CONSEIL D'ORIENTATION DES RETRAITES
Séance plénière du 25 novembre 2021 à 10h00
« Choix des hypothèses économiques de long terme »

Croissance de la productivité horaire du travail : que peut-on espérer ?

Gilbert Cette, propos introductif à la 1ère table ronde du colloque du COR du 15 novembre 2021

Growth and productivity over the long term: Retrospective and prospective view

Conférence organisée par le COR

« **Le COR est-il trop optimiste?** »

Paris, Lundi 15 novembre 2021

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Growth and productivity over the long term:
Retrospective and prospective view

Content

1. Introduction - Takeaways

➢ **Productivity growth is the main factor of GDP per capital growth**
➢ **Huge decrease of the productivity growth over the last decades**
  Historical minima (except war periods) currently observed
➢ **Productivity puzzle: simultaneously global productivity slowdown and analyses indicate large impact on productivity from ICTs, robots and digitalization**
➢ **The digital revolution: Strong potential, need for structural reforms to benefit fully from this opportunity**
➢ **'Anthropogenic' circular relationship: ↘ r^* → ↘ g^* and ↘ g^* → ↘ r^***
  Only way to escape from this *secular stagnation* trap: Positive shock on g^*
➢ **Three phases for a dynamic growth:**
  o **In the short term (i): Demand effects from growth enhancing policy mix**
  o **In the medium term (ii): Supply effects from policies increasing potential GDP level**
  o **In the long term (iii): Other supply effects from policies gradually increasing productivity and GDP growth**
  Some personal evaluations show that from phase (ii) we could benefit from a potential growth of 2% to 2.5%
➢ **Possibly a productivity significant acceleration from a faster digitalisation after the COVID crisis**
➢ **Low or high growth scenario remain both possible**

1. Introduction - Takeaways

➢ **La croissance de la productivité est le premier facteur de croissance du PIB par habitant sur longue période**

➢ **Fort ralentissement de la productivité sur les dernières décennies**
   Nous sommes actuellement à des minima historique (hors périodes de guerres)

➢ **Enigme de la productivité : faible croissance de la productivité alors que de nombreuses études indiquent un fort impact des TIC, des robots et de la digitalisation**

➢ **La révolution numérique : fort potentiel, et besoin de réformes structurelles pour tirer le plus grand bénéfice de cette opportunité**

➢ **Relation circulaire 'anthropique' : ↘ r^* → ↘ g^* et ↘ g^* → ↘ r^***
   Seule voie de sortie de cette trappe à se*cular stagnation* : un choc positif sur g^*

➢ **Trois phases pour une croissance dynamique :**
   o **A cout terme (i) : Effets demande d'un *policy mix* très accommodant**
   o **A moyen terme (ii) : Effets d'offre de politiques augmentant le niveau potentiel du PIB**
   o **A long terme : Autres effets d'offre de politiques augmentant graduellement la croissance de la productivité et du PIB**
   Evaluations personnelles : à partir de la phase (ii), la croissance potentielle pourrait être de 2% à 2.5%

➢ **Possible accélération de la productivité après la crise de la COVID, liée à une accélération de la numérisation de l'économie**

➢ **Des scénarios à faible ou forte croissance demeurent plausibles**

2. Over the long term
Productivity is the main growth factor

Changes in GDP per capita from 1890 to 2019 – PPP $ 2010
Source: Bergeaud. Cette and Lecat (2016) - See: www.longtermproductivitv.com
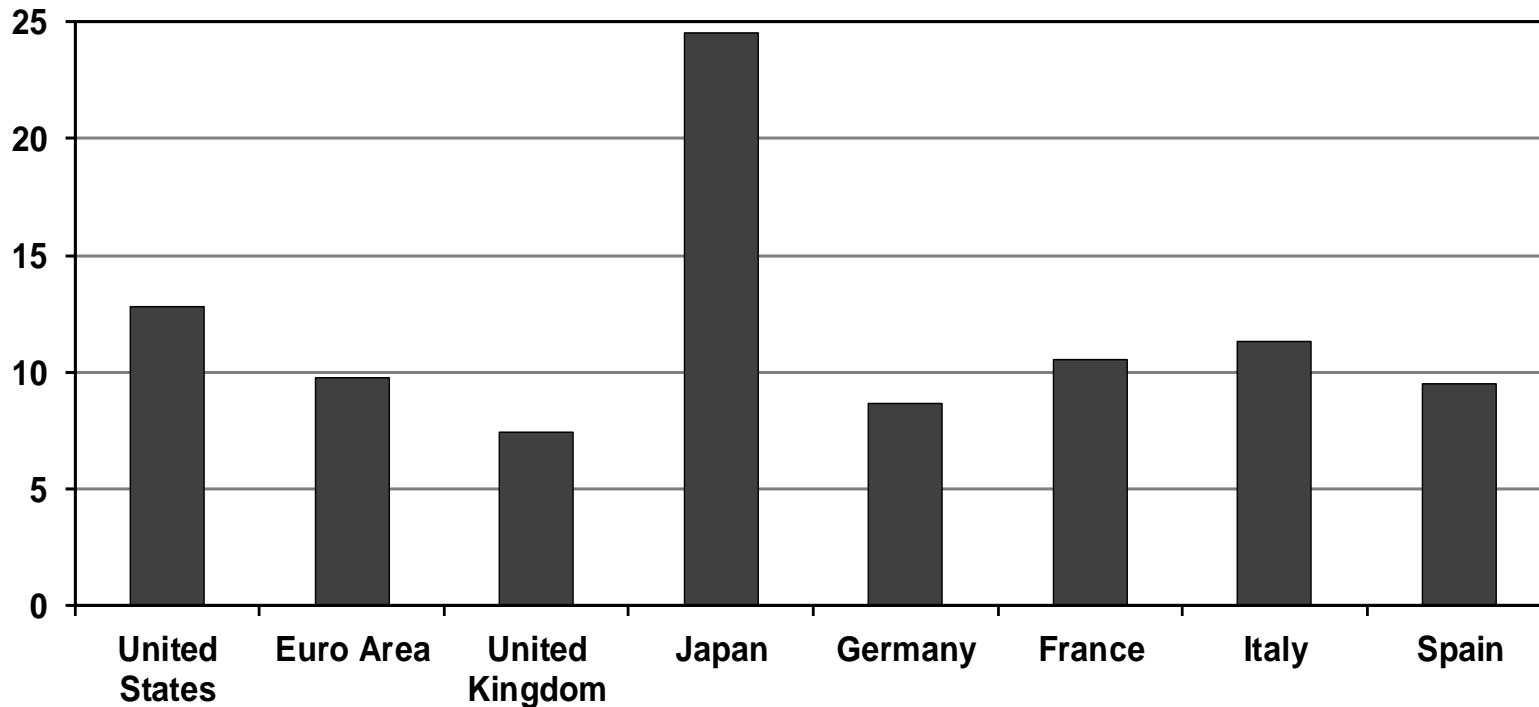
- o Very strong change in GDP per capita from 1890 to 2019
- o From 1890 to 2019, level of GDP was multiplied by a factor of 7 (UK) to 25 (Japon)
- o These differences are linked to the initial level (in 1890) and to the catch up process after
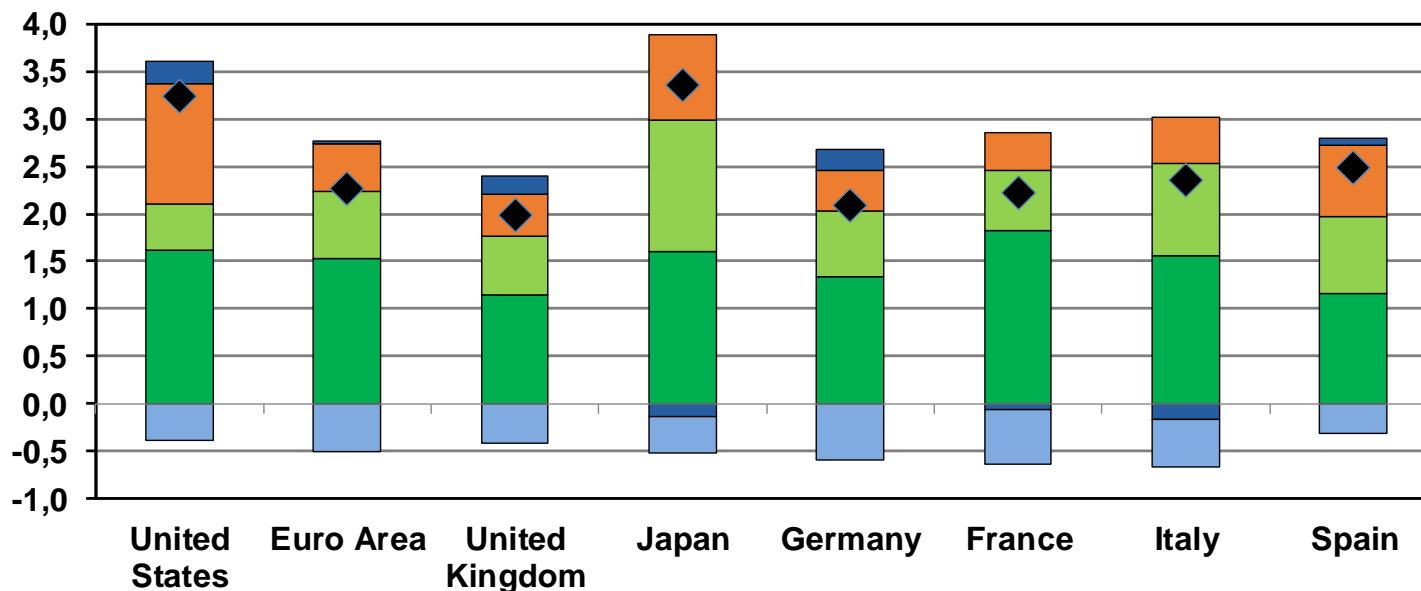
2. Over the long term
   ## Productivity is the main growth factor

Factors of GDP growth from 1890 to 2019 – accounting decomposition
Changes (in %) and contributions (in pp) annual averages
Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com


