

**The productivity Puzzle in Network Industries:  
*Evidence from electricity, gas and water sectors***

by  
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# Outline

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1. About the paper
2. Methodology
3. Results and discussion
4. Final remarks

# 1. About the paper

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- Evaluates the productivity growth of network industries (EGW), period 1998-2015.
- Explores other factors that may have contributed to a slow productivity growth (productivity puzzle) after...
- Use of EU KLEMS database (latest one from 2017).
- Focus on the 6 largest economies from Europe (DEU, ESP, FRA, ITA, NLD, UK) and USA.
- Based on a previous report prepared to Ofgem (Dec. 2018)  
<https://www.ofgem.gov.uk/publications-and-updates/riio-2-sector-specific-methodology-consultation>

## 2. Methodology

- **Growth Accounting** measures the growth of economic activity by examining changes in a set of inputs (L, K) over time and by an unaccounted or unexplained growth (Solow residual).
- The residual represents the total factor productivity (TFP) growth.
- Focus on valued added only.

The production function ( $f$ ) can be represented as follows:

$$\Delta \ln Y_t = \tilde{v}^M \Delta \ln M + \tilde{v}^K \Delta \ln K + \tilde{v}^L \Delta \ln L + \Delta \ln A$$

Where  $Y$ : output,  $K$ : capital services,  $L$ : labour services,  $M$ : intermediate inputs and  $T$ : technology indexed by time

For VA growth, we have:

$$\Delta \ln VA_t = \bar{e}^K \Delta \ln K + \bar{e}^L \Delta \ln L + \Delta \ln A$$

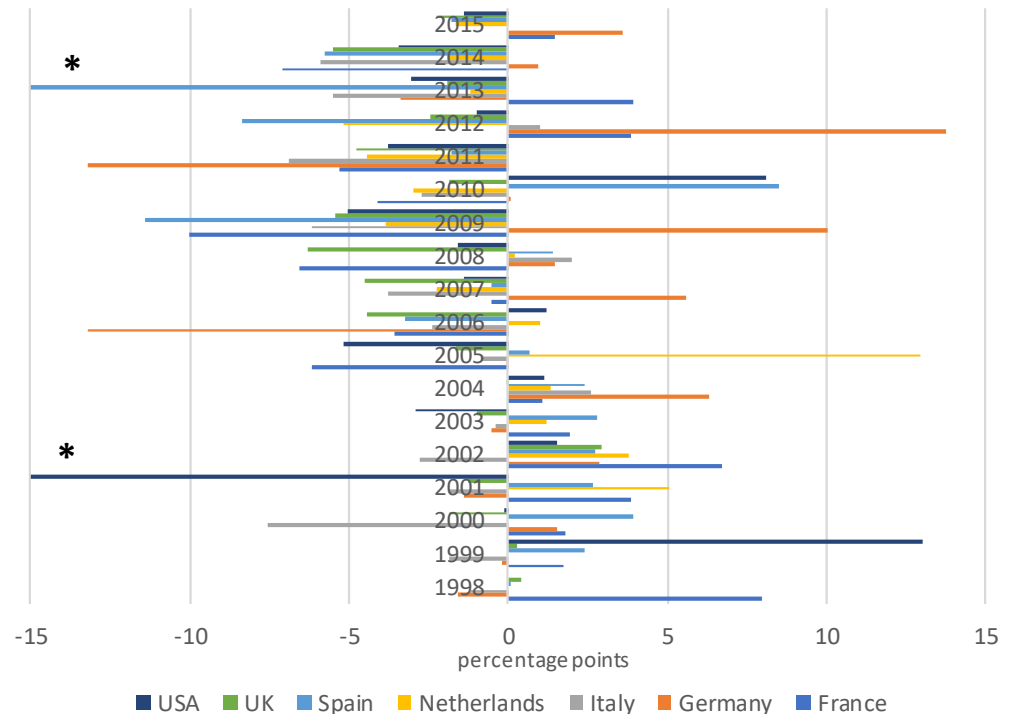
Where  $\Delta$  denotes changes between periods (t, t+1) for all the inputs, A is the TFP and  $e^{-k}, e^{-L}$  are average value shares between periods,  $e^{-k} + e^{-L} = 1$

# 3. Results and Discussion

## 3.1 EGW TFP growth over time (1998-2015), annual figures

- TFP growth decreases after 2005.
- TFP growth for EGW with a positive contribution to the VA growth until around 2005.
- But with some peaks observed before 2005.
- Germany and Netherlands with positive TFP growth for the whole period.

