



# Total Factor Productivity – Lessons from the Past and Directions for the Future

Bart van Ark, 16 October 2014

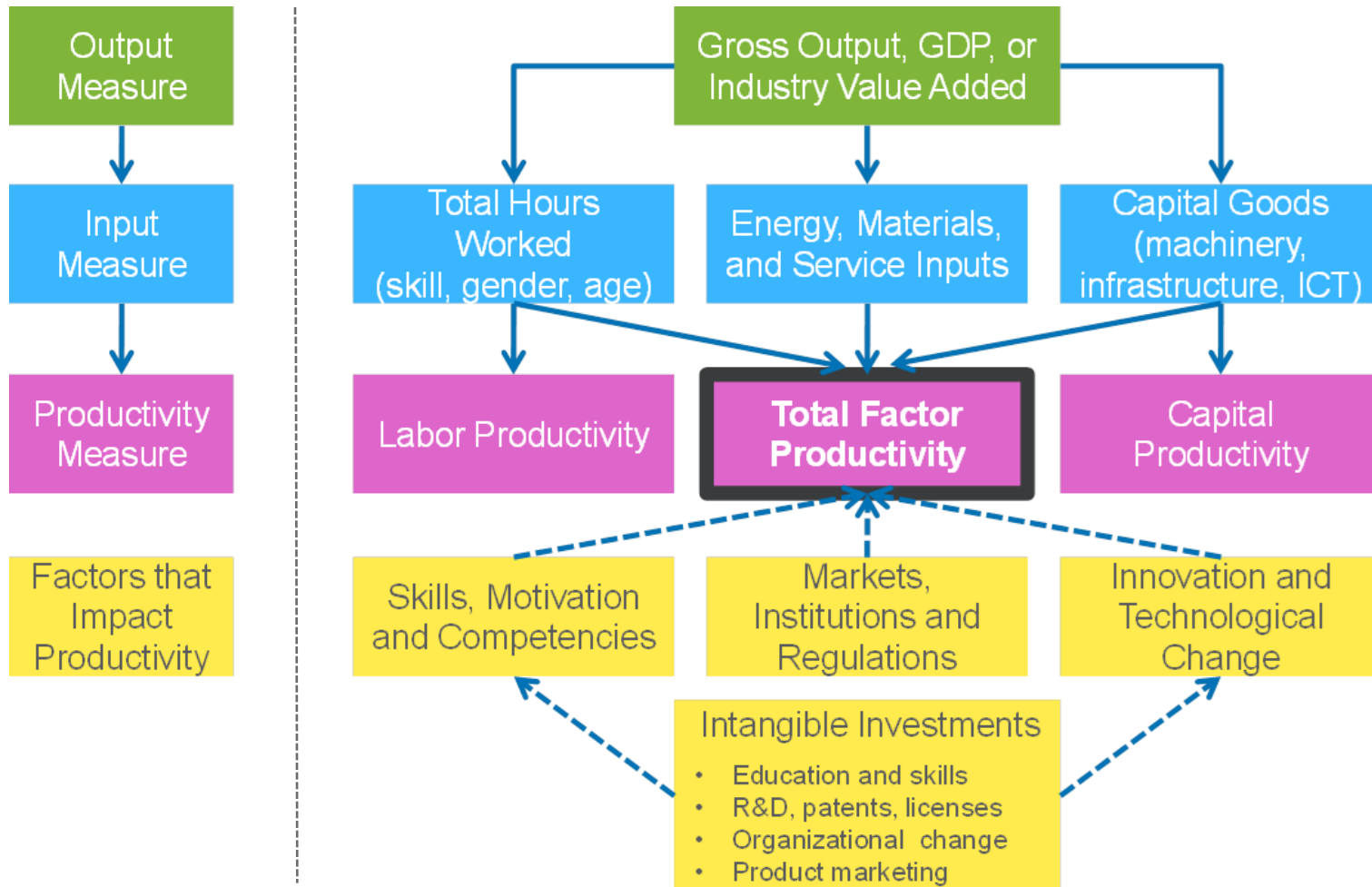


# The most celebrated residual in the world of economics

- Total Factor Productivity is the only sustainable source of long-term economic growth
- TFP represents so-called spillovers or externalities, creating societal benefits, arising from returns on inputs that go beyond those that can be internalized by the investor
- TFP growth is a compounding measure: small annual improvements do add up to a lot over longer periods of time.
- While strongly embedded in neoclassical economics (perfect competition, constant returns to scale and Hicks-neutral technical change), the empirical approach of growth accounting is much more eclectic
- TFP growth therefore reflects:
  - ✓ Technological change and other spillovers
  - ✓ Market structure and institutional effects
  - ✓ Everything else that is wrongly measured (outputs, inputs) or unmeasured (e.g. intangible assets)



# Diving deeper into the drivers of productivity growth



## This review builds on body of work by The Conference Board, the University of Groningen, and its collaborators

- Timmer, M.P., R. C. Inklaar, M. O'Mahony and B. van Ark (2010), ***Economic Growth in Europe. A Comparative Industry Perspective***, Cambridge University Press.
- Ark, B. van, V. Chen, B. Colijn, K. Jäger, W. Overmeer and M.P. Timmer (2013), ***Recent Changes in Europe's Competitive Landscape and Medium-Term Perspectives: How the Sources of Demand and Supply are Shaping Up***, Economic Papers 485, DG ECFIN, European Commission, April.
- Ark, B. van (2014), ***Productivity and Digitalisation in Europe: Paving the Road to Faster Growth***, The Lisbon Council and The Conference Board, Brussels/New York.
- Corrado, C. and K. Jäger (2014), ***Communication Networks, ICT and Productivity Growth in Europe***, Report for Telefónica S.A., The Conference Board, New York.
- Corrado, C, J. Haskel, and C. Jona-Lasinio and M. Iommi (2013a), ***Innovation and intangible investment in Europe, Japan, and the United States***, Oxford Review of Economic Policy, Volume 29, Number 2, pp. 261–286.



# Data are publicly available to use and improve !!

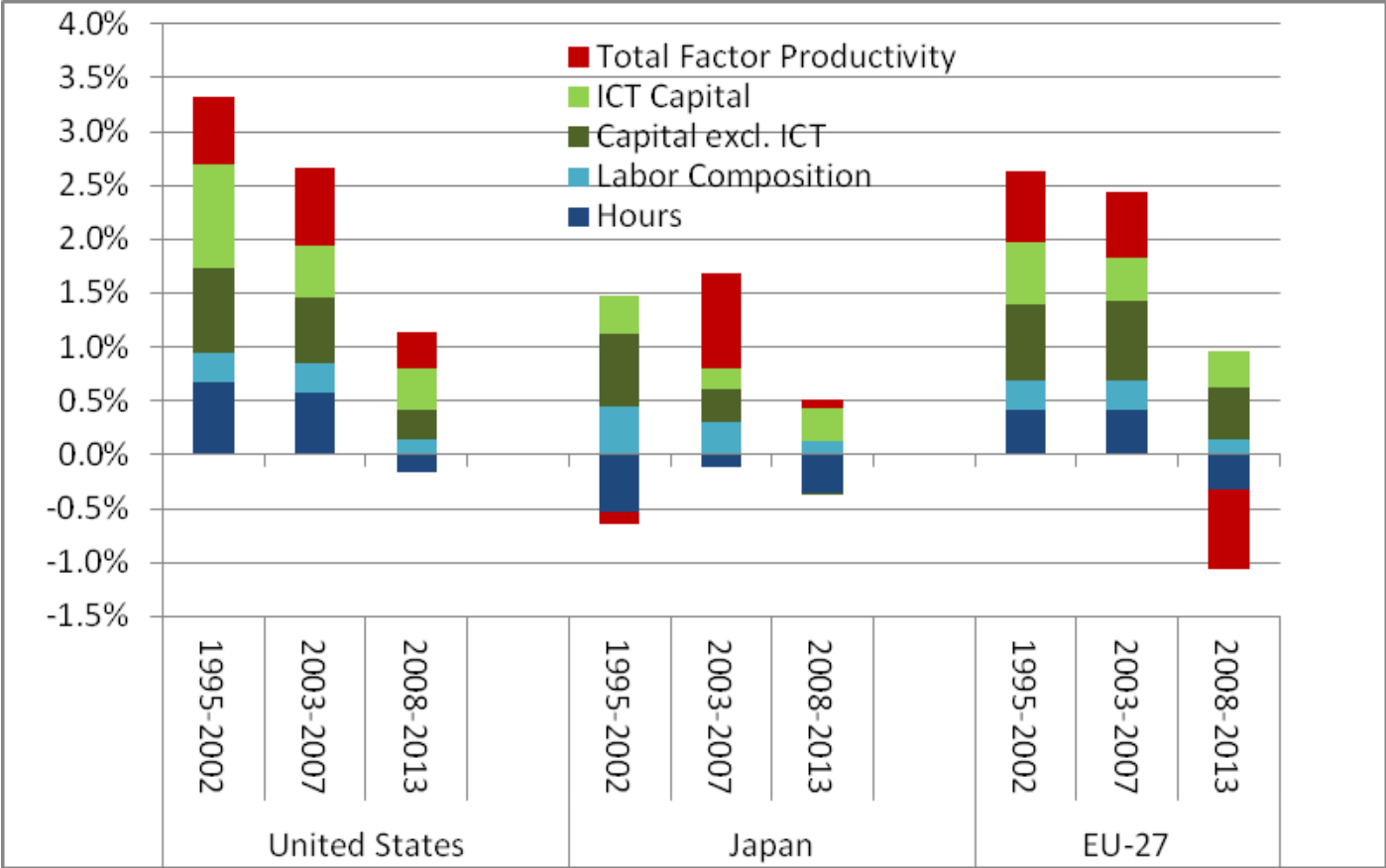
- ***The Conference Board Total Economy Database:***
  - Growth accounts for aggregate economy for 125 economies around the world
  - <http://www.conference-board.org/data/economydatabase/>
- ***EU KLEMS Growth and Productivity Accounts (2012 release):***
  - Data in the ISIC Rev. 4 industry classification for 34 industries, rolling updates
  - <http://www.euklems.net>
- ***INTAN Invest:***
  - cross-country intangible investment data website
  - <http://www.intan-invest.net/>



