



Exploring the Link between the Macroeconomic and Financial Cycles

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Motivation

- Literature suggests that the financial cycle longer in length and larger in amplitude than the business cycle
Claessens, Ayhan Kose and Terrones (2011); Drehmann, Borio and Tsatsaronis (2012); Aikman, Haldane and Nelson (2015); Rünstler and Vlekke (2015)
- Increased attention on managing the financial cycle separately from the business cycle (e.g. countercyclical capital buffer)



Research questions

1. Is there evidence of a financial cycle that is longer than the business cycle?
2. How might these cycles be related and what are the main policy implications?



Is there evidence of a financial cycle that is longer than the business cycle?



Data

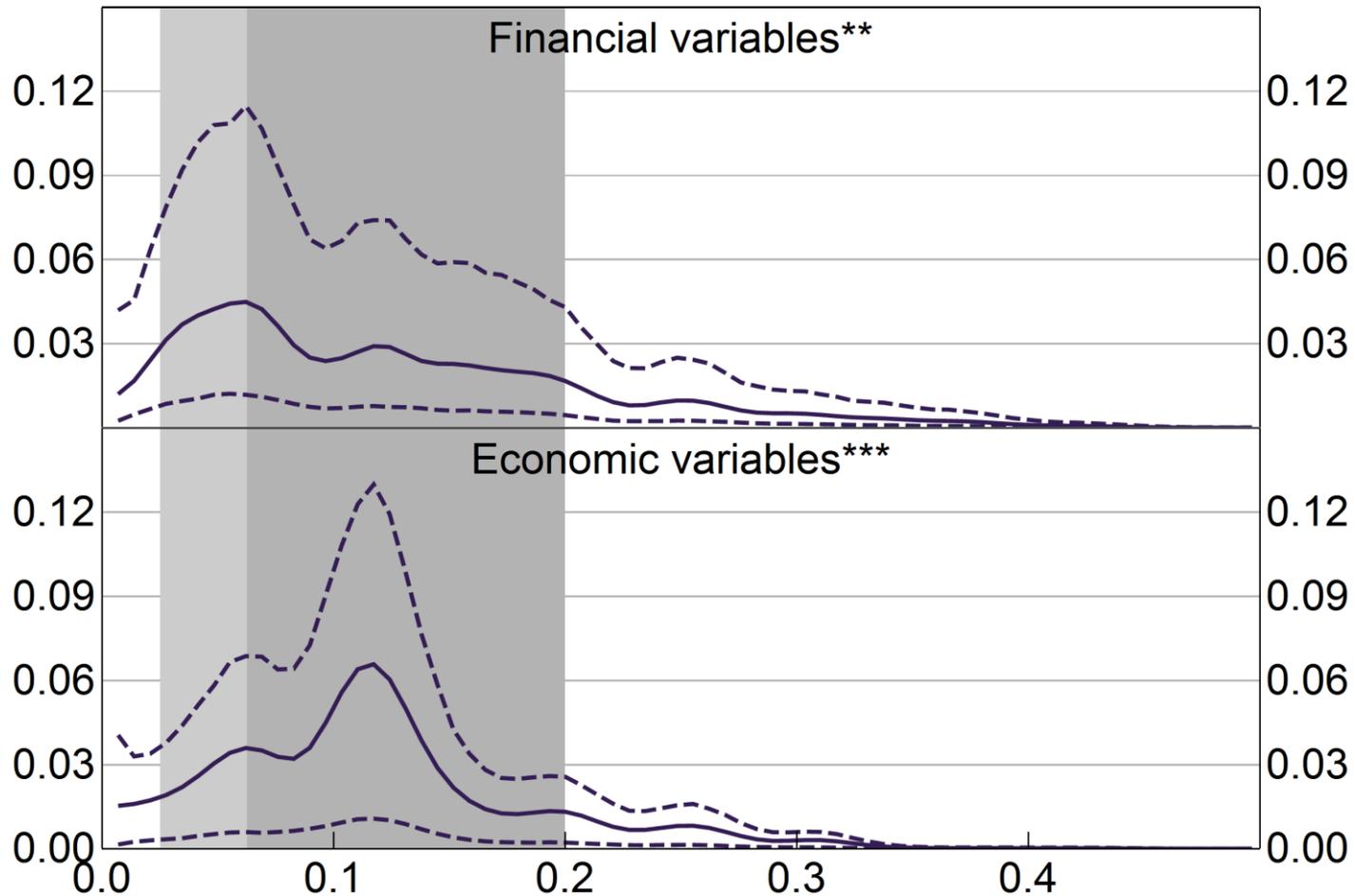
- Financial variables: credit, housing prices, equity prices, 10-year government bond rates
- Economic variables: GDP, employment, unemployment rate

Methodology

- Multivariate spectral analysis
- Multivariate Bry-Boschan quarterly algorithm (MBBQ)

Multivariate Spectral Densities*

Australia



* Smoothed with a Parzen window; using quarterly data 1980Q1 to 2016Q1; dotted lines are the 95% confidence bands

** Credit growth, housing price growth, equity price growth, corporate bond spreads, change in 10 year government bond yields

*** GDP growth, change in unemployment rate and employment growth

Sources: BIS; OECD; RBA

Multivariate spectral analysis

Estimates of financial and macroeconomic cycles Years

	Financial variables ^(a)		Economic variables ^(b)	
	Cycle length	95% CI	Cycle length	95% CI
Australia	8.1	[2.9, 18.1]	4.3	[3.6, 10.4]
US	8.2	[5.3, 22.6]	5.7	[4.5, 11.3]
UK	5.2	[4.3, 94.0]	8.5	[4.5, 15.7]
Germany	7.5	[5.7, 22.6]	9.1	[4.7, 18.1]
France	12.6	[3.5, 17.7]	9.8	[3.1, 14.8]

(a) Financial variables include credit growth, housing price growth, equity price growth and change in 10-year government bond rates

(b) Economic variables include GDP growth, employment growth and change in unemployment rate

Note: sample period differs across countries due to data availability, but generally begins between 1970 and 1980, and ends in 2016

Sources: Bank of England; BIS; INSEE; OECD; RBA

MBBQ

Estimates of financial and macroeconomic cycles

Years

	Financial variables^(a)	Economic variables^(b)
Australia	5.8	9.8
US	6.5	6.4
UK	6.4	7.0
Germany	4.6	5.1
France	7.3	8.5

(a) Financial variables include credit, housing prices, equity prices and 10-year government bond rates

(b) Economic variables include GDP, employment and unemployment rate

Note: sample period differs across countries due to data availability, but generally begins between 1970 and 1980, and ends in 2016

Sources: Bank of England; BIS; INSEE; OECD; RBA



How might these cycles be related?



