

Which role for ICTs

**As a Productivity driver
over the last years and the next future?***

Gilbert CETTE Presented by Yves GASSOT
Aix-Marseille School of Economics
CNRS-EHESS

* published in DigiWorld Economics Journal n°100

19 November 2015

Outline

Productivity developments in advanced countries: Some pictures

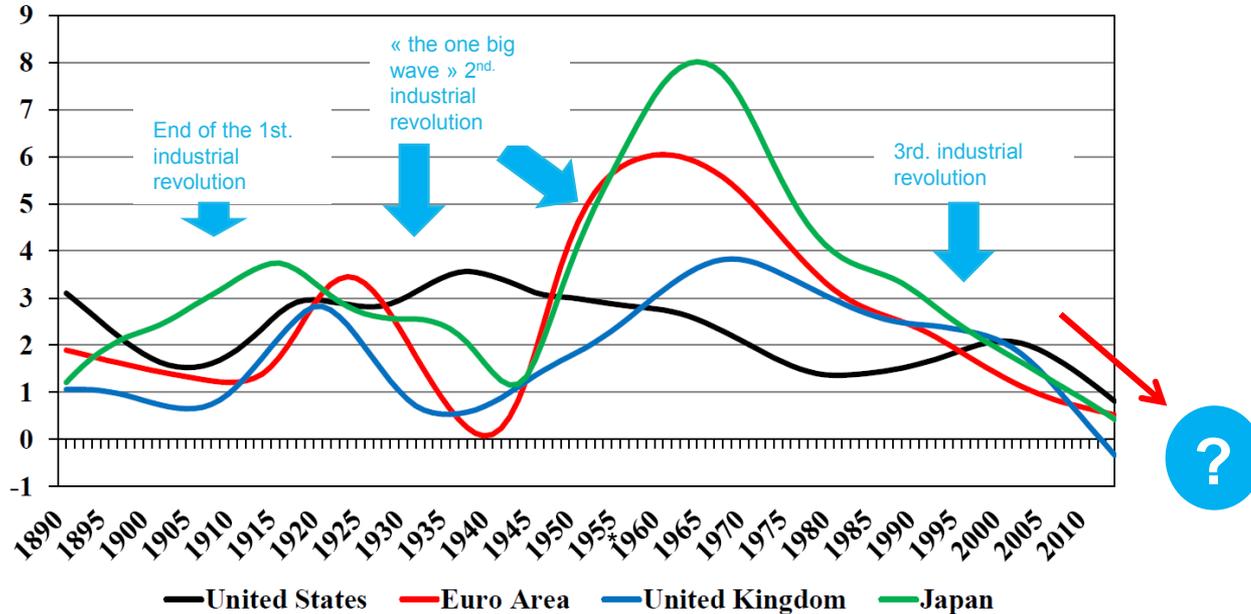
1. Labour productivity Growth waves
2. How to explain the productivity slowdown from the early 2000?
3. Sources of the ICT capital coefficient gap with the US?
4. Are we facing a gradual exhaustion of the rate of improvements in the ICT performances?
5. To conclude...

1. Labour productivity Growth waves = $\left(\frac{GDP}{\sum \text{hours worked}} \right)$

Average annual growth rate of labor productivity per hour

Smoothed indicator (HP filter, $\lambda = 500$) - Whole economy - 1891-2014 - In %

Source : Bergeaud, Cette and Lecat (2014)