# Europe's Productivity Slowdown

# Significant slowdown in TFP growth – not only in Europe

Sources of GDP Growth, average annual contribution % change

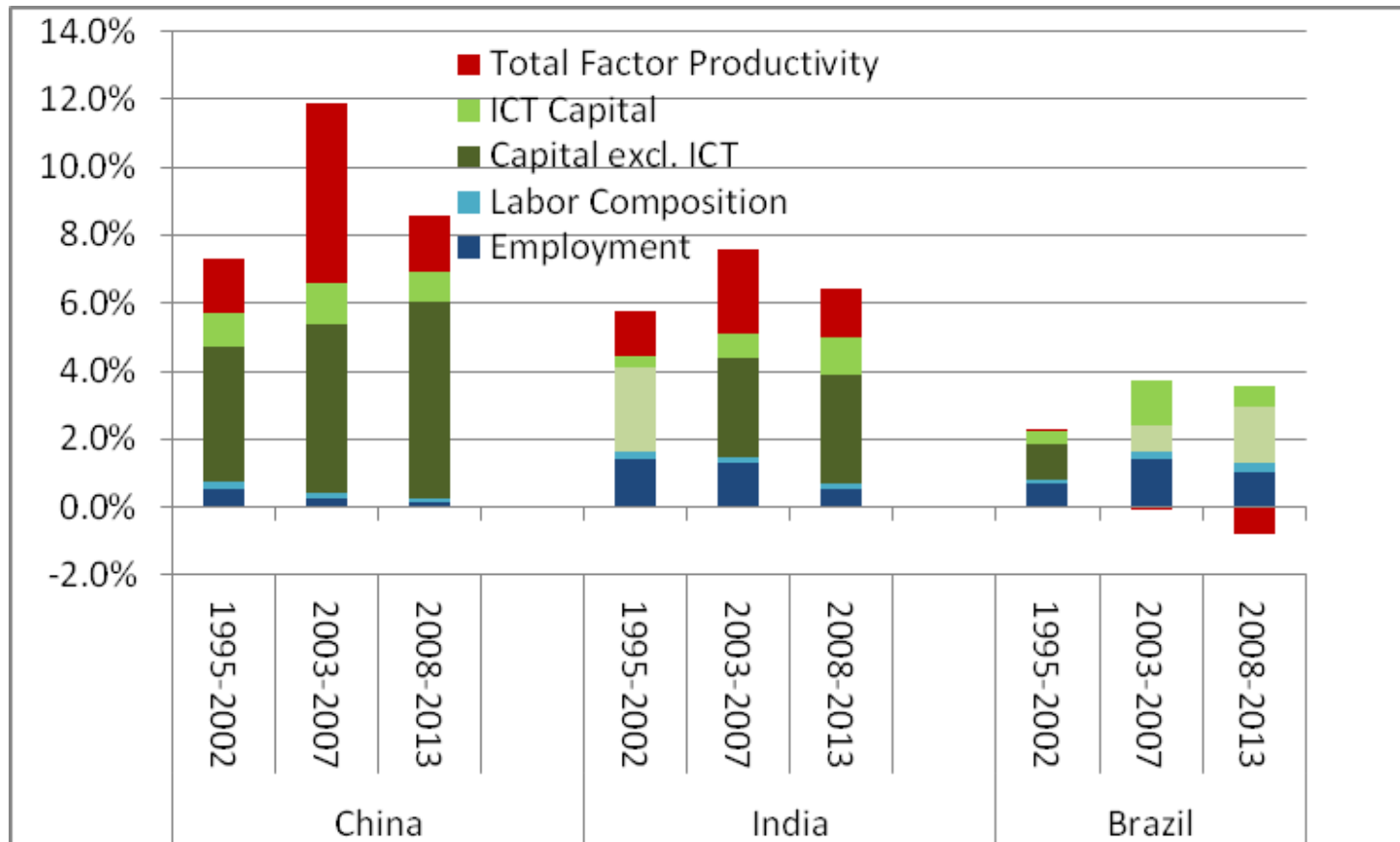


Source: The Conference Board Total Economy Database & Global Economic Outlook 2014, Update February 2014 (<https://www.conference-board.org/data/globaloutlook.cfm>)



# Major emerging markets only partially compensated for the downtrend

Sources of GDP Growth, average annual contribution % change

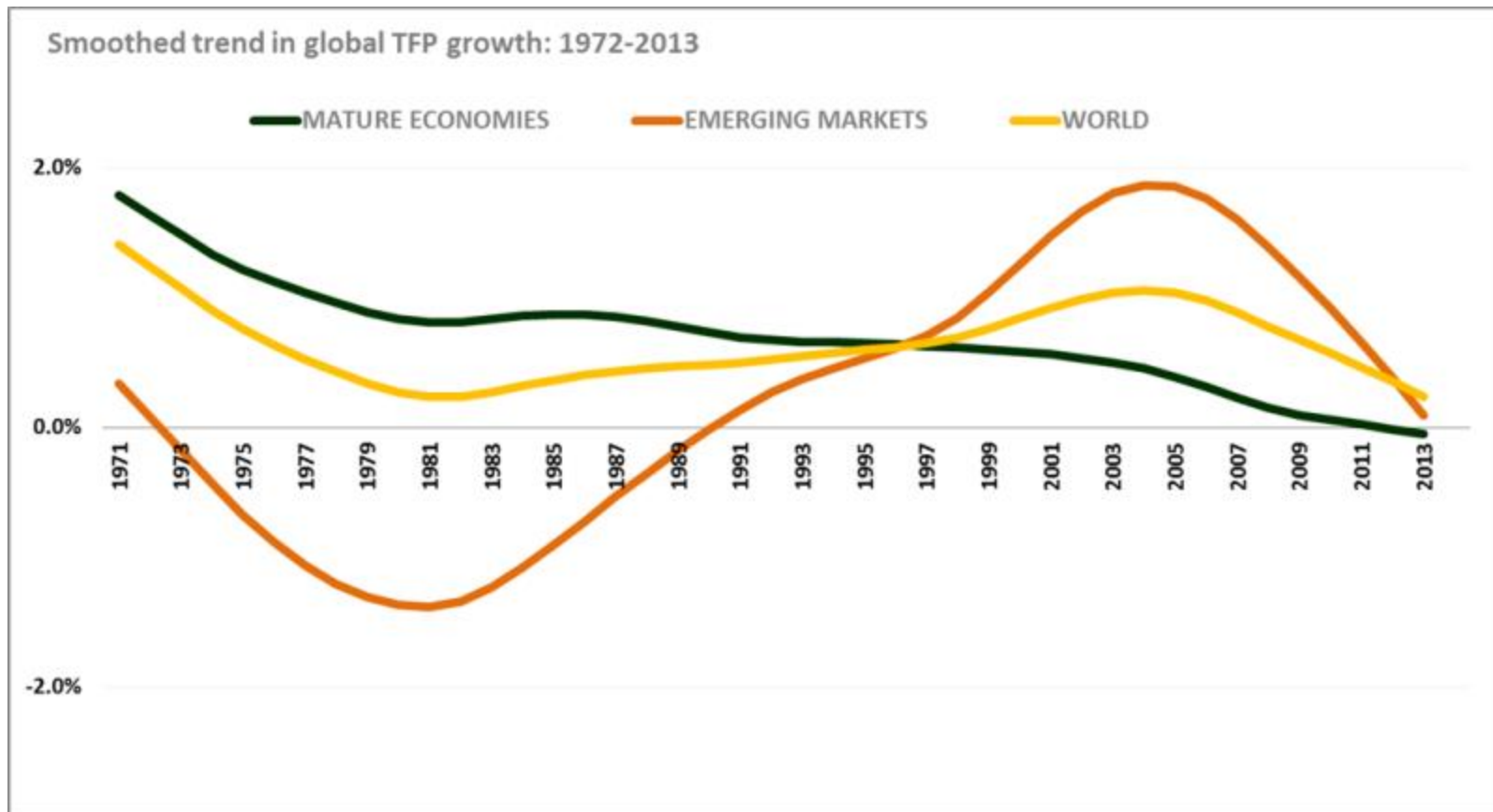


Source: The Conference Board Total Economy Database & Global Economic Outlook 2014, Update February 2014 (<https://www.conference-board.org/data/globaloutlook.cfm>)





# The TFP growth slowdown in emerging markets is a decisive break compared to the 1990s and early 2000s



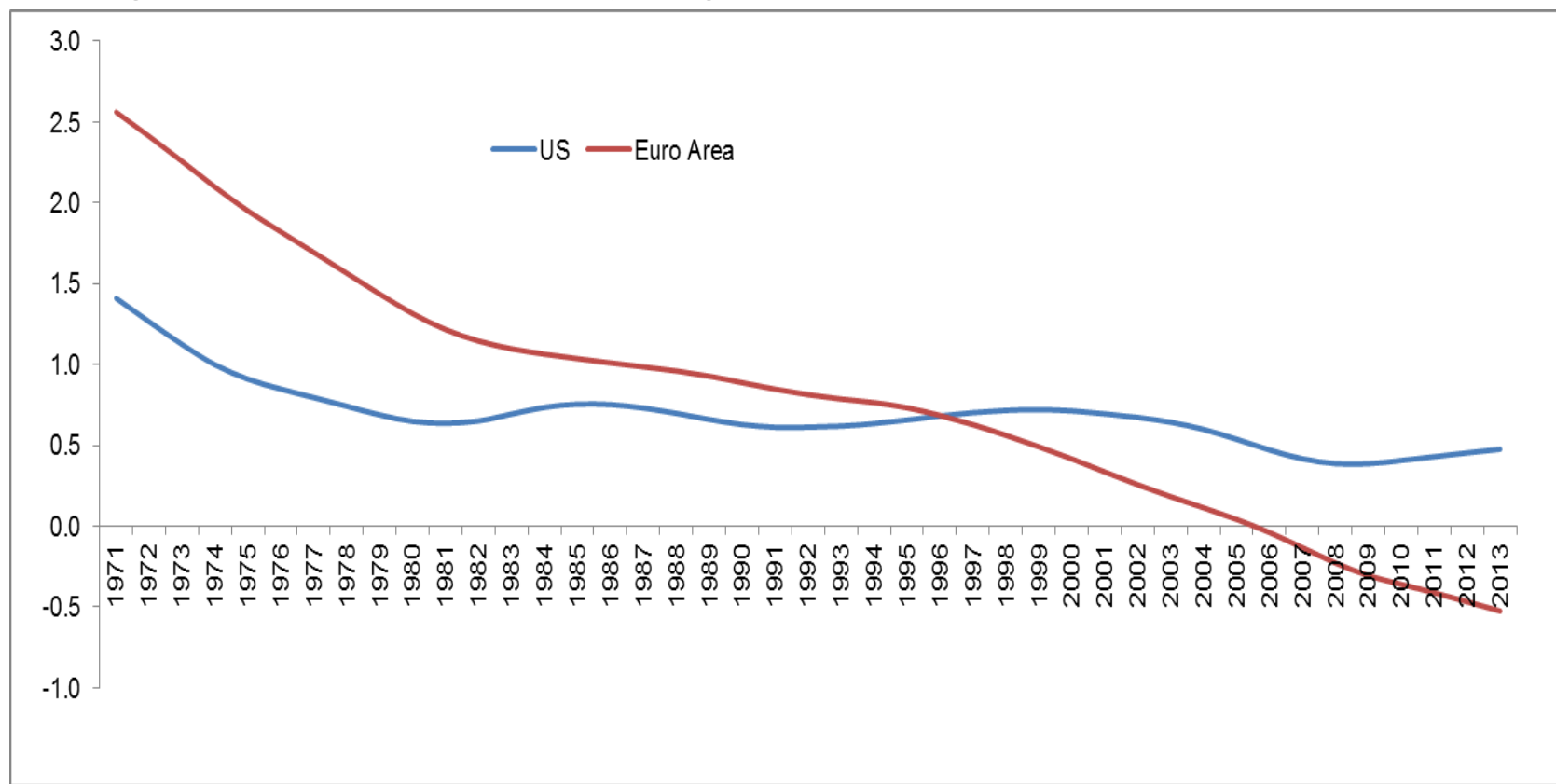
Note: Total factor productivity growth accounts for the changes in output not caused by changes in labor or capital inputs.

