Survey-based measures of supply pressures and potential output

Insee

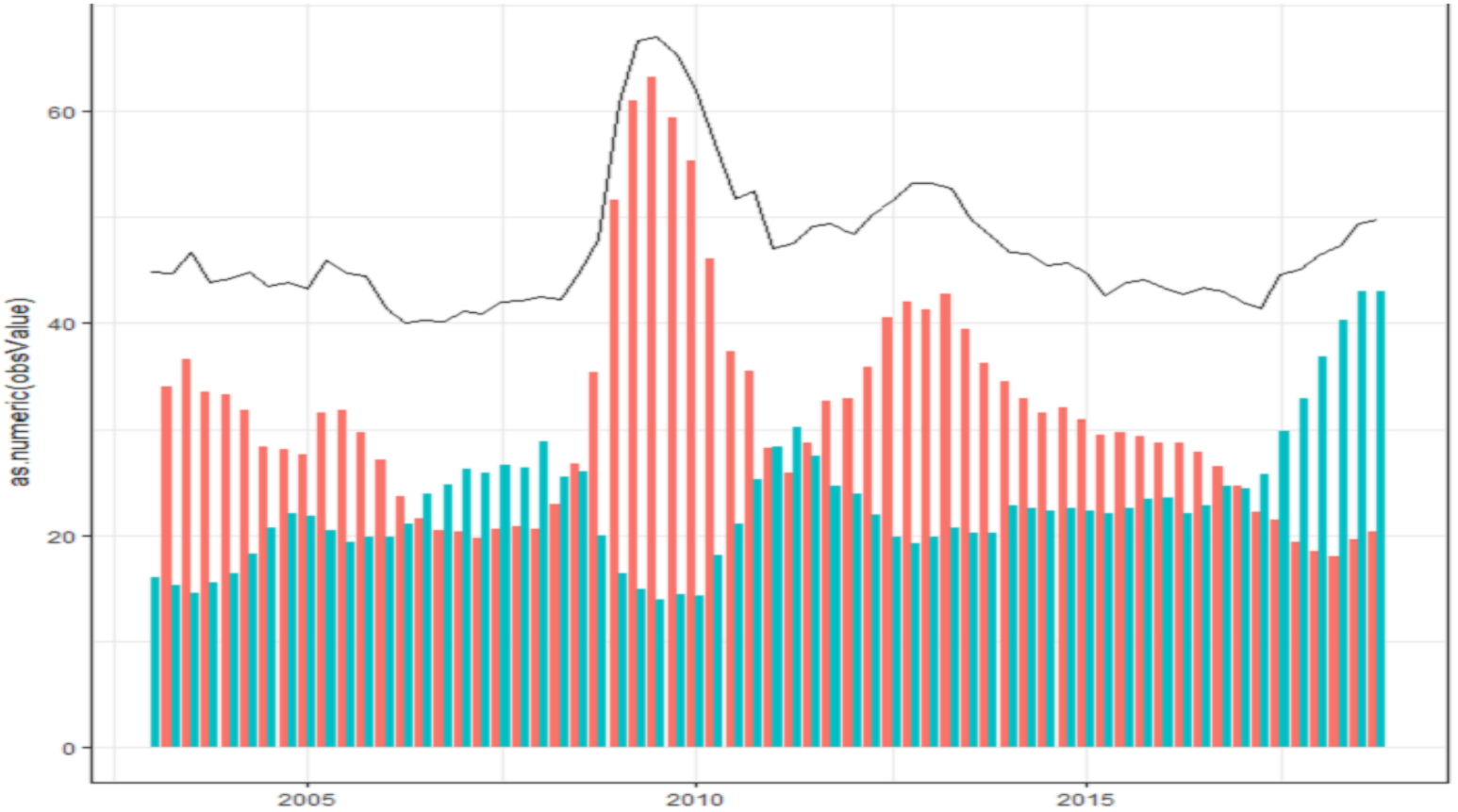
Measuring, understanding

01 · Supply pressures in Europe
02 · Direct method
03 · Semi-structural method
04 · Structural method
05 · Main results
06 · Focus: spectral analysis

01 Rising supply pressures in Europe

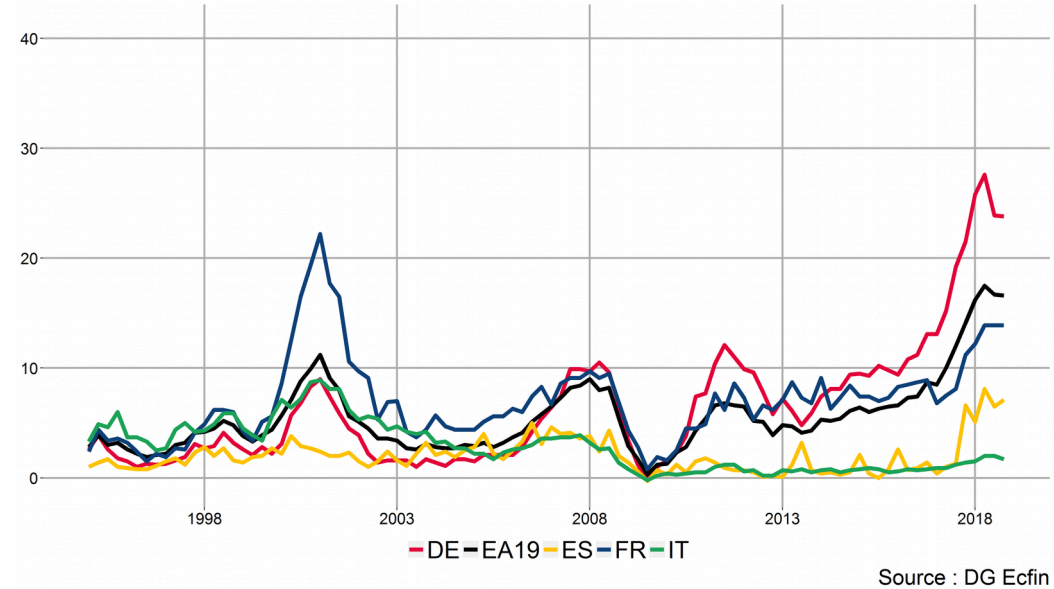
More businesses hampered in their production by supply difficulties

In the Eurozone, since mid-2017, industrial companies have been more numerous to express difficulties to increase production, more often due to supply difficulties than to insufficient demand



