
    - Input-output and associated income-induced effects
- Historically, positive employment effects dominate negative employment effects at the aggregate level, alongside winning and losing sectors and occupations