

Robotization as a Global Social Challenge and an Opportunity: A Robotician's Perspective

Prof. H. Atakan Varol

Department Chair of Robotics, Nazarbayev University

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email: ahvarol@nu.edu.kz website: arms.nu.edu.kz

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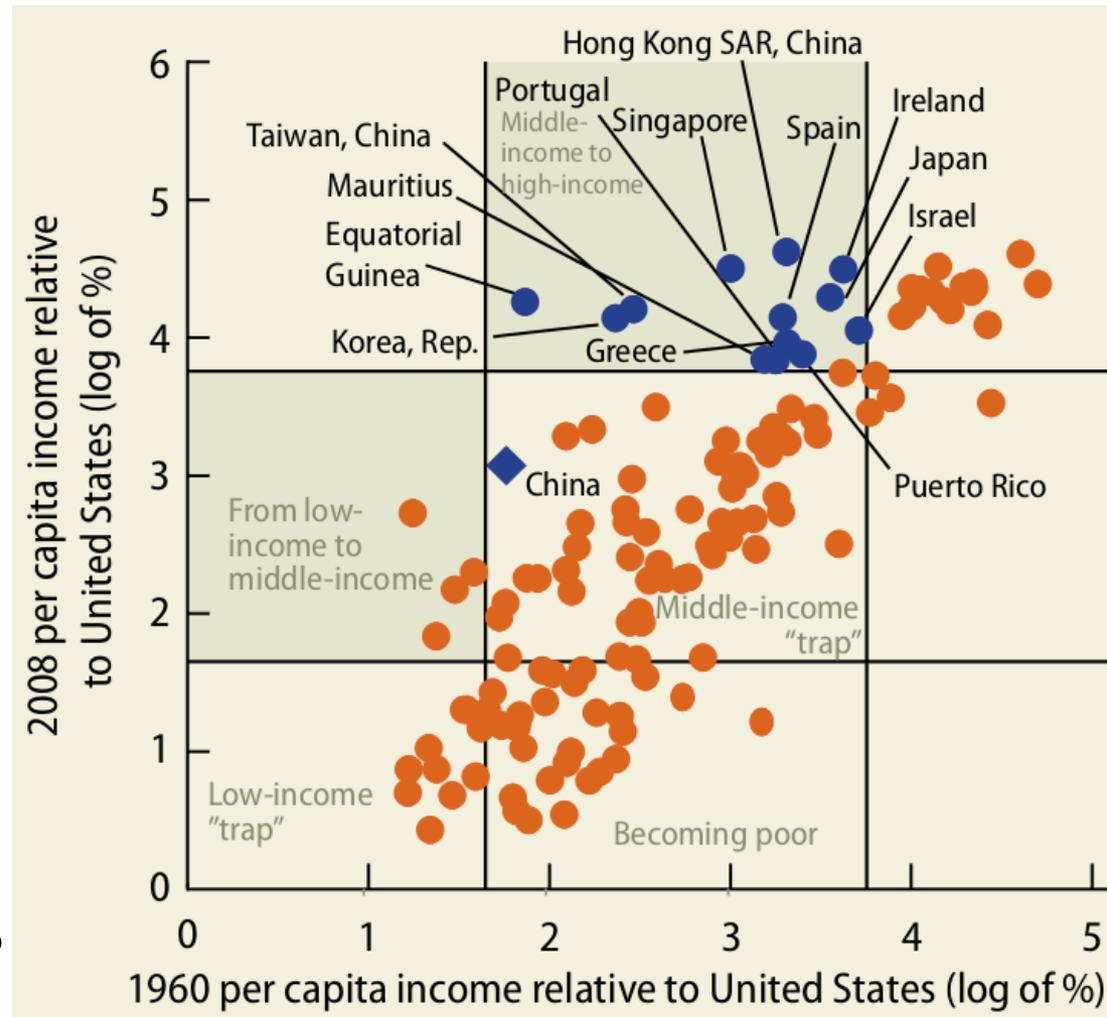
Convergence versus Middle Income Trap

Economic Convergence: (Abramovitz, 1986)

Per capita incomes of poor countries will tend to grow faster than richer ones. Eventually, all countries will converge to the same level of income per capita.

Middle Income Trap: (Gill and Kharas, 2006)

Low-income countries rapidly grow to middle-income levels and fail to become high-income countries. No country with a population over 5 million escaped the middle income in the last two decades.



Data Source: World Bank
Source: Economist.com



Robotization (Digitalization of Manufacturing)

- An umbrella term encompassing the use of multiple emerging technologies such as soft robotics, physical human-robot interaction, Internet of Things, machine learning, advanced sensing, 3D printing, augmented/mixed/virtual reality for the **digitalization of manufacturing**.
- Country-level strategies: Industry 4.0 (Germany), Society 5.0 (Japan), Catapult (UK).
- More complex tasks can be executed by machines without direct supervision of humans.



What will be the effect of these technologies to the economic development of different income level countries?

Effects of Robotization - Developed Countries

- I assume **artificial generalized intelligence** is still far away.
 - Humans will still be needed for intellectual work (e.g. designing and programming the robots).
- Productivity increase thanks to advanced robotization and digitalization will solve many problems of the developed countries (shrinking workforce due to aging and loss of competitiveness due to worker rights and high salaries).
- Possible trends:
 - Gradual decrease in working hours.
 - Aggressive policies for immigration of intellectual workforce.
 - Distribution of universal basic income to ensure consumption and prevent social unrest.
 - Emergence of gig economy: Low skilled workers engaging in multiple short-term tasks usually assigned by software applications utilizing machine learning.



Effects of Robotization – Developing Countries

- New generation robots with autonomy will be expensive due to patent protection.
 - Industrial workers in developing countries are easily-programmable efficient biological machines with self-repair capability (Salary ~5000 USD per year).
 - International investors will seek less trained and cheaper workforce since robots will do most of the complex operations and human workers will be guided through augmented reality by the robots.
 - Less number of highly-trained personnel will be needed in the factories since most of the diagnostics, programming and technical service will be done online thanks to the Internet of Things and Augmented Reality.
 - Less demand on skilled workforce might cause brain-drain and decreased interest in education.
- Advanced robotization on average will **negatively** affect the developing countries.
- Getting ahead of this curve will be an uphill battle.
 - Solutions: Deregulation?, Education?, Specialization?

