GSBC - EIC

Innovation and Future Growth

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L'economia italiana e mondiale nei prossimi decenni

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- „Almost by definition, **it is hopeless to develop a model which will genuinely predict innovations**: an innovation is something new, and if you know what will be in the future, you know it now. [...]

- However, I do not conclude from this that dynamic models which incorporate technical change are useless. **What they give you is not any predictions of specific innovations, but an idea of the statistical properties of technological progress.** We may have some useful idea of the average rate of technological change, of the degree of fluctuations and the kinds of surprise that we may find in the future.

- We cannot, of course, predict a surprise; that is a contradiction in terms. **But we can predict the kind of surprises that might occur**."

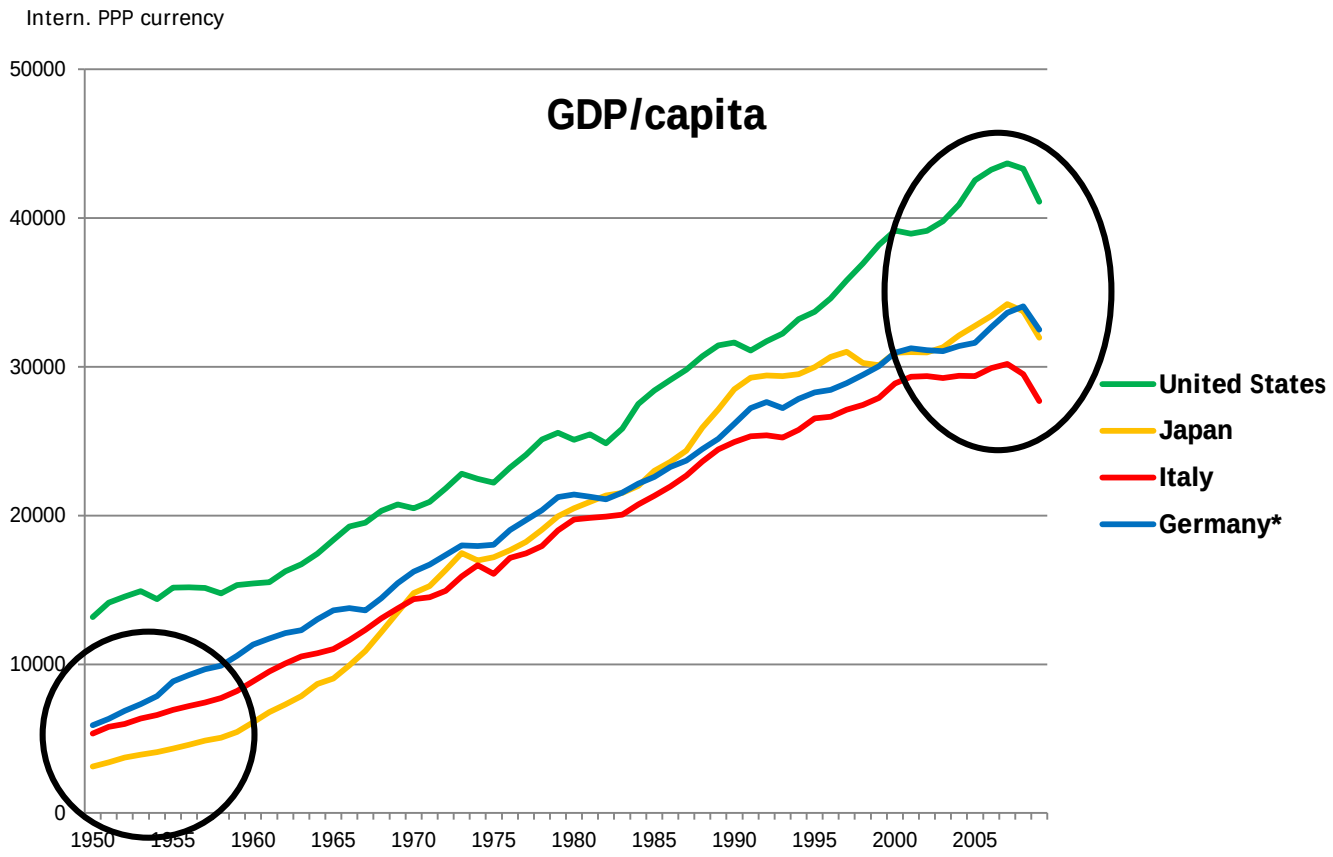
Kenneth Arrow (1991, 473)

1

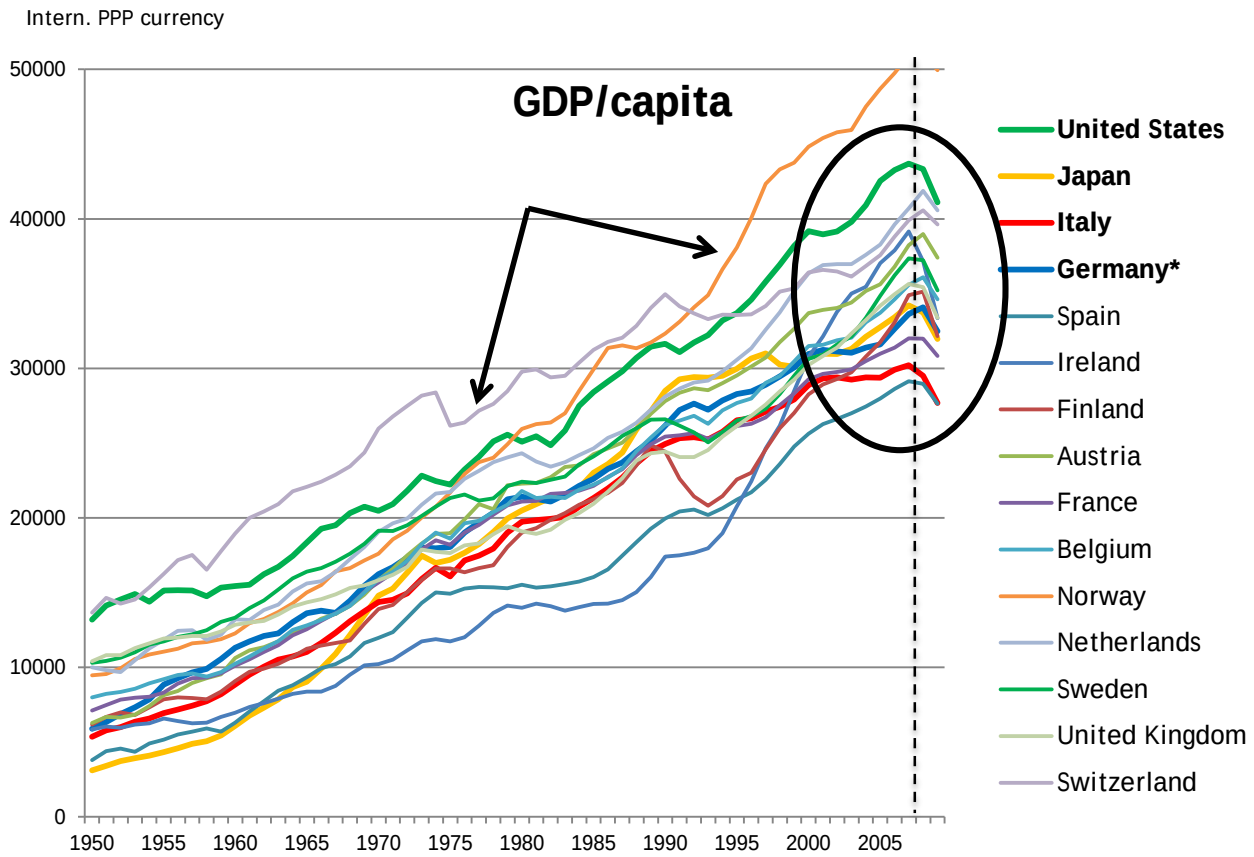
Welfare: Growth and the International Distribution of Income

- **Welfare**: per capita income of country i: $\left(\frac{GDP}{population}\right)_i$
- **Growth**: development of GDP/capita over time: $\left(\frac{GDP}{population}\right)_{it}$
- **Differential growth**: convergence hypothesis
- **Distribution of income**: twin peak structure

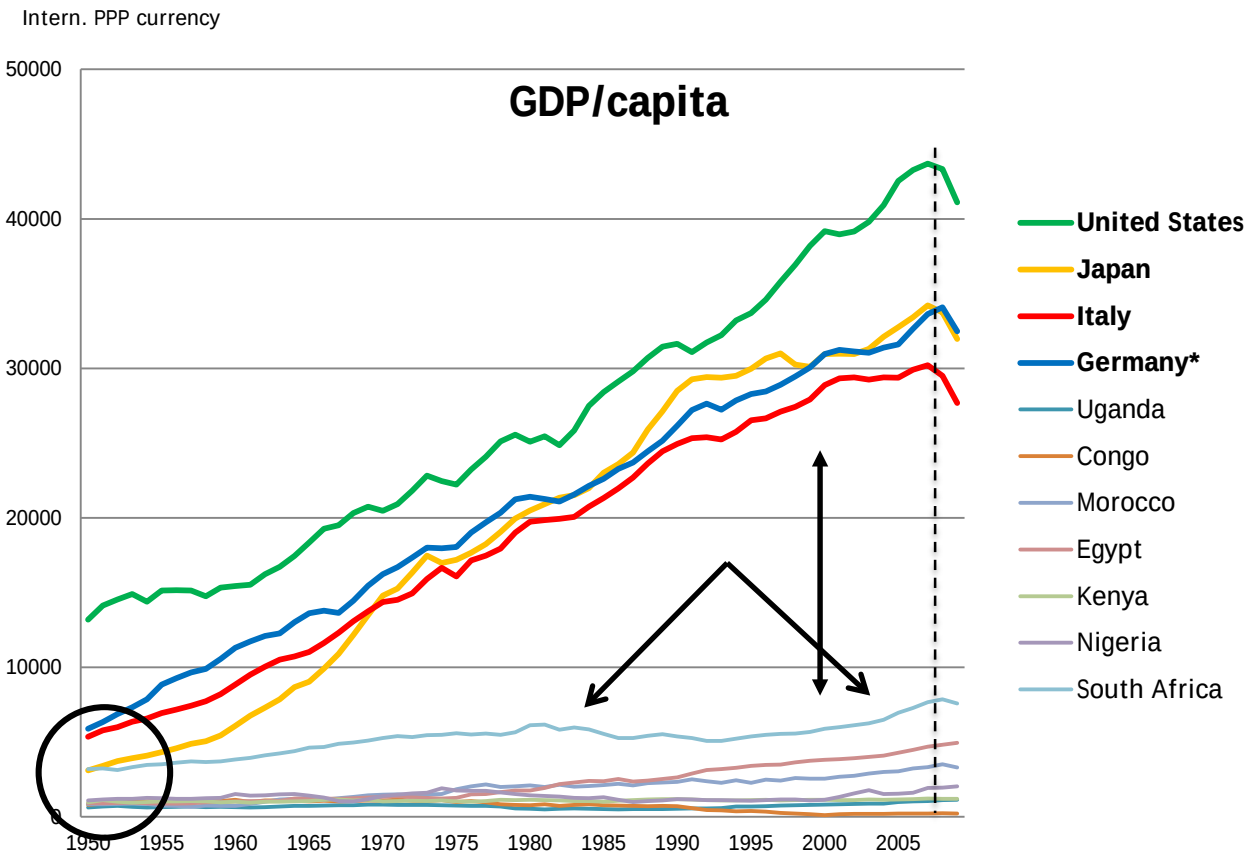
- **4 benchmark countries**
- **Rather parallel and increasing GDP/capita**
- **Income leader US**
- **Japan with a low starting level and some convergence to the US**
- **2007/8 crisis**



