Business Cycle stylised facts: new evidence for the Euro area using business survey data

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Aim of the paper

- We build upon a previous study on the Italian economy (Malgarini, 2007) to provide:
  - a first assessment on the role of inventory accumulation in shaping business cycle volatility
  - for the countries of the Euro Core (Italy, France and Germany)

Novelty of the paper

- Characterization of the main features of Euro Area and US business cycles (use of a Euro Core aggregate).
- Further evidence on the Great Moderation using data starting from 1963 (Blanchard and Simon, 2001; Stock and Watson, 2002; Ahmed, Levin and Wilson, 2004)
- Investigation of the hypothesis on advances in inventories management techniques due to computerization as an explanation for volatility reduction (Mc Connel,and Perez Quiros, 2000; Maccini and Pagan, 2008)
- Use of Business Tendency survey data at the European level

Data Description

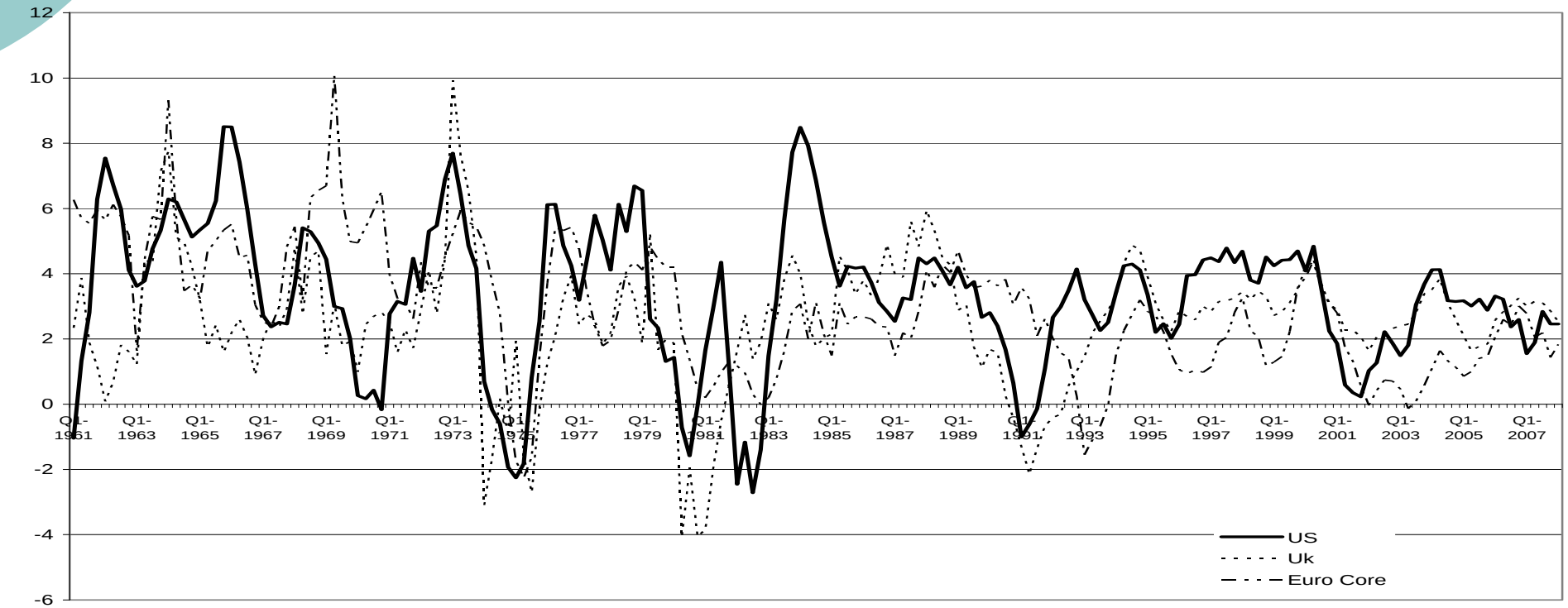
- Real Economy:
  - GDP seasonally adjusted.
  - Industrial Production index seasonally adjusted
- Qualitative data coming from Business Tendency surveys:

  (Current orders, Current production, Inventories, Expected production)

- Frequency: Quarterly, 1963:1-2008:1
- Countries: US, UK, EA, IT, FR, DE and Euro Core aggregates