Data

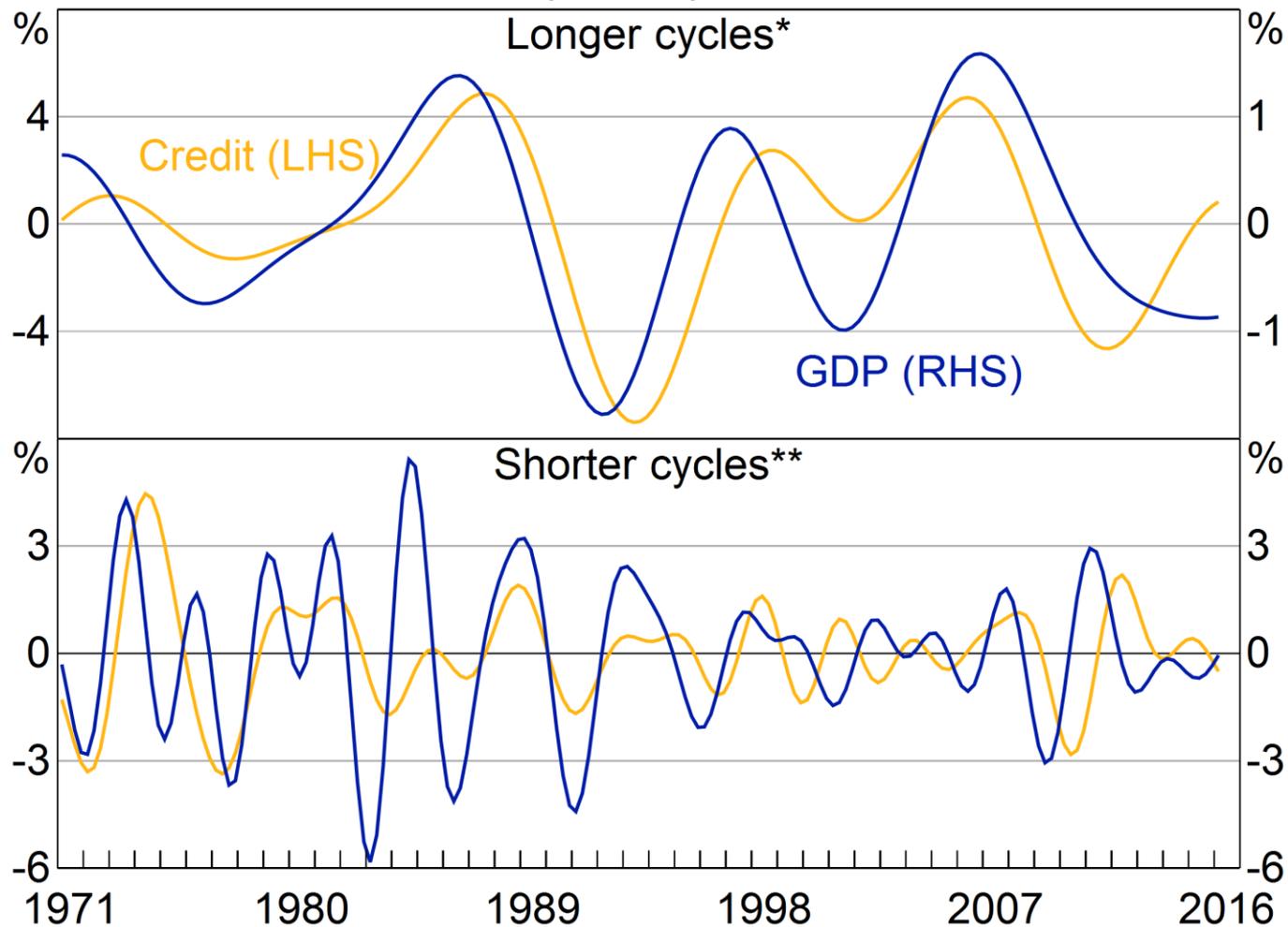
- Only use credit and GDP growth

Methodology

- Time series: Christiano-Fitzgerald band-pass filter and HP filter
- Synchronisation: Bry-Boschan quarterly algorithm (BBQ)
- Relationship: cross-correlograms, cross-spectral analysis and Granger Causality tests

Real Credit and GDP Growth – Australia

Quarterly data, year-ended



* Using a Christiano-Fitzgerald band-pass filter with a lower cut-off frequency of 8 years and upper cut-off frequency of 30 years

** Using a Christiano-Fitzgerald band-pass filter with a lower cut-off frequency of 2.5 years and upper cut-off frequency of 8 years

Sources: BIS; OECD; RBA

**Granger Causality Tests***p*-values, sample period 1980:1 – 2016:1

Alternative hypothesis	Australia	US	UK	France	Germany
Longer cycle					
Credit growth → GDP growth	0.06	0.05	0.39	0.24	0.01
GDP growth → credit growth	<0.00	<0.00	<0.00	<0.00	<0.00
Shorter cycle					
Credit growth → GDP growth	0.01	0.18	0.23	0.58	0.09
GDP growth → credit growth	0.10	0.06	<0.00	<0.00	0.08



Synthesis of results

- Little evidence to be able to conclude that cycles in financial and economic variables fluctuate at different frequencies
- Economic and financial variables do have cycles, these cycles are linked, but can be at different phases
- Evidence is more suggestive of economic activity leading financial conditions



What are the drivers of financial cycle?

- If drivers are real (e.g. productivity), business cycle leads financial cycle
- If drivers are financial, financial cycle can lead business cycle
- The drivers of 'financial cycles' are still unclear
 - Most explanations relate to risk sentiment and expectations
 - Some argue monetary policy plays a role



What should policy do?

- In a first-best world, address distortions and market failures that produce a financial cycle that is different from the business cycle



Role of monetary policy

- Monetary policy can affect agents' risk taking
- Financial booms can lead to financial crises, which have severe economic consequences
- However, there can be a trade-off in the short-term
 - May need to balance short-term costs of missing inflation target against the longer-term benefit of avoiding or mitigating the effects of a financial crisis



Issues with using monetary policy

- Monetary policy is a blunt tool and unable to target specific risks
- Tinbergen (1952) principle – number of instruments should be equal to the number of policy objectives
 - Are we asking too much of monetary policy?
- When is risk-taking ‘over-exuberant’?
- Smets (2013) and others suggest that prudential policy plays a role in managing some of these risks



Role of macroprudential policy

- Can be more flexible in addressing risks – more tools are available and the scope of these tools can be varied
- Can strengthen financial system resilience
- However:
 - Leakages may occur (e.g. unregulated financial sector)
 - These tools are not very well understood
 - Institutional arrangements can be difficult



Monetary and macroprudential policies

- Macroprudential policy could be a valuable complement to monetary policy
- However, the use of macroprudential tools could limit the effectiveness of some channels of transmission of monetary policy
- As a result, coordination is required



Conclusions

- The evidence is still not strong enough to suggest that there is a financial cycle that is longer than the business cycle
- Policy, broadly defined, should not solely focus on managing the business cycle – needs to be aware of managing the risks from financial booms
- Macroprudential policy can be a good complement to monetary policy in managing these risks, but it is not perfect



Spares

Spectral analysis – robustness: financial variables

Estimates of financial and macroeconomic cycles

Years

	Financial variables*		Economic variables**	
	Frequency of peak (years)	95% CI	Frequency of peak (years)	95% CI
Australia	14.5	[4.3, 18.1]	4.3	[3.6, 10.4]
US	12.9	[7.5, 22.6]	5.7	[4.5, 11.3]
UK	13.4	[4.7, 23.5]	8.5	[4.5, 15.7]
Germany	12.9	[7.5, 22.6]	9.1	[4.7, 18.1]
France	12.6	[4.9, 17.7]	9.8	[3.1, 14.8]

* Financial variables include credit growth, housing price growth

** Economic variables include GDP growth, employment growth and change in unemployment rate

Note: sample period differs across countries due to data availability, but generally begins between 1970 and 1980, and ends in 2016