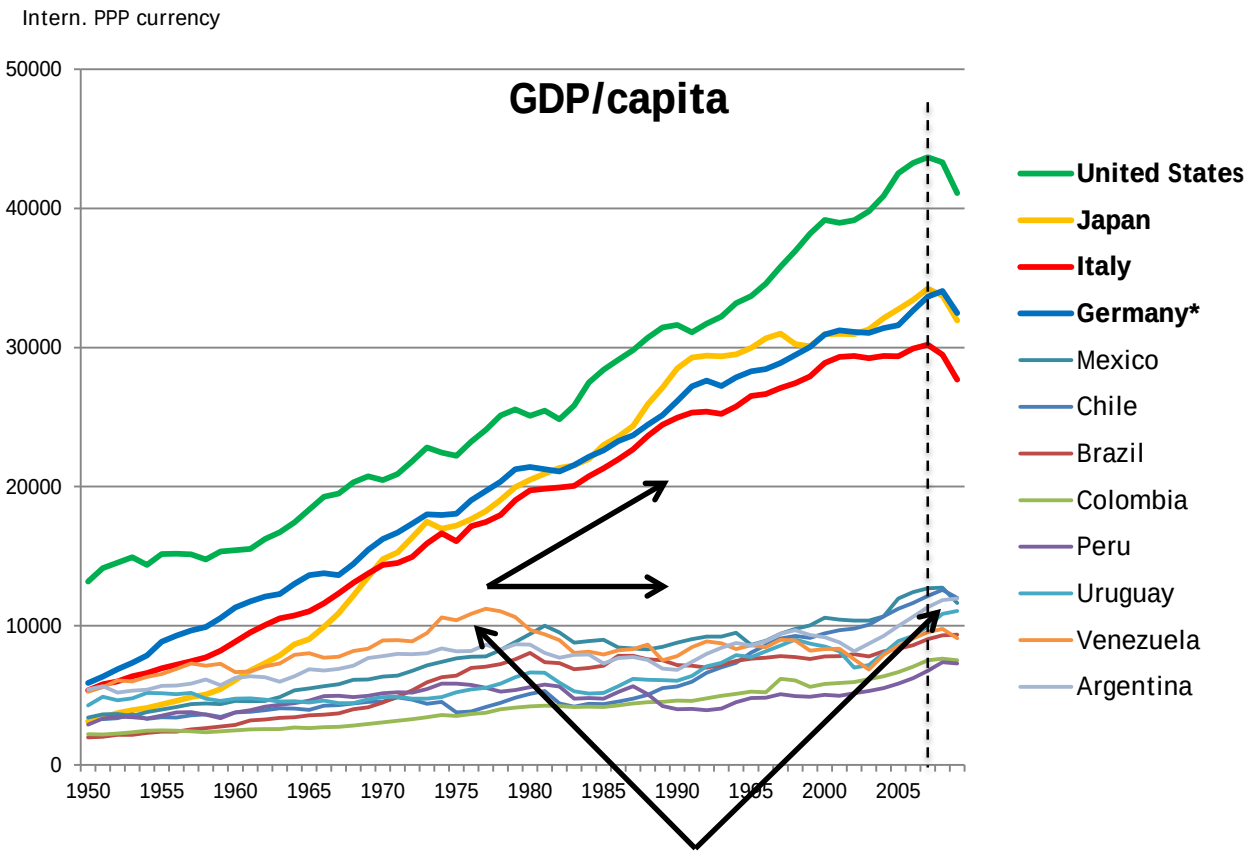
- **Industrialized European economies**
- **Rather parallel and increasing GDP/capita**
- **Income leader CH and N**
- **2007/8 crisis**



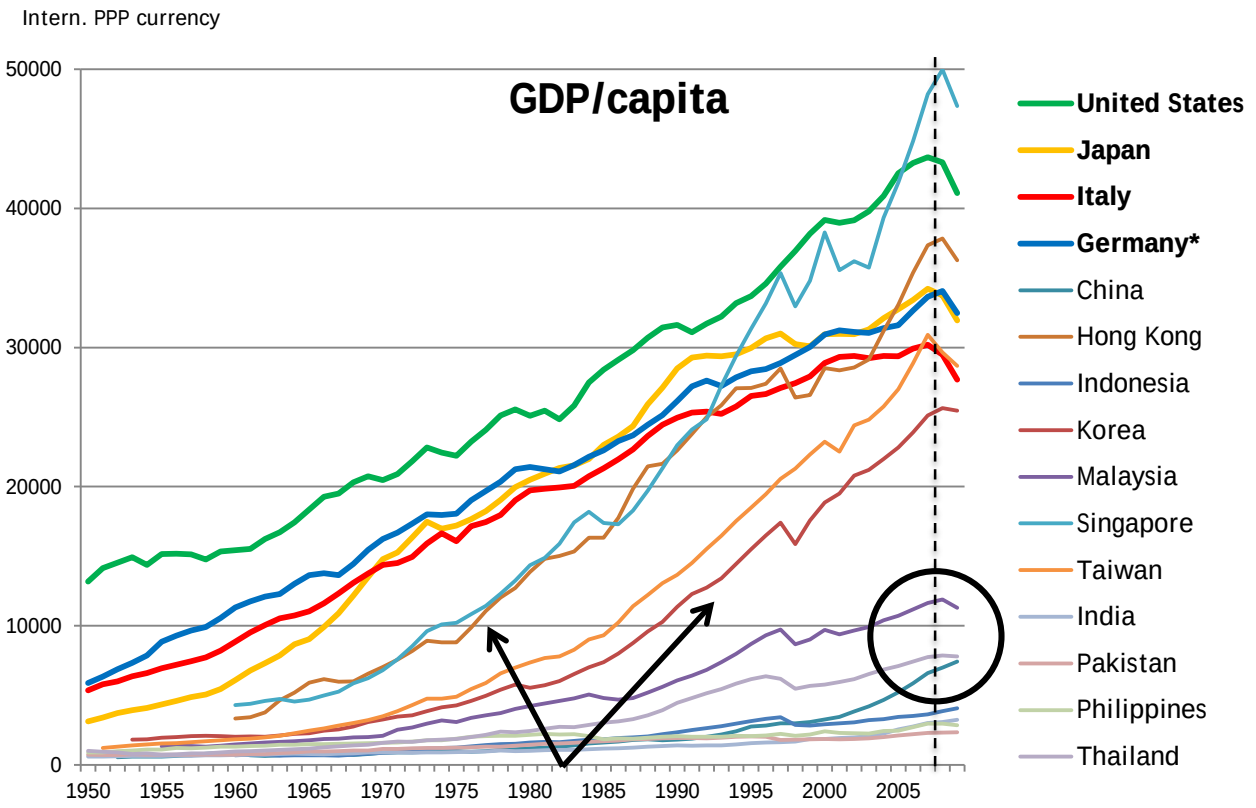
- **African economies**
- **No or modest growth**
- **Increasing income gap**
- **Japan and South Africa start a about the same level in 1950!**



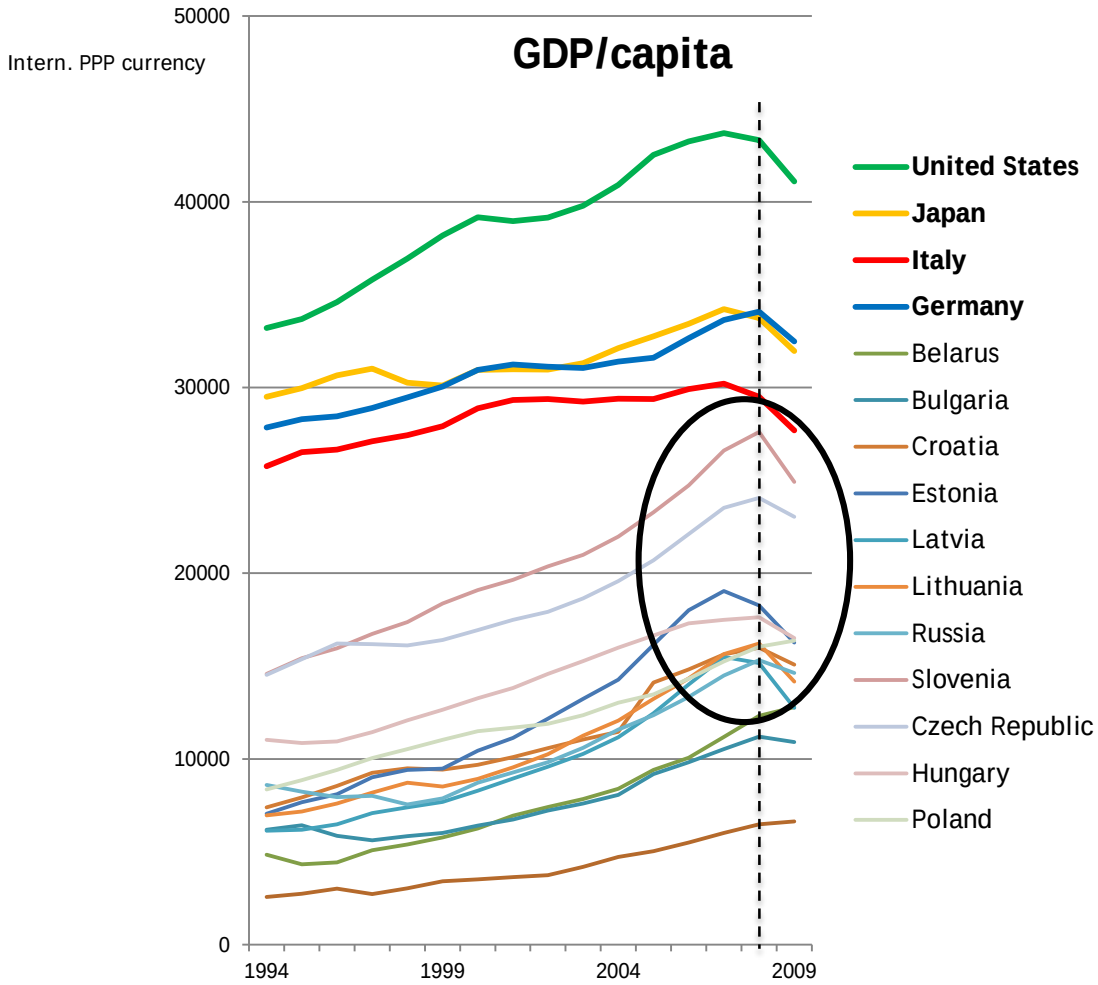
- **Latin American economies**
- **Since the mid 1970ies the income gap increases**
- **Some economies were able to follow in the beginning (e.g. Venezuela) and in the end (e.g. Chile)**