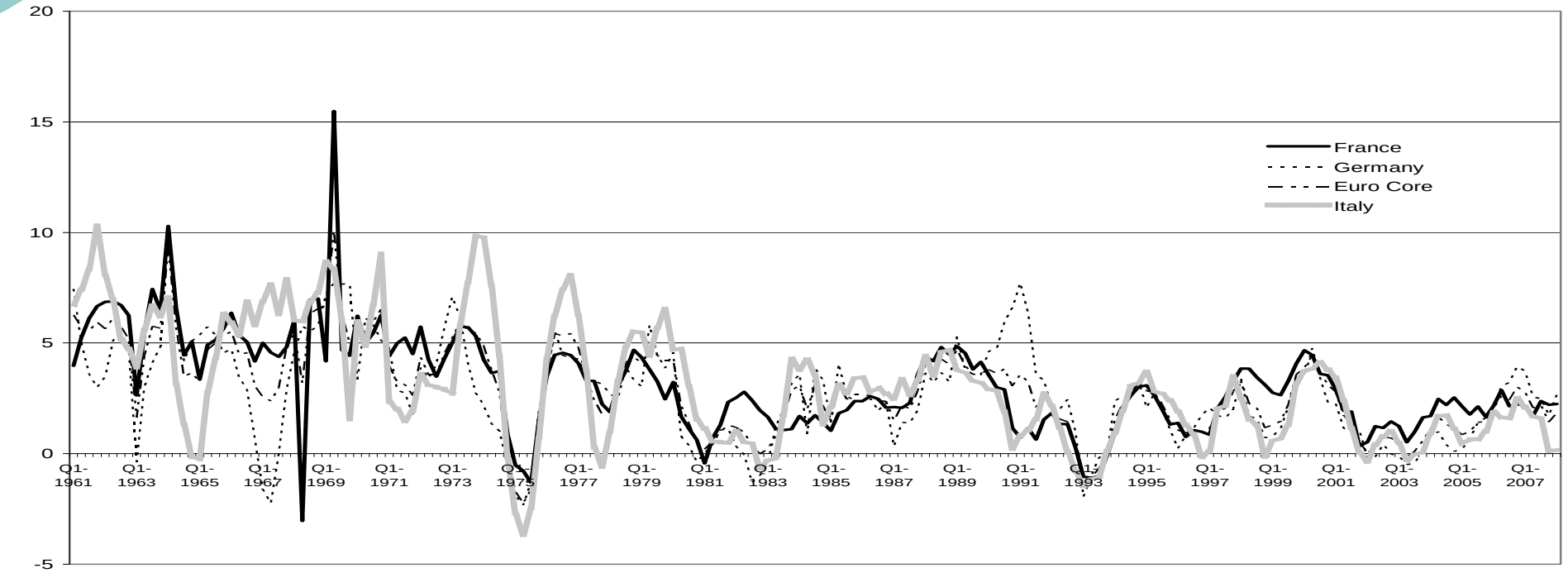
GDP growth component for the Euro Core, the UK and the US

- Timing of cyclical patterns is quite similar
- US activity seems to be leading with respect to European fluctuations



GDP growth for countries of the Euro Core

- Strong similarity of cyclical patterns within the Euro Core
- Also volatility of fluctuations is similar, and it tends to slow down towards the end of the sample



Cross correlations of European countries with US business cycle

- Cross correlations among the US and the Euro Core are respectively equal to .4 and .6 for GDP and Industrial Production
- Cross correlation functions peak at lag 2 and 1 respectively, confirming that US cycles are leading with respect to the European ones

Cross correlation with US GDP (t+k)

k	-4	-3	-2	-1	0	1	2	3	4
Germany	0.11	0.28	0.42	0.48	0.44	0.28	0.06	-0.16	-0.31
France	0.32	0.46	0.52	0.47	0.32	0.09	-0.14	-0.32	-0.38
Italy	0.35	0.46	0.50	0.43	0.27	0.03	-0.22	-0.42	-0.51
Euro core	0.28	0.45	0.56	0.55	0.42	0.19	-0.09	-0.33	-0.47
Uk	0.10	0.26	0.40	0.48	0.48	0.41	0.30	0.17	0.06
US	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Cross correlation with US Industrial Production (t+k)

k	-4	-3	-2	-1	0	1	2	3	4
Germany	0.01	0.20	0.38	0.50	0.51	0.39	0.19	-0.06	-0.27
France	0.02	0.28	0.52	0.65	0.64	0.47	0.20	-0.10	-0.33
Italy	0.06	0.28	0.47	0.57	0.54	0.37	0.12	-0.14	-0.36
Euro core	0.03	0.27	0.49	0.61	0.60	0.45	0.19	-0.10	-0.34
Uk	0.20	0.38	0.52	0.57	0.52	0.39	0.22	0.06	-0.06
US	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

