

**Trends and cycles in the Euro area: how
much heterogeneity and should we worry
about it?**

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Old and recent debate

Before the EMU: optimal currency area debate (heterogeneity)

After 6 years: have things changed?

This paper look at the issue from a narrow perspective

- analyze output differentials within EMU in the last thirty years: levels, growth, recessions
- ask whether heterogeneous dynamics is generated by national/idiosyncratic shocks or heterogeneous response to Euro-wide shock
- ask whether Euro-wide shocks should be interpreted as world (US) shocks
- ask whether consumption correlations conditional on output have changed over the last years (risk sharing)

Four Findings

1. Asymmetries in output per capita (whatever the concept) between the Euro area countries have remained roughly the same in the last thirty years (+ similar to asymmetries within the US)
2. Asymmetries mainly explained by small but persistent idiosyncratic shocks while the bulk of output fluctuation are explained by a common shock
3. The common shock can be interpreted as a US shock that affects the Euro area with a lag and generates a Euro cycle that is more persistent but less volatile than the US's.
4. Risk-sharing within the Euro area has increased since the early 1990s.

STEP 1: Look at levels of output per capita

Why?

It is what goes into people's pockets

Define

$y_t^i \times 100 \log$ of real GDP per-capita of country i in year t (PPP adjusted).

$\text{gap}_t^i = y_t^i - y_t^{EU}$: percentage deviation of real GDP per-capita of country i from Euro Area.

Measure of asymmetry 1: gap_t^i

How should we interpret the level gap?

$$\text{Gap}_{t+h}^i = \underbrace{\text{Gap}_t^i}_{\text{Initial cond}} + \sum_{s=1}^h \underbrace{\Delta \text{Gap}_{t+s}^i}_{\text{Growth gap}}$$

$$\text{Growth gap: } \Delta \text{Gap}_{t+s}^i = \Delta y_{t+s}^i - \Delta y_{t+s}^{EU}$$

Level gap \leftrightarrow the cumulative sum of the differences between country i and Euro Area growth rate.

It depends on initial relative conditions and growth performance in the past years up to today

Questions

1. How large are the asymmetries?
2. How do they evolve over time?
3. Do the differences in growth rates (growth gap) cancel out over time (the last 30 years) or are they persistent?
4. Clubs or convergence?

Table + Plots

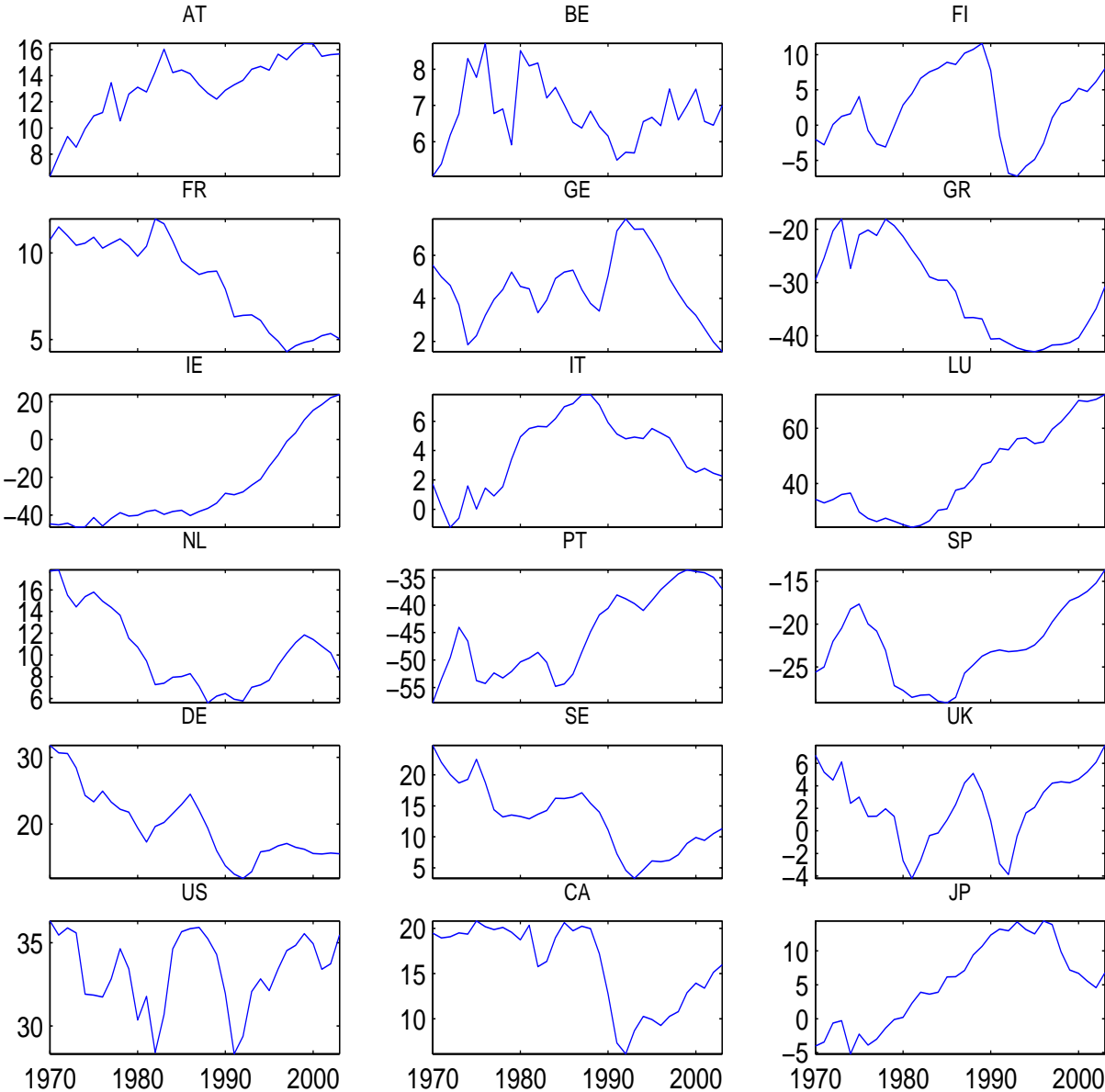
Table 1

Per Capita GDP at PPP and 2000 prices: Gap with respect to Euro Area

	1970	1980	1990	1999	2003	AVE 70-03	AVE 70-89	AVE 90-03	AR1	
AT	6.32	13.13	12.88	16.49	15.67	13.18	11.90	15.01	0.81	*
BE	5.05	8.51	6.16	7.00	7.00	6.81	7.02	6.52	0.51	**
FI	-2.00	2.89	7.77	3.57	8.05	2.54	3.77	0.78	0.88	*
FR	10.76	9.81	7.92	4.83	5.05	8.38	10.35	5.56	0.98	
GE	5.54	4.55	5.04	3.63	1.53	4.47	4.15	4.92	0.90	
GR	-29.51	-21.33	-40.63	-41.28	-30.79	-31.85	-26.07	-40.12	0.94	
IE	-44.63	-40.13	-28.50	10.40	23.84	-25.72	-40.71	-4.30	1.07	
IT	1.74	4.94	5.91	2.86	2.26	3.88	3.69	4.14	0.93	
LU	34.23	25.07	47.79	65.91	72.24	43.60	31.86	60.37	1.04	
NL	17.73	10.73	6.47	11.85	8.58	10.38	11.47	8.82	0.90	
PT	-57.78	-50.34	-40.59	-33.55	-37.06	-45.04	-50.65	-37.01	0.92	
SP	-25.61	-27.73	-23.23	-17.25	-13.64	-22.65	-24.68	-19.75	1.01	
EU12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
DE	31.80	19.43	13.78	16.26	15.57	19.90	23.23	15.15	0.88	
SE	24.73	13.29	11.15	8.96	11.34	13.03	16.82	7.63	0.88	
UK	6.71	-2.64	0.90	4.27	7.59	2.26	2.00	2.65	0.84	
EU15	2.31	0.23	0.62	1.14	1.73	1.01	1.13	0.84	0.81	
US	36.31	30.35	31.95	35.54	35.48	33.38	33.62	33.04	0.66	**
CA	19.48	18.73	12.79	12.89	15.98	15.93	19.25	11.20	0.90	
JP	-4.04	0.20	12.35	7.20	6.79	5.20	1.46	10.54	0.92	
OECD	3.72	-0.13	0.84	1.58	1.94	1.43	1.70	1.04	0.61	**

↘ The last column denotes the results from an ADL test for unit root.
, **, and *** indicate if the Unit Root is rejected at 10% and 5 %
and 1% level respectively

Figure 1, Real GDP per-capita, gap with respect to Euro Area



Results

1. The gap of Euro Area countries are persistent / non-stationary → no clear tendency of convergence toward a common level of income (no common trend)

Exceptions: Spain and Ireland (convergence?)

No sign of changes recently [impossible to detect given persistency]

2. The gap between US as a whole and EMU aggregate is less persistent / stationary → US citizen have been on average in the three decades 33% richer than Europeans and the gap has been fluctuating around this value

Is the lack of common trend between Euro countries and Euro aggregate explained by convergence dynamics?