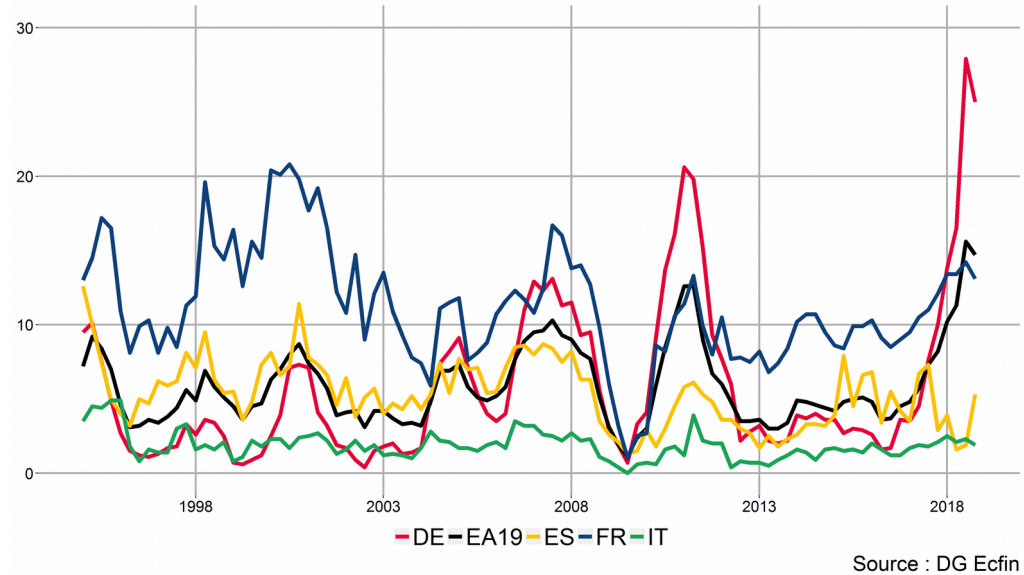
Greater supply difficulties, mainly lack of manpower and material/equipment

Industrial enterprises hampered in their production by shortage of labour force (%)



Source : DG Ecfin

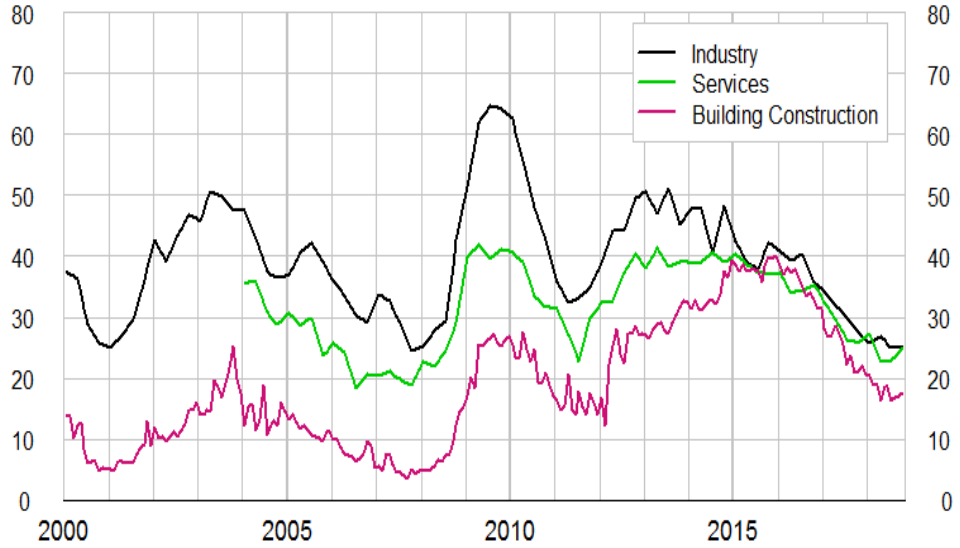
Industrial enterprises hampered in their production by shortage of material and/or equipment (%)



Source : DG Ecfin

In France, more supply difficulties only than demand difficulties only

French businesses facing demand difficulties only (%)



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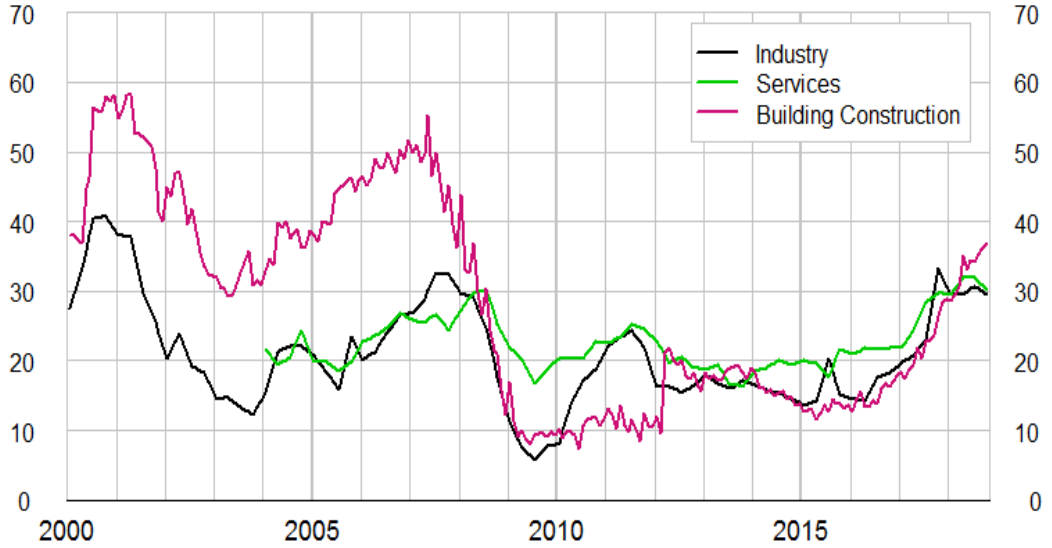
French businesses facing supply difficulties only (%)