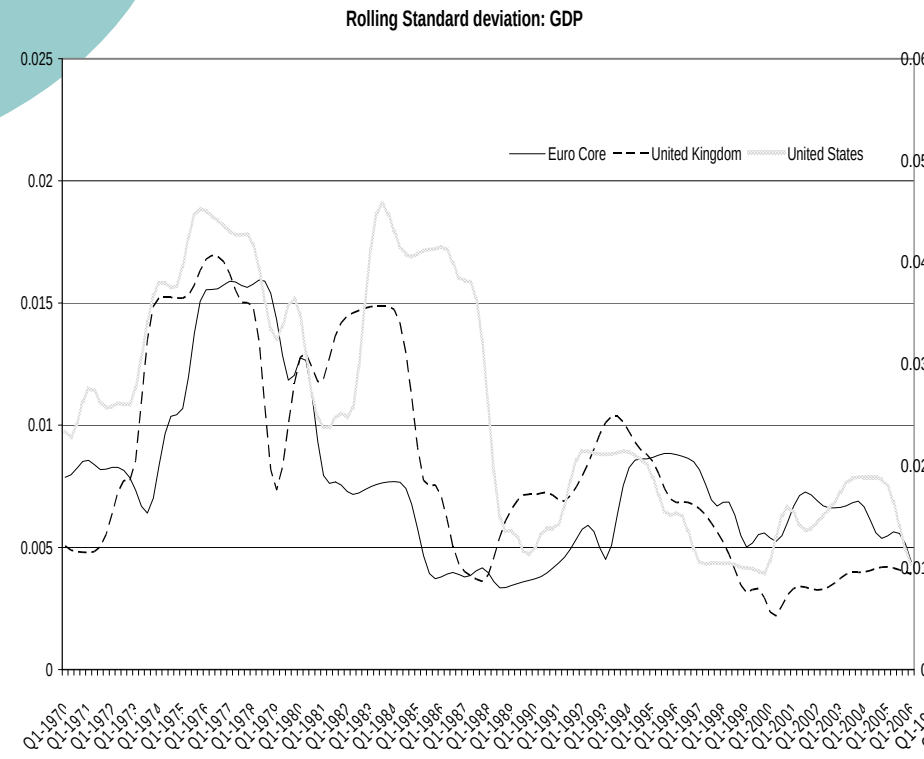
Investigation of Euro Area volatility reduction

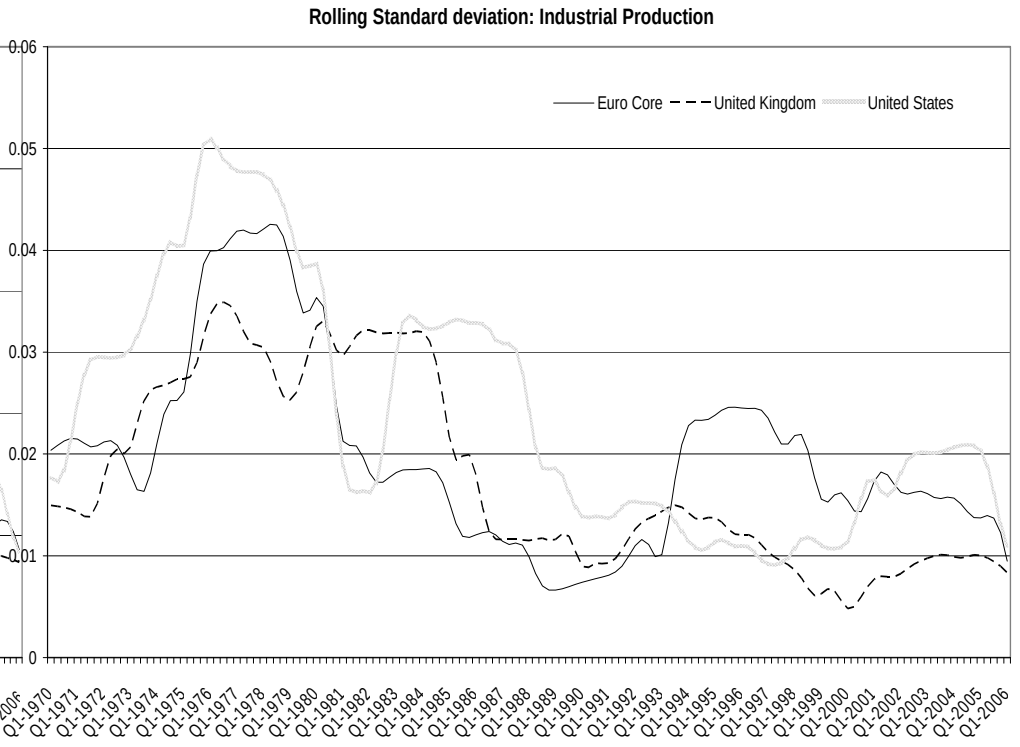
- Business cycle volatility is slowing down after 1984 (Kim and Nelson, 1999) both in the US and in Europe
- Considering the whole sample, volatility is lower in Europe than in the US, with the only exception of Italy