The Literature:

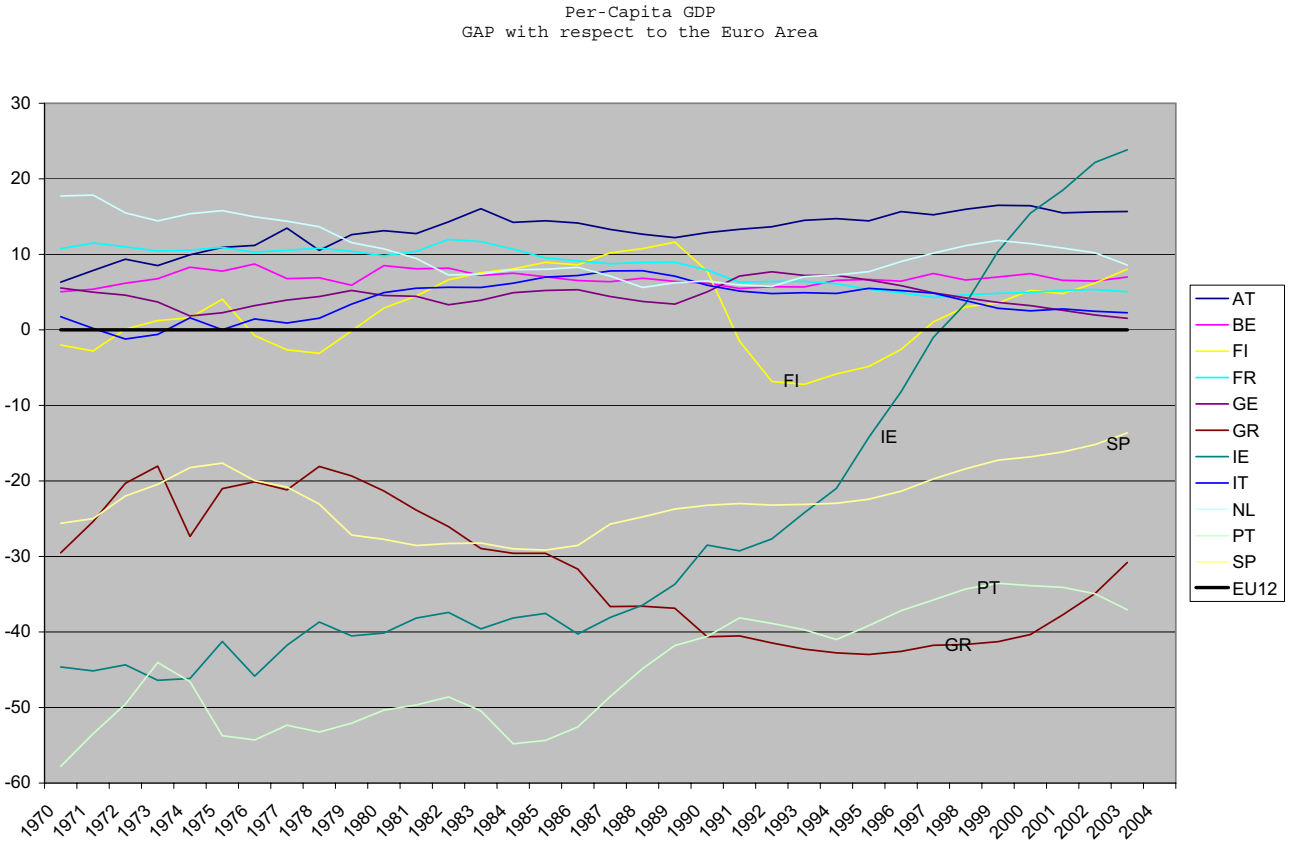
Harvey, 2005: Rich countries stay close to average and poor countries (Greece, Portugal, Spain) converged to a low level of output around 30% below average [Ireland is an exception]

Our point:

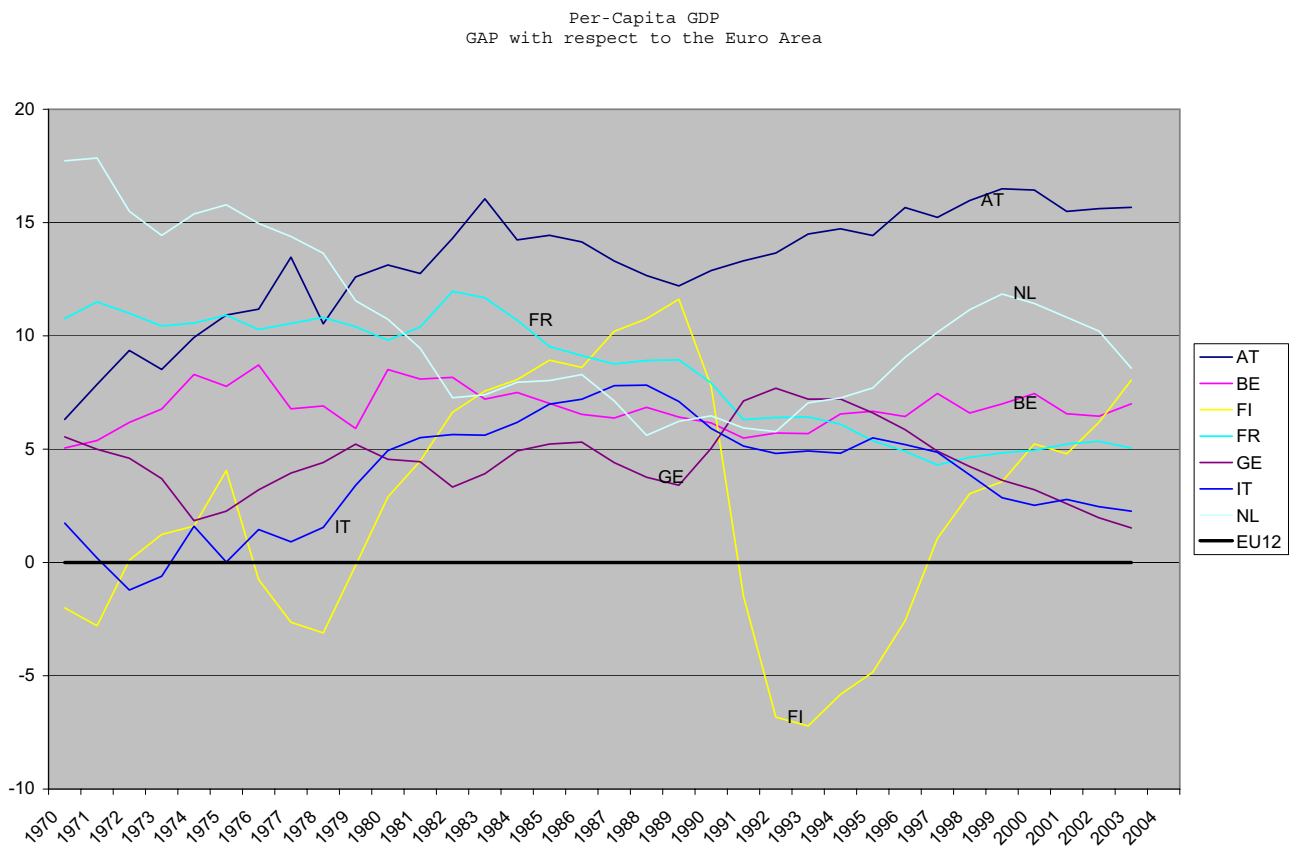
These predictions are difficult and unreliable since gaps are very persistent, hence their long run behavior is difficult to predict

For example, looking at the last few years there appears to be a tendency for the Spanish gap to close, contrary to what predicted by Harvey

Figure, Real GDP per-capita, gaps with respect to Euro Area



Figure, Real GDP Per-Capita, gaps with respect to Euro Area



STEP 2: Cyclical asymmetry: output per capita

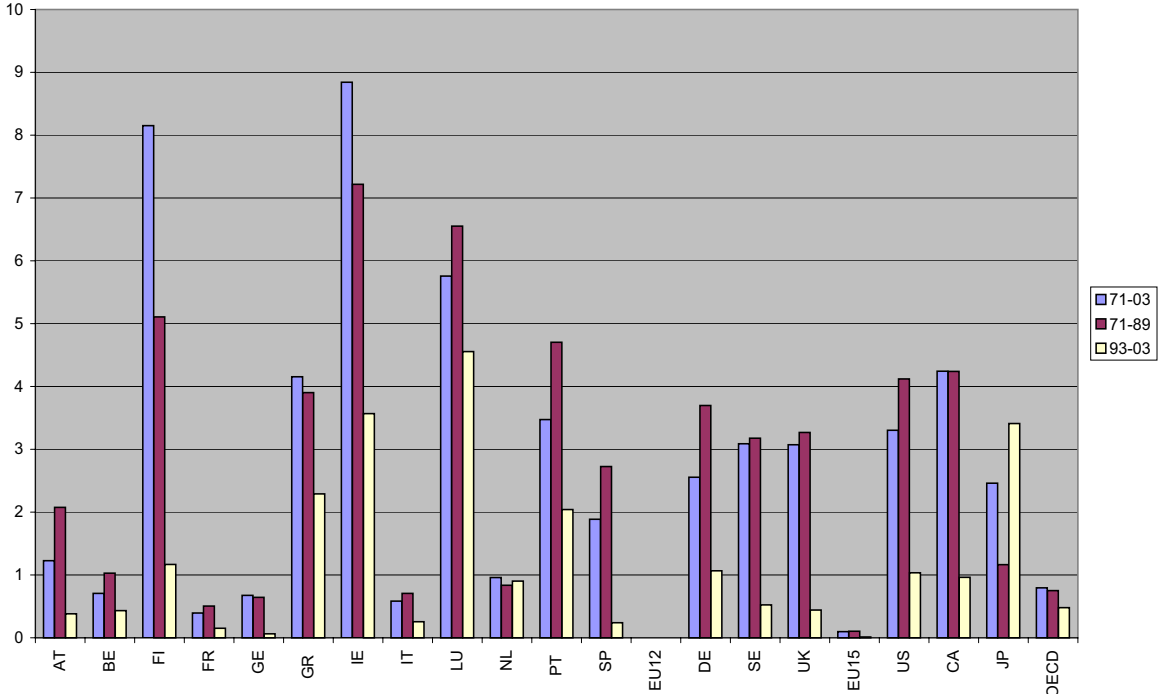
Measures of asymmetry 2: growth rates

How large is the growth rate gap?

$$\text{Var}(\Delta y_t^i - \Delta y_t^{EU})$$

Cfr. Figure

Figure, Real GDP per-capita, Variance of the gap with respect to Euro Area



- Decrease in asymmetry? NO!!

