

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

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**What effects is EMU having on the Euro area and its member countries?**  
European Central Bank  
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Recently, the press has given a lot of attention to heterogeneity of economic performance of EMU member countries

## **This paper**

### **2 Questions**

- Is (increasing) heterogeneity a fact or a fiction?
- Should we worry about it?

### **The Analysis**

- Selected review of the literature (huge and inconclusive) on cyclical commonality
- Some of our own data analysis

We take a narrow perspective → analyze output per capita (mainly) and consumption [other papers in this conference look at other aspects]

## Five findings

1. Output per capita gaps between EMU member countries and EMU aggregate have historically (since 1970) been very persistent + long-run paths are not common

– no change in the last decade

– However ... same between US regions and US aggregate

On the other hand, the gap between EMU aggregate and the US is sizeable but stationary → difference in output per capita between US and EMU less persistent than between US regions and US or EMU countries and EMU aggregate!

→ SIZE MATTERS

2. Recessions in Euro Countries and US are synchronized → Explained mainly by global shocks

3. The world shocks generate a common Euro area cycle which is more persistent than in the US and lags it.

4. Persistent differences within the Euro area are generated by small country specific shocks rather than heterogenous responses to area wide shock.

5. Although output growth correlations have remained constant in the last 30 years, that part of consumption insured by capital market or other mechanisms has increased dramatically since the early 90s

## **Some basic facts**

*A. GDP per capita gaps of EMU members (and other countries) with respect to EMU aggregate since 1970*

*B. Personal Income per capita gaps of US regions with respect to US aggregate since 1970*

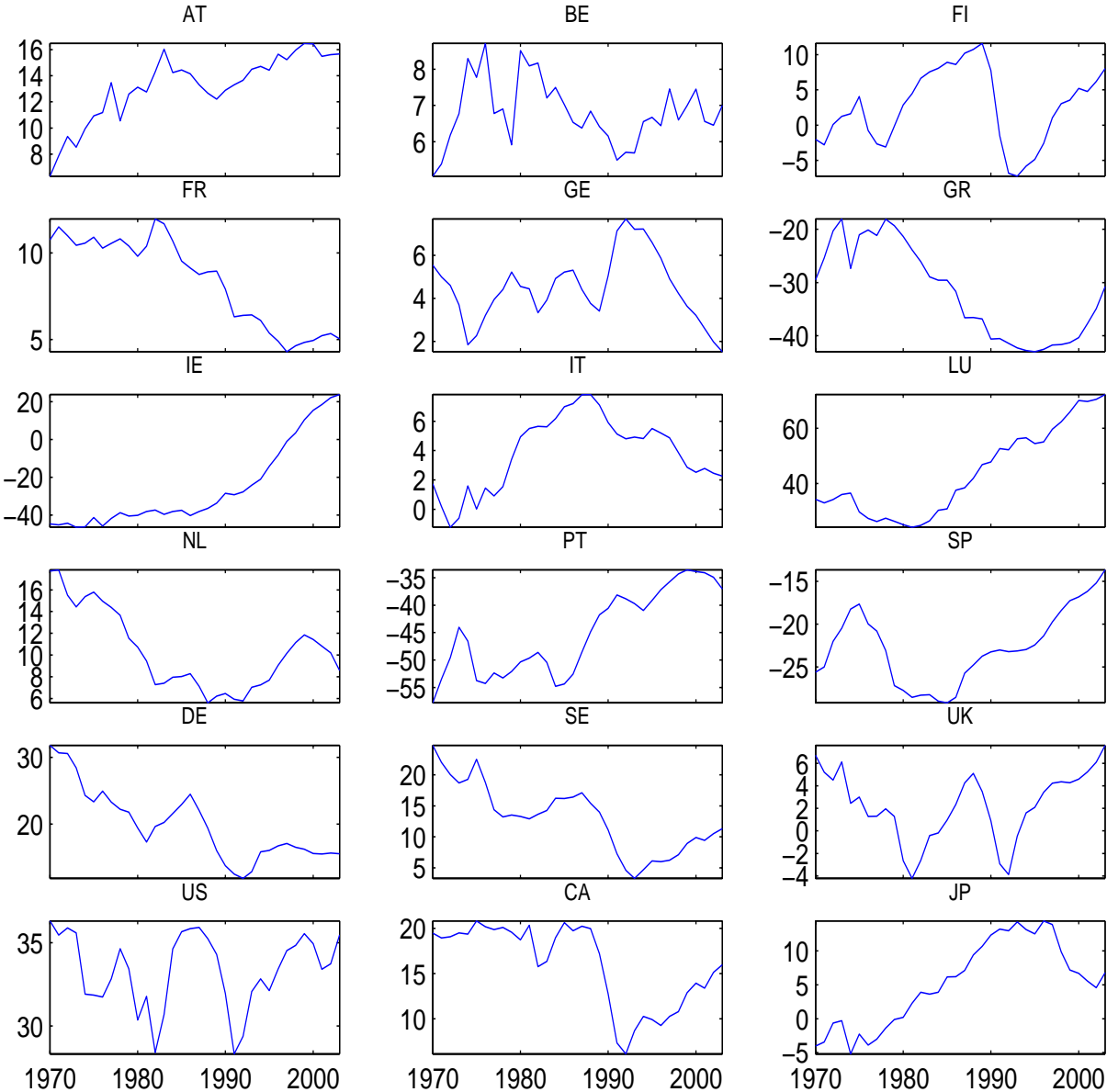
**Table 1**

**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	**

<sup>51</sup> 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 1a**, Real GDP per-capita, gap with respect to Euro Area



**Table 1b**

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

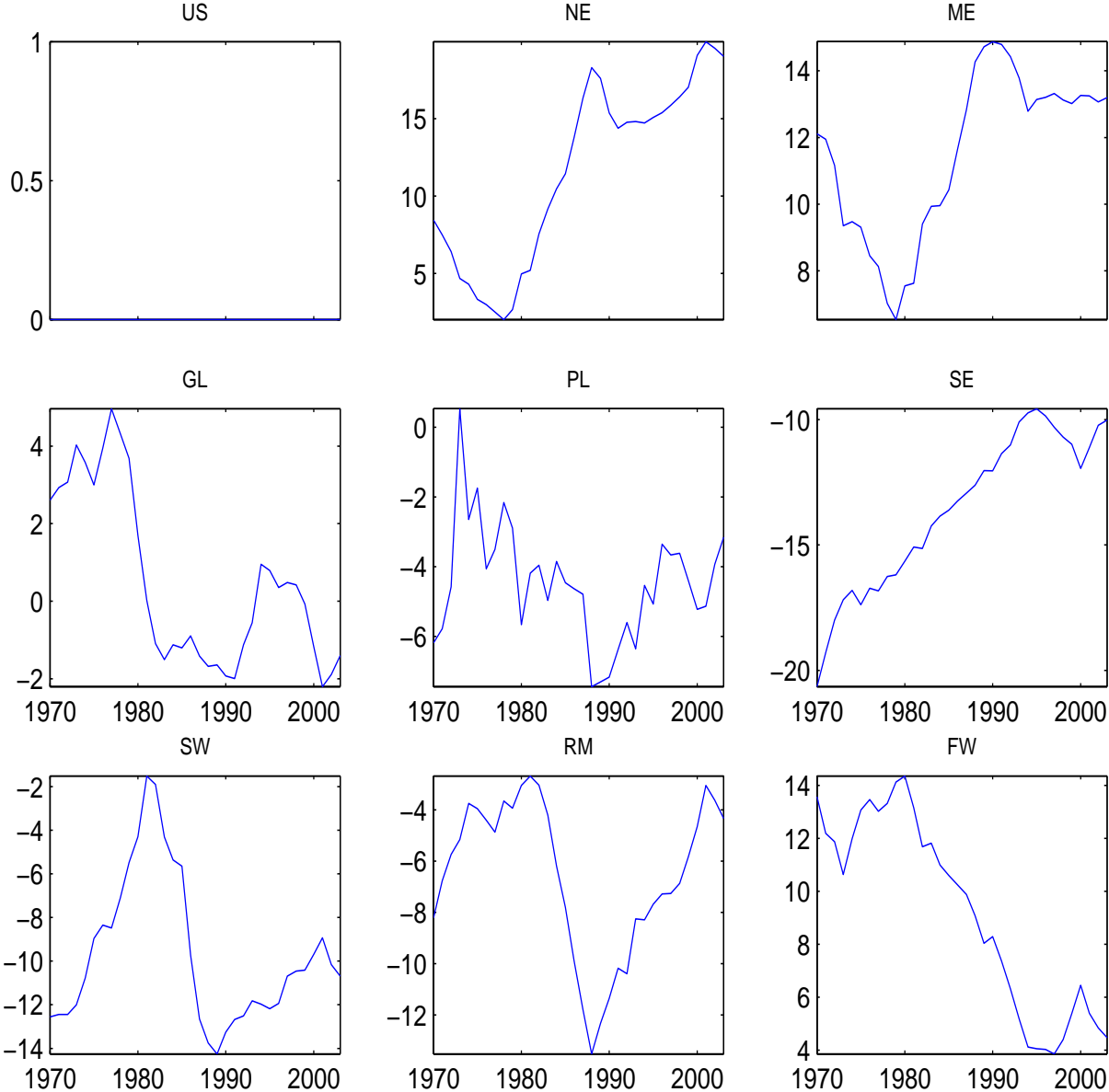
	1970	1980	1990	1999	2003	AVE 70-03	AVE 70-89	AVE 90-03	AR1
US	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	8.45	4.97	15.37	17.03	19.02	11.50	7.98	16.53	1.00
ME	12.11	7.55	14.88	13.02	13.20	11.50	10.09	13.52	0.96
GL	2.61	1.70	-1.93	-0.08	-1.40	0.53	1.36	-0.67	0.94
PL	-6.18	-5.66	-7.17	-4.40	-3.15	-4.47	-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

## US regions

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

**Figure 1b**, Personal Income, gaps of US region with respect to US aggregate



## 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. Same between US regions and US aggregate (Personal Income)

3. 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

## 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!!!

## **Lack of common trend between Euro countries and Euro aggregate might be explained by convergence dynamics**

The Literature:

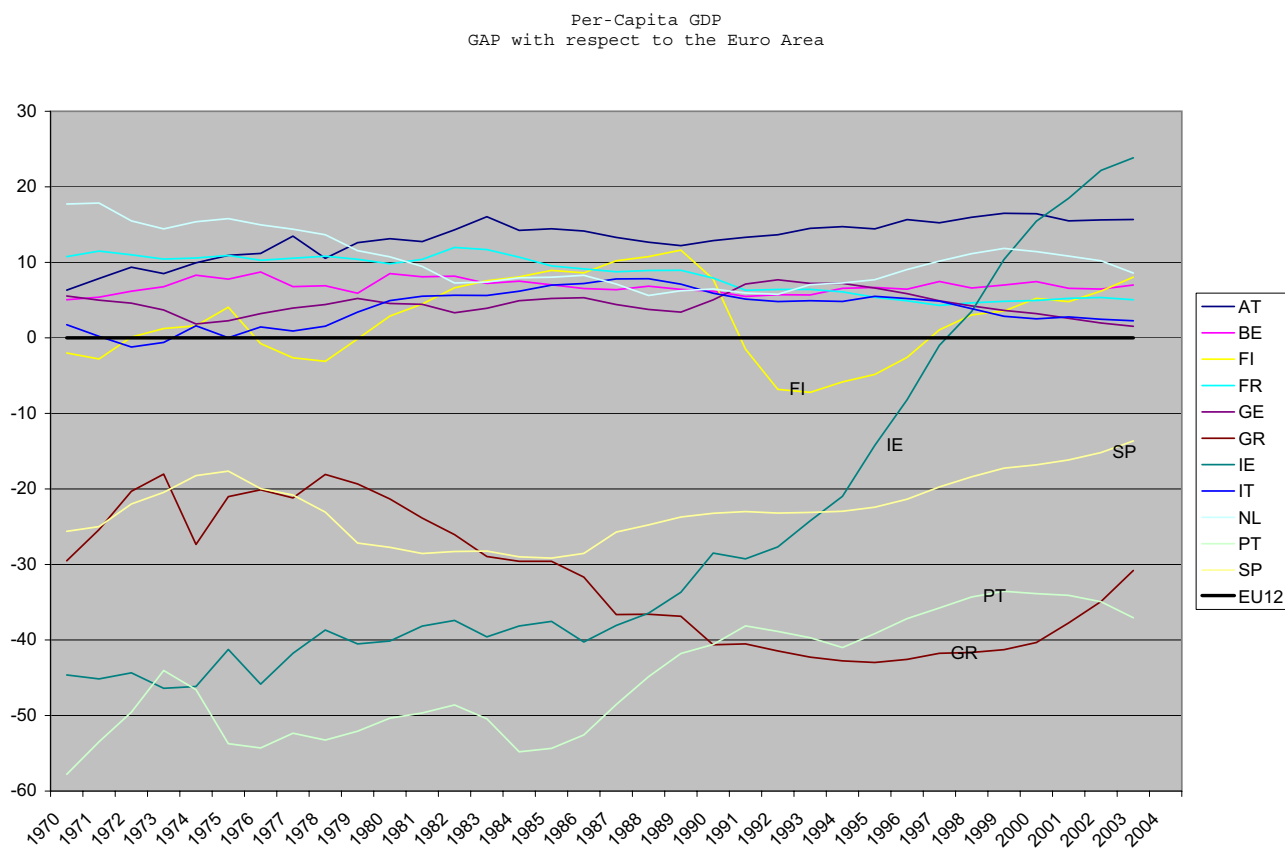
Harvey, 2005: Rich countries stay close to average and poor countries (Greece, Portugal, Spain) converged to a low level of output around 30% below average [Ireland is an exception]

Our point:

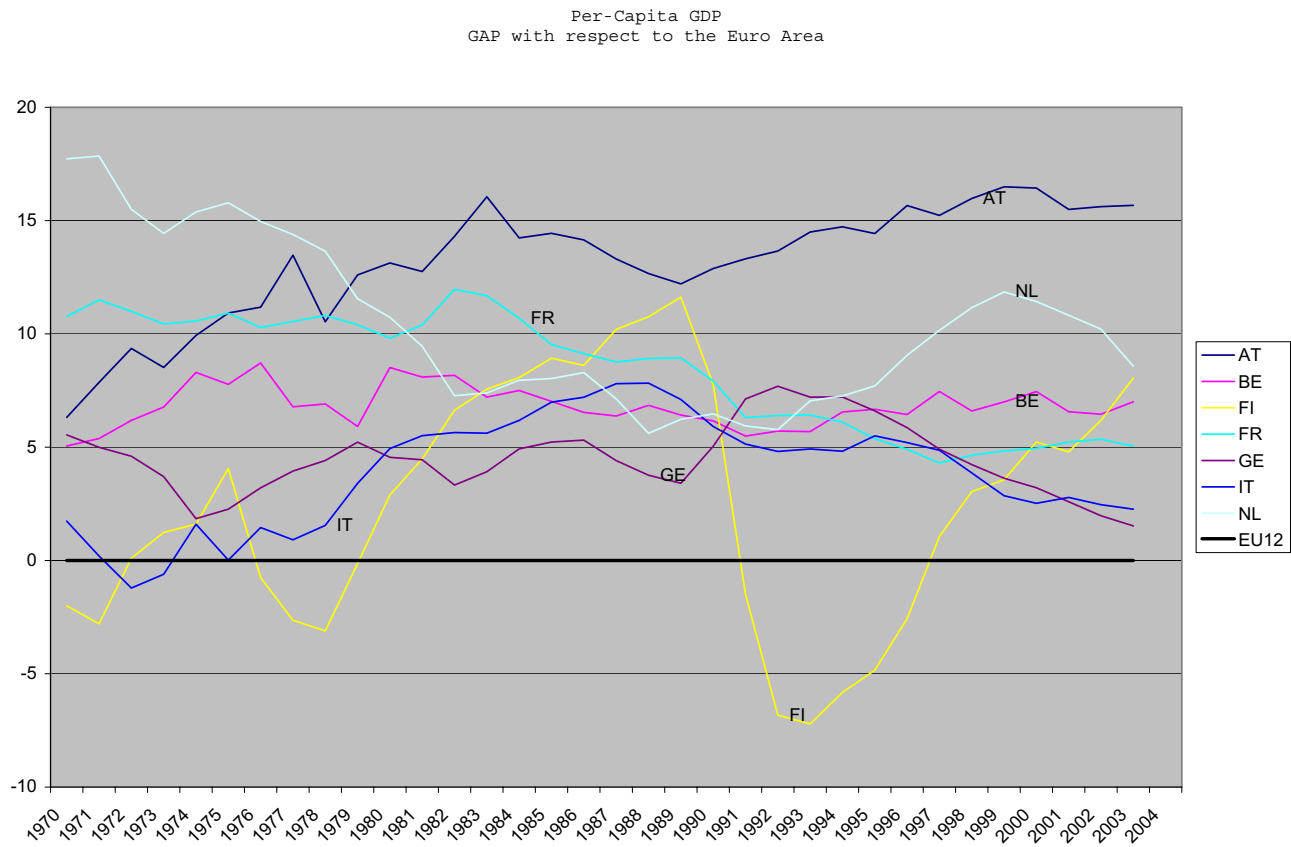
These predictions are difficult and unreliable since gaps are very persistent, hence their long run behavior is difficult to predict

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 2a, Real GDP per-capita, gaps with respect to Euro Area**



**Figure 2b, Real GDP Per-Capita, gaps with respect to Euro Area**



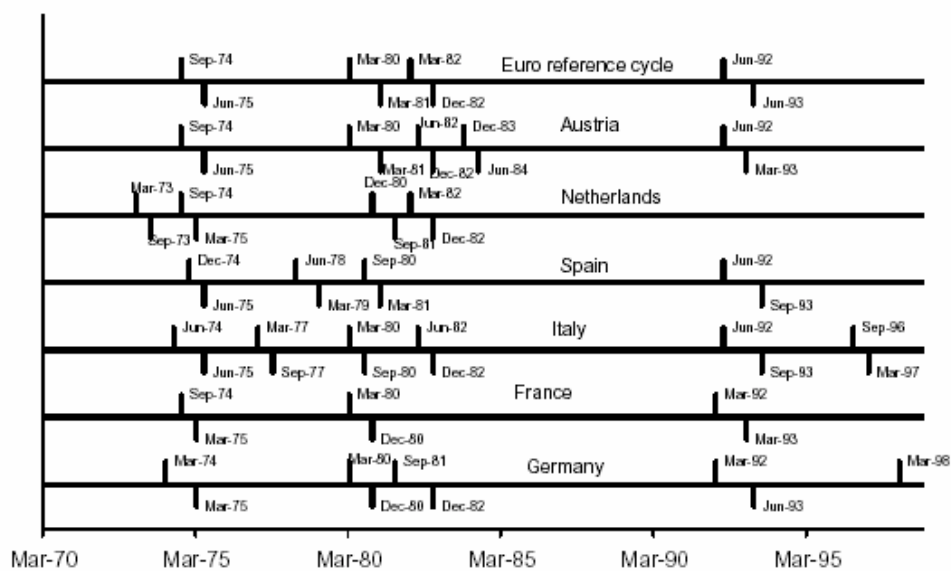
**Gap are persistent but recessions are synchronized**

Harding and Pagan, 2001 [Figure]

Note: recessions are rare, expansions is the normal state of the economy

Cycles are very similar!!!

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



• **What explains medium/long run asymmetries and cyclical symmetries ?**

- Propagation of common (euro or world wide) shocks?
- OR
- Idiosyncratic (country-specific) shocks?

To discriminate between these hypotheses run a VAR for each country

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

$u_t^{EU}$ : Euro Area Wide shock

$u_t^i$ : Country  $i$  specific shock.

Identifying assumption: country specific shocks ( $u_t^i$ ) affect Euro Area only with a lag.

**Ask:**

- How **large** are the effects of country specific shock on Output?

**Answer:** Not so much

- How **large** and how **persistent** are the effects of country specific shock on the gap with respect to the Euro Area?

**Answer:** Both large and persistent

↓  
Variance Decompositions

- How **different** are the propagation mechanisms of area-wide shocks to individual countries?

**Answer:** Not so much

↓  
Variance decomposition  
+  
Correlations conditional to Area Wide Shocks

Correlations conditional to area-wide shocks: what would have correlations been if there had only been euro area-wide shocks? → (shut down  $u_t^i$ )

## Impulse Response Function

Invert the VAR to obtain the Moving Average representation of our system

$$y_t^i = \mu^i + \psi_{EU}^i(L)u_t^{EU} + \psi_i^i(L)u_t^i$$

$$y_t^{EU} = \mu^{EU} + \psi_{EU}^{EU}(L)u_t^{EU} + \psi_i^{EU}(L)u_t^i$$

$$\begin{aligned} y_t^i - y_t^{EU} &= \left( \eta^i - \eta^{EU} \right) \\ &+ \left( \psi_{EU}^i(L) - \psi_{EU}^{EU}(L) \right) u_t^{EU} \\ &+ \left( \psi_i^i(L) - \psi_i^{EU}(L) \right) u_t^i \end{aligned}$$

Analyze the propagation mechanisms of both country specific and area-wide shocks on output of country  $i$  and on the output gap of country  $i$  with respect to the Euro Area.

If area-wide shocks propagate similarly across member countries,  $\psi_{EU}^{EU} \sim \psi_{EU}^i$   
⇒ global shocks have no significant effects on the GAP, but they have on levels  
⇒ fluctuations in the gap are due only to country specific shocks.