	GDP				Industrial Production			
	Std Abs.	Relative to US	Standard deviation relative to 1965-2006		Std Abs.	Relative to US	Standard deviationrelative to 1965-2006	
	1965:1-2006:1	1965:1-2006:1	1965:1-1983:4	1984:1-2006:1	1965:1-2006:1	1965:1-2006:1	1965:1-1983:4	1984:1-2006:1
Euro Core	0.82	0.73	1.25	0.73	2.59	1.13	1.25	0.72
Germany	1.00	0.88	1.23	0.75	2.27	0.99	1.22	0.77
France	0.71	0.63	1.15	0.84	2.94	1.28	1.30	0.64
Italy	1.16	1.03	1.34	0.59	2.36	1.03	1.31	0.62
United Kingdom	0.91	0.81	1.28	0.68	2.09	0.91	1.34	0.56
United States	1.13	1.00	1.33	0.59	2.29	1.00	1.32	0.61

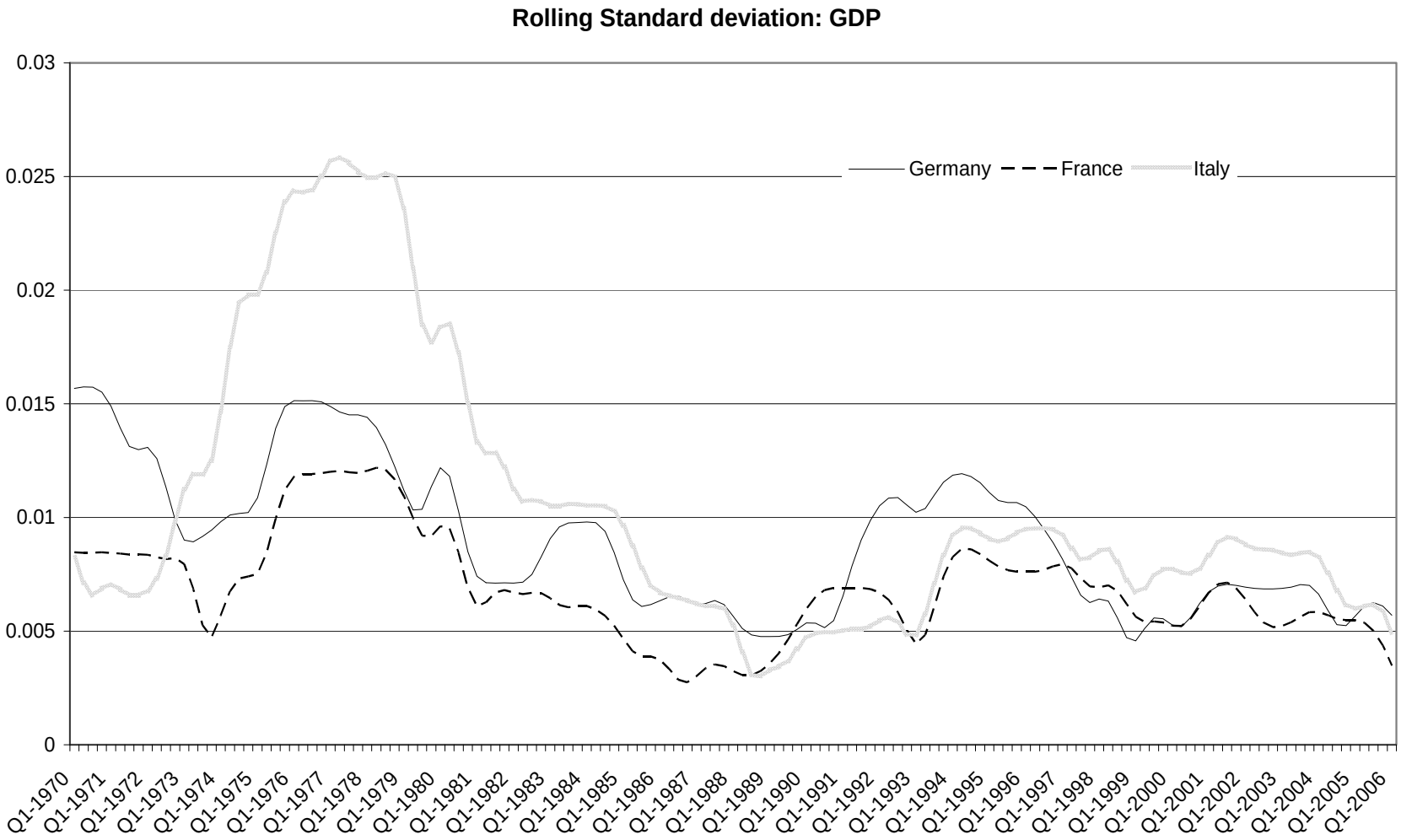
Volatility of Output growth (BP filter)