- Strong contribution from the hourly labor productivity: from 1.7 (UK) to 3.0 (Japan) pp
- Within hourly labor productivity, strong contribution from TFP: from 1.1 (UK) to 1.6 (Japan) pp
- Population contribution always positive, working time contribution always negative

3. A declining growth over the long term …

Growth of GDP per capita from 1890 to 2019
Average annual growth rate - in % (HP filter, λ = 500)
Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com
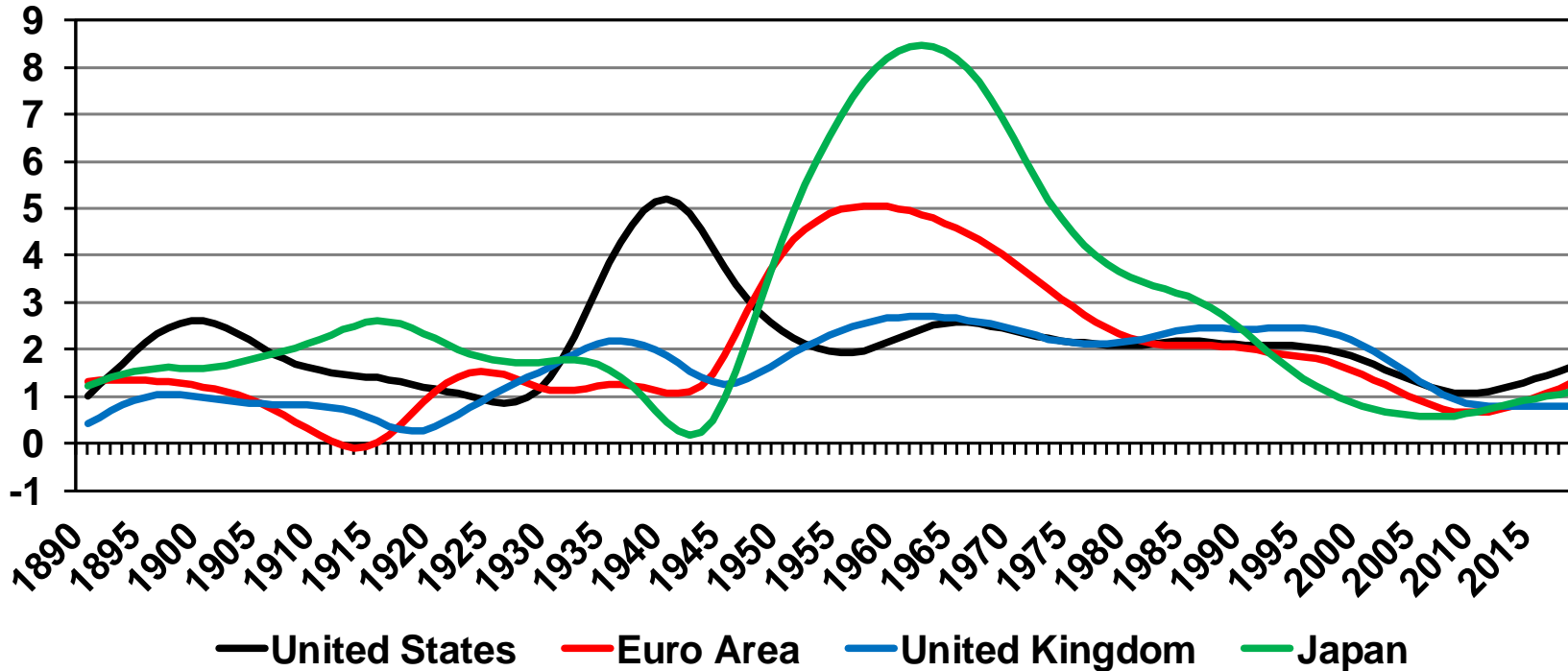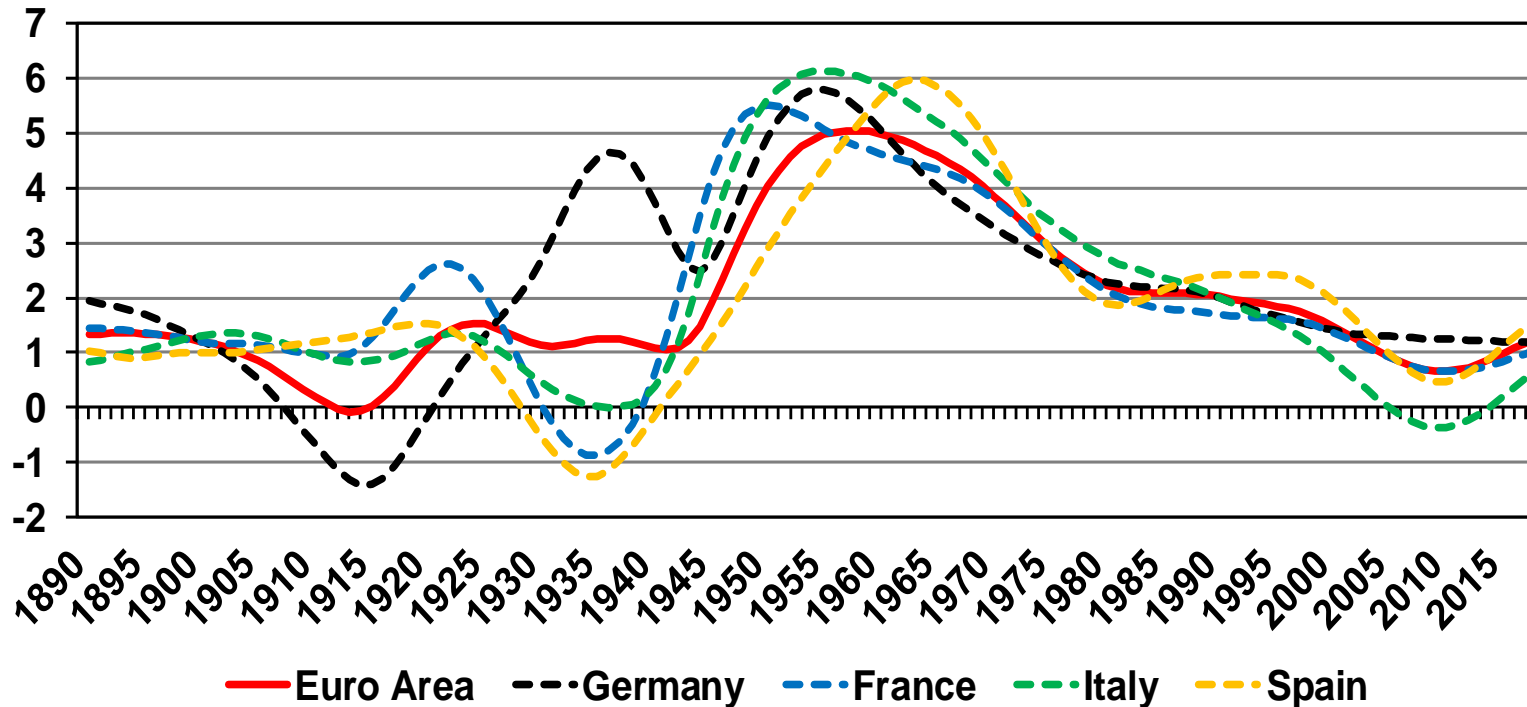

- o Decrease in GDP per capita growth in the US since the 1990s
- o Decrease also in the EA, in the UK and in Japan
- o Historical minima (except war periods) currently observed
- o **Risk of *Secular Stagnation*?**

3. A declining growth over the long term …

Growth of GDP per capita from 1890 to 2019
Average annual growth rate - in % (HP filter, λ = 500)
Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com

o The decrease in GDP per capita growth also observed in the large EA countries
o Historical minima (except war periods) currently observed
o **Risk of *Secular Stagnation*?**

