The future of Work: Employment in the Age of Robots and AI

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Road map

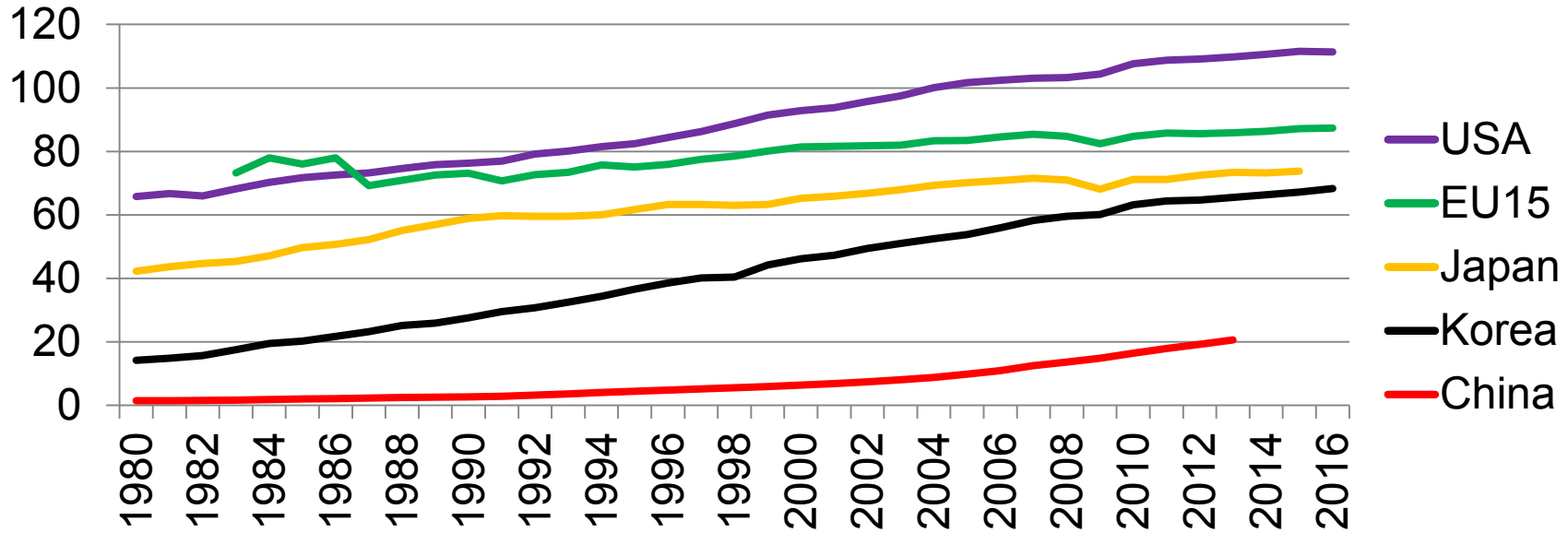
1. New technology and economic growth
2. The structural transformation
3. Job destruction in the age of computers
4. Job creation in the age of robots and AI
5. How can policy help?

1. New technology and economic growth

Economic growth

- Sustained economic growth requires new technology
- New technology brings productivity growth
- Without new technology there can only be one-off episodes of growth (due e.g., to land reform, as in China in the 1980s)

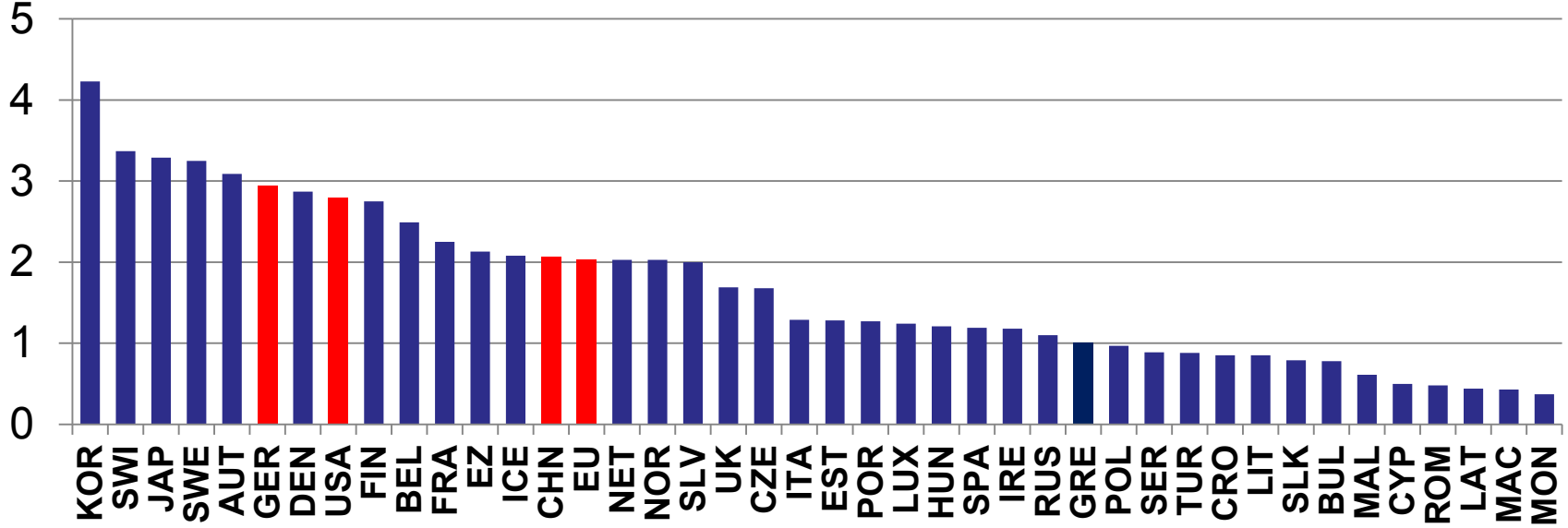
Labour productivity (GDP/Employment USD PPP)