Fig. 1: TFP growth on EGW industries



(\*) USA and Spain with a negative annual TFP growth of 15.5 and 21.9 in 2001 and 2013 respectively.

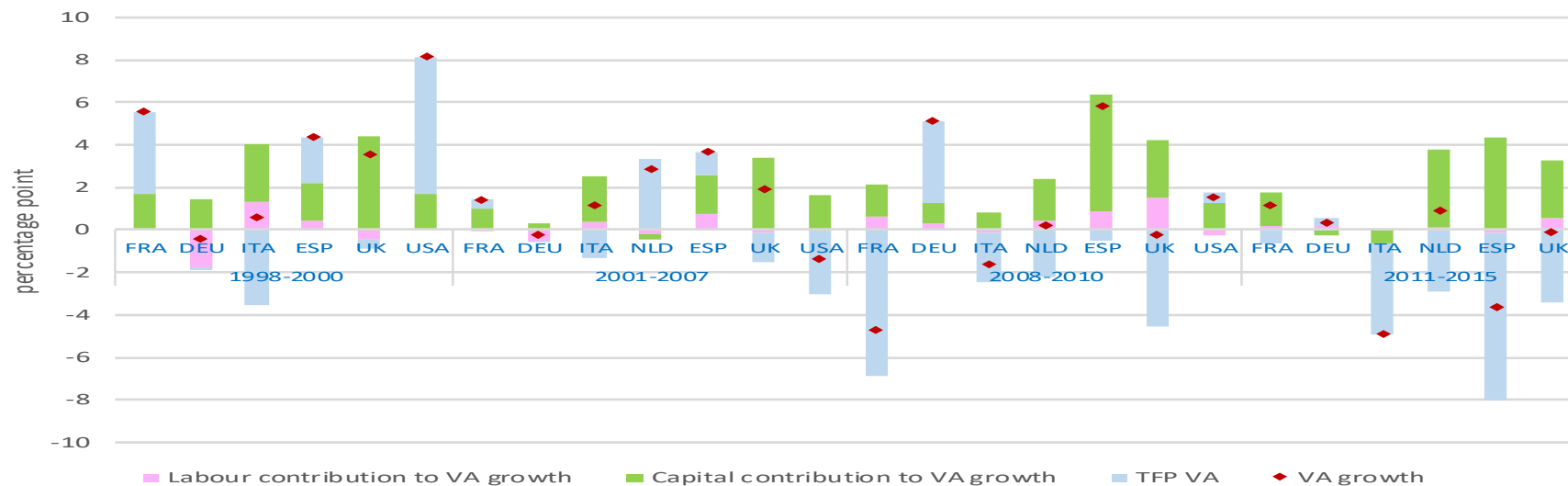
Source: EU KLEMS database.

# 3. Results and Discussion

## 3.2 EGW TFP growth (annual average for selected periods)

- Economic downturns explain poor TFP growth in EGW sectors (e.g. USA: dotcom in 2001, Europe: financial crisis 2008, debt crisis: 2011/12).
- TFP growth rates have not returned to the pre-crisis levels (2005 and backwards).
- In the UK a continuation of a downward trend is envisaged (Brexit referendum!).
- VA added growth is driven by TFP growth and capital growth mainly in EGW sectors.

Fig. 2: EGW TFP growth (specific periods)



In Netherlands, 1998-2000 figures are not available. Data for the first period (1998-2000) start with 1999 for USA. Data for the last period (2011-2015) end in 2014 for Italy. Estimations for each period based on average annual rates (expressed in logs).