- Volatility is showing a clear trend decline, both looking at GDP and Industrial production data

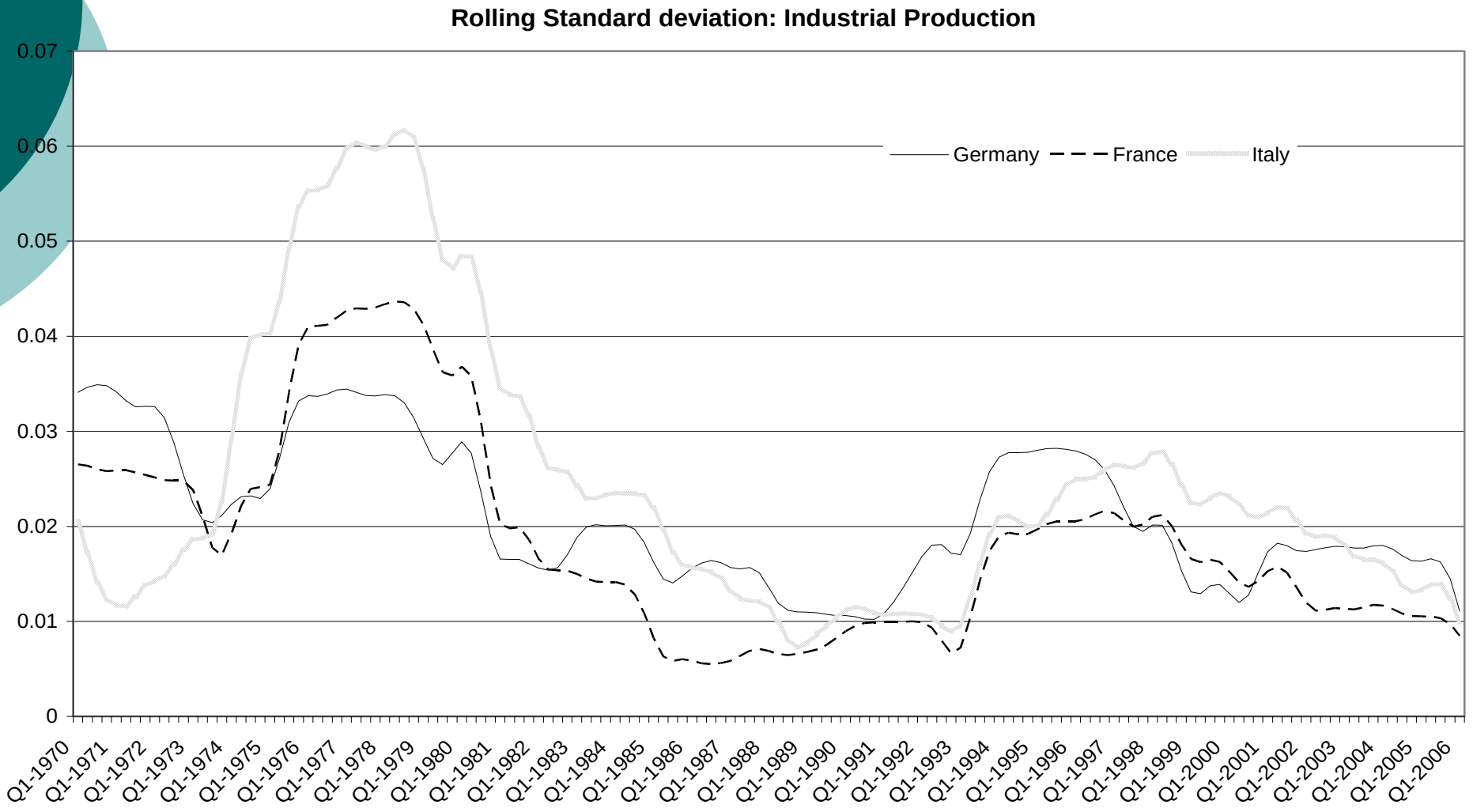




Volatility of Output growth



Volatility of Output growth



Business survey data

- We use BTS data on Current orders, Production (levels and expectations) and inventories for the countries of the Euro Core (both taken as a whole and by country)
- BTS data usually show a clear correlation with industrial activity
- Cross correlations generally peak at lead 1, indicating that survey variables leas actual industrial production by 1 quarter
- Coefficients are generally rather high, being above .7 in absolute terms for assessments on production and inventories
- Inventories are confirmed to be countercyclical (see below)

Are BTS data a good proxy for real activity?

Table 6 - Correlation between business surveys data and industrial production, 1965-2006

Current orders (t-k)

K	-4	-3	-2	-1	0	1	2	3	4
Germany	0.30	0.50	0.67	0.74	0.70	0.53	0.28	-0.02	-0.29
France	0.19	0.34	0.49	0.57	0.55	0.42	0.19	-0.06	-0.30
Italy	0.17	0.40	0.59	0.66	0.60	0.38	0.10	-0.18	-0.39
Euro core	0.21	0.45	0.63	0.72	0.66	0.47	0.19	-0.12	-0.37

Current production (t-k)

K	-4	-3	-2	-1	0	1	2	3	4
Germany	0.44	0.61	0.69	0.64	0.44	0.12	-0.21	-0.46	-0.59
France	0.14	0.35	0.55	0.67	0.63	0.45	0.17	-0.13	-0.40
Italy	0.00	0.20	0.42	0.58	0.60	0.45	0.20	-0.08	-0.30