Source: [The Conference Board Total Economy Database](#)



# Negative TFP growth is not sustainable in the long term, and remains a concern for the Euro Area

Trend growth of total factor productivity using HP filter



Note: Total factor productivity growth accounts for the changes in output not caused by changes in labor or capital inputs.

Source: [The Conference Board Total Economy Database](#)

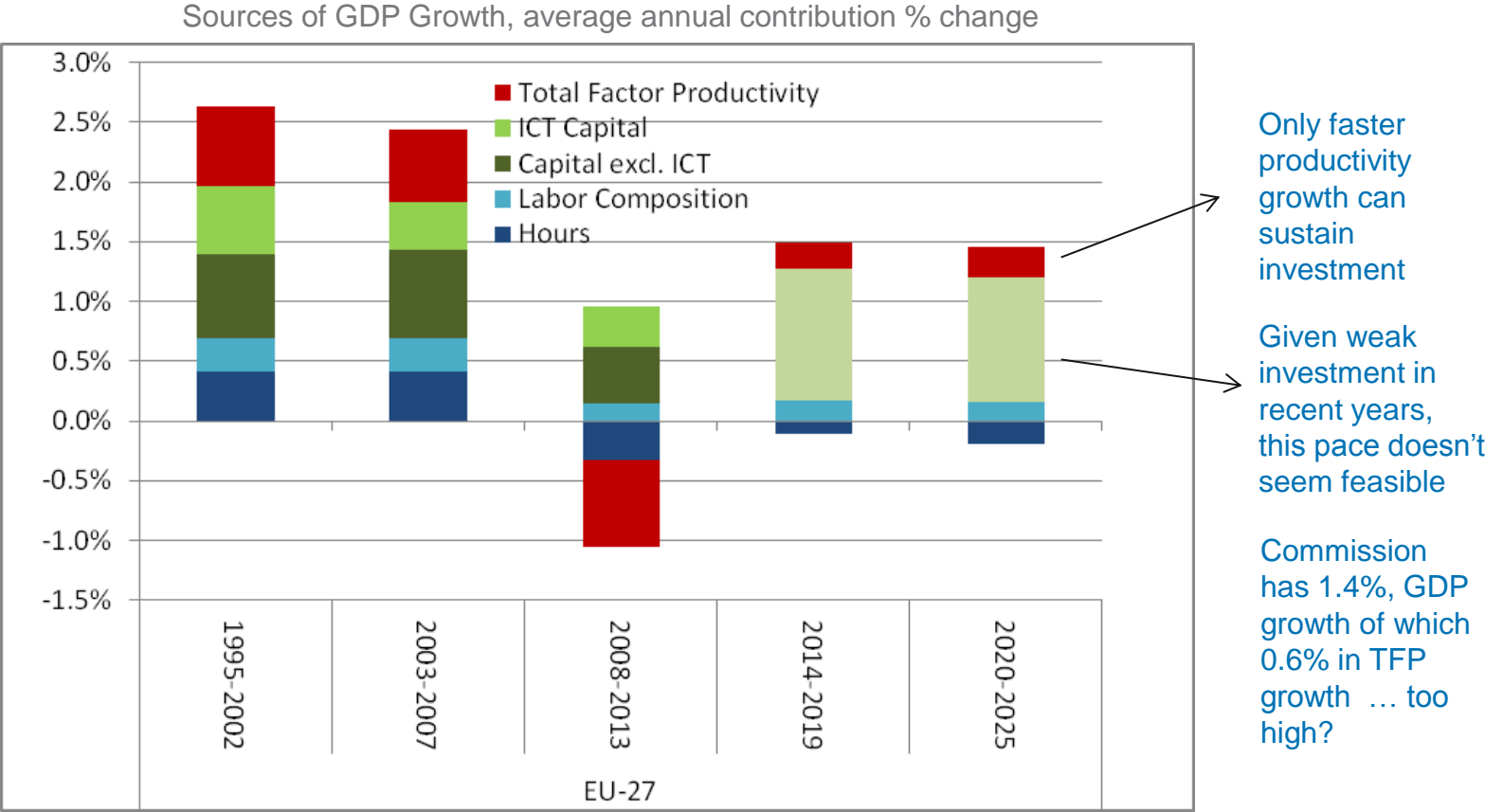


# How can negative total factor productivity growth happen and can it last for long?

- Negative effects from recession should be short-lived once the economy recovers
- Longer-term, TFP signals weaker technological progress and innovation – an ongoing trend since decades
- Increased rigidities in labor, product and capital markets lead to greater misallocation to less productive firms
- Negative reallocation effects with more resources going to less productive sectors in the economy (EU KLEMS)
- Caveat: TFP is a residual, so measurement error in output or inputs and unmeasured effects end up here



# Projections show an investment pace which cannot be sustained with such low productivity growth

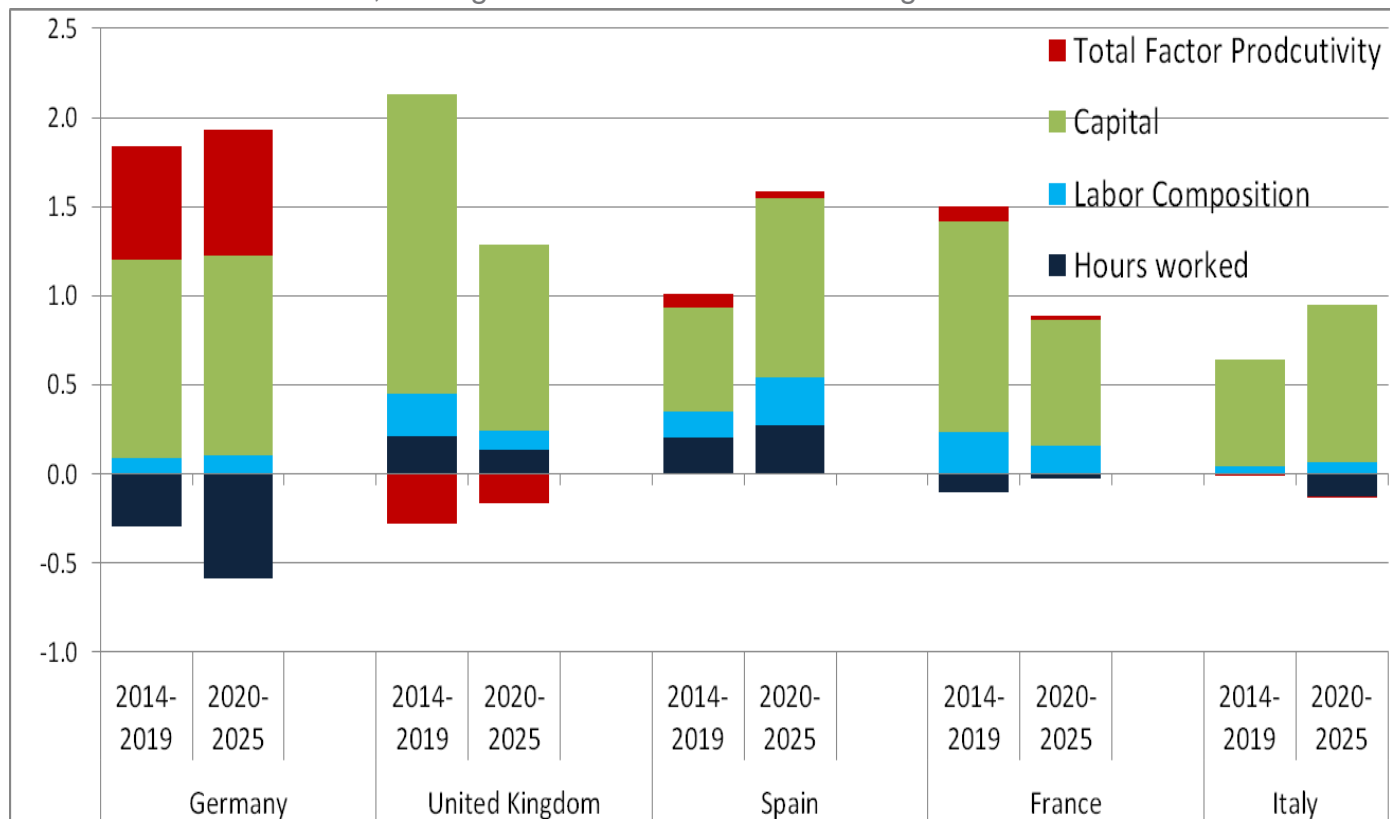


Source: The Conference Board Total Economy Database & Global Economic Outlook 2014, Update February 2014 (<https://www.conference-board.org/data/globaloutlook.cfm>)