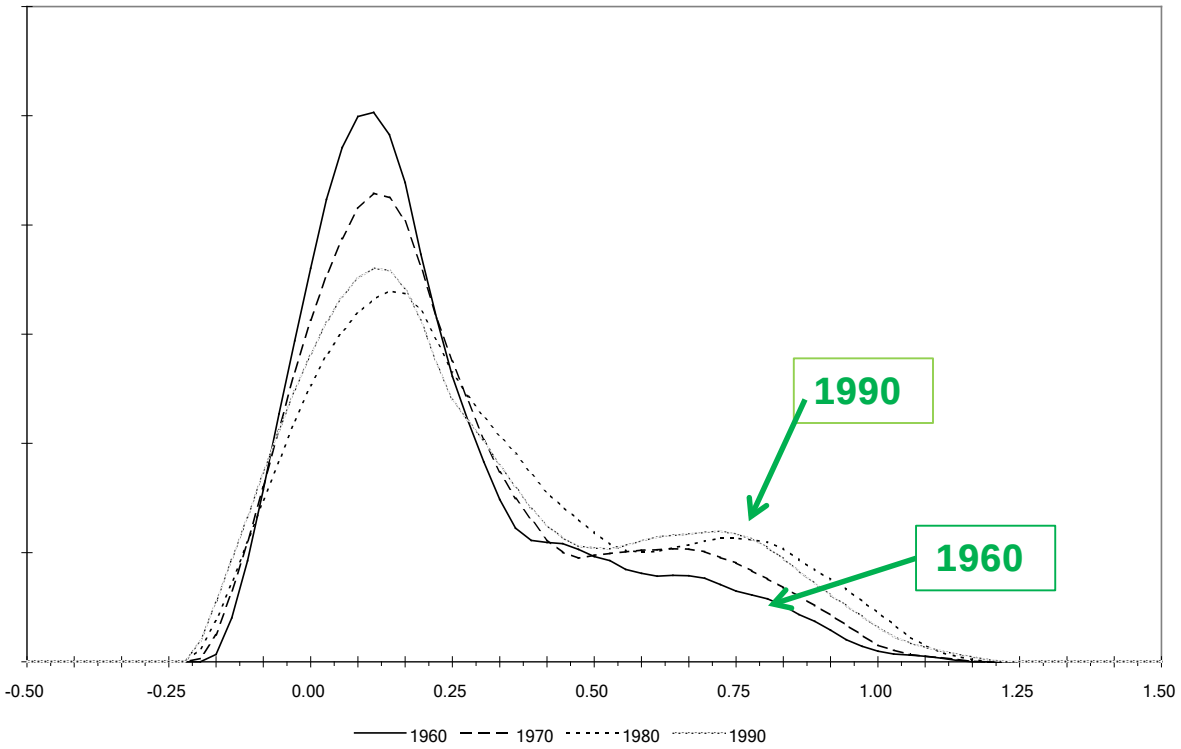
- **Asian economies and Tigers**
- **Remarkable convergence // overtaking by Asian Tigers Singapore, Hong Kong, Taiwan, Korea**
- **Recently a take of by Malaysia, Thailand, and China**



- **European transition economies**
- **Some convergence for most of the countries, lead by Slovenia, Czech Republic, Estonia**



- **Twin-peaks**
- **Emerging structure**
- **Two “clubs” of countries**
- **Left: the lower income countries**
- **Right: the small “club” of income rich countries**



rel. **low** GDP/capita

rel. **high** GDP/capita

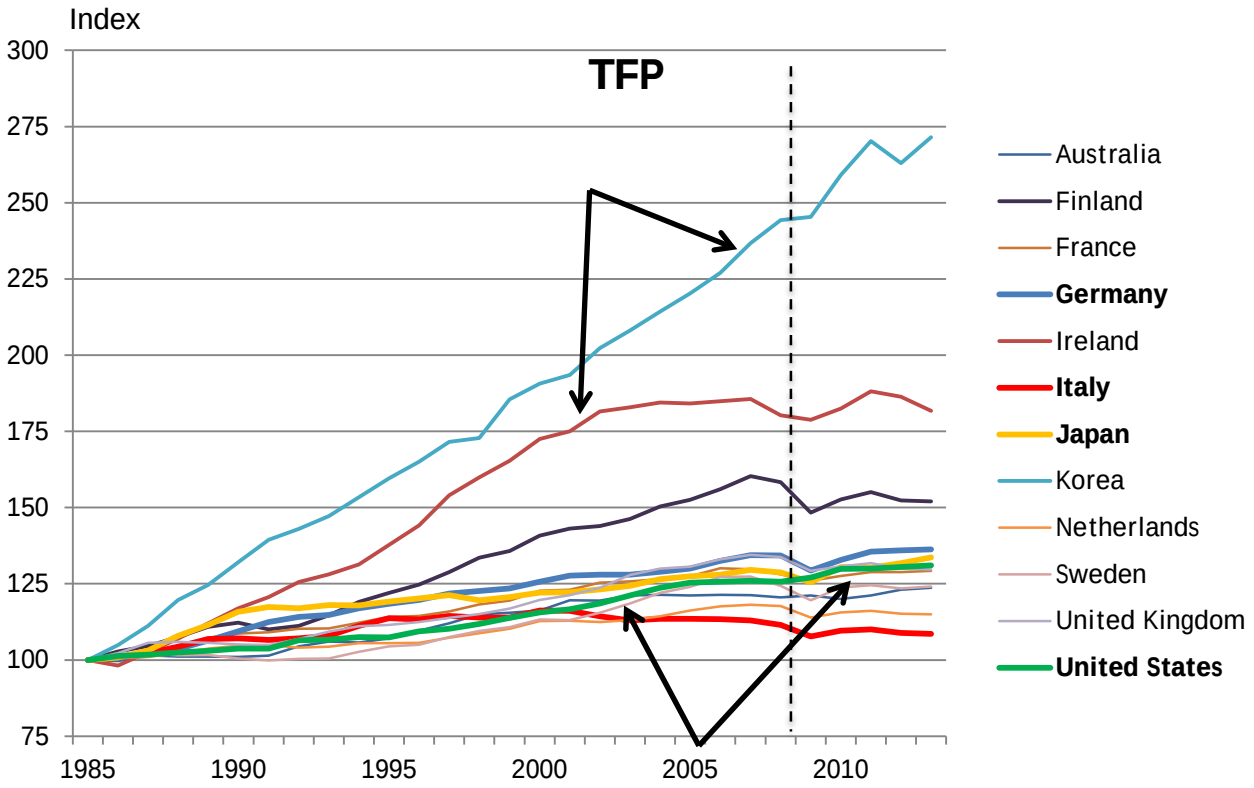
2

Technological change: innovation and the technological gap

- Important factor next to capital: **technological level of production**
- Measured by **total factor productivity** $\boldsymbol{A}$: $GDP = \boldsymbol{A} \cdot inputs$
- **Level** $\boldsymbol{A}$: "ability" to produce output by inputs
- **Change** of $\boldsymbol{A}$ over time: measure of technological change

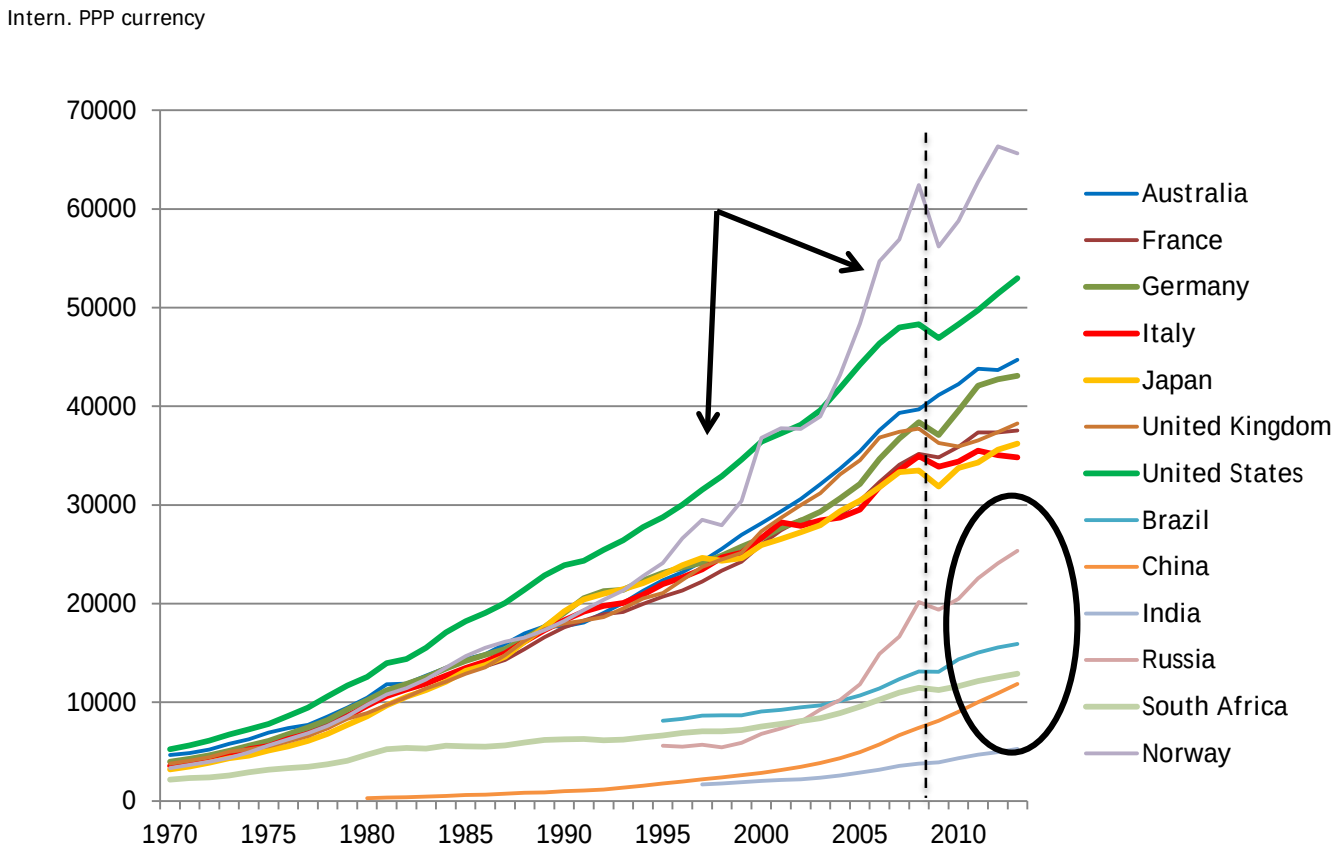
- Alternative measure: labor productivity $\boldsymbol{LP}$: $\left(\frac{\boldsymbol{GDP}}{\boldsymbol{labor\ force}}\right)_i$
- **Change** of $\boldsymbol{LP}$ over time: measure of technological change

- *A* **TFP-Index: 1985=100**
- **TFP development is mainly positive**
- **Technology leaders US, JP and D show modest improvements**
- **KOR, IRE, FIN highest improvements: Knowledge based capital (R&D,…)**
- **A lot of economies below US, JP and D**



(OECD)