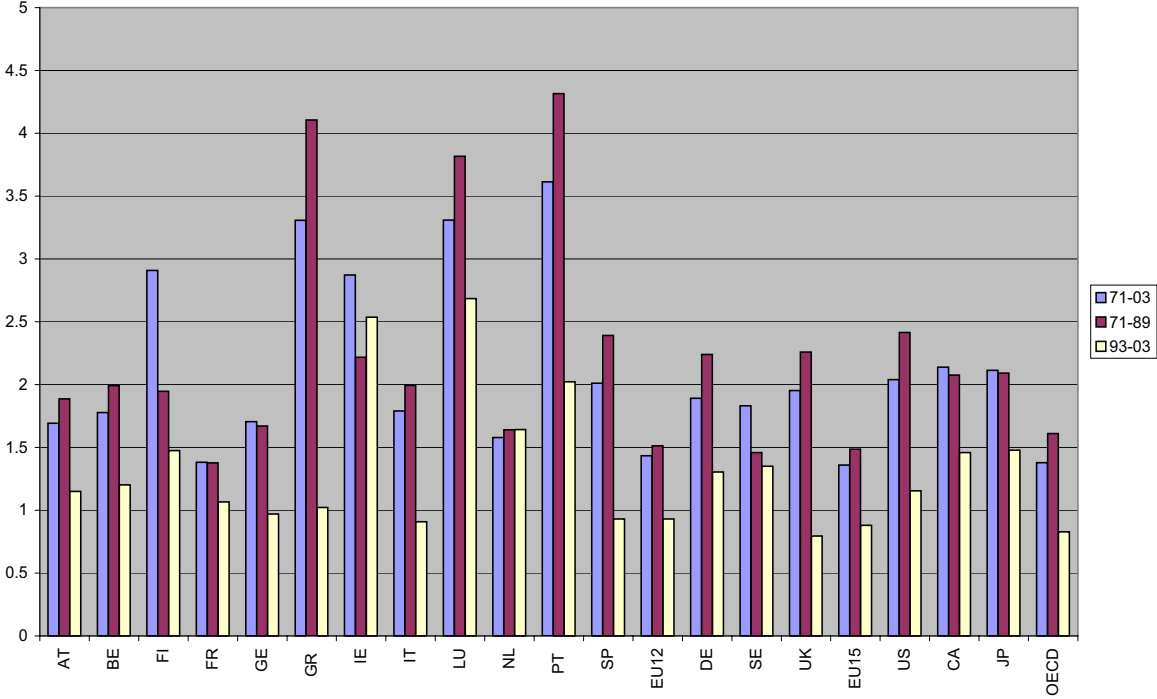
- Need to control for size of output fluctuations

$$\text{Var}(\Delta y_t^i)$$

cfr. Figure

Figure

Variance of per-capita GDP growth rates



- Variance has decreased everywhere

⇒ The “great moderation” is a worldwide phenomenon

eg. Stock and Watson, huge literature...

Controlling for the great moderation

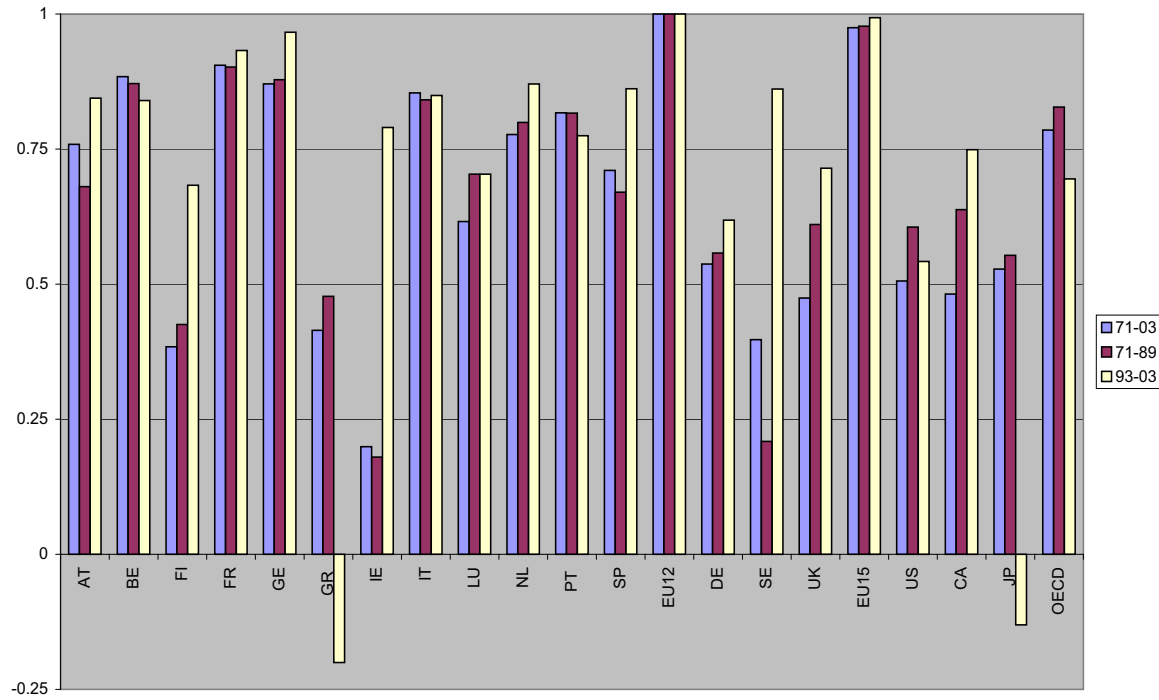
How correlated is growth of country i with the Euro area?

$$\text{Corr}(\Delta y_t^i, \Delta y_t^{EU})$$

cfr. Figure

Figure

Correlation of per-capita GDP growth rates with respect to the Euro area



Comments

- Cyclical comovement is **high** and **stable** within the Euro Area and between Euro area and the rest of the world...

⇒ Stability: Stock and Watson

⇒ Large world business cycle: Kose et al., Canova et al., Montfort et al., Artis and coauthors, Madrid Conference ...

- Comovement is higher within Euro area than between the Euro area and the rest of the world.

Euro area cycle? See later...

Remark

Asymmetry 1 (levels) vs Asymmetry 2 (cycle)

See later

STEP 2: Cyclical asymmetry output per capita

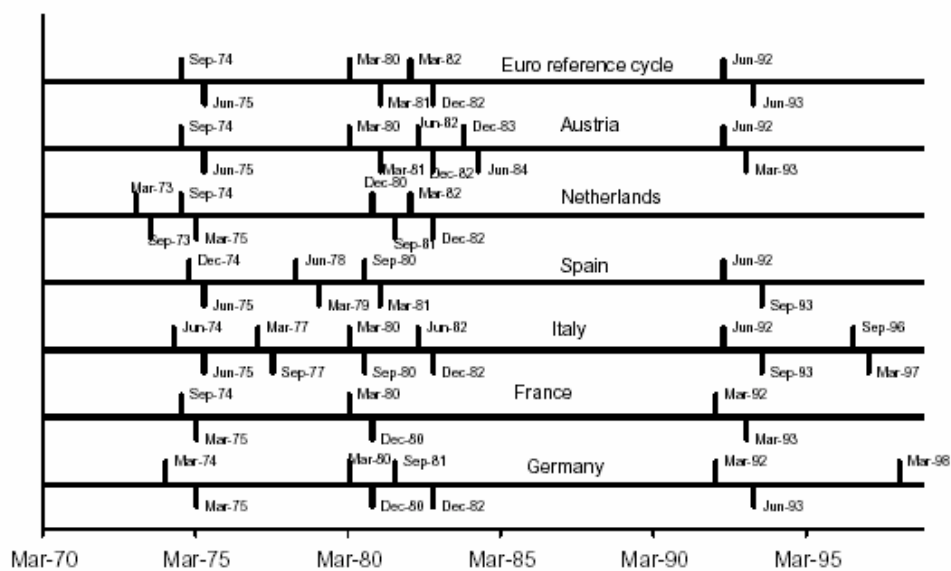
Measure of asymmetry 3: recessions

cfr. Harding and Pagan dating

⇒ Cycles are very synchronized, within the Euro area

For EU and Rest of the World see later

Figure 6: Euro area classical reference cycle and specific cycles in GDP for individual Euro countries



Summary

- Great moderation
⇒ Worldwide phenomenon
- Cyclical asymmetry: **small** and **stable** within the Euro area and between the Euro area and the Rest of the World
- Higher comovement within the Euro area: Euro area cycle different from world cycle?
- Asymmetries in levels are small but persistent: they do not cancel out as time passes by...

What drives asymmetries/symmetries?

(i) country specific shocks?

and/or

(ii) Asymmetric propagation of Area wide shock?

To evaluate, need identifying assumption and model

• Identifying Assumption

→ Country specific shocks affect Euro Area only with a lag.

• Model: Structural VAR

$$\begin{pmatrix} y_t^{EU} \\ y_t^i \end{pmatrix} = \begin{pmatrix} \mu^{EU} \\ \mu^i \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} y_{t-1}^{EU} \\ y_{t-1}^i \end{pmatrix} + \begin{pmatrix} b_{11} & 0 \\ b_{21} & b_{22} \end{pmatrix} \begin{pmatrix} u_t^{EU} \\ u_t^i \end{pmatrix}$$

u_t^{EU} : Euro Area Wide shock

u_t^i : Country i specific shock.

Remarks

a. Robust to cointegration issues

b. Medium run

Country specific and Area wide **shocks**

Ask

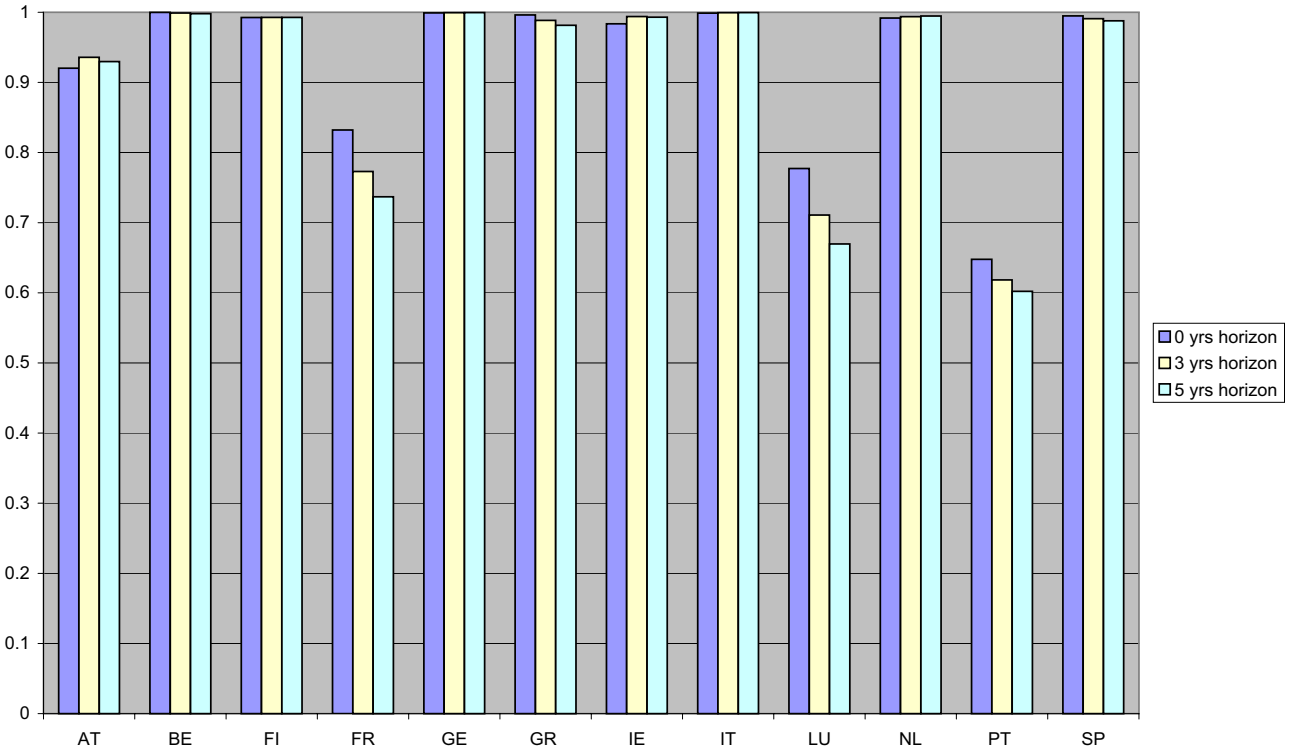
- Which shocks are responsible for the asymmetries?

