Uncertainty and Business Cycle Synchronization in Europe

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Research question

- Uncertainty affects business cycle dynamics (Bloom, 2014; Baker et al, 2016; Caldara et al., 2016; Jo and Sekkel, 2019)
- Business cycle synchronization is a natural proxy for the optimality of currency areas (Mundell, 1961)
- Which role does uncertainty plays as a determinant of business cycle synchronization dynamics in the European Monetary Union?

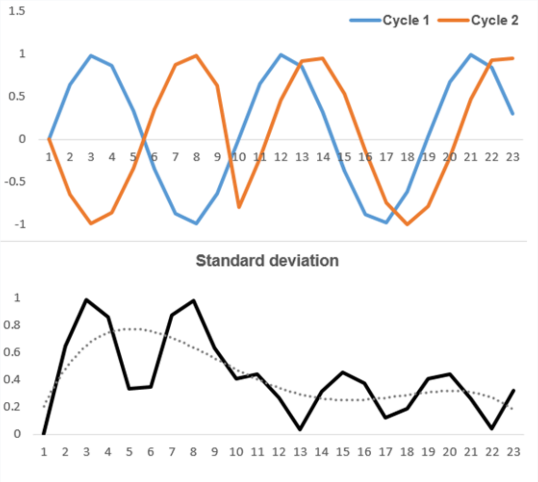
Measuring Business Cycle Synchronization

- From business cycle correlation to time-varying, country-specific measures of synchronization (Crespo Cuaresma and Fernández Amador, 2013a, 2013b)
- Measuring business cycle synchronization using the dispersion of business cycles instead of correlation measures,

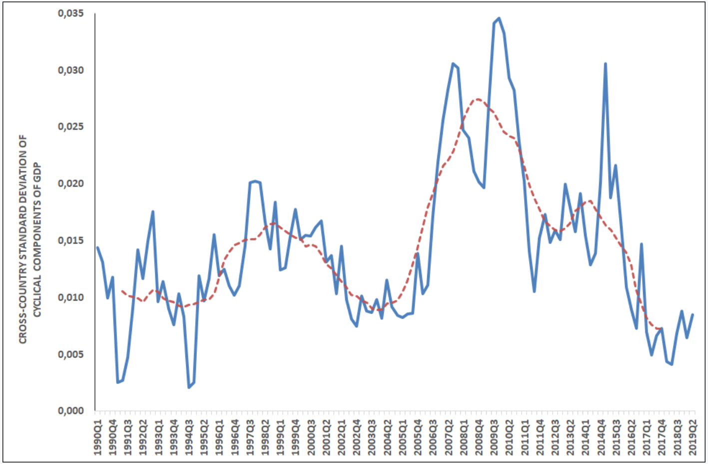
$$\text{synch}_{it} = \log(s_{it}) - \log(s_t)$$

where $s_t = \sqrt{\left(\sum_j (c_{jt}) - \bar{c}_t)^2\right) / N}$ and $s_{it} = \sqrt{\left(\sum_{j \neq i} (c_{jt}) - \bar{c}_{jt})^2\right) / (N-1)}$ denote the standard deviation of the estimates of the cyclical component of GDP (c_{it}) including all N countries that compose the monetary union and the same measure excluding country i

Measuring Business Cycle Synchronization



Measuring Business Cycle Synchronization



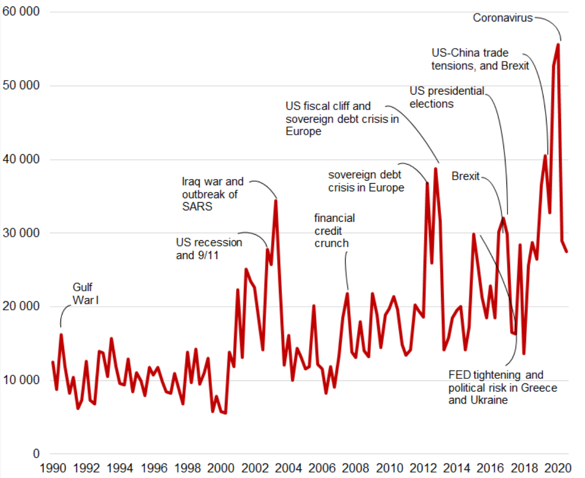
Uncertainty and business cycle synchronization

