Inflation Differentials in the Euro Area – an Empirical View

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Motivation

- Inflation differentials, their origin and evolution are of great relevance for monetary unions.
- In the case of the Euro area, widely acknowledged regional asymmetries represent a major challenge for policy-making since, absent the possibility of adjusting the nominal exchange rate, movements in the real exchange will directly follow the path of inflation differentials.
- There are white places in the literature, especially taking into account the absence of up-to-date analyses of the impact of key macroeconomic variables on inflation differentials

Why worry about inflation differentials?

1. Inflation differentials are not a rare phenomenon in other monetary unions (like the US);
2. Even some sources are viewed as benign (price level convergence and differences in basket composition);
3. . . . but not all sources can be seen as benign:
   - persistent inflation differentials imply persistent short-term real interest rate differentials, potentially generating self-reinforcing internal imbalances (can be exacerbated by cyclical considerations and/or alleviated by REER movements);
   - with different compositions of extra-union trade, movements of exchange rate can help importing inflation from non-member countries;
   - less integration in labor and goods markets in Europe relative to other monetary unions like the US imply slower adjustment;
   - political economy considerations.

- This paper aims at analyzing inflation differentials in a monetary union from an empirical dimension.
- This paper tries to address three empirical questions:
  1. How sizable are the inflation differentials in the Euro area in comparison with other currency areas?
  2. Are the inflation differentials in the Euro area a sectora phenomena (tradable vs. non-tradable)?
  3. What are the determinants of inflation differentials in the Euro area?

Content

Literature review

There are two main strands in the literature:

1. Small calibrated New Keynesian models with microfoundations: Angeloni and Ehrmann (2007), Hofmann and Remsperger (2005), Altissimo et al (2005);
   - Strong support for inflation persistence, demand and potential output shocks. Weaker support for effective exchange rate (Hofmann and Remsperger, 2005).
2. Descriptive analyses backed by panel regression results: Honohan and Lane (2003, 2004), Égert (2007);
   - Strong support for effective exchange rate, output gap and price level convergence (in particular Honohan and Lane, 2003, 2004). Only partial support for additional variables such as oil and regulated prices.

Literature review

Other studies:

- Alberola (2000) – the first analysis of post-EMU data (cross-country inflation differentials);
- ECB (2003) – a very extensive survey (both a theoretical and an empirical dimension);
- Horváth and Korpnická (2008) – main focus on the new EU member states;

Simple measures of inflation dispersion

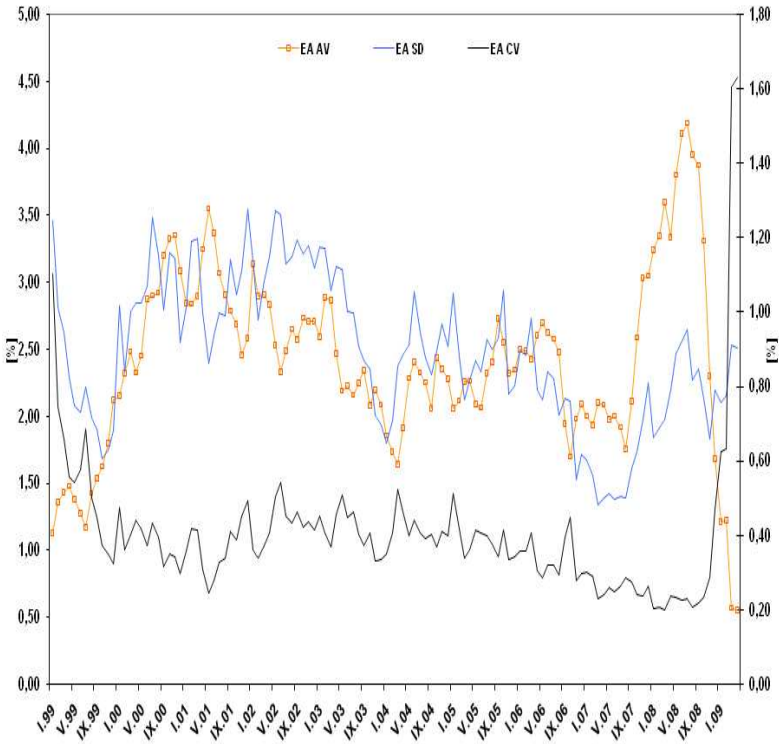
- The main aim of the empirical part was to search for answers related to these questions:
  1. Inflation differentials and their role in the Euro area.
  2. Main sources (drivers) of these differentials if any.
  3. Main determinants of inflation in the Euro area.
- $\Rightarrow$ The analysis in three steps:
  1. A first (brief) look at data: some simple unweighted and weighted measures of inflation (minimum, maximum, mean, standard deviation, variation coefficient) – *caveat:* simple but several problems.
  2. Detailed analysis: based on decomposition of the HICP index (five or twelve main main subindices according to the classification of consumption – COICOP).
  3. Estimations using two different econometric methods and various specifications.