4. … Mainly from the productivity slowdown

GDP annual growth (in %) and contributions (in pp) – Whole economy
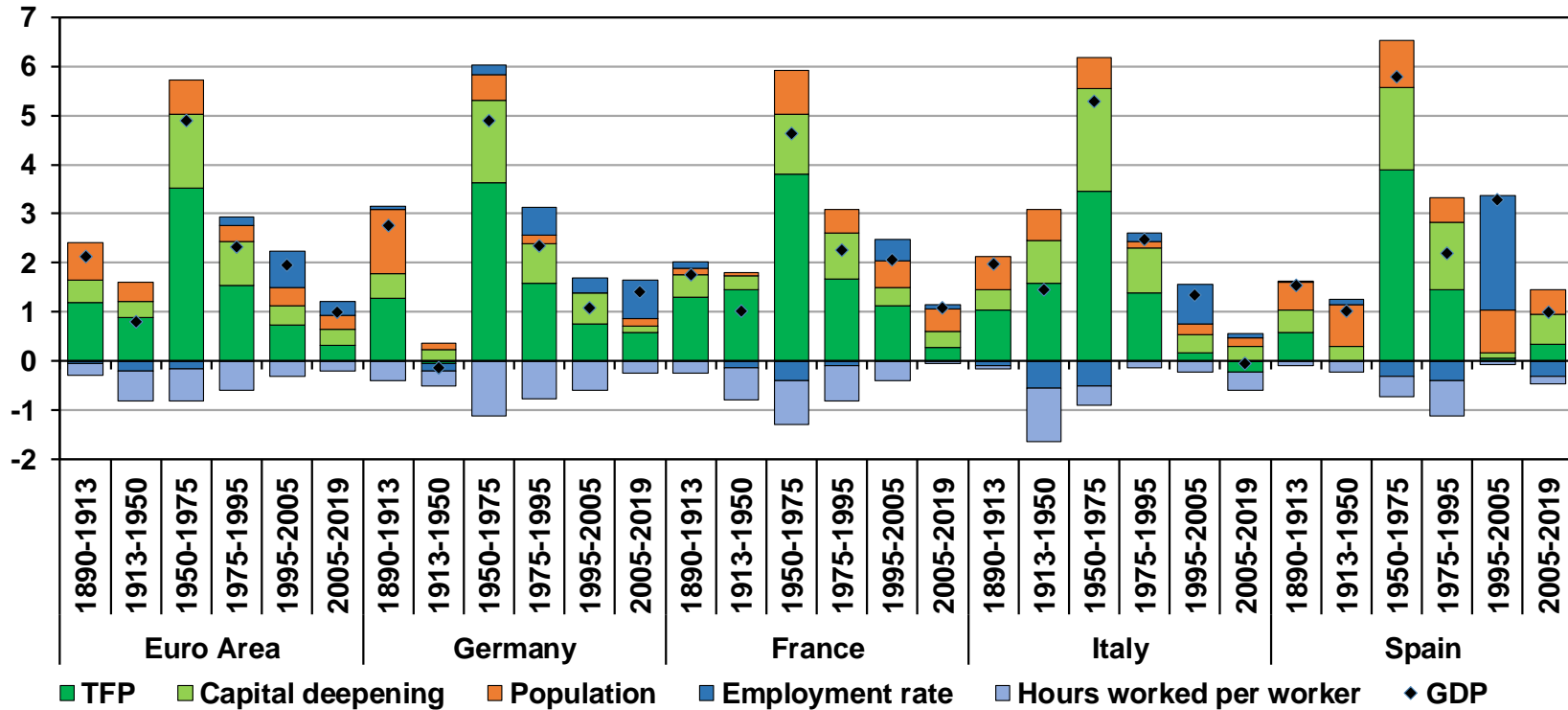Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com
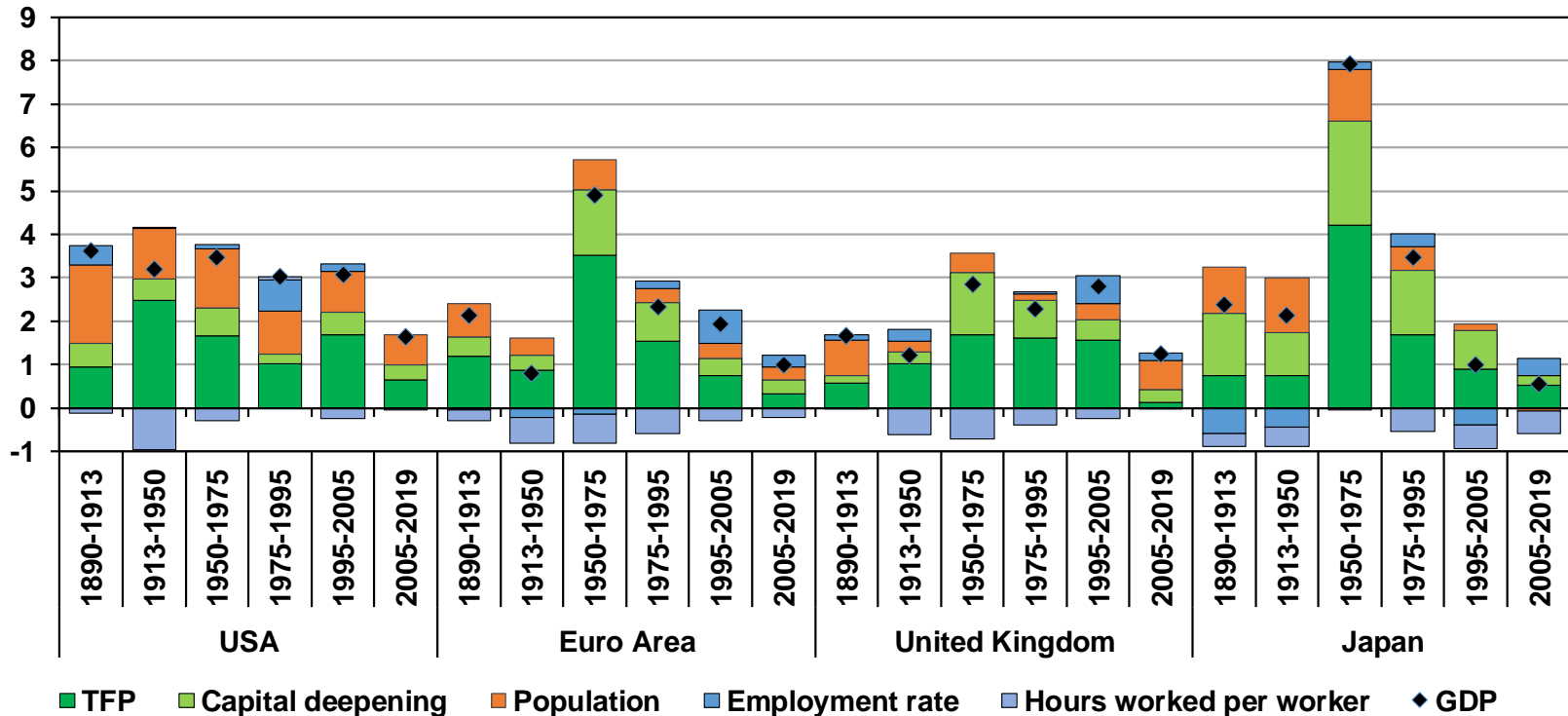
- o Main GDP growth driver: Productivity growth; and within productivity growth: TFP growth
- o Since WW2, growth decrease in the main developed areas
  Except for 1995-2005 in US and UK thanks to ICTs
- o Main factor of this growth decrease: TFP slowdown
- o **Risk of Secular Stagnation?**

4. ... Mainly from the productivity slowdown

GDP annual growth (in %) and contributions (in pp) – Whole economy
Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com


- Same slowdown in the main EA countries
  Except in Spain, over 1995-2005, but unsustainable growth
- Main factor of this growth decrease: TFP slowdown
- **Risk of Secular Stagnation?**

4. … Mainly from the productivity slowdown

Average annual growth rate of labor productivity per hour
Smoothed indicator (HP filter, λ = 500) **- Whole economy – 1891-2019 – In %**
Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com
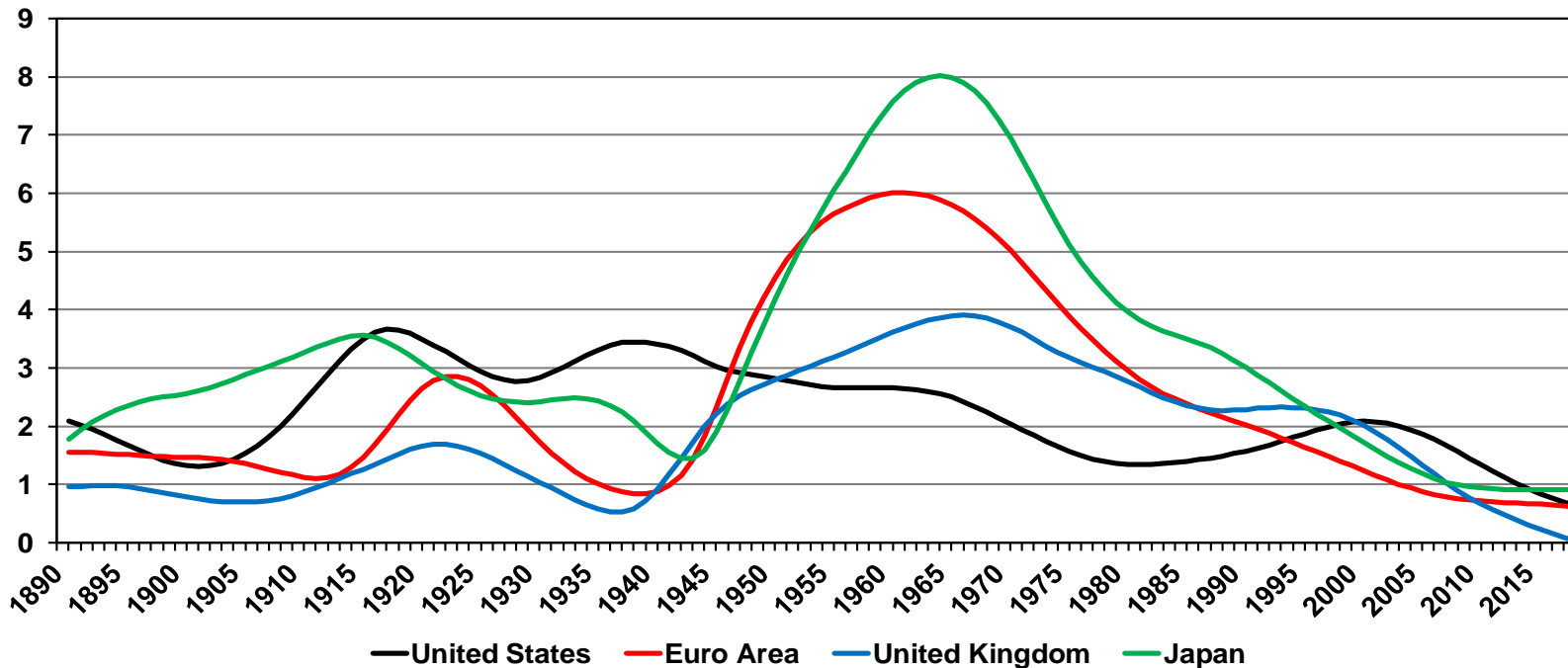
o   US: one big wave over the XXth Century, pause during the Great Depression
    Decrease since WW2, with a small (ICT) wave between 1995-2005
o   In non-US areas, delay for the big wave, decrease since the 1970s
    Small (ICT) wave in the UK between 1995-2005
o   Huge decrease from the mid 2000s in all areas
o   Historical minima (except war periods) currently observed
o   **Risk of *Secular Stagnation*?**