- We entertain models embedded in the ARDL specification given by

$$\text{synch}_{it} = \sum_{j=1}^{4} \gamma_j \text{synch}_{it-j} + \sum_{j=1}^{4} \beta_j \text{uncert}_{it-j} + \sum_{k=1}^{N} \sum_{j=1}^{4} \theta_{kj} x_{kit-j} + \alpha_i + \lambda_t + \varepsilon_{it},$$

  where the pool of potential covariates $\{x_{kt}\}, k = 1, \ldots, N$ contains trade and government balance variable, as well as the variable identifying negative values of synch_{it} ($I(\text{synch}_{it} < 0)$) and its interaction with the uncertainty, trade and government balance variables.
- Uncertainty index using frequency counts of “uncertainty" (and its variants) in the quarterly Economist Intelligence Unit (EIU) country reports (Ahir, Bloom and Furceri, 2020)

The Uncertainty Index



Some model-specific results

	(1)	(2)	(3)	(4)
Uncertainty	-0.0302*	-0.0214*	-0.0171*	0.0331*
	(0.0151)	(0.0103)	(0.00903)	(0.0159)
Lagged synchronization		0.532***	0.504***	0.419***
		(0.0234)	(0.0234)	(0.0167)
Exports to EMU			0.0291**	0.0187*
			(0.0123)	(0.00952)
Government balance			-0.0478	-0.0418
			(0.0856)	(0.0643)
Uncertainty $\times I(\text{synchro}_{it} < 0)$				-0.285***
				(0.0447)
N	1230	1215	1183	1183
R^2	0.024	0.304	0.299	0.413

Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Country and time fixed effects in all specifications.

Is uncertainty a robust determinant of synchronization?

- Bayesian Model Averaging (BMA): Base inference on the full set of models given by specifications of the type

$$\text{synch}_{it} = \sum_{j=1}^{4} \gamma_j \text{synch}_{it-j} + \sum_{j=1}^{4} \beta_j \text{uncert}_{it-j} + \sum_{k=1}^{N} \sum_{j=1}^{4} \theta_{kj} x_{kit-j} + \alpha_i + \lambda_t + \varepsilon_{it},$$

- Inference robust to specification uncertainty,

$$p(\beta_j|y) = \sum_{c=1}^{M} p(\beta_j|y, M_c) p(M_c|y),$$

where $p(M_c|y) \propto (y|M_c)P(M_c)$

Is uncertainty a robust determinant of synchronization?

- $p(y|M_c)$, the marginal likelihood of model M_c can be easily obtained using a g-prior on the parameters of model M_c
- Eliciting $p(M_c)$:
  - Flat prior over model size (Ley and Steel, 2009)
  - Strong heredity prior (Chipman, 1996; Crespo Cuaresma, 2011), $p(M_c) = 0$ if an interaction term is in M_c but the parent variables are not included
- Since we have 29 covariates ($2^{29} = 536,870,912$ models), Markov Chain Monte Carlo Model Composition method used to compute posterior model probabilities