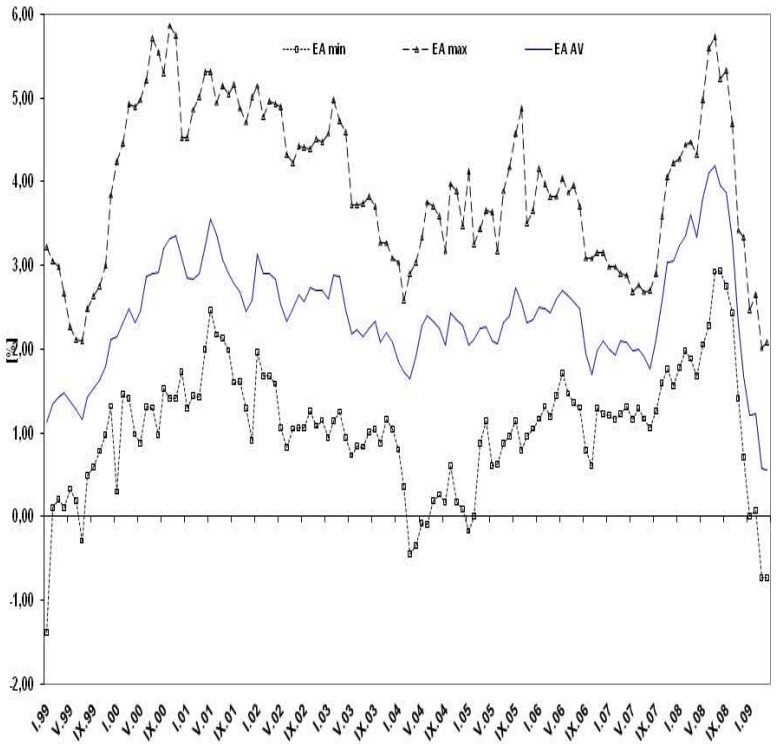
Descriptive statistics for the Euro area, 1999–2008

	mean	SD	CV
Austria	1.83	0.72	0.39
Belgium	2.20	0.64	0.29
Finland	1.96	0.76	0.39
France	1.85	0.59	0.32
Germany	1.60	0.74	0.46
Greece	3.09	0.62	0.20
Ireland	3.11	1.18	0.38
Italy	2.41	0.33	0.13
Luxembourg	2.37	1.26	0.53
Netherlands	2.42	1.27	0.53
Portugal	2.54	1.10	0.43
Spain	3.02	0.97	0.32
EA12	2.48	0.39	0.16
Slovenia	5.11	2.32	0.45
EA13	2.71	0.48	0.18
Cyprus	2.53	0.88	0.35
Malta	3.35	0.99	0.30
EA15	2.61	0.33	0.13

Notes: Mean – unweighted average inflation, SD – unweighted standard deviation, CV – variation coefficient.*Source:* Eurostat (2009), own calculations.

The Euro area – much ado about nothing?