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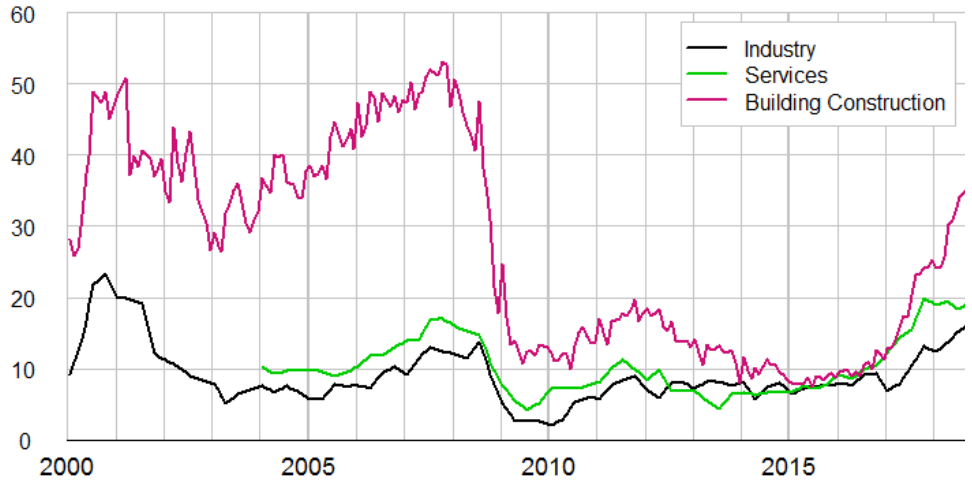
In France too, lack of manpower and equipment shortage are more often reported than before

French businesses hampered in their production by shortage of labour force (%)



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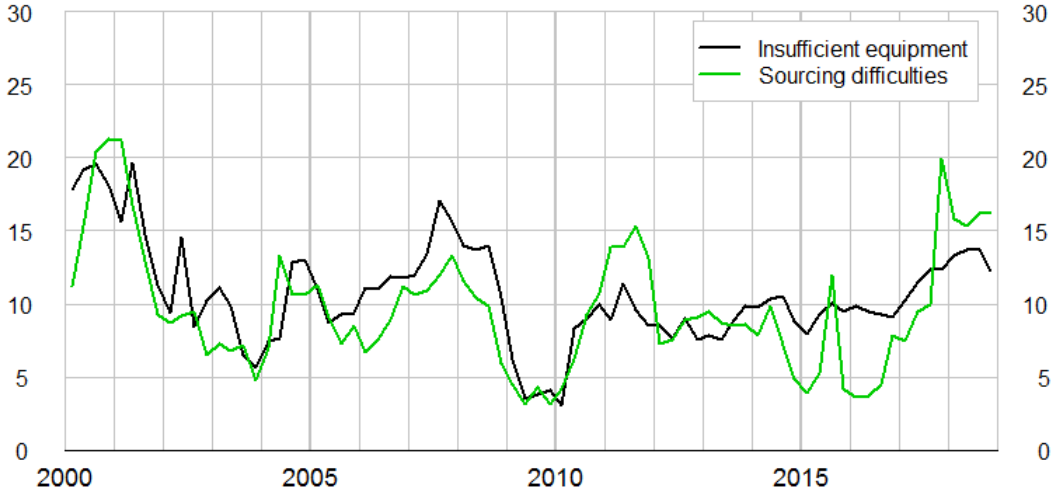
French industrial businesses hampered in their production by insufficient equipment and sourcing difficulties (%)



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02 Estimating the output gap with a direct method

Estimating the output gap with a direct method
1. Basic principle

- **The direct method** is a **purely statistical approach**
- **Purpose**: to extract, from the joint development in a set of economic indicators, a common information on the extent of possible imbalances between supply and demand, in order to describe the economic cycle.
- The selected indicators:
  - traditional macroeconomic indicators (unemployment rate, inflation, etc.)
  - indicators from business tendency surveys giving an information about production pressures
- Common factor extracted by the mean of a **principal component analysis**
- The **first principal axis** is considered as an overall **indicator of imbalance**
- To homogenize this to an output gap, **the result is normalised** (mean and variance) thanks to an output gap estimated elsewhere
- In this study, it is normalised via **the structural method** presented *infra*

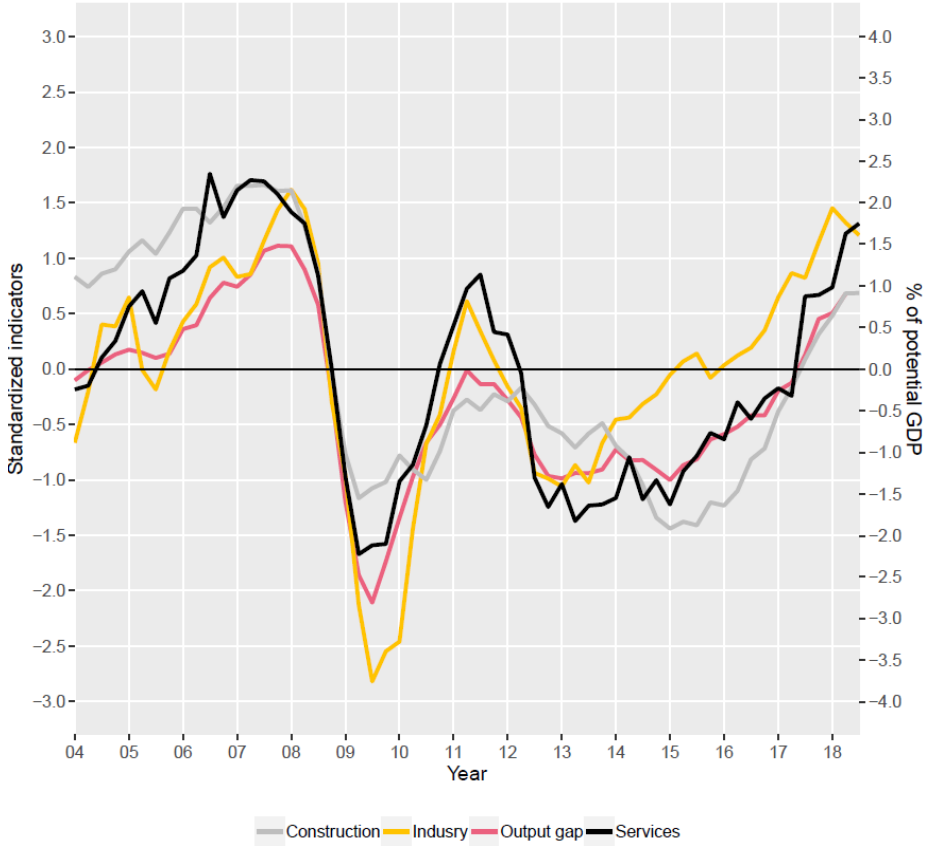
Estimating the output gap with a direct method
2. Selected variables