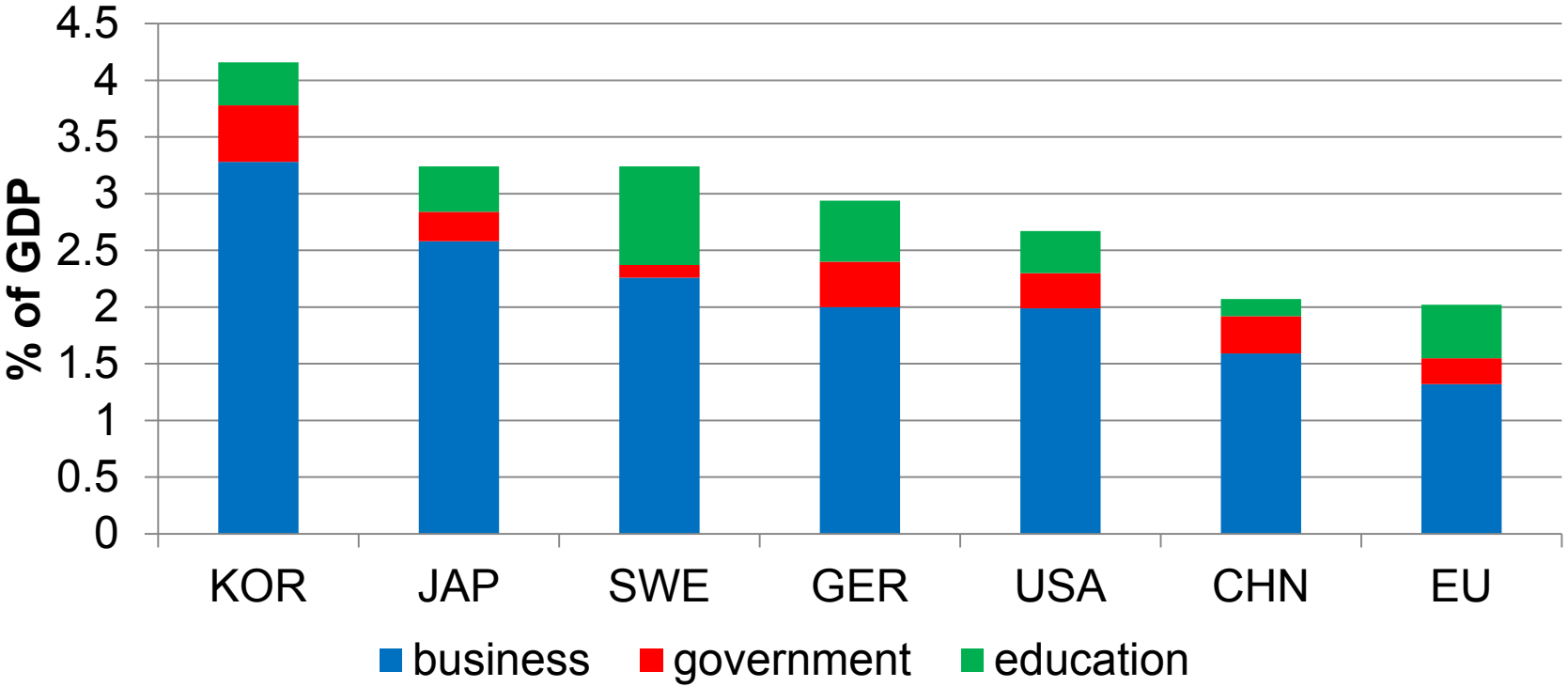
New technology

- In that sense new technology (robots and AI currently) should be embraced and research encouraged
- Look first at research: New technological discoveries come from R&D
- Who are the leaders?

Total R&D
(% GDP, 2016 or latest year)