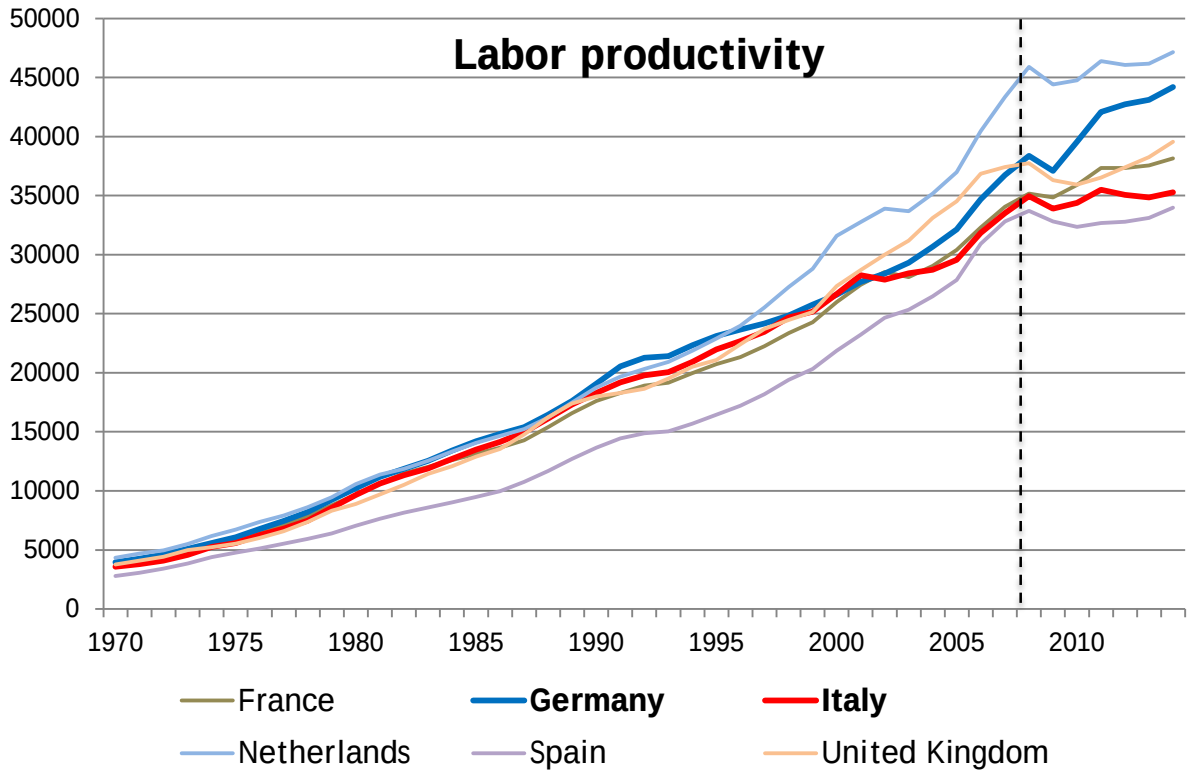
- *LP*
  Over time increasing levels
- **4 benchmarks among the technology leaders**
- **Technology frontier: US, NOR**
- **Catching-up economies BRICS: Knowledge based capital (R&D,…)**
- **Slight drop in the aftermath of the 208 crisis**



(OECD)

- **European view**
- **after 2008: Slowing down of labor productivity development**
- **Financial crisis?**

Intern. PPP currency

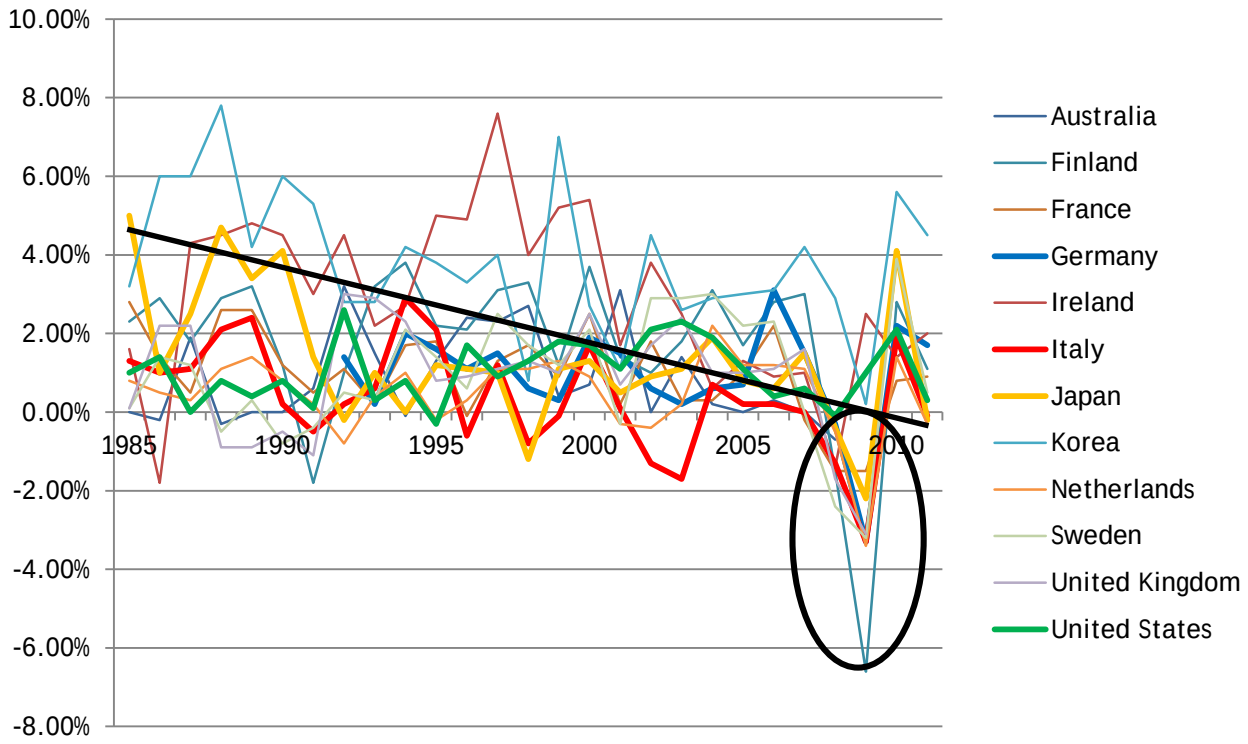


(OECD)

3

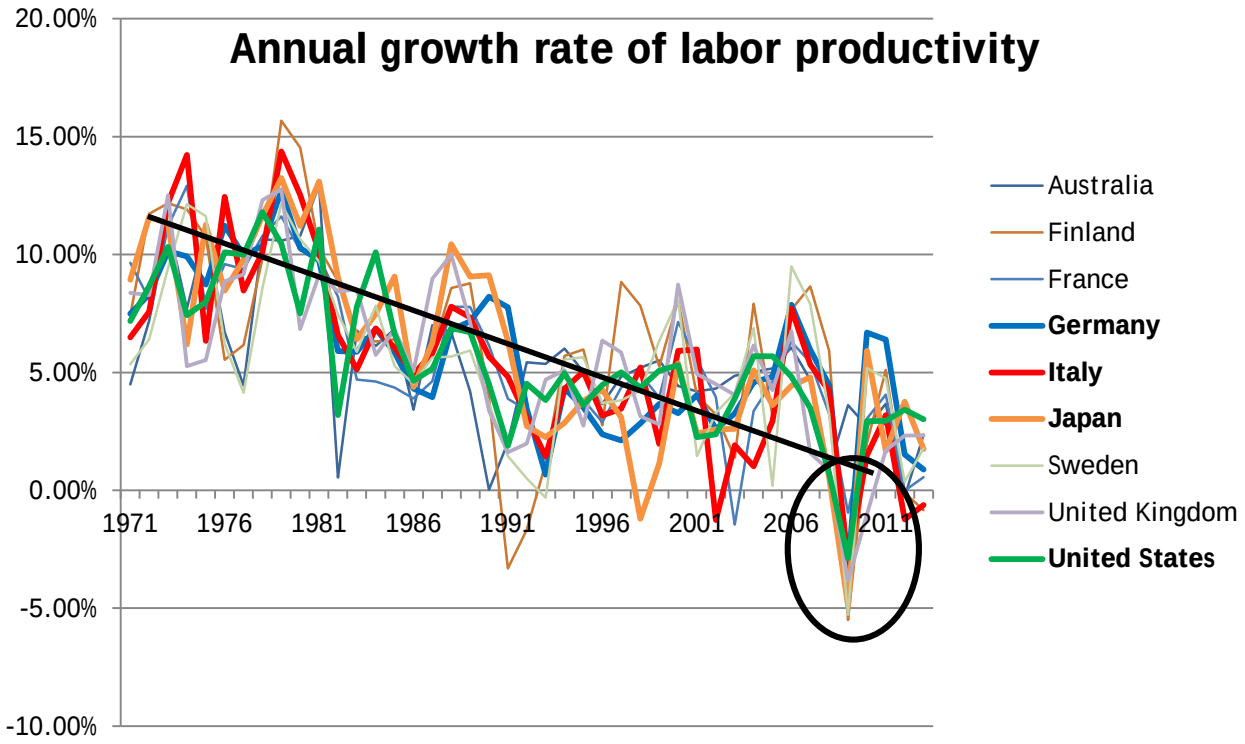
Where we come from: Long-run tendencies

- **Growth rate of TFP as indicator of technological change**
- **A slightly negative development** (less for US and D)
- **Drop in the aftermath of the 2008 financial crisis**
- **Slowdown of technological change?**



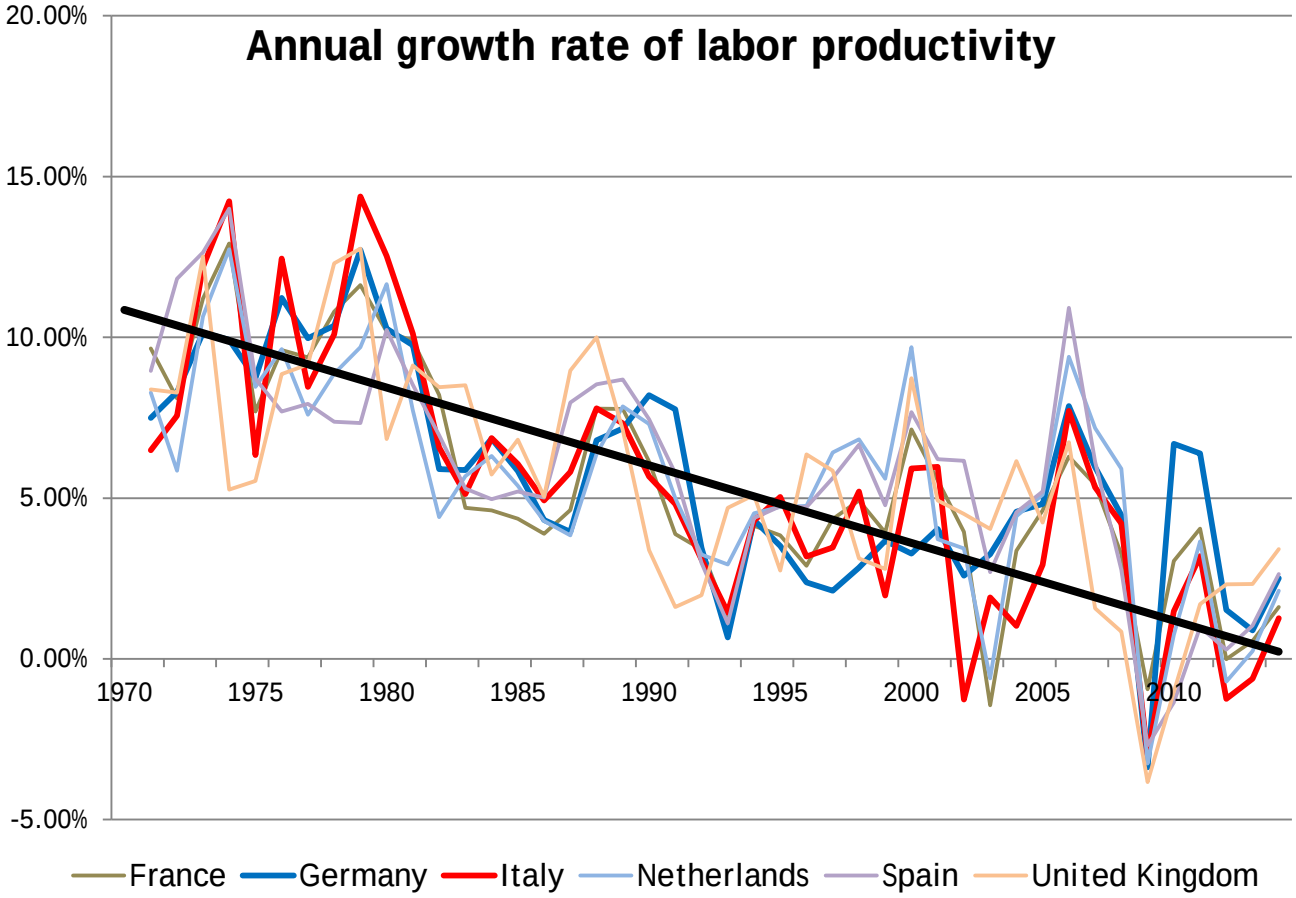
(OECD)

