Câmara dos Deputados – Audiência Pública

"Sustainable Development, Industrialization and Innovation"

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Robots, Industrialization and Innovation Policy

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What is the issue?

- 2030 Agenda for Sustainable Development emphasizes link between technological innovation and industrialization on the one hand and industrialization and sustainable development on the other (Goal 9)
- But gaining productivity growth through automation that causes job displacement and wage erosion would compromise attaining this goal as the Agenda aims at tackling poverty and achieving inclusiveness through the creation of more and better jobs
- Some predict that about two thirds of all occupations in developing countries risk being automated; others estimate that displacement risks are highest in those developing countries that rely on low-wage, labour-intensive export-led manufacturing as a development strategy
- **Does emerging greater scope & speed of automation reduce effectiveness of industrialization as a development strategy**?

Outline

1) What are industrial robots?
2) Why has the scope and speed of automation increased?
3) Where have industrial robots been used most and how is this linked to industrialization?
4) What impact on innovation policy?
5) Summary and conclusions

1) What are industrial robots? Part of "industry 4.0"

- Industry 1.0 (late 18th century): mechanical production driven by steam and water power
- Industry 2.0 (late 19th century): electrification of machines and mass production
- Industry 3.0 (starting in 1970s): information-and-communications-technology-based production management; simple industrial robots
- Industry 4.0 (now): connection via digital interfaces linking advanced internet and ITC technologies, Big Data, intelligent robots

1) What are industrial robots? Definition

- ISO 8373 : Industrial robots are automatically controlled, reprogrammable, multipurpose manipulators programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications
- Industrial robots are distinct from
  - Service robots for professional use deployed in, e.g., agriculture, professional cleaning, construction, logistics, medicine and defence; number of such units sold in 2015 was only about one sixth of that of industrial robots
  - Service robots for domestic/household tasks and entertainment and leisure robots: sold in large numbers but of little relevance here
  - Other forms of automation, such as Computer Numerical Control systems that have allowed for automation of machine tools since 1960s but are designed to perform very specific tasks and, even if digitally controlled, lack the flexibility and dexterity of industrial robots

2) Why has the scope and speed of automation increased?

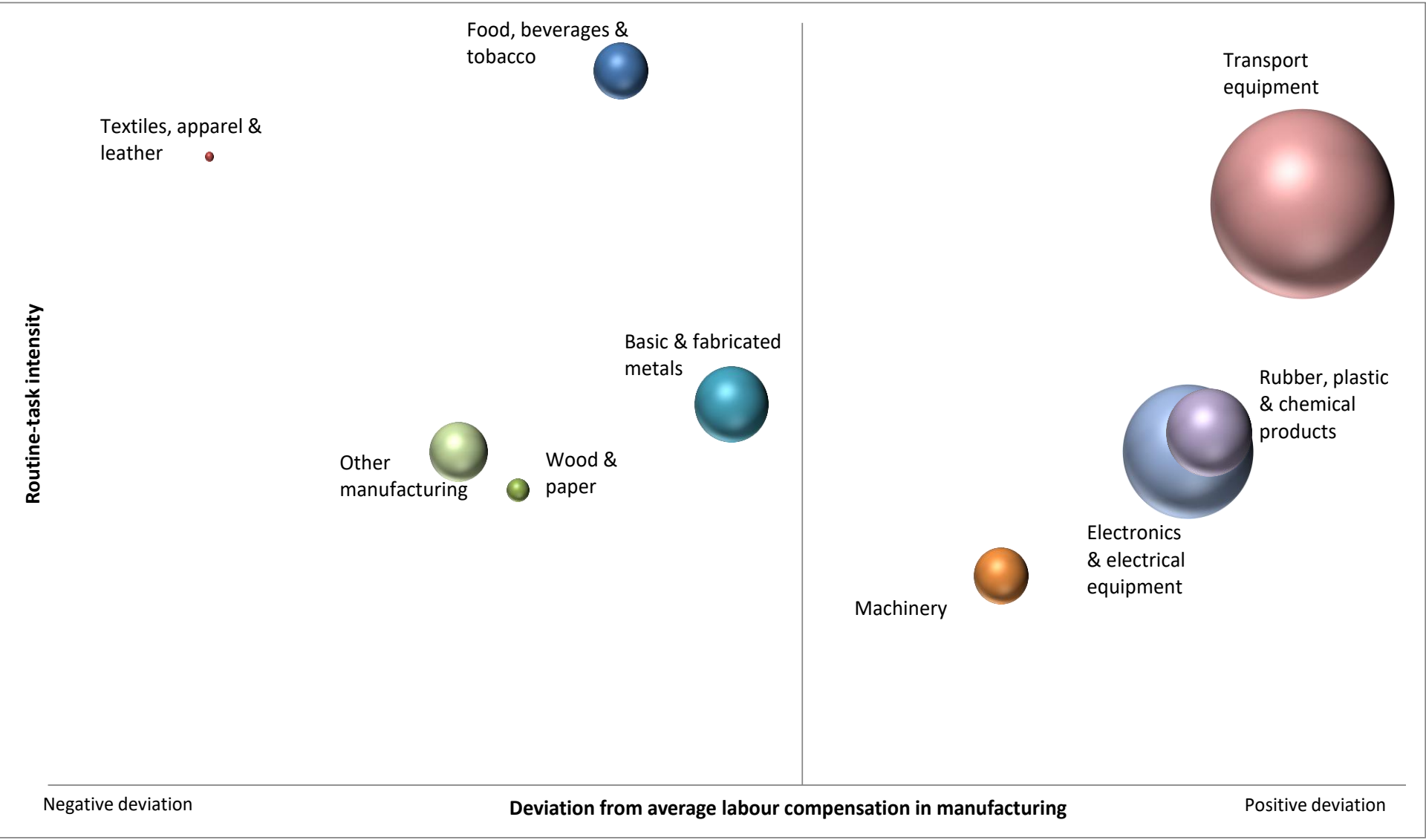
- Robot-based automation comes in addition to mechanization
- Increased speed of automation: power of computer software increases exponentially (Moore's law)
- Industrial robots replace specific tasks not entire jobs
- Industrial robots do not replace manual & repetitive tasks of low-skilled workers, but routine tasks:
  - Tasks that can be clearly defined and follow pre-defined patterns, so that they can be coded and translated into software that drives robots