Figure 4a

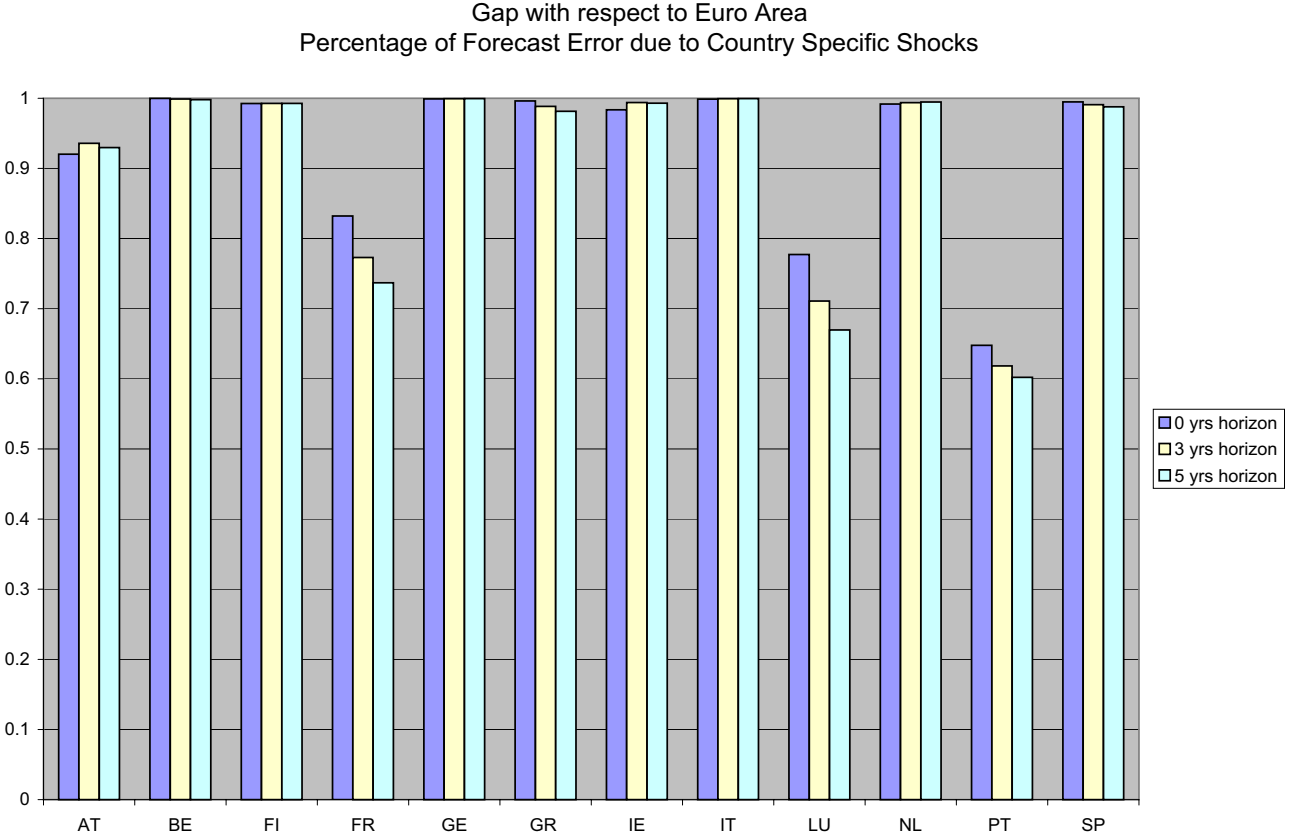


Figure 4b

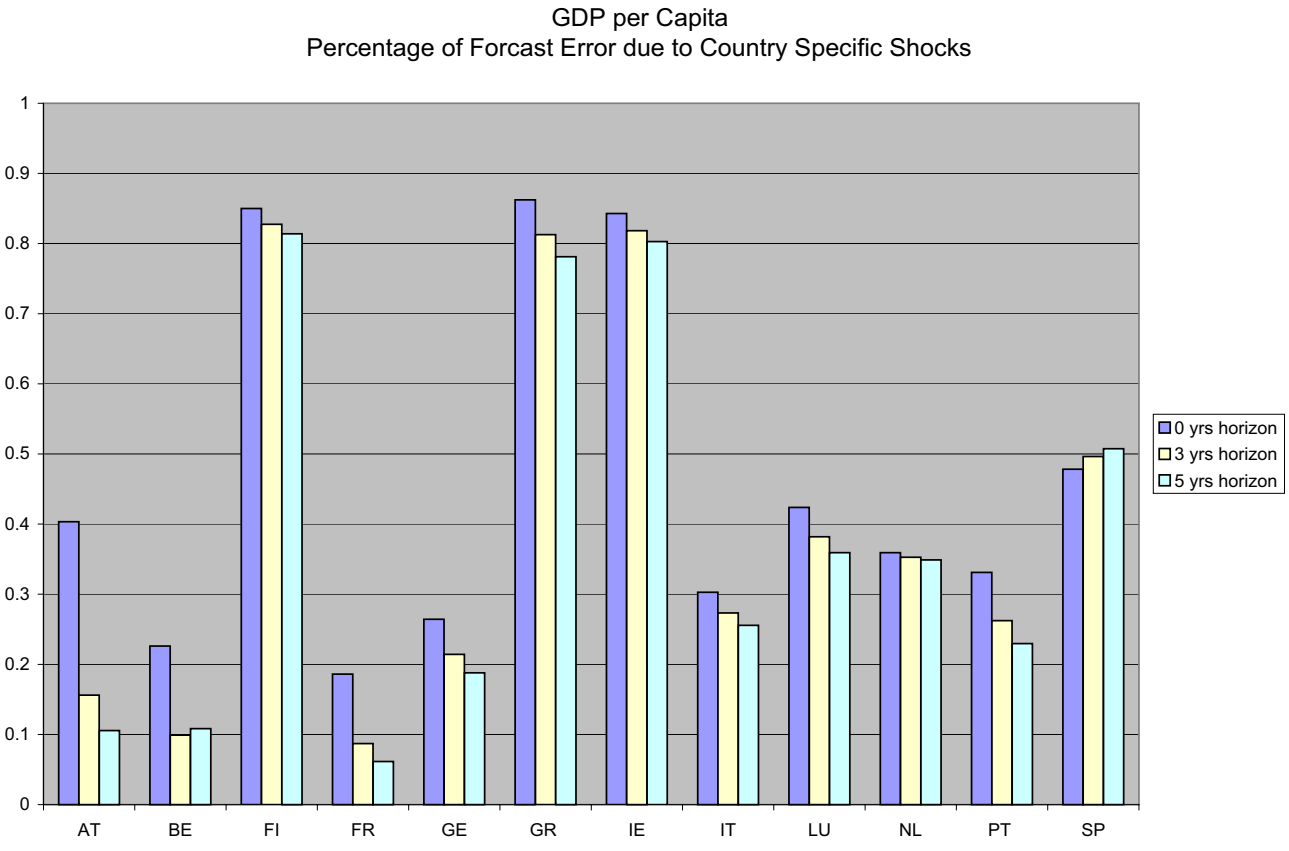
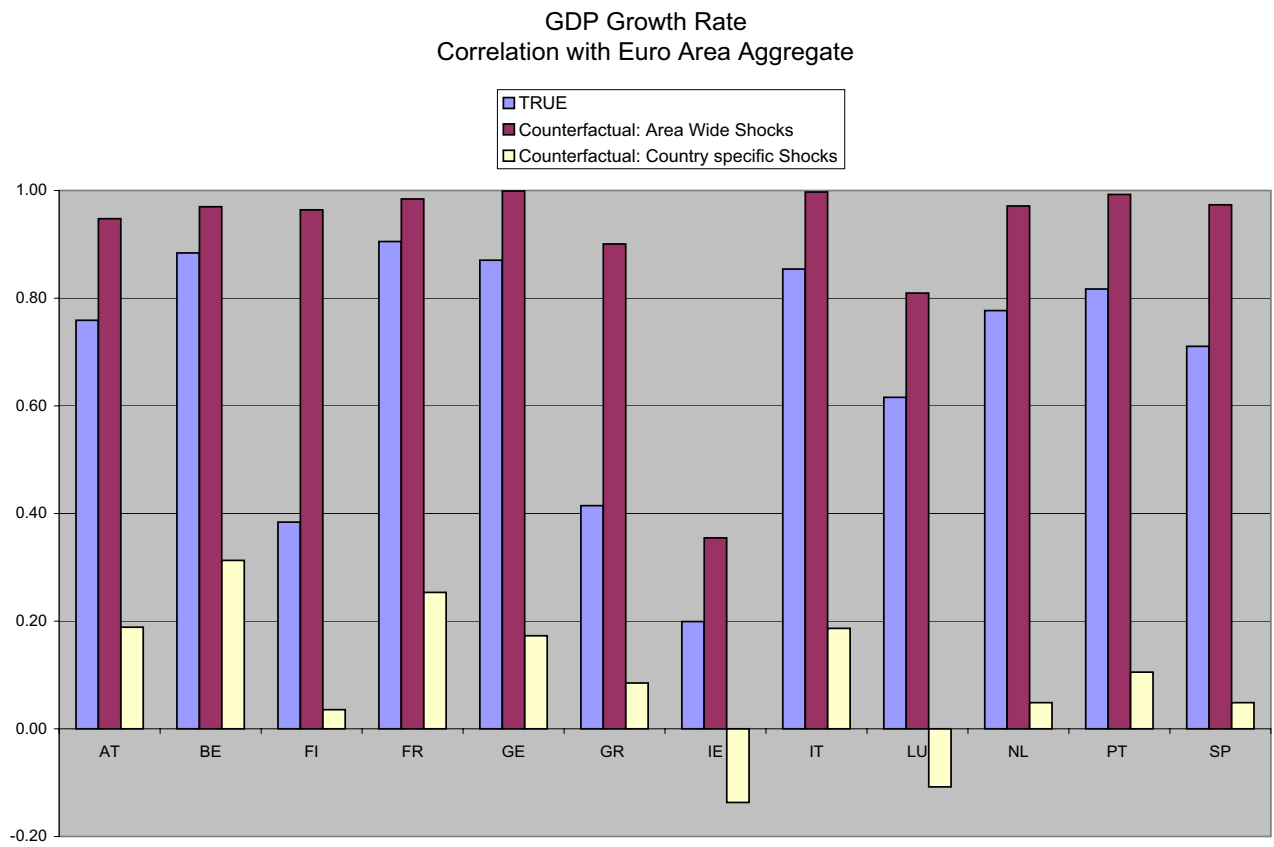


Figure 4c



## Results

- 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 about the US?** Repeat the same exercise with US and US regions' (per capita personal Income)