Sectors of R&D



2. The structural transformation

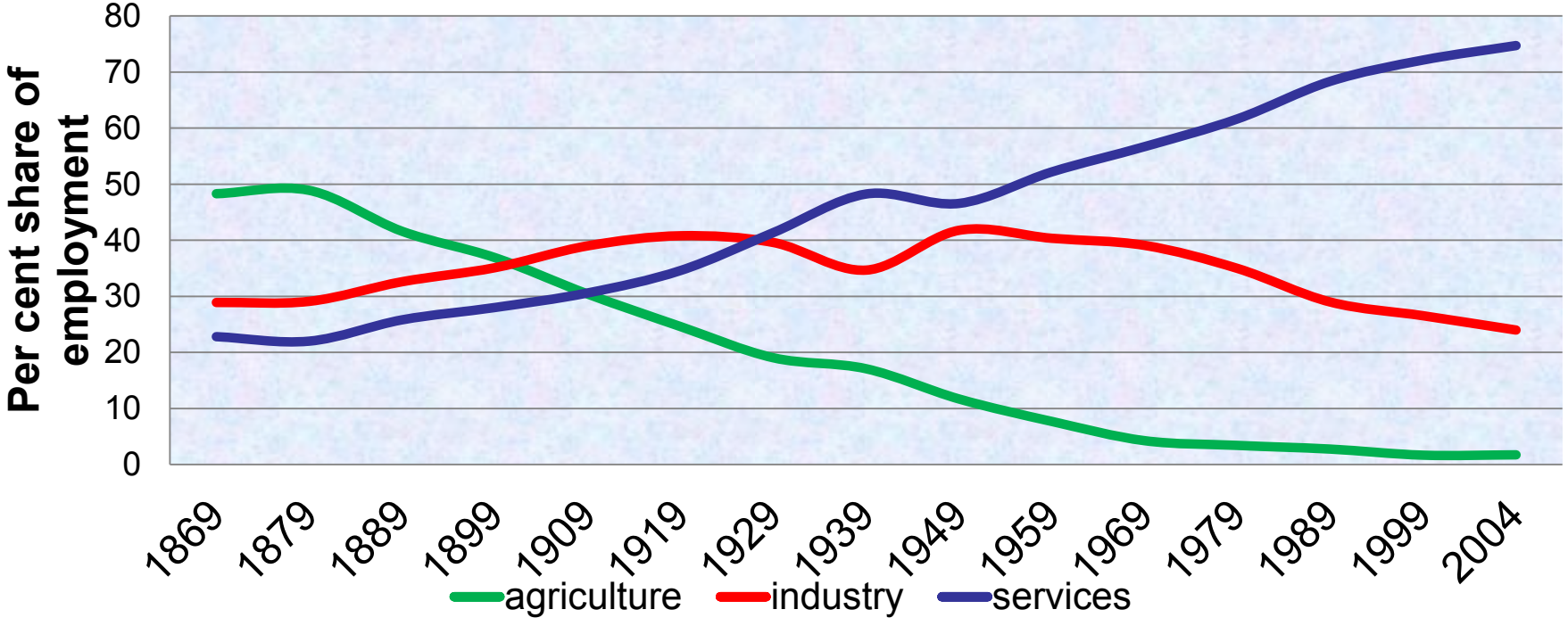
The structural transformation

- Technology is not discovered and implemented uniformly across the economy
- There are differences across sectors that lead to wage inequality and restructuring of jobs
- This is known as the structural transformation. All growing economies undergo a structural transformation

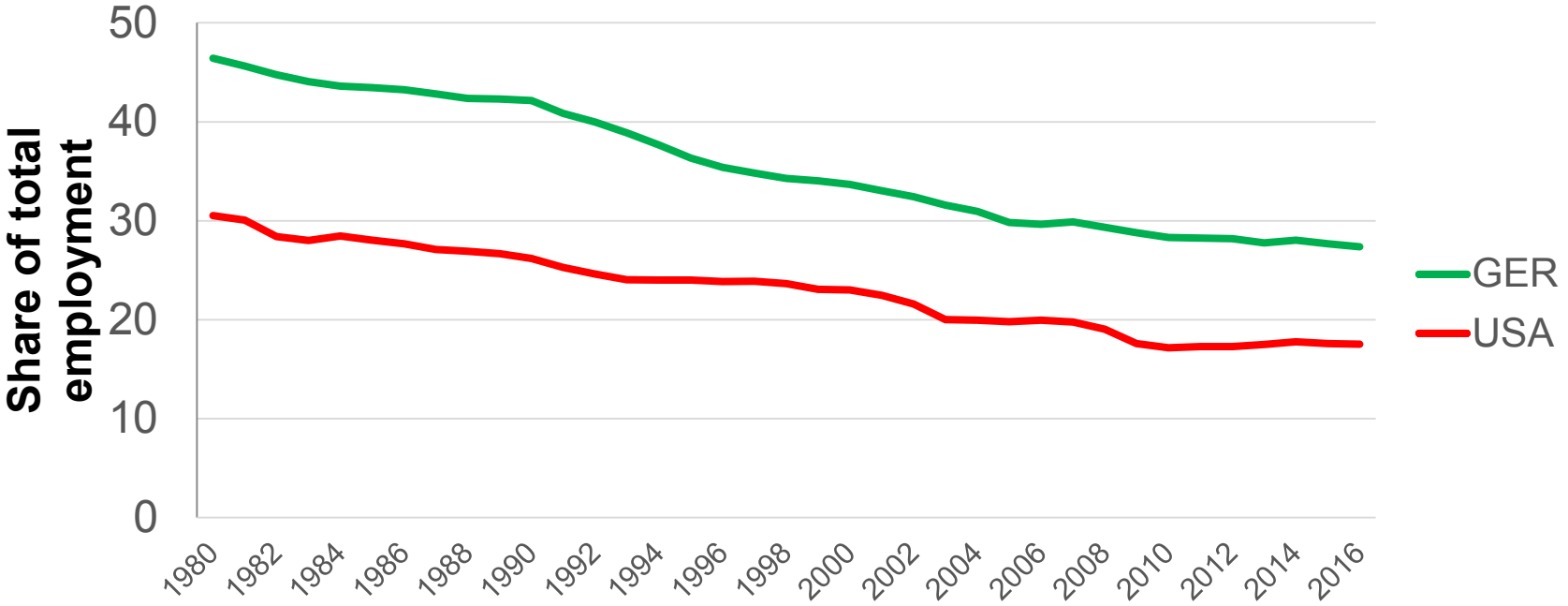
Sector expansion and shrinkage during growth

- Growth begins with a “revolution” in agriculture, which increases productivity and releases labour
- Industrial employment in factories first rises but then falls as new technology is implemented
- Labour moves to technologically less advanced service sectors, so as to enable their output to keep up with industrial and agricultural output