The task-based approach determines the technical feasibility of work place automation

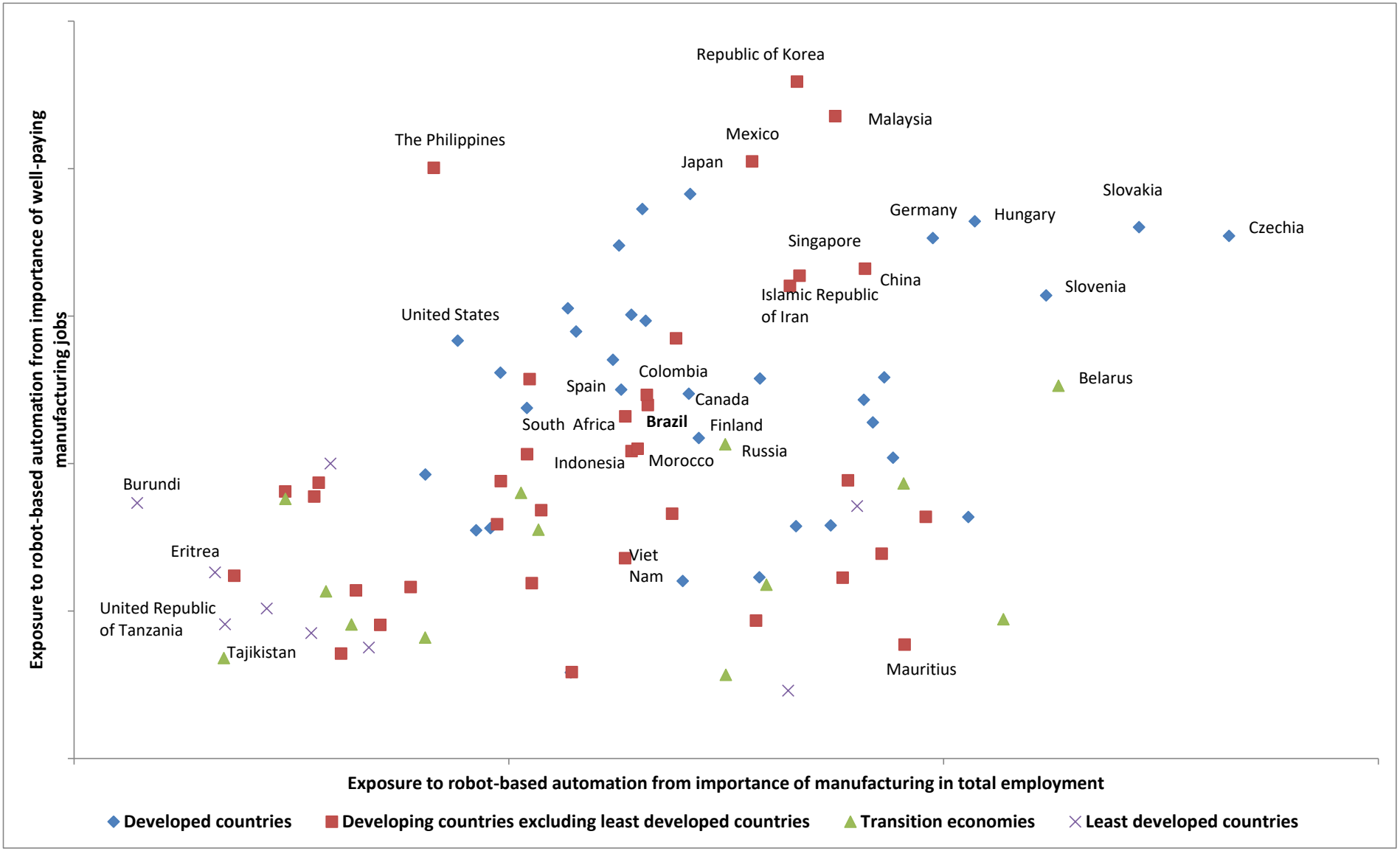
- Calculation of a routine-task intensity index, linking routine tasks to occupations that workers perform on their jobs
- Such indices indicate that routine-based tasks dominate in occupations that are typical for the manufacturing sector
- They more generally indicate the technical feasibility of work place automation
- Such calculations underlie the often dramatic predictions about work place automation