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

$u_t^{EU}$ : US Wide shock

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

**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

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

Figure 5a

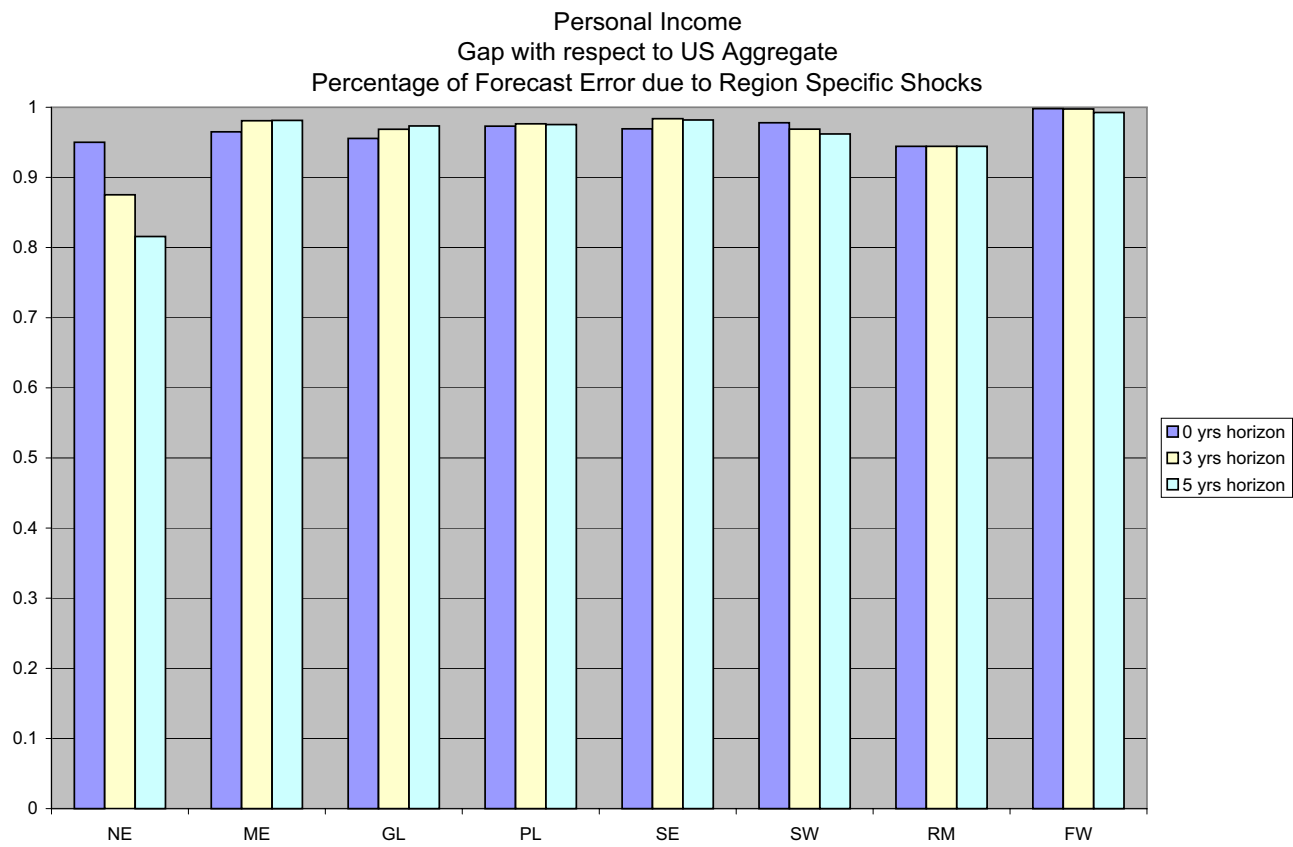


Figure 5b

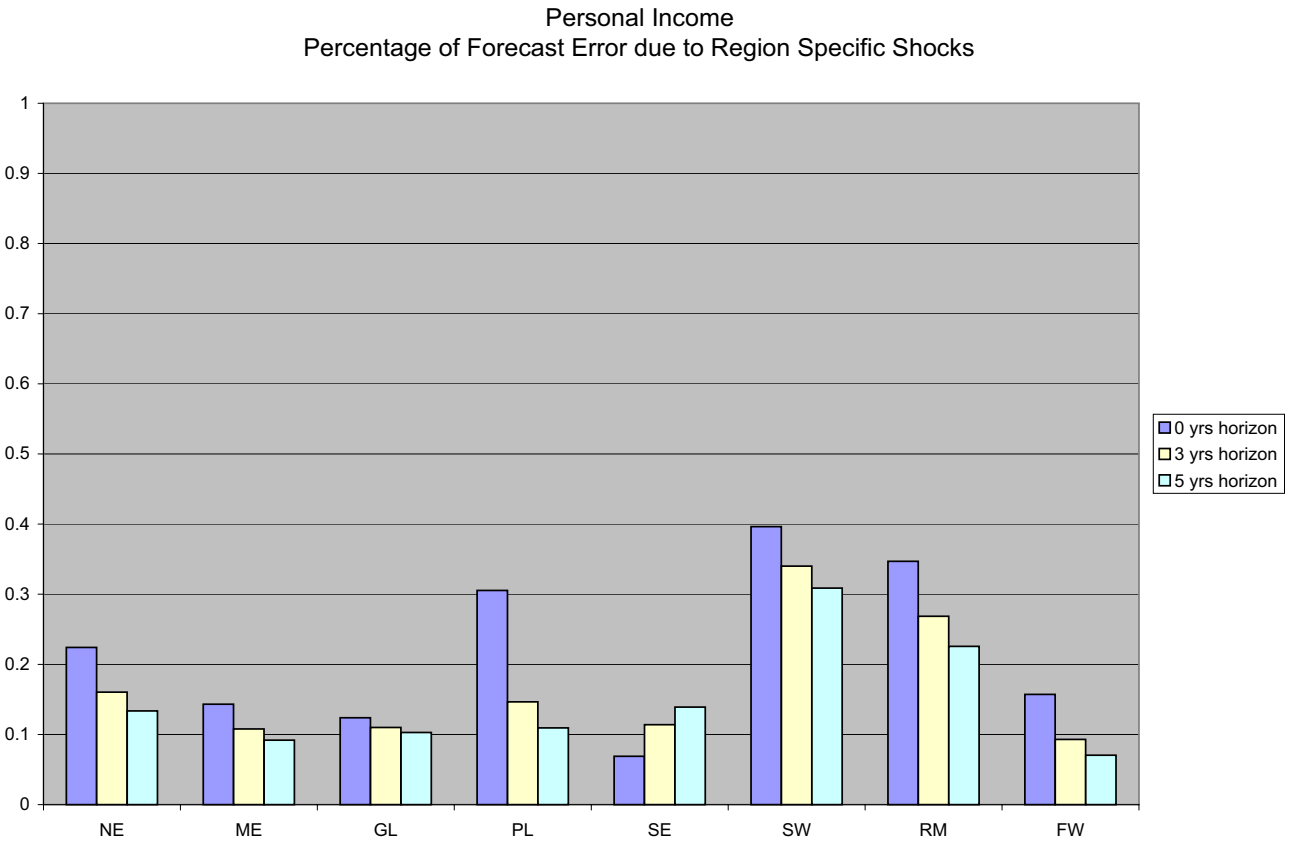
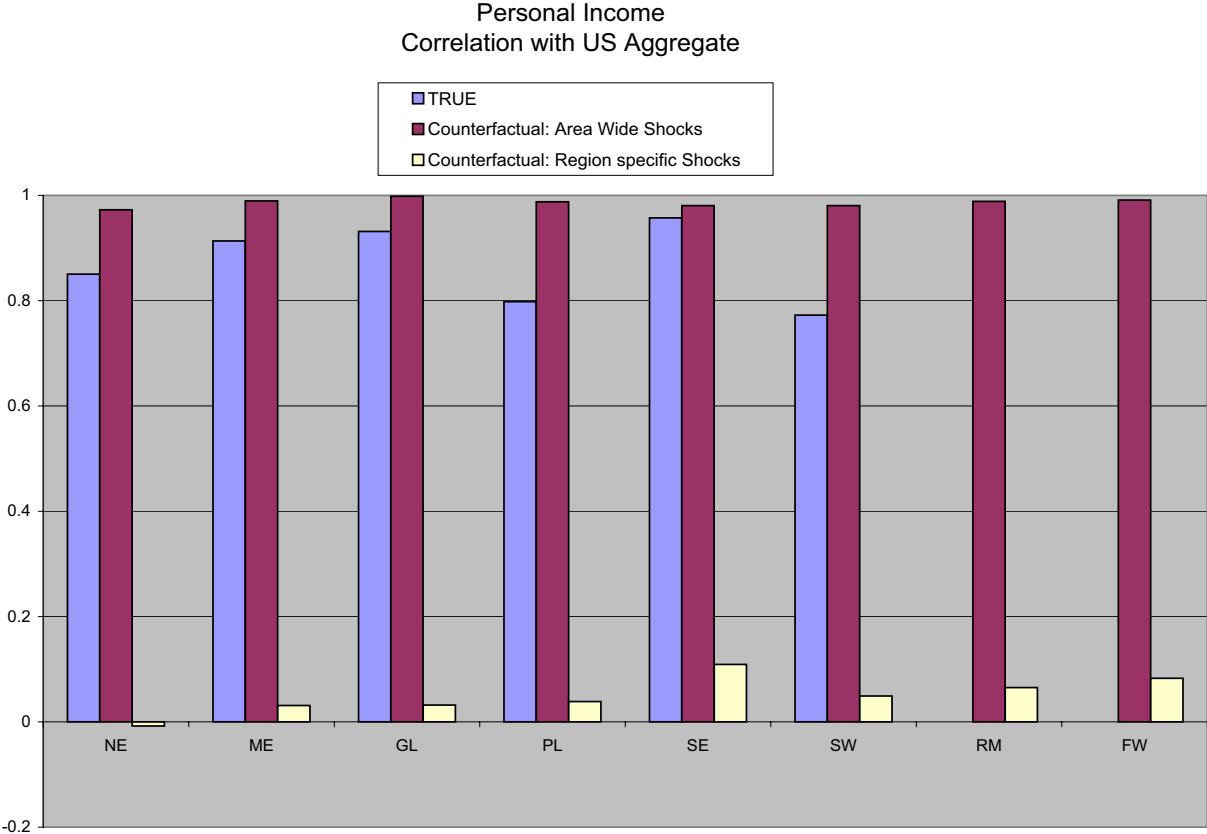


Figure 5c



**The global component is important → characterize differences between the US and the Euro area as a whole**

(Giannone and Reichlin, 2005)

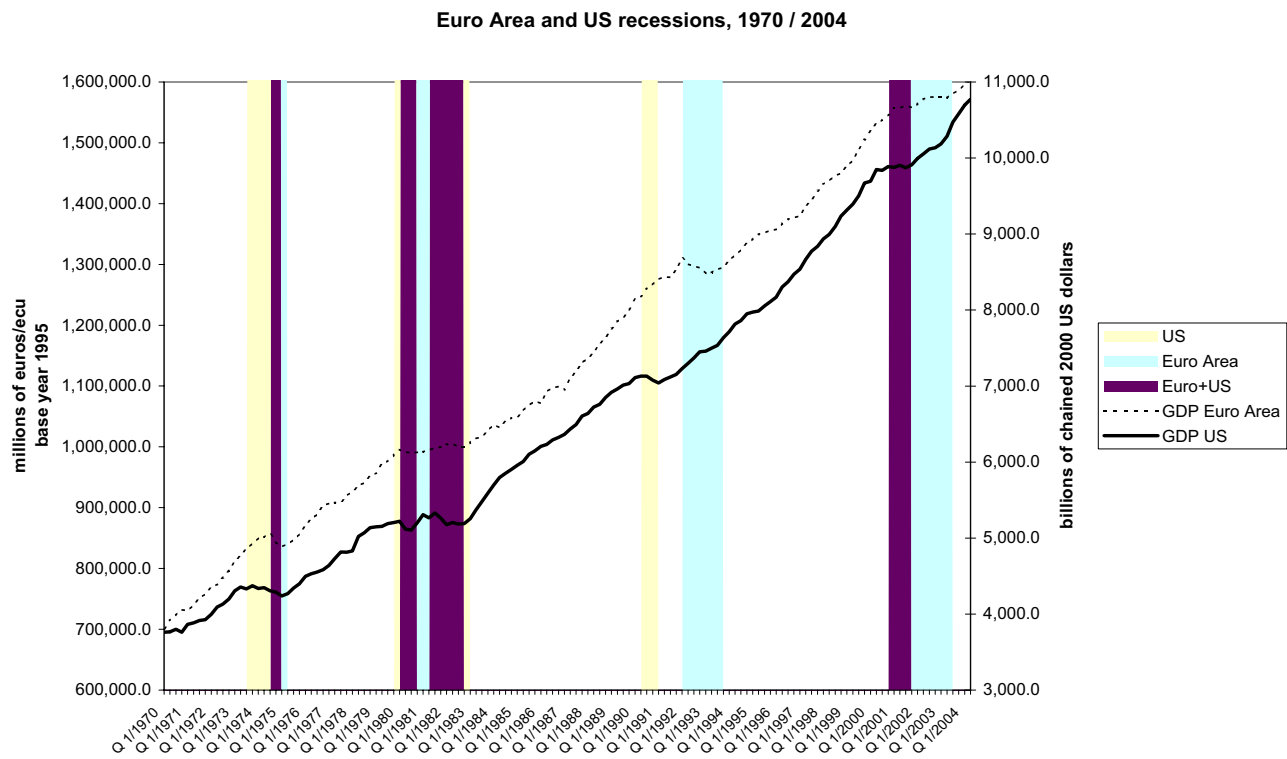
**Ask:** Have things changed in the recent years?

