

Commonalities and heterogeneity in the Iberian business cycle

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Hugo Morão António Afonso

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ISEG – Lisbon School of Economics and Management, University of Lisbon
REM/UECE

Spain and Portugal: shared history, different economies

- Both countries made their **democratic transition at the same time** and joined the European Economic Community in its **1986 enlargement**
- Yet they differ: Spain's economy is **larger and more diversified**; Portugal's is smaller and relies heavily on tourism, an asymmetry in sensitivity to external shocks (and likely to policy changes)
- Both are peripheral economies of the Eurozone: a laboratory for the interplay of **convergence and divergence** in the economic and monetary union
- EU cohesion funds aim at convergence: between 2014 and 2020 Spain and Portugal received approximately **EUR 42.4 billion** and **EUR 23 billion**

Question

Have these policies, and EU integration more broadly, synchronized the business cycles of the two economies?

Research questions and approach

- **Q1.** Are the business cycles of the Iberian Peninsula becoming more similar?
- **Q2.** Did joining the EU (1986) increase interdependence between the two countries?
- **Q3.** Are national idiosyncrasies expected to mitigate under common policies, notably the Euro?
- **Approach:** time-varying multi-country Bayesian VAR (Canova and Ciccarelli 2009; Ciccarelli et al. 2016) for Spain and Portugal, annual data 1870–2017

Why this model (the paper's three reasons)

(i) it allows international spillovers, ignored by country-by-country VARs; (ii) it accounts for country-specific dynamics; (iii) its parsimonious factor decomposition allows time-varying coefficients

Preview of results

- **Common cycle:** significant co-movement between the Spanish and Portuguese cycles, except in certain periods of political uncertainty and economic contraction. Synchronization rose after entry into the EEC and peaked in the mid-1990s; co-movement decreased after the Euro
- **Heterogeneity:** idiosyncratic factors remain important and are not expected to disappear soon; time variation after the Euro is negligible, particularly for Spain
- **Financial variables:** budget deficits and stock prices converge, but credit and country spreads do not (idiosyncratic dynamics remain significant)

The evidence suggests EU policies have not bridged the gap between the two countries' cycles.

Related literature: three strands

1. **Synchronization and the global cycle:** trade agreements (Hirata et al. 2013), deeper financial ties (Lane and Milesi-Ferretti 2007), the rise of emerging economies (Ductor and Leiva-Leon 2016); national cycles are more connected to the global one, with time-varying sensitivity (Kose et al. 2013); EU determinants (Beck 2019)
2. **Europe and the Euro:** little changed in European cycles since the monetary union (Giannone et al. 2013); no Euro cycle detected (Canova, Ciccarelli, and Ortega 2007); idiosyncrasies persist in the Mediterranean basin (Canova and Ciccarelli 2012); convergence precedes Maastricht and the Euro (Canova, Ciccarelli, and Ortega 2012); synchronization slowed in the Euro (Bekiros et al. 2015)
3. **Multi-country, time-varying BVARs:** Canova and Ciccarelli (2009) and Ciccarelli et al. (2016); applied to Australian states (Poon 2018) and to international shocks on state cycles (Cross and Poon 2020)

Spain and Portugal. Little literature on their interactions: the only paper on cross-country heterogeneity is Balaguer and Ripollés (2018), on diesel retailers and border effects.

Contribution

- **Applies the multi-country time-varying BVAR** of Canova and Ciccarelli (2009) and Ciccarelli et al. (2016) to the Iberian Peninsula, using its institutional and historical features
- **Long time dimension (1870–2017)**: to the authors' knowledge the first paper to exploit it, relying on the macro-financial historical dataset of Jordà et al. (2017)
- Time-varying evidence on **volatility** in the two countries over a large sample
- **Convergence of financial variables**: fiscal deficits, country and credit spreads, stock prices (cf. Busetti et al. 2007; Franks et al. 2018; Diaz del Hoyo et al. 2021)

Long-run evidence on whether Iberian cycles converge, and on what the Euro changed.