Sources: Bank of England; BIS; INSEE; OECD; RBA

Spectral analysis – robustness: sample length

Estimates of financial and macroeconomic cycles

Years

	Financial variables*		Economic variables**	
	Frequency of peak (years)	95% CI	Frequency of peak (years)	95% CI
Australia	8.1	[3.2, 24.2]	4.3	[3.5, 14.5]
US	8.1	[6.0, 36.3]	8.1	[4.3, 14.5]
UK	12.1	[4.5, 24.2]	8.1	[4.8, 18.1]
Germany	8.1	[3.2, 14.5]	10.4	[3.8, 18.1]
France	10.4	[5.2, 24.2]	9.1	[4.5, 72.5]

* Financial variables include credit growth, housing price growth, equity price growth and change in 10-year government bond rates

** Economic variables include GDP growth, employment growth and change in unemployment rate

Note: Sample period limited to 1980:1 to 2016:1 for all countries

Sources: Bank of England; BIS; INSEE; OECD; RBA

Spectral analysis – robustness: annual data

Estimates of financial and macroeconomic cycles

Years

	Financial variables*		Economic variables**	
	Frequency of peak (years)	95% CI	Frequency of peak (years)	95% CI
Australia	4.2	[2.6, 42.0]	6.7	[2.2, 30.3]
US	7.9	[5.2, 49.5]	6.2	[5.0, 19.8]
UK	13.0	[4.2, 18.2]	7.6	[2.5, 91.0]
Germany	12.7	[2.0, 29.7]	12.7	[3.0, 29.7]
France	14.1	[6.3, 56.5]	12.6	[2.6, 56.5]

* Financial variables include credit growth, housing price growth, equity price growth and change in 10-year government bond rates

** Economic variables include GDP growth, employment growth and change in unemployment rate

Note: using the annual Jordà, Schularick and Taylor (forthcoming) database, using data from 1920 onwards

Sources: Jordà, Schularick and Taylor (forthcoming); RBA

Spectral analysis – robustness: No Parzen window

Estimates of financial and macroeconomic cycles

Years

	Financial variables*		Economic variables**	
	Frequency of peak (years)	95% CI	Frequency of peak (years)	95% CI
Australia	14.5	[3.0, 18.1]	4.3	[3.5, 10.4]
US	12.9	[6.0, 18.1]	8.2	[2.6, 10.1]
UK	13.4	[3.2, 31.3]	8.5	[4.7, 15.7]
Germany	7.0	[4.8, 30.2]	5.3	[3.4, 22.6]
France	12.6	[3.2, 17.7]	5.2	[3.1, 29.5]

* Financial variables include credit growth, housing price growth

** Economic variables include GDP growth, employment growth and change in unemployment rate

Note: sample period differs across countries due to data availability, but generally begins between 1970 and 1980, and ends in 2016

Sources: Bank of England; BIS; INSEE; OECD; RBA

MBBQ – robustness: financial variables

Estimates of financial and macroeconomic cycles

Years

	Financial variables*			Economic variables**		
	Contraction	Expansion	Cycle	Contraction	Expansion	Cycle
Australia	3.1	2.5	5.6	1.8	7.4	9.8
US	2.3	9.6	11.5	1.2	4.7	6.4
UK	6.4	5.6	8.2	1.8	5.2	7.0
Germany	2.8	0.5	3.3	2.0	2.9	5.1
France	3.8	4.9	9.8	1.6	6.0	8.5

* Financial variables include credit, housing prices

** Economic variables include GDP, employment and unemployment rate

Note: sample period differs across countries due to data availability, but generally begins between 1970 and 1980, and ends in 2016

Sources: Bank of England; BIS; INSEE; OECD; RBA

Power Cohesion

We follow Schuler *et al* (2016) and calculate a measure of the multivariate spectral density called the Power Cohesion:

$$PCoh_X(\omega) = \frac{1}{(M-1)M} \sum_{a \neq b} |f_{x_a x_b}(\omega)|$$
$$f_{x_a x_b}(\omega) = \frac{S_{x_a x_b}(\omega)}{\sigma_{x_a} \sigma_{x_b}} = \frac{1}{2\pi} \sum_{k=-\infty}^{\infty} \frac{Cov[x_{a,t}, x_{b,t+k}]}{\sigma_{x_a} \sigma_{x_b}} e^{-ik\omega}$$

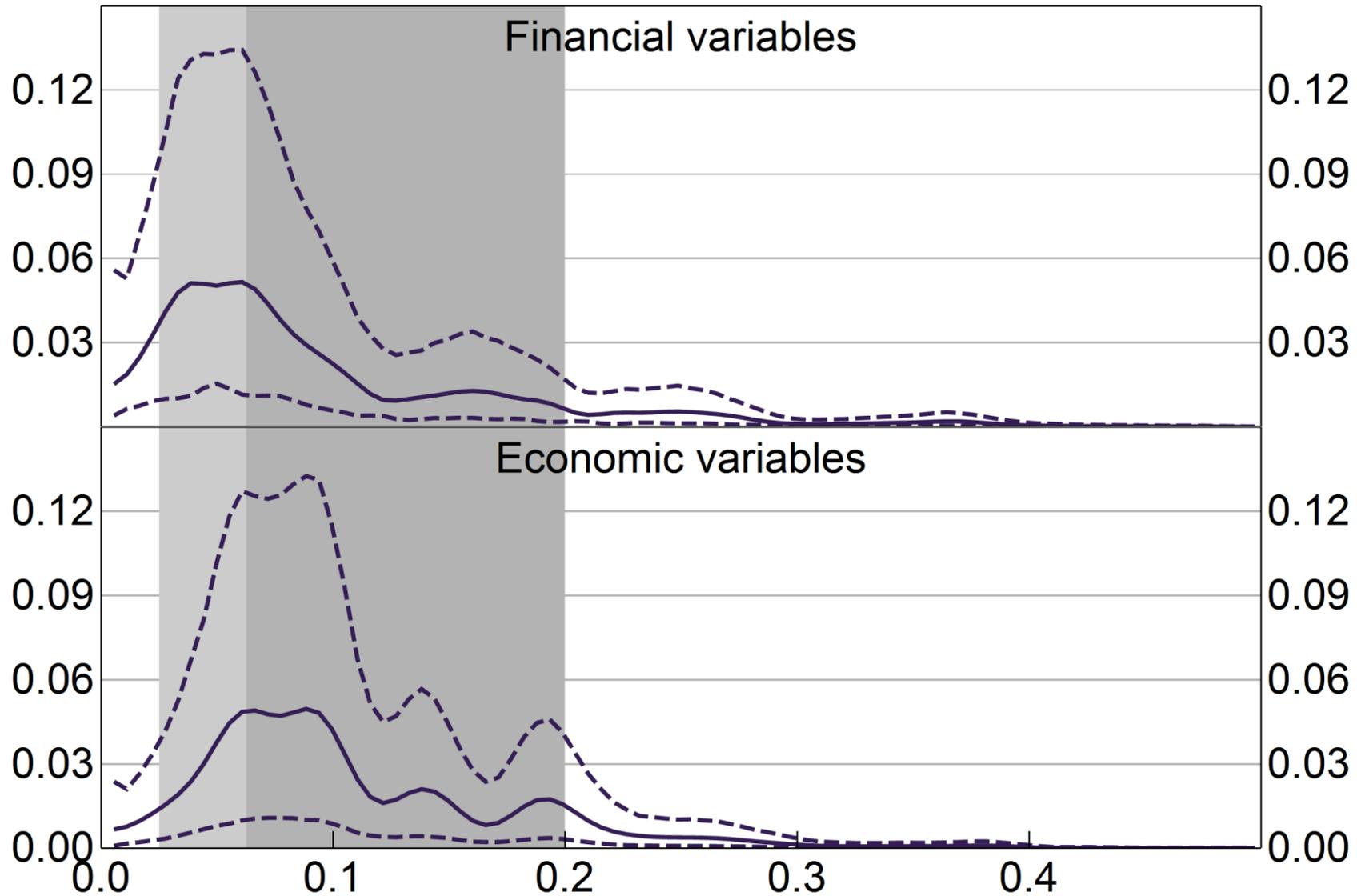


Bootstrapping

- 1. Berkowitz and Diebold (1998):** Estimate smoothed and unsmoothed spectral densities. The ratio should follow a Chi-squared distribution. Draw randomly from a Chi-squared distribution to estimate i^{th} bootstrap of unsmoothed spectral density.
- 2. Circular block bootstrap:** Replicate time series using fixed block lengths. Randomly choose to create i new time series of same length as original data