* Germany, France, Italy, Spain, the Netherlands, Belgium, Portugal and Finland

1. Labour productivity Growth waves

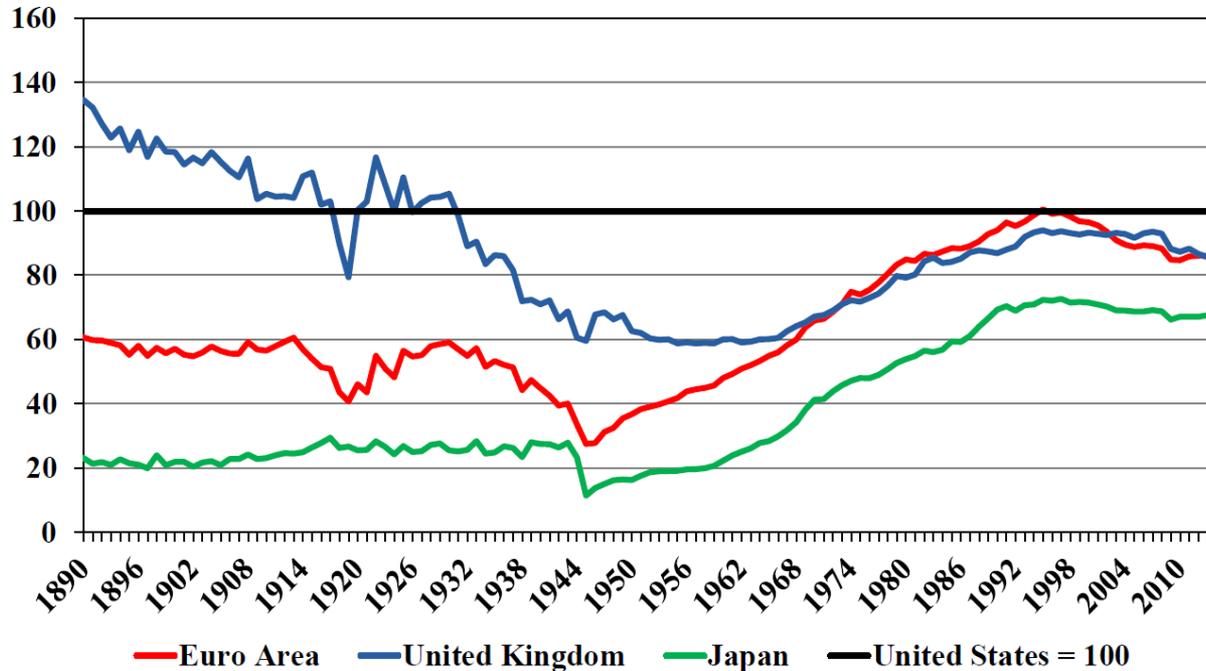
- Labor productivity waves: **3 industrial revolutions** (Gordon, 2012, 2013; Bergeaud, Cett and Lecat, 2013, 2014; ...):
 - End of XIXth Century (steam engine, railways...)
 - Middle of the XXth Century (electricity, internal combustion engine, chemistry, ...)
 - End of the XXth Century (ICTs)
- **Delay of non-US countries** compared to the US (BCL, 2013, 2014; Craft and O'Rourke, 2013...)
- **Decline of productivity growth** at the beginning of the XXI Century, before the GR (same; ...)
- **Different story for 2 decades in core and peripheral European countries**, from capital allocation driven by real interest rates (Cette, Fernald and Mojon, 2015)

2. Labour productivity levels

Labor productivity per hour - Level relative to the US level

Whole economy – 1890-2014 – US level = 100 - \$ 2010 PPP - ln %

Source : Bergeaud, Cette and Lecat (2014)



2. Labour productivity levels

- **Catch-up achieved in the 1990s, for the EA,**
From non-structural factors: lower working time and/or employment rate (Bourles and Cette, 2005, 2009)
- **Increasing gap from the 1990s**
- > **Numerous explanations:**
 - Technology diffusion (BCL, 2013, 2014, 2015; OECD, 2015; ...)
 - Institutions and regulations (Same; Clark and O'Rourke, 2013 ; Van ark, 2015; ...)

2. How to explain the productivity slowdown from the early 2000? (1)

“A candidate to explain the productivity slowdown could be a sharp slowdown of the ICT capital deepening process” (with possible 2 components):

- a) a lower decrease of the ICT relative price, ... (cf. figure)
- b) a slowdown of the ICT diffusion

**Annual average growth rate of investment price relative to GDP price
In the United states - 1960-2014 - in %**

Source: BEA

	1959-2014	1959-1974	1975-1995	1995-2004	2004-2014
Investment	-0.59	-0.48	-0.54	-1.05	-0.44
ICT	-5.49	-4.61	-6.17	-7.67	-3.35
Computers	-17.96	-22.70	-18.37	-18.99	-8.31
Software	-4.07	-4.45	-5.29	-2.96	-1.89
Others	-2.46	-1.31	-1.93	-5.01	-2.94

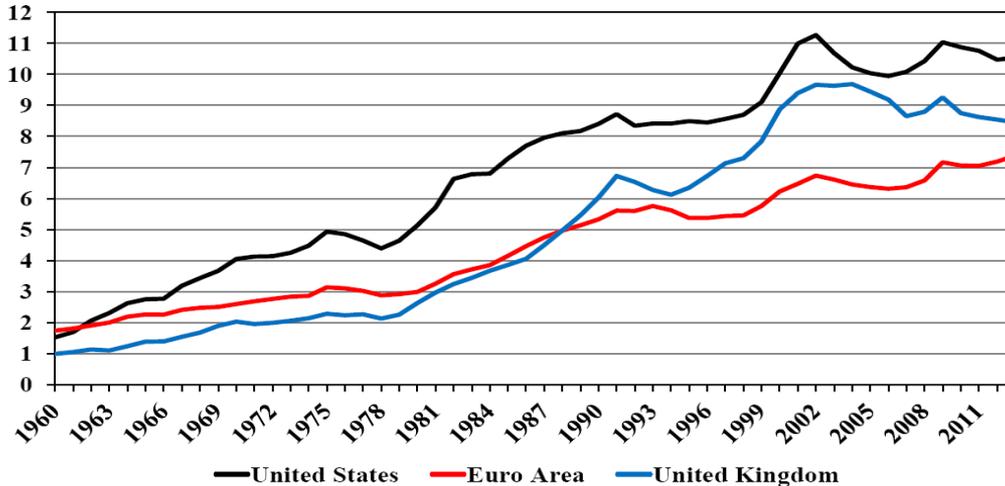
2. How to explain the productivity slowdown from the early 2000? (2)

b) The slowdown of the ICT diffusion:

- ICT capital coefficient rose in the 1980s and 1990s = growth in the ICT diffusion
- Maximum at the beginning of the 2000s
- **Stagnation of the ICT capital coefficient since 2000**

ICT capital coefficient (x100), at current prices (Ratio of ICT capital stock to GDP in current prices) -
Scope: The whole economy - 1970-2013

Source: Cette, Clerc and Bresson (2014) from OECD data

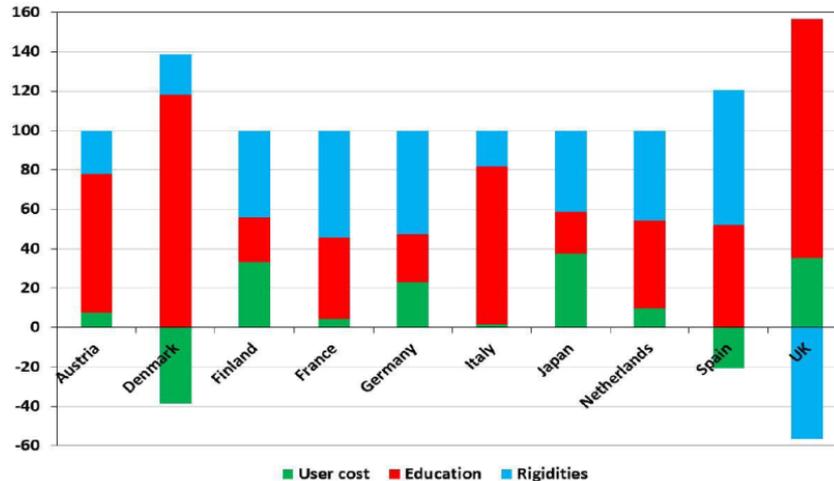


3. Sources of ICT capital coefficient gap with the US in 2007

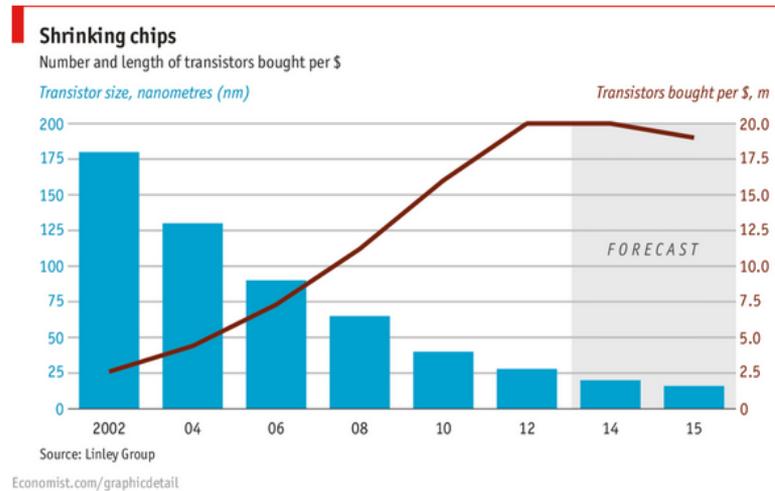
- by 2012, US ICT capital investment = 30% higher than in the EA
- **Explanation of the international differences**
 - post secondary education
 - flexibility in the firms organisations and labor market regulations
 - competition and market regulations

In % of the gap - Scope: the whole economy

Source: Cetto and Lopez (2012)



3. Are we facing a gradual exhaustion of the rate of improvements in the ICT performances?



- There is a **debate on the statistics** relative to the prices (cf. Byrne, Oliner & Sichel on the chip price mis-measurements)
- Nevertheless, **the focus is no more on the clock speed but on the heat reduction... which could be seen as a slowdown of chip performance gains**

3. Are we facing a gradual exhaustion of the rate of improvements in the ICT performances?

- a dramatic productivity slowdown has happened in the US and other developed areas...
- this productivity slowdown seems to be at least partly linked to a decrease of ICT / chips performance gains...

➔ What to expect in the future concerning ICT performances and productivity growth?

A : More on the Moore's law ?...



1974-2004

2004-2012

ITRS (thanks to "3D", quantum computing, biochips ...)

Byne – Oliner- Sichel

Gordon - Pillai

B : Other techno-optimistic arguments :

- Improvements for robotics (Pratt)
- Gains of research efficiency (Mokyr)
- Big date, IA, 3D printing... (Brynsolfsson & McAfee)
- Rise of China, India ... (Fernald & Jones)
- Structural reforms (Cette, Fernal & Mojon) - (Cette, Lopez & Mairesse - 2014)