Data and Method

Data: five core variables for two countries, 1870–2017

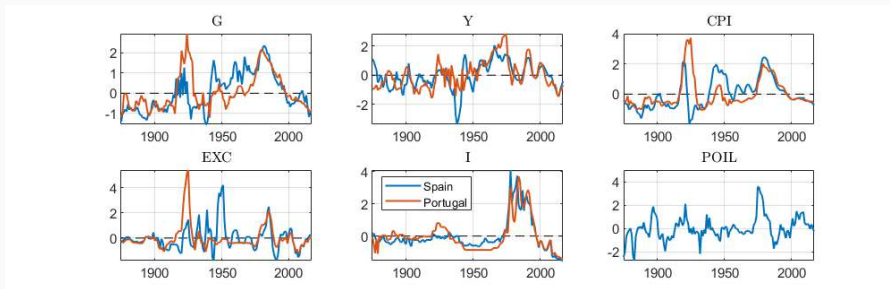
Label		Description	Source
Y_t	Δ	Nominal GDP (local currency), deflated with the CPI	Jordà et al. (2017)
CPI_t	Δ	Consumer prices (index, 1990=100)	Jordà et al. (2017)
G_t	Δ	Government expenditure (nominal, local currency), deflated with the CPI	Jordà et al. (2017)
EXC_t	Δ	USD exchange rate (local currency/USD)	Jordà et al. (2017)
I_t	%	Short-term interest rate (nominal, percent per year)	Jordà et al. (2017)
O_t	Δ	Oil price (index, 1900=100), exogenous	Jacks and Stuermer (2020)

Notes: Annual series, 1870–2017; all variables standardized; Δ is a growth rate, the interest rate is in percent.

- Restricted to these variables because others are not available for both countries over the whole sample
- **Financial block:** country and credit spreads, budget deficit, share prices; quarterly, 1999–2022

Descriptive statistics

The raw series already show a closer fit after EEC entry



Notes: Macroeconomic variables used in the model, standardized; Spain (blue) and Portugal (red). Notation: *G* government expenditure, *Y* output, *CPI* consumer prices, *EXC* exchange rate, *I* interest rate, *POIL* oil price.

- By visual inspection, a noticeable increase in synchronization after EEC entry (January 1986)
- The most significant instability in Spain was the civil war (1936–1939); after 2000 Spanish public expenditure growth rose above Portugal's

A multi-country BVAR with time-varying coefficients and volatility

$$y_t = \bar{X}_t \beta_t + \varepsilon_t, \quad \varepsilon_t \sim \mathcal{N}(0, \Sigma_t), \quad \Sigma_t = \exp(\zeta_t) \tilde{\Sigma}, \quad \zeta_t = \gamma \zeta_{t-1} + v_t, \quad \theta_t = (1 - \rho) \bar{\theta} + \rho \theta_{t-1} + \eta_t$$
$$\beta_t = \Xi_1 \theta_{1t} + \Xi_2 \theta_{2t} + \Xi_3 \theta_{3t} + \Xi_5 \theta_{5t}$$

- y_t stacks, for each country, **government expenditure growth, real output growth, inflation, exchange-rate growth and the short-term interest rate**; oil prices are exogenous; one lag
- **Three features**: interdependencies between the two economies; country-specific slopes and variances; coefficients that vary over time (crises and political transformations can change business-cycle relationships)
- β_t is factorized following Canova and Ciccarelli (2009): the θ 's are mutually orthogonal factors, Ξ 's known selection matrices; ζ_t is the common volatility factor
- Keeps the model unrestricted and uses shrinkage priors to reduce dimensionality