- Evidence on real GDP

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

History of classical (level) cycles is broadly similar

Figure 6



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

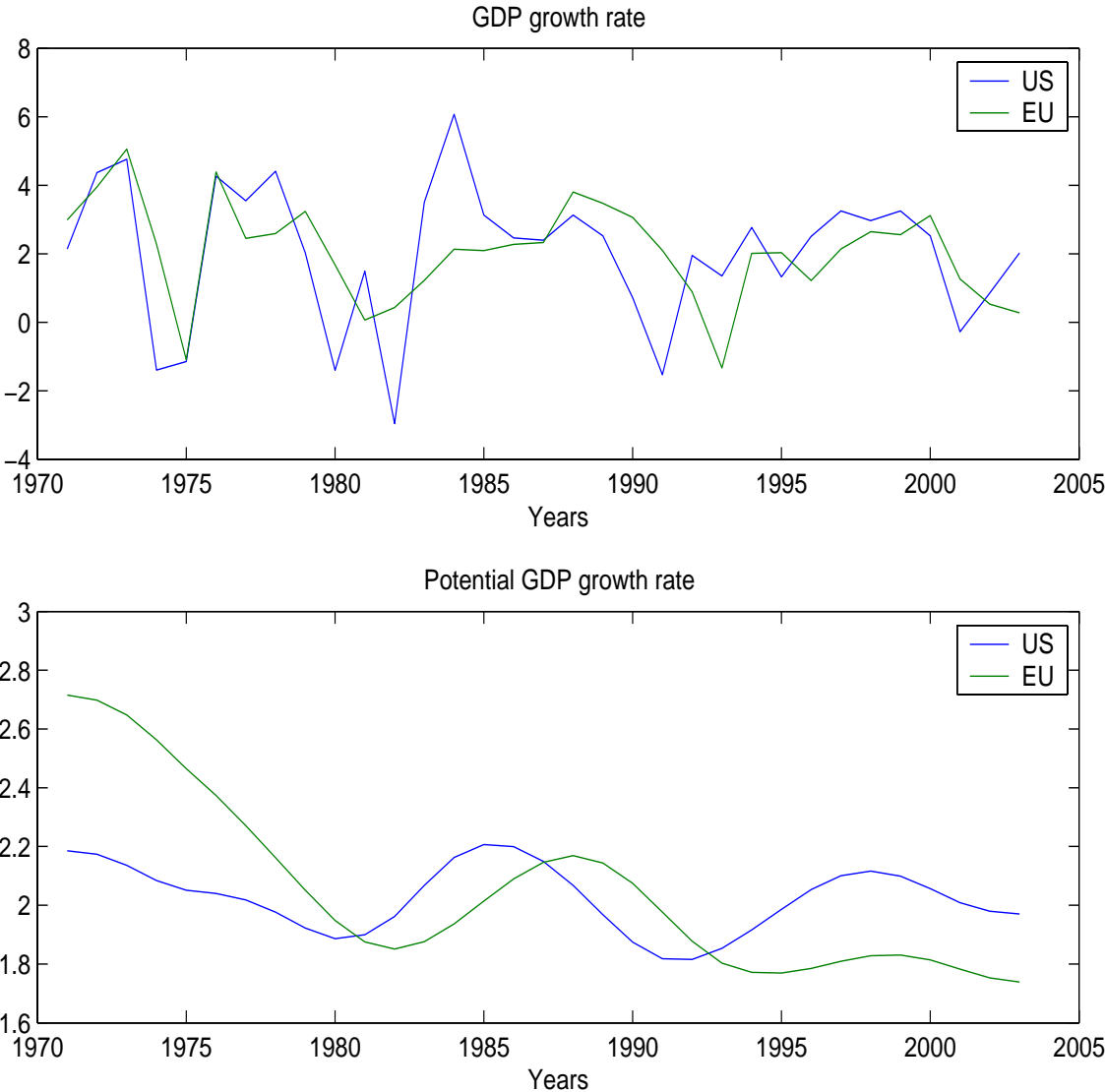
**Euro cycle is smoother than the US cycle  
(more persistent)**

**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 6**



## Does US output Granger cause the Euro area output?

Table 6, Granger causality test

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

**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

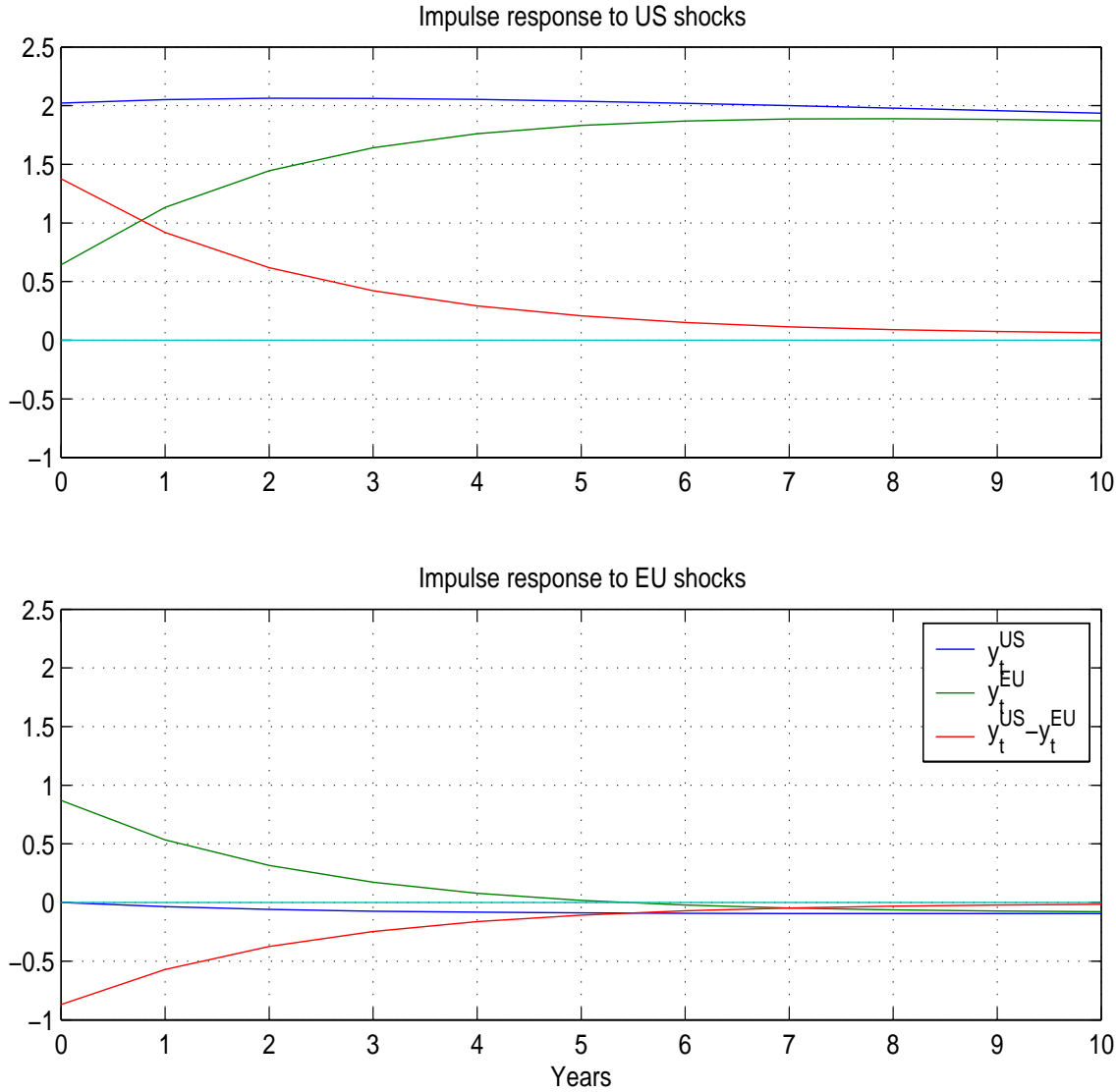
- The US moves first

→ 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 7 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

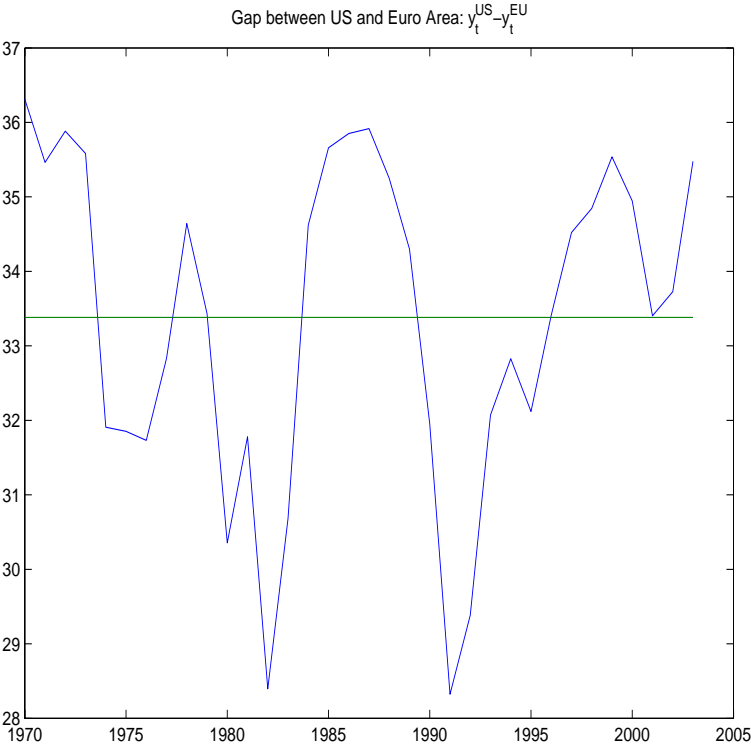
## **Impulse response and variance decompositions**

- 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.