# Offsetting effects between productivity growth and demographics are challenging across Europe

Sources of GDP Growth, average annual contribution % change



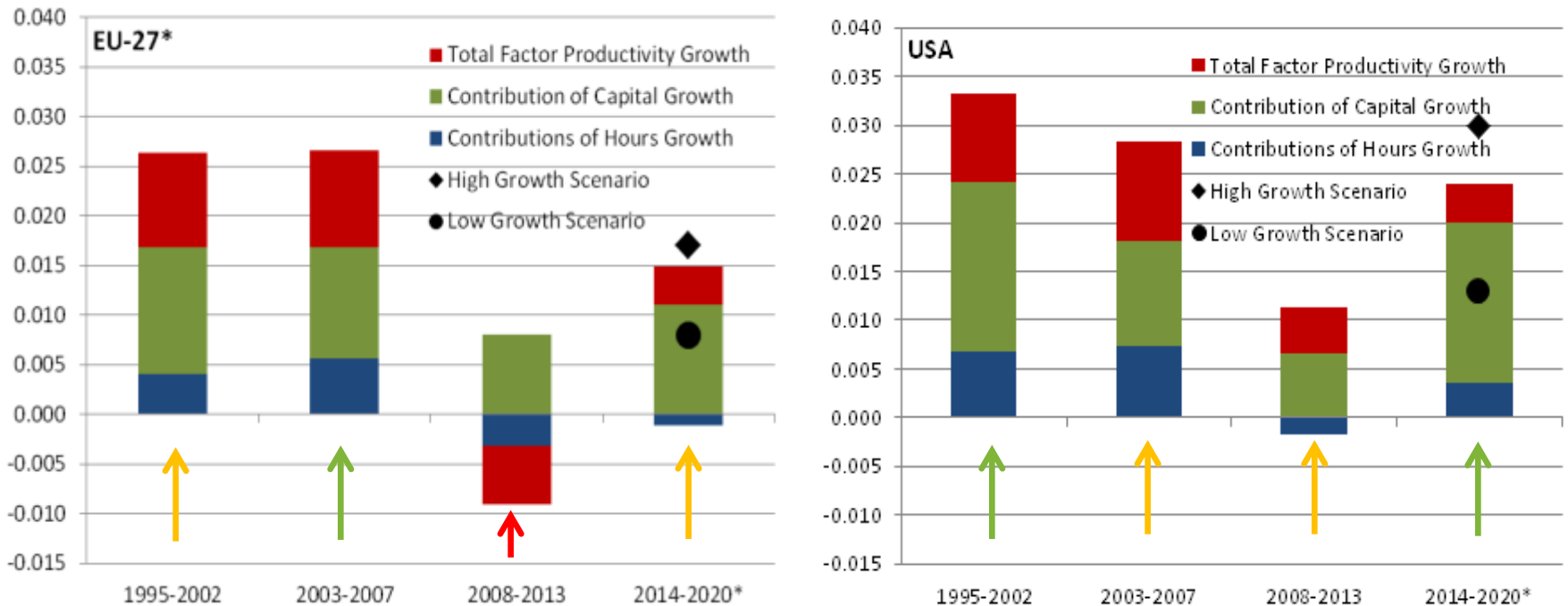
Source: The Conference Board Total Economy Database & Global Economic Outlook 2014, Update May 2014 (<https://www.conference-board.org/data/globaloutlook.cfm>)



# Network Effects of ICT

# Despite weak demographics and low investment, increase in productivity is key to a sustainable recovery in Europe

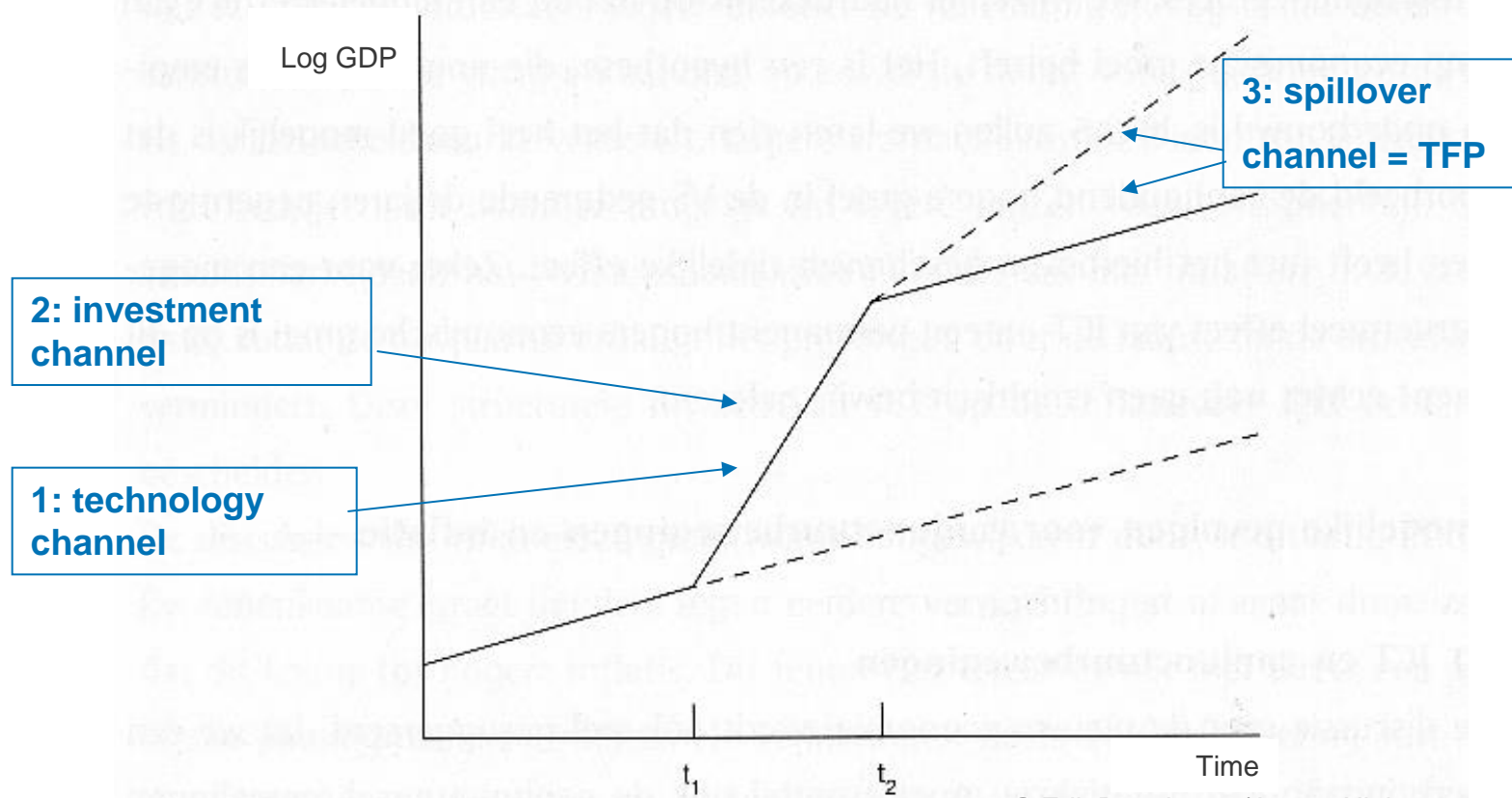
Average annual GDP growth in the EU27 (excl. Croatia) and USA, 1995-2013 and 2014-2019 projections,



- 1995-2002: ICT investment hype: EU showed smaller investment effect than U.S.
- 2002-2003: dot-com crash hurts U.S. investment ;EU productivity growth held up on average
- 2008-2013: Economic crisis pushes Europe in deep productivity crisis; US retains positive TFP growth
- 2014-2019: Recovery in Europe slower due to demographic weakening and lower investment



# The impact of ICT on economic growth and productivity



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## Recent deployment of Information and Communication Technology is difficult to capture in productivity statistics

Process	Description	Where in SOG?
1. Network buildout	High investment and capacity building	Capital stocks
2. Network take-up	Utilization of installed capacity rises	Capital contribution (via capital income)
3. Network externalities	a. Returns to scale (Metcalfe's Law)	MFP
	b. Innovative adaptations (Internet and wireless technologies as GPTs)	MFP

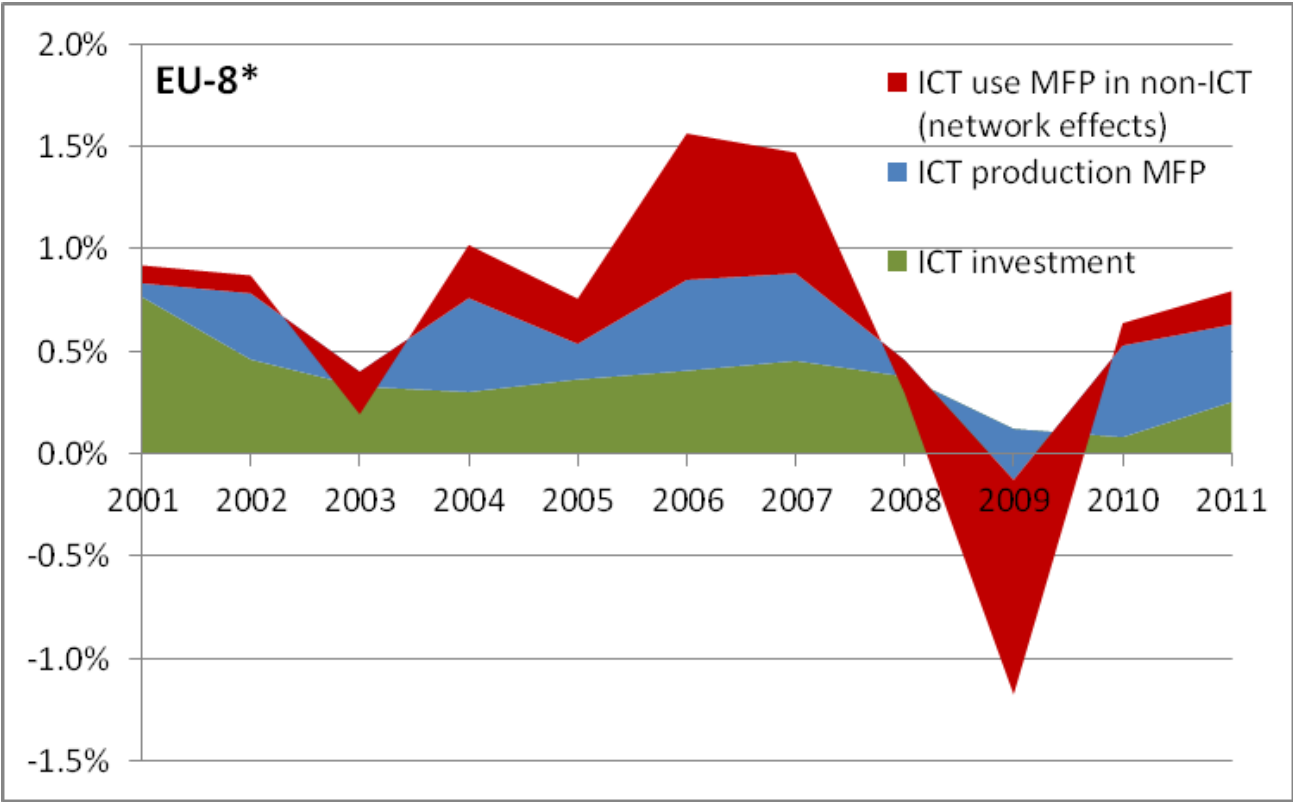
NOTES—SOG refers to sources-of-growth analysis.