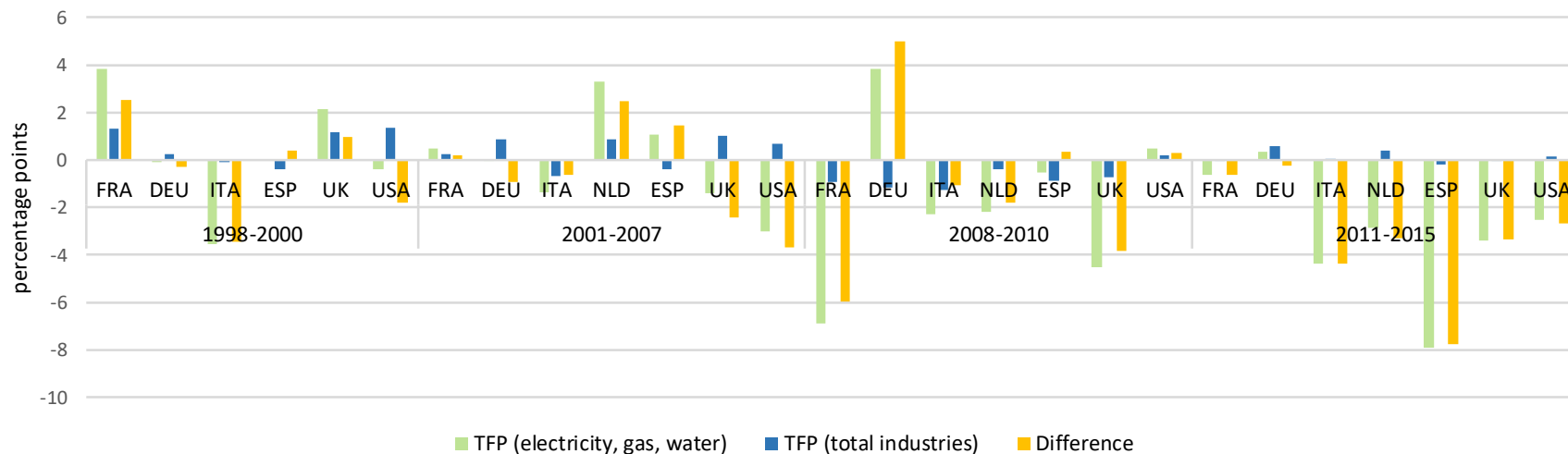
Source: EU KLEMS country level database.

# 3. Results and Discussion

## 3.3 Comparing TFP growth: EGW versus total industries

- EGW sectors have been hit more (with lower annual growth rates) than total industries, except in Germany.
- Italy and Spain also have a negative annual average TFP growth for all industries (and EGW).

Fig. 3: TFP growth: Total industries versus EGW sectors



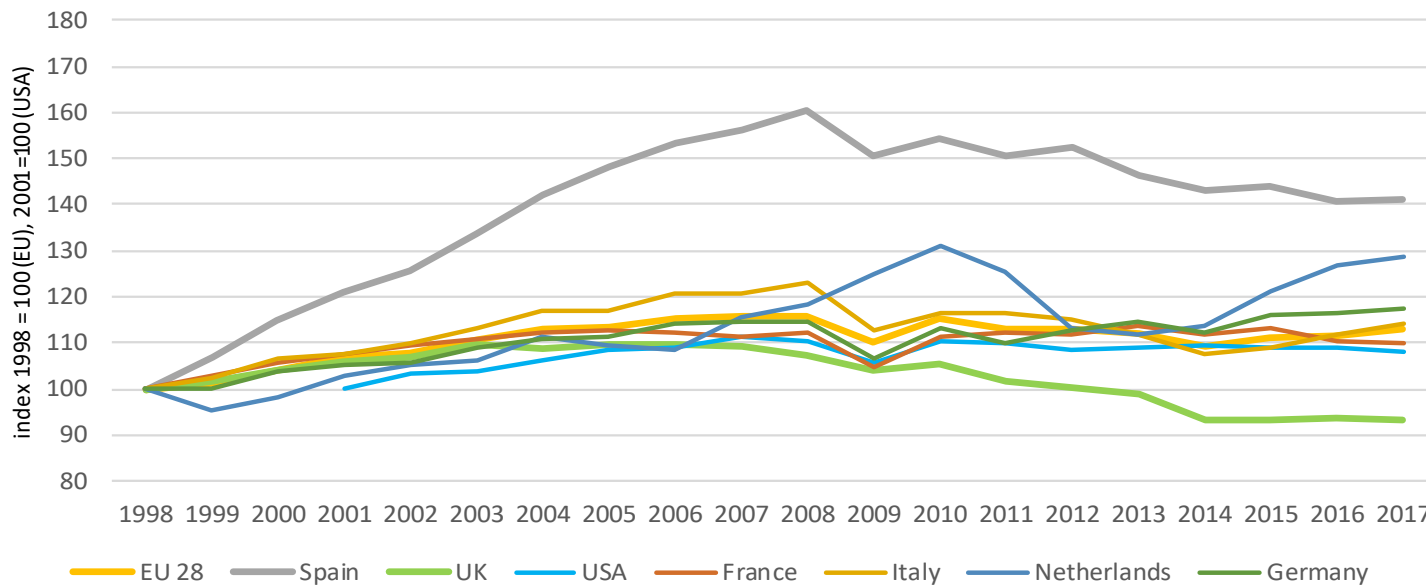
In Netherlands, 1998-2000 figures are not available. Data for the first period (1998-2000) start with 1999 for USA. Data for the last period (2011-2015) end in 2014 for Italy.  
 Source: EU KLEMS country level database.