- **Growth rate of LP as indicator of technological change**
- **A negative development**
- **Drastic drop in the aftermath of the 2008 financial crisis**
- **Slowdown of technological change?**



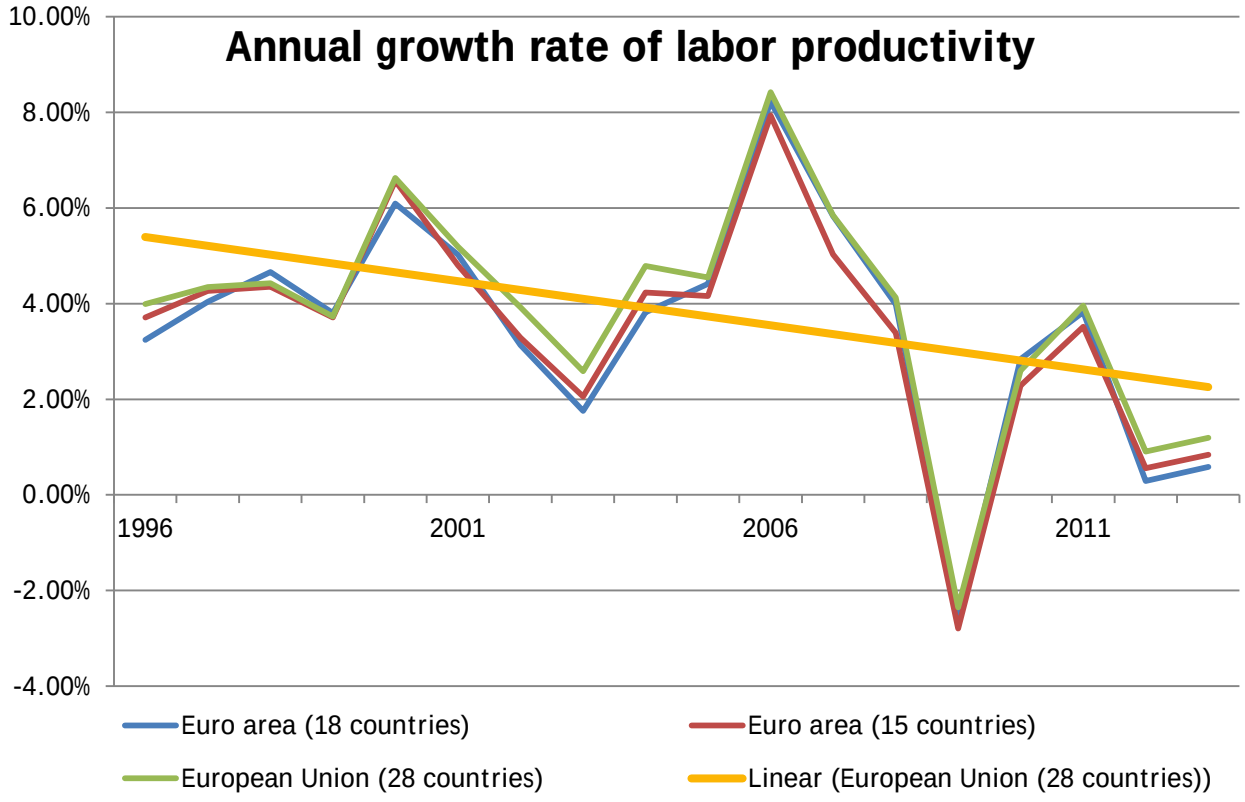
(OECD)

- **European view**
- **Declining growth rates of labor productivity**
- **Technological potentials exploited?**



(OECD)

- **Different EU areas**
- **Declining growth rates of labor productivity**



(OECD)

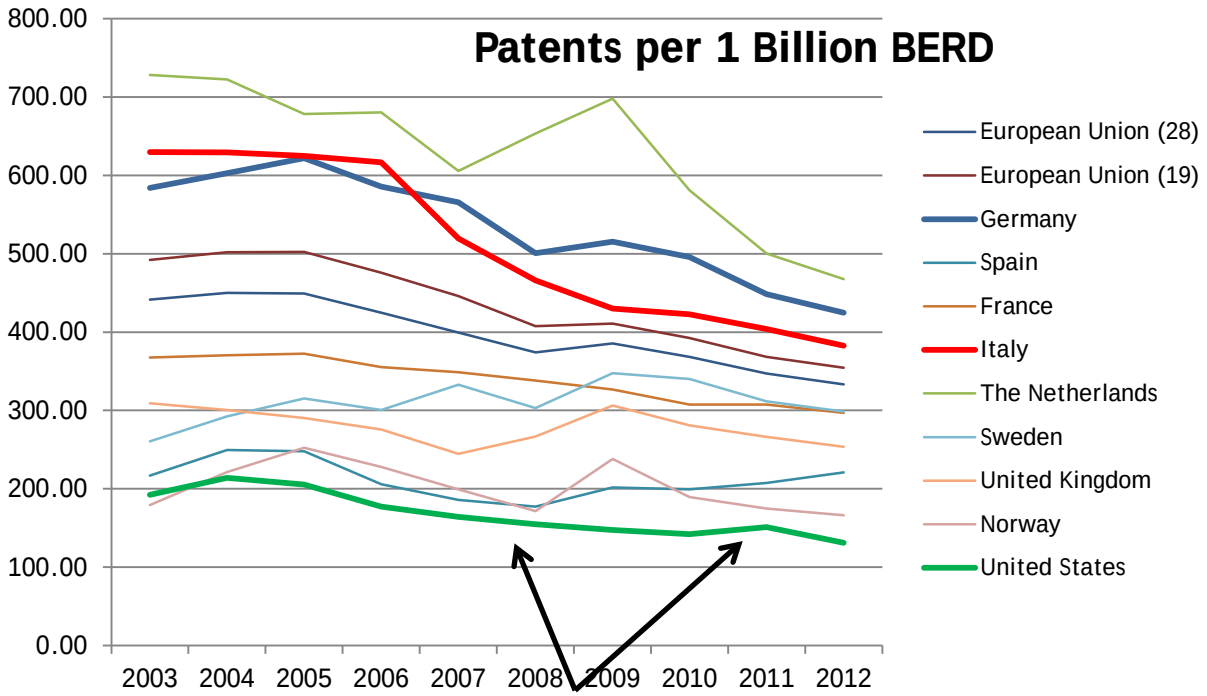
- **Productivity slowdown**

1. **Pessimistic View:** **Permanent development leading to stagnation in growth** and enhanced by factors like demography, inequality, environment, debt, … . (e.g. Robert Gordon)

2. **Optimistic View:** Despite the productivity slowdown, the **underling rate of technological change has not slowed down and ICT will continue** to dramatically transform frontier economies. (e.g. Brynjolfsson/McAffee)

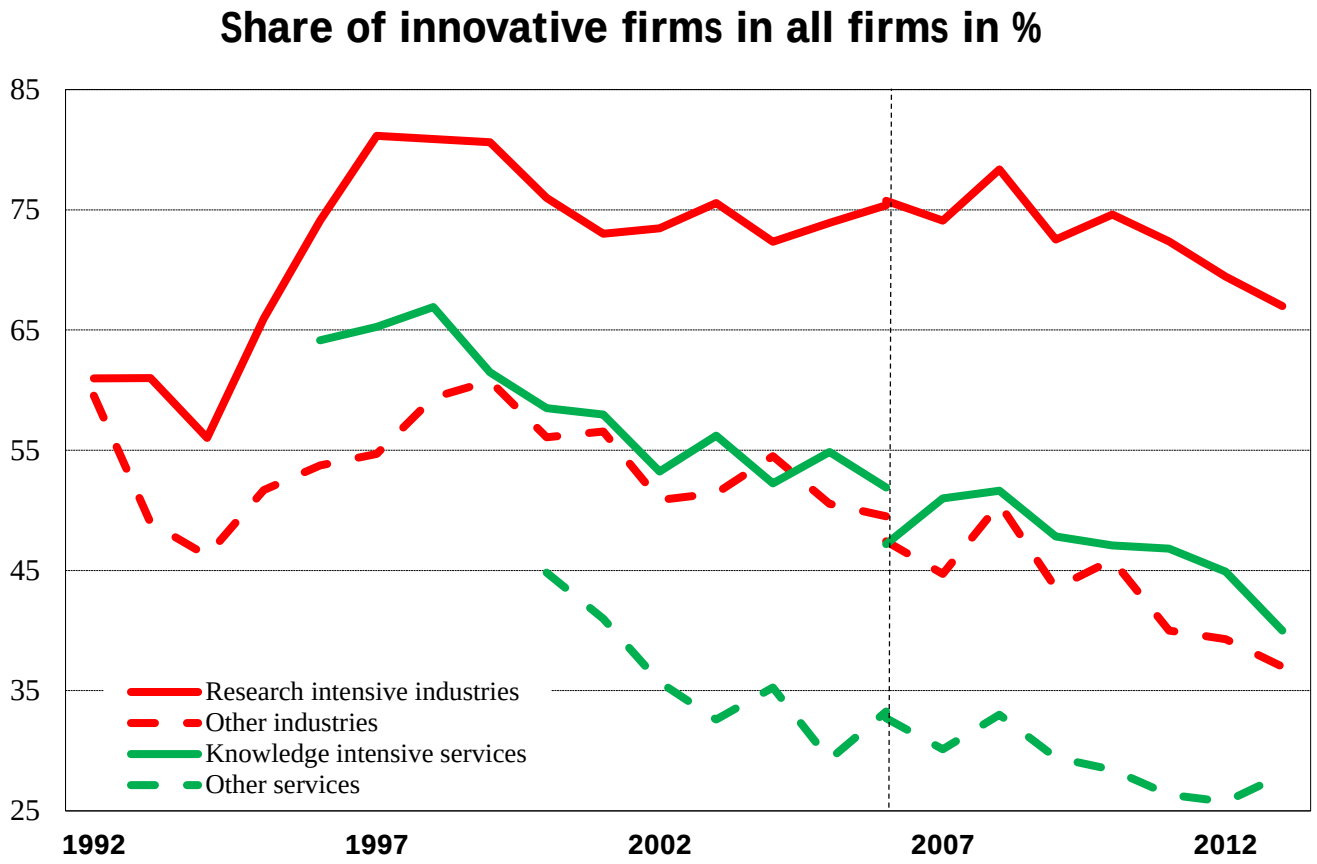
3. **Challenge**: The productivity slowdown is an indication of a secular development with **exploited current technological opportunities** and the **prospect of renewed plentiful opportunities**, for all and not only the former frontier countries.