→ Look at the cumulative effects of country specific shocks on growth gap ...

$$u_t^i \longleftrightarrow \sum_{s=1}^h [\Delta y_{t+s}^i - \Delta y_{t+s}^{EU}], h = 1, 3, 5 \text{ years}$$

Figure

Gap with respect to Euro Area
Percentage of Forecast Error due to Country Specific Shocks



Country specific and Area wide **shocks**

Ask

- Which shocks are responsible for the asymmetries?

Answer

Gap is mainly explained by country specific shocks at all horizons

Country specific and Area wide **shocks**

Ask

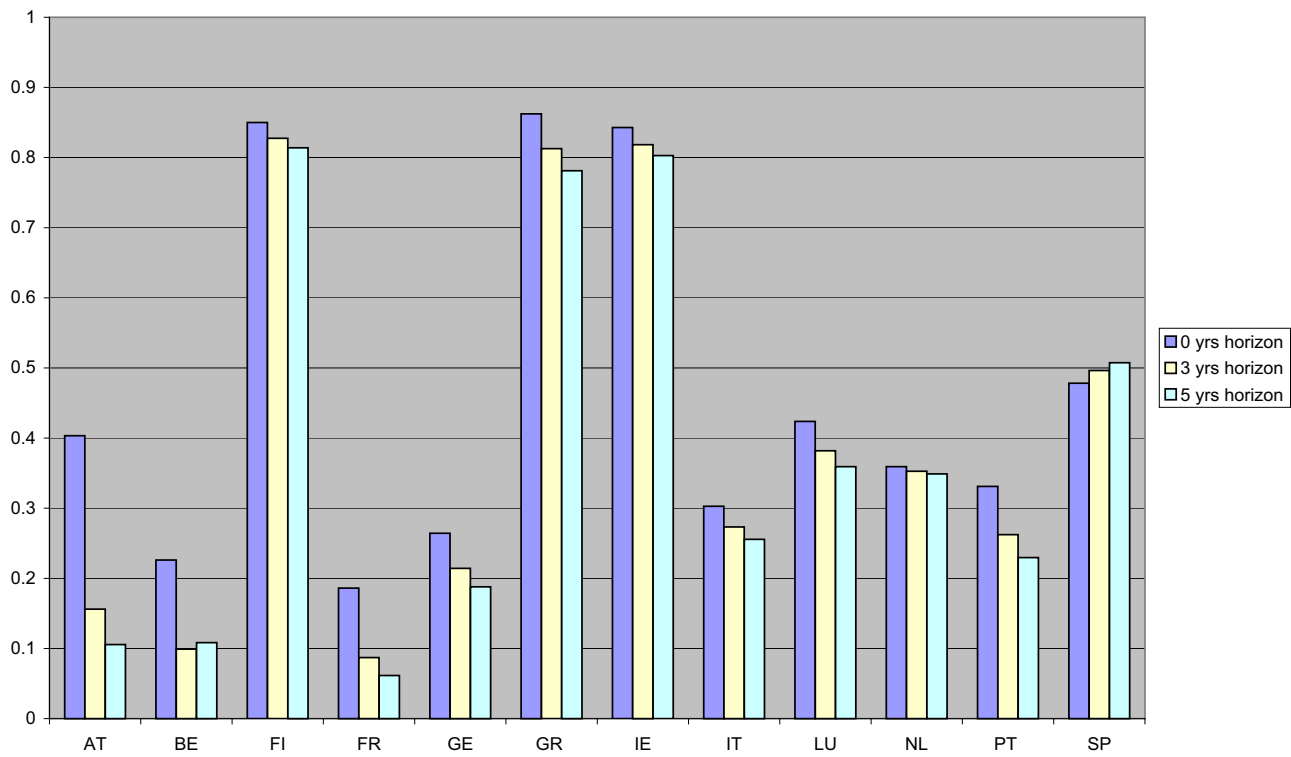
- How large are country specific shocks?

→ Look at the cumulative effects of country specific shocks on country output growth

$$u_t^i \longleftrightarrow \sum_{s=1}^h \Delta y_{t+s}^i, h = 1, 3, 5 \text{ years}$$

Figure

GDP per Capita
Percentage of Forecast Error due to Country Specific Shocks



Country specific and Area wide **shocks**

Ask

- How large are country specific shocks?

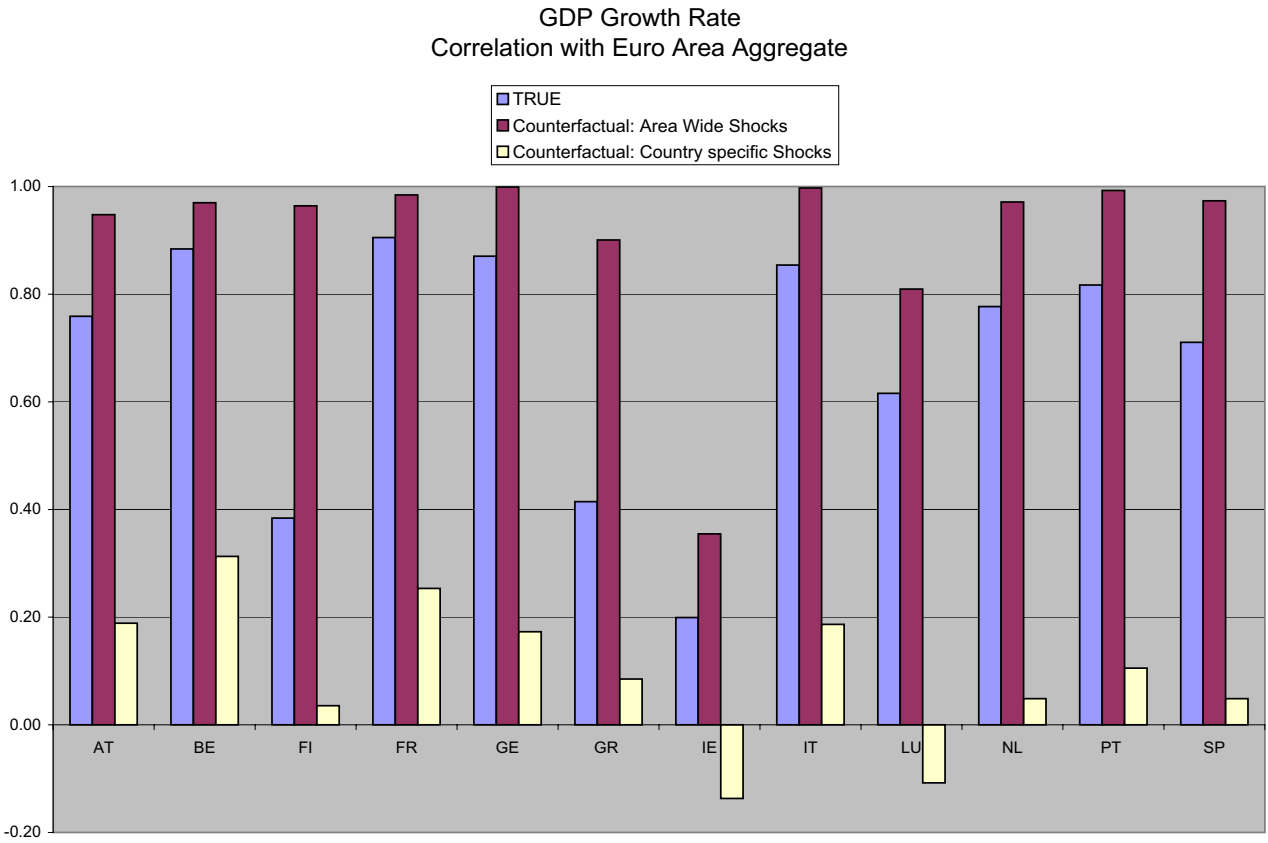
Answer

- Output fluctuations y_t^i are mainly explained by Area wide shocks at all horizons
- Country specific shocks: small + persistent

Country specific and Area wide **shocks**

- Counterfactuals: what would have correlation been if no country specific shocks?

Figure



Country specific and Area wide **shocks**

- Counterfactuals: what would have correlation been if no country specific shocks?

Answer

- correlations would have been quite high and stable if there had been only area-wide shocks!!

⇒ Area wide shocks propagate similarly across Euro area countries...

Results: Summary

- a) Idiosyncratic shocks have large effects on the gap
→ correlations would have been quite high and stable if there had been only area-wide shocks!!
- b) Most of the fluctuations of output are due to area wide shocks
Exceptions are Greece, Finland, Ireland. Spain is half way (convergence and country specific shocks!!!)
- c) Country specific shocks have large and quite persistent effect on the gap: they generate persistent differences across countries

Implications

- Although small, national factors have persistent effects
- Common Euro area shocks account for the bulk of business cycle fluctuations

What is a reasonable benchmark?: US regions

Compute the same measures...

- Use Personal Income

Remark since we use Personal Income we overestimate similarities across US regions.

Levels

STEP 1: Look at levels of Income

Define

$\tilde{y}_t^i \times 100$ log of real per-capita Personal Income of region i in year t (PPP adjusted).

$\widetilde{\text{gap}}_t^i = \tilde{y}_t^i - \tilde{y}_t^{US}$: percentage deviation of real Income per-capita of region i from US aggregate.