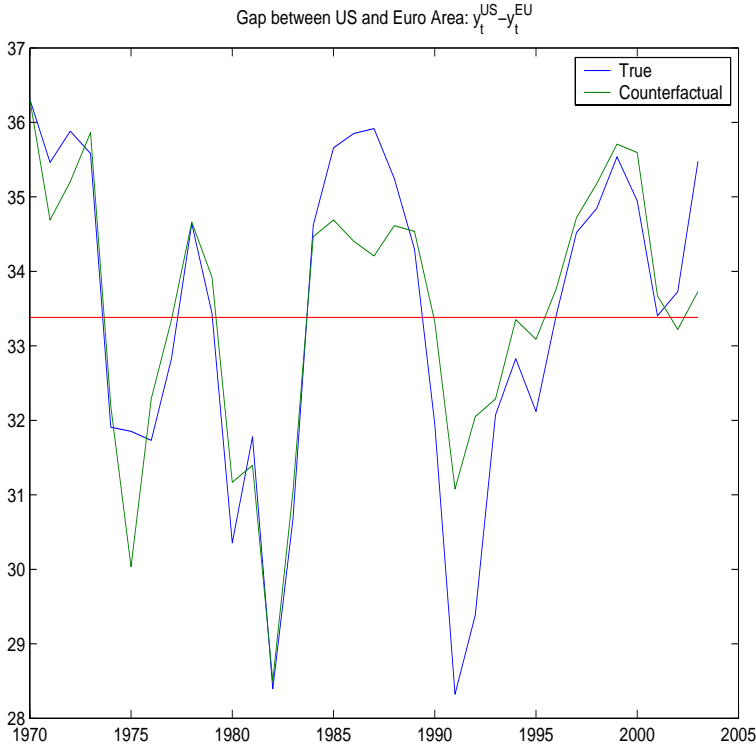
## **Counterfactual I**

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

# Figure 8a The Gap



# Figure 8b The Counterfactual GAP



# Counterfactual 2

What would have correlations and variances been if only worldwide shock had realized?

Table 6b

**Real GDP per capita growth: realized and counterfactual variances**

		70-03	70-89	90-03	93-03
cov( $\Delta y_t^{US}, \Delta y_t^{EU}$ )	TRUE	0.51	0.61	0.26	0.54
	Counter	0.51	0.67	0.73	0.68
var( $\Delta y_t^{US}$ )	TRUE	4.16	5.83	2.02	1.33
	Counter	4.11	5.80	2.00	1.33
var( $\Delta y_t^{EU}$ )	TRUE	2.05	2.29	1.44	0.86
	Counter	0.87	1.13	0.38	0.27

## 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.

## Has the picture changed in the last 10-15 years?

**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 ↓

**Has the picture changed in the last 10-15 years?**

## **Empirics**

Show variance and correlation of growth rates

- Variance has decreased everywhere
- Covariances stable

(see also Stock and Watson, 2004 for a review)

Figure 9a

Variance of per-capita GDP growth rates

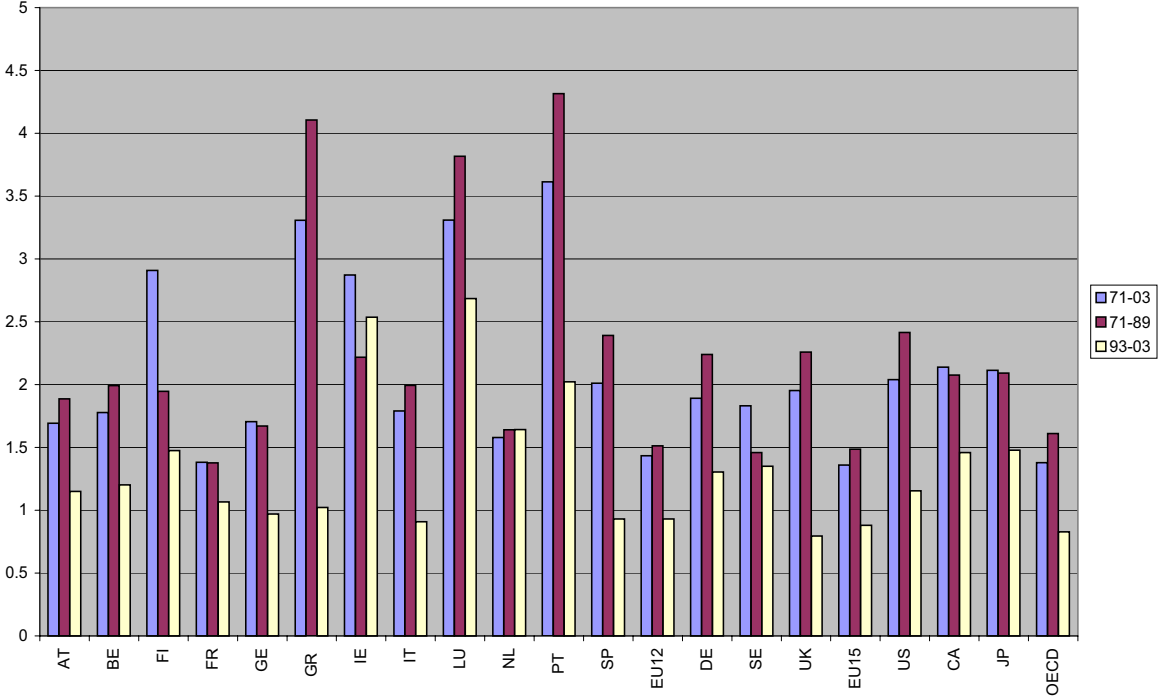
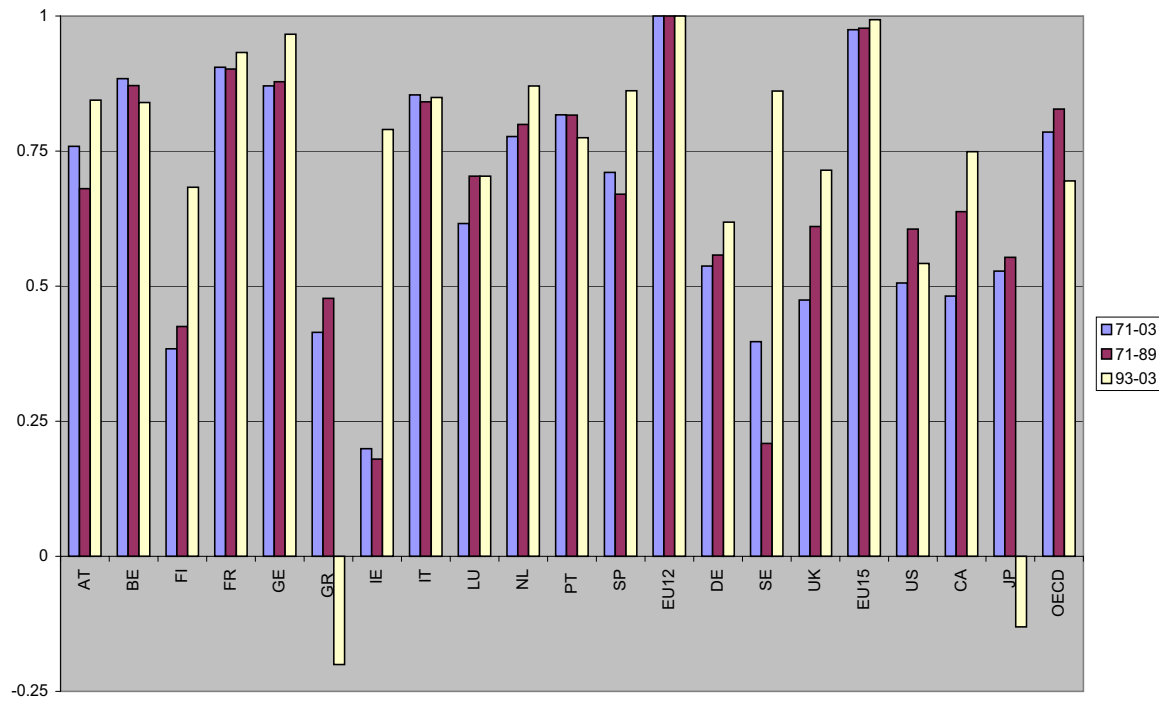


Figure 9b

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



Conclusions so far point to no visible changes in output per capita heterogeneity within the Euro area or between the Euro area as a whole and the US

However ... consumption is what matters for welfare

Potential gains come from risk sharing

## **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

# **Statistics on Consumption [NOT FOR ORAL PRESENTATION]**

Define

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

$\text{gap}_t^i = y_t^i - y_t^{EU12}$ : percentage deviation of real individual consumption of country  $i$  from Euro Area.

Table 7, shows the measure at different years,

$t = 1970, 1980, 1990, 1999, 2003$

.

**Table 7**

**Individual Consumption 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	4.95	10.78	12.90	14.16	11.52	12.42	11.11	14.29	0.79	
BE	3.13	5.06	3.52	3.44	3.16	4.71	5.41	3.70	0.76	
FI	-11.94	-11.54	-2.48	-12.41	-8.69	-10.09	-8.34	-12.58	0.89	**
FR	14.99	11.13	8.65	4.23	5.81	9.76	12.56	5.76	0.96	
GE	2.57	6.20	4.65	6.85	4.05	5.55	4.75	6.69	0.83	
GR	-37.87	-28.39	-32.26	-32.58	-27.44	-32.28	-32.55	-31.89	0.78	*
IE	-25.21	-31.16	-35.09	-13.08	-3.86	-28.27	-33.38	-20.96	1.05	
IT	0.21	2.12	7.64	3.74	3.57	2.76	1.48	4.60	0.94	
LU	18.36	18.89	33.41	37.95	43.36	26.80	19.55	37.17	1.01	
NL	21.77	12.81	-1.51	2.82	1.27	6.62	11.05	0.28	0.93	
PT	-48.88	-46.68	-37.49	-26.98	-30.04	-37.82	-42.65	-30.91	0.90	
SP	-23.46	-25.95	-22.31	-17.47	-13.20	-22.14	-24.22	-19.18	1.01	
EU12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
DE	36.65	19.38	8.73	11.82	8.18	17.79	22.86	10.54	0.90	
SE	41.65	22.26	16.24	5.85	8.81	19.12	27.09	7.74	0.94	
UK	11.44	1.28	9.84	14.58	19.65	9.05	6.67	12.46	1.00	
EU15	3.76	1.08	2.14	2.72	3.65	2.28	2.19	2.40	0.89	
US	41.32	29.99	34.69	38.46	41.77	36.04	35.74	36.47	0.87	
CA	23.14	18.96	13.26	7.18	10.17	15.44	20.35	8.43	0.96	
JP	-17.34	-15.49	-5.18	-5.77	-6.73	-9.26	-13.02	-3.89	0.93	
OECD	5.56	-1.33	0.06	1.09	2.79	1.15	1.48	0.67	0.80	

5 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

## **Results**

Differences in consumption are more pronounced with respect to differences in Output.

Some more evidence → Look at variances and correlation with respect to the Euro Area.