What is technically feasible to automate is not necessarily also economically profitable

Size of bullets reflects global use of robots



As of now, most developing countries do not seem to be overly threatened by automation



3. Where have industrial robots been used most: summary of cross-country and cross-sectoral evidence

- Robot deployment has been very concentrated
  - In a few countries, which are largely the same in which manufacturing output has become concentrated
  - In a few sectors, which are largely those demanding medium skills and those important for industrial upgrading
- Risk that robotics will eventually reinforce concentration of manufacturing activities
- But for now: initial stage of industrialization and establishment of labour-intensive manufacturing activities based on traditional labour-cost advantages seems still possible
- Further development in robotics, e.g. smaller robots affordable for SMEs, combined with 3D-printers, may make it profitable to produce smaller production runs in high-productivity sectors

4. What impact on innovation policy? (1)

- Digital technologies change organization of production processes and business models: policy needs a digital focus, including for innovation
- Policy challenges include connectivity (digital infrastructure, broadband connectivity, digitally-skilled labour force), technology or innovation hubs & incubators, venture finance, competition rules & regulatory capacity
- Policy objective: participation in digital economy, including by smaller firms and in new markets, and upgrading in export-oriented value chains
- A tightening of international trade and investment rules would reduce existing flexibilities regarding policies to support the digital economy (where access to data is key)
  - Current regulation allows policies (sometimes controversial Internet filtering; data localization and technology transfer requirements) to promote domestic digital firms and allow them to catch up with leading digital MNEs

4. What impact on innovation policy? (2)

- Moreover, concentration (for now) of robots in developed countries plus shift in end markets towards developing countries may offer industrialization opportunities based on domestic innovation and manufacturing workers
- Policy objective: animate link between domestic innovation & domestic demand that uses low-wage labour to produce low-priced products in sectors, such as the automotive industry, which have been robotized only in high-wage countries?
  - Do MNEs have a crucial advantage over domestic firms in designing vehicles from concept definition to production, rather than just in adapting global models to local market conditions?
  - What can standard setting, public participation in long-term finance, public procurement, bold demand policies and other policies achieve?
  - How could the data gathered from domestic innovation, production & sales be used for customized products also in subsequent upgrading?

5) Summary and conclusions

- Robots used more in higher-wage & higher-productivity sectors
  - These sectors may concentrate in a few countries
  - Others may be driven to lower-wage & lower-productivity sectors
  - Initial stage of industrialization & establishment of labour-intensive manufacturing activities seems still possible
- Further developments in digitization may create new high-productivity manufacturing sectors with new job and income opportunities, and new prospects for industrialization
- Developing countries should embrace the digital revolution and prepare for digitization in order to benefit from its advantages – final outcomes depends on policy
- What role for digital industrial policy, including for innovation?

Thank you !

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UNCTAD
Trade and Development Report 2017: Chapter 3: Robots, industrialization and inclusive growth

http://unctad.org/en/Pages/Publications/TradeandDevelopmentReport.aspx