→ **Both methods produce similar results**

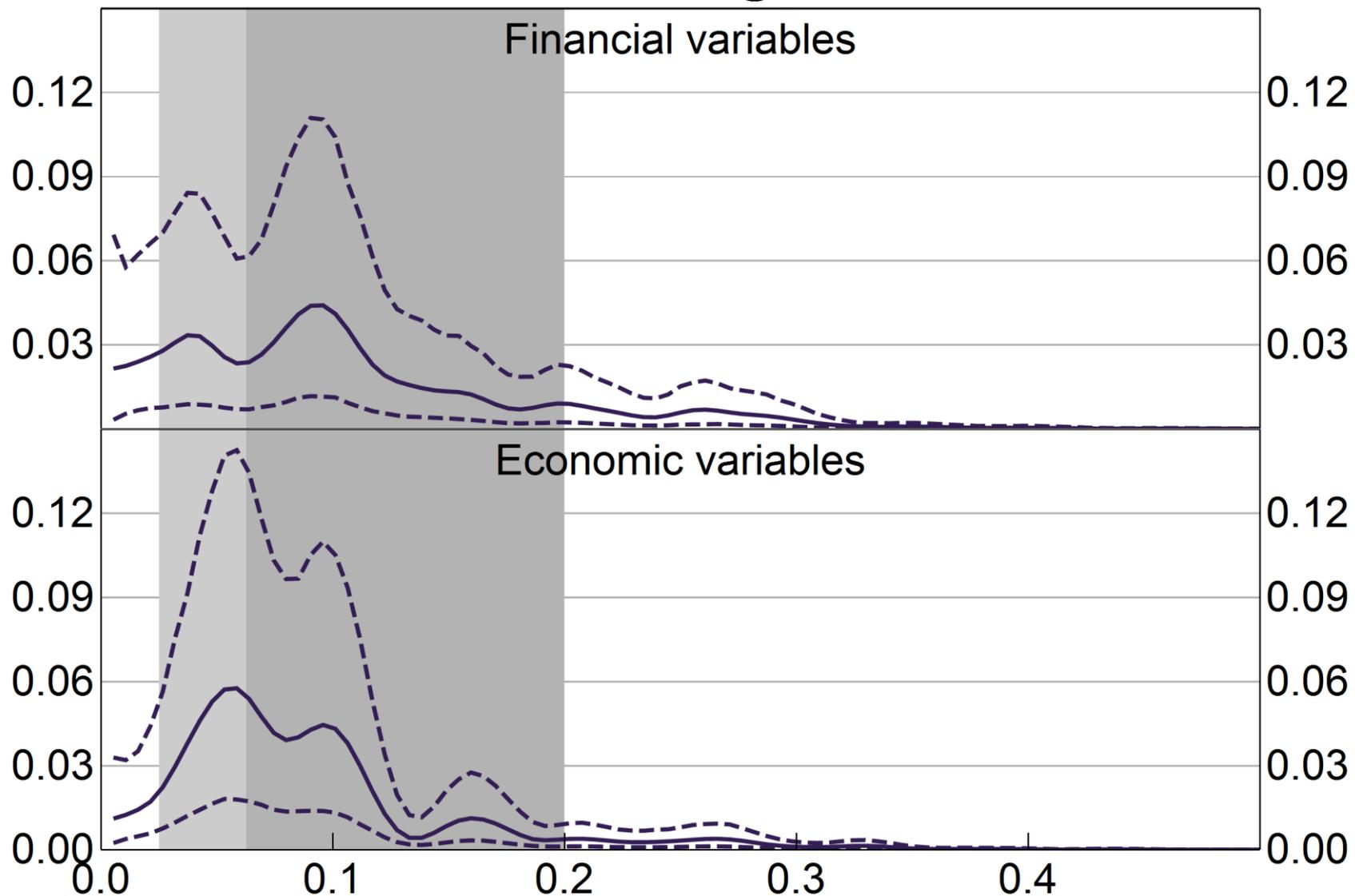
United States*



* Quarterly data 1971Q1 to 2016Q1

Sources: BIS; OECD; RBA

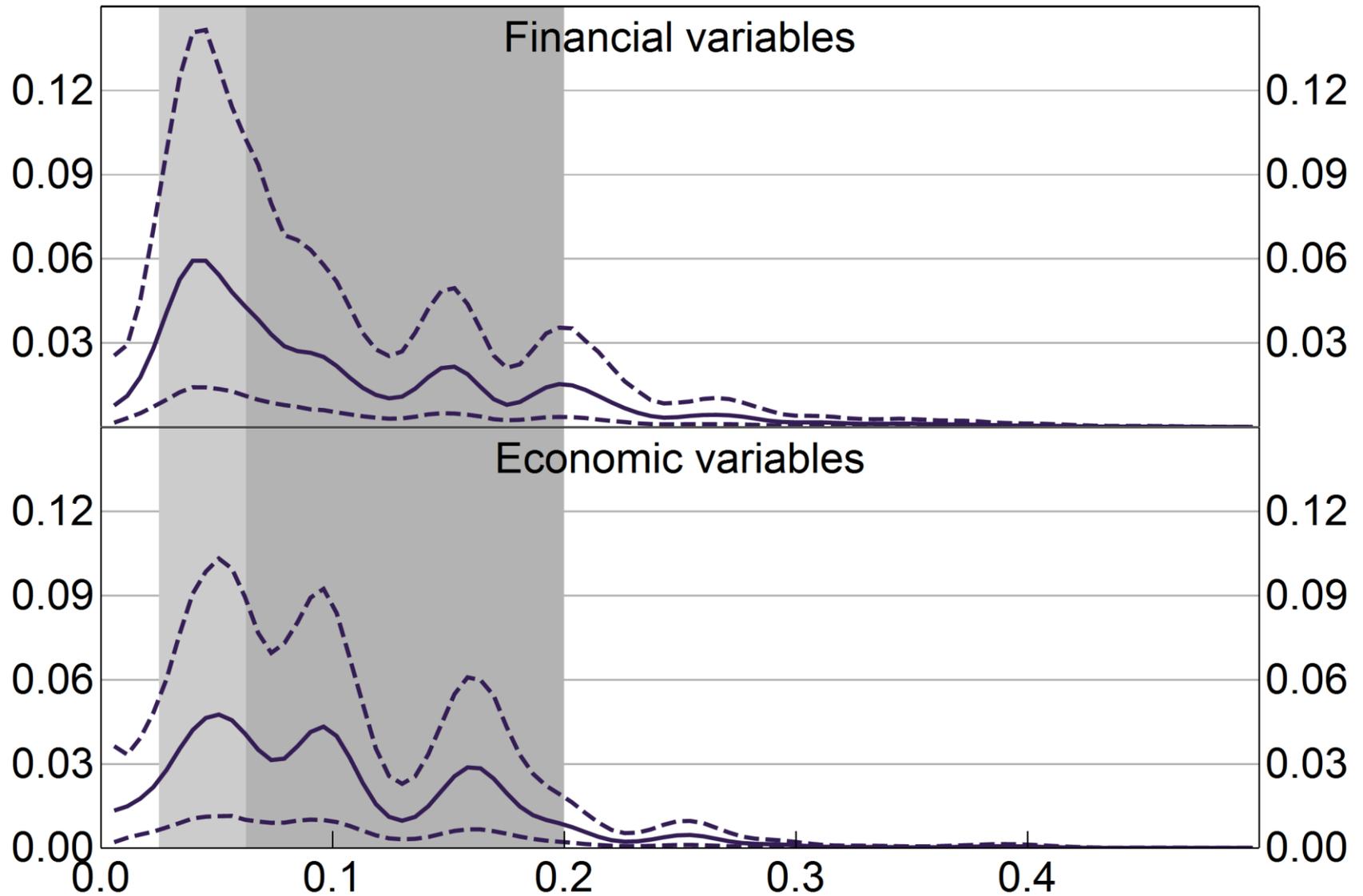
United Kingdom*



* Quarterly data 1969Q2 to 2016Q1

Sources: Bank of England; BIS; OECD; RBA

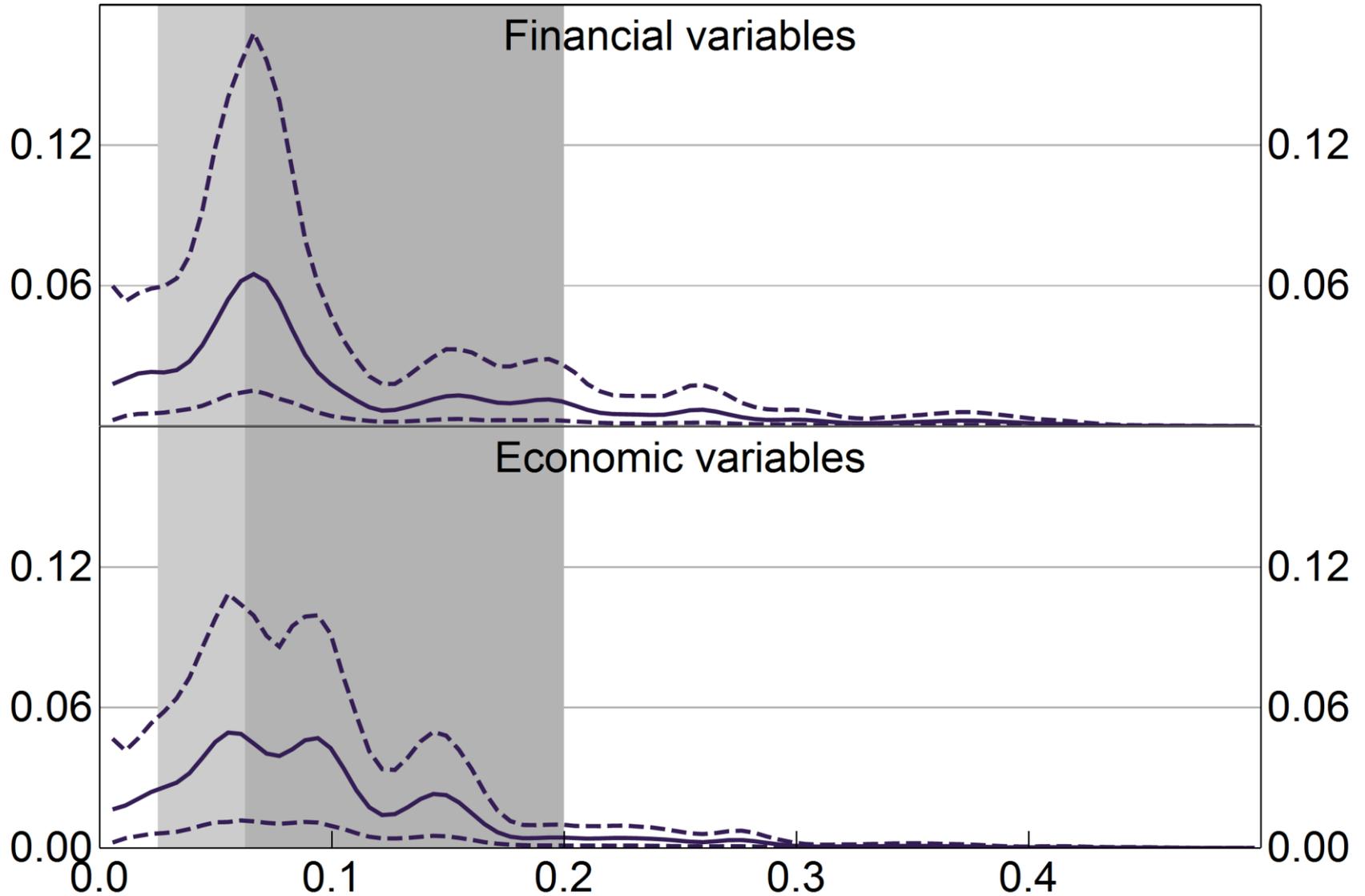