4. … Mainly from the productivity slowdown

Average annual growth rate of labor productivity per hour
Smoothed indicator (HP filter, λ = 500) - **Whole economy – 1891-2019 – In %**
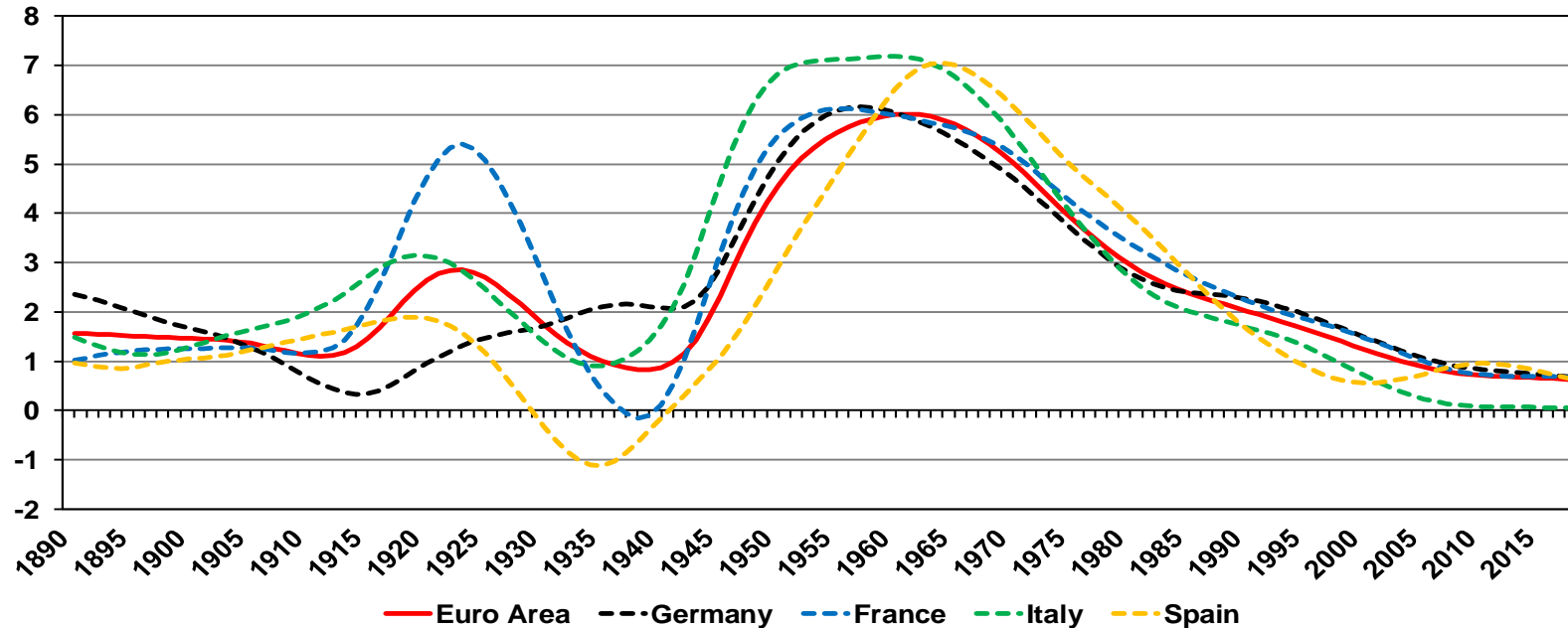Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com

o In the main EA countries, delay for the big wave, decrease since the 1970s, no small wave 1995-2005
o Huge slowdown from the mid 2000s in all areas
o Historical minima (except war periods) currently observed
o **Risk of *Secular Stagnation*?**

4. ... Mainly from the productivity slowdown

Average annual growth rate of labor productivity per hour
Whole economy – 1890-2019 – In %
Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com

	1890-1913	1913-1950	1950-1975	1975-1995	1995-2005	2005-2019
United States	1,57	3,09	2,42	1,31	2,46	1,06
Euro Area	1,73	1,26	5,37	2,59	1,26	0,69
Japan	2,32	1,79	7,12	3,39	1,98	0,81
United Kingdom	0,78	1,35	3,31	2,64	2,27	0,45
Canada	2,30	2,17	3,02	1,27	1,56	0,78
Australia	-0,49	1,18	2,66	1,25	1,91	1,15
Germany	1,87	0,20	5,69	2,55	1,54	0,77
France	1,84	1,79	5,35	2,78	1,66	0,66
Italy	1,54	2,56	5,94	2,45	0,60	0,06
Spain	1,10	0,29	5,96	3,00	0,19	1,02
Netherlands	1,08	2,00	4,00	1,68	1,76	0,40

o   Golden Age: 1913-1950 in the US, 1950-1975 in other advanced countries
o   Productivity slowdown since the Golden Age (except the short 1995-2005 revival in the US)
o   In all advanced countries and areas, historical minima (except war periods) currently observed
o   **Risk of *Secular Stagnation*?**

5. *Secular stagnation* and *productivity puzzle*

➢ *Secular stagnation*?

   o The expression *Secular Stagnation* used for the first time by A. Hansen (1939)
     In this paper, A. Hansen used this expression only once in the sentence:
     « *This is the essence of **secular stagnation** – sick recoveries which die in their infancy and depressions which feed on themselves and leave a hard and seemingly immovable core of unemployment.* »
     (A. Hansen, 1939, p. 4)

   o History has disproved Hansen

   o Larry Summers (2013, 2014, 2015, …) has used this expression to describe the current weak growth
     His meaning of *Secular Stagnation* is through **demand channels**:
     Weak growth is linked to a lack of demand

➢ But other approaches to *Secular Stagnation* stress **supply channels**:
   Weak growth is linked to a lack of productivity gains

5. *Secular stagnation* and *productivity puzzle*

➢ **Demand based approaches**
L. Summers (2013, 2014, 2015, …); B. Eichengren (2015); …

- o **Imbalance: savings > investment - S*avings glut and* lack of investment**
  - ✓ Multiple causes of the ***savings glut***: Increasing importance of emerging countries with high savings rates (including China, …); Increase of income inequalities; Increasing importance of high savings companies (Google, Amazon, Facebook, Apple …); …
  - ✓ Multiple causes of the **lack of investment:** population slowdown; Investment price decrease; Investment opportunity decline; Risk premium increase; High real interest rates; …

- o **'*Usual*' economic policies are inappropriate to stimulate demand**
  - ✓ Fiscal policies are constrained, except in some countries (Germany, The NdL, …)
  - ✓ Monetary policies are also constrained by the ZLB and very low inflation rates
  - ✓ Poor coordination in Europe: Large savings surpluses in Germany and The NdL

- o **How to respond?** (for L. Summers, 2015)
  - ✓ **Non-conventional monetary policies** increase financial bubble risks
  - ✓ **Structural policies** may decrease inflation and thereby the gap between natural and effective real interest rates (Eggertsson, Ferrero, Raffo, 2013, …)
  - ✓ Only advice: **More fiscal spending maximising the multiplier effect** and growth in the medium to long term (infrastructure …)

5. *Secular stagnation* and *productivity puzzle*

➤ **Supply approaches**
R. Gordon (2012, 2013, 2014, 2015) ; …

o **Exhaustion of productivity gains in all countries** (Bergeaud et al. 2019; Gordon and Sayed, 2020; …)

✓Early end of the 3rd industrial revolution?
✓Weak impact of GDP measurement difficulties (Byrne, Fernald and Reinsdorf, 2016; Syverson, 2016; Feldstein, 2017; …)

o **Productivity puzzle: simultaneously global productivity slowdown** and **firm level analyses indicate large impact from ICTs, robots and digitalization on productivity** level/growth
For instance among others:
ICTs: Jorgenson and Stiroh (2000), Inklaar *et al.* (2020) …
Robots: Acemoglu *et al.* (2020), Graetz and Michaels (2015, 2018), Aghion et al. (2020), Cette & Devillard & Spiezia (2021), …
Digitalization, see Andrews *et al.* (2018), Gal *et al.* (2019a & 2019b), Cette *et al.* (2020) …

o **Puzzling**
It reminds us of the 1987 Solow paradox: "*You can see the computer age everywhere, but in the productivity statistics*"

6. Pessimistic or optimistic views

➢ **Multiple causes of the productivity slowdown: pessimistic view**
  o Slowdown of gains from *education*
  o Exhaustion of the *Moore law* whose continuous progress i) hits physical limits (Kortum and Pillai, 2015), ii) stems from unsustainable growth of *R&D spending* (Pillaï, 2011)
  o Exhaustion of *new products emerging*: replacement; technological revolution now concerns contracted activities …
  o Declining productivity gains in R&D activities (Bloom *et al.* 2020); …

➢ **Optimistic view: likely productivity revival**
  o Increasing number of innovators (Fernald and Jones, 2015)?
  o New wave of ICT performance gains? First step: 3D chips? (ITRS, 2013a, 2013b ; Cette, 2014, 2015 ; …); Reorientation of research towards *clock speed* gains*?*; …
  o Strong potential benefits from existing technologies? '*More than Moore*' *process*? (ITRS, 2013b; Mokyr *et al.* 2015; …)
 o **Digital revolution**

6. Pessimistic or optimistic views

➢ **The digital revolution**
- o **Strong potential** (Bart Van Ark, 2016; Branstetter and Sichel, 2017; Brynjolfsson et al., 2014, 2017, 2018; …)
- o Long time lag usually from initial innovations to generalised impact (David, 1990; …)
- o **First activities directly concerned**: transportation, financial activities, retail … All activities will be impacted in one way or another …
- o But need adapted institutions (Brynjolfsson and McAfee, 2014; …)
- o **Employment risks**: to manage the workforce transfers
- o The digital revolution is an **historical opportunity** that we must not miss
- o The productivity acceleration from it is **the only easy financing source of the headwinds** that we face: ageing population, State dis-indebtedness, environmental investment… And expectations of purchasing power gains (cf. French yellow jacket movement).
- o Need of **structural reforms** to benefit fully from this opportunity
- o To miss this opportunity would condemn us to a downgrading process (to become '*the Argentina of the XXI century*').
  Without this financing source, our social model (and further, democracy itself…) could be under threat