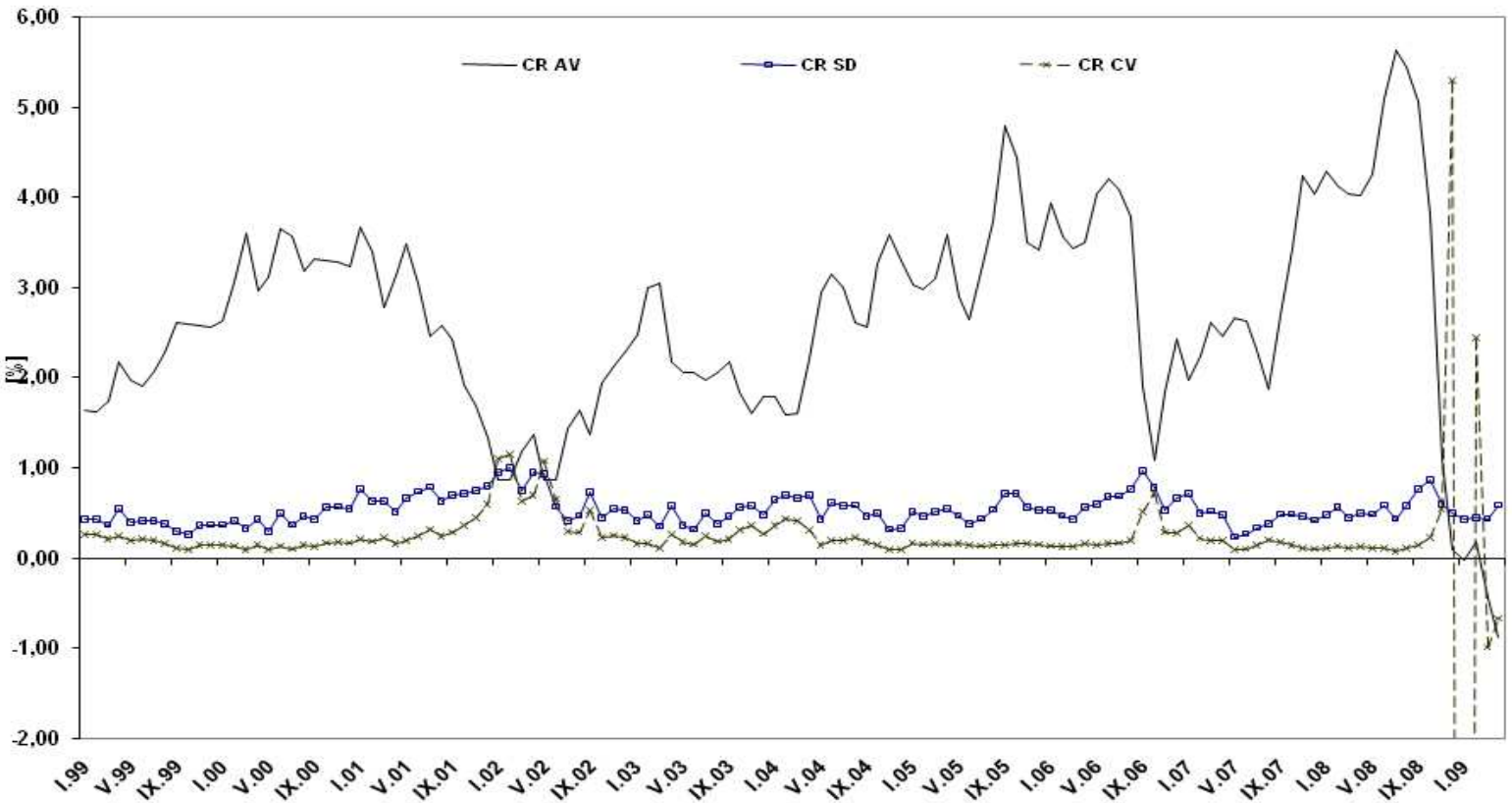
Notes: EA AV – mean (lhs), EA SD – standard deviation, EA CV – variation coefficient (rhs).

Source: Eurostat (2009).

A brief comparison – the four U.S. regions

- Comparison of the Euro area with a monetary union is difficult but possible.
- The U.S. regions: either the U.S. Census regions (CRs) or the U.S. metropolitan areas (MSAs).
- Pros & cons: CRs – larger than individual euro area countries (only 4 CRs) vs. MSAs too small (14 MSAs); main drawbacks: only town areas, no full coverage of the U.S., more volatile prices indices...
- The appropriate region would be somewhere in-between these aggregates and probably in the direction of the U.S. Census regions (see e.g. Angeloni and Ehrmann, 2007).