Estimation and priors

Four kinds of factors, each read as an index

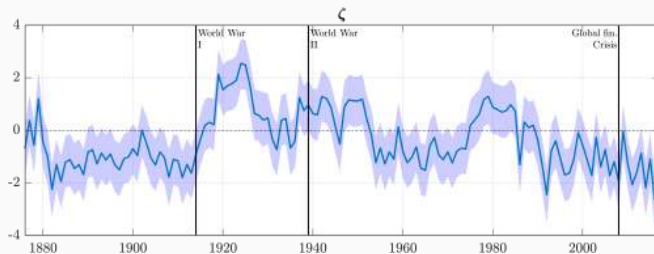
Factor	Captures	Role in the paper	#
θ_1	Commonality across countries and variables	Low-frequency proxy for Iberian business-cycle fluctuations	1
θ_2	Components within each country (θ_{21} Spain, θ_{22} Portugal)	Idiosyncratic, higher-frequency fluctuations	2
θ_3	Components specific to each endogenous variable ($\theta_{31}-\theta_{35}$)	Common fluctuation of each variable across both countries	5
θ_5	Component of the exogenous variable	Effect of oil prices	1

- θ_4 is omitted because the main specification uses one lag
- The factors can be interpreted as **indices** of fluctuations in the variables of interest; this lets the paper ask how much commonalities, variable-specific and idiosyncratic factors explain y_t over time

Oil factor θ_5

Results

Volatility is far from constant: a constant-variance model would not do

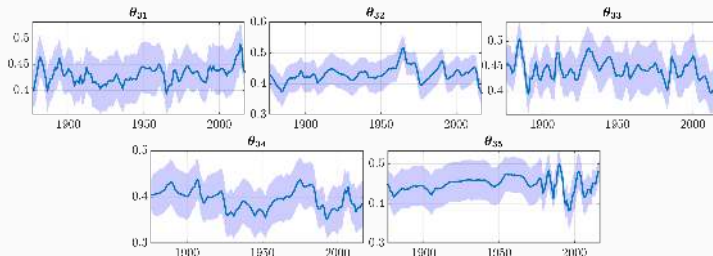


Notes: Common volatility factor ζ_t , posterior median and 68% bands, in standard deviations.

- Most turbulent: the downfall of Portugal's 1st Republic; high again in the 1970s (democratic transitions, quadrupled fuel prices)
- 1950s–1960s: intervals include zero for most of these decades; stabilization after EEC entry
- First decade of the Euro: a downward trend, later reversed, possibly due to the global financial crisis

Five periods

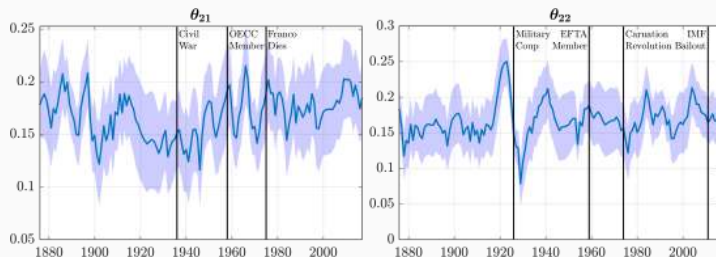
Each variable has a common Iberian component that is clearly non-zero



Notes: θ_{31} – θ_{35} : government spending, output, prices, exchange rate, interest rate; median and 68% bands.

- No band includes zero: a common dynamic across both countries; exceptions to synchronization are the start of Portugal's dictatorship and the latest democratic transition
- **Output:** tracks the dictatorship and the democratic transitions; minor global financial crisis effect (both countries were already in the EU and Euro)
- **Interest rates:** a first synchronization wave around 1900, likely from banking modernization; convergence again with the Eurozone

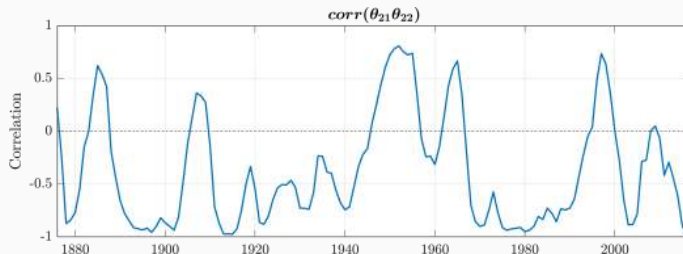
Country-specific factors do not fade, not even in the Euro era



Notes: θ_{21} (Spain) and θ_{22} (Portugal), median and 68% bands; bars mark national political events.