6. Pessimistic or optimistic views

➢ **ICT Capital Coefficient, 1960-2019**
Ratio of ICT capital stock to GDP in current prices, in %
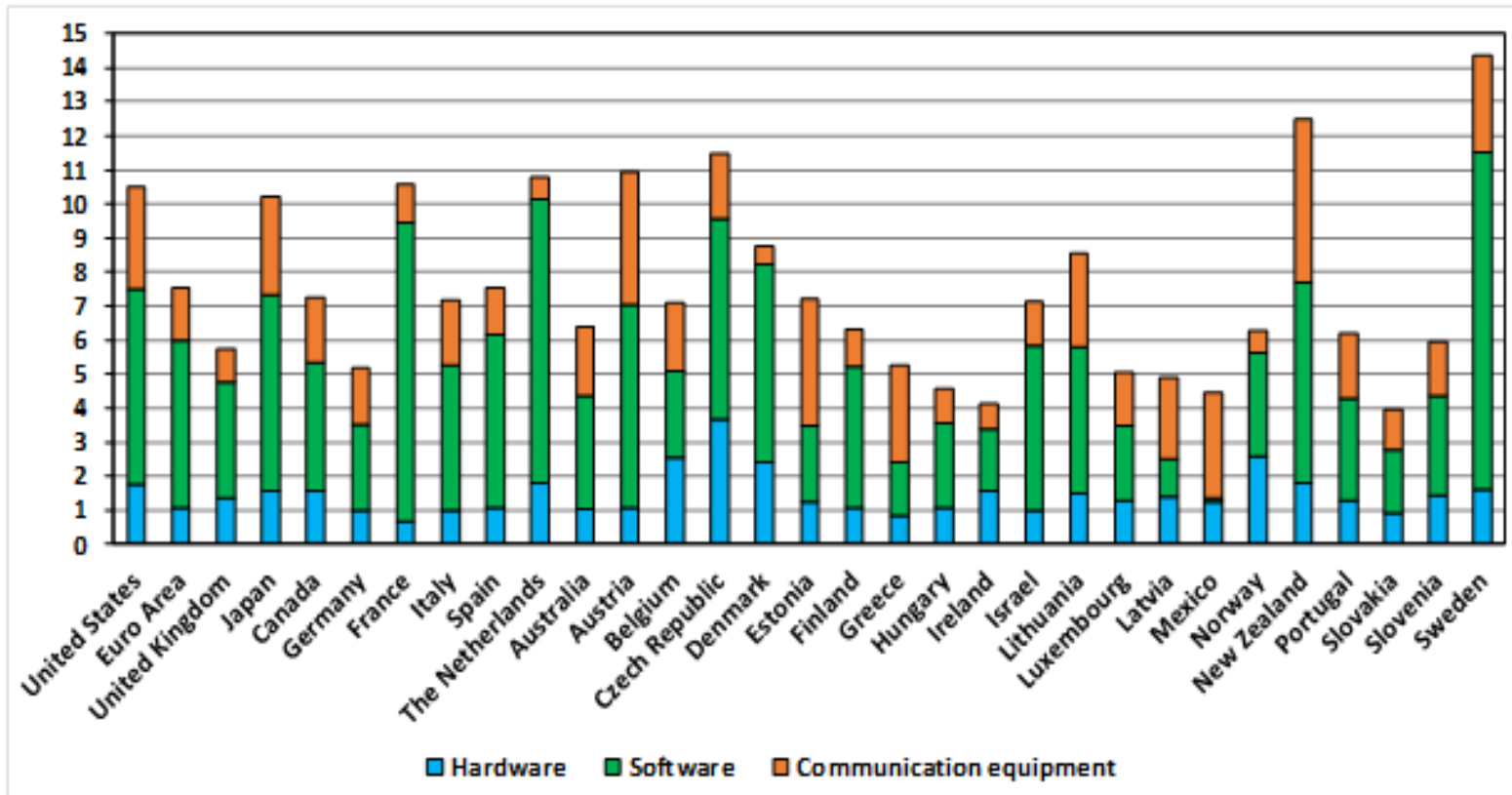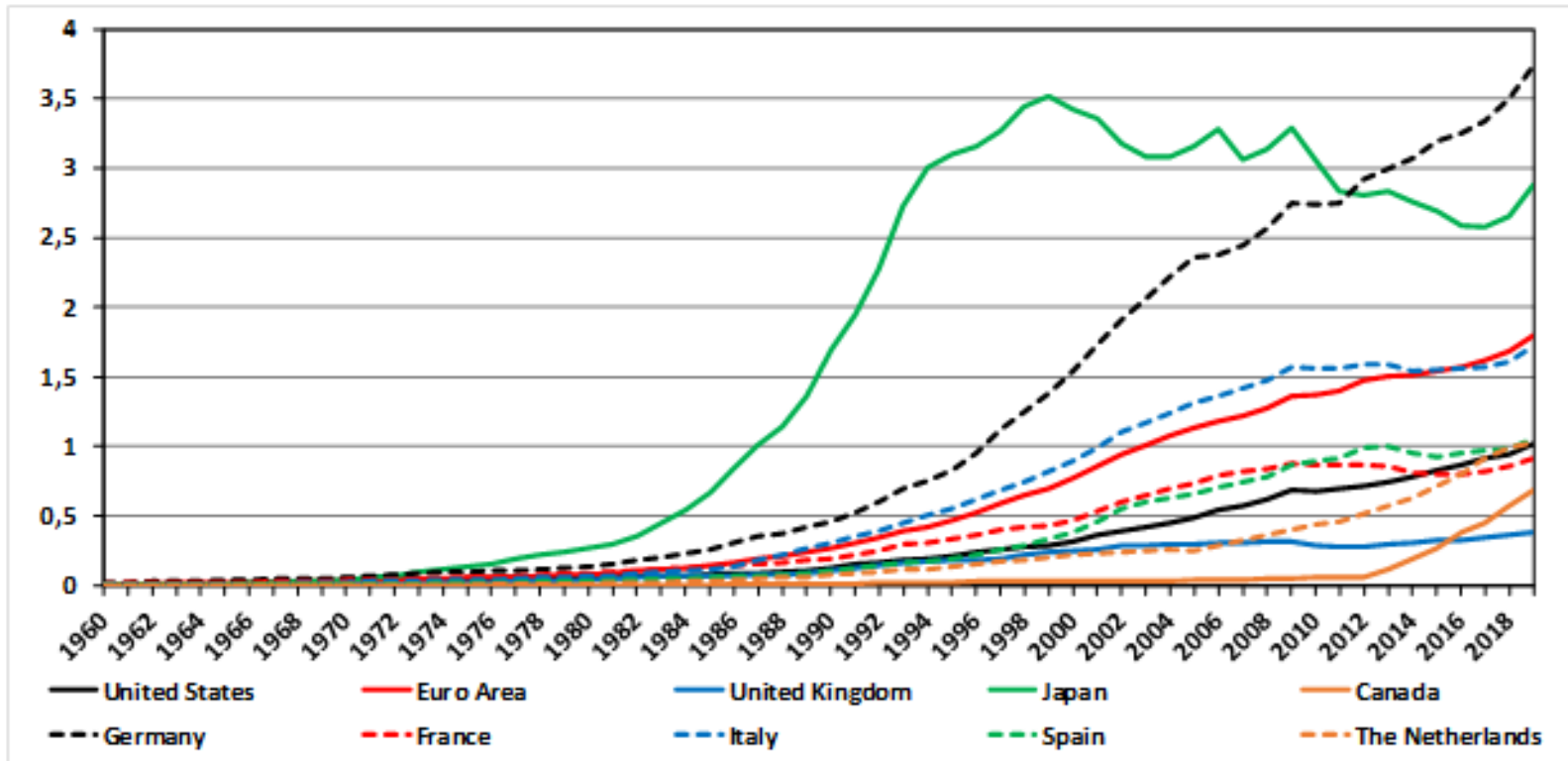Source: Cette, Devillard & Spiezia (2021)
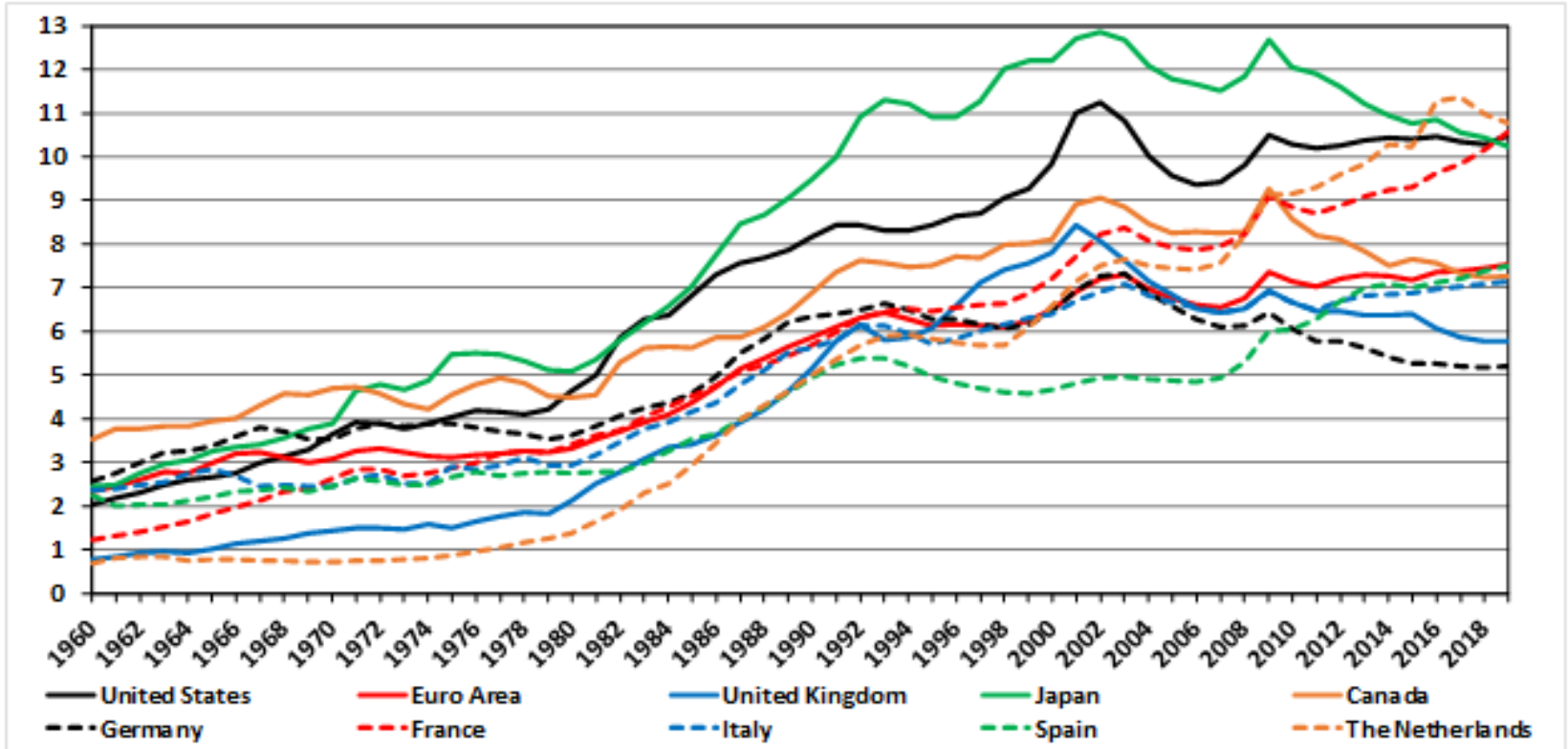
o Increasing ICT diffusion until the early 2000s
o Stable diffusion since
o Exhaustion of the ICT diffusion?