Figure 10a

Variance of per Capita Individual Consumption Growth Rates

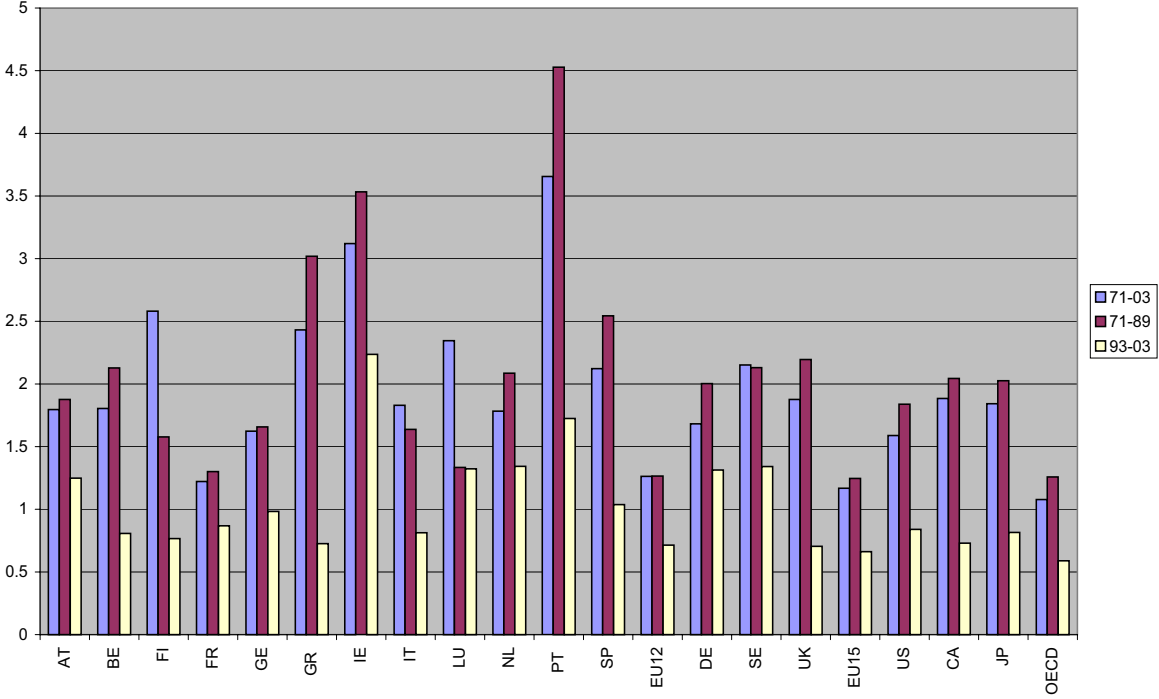


Figure 10b

Correlation of per Capita Individual growth rates with respect to the Euro Area

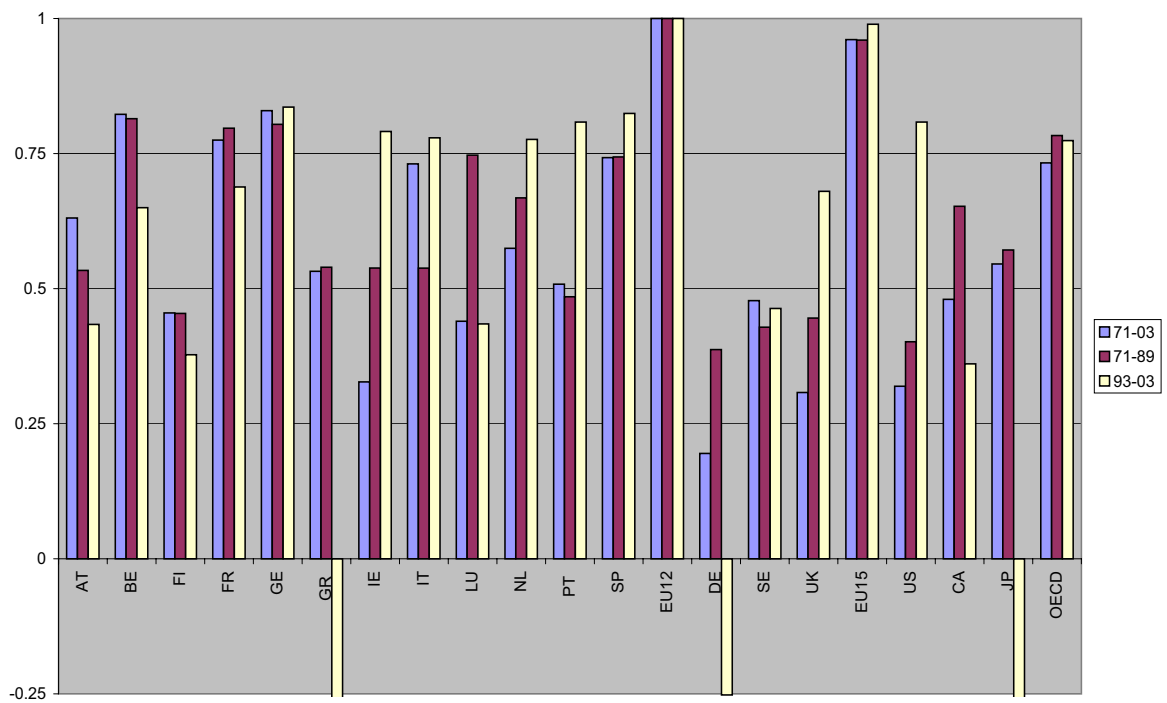
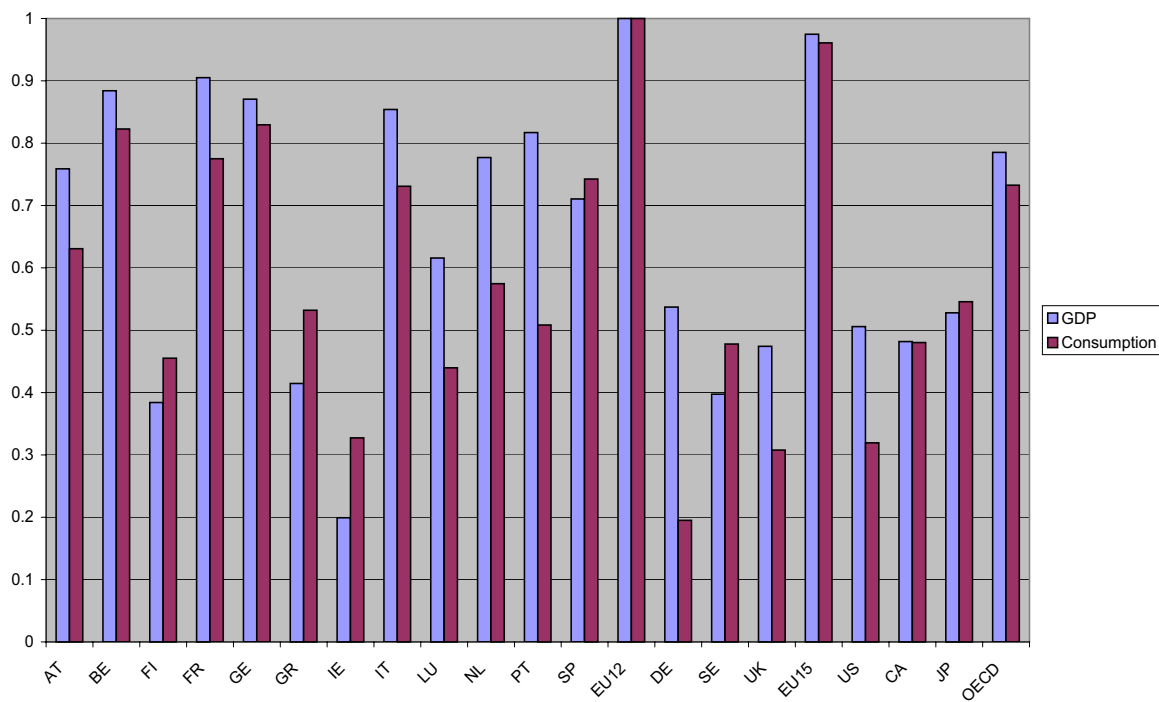


Figure 10c

Correlations with respect to the Euro Area Aggregate: Consumption and Output



## Results

- Correlation within Euro Area are smaller than Output correlation, Consumption correlation puzzle (Taste shocks???)
- Correlation within Euro Area has not increased in the last decade although there has been financial integration → larger country specific taste shocks, measurement error ...

## Country specific shocks or different reaction to area-wide shocks?

Strategy: VAR on:

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

$e_t^{EU}$ : Euro area-wide shock

$e_t^i$ : Country  $i$  specific shock: Can affect Euro Area only with a lag.

Look at Variance decompositions and counterfactual and correlations

Figures 10 a-c

Figure 10a

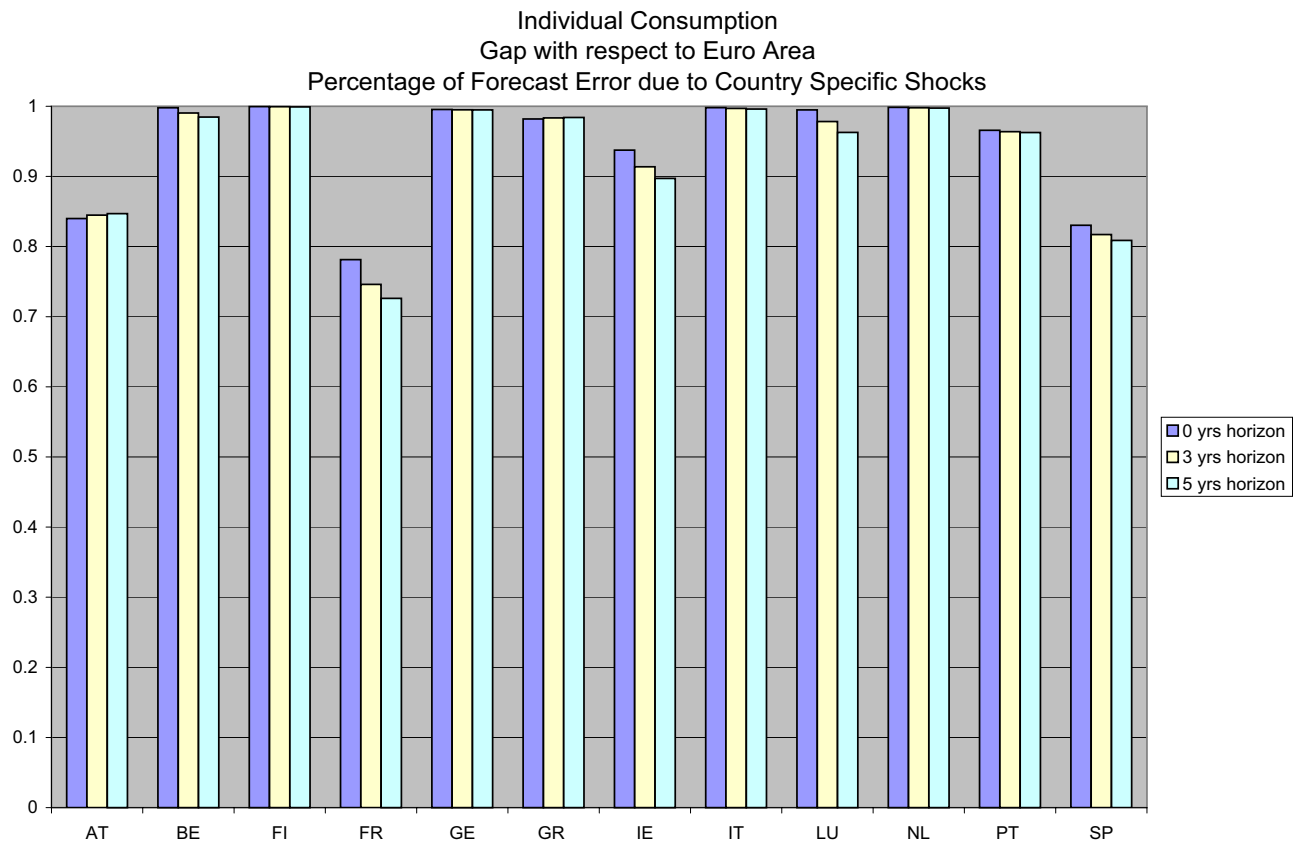


Figure 10b

Individual Consumption  
Percentage of Forecast Error due to Country Specific Shocks