- Both factors stay clearly above zero through the sample, including after the Euro: **idiosyncrasies persist**
- After entry into the European community the paper finds a remarkable synchronization and stability of both cycles: no other period shows such similarity
- Bekiros et al. (2015) reach a similar result for the Euro period with frequency-domain techniques

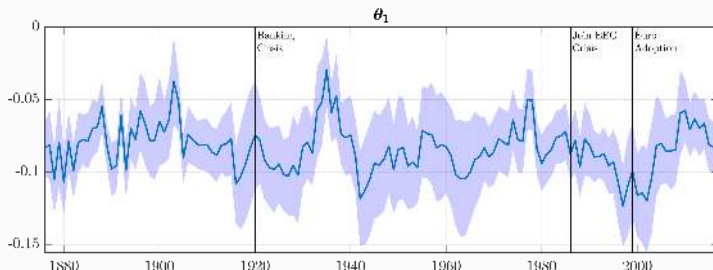
Cycle correlation rose after EEC entry, then fell with the Euro



Notes: 10-year rolling correlation between θ_{21} and θ_{22} (posterior medians).

- From strongly negative in the 1970s–80s the correlation climbs to a **peak around 1997**, then drops after the Euro changeover (the paper: peak in the mid-1990s)
- Earlier positive episodes in the 1950s and mid-1960s; the paper ties the 1960s to internationalization and foreign investment
- Persistence of country-specific factors after the Euro is consistent with heterogeneous behavior (the paper)

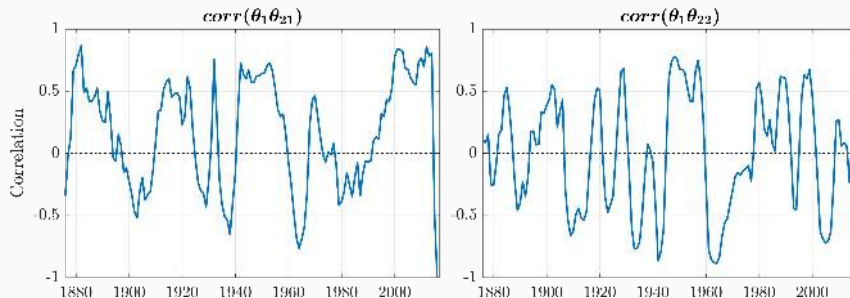
A distinct common factor, notable in the 1960s and at Euro adoption



Notes: Common factor θ_1 , median and 68% bands; bars: 1920 banking crisis, EEC entry, Euro adoption.

- The bands exclude zero at all dates: a statistically relevant common factor linking both countries
- Two notable periods of commonality: the **1960s** (highest real output growth of both countries) and the **Euro adoption** (convergence of exchange rates); 1983–1993 is the most stable stretch
- Tracks the 1920 banking crisis, the Great Depression and the last double-dip recession; unstable in WWII and from the mid-1970s to the early 1980s

EEC entry raised synchronization with the common cycle, in particular for Spain



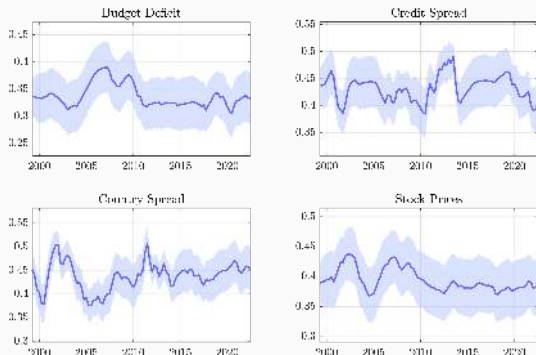
Notes: 10-year rolling correlation of the common factor with each country-specific factor (posterior medians).