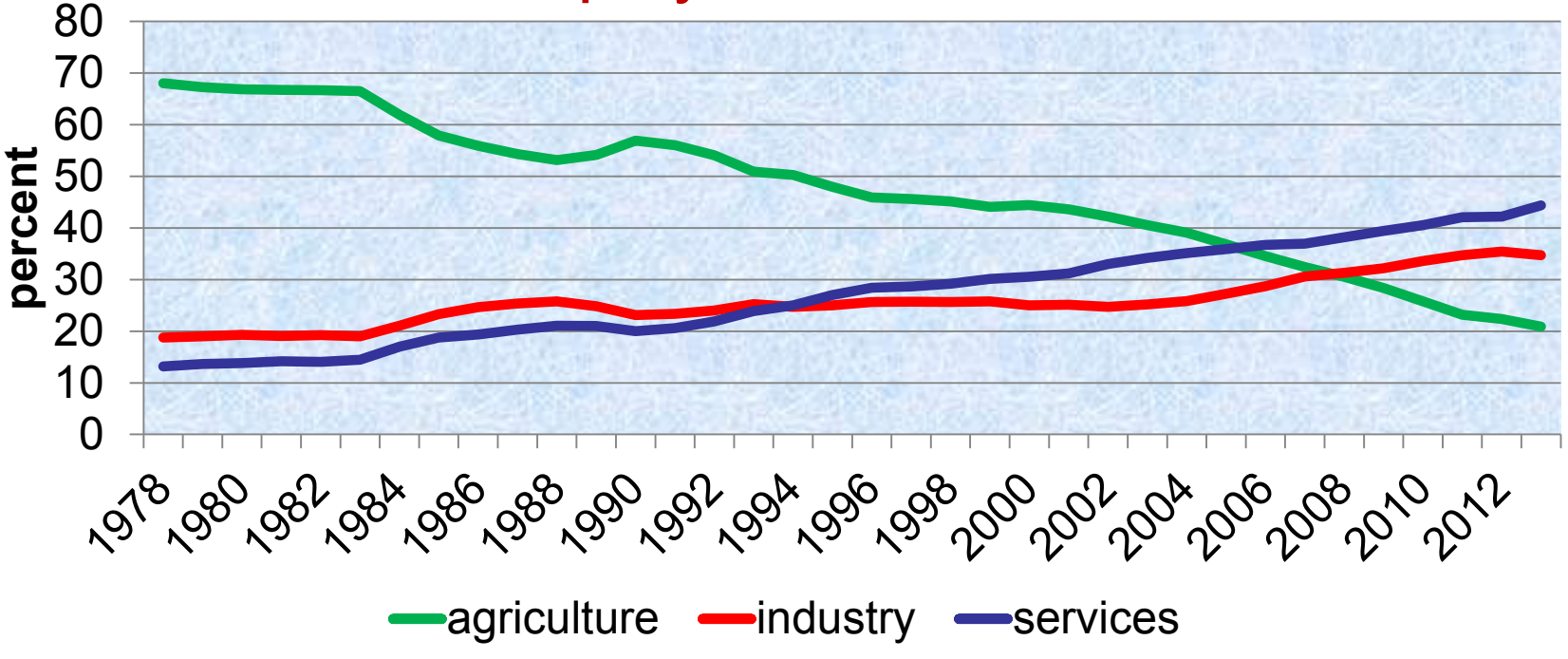
The structural transformation in the United States: employment shares



Industrial employment shares



The structural transformation in China: Employment shares



Transformations compared

- In terms of the three big sectors, China is at the point that the United States was in the early 1930s
- But things are different now: expansions and contractions are faster and technology diffuses faster because of better education and communications
- It took the US 60 years (1870-1930) to cover the ground that China covered in 20 years (1993-2013)

The digital revolution

- Current technologies are based on computers, the internet and artificial intelligence
- The structural transformation in the digital revolution is different from earlier technological breakthroughs

Earlier technological breakthroughs

- In the early stages of industrialization the jobs destroyed were skilled (artisans, craftsmen etc.)
- Later more unskilled jobs were destroyed – with electric power fewer people with more machines could produce more output than before, when more people were employed in factories

Technological disruption: Modes of transportation in central London just before the introduction of the motor car

Computerization and the internet

- Computers destroy jobs done by more skilled people.
- They replace routine tasks but not manual unskilled tasks
- Cashiers, booking agents, booksellers, typists, clerks: both industrial and service jobs, mid-range skills

3. Job destruction in the age of computers

Implications of computerization for jobs

- Large literate exists documenting that routine jobs that could be computerized are heavily concentrated in the middle of the skills distribution
  - Middle range jobs receive negative shock because they are replaced by computers
  - top jobs employ computers and increase their productivity
  - bottom jobs survive because they cannot be taken over by computers but don’t benefit from them
- These have implications for wages, increasing inequality

Range of estimates

- Frey and Osborne concluded that close to 50% of tasks could be taken over by machines; but not necessarily jobs
- The OECD has the most conservative estimates – less than 10% destruction; because they focused on jobs
- McKinsey Global Institute recently concluded that about 14% of workers will lose their jobs (in US)

What do we know?

- We still know very little about automation in the 21st century
- Each new innovation puts at risk different kinds of jobs
- So it's not possible for either companies or workers to plan on how to avoid the risk of job loss, they need to react to news
- One thing we know is that computers and AI will replace jobs that have **predictable environments** – they need to be programmed to respond to their environment

Technical capabilities vs. economics

- So far most studies focused on technological capabilities
- But implementation and diffusion depends on economic incentives too
- Robots and AI are replacing human labour or other machines
- Their speed of adoption depends on the cost of the alternative factors
- High-wage countries are more likely to adopt them than low-wage ones