6. Pessimistic or optimistic views

➢ **ICT Capital Coefficient, 2019**
Ratio of ICT capital stock to GDP in current prices, in %
Source: Cette, Devillard & Spiezia (2021)

o Exhaustion of the ICT diffusion at contrasted levels
o In 2019, highest diffusion: Sweden
o Among large countries, highest diffusion: US, France

6. Pessimistic or optimistic views

➢ **Robot diffusion, 1960-2019**
  Number of robots per million hours worked
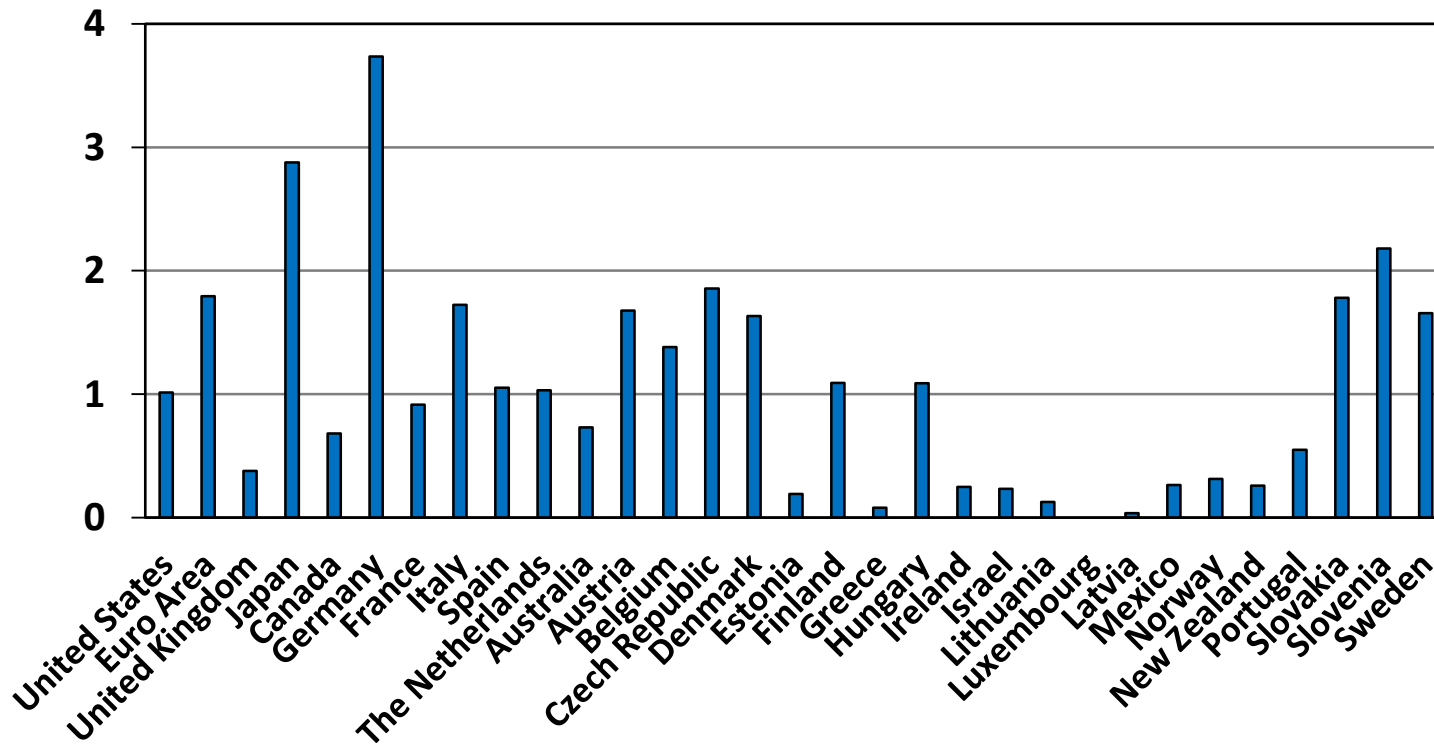 Source: Cette, Devillard & Spiezia (2021)

o Increasing robot diffusion in all countries, except in Japan from the early 2000s

6. Pessimistic or optimistic views

➢ **Robot diffusion, 2019**
Number of robots per million hours worked
Source: Cette, Devillard & Spiezia (2021)

o Contrasted level of robot diffusion
o In 2019, highest diffusion: Germany, Japan

7. A circular relationship between *r** and *g*?*

➢ **On individual data, results apparently contrasted in the literature regarding the impact of financial constraints/high real interest rates on average productivity growth**

   o **Favorable impact**, through cleansing mechanisms (closing of low-productivity firms and reallocation of their labour and capital to more productive firms)
   Gropp, Rocholl and Saadi (2017); …

   o **Detrimental impact**, through IT investment, R&D, innovation, management quality…
   Aghion *et al.* (2012); Duval, Hong and Timmer (2017); Manarasi and Pierri (2018); …

➢ Aghion, Bergeaud, Cette, Lecat & Maghin (2019) estimate these two mechanisms in a unifying framework, on a dataset of French firms

➢ If the two mechanisms coexist, **which one dominates currently (before the COVID crisis) at the macro level?**
   Seems to be the first one (favourable impact)
   See Reis (2013); Gopinath *et al.* (2015); Gorton-Ordonez (2015); Cette, Fernald & Mojon (2016); Borio, Kharroubi, Upper & Zampolli (2016); Bergeaud, Cette & Lecat (2020); …
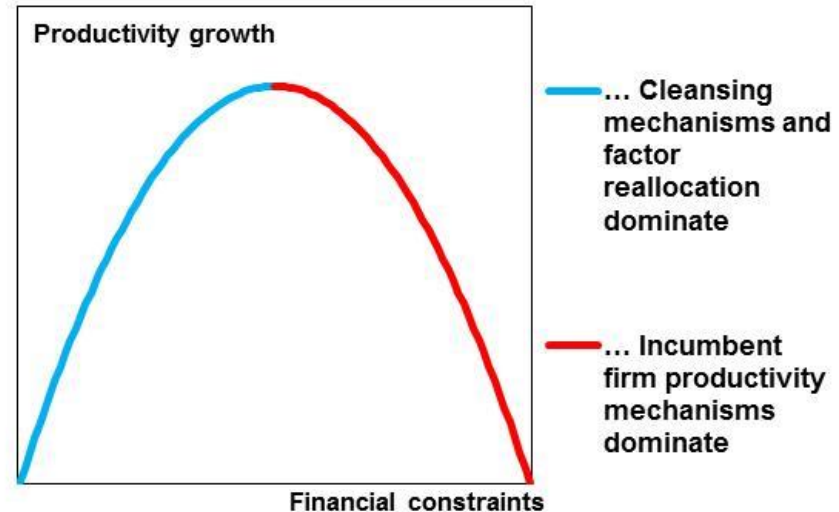
7. A circular relationship between *r** and *g**?

➢ **Productivity impact of financial constraints at the aggregate level:
An inverted U curve**
We would currently be
on the left part of the curve

Increase of *r** or more widely
of financial constrainsts
→ productivity growth increase

➢ Bergeaud, Cette & Lecat (2020, 2021) estimate **an 'anthropogenic' circular relationship:** ↘ *r** → ↘ *g** and ↘ *g** → ↘ *r**
  o **↘ financial constraints → ↘ growth** (from productivity slowdown)
  o **↘ growth → ↘ real interest rates & ↘ financial constraints**
➢ Only way **to escape from this *secular stagnation* trap**:
Positive shock on *g**

8. Scenario for the future

➢ **An optimistic scenario**
  o **Three phases for a dynamic growth**
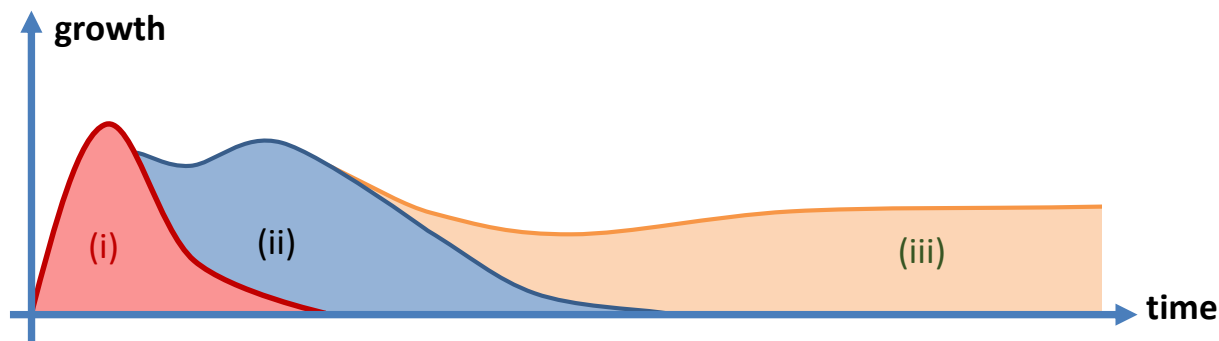
✓ **In the short term** (i): **Demand effects** of a very accomodative **policy mix**
✓ **In the medium term** (ii): **Supply effects** from policies **increasing the potential GDP level**, for instance through the increase of participation rate and the decrease of the NAIRU (pension reform, unemployment benefit reform, reforms for a better integration of young people on the labor market…, …)
✓ **In the long term** (iii): **Other supply effects gradually increasing productivity and GDP growth**: digitalisation, capital income reforms, reforms (to continue) on the product and the labor markets …

o Some **personal evaluations** show that **from phase (ii) we could benefit from a potential growth of 2% to 2.5%:**
✓ In phase 2: 1% to 1.5% from productivity and 1% to 1.5% from employment
✓ In phase 3: 1.5% to 2% from productivity and 0.5% to 1% from employment