Euro core	0.17	0.42	0.63	0.73	0.68	0.48	0.20	-0.10	-0.34

Expected production (t-k)

K	-4	-3	-2	-1	0	1	2	3	4
Germany	0.50	0.63	0.67	0.58	0.36	0.04	-0.28	-0.52	-0.63
France	0.31	0.49	0.58	0.53	0.36	0.10	-0.16	-0.36	-0.44
Italy	0.25	0.43	0.53	0.51	0.39	0.15	-0.09	-0.30	-0.40
Euro core	0.43	0.59	0.66	0.59	0.38	0.08	-0.22	-0.46	-0.57

Inventories (t-k)

K	-4	-3	-2	-1	0	1	2	3	4
Germany	-0.41	-0.61	-0.75	-0.77	-0.66	-0.43	-0.12	0.20	0.45
France	-0.12	-0.42	-0.65	-0.74	-0.63	-0.36	-0.01	0.32	0.54
Italy	-0.16	-0.40	-0.57	-0.62	-0.53	-0.31	-0.04	0.21	0.38
Euro core	-0.26	-0.51	-0.70	-0.76	-0.65	-0.41	-0.08	0.24	0.49

Volatility of BTS data

- Also for BTS data, volatility appear to be much lower in the second part of the sample
- Moreover, volatility of survey data also show a clear decline over time
- In all countries inventories balance experiment the highest volatility reduction
- The volatility reaches the lowest level in the last part of the sample (2000-06)

Volatility of Business survey data

Current orders

	Standard deviation	Standard deviation, relative to 1962-2008						
	1965-2006	1964-1969	1970-1979	1980-1989	1990-1999	2000-2008	1965-1984	1985-2008
Euro Core	16.66	1.02	1.13	0.94	0.93	0.73	1.11	0.83
Germany	19.13	1.28	1.00	0.80	0.98	0.78	1.12	0.84
France	16.66		0.55	1.05	1.11	0.81	0.64	1.04
Italy	19.48	1.13	1.21	1.05	0.75	0.49	1.20	0.66