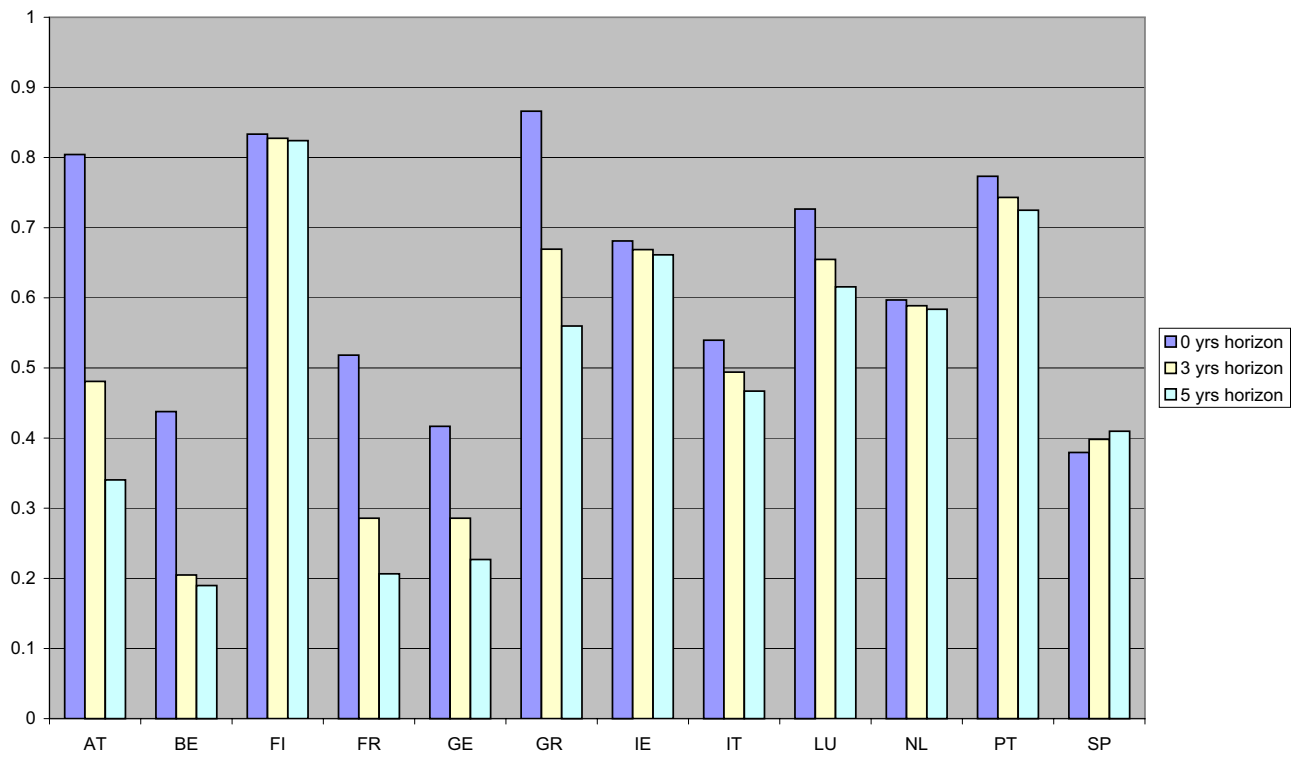
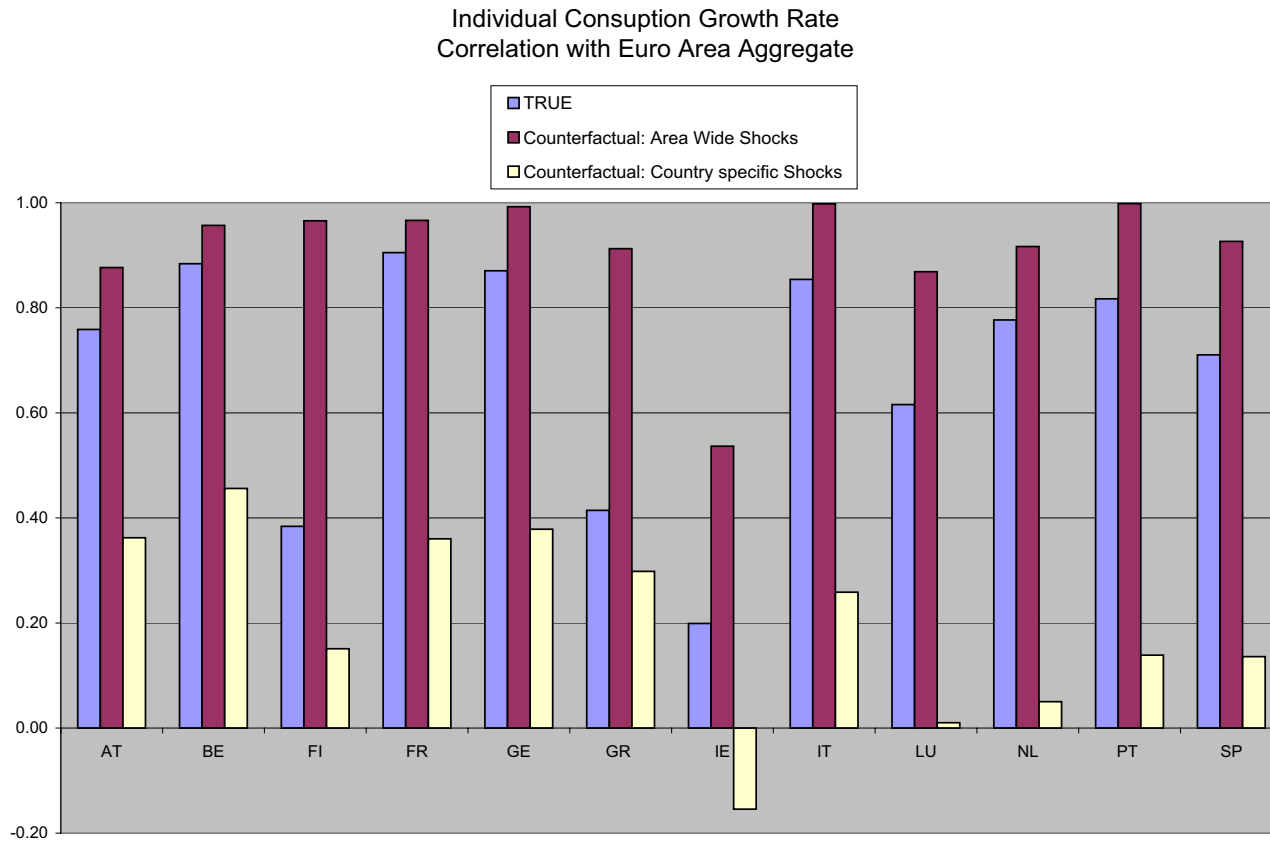


Figure 10c



## Comments

Country specific shocks have large effects particularly on short forecast horizon. AT medium horizon, euro-wide shocks explain large part of consumption variance (core countries). This is consistent with the presence of large measurement error in country specific shocks...

→ not good idea to look at changes in consumption correlations to assess changes in risk sharing...

- Alternative strategy: Asdrubali, Sorensen and Yosha, 1996

FOR PRESENTATION FROM NOW ON

## Measuring risk sharing, I

ASY, 1996 and 1999 on sample 1970-2004

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

$\Delta_h$ : h-th differences  $1 - L^h$

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

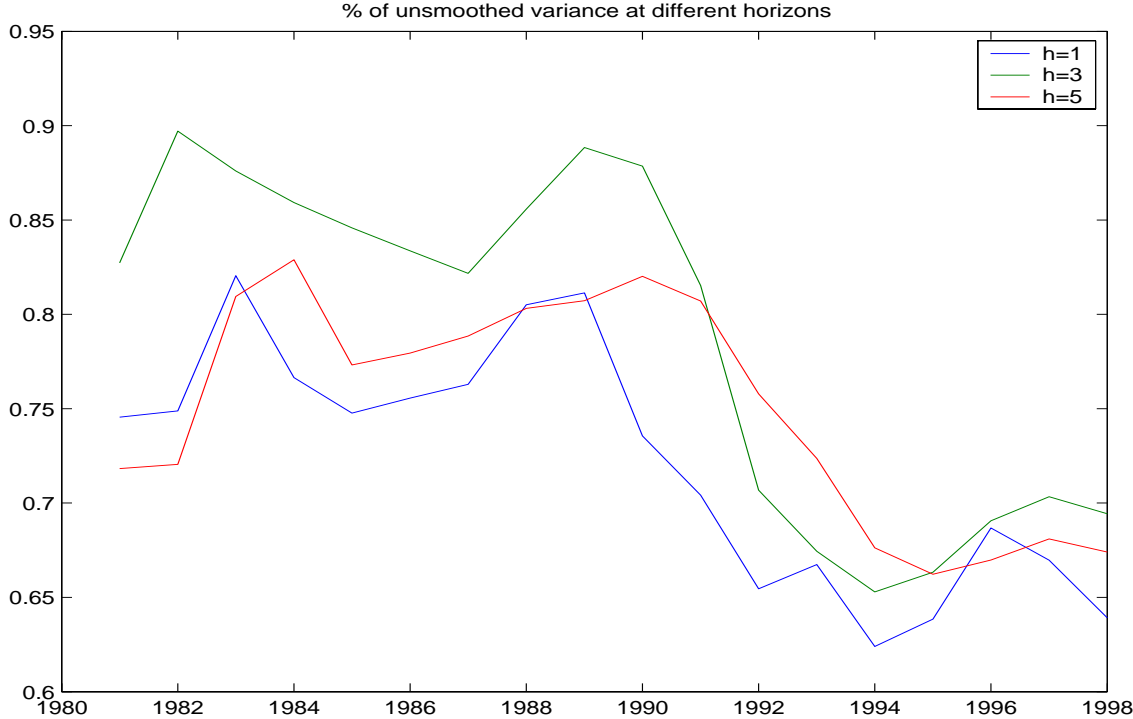
Estimate  $\beta_t$  by OLS regression.

Plot smooth versions of  $\beta_t$  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 11 Risk shared over time



## Measuring risk sharing, II

Panel regressions in subsamples

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

We estimate it using OLS and WLS (down-weight countries with larger regression error)

**Panel estimates of  $\beta$  for selected subsamples: OLS**

Sample	h	$\beta$
70-89	1	0.59 (0.06)
90-03	1	0.64 (0.05)
93-03	1	0.57 (0.09)
70-89	3	0.81 (0.07)
90-03	3	0.70 (0.04)
93-03	3	0.72 (0.06)
70-89	5	0.95 (0.09)
90-03	5	0.68 (0.04)
93-03	5	0.73 (0.04)

**Panel estimates of  $\beta$  for selected subsamples: WLS**

Sample	h	$\beta$
70-89	1	0.70 (0.06)
90-03	1	0.66 (0.06)
93-03	1	0.67 (0.08)
70-89	3	0.89 (0.05)
90-03	3	0.73 (0.05)
93-03	3	0.76 (0.06)
70-89	5	0.93 (0.05)
90-03	5	0.74 (0.04)
93-03	5	0.79 (0.04)

## 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...

## Conslusions

- For both cycles and levels of economic activity, 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]
- Risk sharing within the Euro area has increased since the early 1990s