- **Research efficiency**
- **Clearly declining**
- **Frontier effect US**
- **Measurement issues: Patent quality**



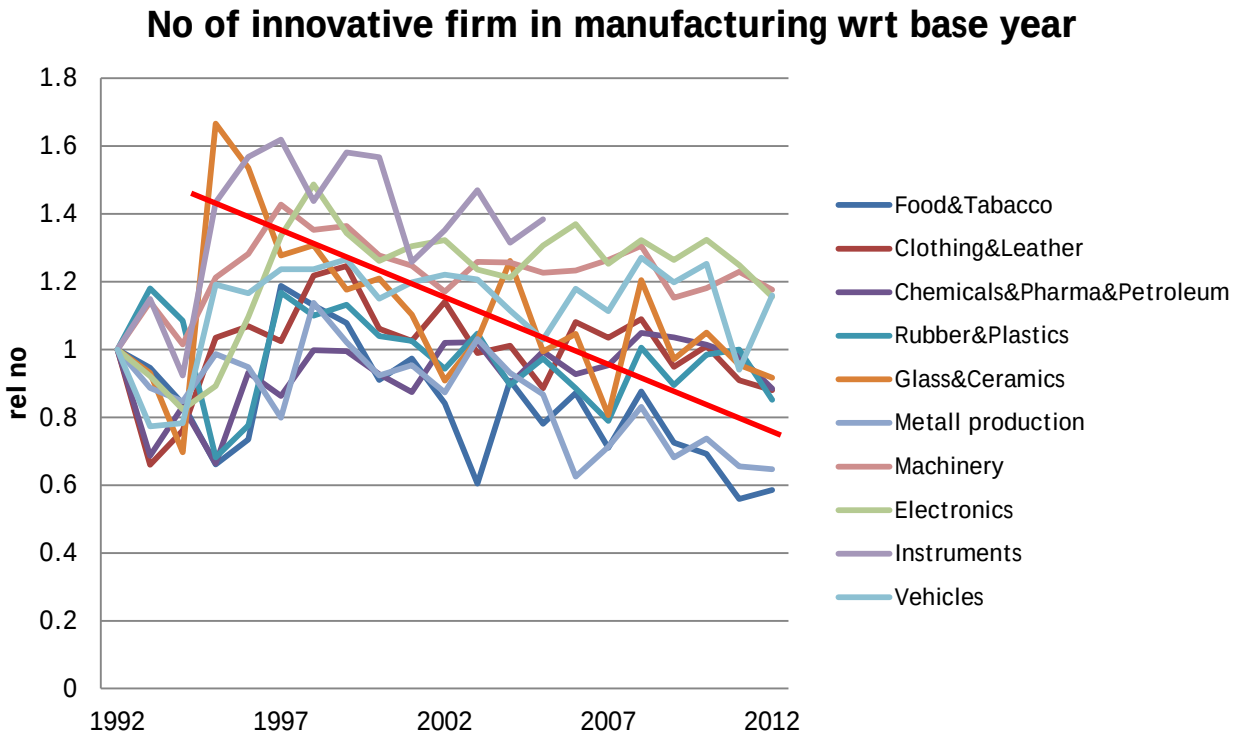
(Eurostat)

- **Germany**
- **Declining innovation activities in Germany**
- **Clear decline already before 2008**
- **and also after 2008 despite**
  - prosperous economic development
  - easy credit conditions



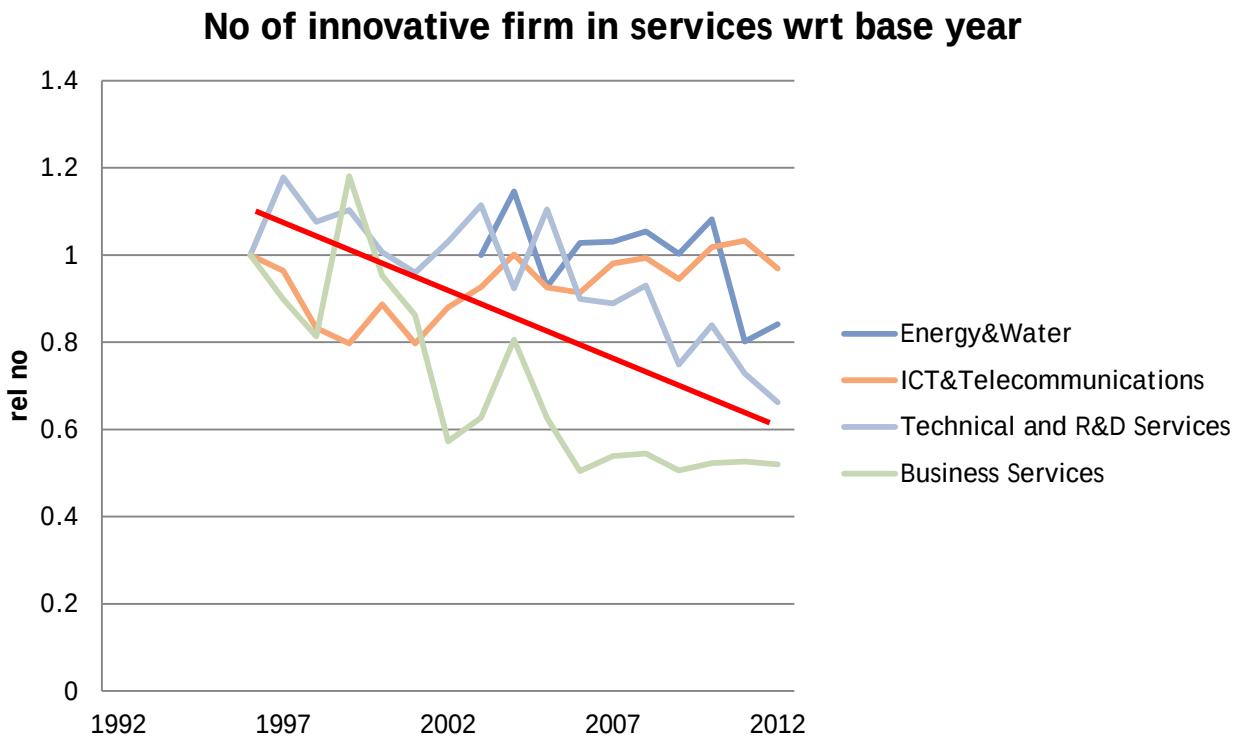
(MIP various years)

- **Germany**
- **Declining innovation activities in Germany's manufacturing industries**
- **No composition effect**



(MIP various years)

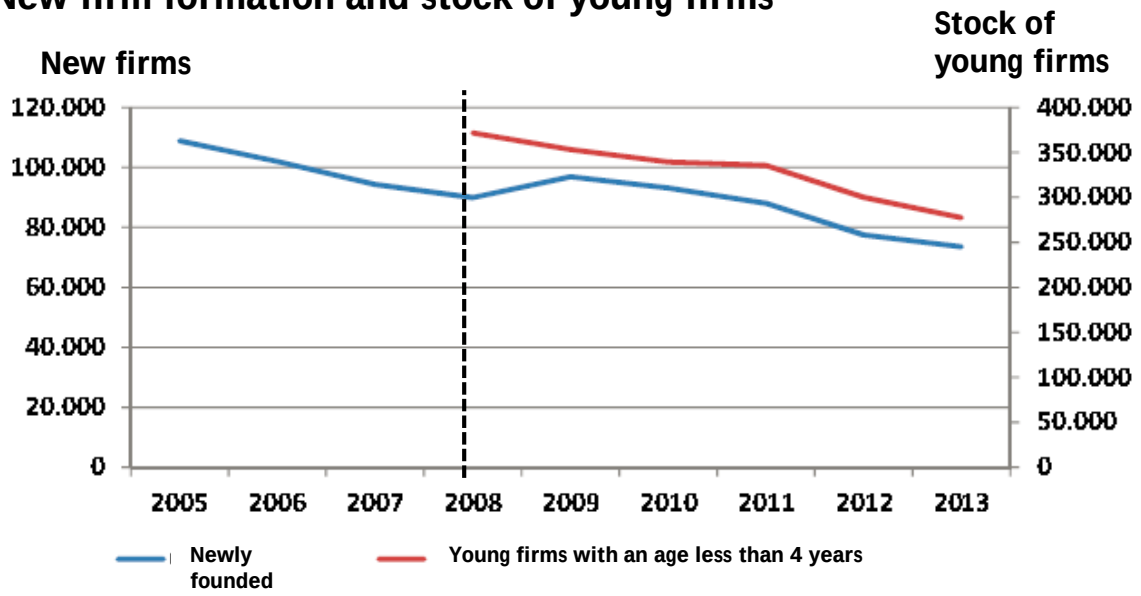
- **Germany**
- **Declining innovation activities in Germany's service industries**
- **No composition effect**



(MIP various years)

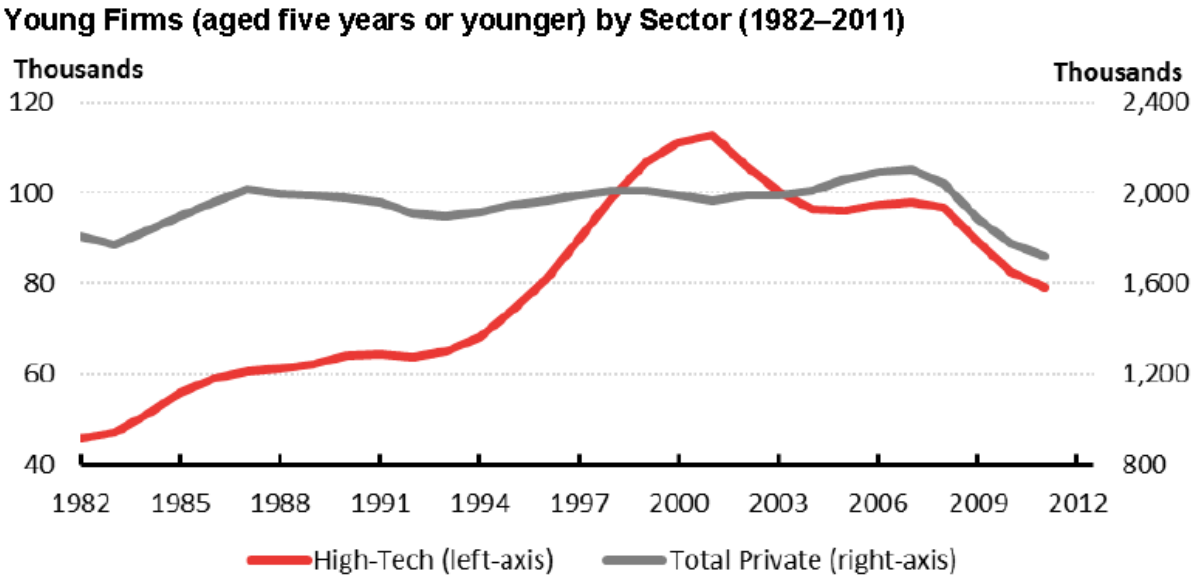
- **Germany**
- **New firm formation**
- **Stock of young firms**
- **Both declining**
- **New firm formation started declining before 2008 crisis**

New firm formation and stock of young firms



(Mannheim Founder Panel)

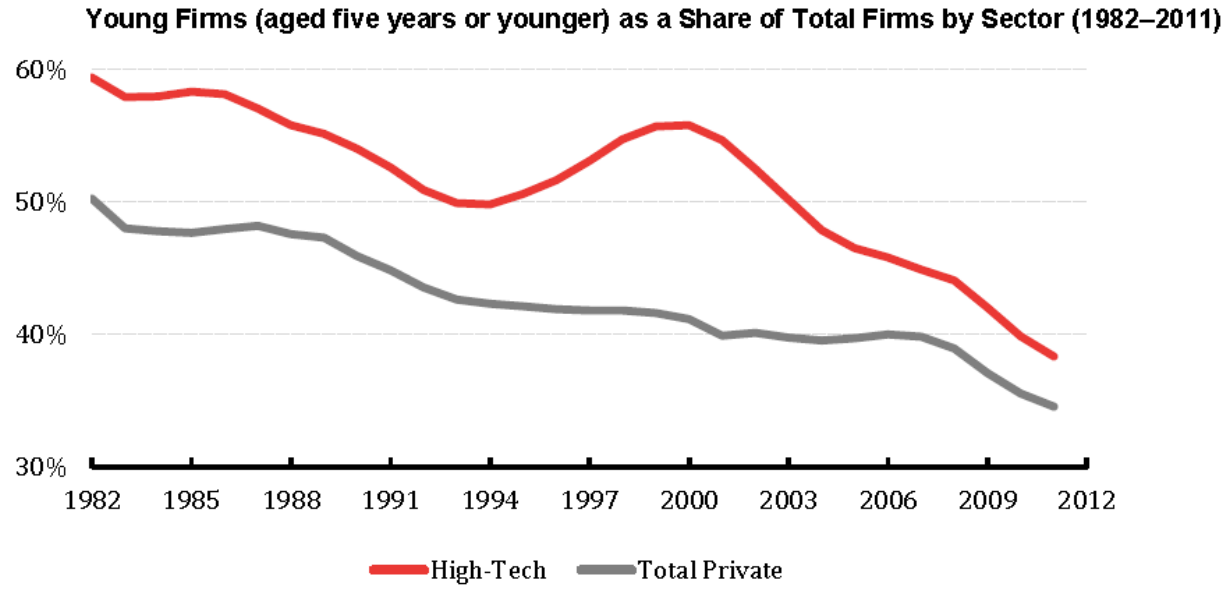
- **United States**
- **Total number high-tech young firms started declining since 2000**
  ➔ No new firm formation
  ➔ "transition" in club of old firms