Sector	Indicators	Source	Type, unit	Period	
Industry	Insufficient demand	Business tendency survey in industry	balance of opinion	1991 Q1	2018 Q3
	Workforce shortage	Business tendency survey in industry	balance of opinion	1991 Q1	2018 Q3
	Production capacity utilisation rate	Business tendency survey in industry	balance of opinion	1991 Q1	2018 Q3
Services	Insufficient demand	Business tendency survey in services	balance of opinion	2003 Q2	2018 Q3
	Workforce shortage	Business tendency survey in services	balance of opinion	2003 Q2	2018 Q3
Construction	Insufficient demand	Business tendency survey in construction	balance of opinion	2003 Q3	2018 Q3
	Workforce shortage	Business tendency survey in construction	balance of opinion	2003 Q1	2018 Q3
Whole economy	Unemployment rate	Labour force survey	%	1983 Q1	2018 Q3
	Core inflation	Consumer price indices	Y-o-y change, %	1997 Q1	2018 Q3
	Unit labour costs per hour worked	Labour cost statistics	Y-o-y change, %	1991 Q1	2018 Q2
	Investment rate of non-financial corporations (% of added value)	National accounts	Y-o-y change, %	1981 Q1	2018 Q2
	Investment rate of households (% of gross disposable income)	National accounts	Y-o-y change, %	1981 Q1	2018 Q2

Estimating the output gap with a direct method
2.1. Results for France

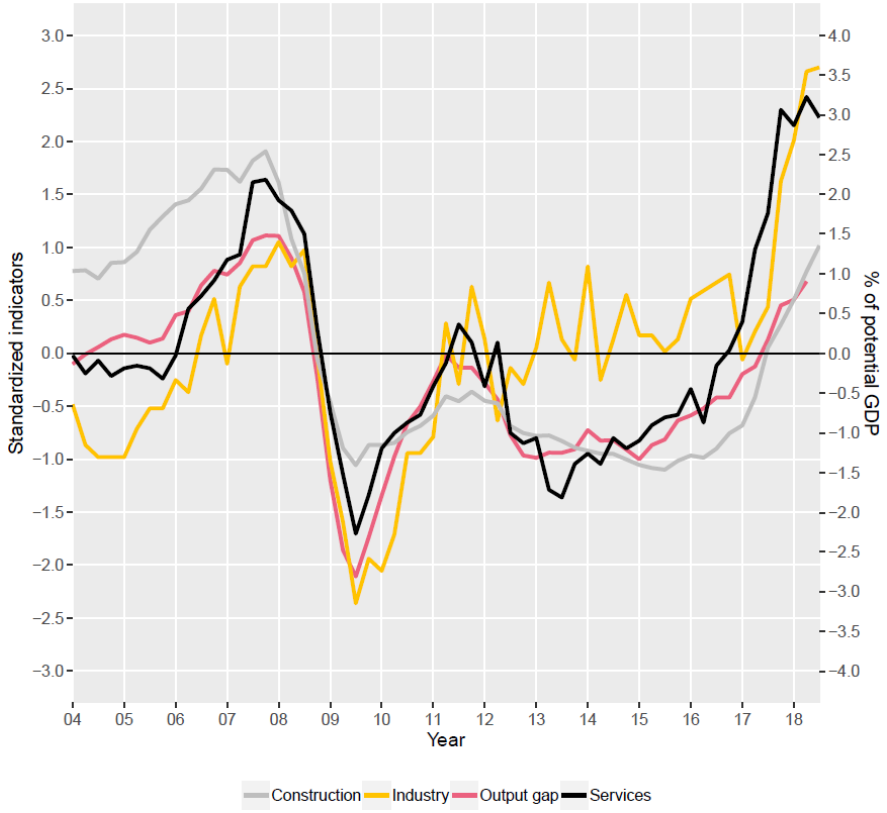
Output gap (direct method) and limiting factor due to insufficient demand

Standardized indicators from 2004 – Opposites are here displayed



Output gap (direct method) and limiting factor due to workforce shortage

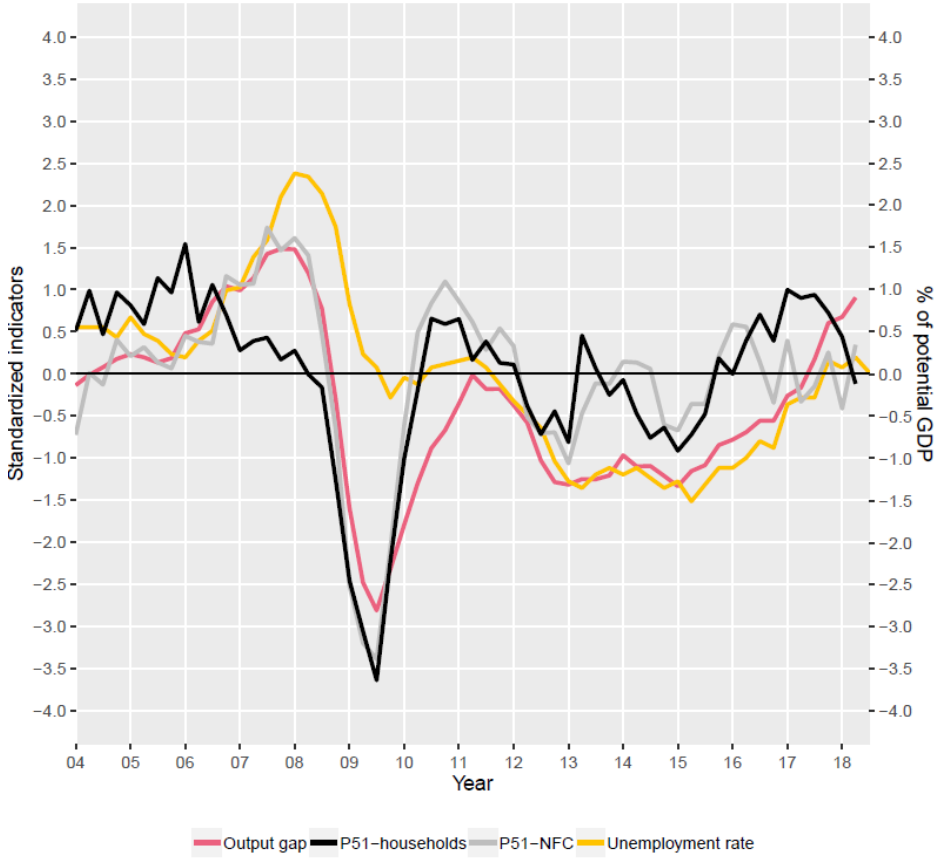
Standardized indicators from 2004



Estimating the output gap with a direct method
2.2. Results for France

Output gap (direct method), unemployment rate and investment rate

Standardized rates from 2004 – Opposite unemployment rate is here displayed



Output gap (direct method) and capacity utilisation rate in industry

Standardized CUR from 2004

Estimating the output gap with a direct method
3. Comparison of coefficients between countries