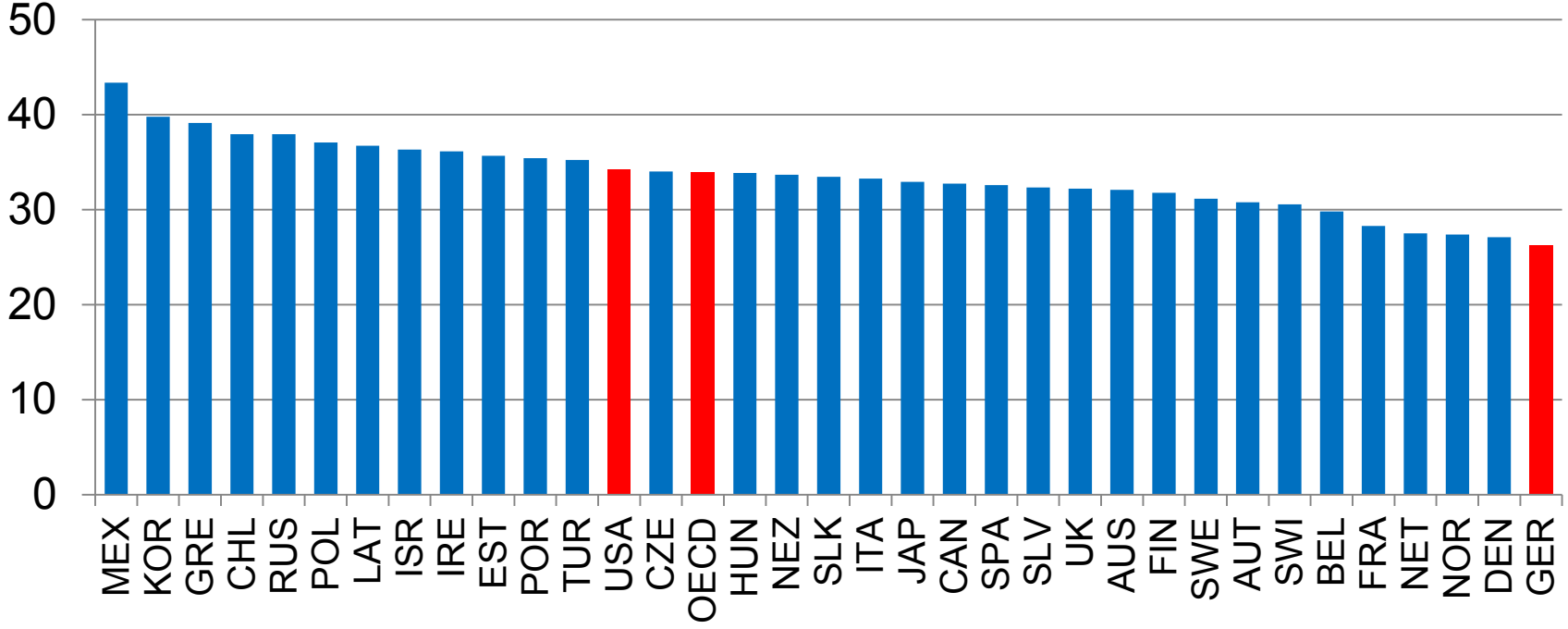
Will there be no work left to do?

- Plenty of new job creation will take place
- But overall hours of work will fall because wealthier societies work less
- John Maynard Keynes writing in 1933 famously predicted that in the longer term the working week will be cut to 15 hours if full employment is to be maintained

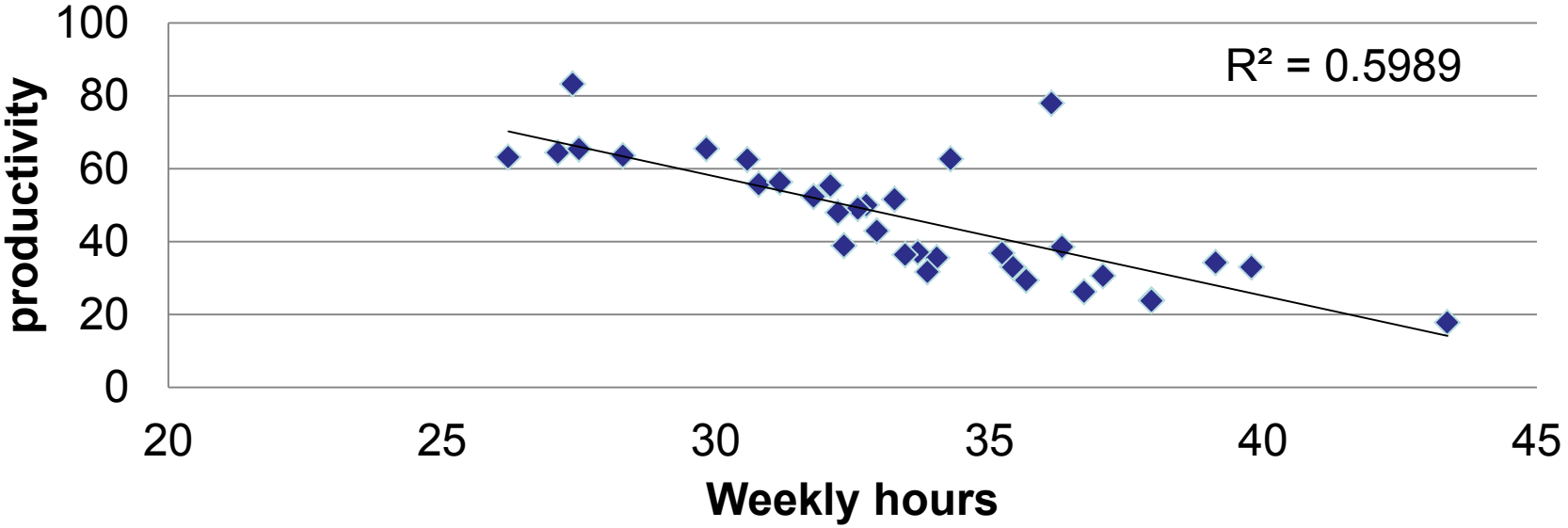
Hours of work

- On average countries with higher productivity work shorter hours
- Yet their employment is as high as that of countries with lower productivity (or even more)
- Some of the gains from new technology are taken as increased leisure time