- Spain's correlation sits near zero in the 1980s and is high from the late 1990s; the paper names EEC entry as the main event raising synchronization, in particular for Spain
- The paper's reading: Portugal is the smaller economy, so changes in the common dynamics reach it first, with Spain following after some time

Why did synchronization slow after the Euro? The paper's possible explanations

- **Portugal's poor economic performance** after adopting the Euro; Spain's performance, though not exceptional, let it converge with another underperformer, Italy
- **The 2004 EU enlargement** shifted the EU's economic and political centre East, spreading cohesion funds over more countries
- **China's WTO accession (2001)** contributed to deindustrialization in Southern Europe (textiles and apparel)
- After the financial crisis, a tourism boom in Portugal only **partially offset** the loss of industry-related activity; convergence in the second decade of the Euro stayed below expectations

Deficits and stock prices stabilize in the Euro era; spreads do not



Notes: Variable-specific factor θ_3 for four financial variables, quarterly data 1999–2022; posterior median and 68% bands.

- The model is re-run with a **country spread** (domestic minus German 10-year rate), a **credit spread** (3-month minus 10-year rate), the **budget deficit** and **share prices**
- First decade of the Euro: highs and lows, no solid convergence; second decade: a split
- **Budget deficits and stock prices** seem to stabilize, signalling convergence, likely driven by harmonized fiscal policies and a deeper capital markets union
- **Both spreads**: no clear signs of convergence; country-specific risk factors (creditworthiness, political stability, domestic conditions) still matter

Robustness: the paper reports unchanged conclusions

- **MCMC**: 10,000 Gibbs iterations, first 2,000 discarded, one in five draws kept; the Metropolis variance targets an acceptance rate of 20–30%
- **More lags**: the 68% interval of the extra lag factor includes zero at all dates, so it is not significant
- **Alternative controls**: identical conclusions after adding exogenous factors such as a world-war dummy, or removing oil prices (Jacks and Stuermer 2020)
- **Hyperparameters**: changes do not influence the results, except for the one intentionally used to target the Metropolis acceptance rate

Overall, the paper reads the results as robust to these checks.

Hyperparameters

Limits and caveats

- **No structural identification:** it is particularly challenging to impose one on this model (Ciccarelli et al. 2016), and the shocks lack interpretation; wars, regime changes and very high inflation likely underestimate supply shocks relative to demand
- **Few variables:** only five core variables, as others are unavailable for both countries over the whole sample
- **Model size** is constrained by computational complexity (curse of dimensionality in time-varying models)
- **Volatility:** a further dataset expansion will be needed to analyze it in greater detail

Conclusion

1. **Co-movement**: apart from some episodes of contraction and political instability, a marked co-movement between Spain and Portugal
2. **Idiosyncrasies** continue to play a crucial role in both economies
3. **Euro**: synchronization grew after EEC accession and peaked in the mid-1990s; the Euro led to a decrease
4. **Financial integration**: convergence of budget deficits and stock prices, but not of spreads; persistent country-specific risk factors limit the harmonizing effect of Euro Area integration

Policy: persistent idiosyncrasies, and their potential to endure, pose challenges to the future progression of the European mechanisms tied to the currency union; they call for policies that handle both shared and national dynamics.

Thank you!

hmarao@phd.iseg.ulisboa.pt

aafonso@iseg.lisboa.pt

Backup

Descriptive statistics

	Obs	Mean	Std. Dev.	Min	Max
Portugal					
Govt expenditure	146	0.0837	0.0996	−0.3894	0.3783
Real output	146	0.0179	0.0220	−0.0444	0.0809
Consumer prices	146	0.0583	0.0899	−0.0392	0.3937
Exchange rates	146	0.0367	0.0956	−0.0803	0.5539
Short-term interest rates	148	5.6448	4.2218	−0.3290	21.273
Spain					
Govt expenditure	146	0.0729	0.0737	−0.12012	0.2461
Real output	146	0.0195	0.0278	−0.07475	0.1082
Consumer prices	146	0.0453	0.0526	−0.05997	0.1741
Exchange rates	146	0.0238	0.0677	−0.09781	0.3094
Short-term interest rates	145	5.4278	3.7469	−0.28622	20.772

Notes: Source: own and Jordà et al. (2017).