Variable	(1) Fixed country and time effects PIP	Post. Mean	Post. SD	(2) Standard BMA PIP	Post. Mean	Post. SD	(3) Strong heredity PIP	Post. Mean	Post. SD
synch_{t-1}	**1.000**	**0.334**	**0.028**	**1.000**	**0.364**	**0.028**	**1.000**	**0.363**	**0.028**
synch_{t-2}	0.003	0.000	0.002	0.001	0.000	0.001	0.001	0.000	0.001
synch_{t-3}	**0.999**	**0.175**	**0.031**	**0.999**	**0.193**	**0.029**	**0.999**	**0.192**	**0.029**
synch_{t-4}	0.111	0.009	0.028	0.050	0.005	0.021	0.057	0.005	0.022
uncert_{t-1}	0.003	0.000	0.001	0.001	0.000	0.000	**0.976**	**0.003**	**0.012**
uncert_{t-2}	0.003	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001
uncert_{t-3}	0.003	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000
uncert_{t-4}	0.003	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000
Exports_{t-1}	0.012	0.000	0.007	0.001	0.000	0.000	0.001	0.000	0.000
Exports_{t-2}	0.017	0.001	0.007	0.001	0.000	0.000	0.001	0.000	0.000
Exports_{t-3}	0.019	0.001	0.005	0.001	0.000	0.000	0.001	0.000	0.000
Exports_{t-4}	0.018	0.000	0.004	0.001	0.000	0.000	0.001	0.000	0.000
Gov.Bal._{t-1}	0.003	0.000	0.003	0.001	0.000	0.001	0.001	0.000	0.001
Gov.Bal._{t-2}	0.003	0.000	0.003	0.001	0.000	0.002	0.001	0.000	0.001
Gov.Bal._{t-3}	0.003	0.000	0.003	0.001	0.000	0.002	0.001	0.000	0.001
Gov.Bal._{t-4}	0.002	0.000	0.003	0.001	0.000	0.002	0.001	0.000	0.002
$I(\text{synch}_{it} < 0)$	**0.973**	**-0.128**	**0.078**	**0.854**	**-0.037**	**0.020**	**1.000**	**-0.042**	**0.007**
$I(\text{synch}_{it} < 0) \times \text{uncert}_{t-1}$	**1.000**	**-0.162**	**0.027**	**1.000**	**-0.163**	**0.026**	**0.986**	**-0.162**	**0.034**
$I(\text{synch}_{it} < 0) \times \text{uncert}_{t-2}$	0.020	0.001	0.009	0.007	0.000	0.005	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{uncert}_{t-3}$	0.003	0.000	0.002	0.001	0.000	0.001	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{uncert}_{t-4}$	0.002	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{Gov.Bal.}_{t-1}$	0.003	0.000	0.006	0.001	0.000	0.003	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{Gov.Bal.}_{t-2}$	0.004	0.000	0.008	0.001	0.000	0.005	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{Gov.Bal.}_{t-3}$	0.004	0.000	0.007	0.001	0.000	0.004	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{Gov.Bal.}_{t-4}$	0.008	0.001	0.012	0.002	0.000	0.007	0.000	0.000	0.001
$I(\text{synch}_{it} < 0) \times \text{Exports}_{t-1}$	0.143	0.001	0.009	0.049	0.000	0.002	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{Exports}_{t-2}$	0.157	0.002	0.010	0.040	0.000	0.002	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{Exports}_{t-3}$	0.161	0.003	0.020	0.034	0.000	0.004	0.000	0.000	0.000
$I(\text{synch}_{it} < 0) \times \text{Exports}_{t-4}$	0.136	0.001	0.017	0.042	0.000	0.003	0.000	0.000	0.000

PIP stands for "Posterior inclusion probability". Results based on 10,000,000 MCMC steps after a burn-in phase of 10,000 steps.
Strong heredity prior in setting 3 based on Crespo-Cuaresma (2011).

BMA Results

- Very few variables that achieve large posterior inclusion probabilities beyond lags of the dependent variable, which appear necessary to account for the persistence in the business cycle synchronization variable
- The uncertainty variable is an extremely robust variable in desynchronization regimes
- The effect implies that in the course of episodes of business cycle desynchronization, increases in uncertainty tend to systematically lead to a more unstable monetary union
- An increase in one standard deviation of the uncertainty variable in countries which are in a desynchronization phase translates on average to a reduction of 0.184 standard deviations in the business cycle synchronization variable

Conclusions

- To the extent that uncertainty affects business cycle dynamics, it may be an important determinant of the optimality of currency unions
- We find evidence that changes in the uncertainty index by Baker et al. (2016) robustly predicts changes in business cycle synchronization in EMU
- Increases in uncertainty lead to further business cycle desynchronization in economies which are not in line with the EMU-wide cycle