Current production

	Standard deviation	Standard deviation, relative to 1965-2006						
	1964-2008	1964-1969	1970-1979	1980-1989	1990-1999	2000-2008	1965-1984	1985-2008
Euro Core	19.263	0.41	1.24	0.94	0.86	0.50	1.22	0.70
Germany	9.93	0.83	1.10	0.89	0.96	0.93	1.14	0.89
France	13.17		0.76	0.92	1.17	0.92	0.82	1.05
Italy	14.15	1.09	0.95	1.08	0.88	0.54	1.08	0.75

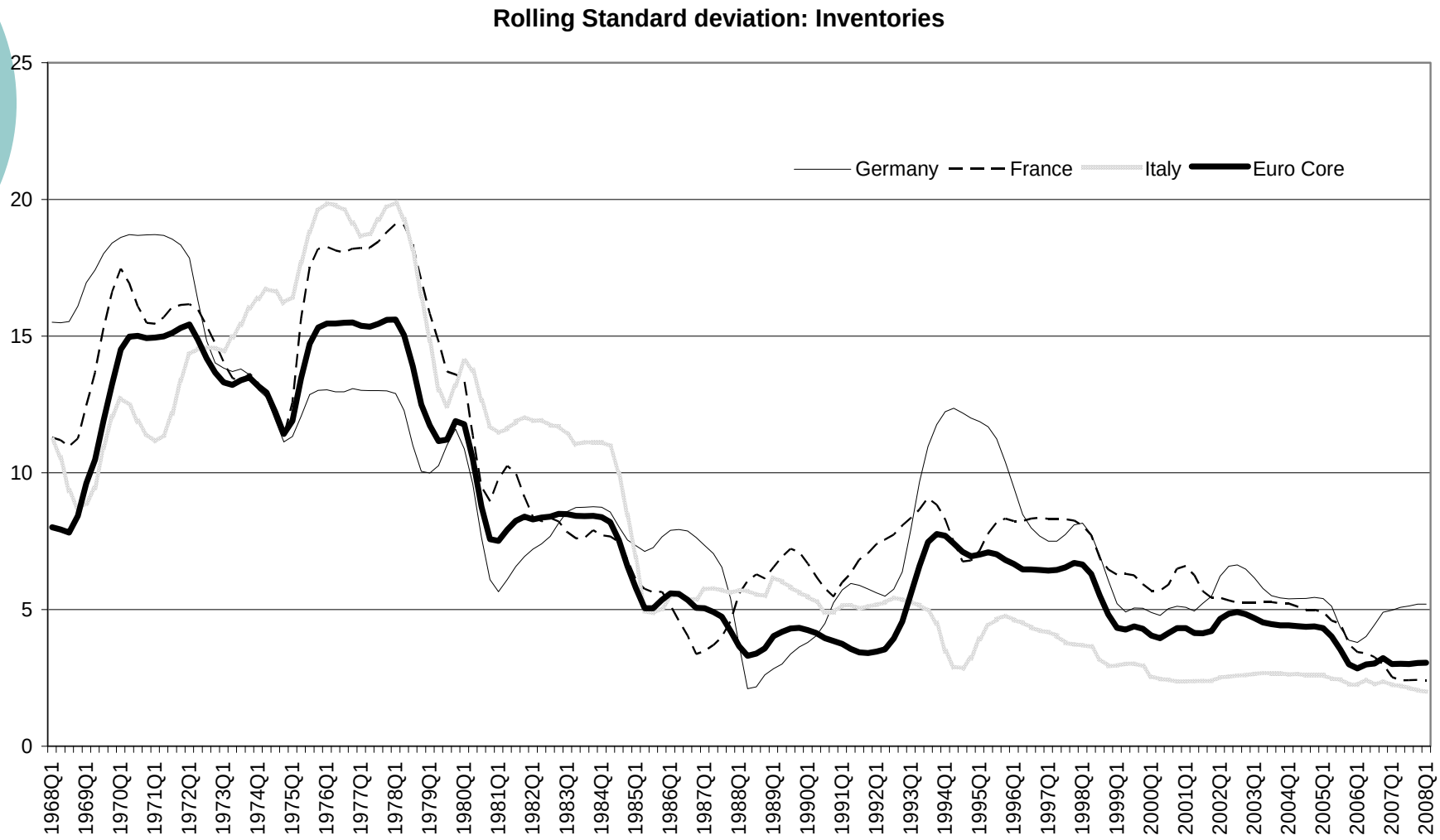
Current inventories

	Standard deviation	Standard deviation, relative to 1962-2008						
	1965-2006	1964-1969	1970-1979	1980-1989	1990-1999	2000-2008	1965-1984	1985-2008
Euro Core	9.24	1.33	1.37	0.83	0.62	0.45	1.31	0.55
Germany	10.69	1.56	1.06	0.75	0.84	0.57	1.25	0.69
France	10.88	1.42	1.33	0.79	0.62	0.38	1.31	0.58
Italy	10.73	1.23	1.57	0.81	0.35	0.23	1.34	0.36

Expected production

	Standard deviation	Standard deviation, relative to 1965-2006						
	1964-2008	1964-1969	1970-1979	1980-1989	1990-1999	2000-2008	1965-1984	1985-2008
Euro Core	19.26	0.85	1.14	0.98	0.95	0.70	1.15	0.80
Germany	11.22	1.12	1.08	0.87	0.95	0.74	1.18	0.79
France	12.58	0.75	1.08	0.83	0.90	0.74	1.16	0.81
Italy	14.05	1.14	1.07	1.01	0.75	0.52	1.08	0.65

Volatility of business survey data



Interpretation for volatility pattern of inventory balance

- Is Inventories volatility reduction an autonomous factor influencing business cycle volatility?
  - Inventory balance indicates how much inventories diverge from their Normal (desired) level.
  - Denoting with Nt and N* the current and desired level of stocks, if:
    - If Nt/N*>1 firms report that inventories are above normal levels, i.e….
    - … the balance can be interpreted as a qualitative measure of the divergence between the actual and desired level of inventories.

Interpretation for volatility pattern of inventory balance

- Let's assume that:
  - for any given period (t) production levels (Y_t) are equal to sales (X_t) plus the variation of inventory holdings (N_t-N_{t-1}), $Y_t = X_t + (N_t - N_{t-1})$
  - The desired level of inventories (N^*) depends positively on the level of sales,
- Then N_t/N^* is higher the higher is the level of current stocks and the lower the level of sales and...
- ... volatility of Nt/N* depends upon:
  - Volatility of sales
  - Ability of firms to adjust the desired level of stocks