Comparison of the coefficients of the indicators in the first axis of the principal component analysis

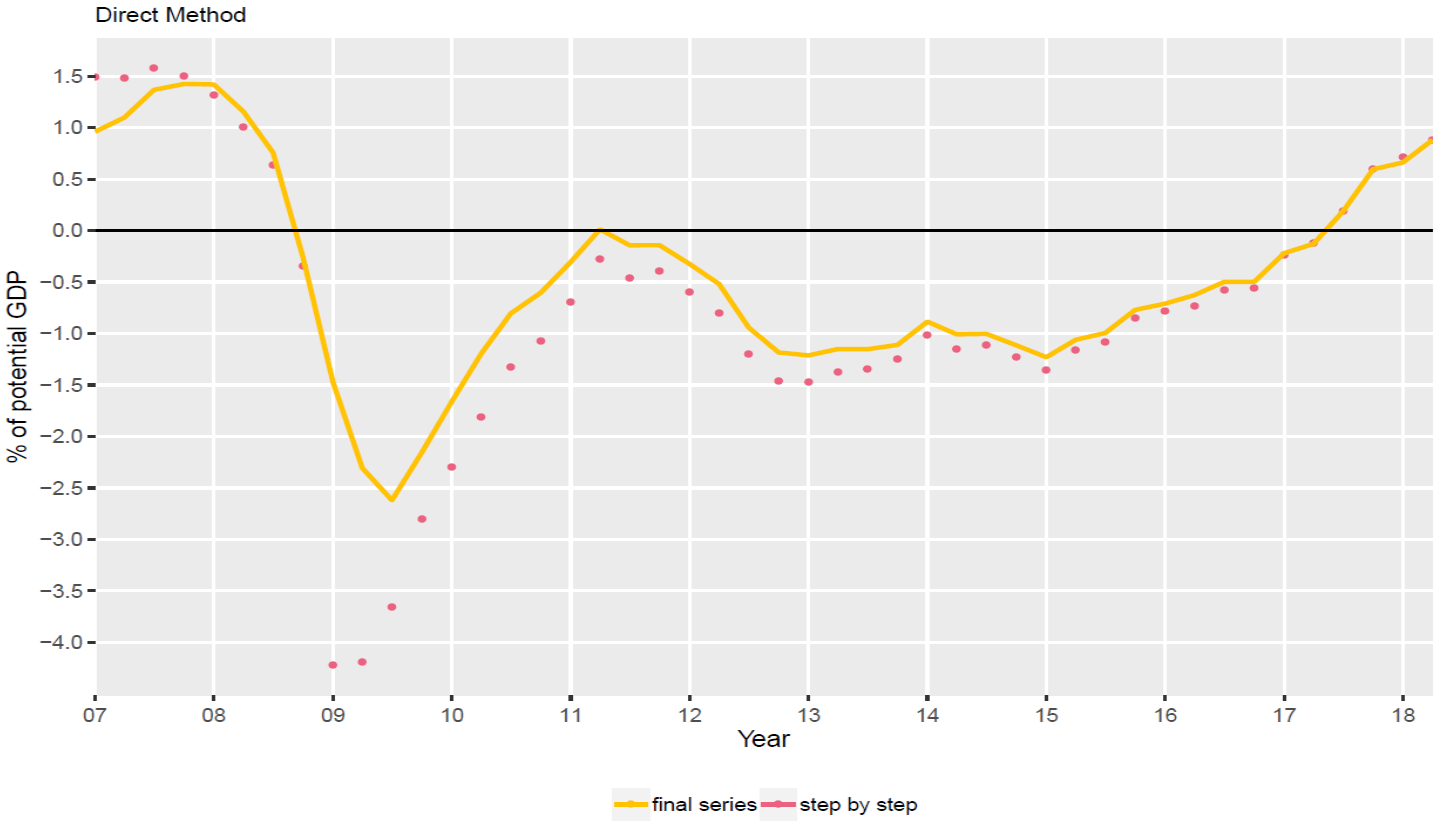
	France	Germany	Italy	Spain
Industry – Insufficient demand	-0.35	-0.28	-0.26	-0.39
Industry – Workforce shortage	0.22	0.37	0.38	0.32
Industry – Production capacity utilisation rate	0.35	0.25	0.32	0.39
Services – Insufficient demand	-0.36	-0.38	-0.31	NA
Services – Workforce shortage	0.33	0.34	0.36	NA
Construction – Insufficient demand	-0.33	-0.37	-0.38	-0.39
Construction – Workforce shortage	0.33	0.36	0.35	0.06
Unemployment rate	-0.26	-0.33	-0.24	-0.40
Core inflation	0.15	0.04	0.10	0.33
Unit labour costs (y-o-y change)	-0.05	-0.03	0.05	0.33
Investment rate of non-financial corporations (y-o-y change)	0.30	0.19	0.18	0.03
Investment rate of households (y-o-y change)	0.27	0.21	0.30	0.25
Share of variance explained by the first principal component	0.56	0.48	0.48	0.53

Estimating the output gap with a direct method
4. Change in the coefficients (France)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ind. – Insufficient demand	-0.32	-0.34	-0.33	-0.34	-0.34	-0.34	-0.35	-0.34	-0.34	-0.34	-0.34
Ind. – Workforce shortage	0.33	0.30	0.30	0.32	0.31	0.29	0.24	0.22	0.20	0.19	0.21
Ind. – Production capacity utilisa	0.34	0.36	0.33	0.34	0.35	0.34	0.34	0.34	0.33	0.34	0.35
Serv. – Insufficient demand	-0.32	-0.35	-0.32	-0.33	-0.34	-0.34	-0.34	-0.35	-0.35	-0.36	-0.36
Serv. – Workforce shortage	0.34	0.32	0.31	0.33	0.33	0.33	0.34	0.34	0.35	0.35	0.33
Cons. – Insufficient demand	-0.32	-0.34	-0.32	-0.32	-0.32	-0.32	-0.33	-0.33	-0.33	-0.33	-0.33
Cons. – Workforce shortage	0.32	0.33	0.32	0.32	0.31	0.31	0.32	0.33	0.33	0.33	0.33
Unemployment rate	-0.30	-0.19	-0.23	-0.25	-0.24	-0.24	-0.25	-0.27	-0.27	-0.27	-0.26
Core inflation	-0.01	0.00	0.16	0.17	0.17	0.17	0.19	0.21	0.21	0.20	0.16
Unit labour costs	0.08	-0.15	-0.17	-0.11	-0.11	-0.13	-0.10	-0.05	-0.03	-0.02	-0.05
NFC investment rate	0.33	0.36	0.32	0.29	0.29	0.30	0.30	0.29	0.29	0.30	0.30
Household investment rate	-0.21	0.17	0.27	0.25	0.25	0.26	0.25	0.26	0.26	0.26	0.27