Inflation differentials for the 4 U.S. Census regions, 1999:I–2009:IV



Notes: CR AV = mean inflation, CR SD = standard deviation, CR CV = variation coefficient. *Source:* BLS (2009).

The Euro area vs. the United States – much ado about nothing?

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	SD	AD
	Austria	-0.1	-0.6	-0.2	-0.6	-0.7	0.2	-0.6	-0.3	0.4	-0.1	0.37	0.39
	Belgium	0.3	0.5	-0.1	-1.0	-0.3	-0.4	0.5	0.2	0.0	1.1	0.57	0.44
	Finland	0.5	0.4	0.3	-0.5	-0.7	-2.2	-1.1	-0.7	-1.1	1.8	1.11	0.93
E	France	-0.4	-0.7	-0.6	-0.1	0.4	-0.0	-0.5	-0.2	-0.3	-0.4	0.32	0.36
U	Germany	-0.4	-0.3	-0.6	-1.1	-0.9	-0.1	-0.1	-0.5	0.0	-0.4	0.37	0.47
R	Greece	0.6	1.1	1.4	1.2	1.1	0.7	1.2	1.2	0.8	0.6	0.31	1.00
O	Ireland	2.1	2.1	2.2	2.2	1.0	0.0	-0.3	1.0	0.1	-0.3	1.07	1.13
	Italy	0.4	0.3	0.2	0.6	0.6	0.0	-0.1	0.2	-0.3	0.8	0.33	0.33
A	Luxembourg	0.6	1.7	-1.1	0.5	0.4	1.1	1.2	0.3	1.2	-0.9	0.91	0.90
R	Netherlands	0.2	0.4	3.0	0.9	-0.4	-1.1	-0.2	-0.2	-1.5	0.1	1.22	0.79
E	Portugal	-0.0	1.3	1.8	1.6	0.3	0.2	0.3	0.6	-0.3	-0.7	0.84	0.73
A	Spain	1.0	1.5	0.4	1.7	0.7	0.9	1.5	0.8	1.2	-0.1	0.54	0.97
	Cyprus	1.8	1.2	0.0	0.8	0.3	1.5	-0.8	-0.4	0.7	0.2	0.83	0.77
	Malta	2.6	-1.5	1.5	-0.2	0.5	-0.5	1.1	-1.2	0.0	3.3	1.55	1.22
	Slovenia	6.0	6.0	4.8	4.6	2.7	0.9	0.2	1.0	2.5	0.2	2.32	2.90
	North East	-0.2	-0.1	0.0	0.5	0.9	0.3	0.1	0.4	-0.2	0.7	0.32	0.36
U	Mid West	0.2	0.1	-0.5	-0.3	-0.2	-0.2	-0.2	-0.8	-0.3	-0.4	0.32	0.34
S	South	-0.2	-0.4	-0.4	0.1	0.2	0.0	0.3	-0.1	0.3	-0.1	0.28	0.20
A	West	0.1	0.5	1.0	-0.2	-0.4	-0.1	-0.4	0.5	0.1	-0.1	0.44	0.37