US regions

New England	NE
Mideast	ME
Great Lakes	GL
Plains	PL
Southeast	SE
Southwest	SW
Rocky Mountain	RM
Far West	FW

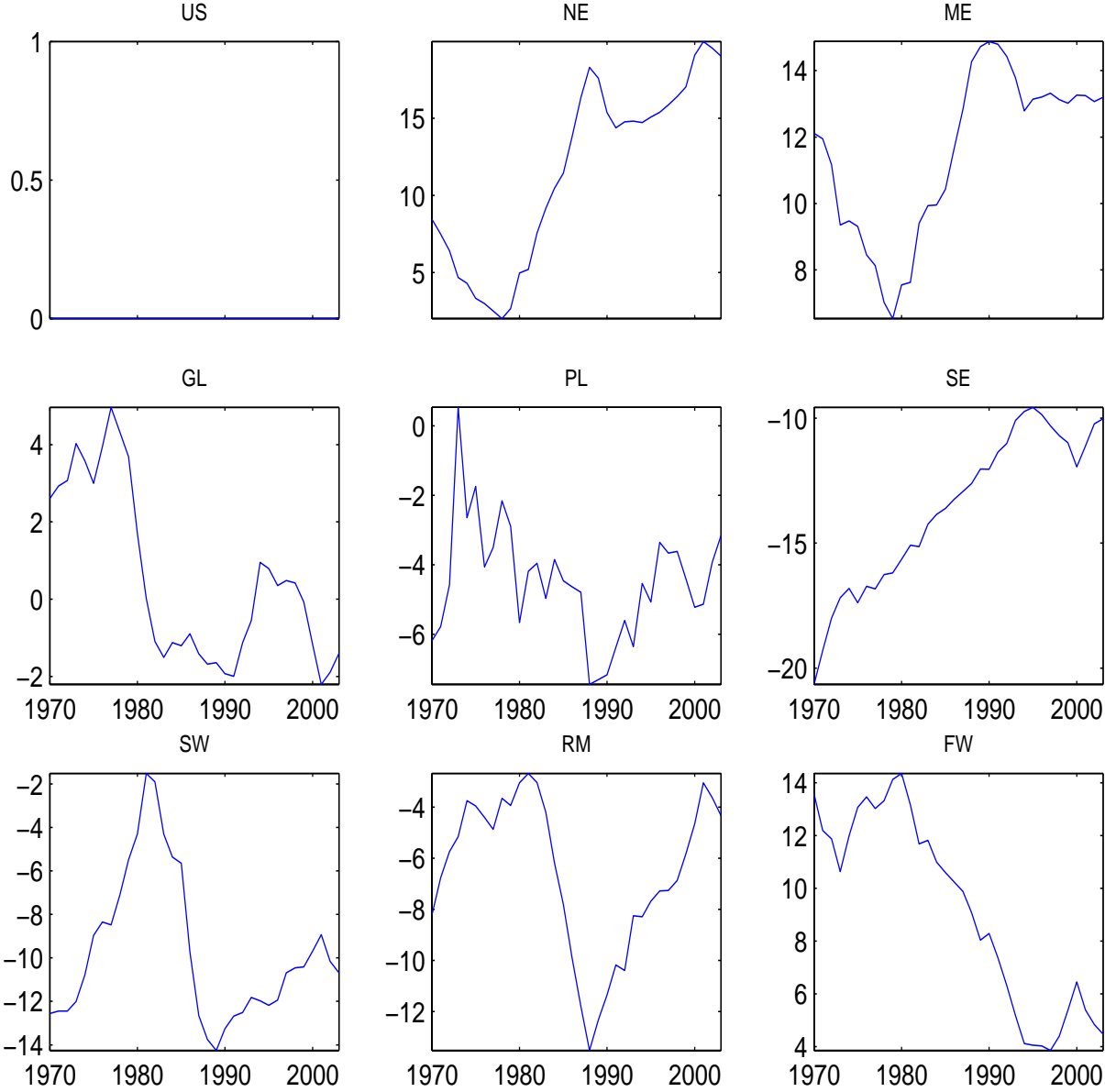
Table 1b

Per Capita Personal Income: Gap with of US region with respect to US aggregate

	1970	1980	1990	1999	2003	AVE 70-03	AVE 70-89	AVE 90-03	AR1
US	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	8.45	4.97	15.37	17.03	19.02	11.50	7.98	16.53	1.00
ME	12.11	7.55	14.88	13.02	13.20	11.50	10.09	13.52	0.96
GL	2.61	1.70	-1.93	-0.08	-1.40	0.53	1.36	-0.67	0.94
PL	-6.18	-5.66	-7.17	-4.40	-3.15	-4.47	-4.21	-4.83	0.55
SE	-20.65	-15.65	-12.05	-10.99	-10.02	-13.61	-15.69	-10.64	0.92
SW	-12.56	-4.30	-13.26	-10.41	-10.69	-9.69	-8.60	-11.24	0.91
RM	-8.21	-3.04	-11.35	-5.83	-4.33	-6.59	-6.24	-7.07	0.93
FW	13.58	14.36	8.29	5.39	4.47	9.16	11.86	5.30	0.98

The last column denotes the results from an ADL test for unit root.
, **, and *** indicate if the Unit Root is rejected at 10% and 5 %
and 1% level respectively

Figure, Personal Income, gaps of US region with respect to US aggregate



Comments

Gaps in the US are as persistent as those within EMU and there is no common trend amongst regions...

US regions do not share a common trend with Europe while the US aggregate does!!!

US wide and region specific shocks

$$\begin{pmatrix} \tilde{y}_t^{US} \\ \tilde{y}_t^i \end{pmatrix} = \begin{pmatrix} \mu^{US} \\ \mu^i \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} \tilde{y}_{t-1}^{EU} \\ \tilde{y}_{t-1}^i \end{pmatrix} + \begin{pmatrix} b_{11} & 0 \\ b_{21} & b_{22} \end{pmatrix} \begin{pmatrix} u_t^{US} \\ u_t^i \end{pmatrix}$$

u_t^{EU} : US Wide shock

u_t^i : Region i specific shock: can affect US aggregate only with a lag.

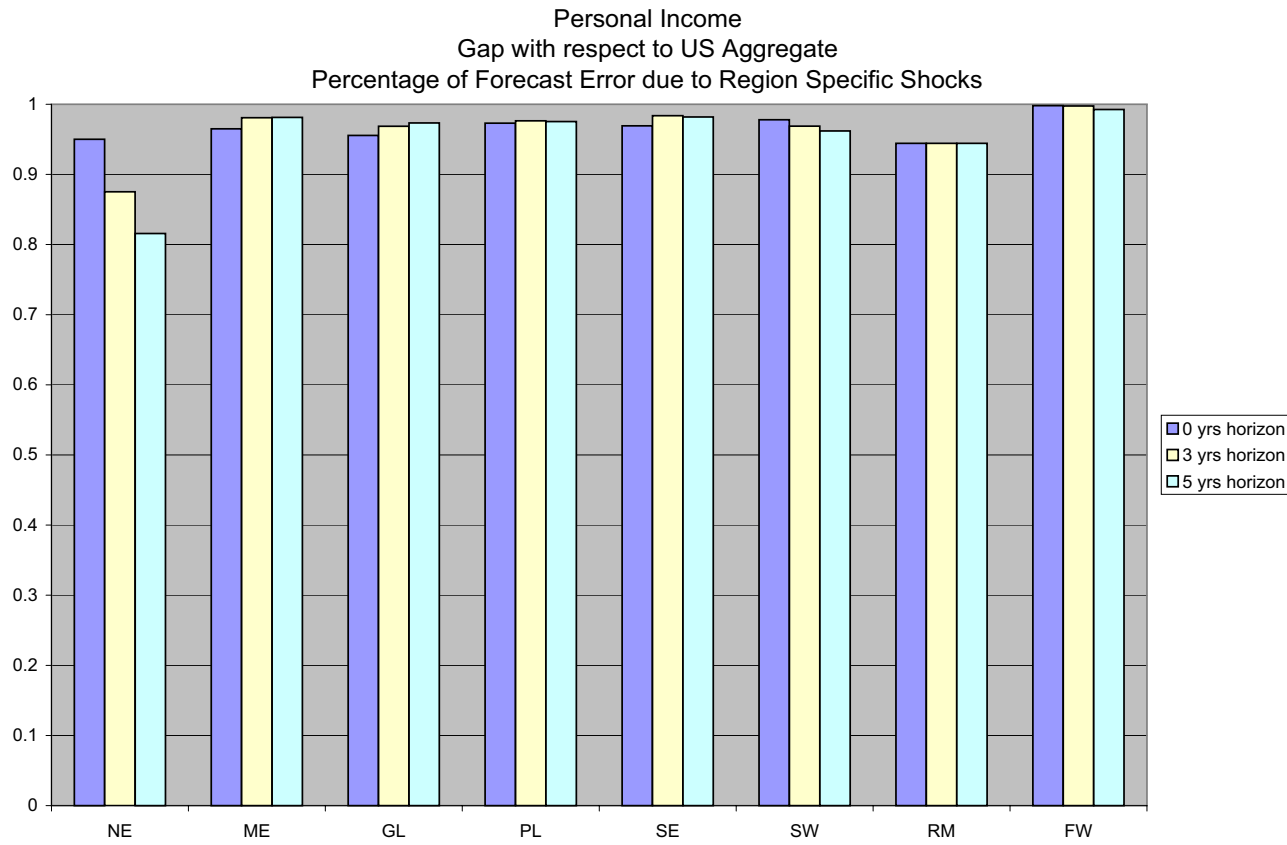
Region specific and US wide **shocks**

Ask

- Which shocks are responsible for the asymmetries?

→ Look at the cumulative effects of region specific shocks on growth gap ...

Figure



Region specific and US wide **shocks**

Ask

- Which shocks are responsible for the asymmetries?

