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

Global Unit Stock of Industrial Robots, 1993-2016

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

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.