Weekly hours of work, 2016



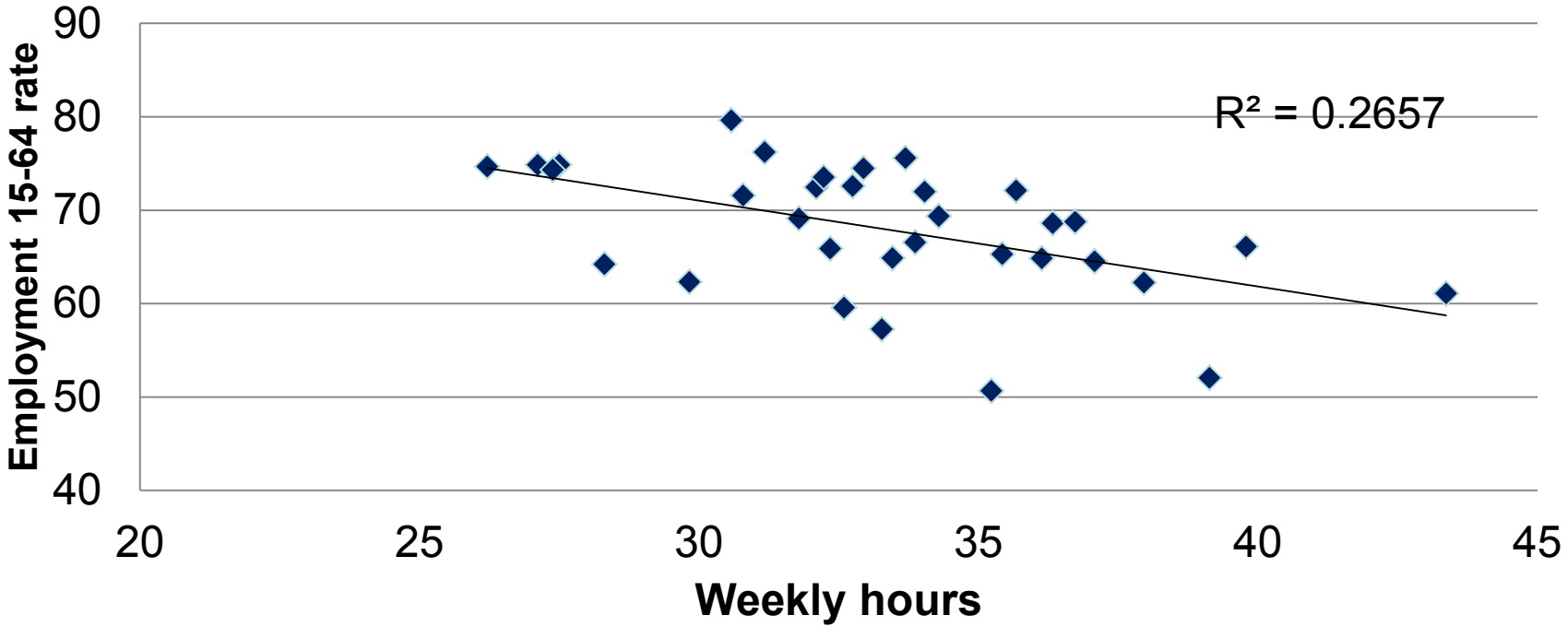
Hourly labour productivity and weekly hours of work, 2016



Job sharing

- But even in Germany, with lowest hours in the OECD, weekly hours are still 26 per week
- Germany also has very high employment
- Of course, full-time workers work longer hours but many jobs are part-time, giving the average of 26 hours: this is a form of “job sharing”

Employment rates and hours of work, OECD, 2016



4. Job creation in the age of robots and AI

Job creation

- Three types:
  - Companies invent new tasks as some get automated, e.g., bank cashiers now do “relationship banking” with customers
  - New jobs created in the sectors of the new technology, e.g., app development, robot repairing etc.
  - New jobs created in other sectors of the economy, e.g., carers for children, old people and pets; plastic surgeons

New sectors

- This new creation requires learning new skills; lifelong learning becomes very important
- And/or a transition to new jobs. McKinsey estimate 14% of workers will need to move onto generally higher skill jobs
- The sectors that create the jobs are ones that cannot be automated; important amongst them are services that make life easier: “luxuries”

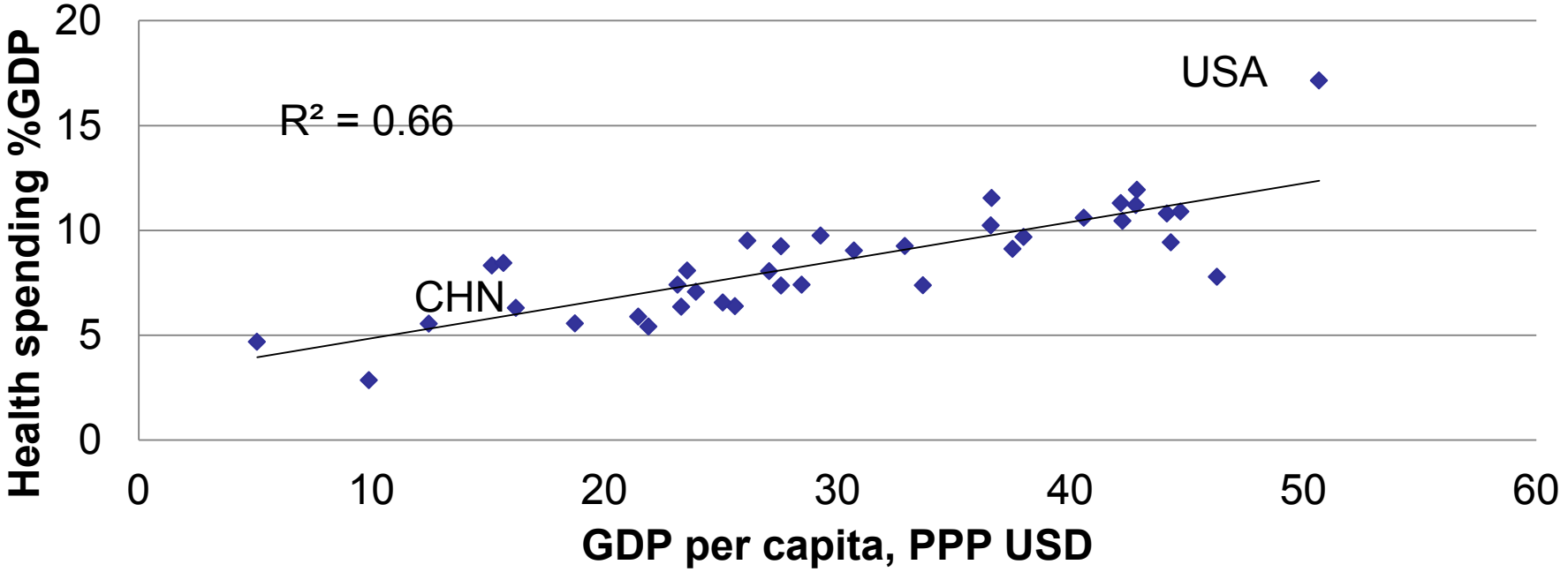
Which sectors will create jobs?