  - Ability of firms to adjust the actual to the desired level of stocks

Interpretation for volatility pattern of inventory balance

- According to this interpretation, the reduction in (Nt/N*) volatility may alternatively be attributed to:
  - Lower standard deviation of exogenous shocks (i.e. shocks hitting sales)
  - Changes dynamic process of inventory accumulation.
  - This latter case can be alternatively interpreted as evidence of technological change affecting
    - the choice of the optimal level of stocks
    - the process of adjustment of the actual to the desired level of stocks.

Interpretation for volatility pattern of inventory balance

Let's assume that Nt/N* follows an AR process:

$$\frac{N_t}{N^*_t} = a(L)\frac{N_{t-i}}{N^*_{t-i}} + \varepsilon_t$$

- The order of the autoregressive process is chosen so as to maximise the likelihood function
- We estimate an AR(4) on two different sample periods, allowing for a discrete break in 1984
- An increase/decrease in the sum of AR coefficients implies an increase/decrease in the persistence of shocks
- Similarly, an increase/decrease in the standard error of the regression (SER) implies an increase/decrease in the magnitude of exogenous shocks hitting the process

Interpretation for volatility pattern of inventory balance

	Sum of AR coefficients		SER	
	1963-1983	1984-2008	1963-1983	1984-2008
Euro Core	0.82	0.86	3.71	1.60
Germany	0.82	0.87	4.20	2.05
France	0.73	0.80	5.51	2.57
Italy	0.76	0.83	5.19	2.49

Results

- During the Great Moderation, innovations to the current/desired inventory ratio decreased substantially in all the countries considered.
- On the other hand, the persistence of shocks increased slightly in the period 1985-2008 with respect to the previous decades.

Results

- According to these findings, the impact of external shocks has played a major role in reducing the volatility of the current/desired inventory ratio.
- Moreover, an increase in the persistence of shocks shows that exogenous innovations have – *ceteris paribus* – a greater impact on inventory volatility with respect to the first part of the sample.

Future research

Use of Microdata coming from Business surveys to test the model for the analysis of inventories behaviour.