France*



* Quarterly data 1972Q1 to 2016Q1

Sources: BIS; INSEE; OECD; RBA

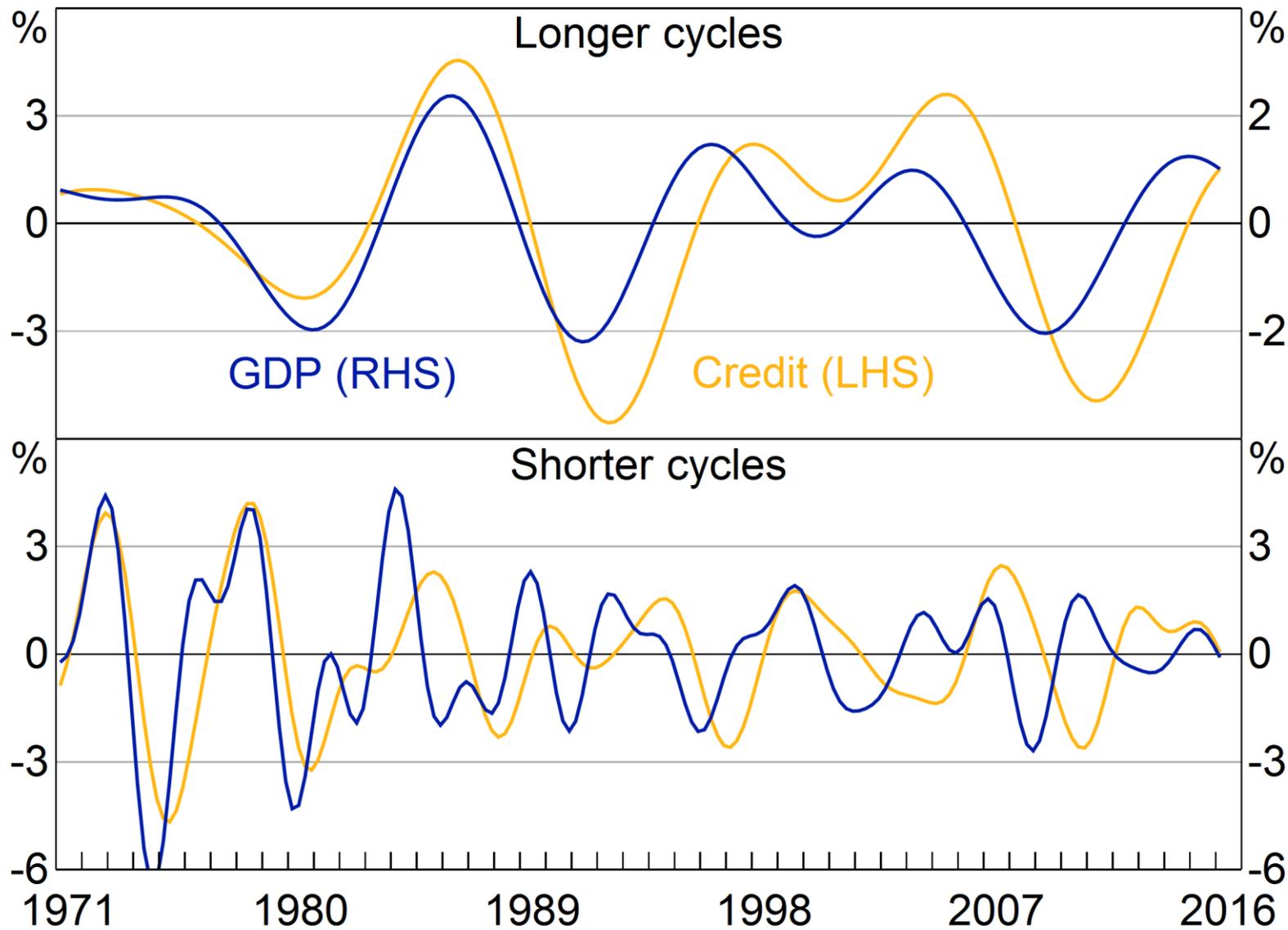
Germany*



* Quarterly data 1971Q1 to 2016Q1

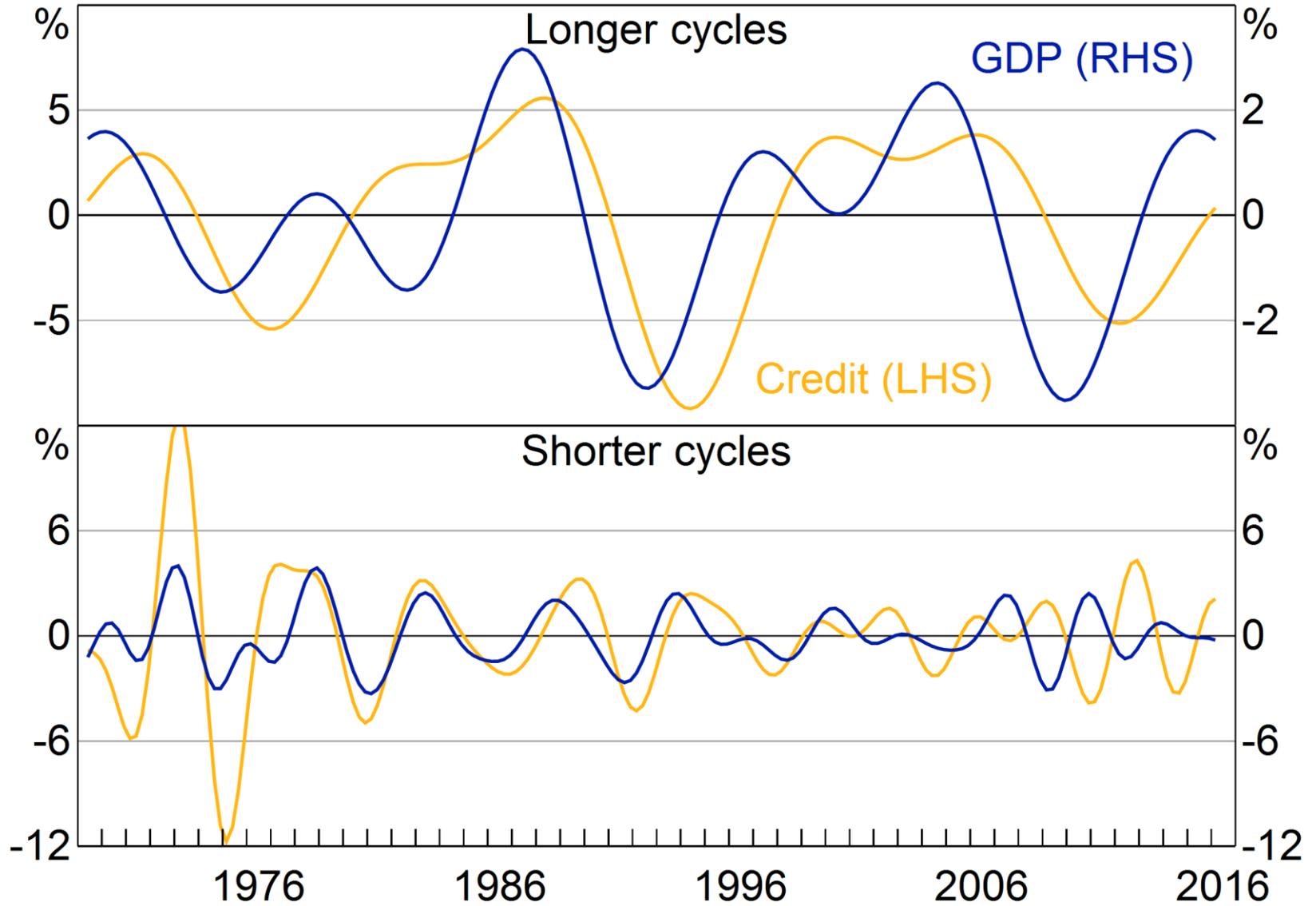
Sources: BIS; OECD; RBA

United States



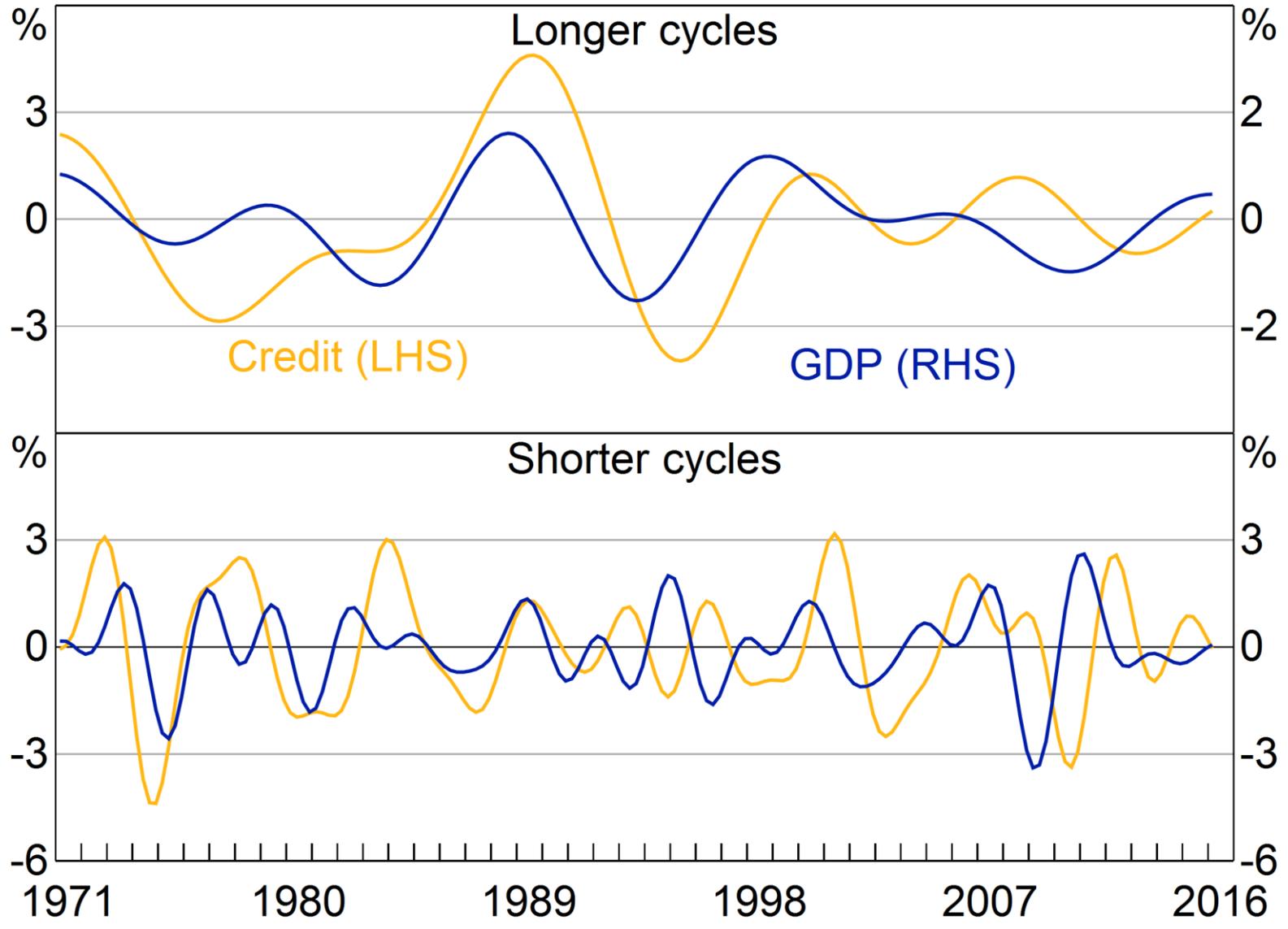
Sources: BIS; OECD; RBA

United Kingdom