Source: U.S. Census Bureau, BDS and Special Tabulation; authors' calculations

Haltiwanger/Hathaway/Miranda (2014)

- **United States**
- **Share of young high-tech firms in high-tech sectors declining since 1982**
  Interregnum 1997-2000: dot-com phase
- **Share of young firms declining since 1982**



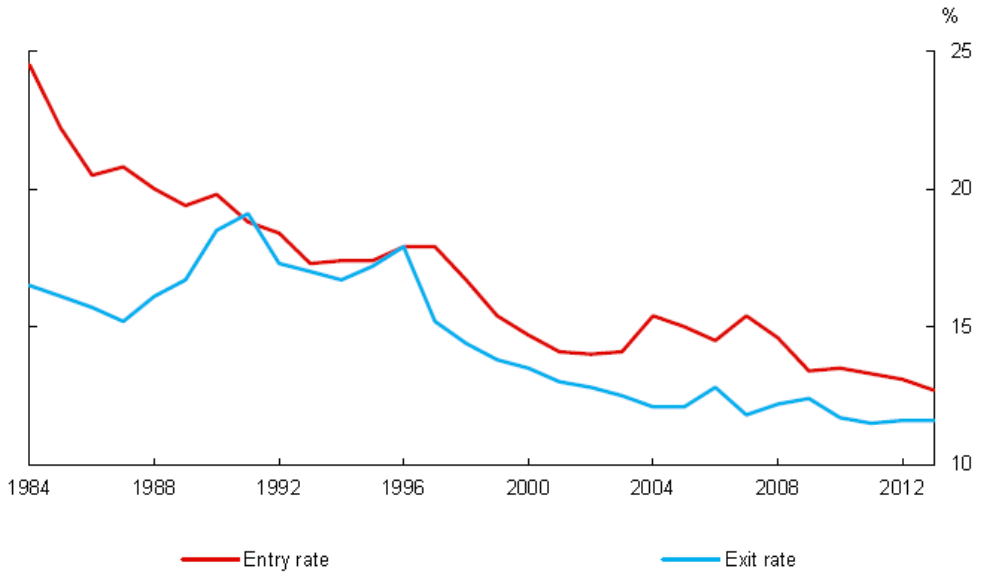
Source: U.S. Census Bureau, BDS and Special Tabulation; authors' calculations

Haltiwanger/Hathaway/Miranda (2014)

- **Canada**
- **Entry rate sharply declining since 1984**
- **Exit rate declining since 1996**

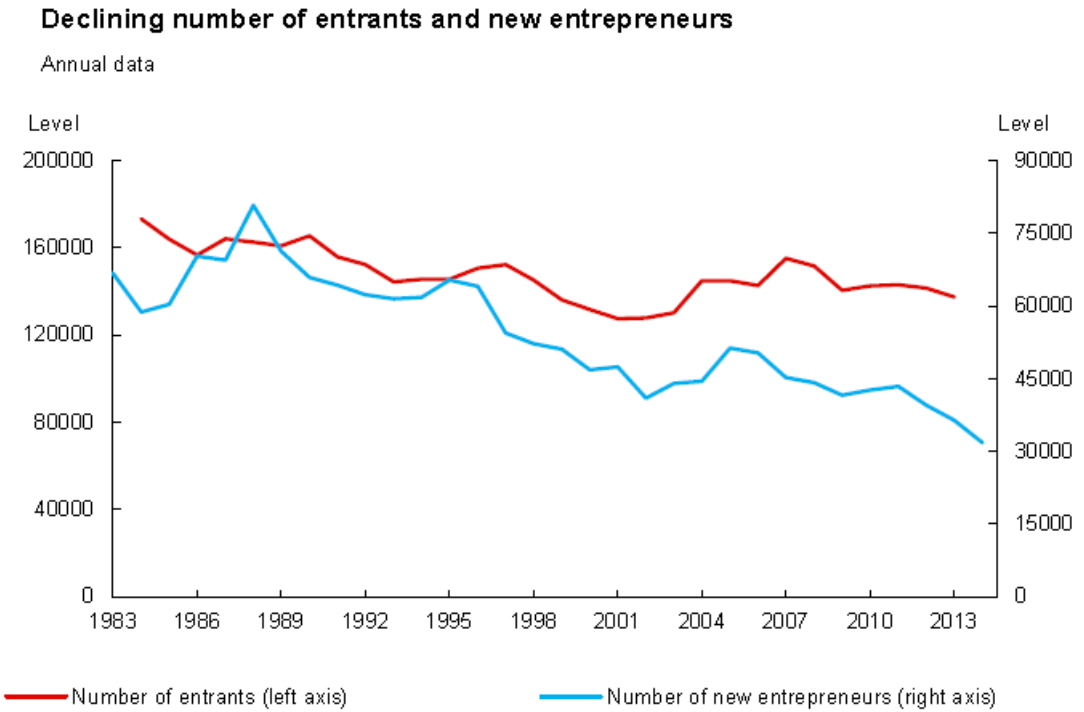
Aggregate entry and exit rates have been declining

Annual data



Cao/Salameh/Seki/St-Amant (2015)

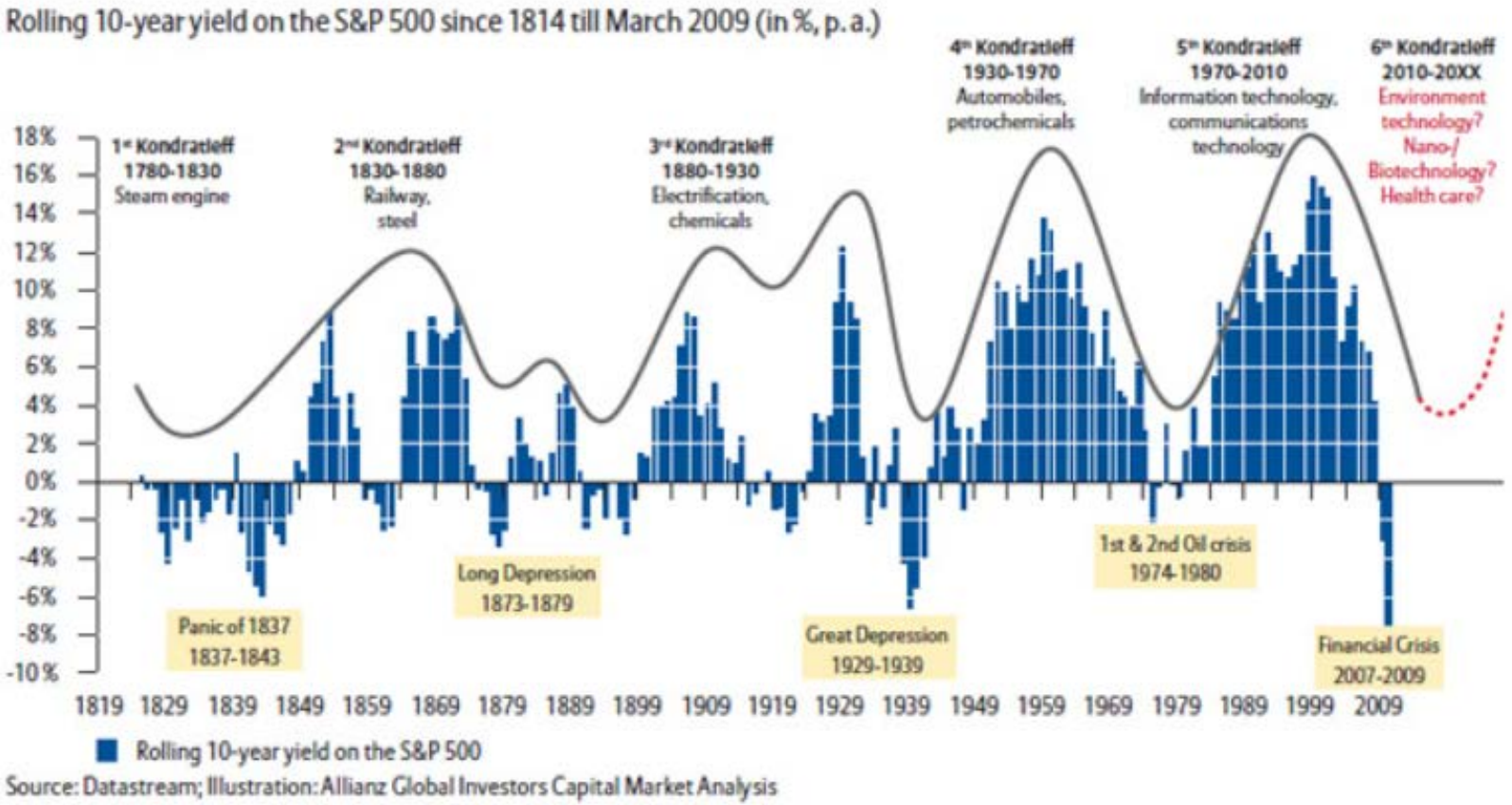
- **Canada**
- **Absolute numbers of entrants versus new firms**
- **New firms declining since 1988**
- **Entrants only slightly decreasing**



Cao/Salameh/Seki/St-Amant (2015)

4

Where we go to: Generic changes, GPTs and Windows-of-Opportunity


Rolling 10-year yield on the S&P 500 since 1814 till March 2009 (in %, p. a.)
1st Kondratieff 1780-1830 Steam engine
2nd Kondratieff 1830-1880 Railway, steel
3rd Kondratieff 1880-1930 Electrification, chemicals
4th Kondratieff 1930-1970 Automobiles, petrochemicals
5th Kondratieff 1970-2010 Information technology, communications technology
6th Kondratieff 2010-20XX Environment technology? Nano-/ Biotechnology? Health care?
Panic of 1837 1837-1843
Long Depression 1873-1879
Great Depression 1929-1939
1st & 2nd Oil crisis 1974-1980
Financial Crisis 2007-2009
18% 16% 14% 12% 10% 8% 6% 4% 2% 0% -2% -4% -6% -8% -10%
1819 1829 1839 1849 1859 1869 1879 1889 1899 1909 1919 1929 1939 1949 1959 1969 1979 1989 1999 2009
Rolling 10-year yield on the S&P 500
Source: Datastream; Illustration: Allianz Global Investors Capital Market Analysis