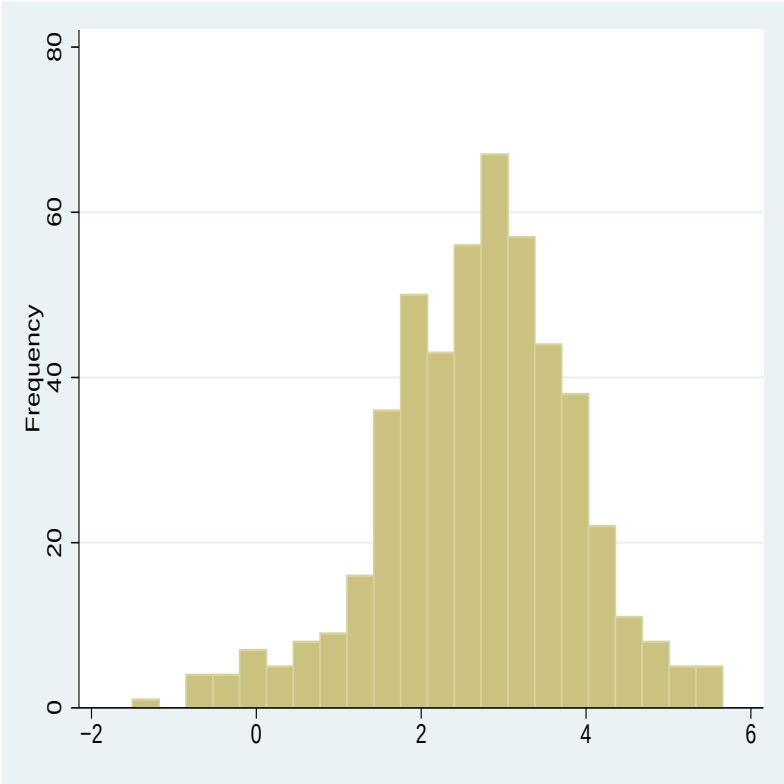
Notes: The differences are calculated as $\{[\ln x_t^i - \ln x_{t-12}^i] - [\ln x_t^j - \ln x_{t-12}^j]\}$, where i are countries/regions numbers, j are numbers for the groups (the EA12 average and the U.S. average). SD – unweighted standard deviation, AD – unweighted absolute mean. *Source:* BLS (2009); Eurostat (2009), own calculations.

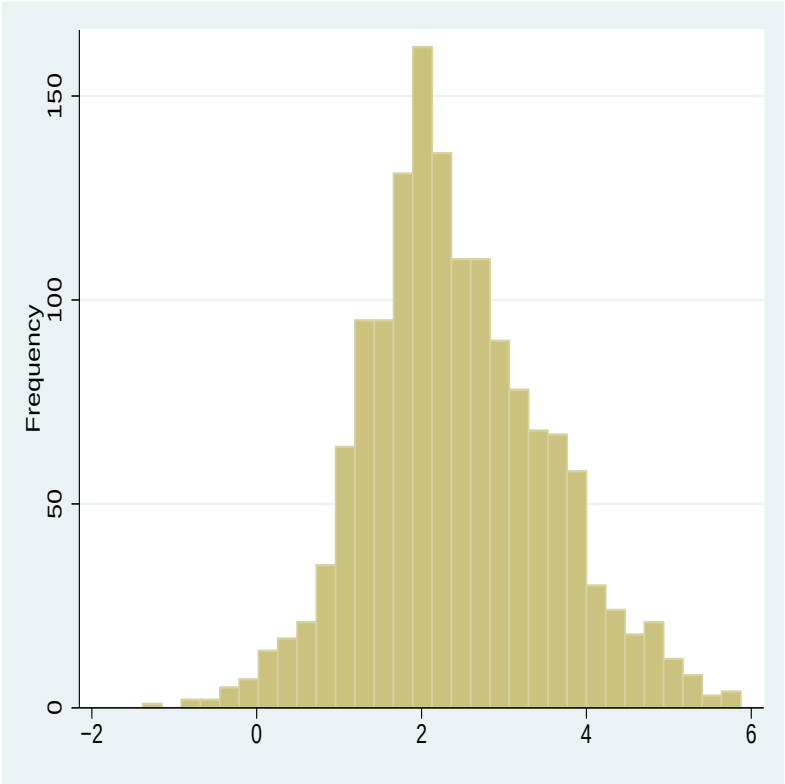
The Euro area vs. the United States. . . II.

	Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Cyprus	Malta	Slovenia	North East	Mid West	South	West
+	2	6	4	1	1	10	8	8	8	5	7	9	8	5	10	6	2	4	5
-	8	4	6	9	9	0	2	2	2	5	3	1	2	5	0	4	8	6	5
changes	4	2	2	2	2	0	3	4	3	2	2	1	2	8	0	3	1	6	3

Notes: $+$ = the number of years with inflation above the EA12 average, $-$ = the number of years with inflation below the EA12 average, *changes* = the number of changes of sings. Source: own calculations. *Source:* BLS (2009); Eurostat (2009), own calculations.

The Euro area vs. the United States. . . III.