Answer

Gap is mainly explained by region specific shocks at all horizons

Region specific and US wide **shocks**

Ask

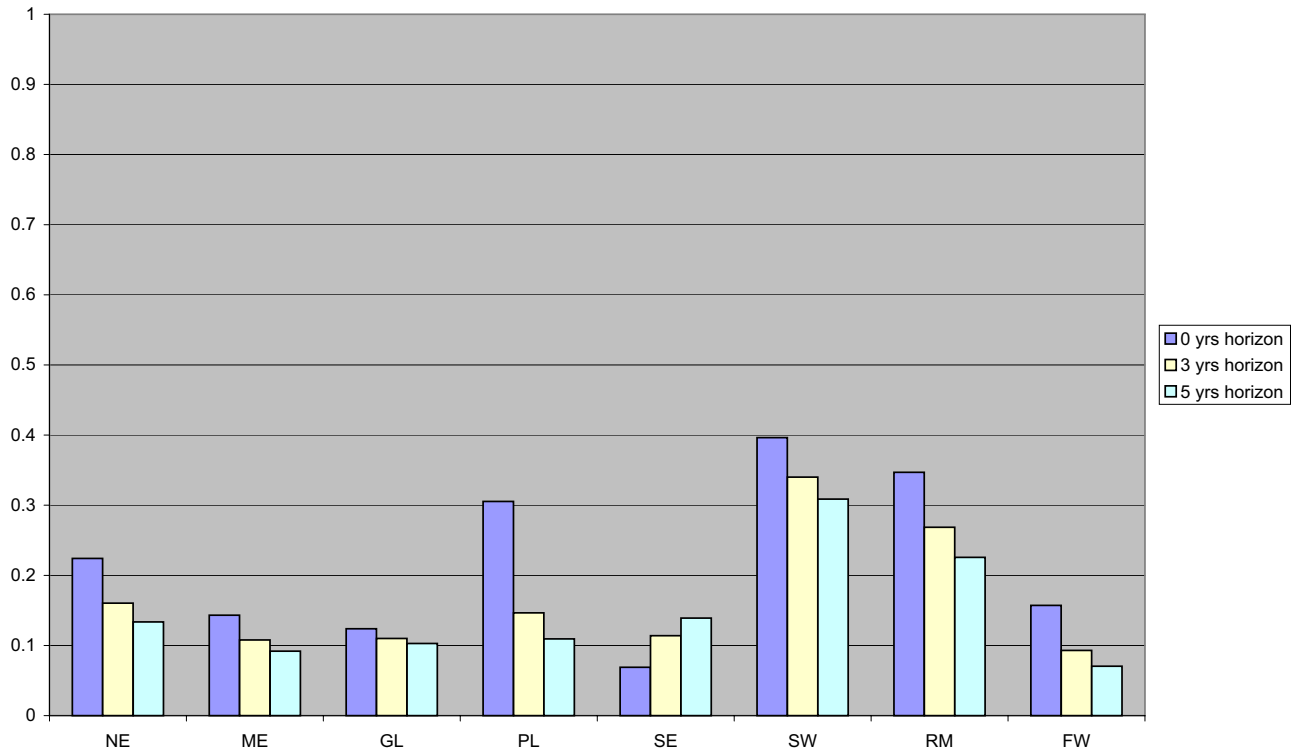
- How large are region specific shocks?

→ Look at the cumulative effects of region specific shocks on country output growth

$$u_t^i \longleftrightarrow \sum_{s=1}^h \Delta y_{t+s}^i, h = 1, 3, 5 \text{ years}$$

Figure

Personal Income
Percentage of Forecast Error due to Region Specific Shocks



Region specific and US wide **shocks**

Ask

- How large are region specific shocks?

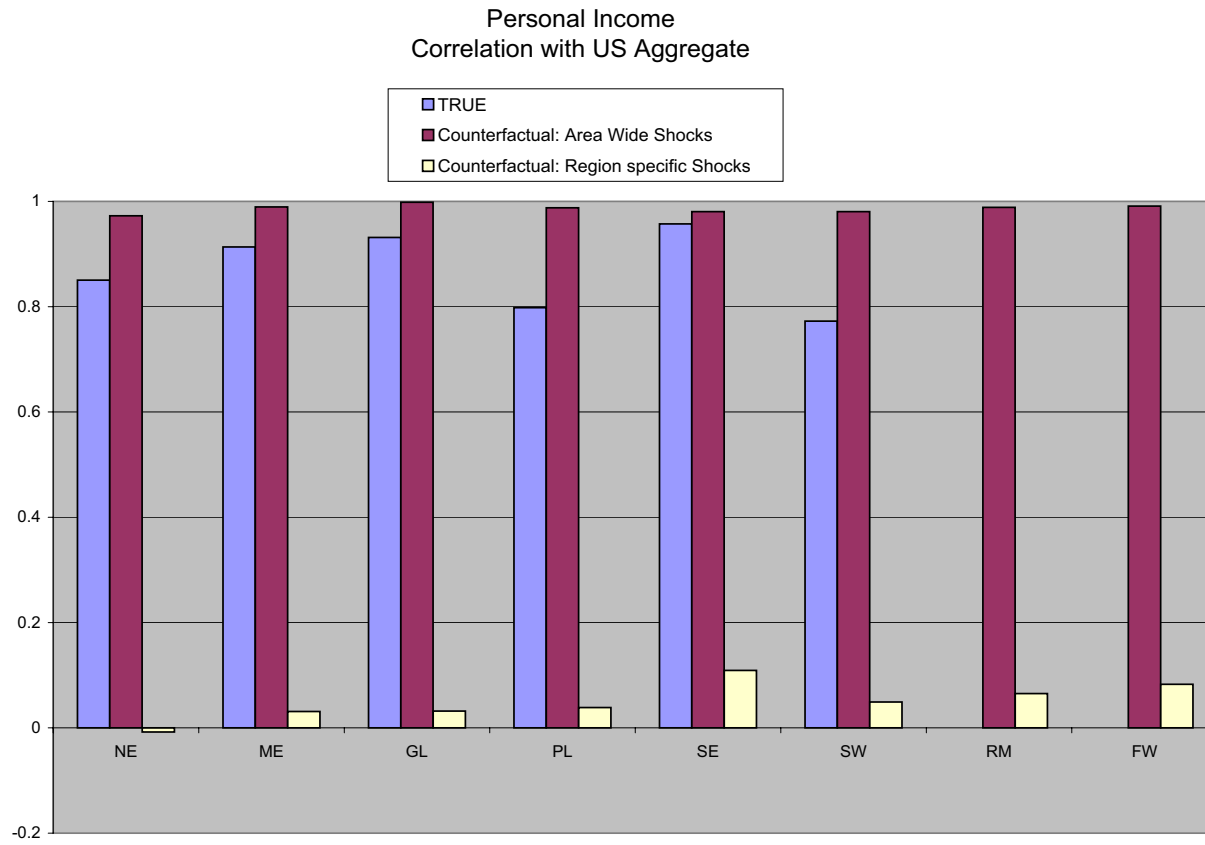
Answer

- Output fluctuations y_t^i are mainly explained by US wide shocks at all horizons
- Region specific shocks: small + persistent

Region specific and US wide **shocks**

- Counterfactuals: what would have correlation been if no region specific shocks?

Figure



Region specific and US wide **shocks**

- Counterfactuals: what would have correlation been if no region specific shocks?

Answer

- correlations would have been quite high and stable if there had been only US-wide shocks!!

⇒ US wide shocks propagate similarly across US regions ...

Summary

Results are similar to the core of the Euro Area.

- Region specific shocks are small on output and are responsible of persistent gap
- US wide shocks generate similar region specific dynamic: do not generate asymmetries

Remember since we use Personal Income we overestimate similarities across US regions.

Is the common Euro shock in fact global?

→ characterize differences between the US and the Euro area as a whole

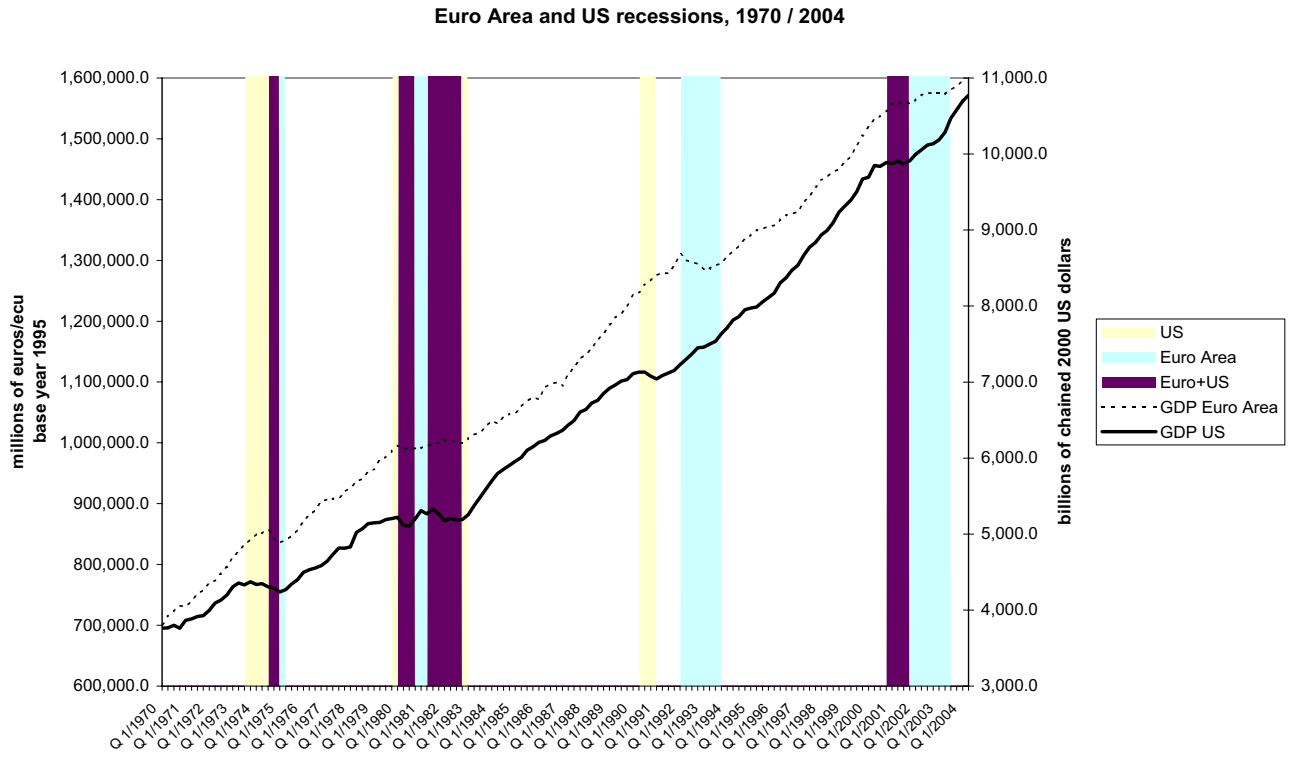
(Giannone and Reichlin, 2005)

- Evidence on real GDP

(Not in per-capita terms following the dating conventions...)

History of classical (level) cycles is broadly similar

Figure



However, differences:

1. Cycles in the US have larger amplitude and shorter duration → GDP growth is less smooth and less persistent.
2. They tend to lead the Euro area.

Table BC statistics

Business Cycle Statistics

	US	Euro Area
peak to trough amplitude	-0.5658 (-0.6294)	-0.2433 (-0.4979)
trough to peak amplitude	0.9445 (0.9589)	0.7653 (0.6254)
peak to trough duration	3.4000 (3.4000)	5.3333 (2.5000)
trough to peak duration	23.25 (23.500)	29 (35.00)
n. of recessions	5.00 (5.00)	3.00 (4.00)
Concordance Index	0.8593 (0.8222)	

The business cycle statistics corresponding to the NBER and CEPR dating are in bold. We show in parentheses the same statistics, produced by the Bry-Boschan Dating Algorithm.