- Long wave research
  - Long wave researchers have provided arguments how basic innovations could correlate with economic development
- J.A. Schumpeter
  - Clustering of innovations, swarms of imitators (Business Cycles, 1939)
  - C. Freeman and F. Louca (As time goes by, 2001)
- G. Mensch and A. Kleinknecht
  - Depression trigger hypothesis
    - Clusters of radical innovations at the end of a long wave down swing
- Clark, C. Freeman and L. Soete
  - Radical innovations during the recovery period

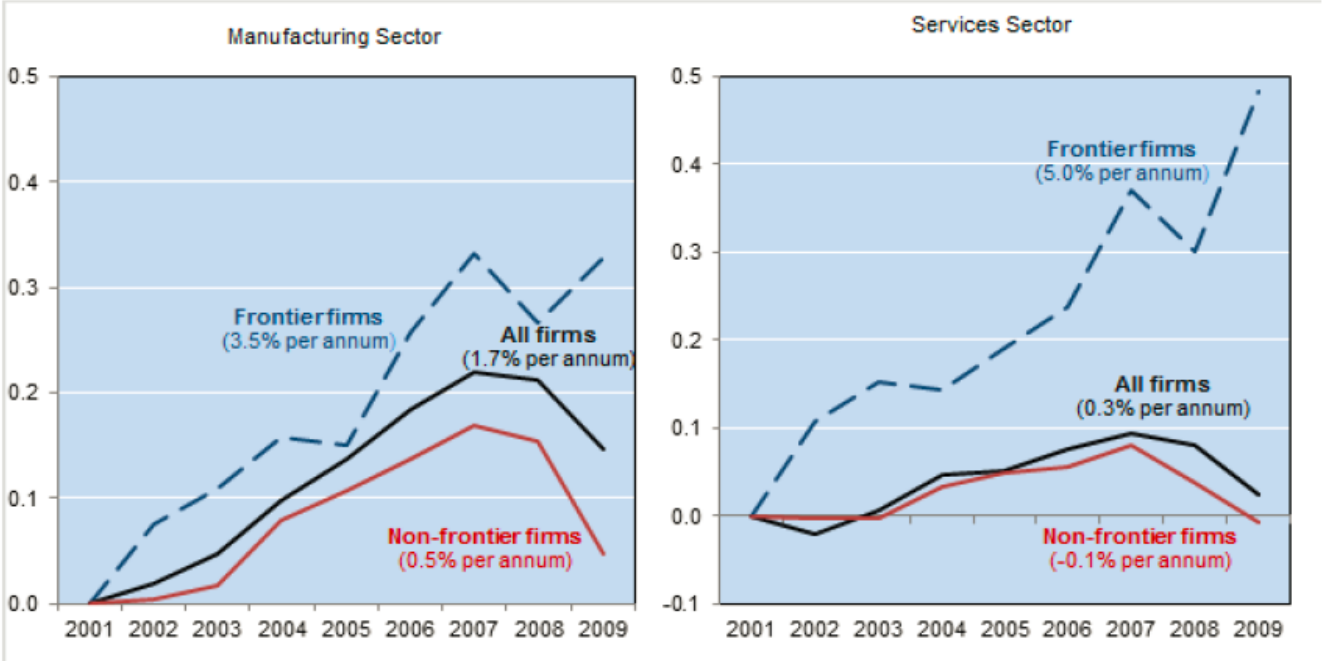
- **Promises**

- **General Purpose Technologies**
  - General applicability
  - Technological dynamism
    dual inducement
  - Innovation spawning
    "innov. complementarities"

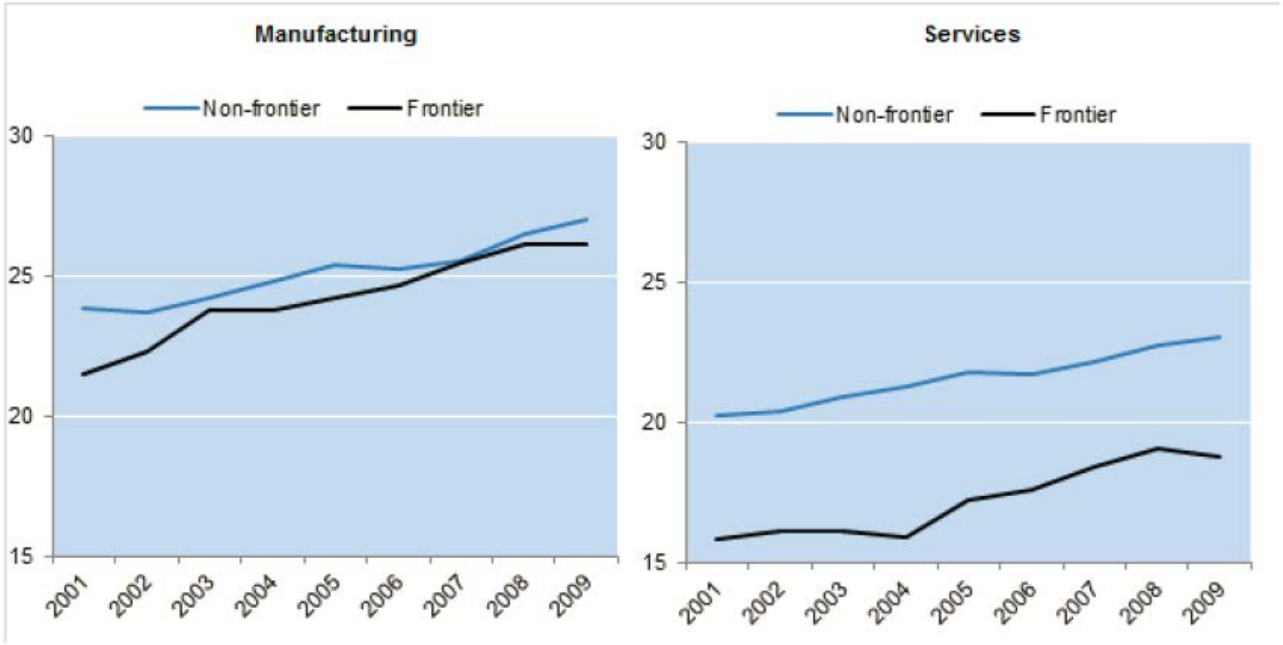
- **examples**
  - Steam engine
  - Dynamo
  - Plastics
  - Computer chip
  - …
  - *Robot*
  - *"Intelligent" materials*
  - …

- Digital economy and society:
  - ***Industrie 4.0 // Internet of Things***
- Sustainable economy and energy
- Innovative workplace
- Healthy living
- Intelligent mobility
- Civil security

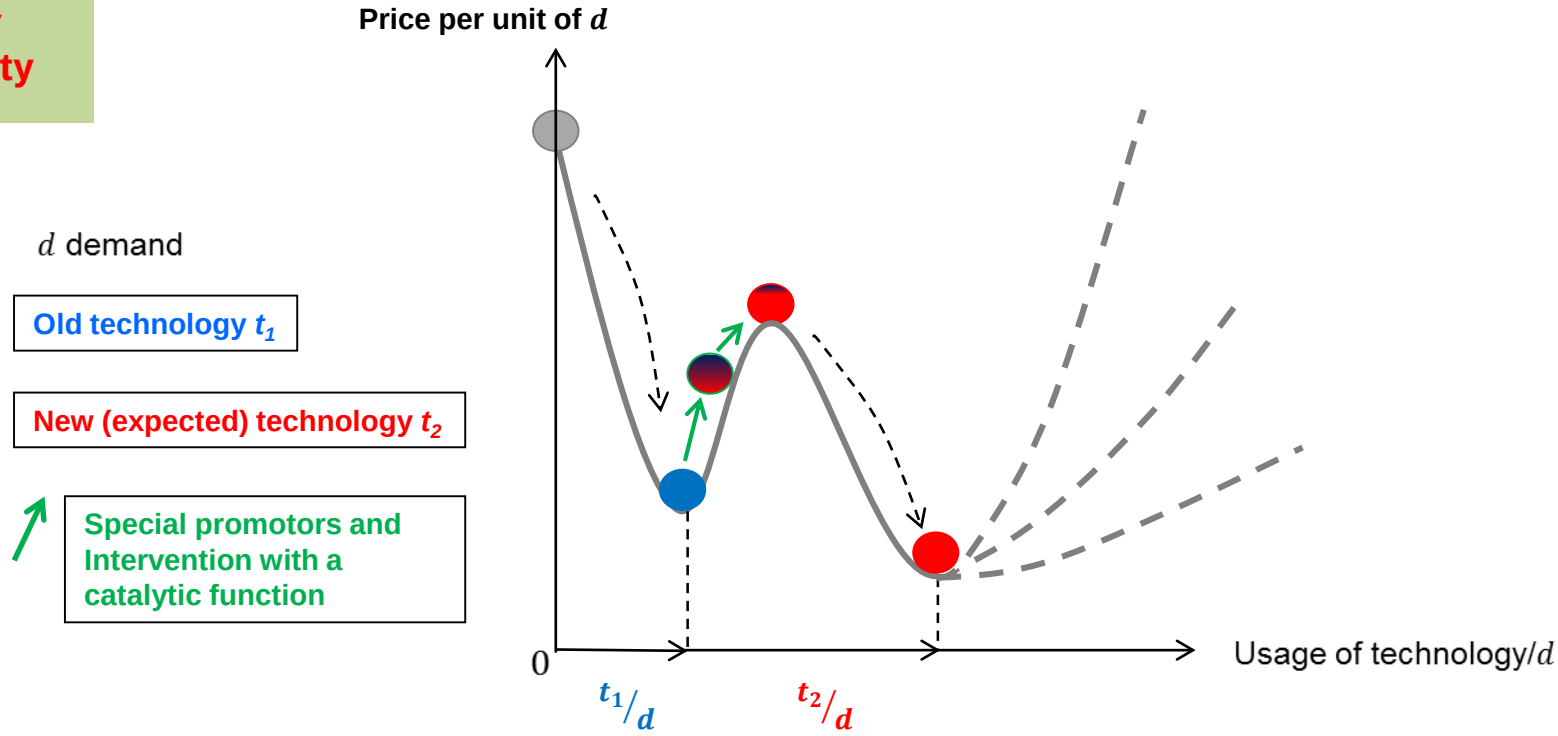
- **Opportunity**
- **Windows of opportunities for lagging economies: KBC of the "old technologies" is depreciated**
- **Frontier firms belong to a broad range of economies**
- **Not restricted to the western industrialized economies**



- **BUT:**
  Frontier firms tend to get older on the average
- **Hence tendency towards established industries and technologies**
- **Trigger by small and new firms**



- **Reachability and feasibility**



- **Reachability and feasibility**

- **The policy debate**
  - New Mission Orientation
    - "long-run" failure
    - lock-in problems
    - intergenerational problems
  - What kind of intervention is appropriate – if at all?
    - Smart Specialization (Foray et al 2010)
    - Entrepreneurial state (Mazzucato 2013)
    - Catalytic Schumpeterian policy for system transition (Cantner&Vannuccini 2014)
  - Policy Mix
    - Push and Pull instruments (Cantner et al 2015)
    - Schumpeterian push and Keynesian pull

- Is radical and systemic change a thread for employment?

- **Concerns**
- **Future of labor**

Short-run creative destruction	⟷	Long-run demand and growth effects
Technology substitution	⟷	Technological complementarities
Thread to routinized work	⟷	Opportunities for anal. and creative work

- **What role do you foresee for Europe in the world and for Italy in Europe in 40 years?**

- Whenever **Europe will be able to coordinate** innovative and entrepreneurial activities with research at universities and research institutes and with a **policy mix towards** technology, demand, education and employment, the radical **systemic transition has a high chance to be successfully mastered**.

- Since **small and medium-sized firms play a big role** in this process, countries with appropriate industry structures may have an advantage – **Italy**!

Thank you!