- Portugal has the lower mean real output growth (0.0179 vs. 0.0195) but higher means for government expenditure, consumer prices and interest rates; its standard deviations are also higher, except for real output

Estimation and priors

$$\begin{aligned}\mathbb{P}(\theta|b) &= \mathcal{N}(\Omega_o, B_o), \quad \mathbb{P}(\tilde{\Sigma}) = \mathcal{IW}(\mathcal{F}_o, \mathcal{Q}_o), \quad \mathbb{P}(\zeta|\varphi) = \mathcal{N}(\mathbf{o}, \Phi_o), \\ \mathbb{P}(\varphi) &= \mathcal{IG}\left(\frac{\alpha_o}{2}, \frac{\delta_o}{2}\right), \quad \mathbb{P}(b_i) = \mathcal{IG}\left(\frac{a_o}{2}, \frac{b_o}{2}\right)\end{aligned}$$

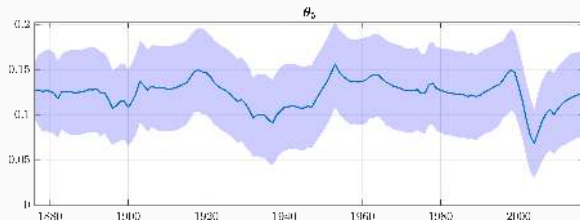
- Bayesian inference, since classical methods are unavailable for this framework; hyperparameters are obtained from the data, tuned for the best model fit
- Hierarchical scheme: θ conditional on b , ζ conditional on φ ; posterior simulated with a Gibbs sampler
- Factors drawn with the **precision sampler** based on a sparse-matrix approach (Chan and Jeliazkov 2009), rather than the Kalman filter and smoother of Chib and Greenberg (1995)
- Chain: 10,000 iterations, first 2,000 discarded, thinning factor of five

Hyperparameters: main model

Hyperparameter	Description	Value	Target
γ	AR coefficient on residual variance	0.9	Standard range
α_0	$\mathcal{IG}$ shape on residual variance	1000	Standard value
δ_0	$\mathcal{IG}$ scale on residual variance	10000	Acceptance rate 20%
ρ	AR coefficient on factors	0.9	Standard range
a_0	$\mathcal{IG}$ shape on factor variance	1000	Standard value
b_0	$\mathcal{IG}$ scale on factor variance	1	Ciccarelli et al. (2016)
ψ	Variance of Metropolis draw	0.0015	Acceptance rate 20%

Notes: All hyperparameters are calibrated using values common in the literature to achieve a target acceptance rate of 20–30%.

Oil factor θ_5



Notes: Exogenous factor θ_5 , posterior median and 68% bands.

- Both countries are oil importers and engaged in world trade only after the 1960s, so the paper argues oil prices control for the global cycle better than world GDP
- The factor falls after the introduction of the Euro; the paper's reading is that the Euro reduced currency risk in the oil market
- Bands are wide throughout

Volatility: the five periods the paper discusses

1. **Downfall of Portugal's 1st Republic:** short-lived governments, large budget deficits, hyperinflation, collapse in purchasing power
2. **Military dictatorship in Portugal,** already established; finances undergoing stabilization
3. **1950s and 1960s:** intervals include zero for most of these decades; stability coinciding with Portugal's EFTA entry and some opening to trade and foreign investment
4. **Democratic transitions** (1974 Portugal, 1975 Spain): quadrupled fuel prices, governmental instability, high inflation, falling external reserves and rising deficits; two IMF interventions in Portugal
5. **EEC integration:** parliamentary majorities (Spain 1982, Portugal 1986), macroeconomic stabilization and convergence with core Europe; volatility trends down in the first decade of the Euro, then reverses, possibly due to the global financial crisis

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