9. Some comments

➢ **Comment 1**
  o To be significant at the global level, productivity revival now must concern **non-farming and non-manufacturing activities**
  o It is the case concerning the digital technological revolution
  o **Share in total employment**
    Source: own calculations, from National accounts, Maddison 2015, Chaigneau 1960, Marchand 1991, …

France

United States
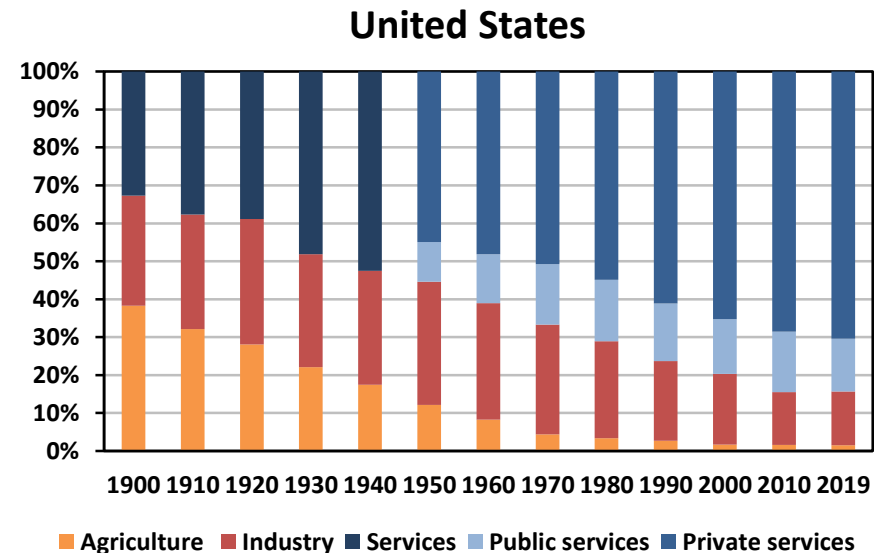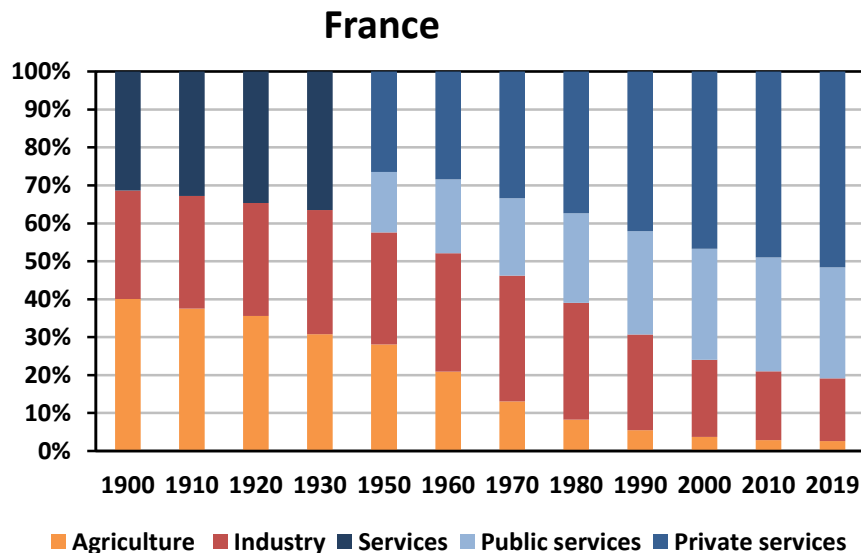
  o Increasing share of services: currently more than 80% of total employment
  o Sequencing: Productivity gains in agriculture, then in industry, now in services…

9. Some comments

➤ **Comment 2**
- ○ Huge **GDP per capita gap to catch** up compared to US situation
- ○ Large possible **increase of the potential GDP level**
- ○ **GDP per capita GAP compared to the US** (in %) **and contributions** (in pp) – 2019 – ppp2014
  - ~~Based on Bergeaud, Cette and Lecat (2016) – Source: ~~ [~~long-term-pro~~]ductivity.com
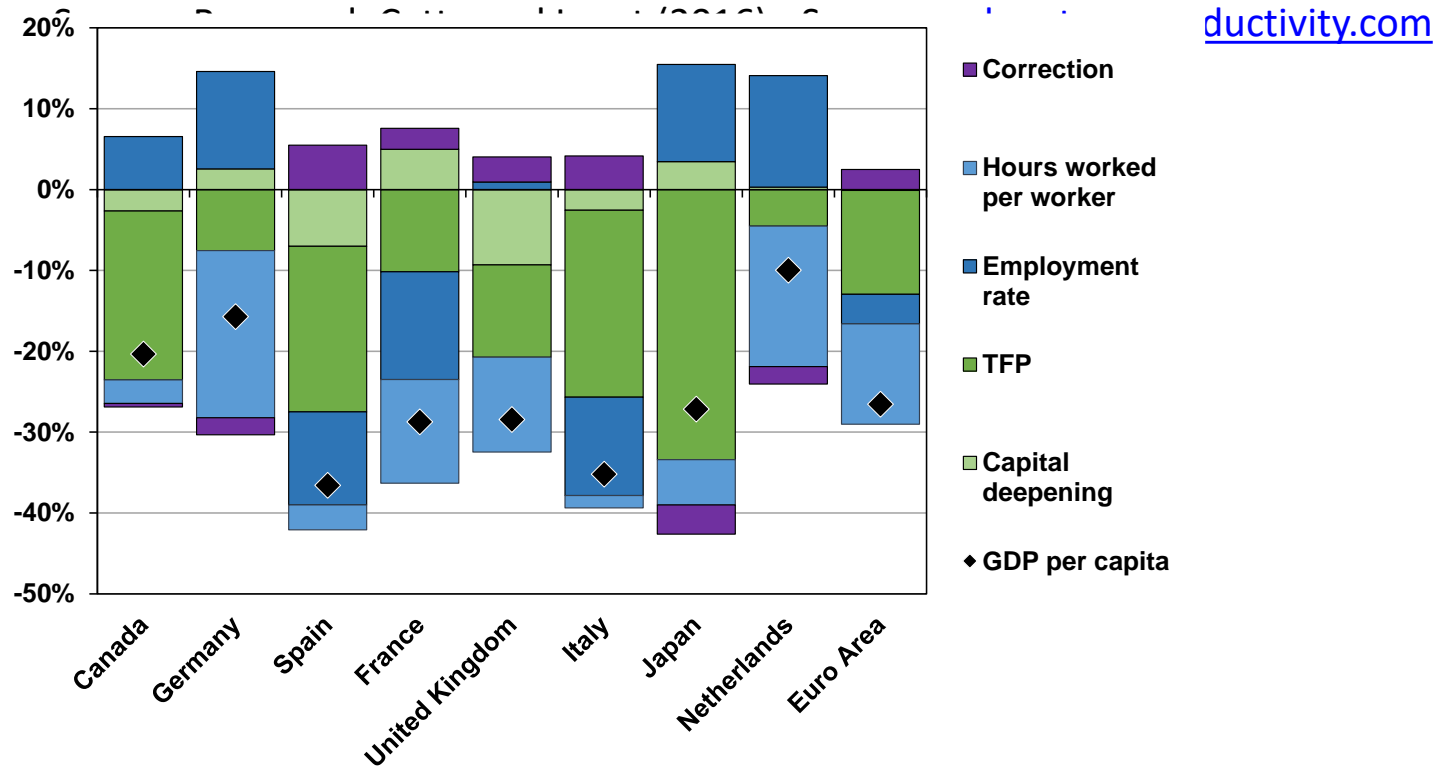
- ○ French GDP per capita GAP compared to the US: -28%
- ○ Main components: Employment rate 12pp, Hours 12pp, TFP 11 pp