SOURCE—Corrado (2011)



# ICT was good for about 1 %-point of EU GDP growth before crisis; since then 10 times less as ICT use effects in non-ICT sector collapsed and slowly recover

Growth Contributions from ICT Production, Investment and Use in Non-ICT sector, 2001-2011



\* EU-8 includes Austria, Finland, France, Germany, Italy, Netherlands, Spain and the United Kingdom



# Productivity through digitalization is the key to returning to a sustainable growth path in Europe

- Improved economic conditions as represented by a rise in GDP can only be sustained through growth in labour productivity.
- The potential of digitalisation to accelerate growth will come primarily from the use of these technologies by industries in the non-ICT sector
- As more companies adopt technology and innovations spread across the economy, the impact on productivity at macro levels becomes more visible
- The rapid diffusion of high-speed networks and mobile devices has the potential to empower consumers and businesses to drive demand in new ways
- Countries with large internet economies are receiving more revenue growth and consumer surplus affiliated with broadband diffusion
- The combined downturns and subsequent economic stagnation may have potentially eroded some sources of long-term growth, such as skills and ICT investment, which need to be restored



# The Role of Intangibles

# The economic view of intangibles (“knowledge based capital”) drastically changes view of growth and productivity

- Traditional capital estimates are understated because many costs of innovation are not counted as investment
- In “economic” view of investment any use of resources today designed to increase the productive capacity of the firm in the future is investment. (Corrado, Hulten and Sichel, CHS, 2006, 2009)
- CHS and Corrado, Haskel and Jona-Lasinio (CHJ-L) use the intangibles framework and propose building an “innovation account” to illuminate innovation processes.
- Many intangibles, beyond R&D, are difficult to value, market and trade creating potential non-rivalrous characteristics and spillovers
- Implementation of this view drastically changes our view of how the rise of the knowledge economy impacts on growth and productivity
- So policy-makers and accountants get more serious about intangibles

# Intangible assets come in many types and forms

- Intangible assets have no physical form:
  - ✓ Technology based – R&D, Patents, Software, Databases, Trade secrets
  - ✓ Artistic – Books, Musical works, Pictures, Video
  - ✓ Contract based – Licensing, royal agreements, advertising contracts, lease agreements, non-compete agreements
  - ✓ Customer related – Customer Lists, Order backlogs, Customer contracts
  - ✓ Marketing related – Brands, Logos, Trademarks, Internet domain names, Images, Copy and Advertising campaigns
- Some intangibles (software, mineral exploration, artistic originals and – since 2013 – R&D) are already captured in national accounts
- Intangibles can be marketized but in-house production is a large share of total production, making valuation difficult – and potentially reducing possibility for spillovers



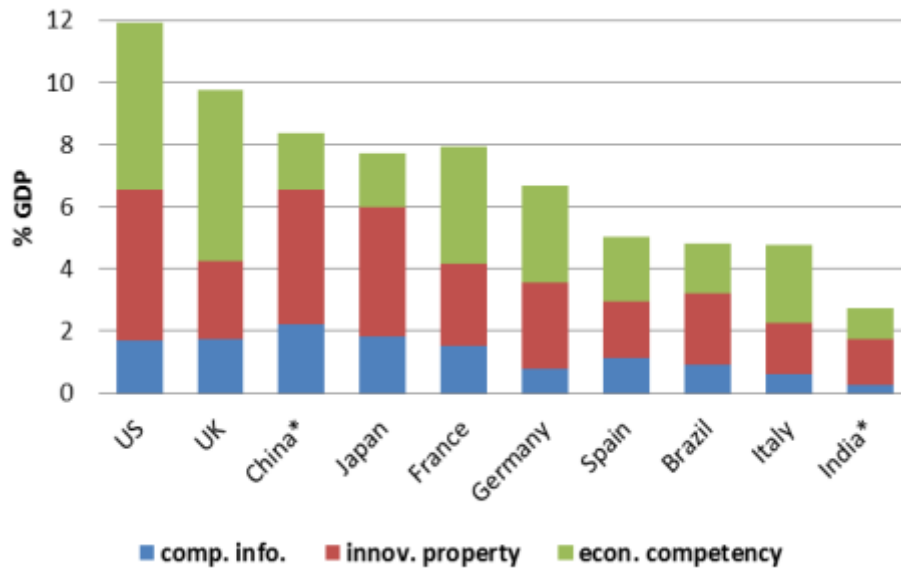
# An extended framework for investment in intangibles is needed to understand impact of technology on growth

Broad category	Type of Investment
Computerized Information	<ul style="list-style-type: none"><li>• Software</li><li>• Databases</li></ul>
Innovative Property	<ul style="list-style-type: none"><li>• R&amp;D</li><li>• Mineral exploration</li><li>• Entertainment and artistic originals</li><li>• Design and other new product development costs</li></ul>
Economic Competencies	<ul style="list-style-type: none"><li>• Branding (market research and long-lived advertising)</li><li>• Firm-specific human capital (training)</li><li>• Organizational capital (business process investment)</li></ul>

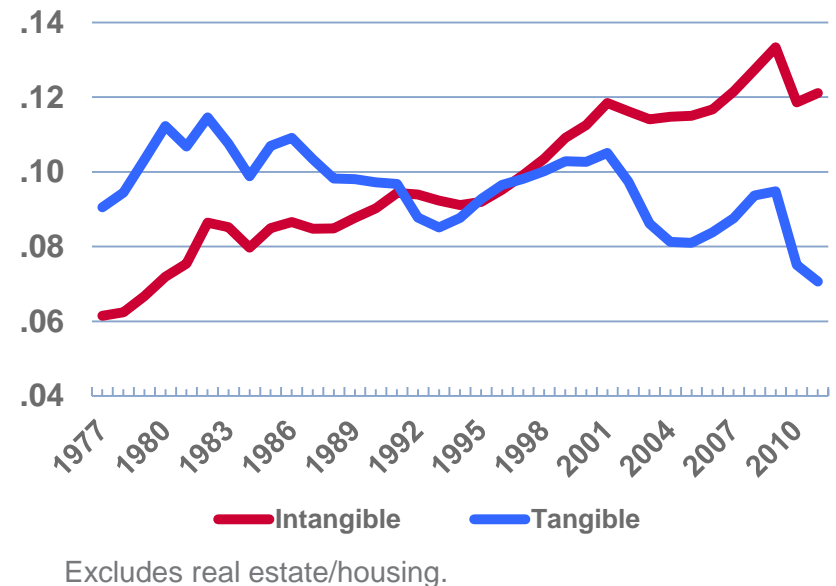


# Intangible capital will gradually overtake tangible capital, fundamentally changing our perspective on growth

Investment in Market Sector GDP in 2008, as % of GDP



Investment in Private Industries in the United States, 1977-2011, as ratio to GDP



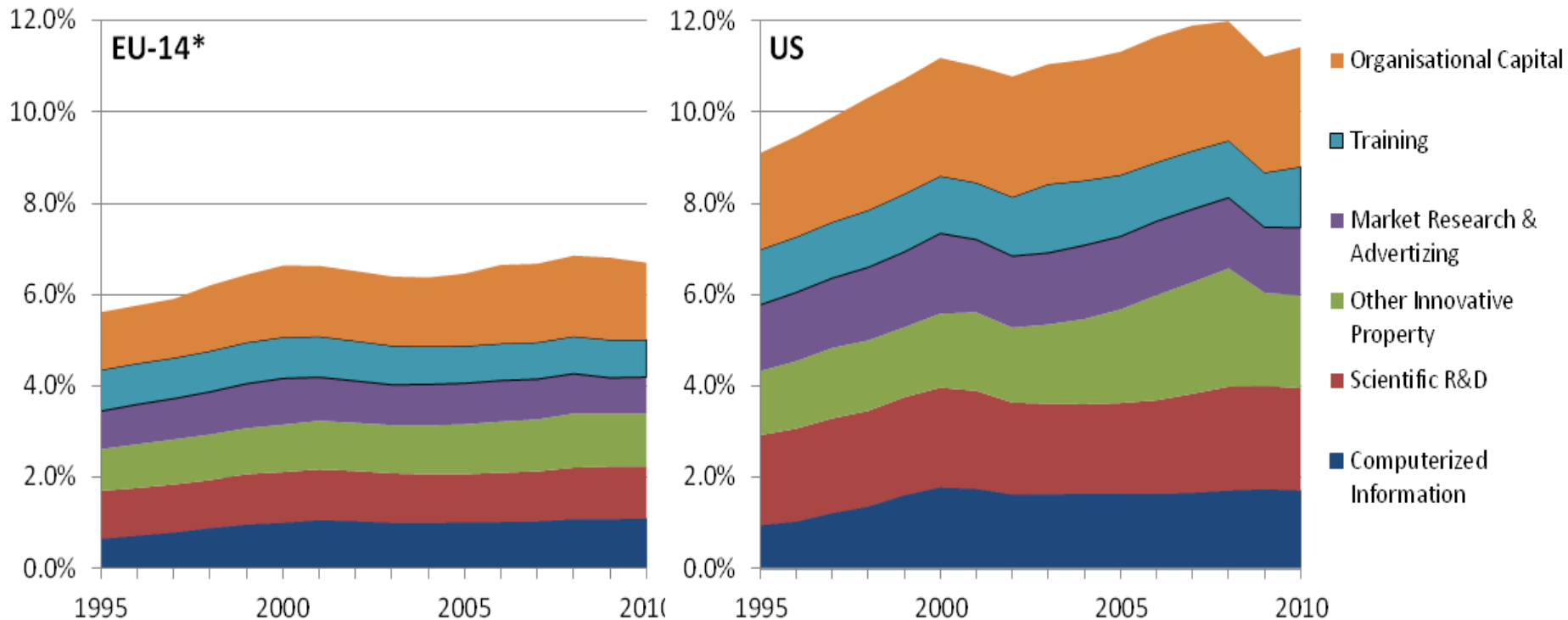
Note: Intangible investment in China and India are for the total economy, while investment in the rest of the countries are for the market sector. Sources: Corrado et. al. (2012), except for China from Hulten and Hao (2012), India from Hulten, Hao and Jaeger (2012), Brazil from Dutz et. al. (2012), and Japan from RIETI.