Estimating the output gap with a direct method
5. Results in pseudo real time

Output gap by the direct method: step by step *vs* final series



03 Estimating the output gap with a semi-structural method

Estimating the output gap with a semi-structural method

$$\begin{cases} y_t &= y_t^p &+ OG_t \\ CU_t &= CU_{ref} &+ \alpha * 100 * OG_t + \epsilon_{1t} \\ BCI_t &= 100 &+ \beta * 100 * (OG_t - OG_{t-1}) + \epsilon_{2t} \end{cases}$$

$$\begin{cases} y_t^p &= y_{t-1}^p &+ \eta_t \\ \eta_t &= \gamma * \eta_{t-1} &+ \epsilon_{\eta t} \\ OG_t &= \delta * OG_{t-1} &+ \epsilon_{OGt} \end{cases}$$

	France	Germany	Italy	Spain
CU_{ref}	83,6 (1,0)	83,7 (2,0)	74,9 (1,7)	77,4 (3,5)
α	2,38 (0,40)	2,06 (0,37)	2,45 (0,31)	2,80 (1,09)
β	7,62 (1,46)	3,60 (1,22)	8,00 (1,92)	8,44 (3,30)
γ	0,91 (0,06)	0,80 (0,09)	0,82 (0,08)	0,82 (0,14)
δ	0,37 (0,21)	0,59 (0,28)	0,45 (0,29)	0,79 (0,33)

04 Estimating the output gap with a structural method

Estimating the output gap with a structural method
1. Estimation

Cobb-Douglas production function

$$Y = TFP \times (POP_{15-64} \times Act \times (1-U) \times Hours)^{\alpha} \times K^{1-\alpha}$$

- Working age population and capital stock are structural
- Labor share is fixed

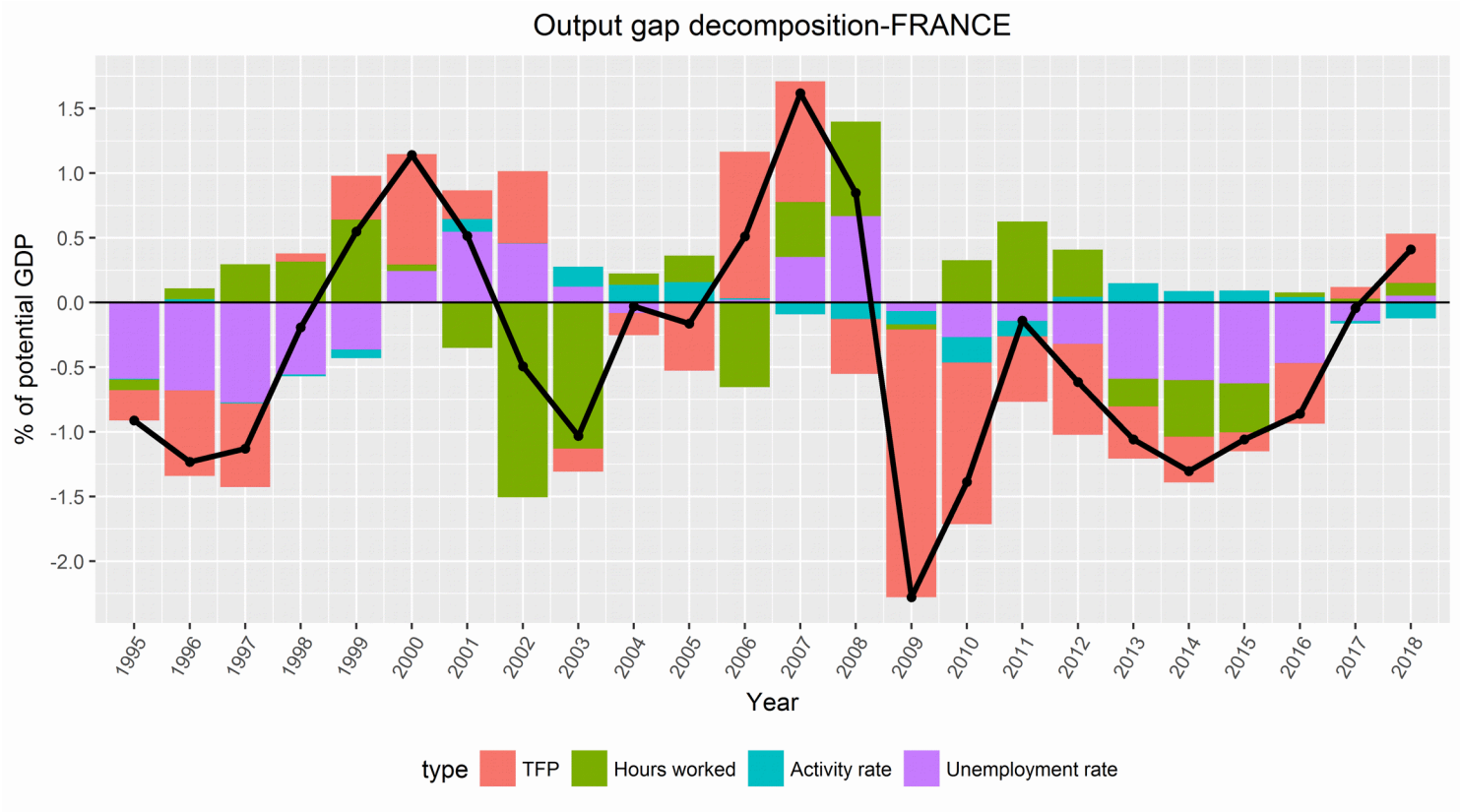
$$\begin{cases} tfp_t &= tfp_t^p &+ \lambda * (CU_t - CU_{ref}) + \epsilon_{pt} \\ \Delta tfp_t^p &= \zeta &+ \theta * \Delta tfp_{t-1}^p + \epsilon_{gt} \end{cases}$$

$$\begin{cases} \pi_t^{core} &= \mu &+ \alpha * \pi_{t-1}^{core} &- \beta * (U_t - U_t^p) + \epsilon_{inft} \\ U_t &= U_t^p &+ c_t \\ \Delta U_t^p &= \gamma \Delta U_{t-1}^p &+ \epsilon_{ut} \\ c_t &= \delta * c_{t-1} &+ \epsilon_{ct} \end{cases}$$

$$\begin{cases} Act_t &= Act_t^p &+ \rho * (CU_t - CU_{ref}) &+ \sigma * (U_t - U_t^p) + \epsilon_{txt} \\ \Delta Act_t^p &= \Delta Act_{t-1}^p &+ \epsilon_{upt} \end{cases}$$