9. Some comments

- ➢ **Comment 3**
  - o Risk not to benefit fully from the third industrial revolution and to become the '*Argentina of the XXI Century*' if institutions are not adapted
  - o **Need for structural reforms**
  - o **GDP per capita compared to the US** – 1820-2018 – PPP 2010
    Ratio of the GCP per capital considered country / US
    Source: Bergeaud, Cette and Lecat (2016) - See: www.longtermproductivity.com
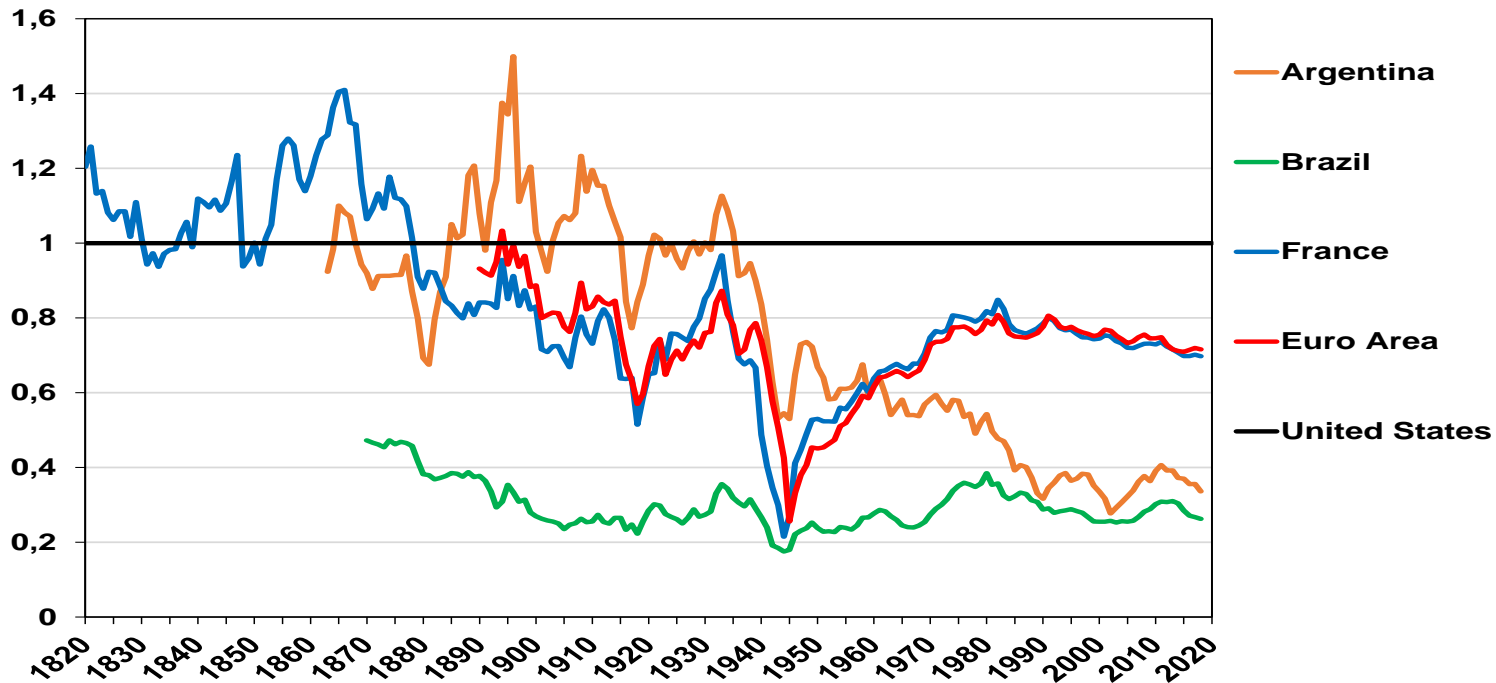
- o Huge downgrading of Argentina since the end of the 1930s
- o Downgrading of France and the Euro Area since the 1980s

9. Some comments

- ➢ **Comment 4**
  - o **Climate policies will have a detrimental impact on productivity growth**
  - o At the **world global level**, at the horizon 2100
    losses from climate policies < avoided damages → **positive net impact**
  - o At the **level of France**, at the horizon of 2100
    losses from climate policies > avoided damages → **slight negative net impact**

Impact of climate policies – Simulations with the ACCL model
Alestra, Cette, Chouard, Lecat (2021) – model ACCL, see: www.longtermproductivity.com
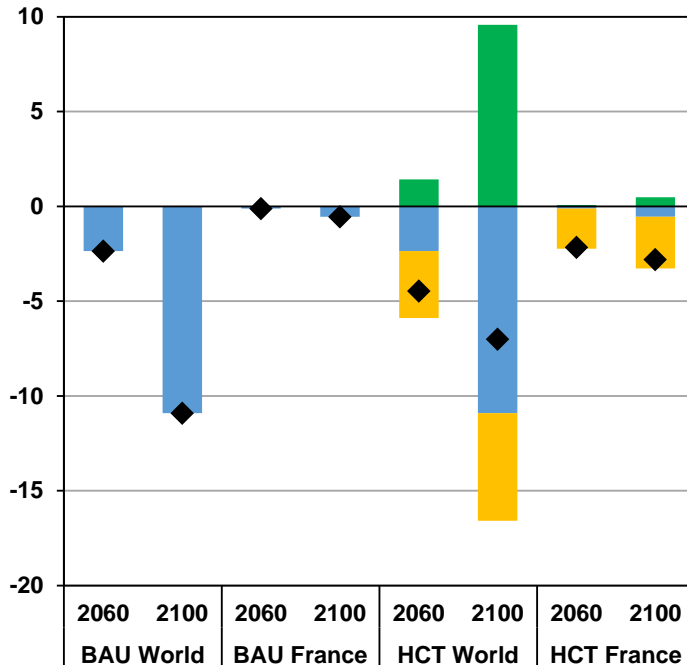
- o **BAU**: Business as usual scenario
  Temperature increase: 4.5°C
- o **HCT**: High carbon tax
  Dirty energy price increase: 3% per year in all countries
  Increase of temperature: 2°C

9. Some comments

➤ **Comment 5**
  - On the demand side…
  - **4 types of possible scenarios**

		Supply: Productivity dynamic …	
		… Depletion [1]	… Revival [2]
Demand: Decrease of savings surplus (via negative real interest rates …?)	… Unrealisable [A]	Scenario [1A] Weak potential and effective growth Weak investment and productivity gains	Scenario [2A] Potential and effective growth weakened by low investment
	… Realisable [B]	Scenario [1B] Weak potential and effective growth	Scenario [2B] Return to strong potential and effective growth

  - **Scenario [2B]:** **Target**; But how to reach it? Certainly not spontaneously…
  - **Scenario [1A]:** **Current situation of the EA**
  - **Strategy:** **Complex mix to escape from the double trap of weak growth**
    Need of saving rebalancing and structural reform implementation
    How to get a better demand coordination?
- Need for more demand from countries with structural surpluses, mainly Germany and The Netherlands
- But difficulties in achieving this better coordination:
  - ✓ Savings surpluses are located in specific countries (Ge, NdL, …)
  - ✓ Under-employment is located in other countries (Fr, It, Sp, …)

10. What to expect from the COVID crisis in the medium term?

➢ **Again, two mechanims at play,** in the context of the COVID-19 pandemic:
   o **Dramatic financial constraints decrease** from both:
      • More expansive monetary policy
      • Large fiscal support to firms
      → Reduces the exits (the cleansing channel)
         Symptom: huge observed decrease of firm failures and bankruptcies
      → Negative impact on productivity growth
   o **Huge acceleration of the digitalization, high increase of telework**
      → Positive impact on productivity growth

➢ **Which one of the two mechanisms will dominate** in the medium term?
   o Open question
   o Possibly a productivity significant acceleration

➢ **Exit strategies: two risks**
   o Not to support performant firms enough → Bankruptcies and not good allocations
   o To support unperformant firms too much and too long → No bankruptcies and bad allocation
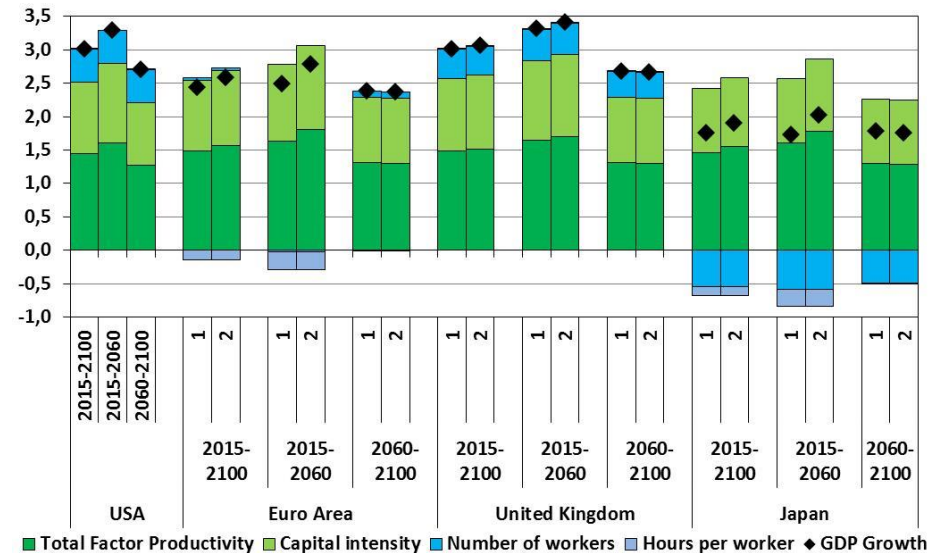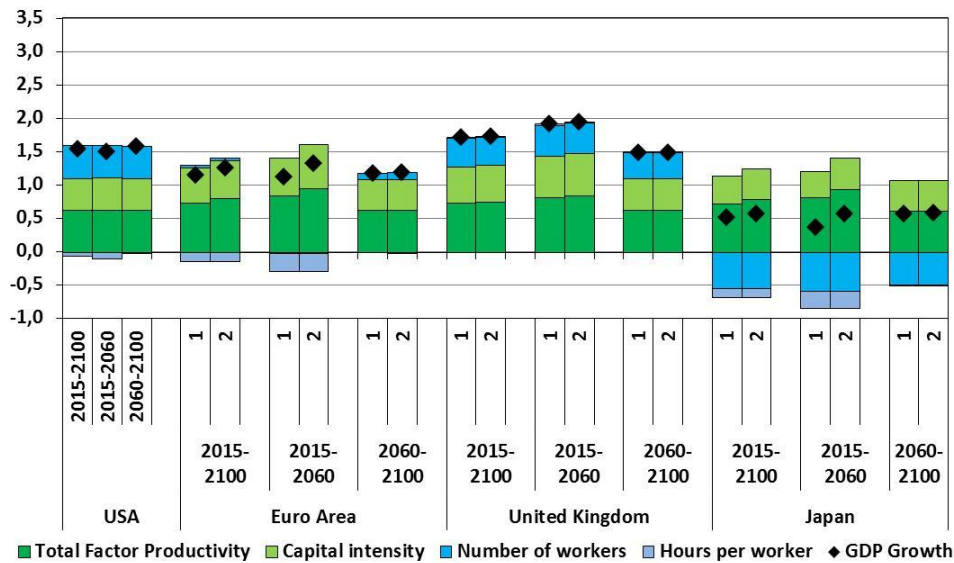   o In both both cases, productivity damage

11. Conclusion

➢**Very different possible long-term scenarios**
Source: Cette, Lecat and Marin (2017) - See: www.longtermproductivity.com

Average annual GDP growth (in %) and contributions (in pp)

Scenario: « Secular stagnation »

Scenario: « Technology shock »

o   The « technology shock » scenario would allow us to face *headwinds*