# Europe should build on its ability to maintain intangibles as driver of knowledge and grow them faster especially in non-tech innovations and competencies

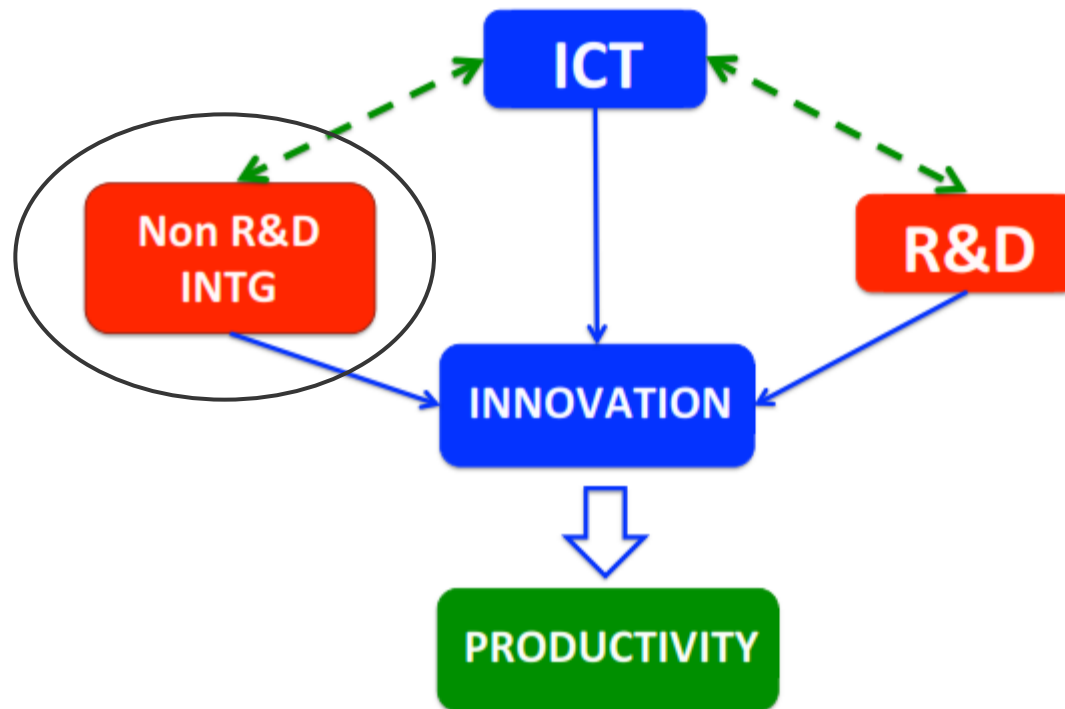
Investment intensity of intangible assets as a % of GDP for 14 EU economies and the US (1995-2010)



EU-14 refers to the EU-15 before 2004, excluding Sweden and Denmark, but including Slovenia

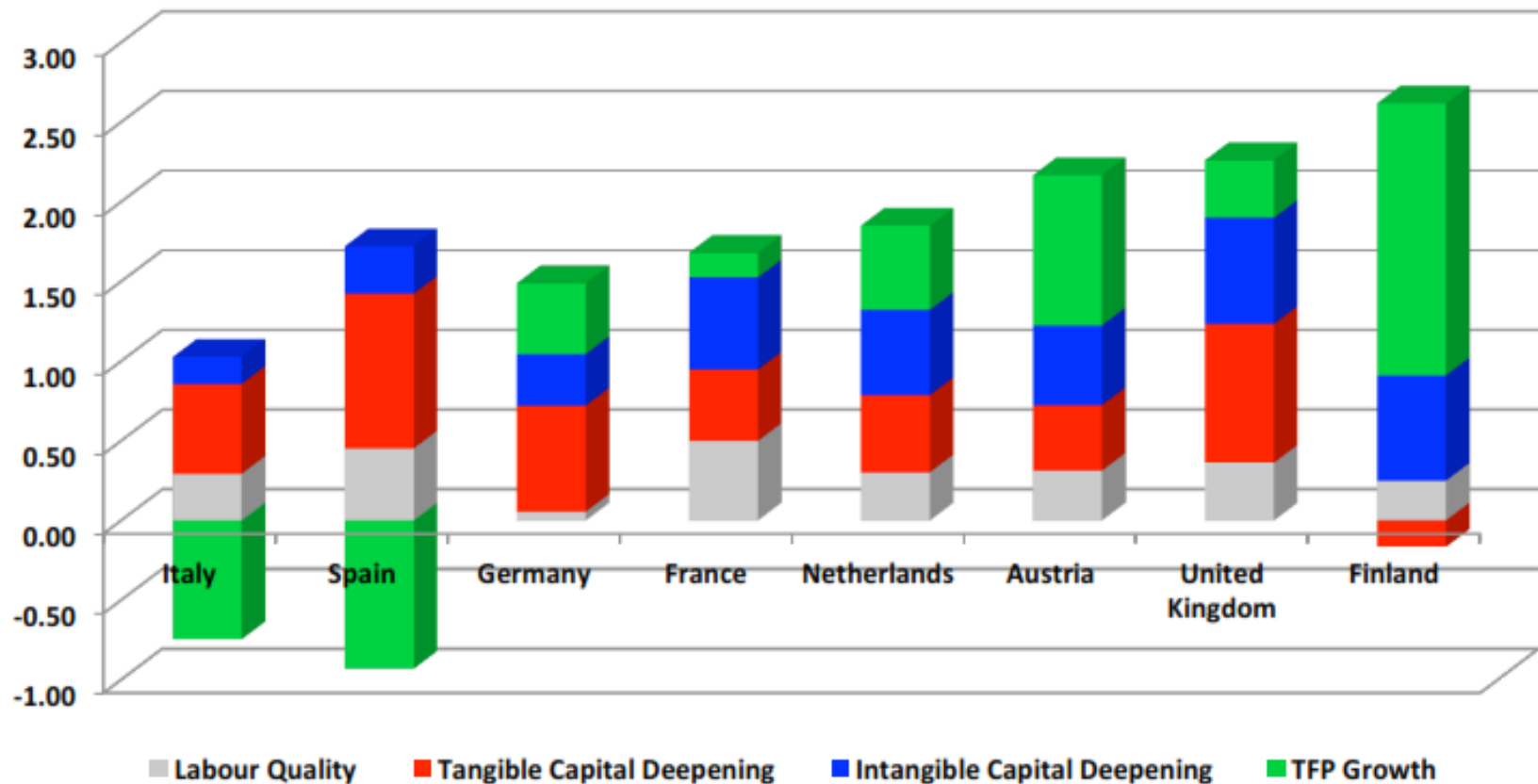


# Why is it important to take a broader perspective on intangibles?



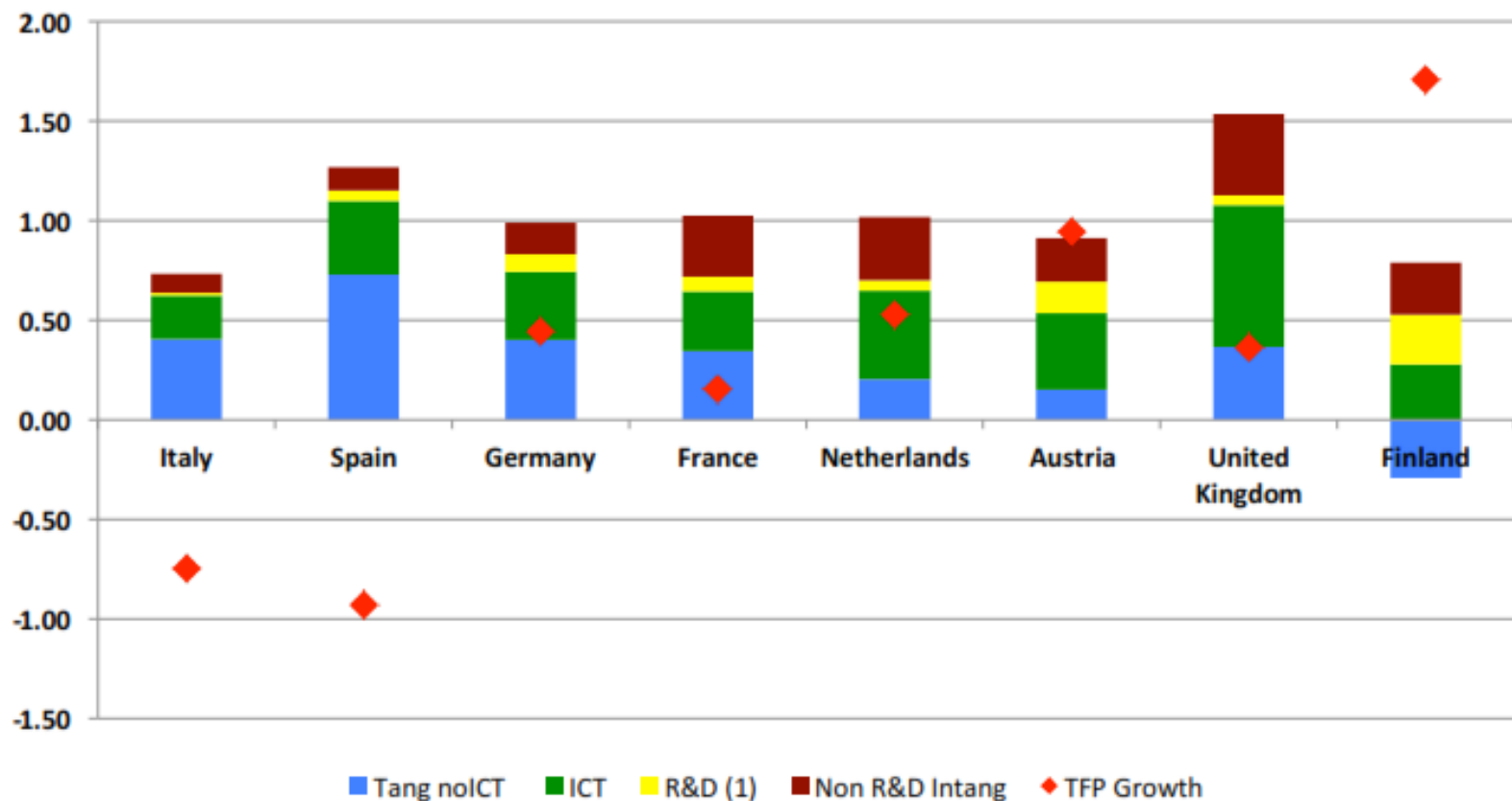
# In several cases the role of intangible capital contribution to labor productivity growth is beginning to outpace tangibles