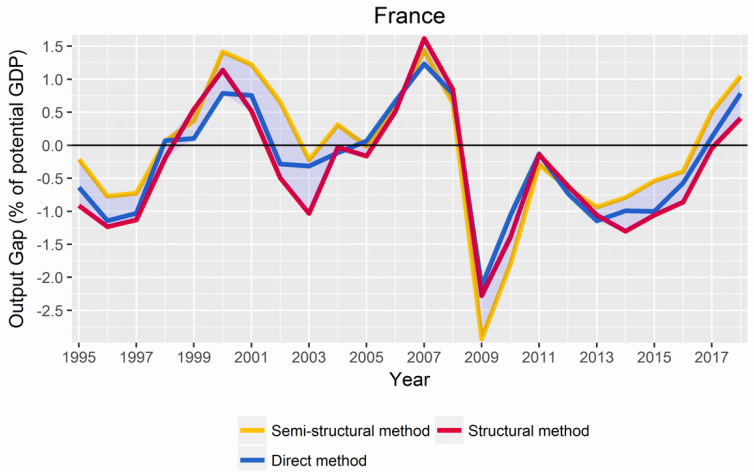
Estimating the output gap with a structural method
2. Results

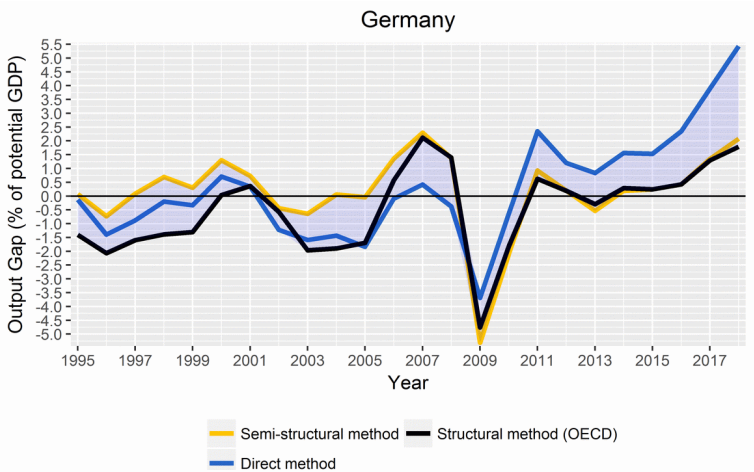
$$OG = \frac{Y - Y^*}{Y^*} \simeq ln(\frac{Y}{Y^*}) = ln(\frac{TFP}{TFP^*}) + \alpha \times [ln(\frac{Act}{Act^*}) + \frac{U^* - U}{1 - U^*} + ln(\frac{Hours}{Hours^*})]$$

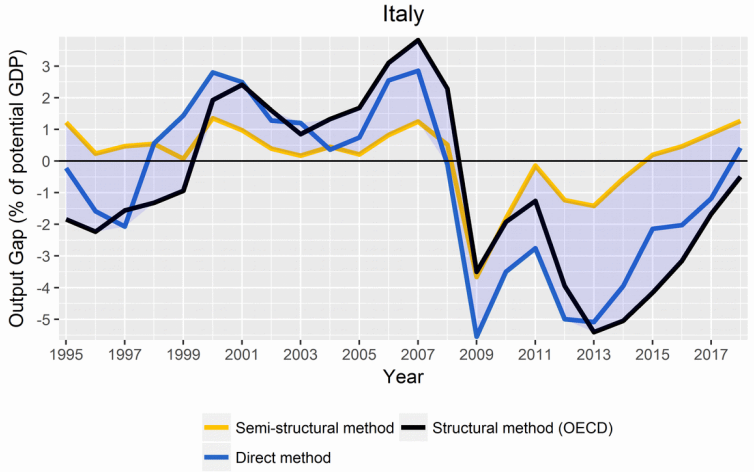


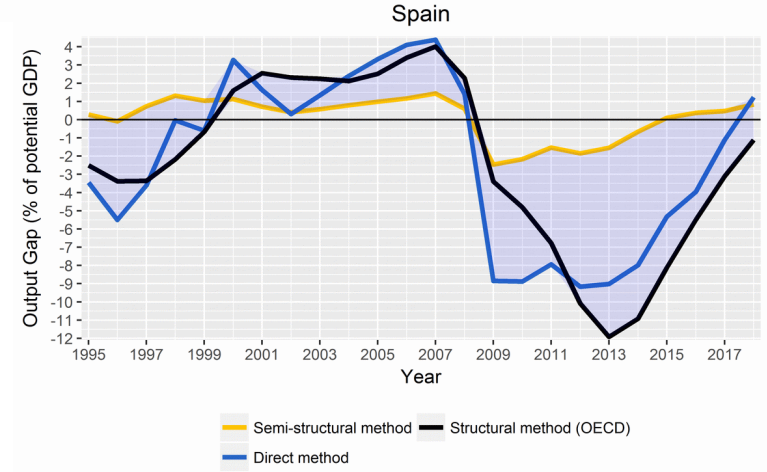
05 Main results

Comparison of different methods
Assessing the cycle : where do we stand ?