Growth cycle characteristics are rather different

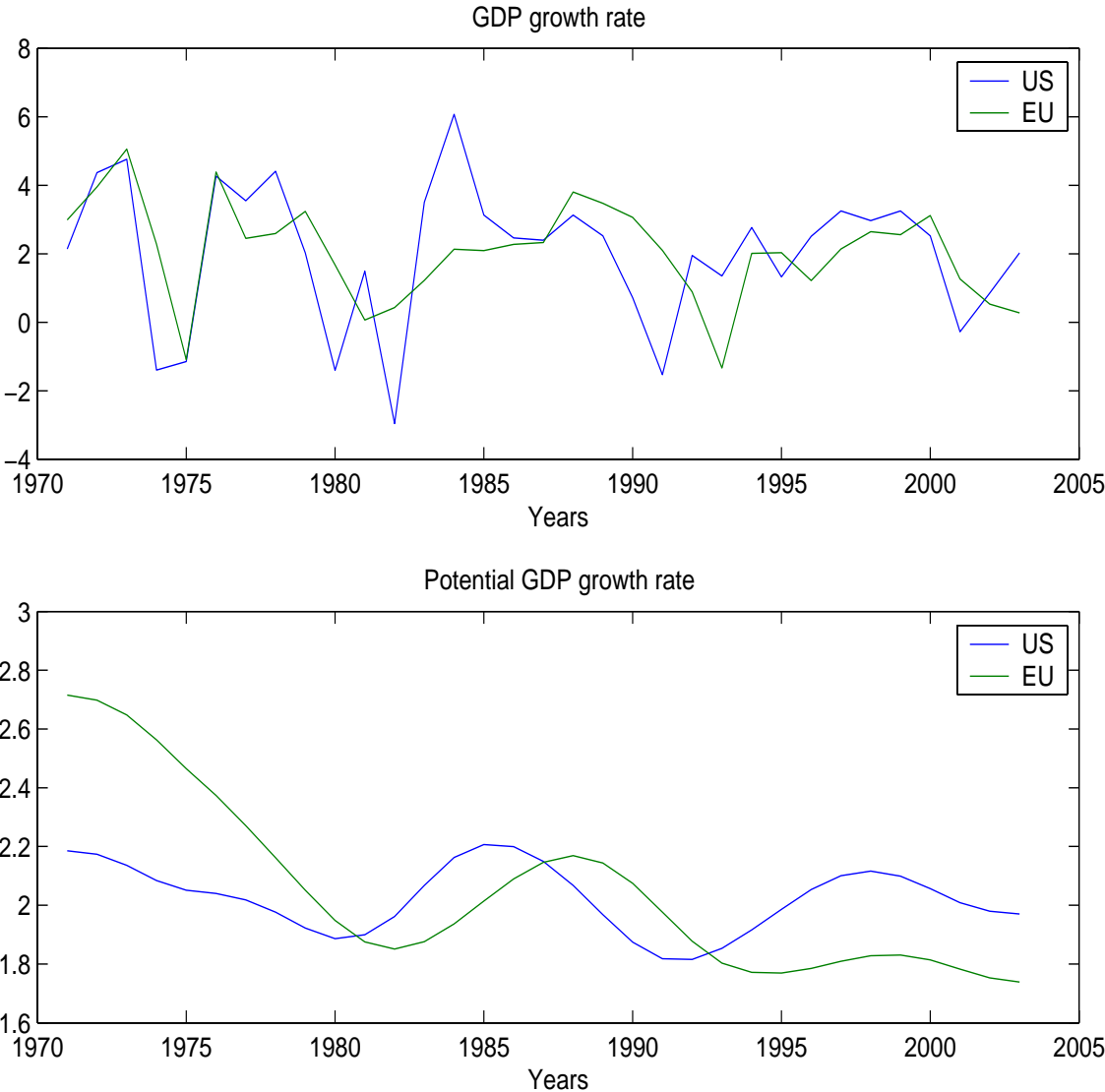
**Euro cycle is smoother than the US cycle
(more persistent)**

**Variance of the growth rate of output
and of the HP trend**

	US	Euro Area
$var(\Delta y)$	4.16	2.05
$var(\Delta HP)$	0.01	0.09
$\frac{var(\Delta HP)}{var(\Delta y)} * 100$.03%	4.22%

Moreover ... the Euro area growth adjusts to the US's [see leading-lagging relation of its HP trend]

Figure



Does US output Granger cause the Euro area output?

Table 6, Granger causality test

			F stat.	p-value
Δy_t^{US}	does not Cause	$y_t^{EU} - y_t^{US}$	0.16	0.85
Δy_t^{EU}	does not Cause	$y_t^{EU} - y_t^{US}$	0.40	0.67
$y_t^{US} - y_t^{EU}$	does not Cause	Δy_t^{US}	0.72	0.50
$y_t^{US} - y_t^{EU}$	does not Cause	Δy_t^{EU}	5.20	0.01**

Transatlantic gap cause EU growth but not US growth

If we add to these facts the previous finding on cointegration, we can build a simple statistical model which accounts for these characteristics

The model:

- The Euro area is “attracted to” the US: error correction mechanism toward a common trend

- The US moves first

→ the shocks driving the common trend originate (or affect first) the US and then Europe [US shock u_t^{US}]

→ the other shock does not significantly propagate to the US [Euro Area shock u_t^{EU}]

$$\begin{pmatrix} y_t^{US} \\ y_t^{EU} \end{pmatrix} = \begin{pmatrix} \mu^{US} \\ \mu^{EU} \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} y_{t-1}^{US} \\ y_{t-1}^{EU} \end{pmatrix} + \begin{pmatrix} b_{11} & 0 \\ b_{21} & b_{22} \end{pmatrix} \begin{pmatrix} u_t^{US} \\ u_t^{EU} \end{pmatrix}$$

Figure Impulse responses

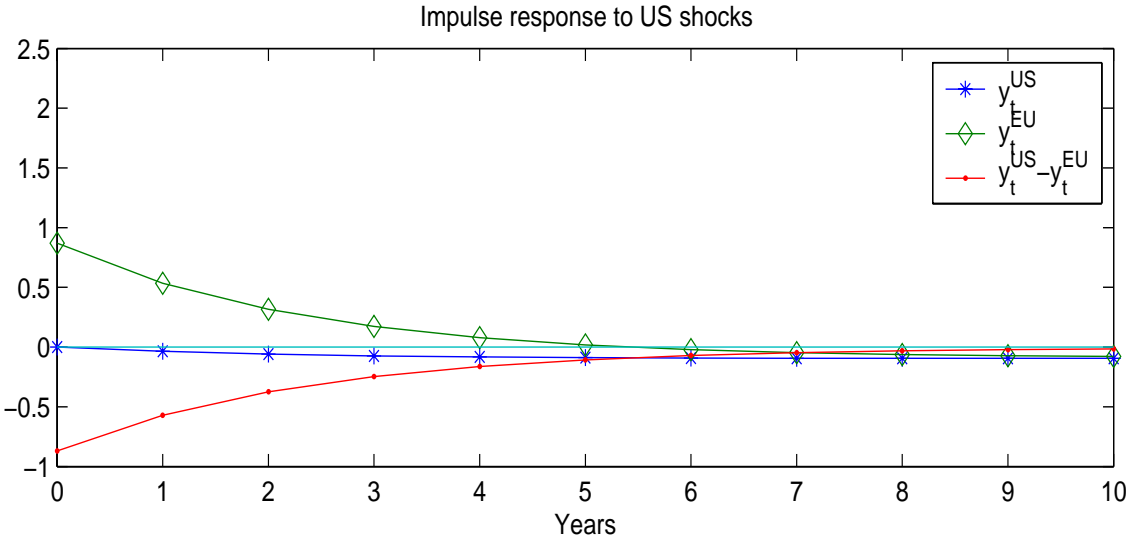
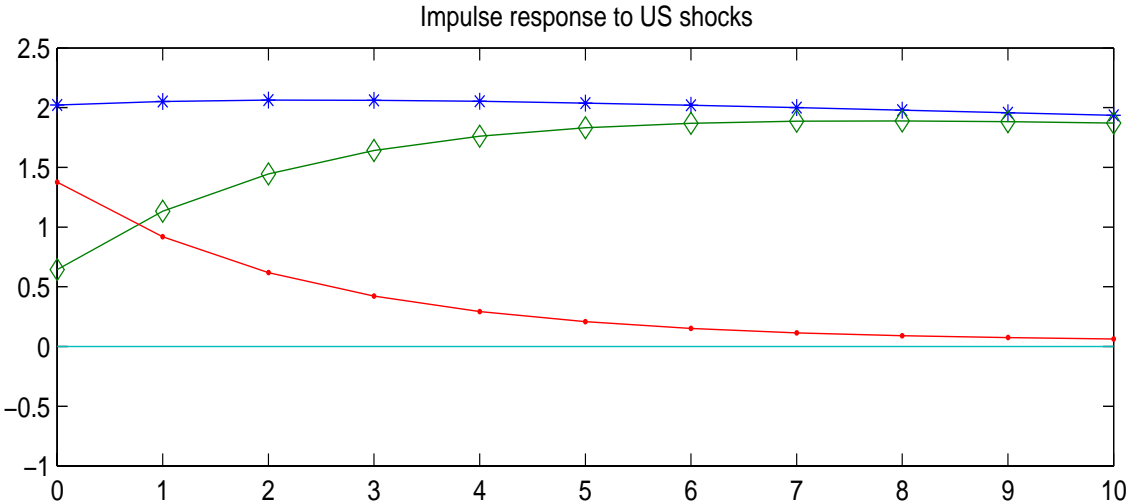


Table3

Real GDP per-capita: Forecast error decomposition

% of forecast error variance explained by the Worldwide (US) shock.