Contributions to labour productivity growth, 1995-2009



# And the non-ICT & non-R&D components are taking up a larger share

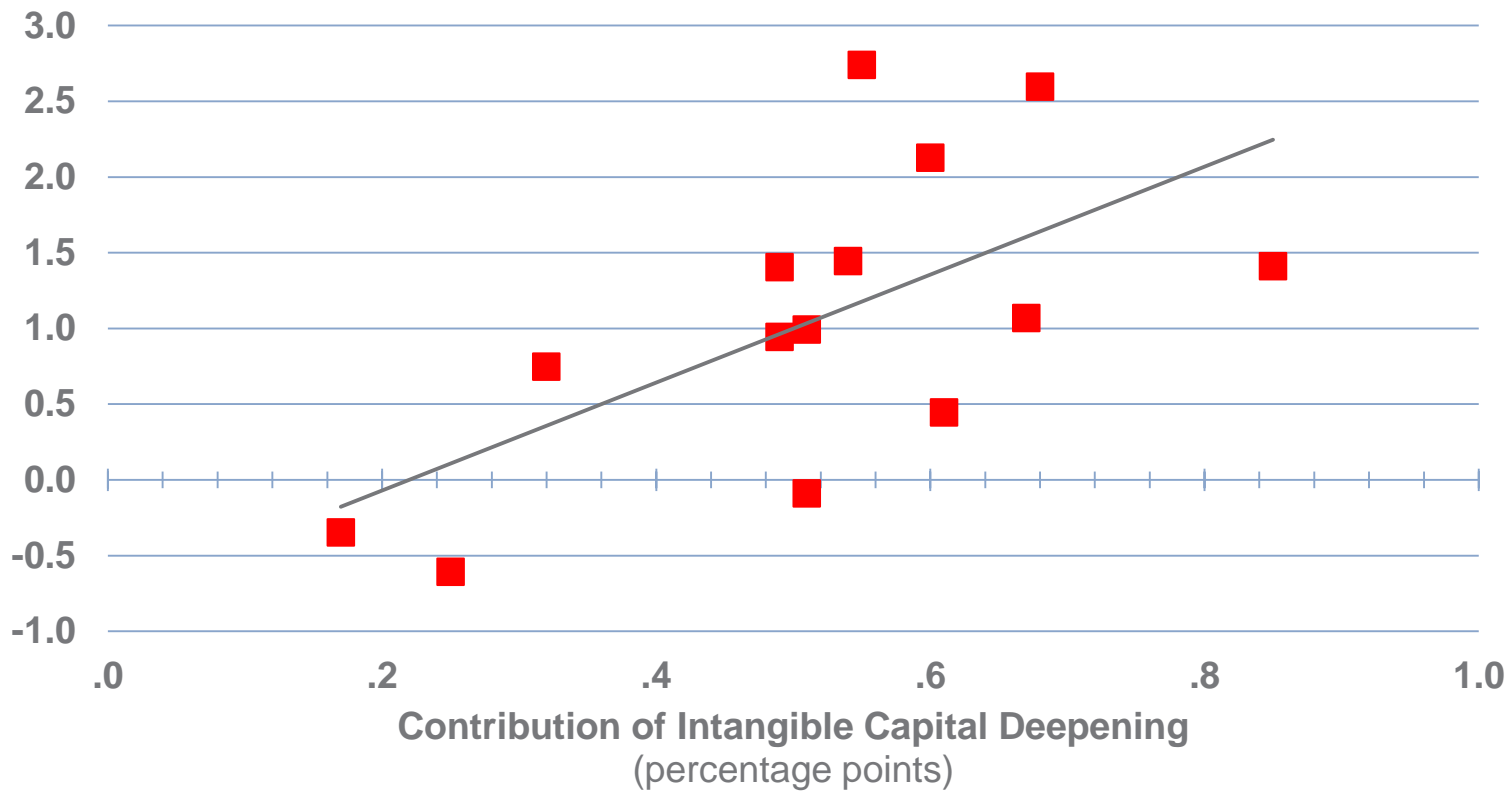
Decomposition of intangible capital contributions to labour productivity growth, 1995-2009



# The non-rival nature of intangibles implies a theoretical link to productivity growth via diffusion

## TFP growth in 14 EU countries, 1995-2007

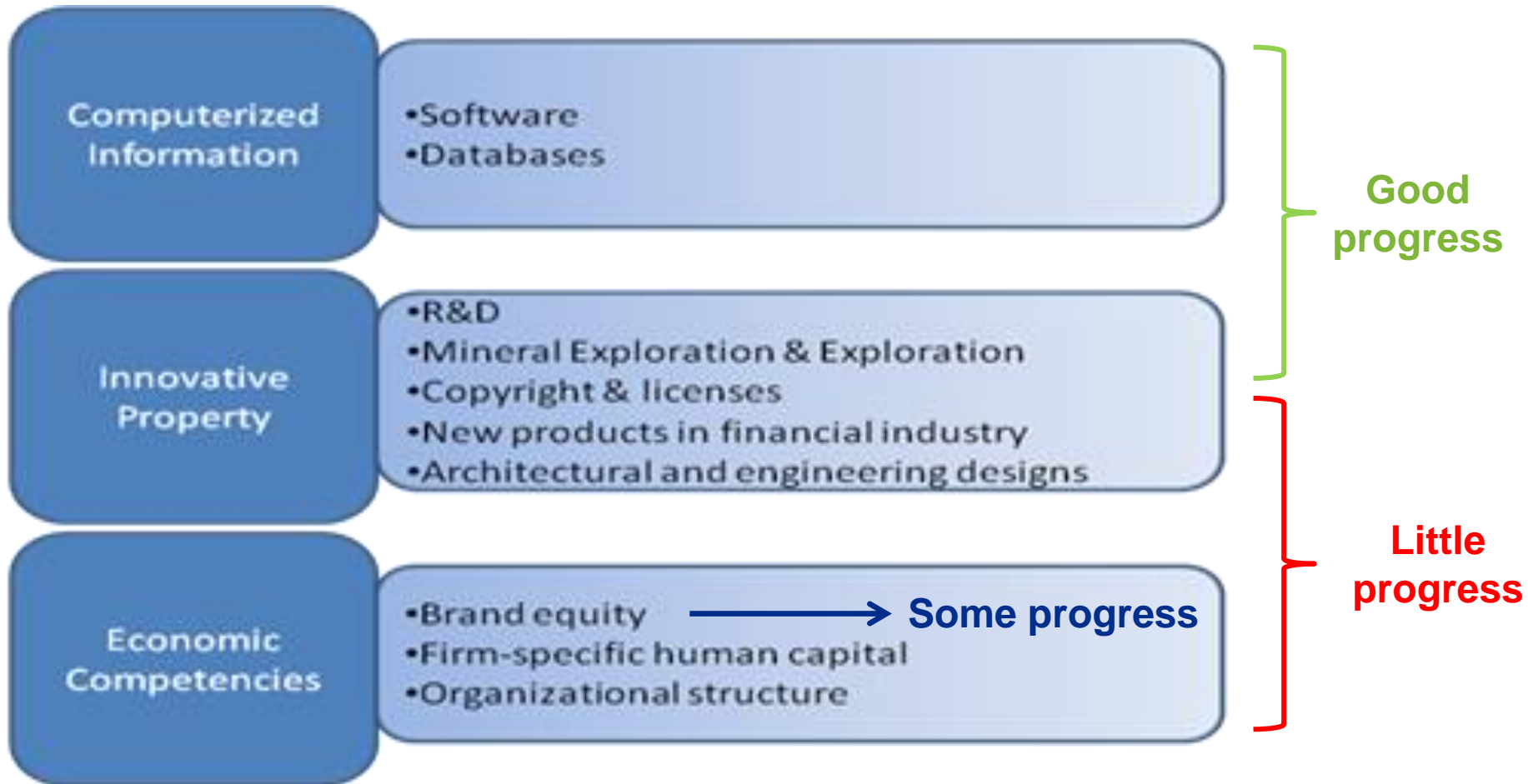
Percent change



## Despite progress on research, why is there caution on embracing the policy implications?

- Some forms of intangible assets are pretty exotic as they have no physical form, making valuation, depreciation, etc. all difficult → national accounts integration goes slowly
- Intangibles can be marketized but in-house production is a large share of total production, making valuation difficult – and potentially reducing possibility for spillovers.
- Integrating the impact of intangibles on growth is tricky:
  - ✓ Spillovers and complementarities are difficult to measure and hard to convey.
  - ✓ Causality is probably a bigger issue with intangibles than with tangibles
- If intangibles is the main story, the focus is long-term, not short-term requiring bigger policy commitments.
- Public-private “partnerships” is probably a bigger deal than for tangible investments

# Three Categories of Intangible Assets



Implications for how to think about the crisis

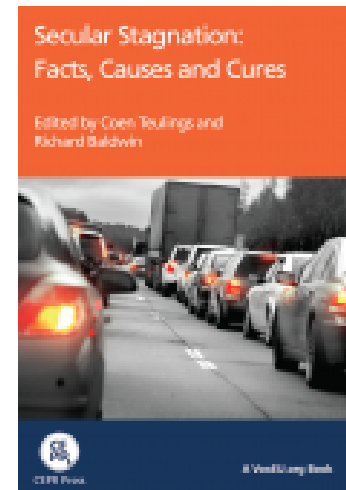


# How big is the challenge? Secular stagnation?

- ✓ **Demand side** (Summers, Krugman): “Macroeconomic policy will have difficulty to achieve full employment and production at potential, and if these goals are attained there is likely to be a price paid in terms of financial stability.”
- ✓ **Supply side** (Gordon): “The gap of actual performance below potential is quite narrow and slow growth is more a problem of slow potential than a remaining gap. The growth slowdown is structural related to demographics, education, inequality and government debt.”
- ✓ The emergence of low (or negative) real interest rates, low inflation and weakened potential output growth are the key ingredients of the secular stagnation hypothesis.