# 3. Results and Discussion

## 3.4 Understanding the productivity puzzle

- Economics downturns matters on TFP growth in the EGW industries but what else...
- A set of regional (European) and national sector reforms in favour of the energy transition and water security.
- EGW sectors with higher capex/interconnection costs due to more renewables.
- And lower revenues: **Reduction or flattening trend of electricity generation** (more renewables, lower wholesale prices, lower demand, etc.).

Fig. 4: Trend of electricity generation (index)



Source: Eurostat database, EIA database

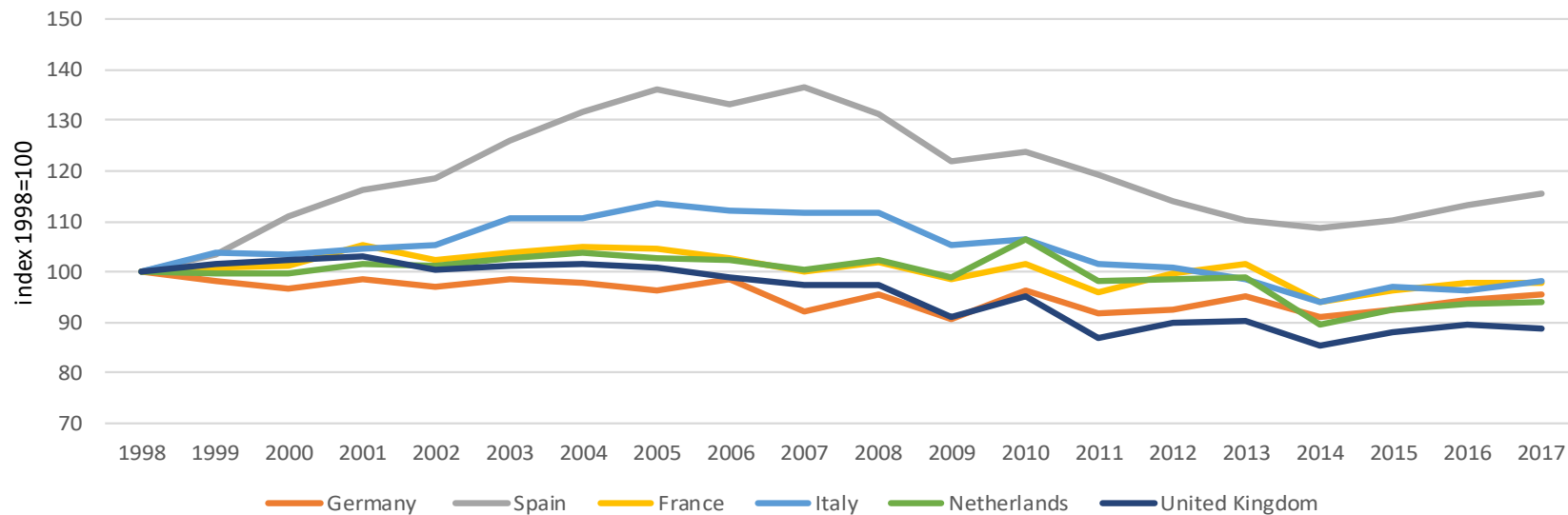


# 3. Results and Discussion

## 3.4 Understanding the productivity puzzle

- **Lower consumption** too (energy efficiency)...
- The UK with the lowest reduction in final consumption (energy use) over time (1998 base).