- The main unrelated sectors that will benefit from new job creation are labour intensive services that wealthier societies demand (the “luxuries”)
  - Health and care
  - Education
  - Hospitality industry – leisure
  - Real estate management
  - Household services
  - Personal services

Wealthy aging societies

- Especially health and care will create jobs, because of higher demand for good quality health care and aging societies
- The leisure industry because of fewer aggregate hours of work
- Household services, real estate management because we become wealthy enough not to “bother” with such chores

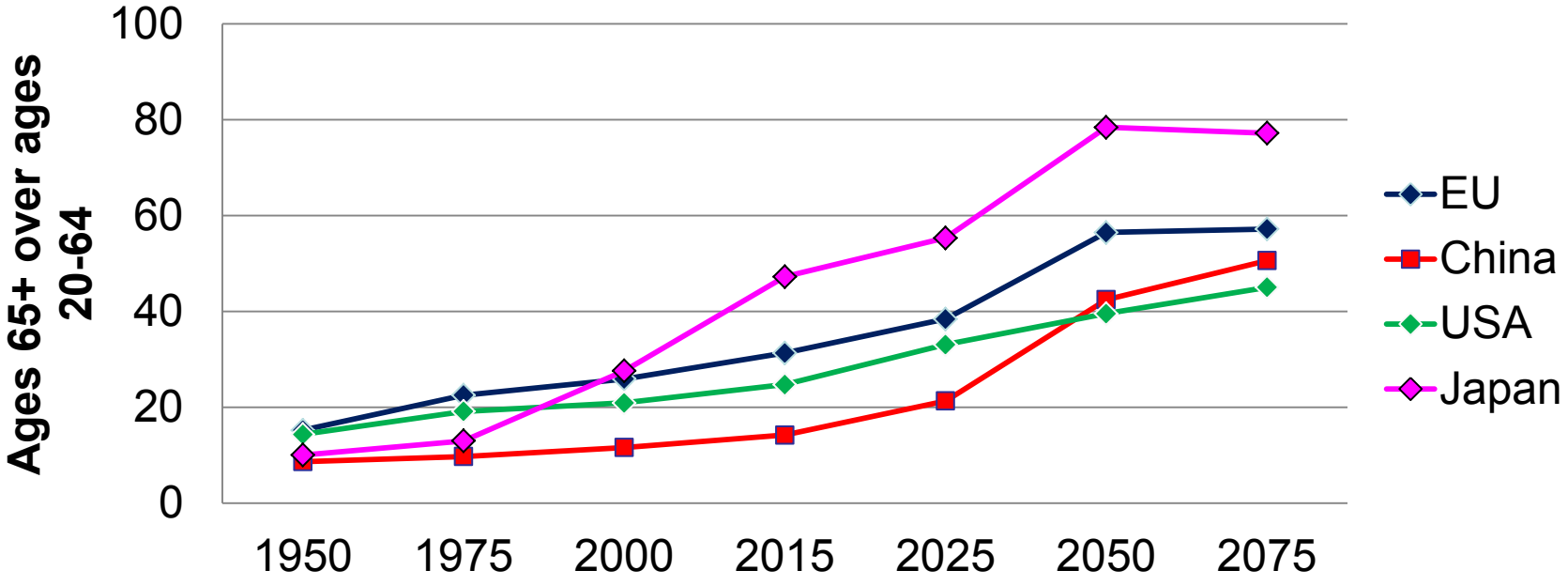
Health services as “luxuries” (major economies, 2014)