## Secular Stagnation

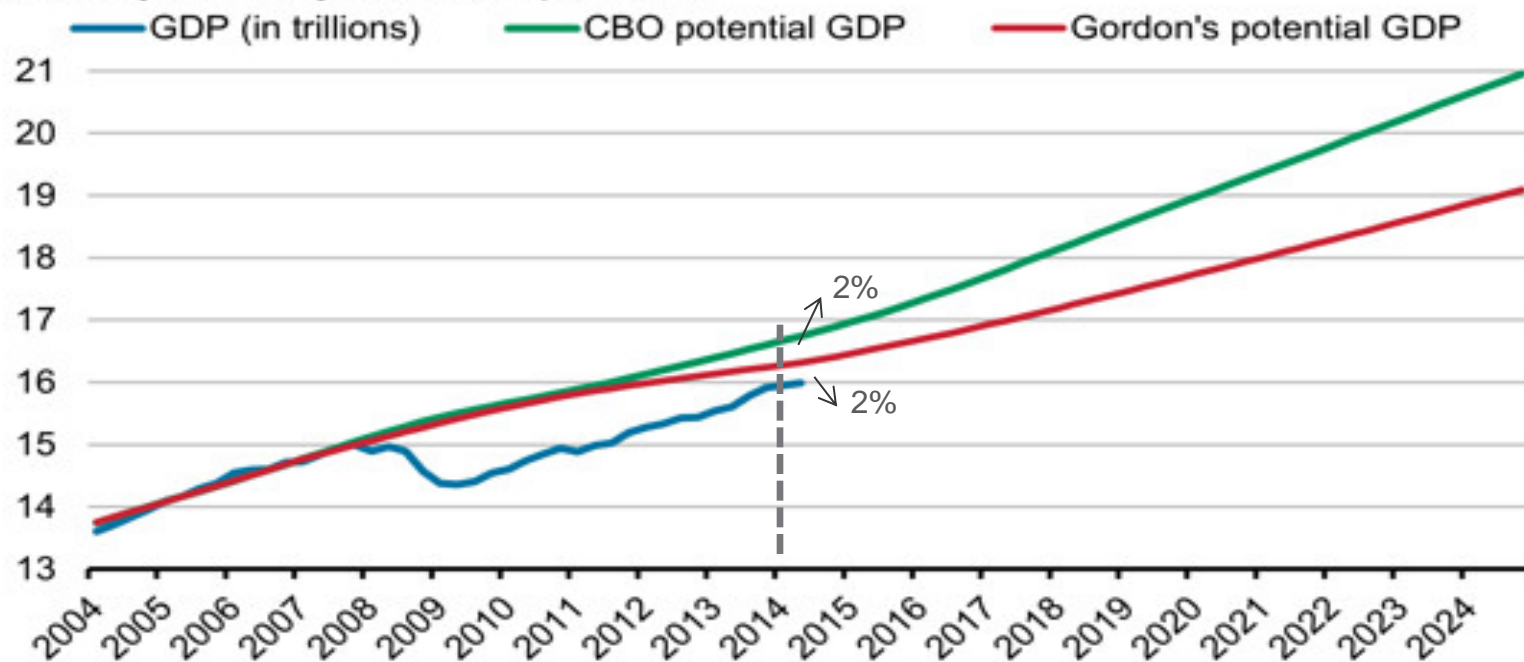
- ✓ Slow global growth and small home markets forces competition on the base of low prices
- ✓ Weak competitive pressures lessen incentive to invest in education & infrastructure.
- ✓ Deflationary pressures worsen debt resolution and slow growth prospects
- ✓ Unfulfilled promises to rising middle classes causes restiveness
- ✓ Between- and within-country inequality rises



# Alternative measures of actual and potential U.S. GDP levels suggest economy to reach full capacity in 2015

## What If the U.S. Economy Has Less Potential?

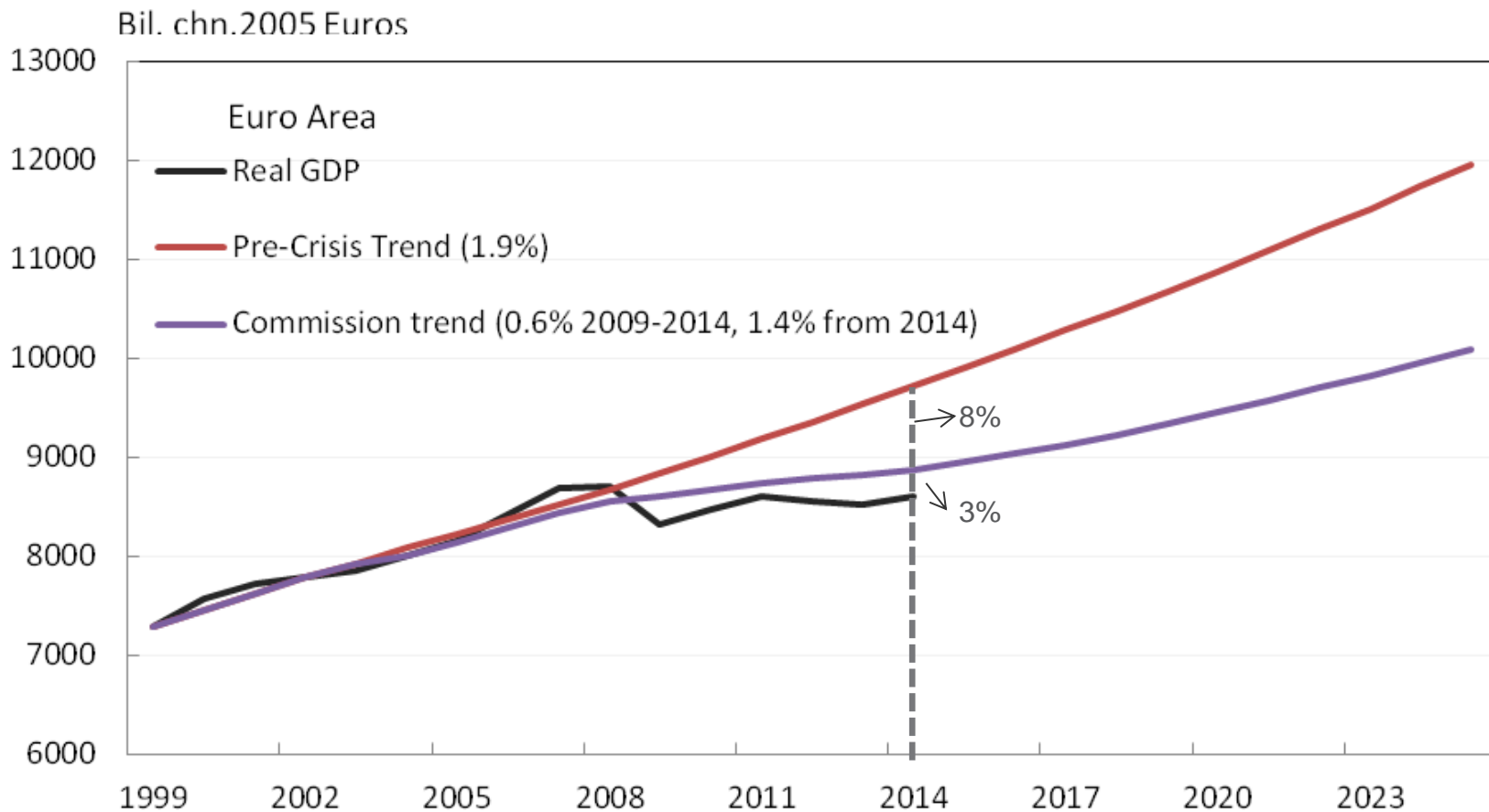
Northwestern University economist Robert Gordon estimates that the economy's potential is weaker than the Congressional Budget Office estimates. By his estimate, the economy is already close to its potential.



Source: Chart obtained from WSJ, sourced from Robert J. Gordon, A New Method of Estimating Potential Real GDP Growth. Implications for the Labor Market and the Debt/GDP Ratio, NBER, Working Paper 20243, August 2014



# ECFIN estimates suggest cyclical deficit has become quite small, whereas structural deficit remains large



Source: Eurostat, The Conference Board; post2014-trend based on potential GDP estimate from DG ECFIN.assumptions



# Total factor productivity is a key tool for policy analysis

- TFP growth has become the Achilles' heel of growth, especially in Europe
- To tackle “secular stagnation”, investment gap in Europe needs to be addressed?
- But which investment gap? Focus on investments that drive technology and innovation
  - ✓ Clear network effects emerging from ICT investment
  - ✓ Spillover effects become clear when bringing intangible investment into the picture
- The strong decline of TFP in Europe suggest more is at stake:
  - ✓ Reforms in labor, capital and product markets
  - ✓ Integration of Single Market, especially services, and in particular digital services matter