Fig. 5: Trend of final consumption (energy use) over time



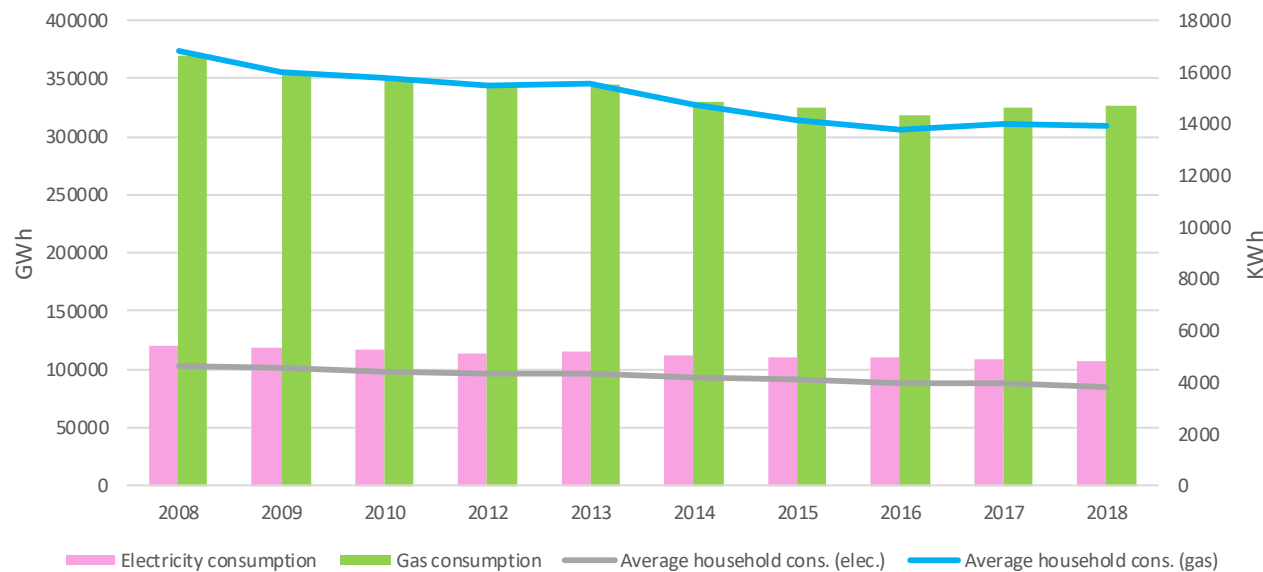
Source: Eurostat

# 3. Results and Discussion

## 3.4 Understanding the productivity puzzle

- A closer view in the UK confirms the reduction of electricity and gas in households in absolute (total) and relative figures (per household).
- However a larger contraction is observed in the consumption of the industrial sector in the UK, 12% versus 18% respectively (1998 base).

Fig. 6: Trend of electricity and gas consumption in households in the UK



Source: BEIS (2018)

## 3. Results and Discussion

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### 3.4 Understanding the productivity puzzle

- Other factors.....
- Market share of the largest generator as a measure of competition (then lower prices), with important reductions in Spain and Italy.
- In the water sector:
  - Increase in water stress (climate change and rising population): pressure to reduce water consumption and system losses.
  - Lower water supply: Italy, Germany and France are among the European countries with the lowest freshwater resources per inhabitant.
  - Tendency to decrease productivity: investments for improving water quality (in line with stricter regulation) and the need to invest more to replace aging infrastructure.

## 4. Final Remarks

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- The productivity puzzle is present in the individual countries, especially in the UK.
- Apart from the economic downturns, productivity growth especially in EG sectors may have been negatively affected by the energy transition which has required higher levels of inputs at the same time as competition, regulation and falling demand (then limited ability to raise revenues).
- Recovery in TFP growth for EGW sectors is not expected to happen in the short term.
- The EGW sectors need to internalise the changes driven by the energy transition and global warming and to adapt their operation and economics in line with this.
- The need of new measures of productivity to properly measure quality of service and environmental improvements.

# Q&A

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**Thank you!**