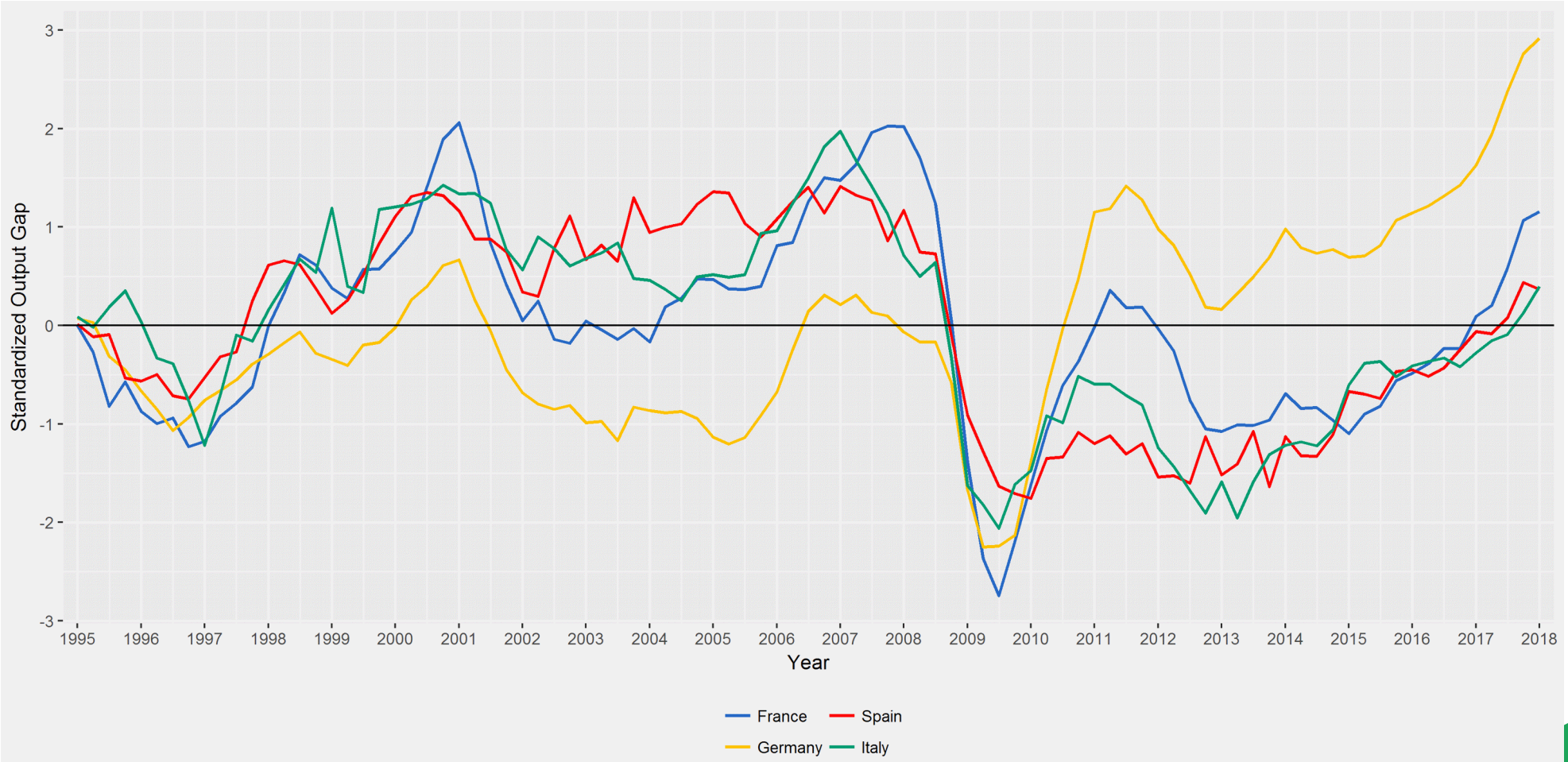






06 Focus: spectral analysis

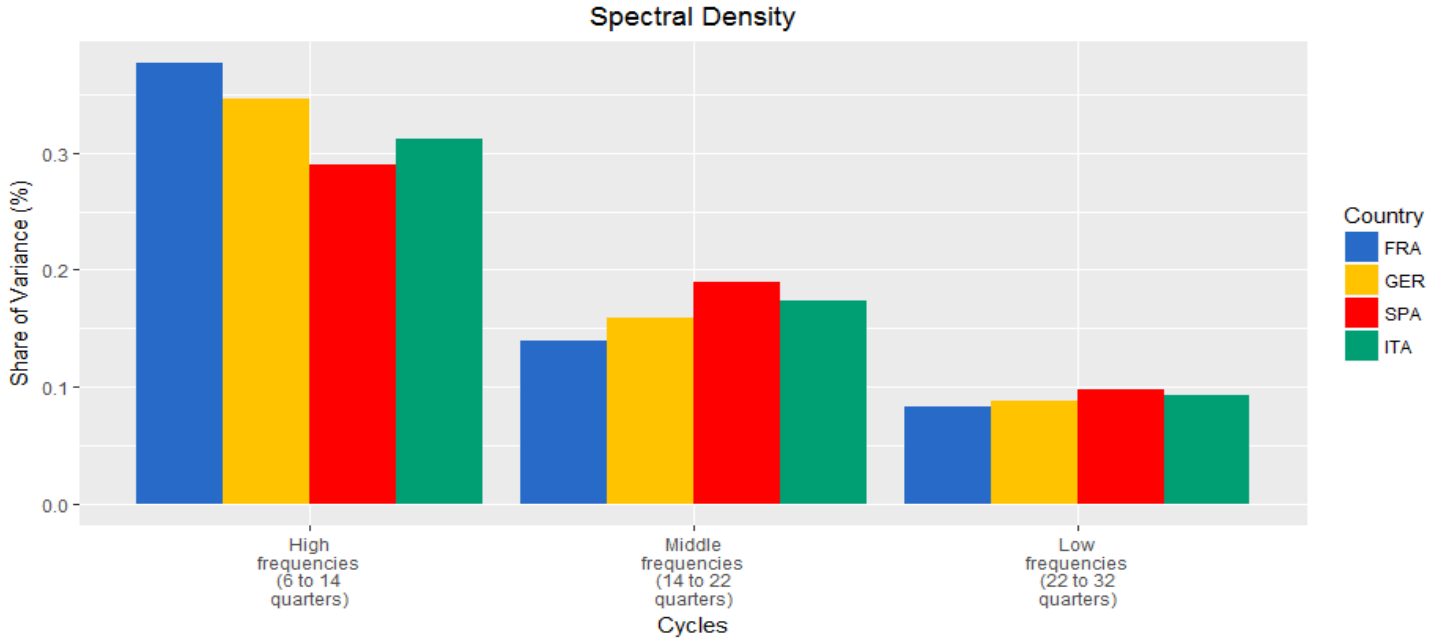
Are business cycles synchronized ?



Spectral Analysis

$$y(t) = \int \hat{y}(\omega) e^{-i\omega t} \frac{d\omega}{2\pi} \iff \hat{y}(\omega) = \int y(t) e^{i\omega t} dt$$

$$Var(y) = \int_{\omega} f(\omega) d\omega$$



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