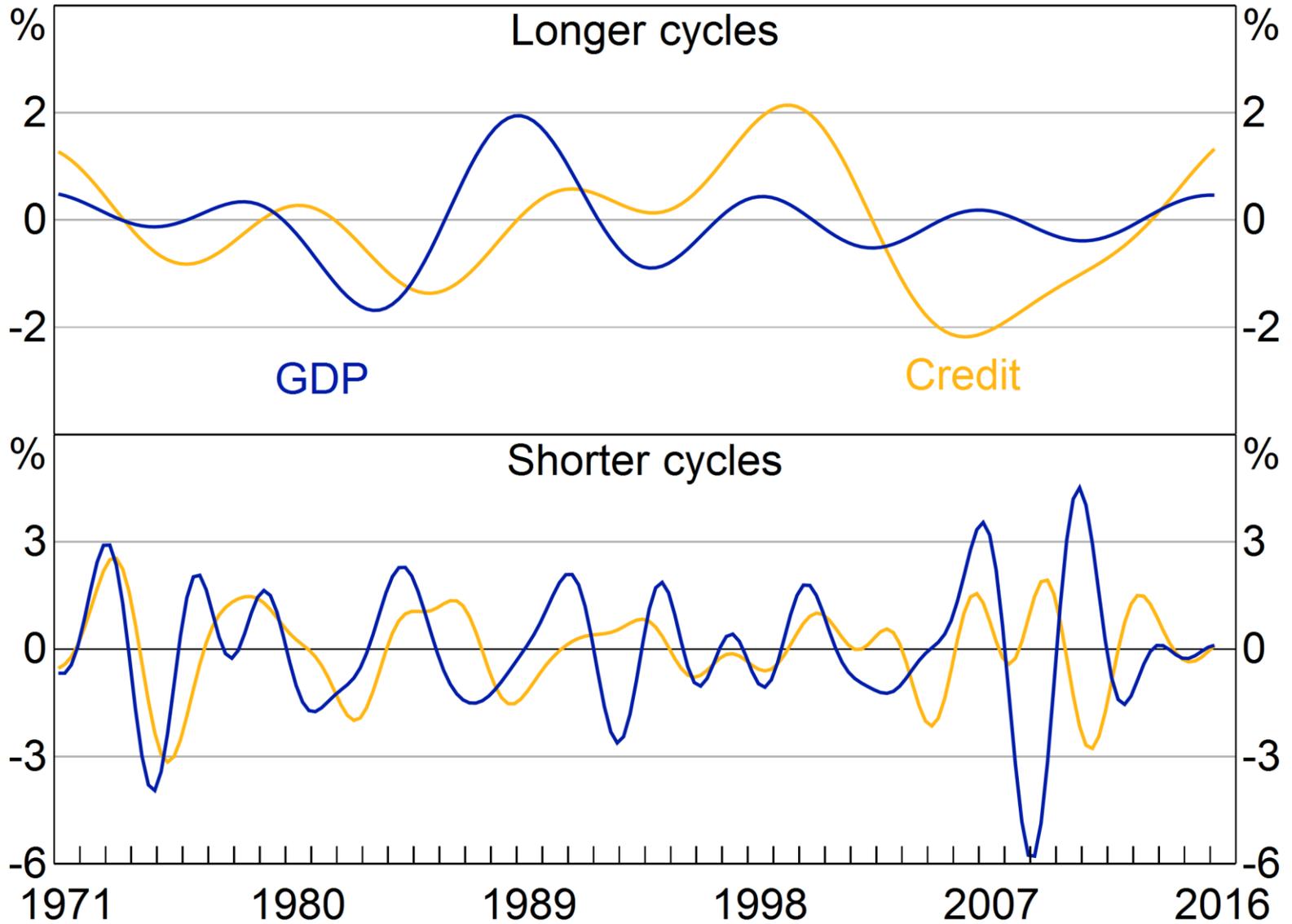
Sources: BIS; OECD; RBA

France



Sources: BIS; OECD; RBA

Germany



Sources: BIS; OECD; RBA

BBQ

Degree of synchronisation

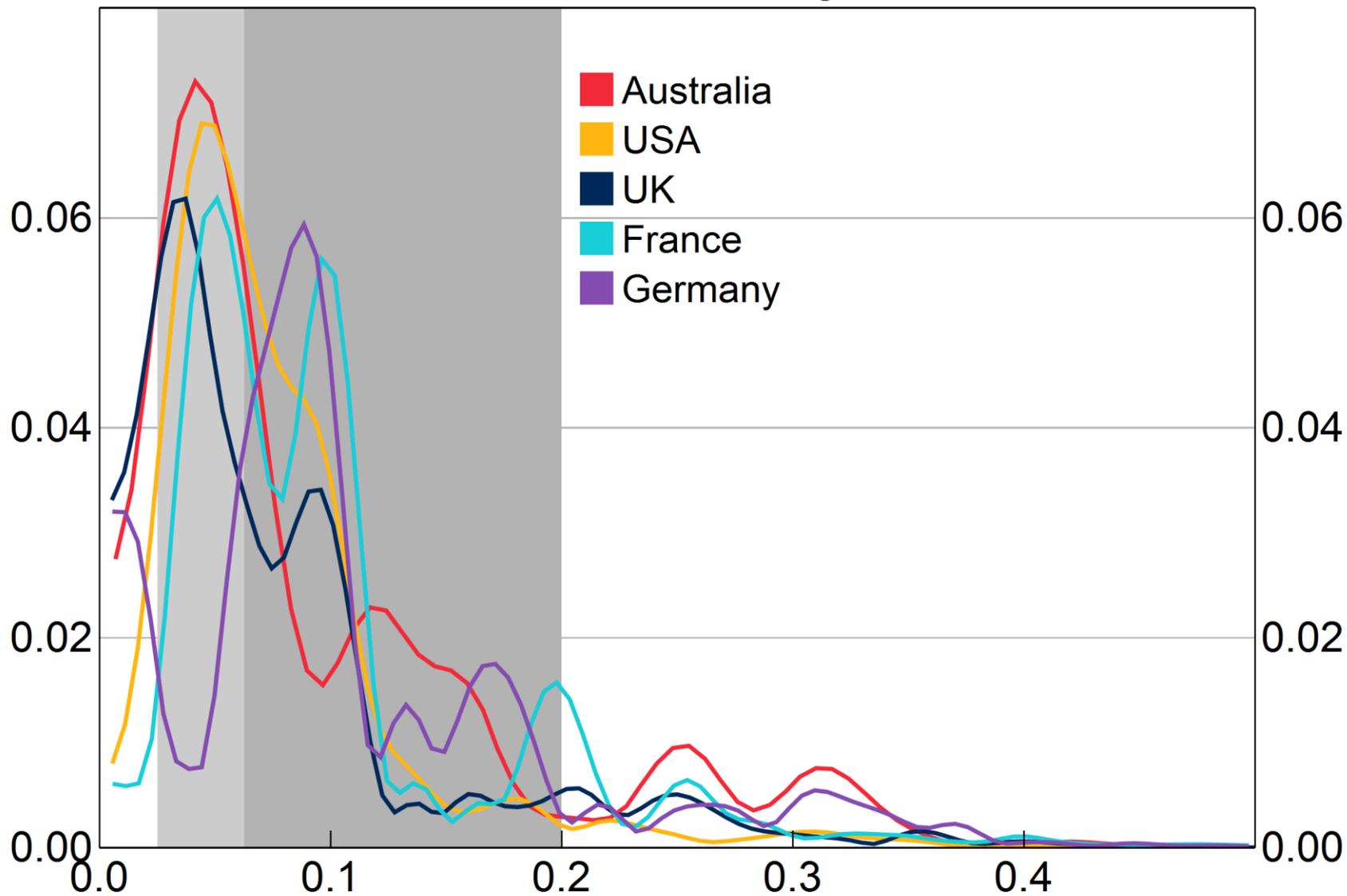
	Longer cycles*	Shorter cycles*
Australia	0.73	0.61
USA	0.77	0.55
UK	0.57	0.60
France	0.65	0.51
Germany	0.64	0.54
Average	0.67	0.57