	Forecast horizon				
	0y	1y	3y	5y	10y
y_t^{US}	1.00	1.00	1.00	1.00	1.00
y_t^{EU}	0.35	0.62	0.85	0.92	0.96
$y_t^{US} - y_t^{EU}$	0.71	0.72	0.72	0.72	0.72

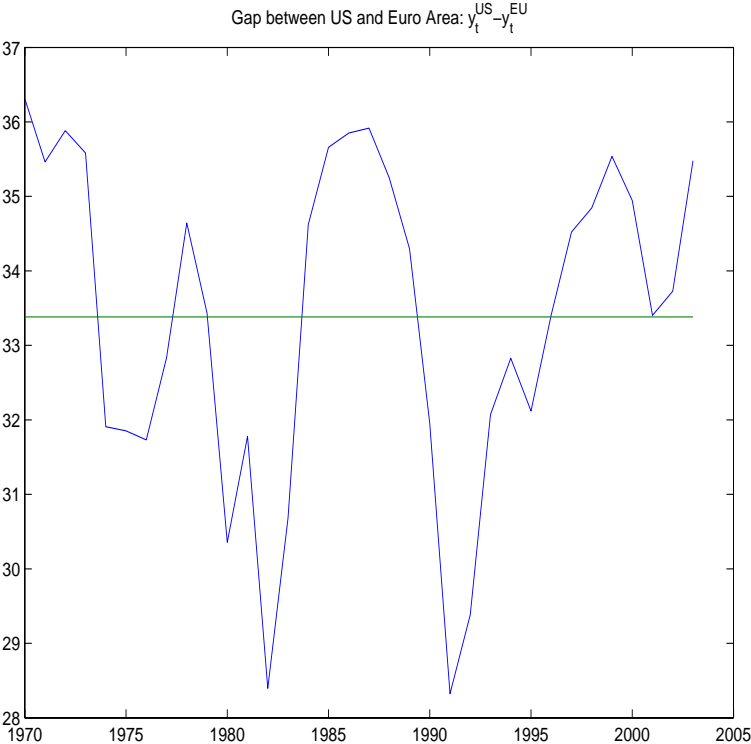
Impulse response and variance decompositions

- After a worldwide shock, the US adjusts immediately while Europe reacts slowly reaching the steady state after 10 years.
- Euro Area specific shocks are very small and transitory.

Counterfactual I

What would have the gap been if there had only been worldwide shocks, and no Euro specific shocks?

Figure The Gap

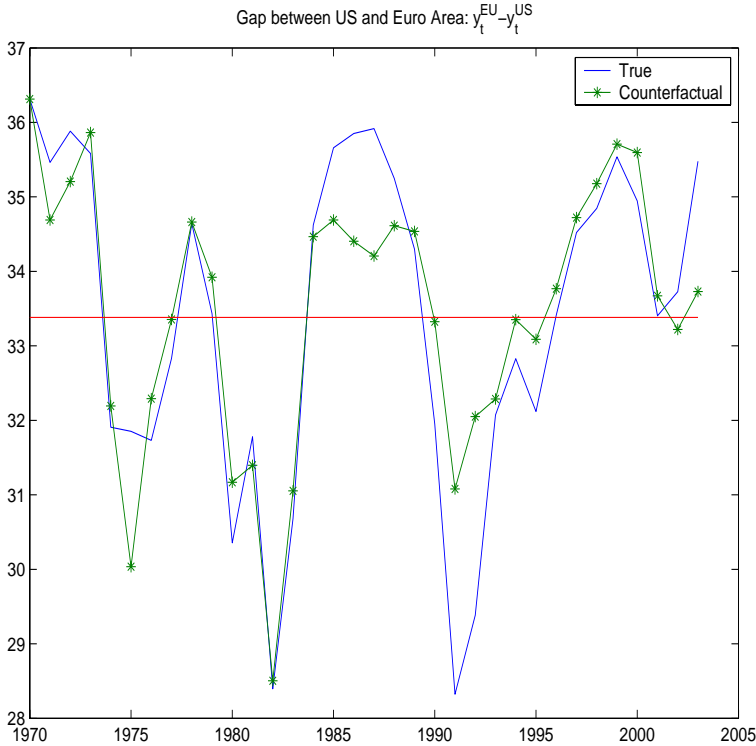


Remark

Recessions: Gap ↓

Expansions: Gap ↑

Figure The Counterfactual GAP



Results

- The world wide shock explains most of the fluctuations of the gap.
- During recessions, the gap tends to close since Europe reacts slowly to the worldwide shock. The gap opens during the expansions. In the middle of the cycle it reaches its maximum, but then Europe starts catching up.
- The Euro area shock reduced the gap during the US recession of the 1990s [German Unification]. However, the Euro area shock only postponed the European recession. Apart for this episode, the recent period is very much in line with past experience (the variance of European specific shocks has not increased)
- There is a specific Euro Area cycle, which is different from the US cycle because of the different propagation mechanism (qualification of Canova et al., 2003)
- Euro specific shocks are small

Conjecture/Implication :

In 2003 there were Euro Area specific forces driving down output.

However, accordingly to past experience these should be transitory.

Business cycle asymmetries and risk sharing should we care about synchronization?

Theory: no clear prediction

a) Integration

- a1) increase risk sharing through financial market
→ countries's need to diversify as insurance against risk decreases → can specialize → more asymmetries ↑
(Asdrubali, Sorensen and Yosha, 1996)
- a2) faster and stronger transmission of shock (country specific, Euro wide and Global)
→ less asymmetries ↓

b) common policy and monetary union:

- b1) countries cannot counterbalance country specific shocks
→ more asymmetries ↑
- b2) countries face same policy shocks
→ less asymmetries ↓

Evidence on risk sharing:

Sorensen and Yosha, 1999: less risk sharing in Europe than in the US

Asdrubali, Sorensen and Yosha, 2004:

- Risk sharing through financial market has increase in the last decade thanks to financial integration
- Specialization show a tendency to increase

Here we do some of (corrected) ASY's calculations on our data

Measuring risk sharing, I

ASY, 1996 and 1999 on sample 1970-2004

Define:

$c_t^i \times 100$ log of real individual consumption of country i in year t (PPP adjusted).

$$\Delta_h(c_t^i - c_t^{EU}) = \alpha_t + \beta_t \Delta_h(y_t^i - y_t^{EU}) + v_t$$

Δ_h : h-th differences $1 - L^h$

β_t : amount of risk not insured, percentage of variance of GDP that is smoothed out through capital market, credit market, transfers and fiscal...

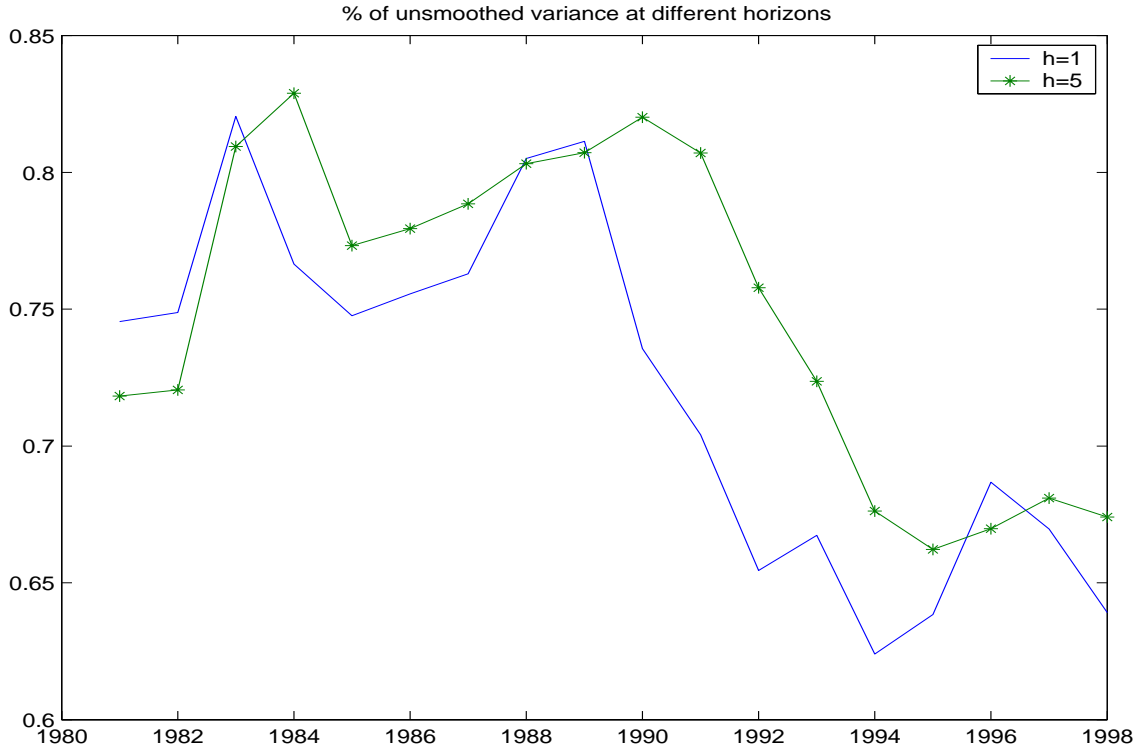
Estimate β_t by OLS regression.

Plot smooth versions of β_t in time and for EU12 countries, excluding Luxemburg:

$$\tilde{\beta}_t = \frac{1}{2m+1} \sum_{j=-m}^m \left(1 - \frac{|j|}{2m+1}\right) \beta_{t+j}$$

we use $m = 5$ yrs.

Figure Risk not shared over time



Result

Risk sharing goes up in the 90's

Measuring risk sharing, II

Panel regressions in subsamples

Panel regressions in subsamples

$$\begin{aligned}\Delta_h(c_t^i - c_t^{EU}) &= \alpha_i + \beta_h \Delta_h(y_t^i - y_t^{EU}) \\ &+ \gamma_i^c \Delta_h c_t^{EU} + \gamma_i^y \Delta_h y_t^{EU} \\ &+ \gamma_i^R \Delta_h R_t^{i,EU} + v_t^i\end{aligned}$$

where $R_t^{i,EU}$ is the real exchange rate between country i and the Euro Area as a whole

We estimate it using WLS (downweight countries with larger regression error)

Panel estimates of β_h for selected subsamples: WLS

	EU 12 (excl. LU)		EU (Largest 6)	
	h=1	h=5	h=1	h=5
1970-2003	0.75 (0.05)	0.77 (0.03)	0.83 (0.07)	0.94 (0.04)
1970-1989	0.80 (0.08)	0.87 (0.04)	0.86 (0.09)	0.91 (0.05)
1990-2003	0.65 (0.07)	0.59 (0.03)	0.70 (0.10)	0.65 (0.08)
1993-2003	0.76 (0.10)	0.59 (0.03)	0.77 (0.12)	0.63 (0.15)

Results

Risk sharing has increased in the last decade. The increase is particularly strong at long horizons

→ increased the ability of countries to smooth persistent shocks to output.

Integration is working and we should care less than before about asymmetries in output...

Conclusions

- If we look at output correlations from an historical perspective, it is business as usual:

Differences between Euro countries levels of activity are persistent, but recessions and expansions are synchronized [same as in the US]

- Euro area countries share certain common characteristics and although they move with the US in the long-run, the characteristics of the Euro cycle are different than the US (it lags, it is more persistence, it is less volatile)
- Risk sharing within the Euro area has increased since the early 1990s