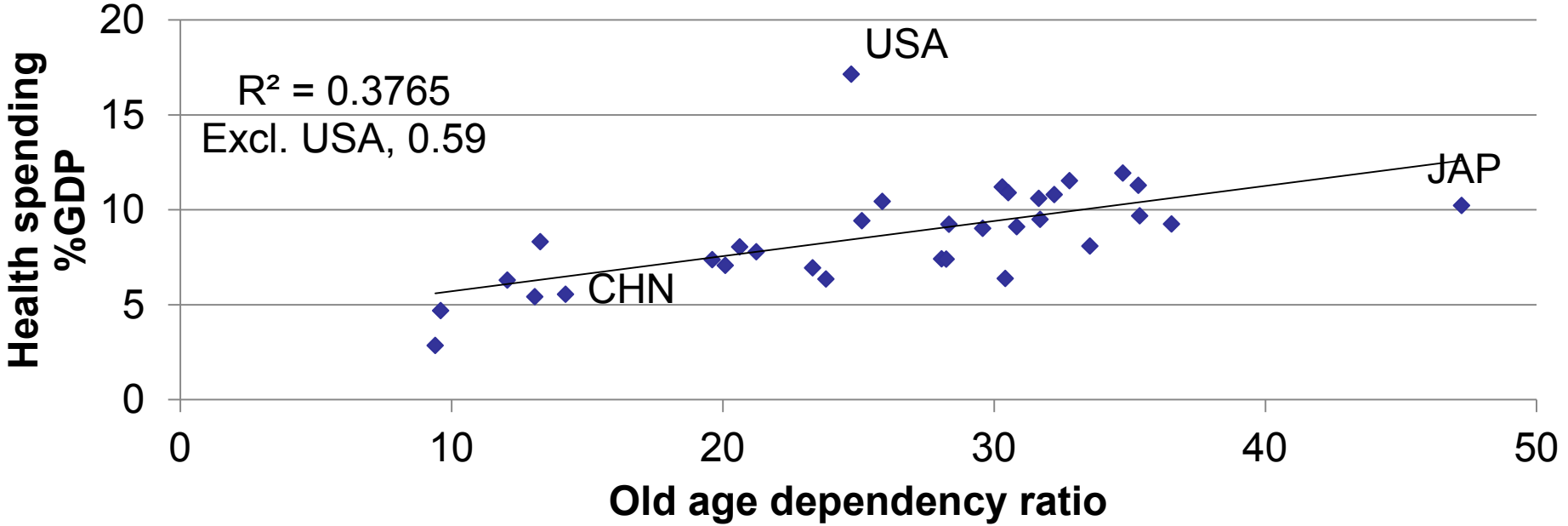
Ageing populations

- In addition, populations are ageing everywhere and older people demand more health services
- It is also important that most ageing people are relatively well off (especially in the west) as they have not experienced major recessions or wars in their lifetime, unlike their parents' generations

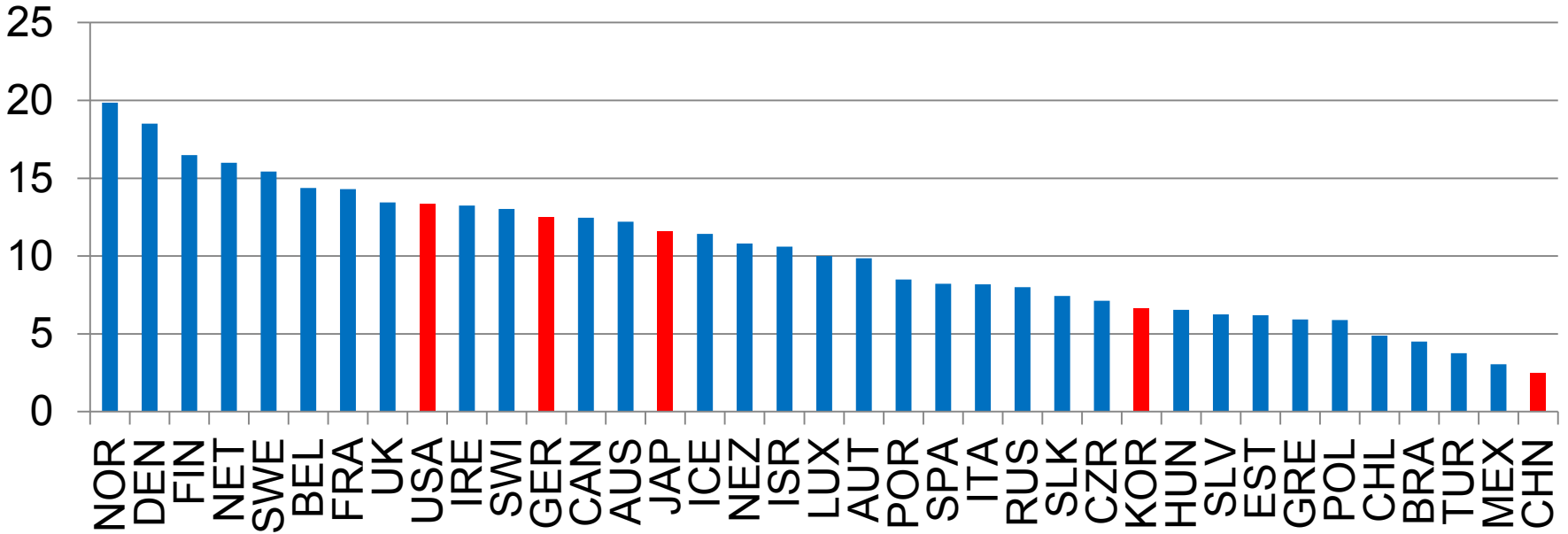
Ageing populations: old-age dependency ratio in major economies



Old age dependency ratio and health spending, major economies, 2015



Employment share of health and care sector, %, 2014 or latest year



5. How can policy help?

Education

- Societal needs change and education needs to reflect this change
- At the top end of the distribution, the need is for technical skills: app developers, improvements in digital technologies, faster computers and further applications of AI
- Policy can help create and support leading research universities – Stanford and MIT in the US and Cambridge in England have been instrumental in the development of robotics

Other skills

- Entrepreneurial activity is rewarded in the age of computers and the internet
- Best hi-tech ideas come from start-ups
- Management and trining in understading the global economy are good skills

Social skills

- But most jobs, especially for unskilled people, will require more social and emotional skills
- This requires training in social work, psychology, social interaction and basic health care
- And as with technical skills, this needs to be continuing into lifelong learning

Job creation support policies

- In order to help in the new job creation governments need to support SMEs by providing the right business environment
- For example, facilitate initial finance, tax incentives and administrative simplicity
- Social policies are needed to provide a cushion of income when workers lose their jobs to new technologies

Inequality

- It is a lot more difficult to deal with the disruption in labour markets and inequality through government because of aversion to taxation and fears that high taxes will push best workers out of the country
- But if societies truly dislike inequality and want to tackle it they have to accept redistributive taxation of some kind
- E.g., of the Scandinavian type, where taxes are raised from higher incomes to provide services to all

Conclusions

- The automation of industry will raise productivity, make society wealthier and bring about a change in the structure of jobs
- The working week will be cut (people take more leisure) but there will also be new job creation, especially in industries that involve human contact
- Health and care is a major beneficiary from this growth, partly because of increasing wealth and partly because of population ageing
- Other sectors, like the leisure industry and household services, will also create jobs

Thank you for listening