* Longer (shorter) cycles are determined using a Christiano-Fitzgerald band-pass filter with a lower cut-off frequency of 8 (2.5) years and a upper cut-off frequency of 30 (8) years

Sources: BIS;OECD; RBA

Cross-spectral Densities

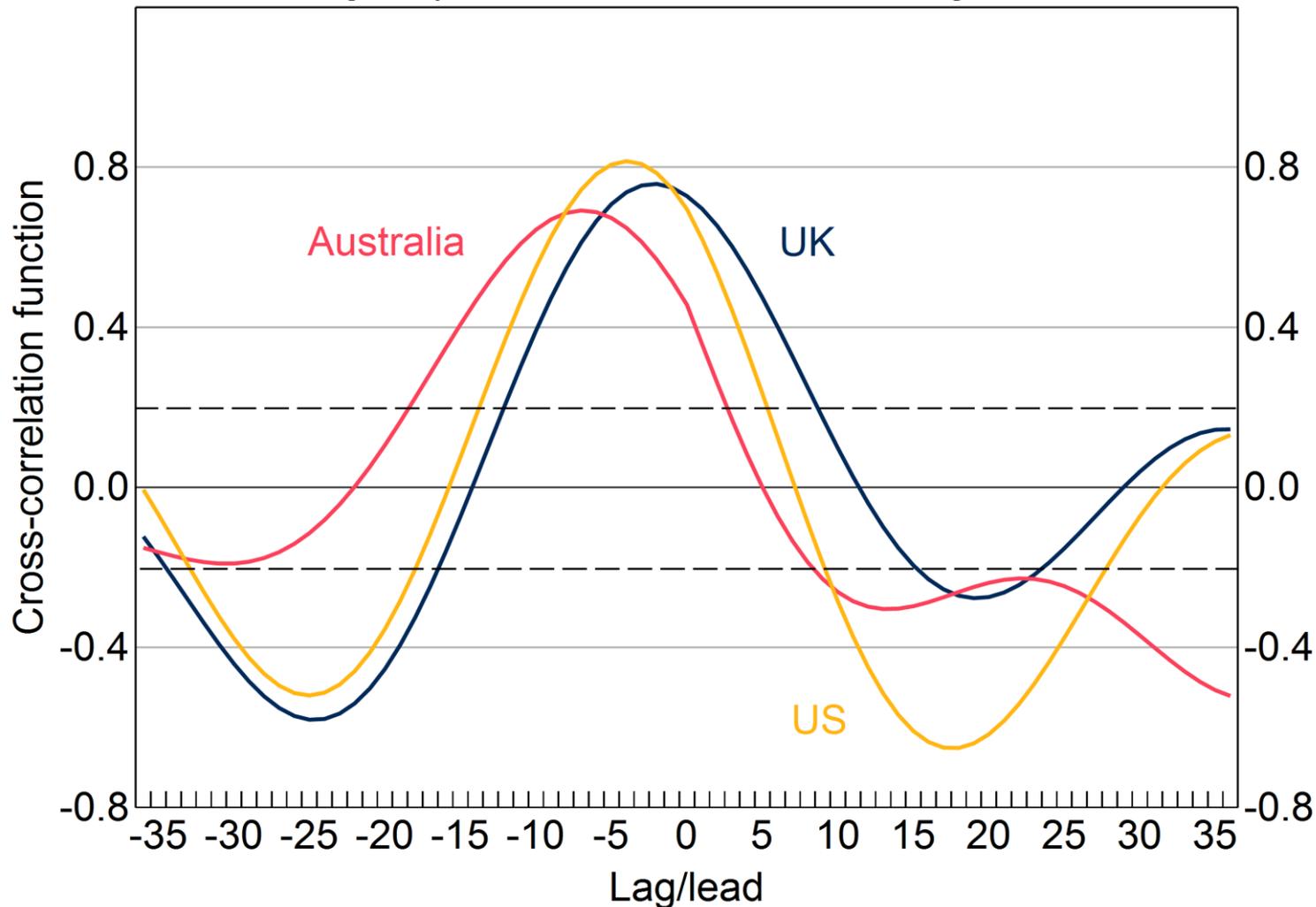
Real credit and GDP growth



Sources: BIS; OECD; RBA

Cross-correlograms*

Longer cycles in real credit and GDP growth**



* Shows the correlation between the cycle in credit growth at time 0 and 36 leads and lags of the cycle in GDP growth; dashed lines represent the approximate 95% confidence interval

** Longer cycles correspond to cycle frequencies between 8 and 30 years

Sources: BIS; OECD; RBA