Notes: the Euro area – inflation rates for 12 countries (right picture), the U.S. regions – the 4 U.S. Census regions (left picture). The yearly inflation rates from January 1999 to April 2009 (1 488 observation for the Euro area, 496 observations for the 4 U.S. regions). *Source:* BLS (2009), Eurostat (2009), own calculations.

Model

- Following Honohan and Lane (2003) we start with a general specification:

$$\pi_{i,t} - \pi_t^E = \beta(z_{i,t} - z_t^E) + \delta([P_{i,t-1} - P_{i,t-1}^{\star}] - [P_{i,t-1}^E - P_{i,t-1}^{E\star}]) + \epsilon_{i,t} \quad (1)$$

  where $\pi_{i,t}$ and π_t^E are the national and Euro area inflation rates, $z_{i,t}$ and z_t^E represent the domestic and Euro area variables having impact on the inflation rate, $P_{i,t}$ and P_t^E are the national and Euro area price levels and $P_{i,t-1}^{\star}$ and $P_{t-1}^{E\star}$ denote the national and Euro area equilibrium price levels.

- Assuming a common long-run national and Euro area price level (convergence club hypothesis), the equation (6) can be simplified to:

$$\pi_{i,t} - \pi_t^E = \beta(z_{i,t} - z_t^E) + \delta(P_{i,t-1} - P_{i,t-1}^{\star}) + \epsilon_{i,t} \quad (2)$$

Model

- Additionally, we can group all the Euro area variables into time dummies that account for common movements in inflation and replace $z = (\Delta NEER_{i,t-1}, GAP_{i,t}, FISC_{i,t})$, where $\Delta NEER_{i,t-1}$ is the lagged growth rate of nominal effective exchange rate, $GAP_{i,t}$ represents the output gap, $FISC_{i,t}$ denotes the cyclically-adjusted fiscal balance and $P_{i,t}$ is the lagged comparative price level).
- $\Rightarrow$ the final expression to be estimated:

$$\pi_{i,t} = \psi_t + \beta_1 \Delta NEER_{i,t} + \beta_2 GAP_{i,t} + \beta_3 FISC_{i,t} + \delta P_{i,t-1} + \epsilon_{i,t} \quad (3)$$

where all coefficients except β_2 are expected to be negative, ψ_t – includes time dummies.

Data

- In order to check the robustness of results we use three different databases for the estimation in the period 1999–2007:
  - Annual OECD plus HICP from Eurostat (comparable with Honohan and Lane, 2003, 2004);
  - Annual Eurostat;
  - Quarterly Eurostat (series for government general deficit and comparative price level were generated by the quadratic match procedure; potential output for output gap was created with HP filter, with end-of-sample bias taken into account).
- Additionally, alternative measures of inflation (*HICP, HICP-E, HICP-EUF, WAGES, GDP Deflator, Labor Cost Index, Expenditure Deflators*) and different specifications of Euro area group (EA10, EA11, EA12, EA13 and EA15) were adopted.

The results for the EA12 – I.

- Methods for estimations:
  1. OLS FE (a benchmark for comparisons) and
  2. standard two-step GMM.
- Since output gap (*OG*) and fiscal balance (*GPB*) can be endogenous to inflation, the main focus was on the GMM estimates, where these two variables are instrumented by their lagged values.

The results for the EA12 and the EA10 – OECD data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EA10							
OGAP	0.00659***	0.00636***	0.00750***	-0.0151	0.00936*	0.0108**	0.00755*
	(0.002)	(0.002)	(0.002)	(0.083)	(0.006)	(0.005)	(0.004)
GPB	-1.21e-07	-1.69e-07	-1.10e-07	-8.41e-06	3.06e-07	6.65e-07	2.55e-07
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DNEER_1	0.000482	-0.000184	-3.52e-05	-0.00304	0.00176	0.00203*	0.00181*
	(0.001)	(0.001)	(0.001)	(0.018)	(0.001)	(0.001)	(0.001)
CPL_1	-0.0483***	-0.0512***	-0.0500***	0.744	-0.0245	-0.00844	-0.0146
	(0.012)	(0.012)	(0.013)	(0.509)	(0.034)	(0.028)	(0.025)
Adjusted R^2	0.942	0.920	0.908	0.723	0.712	0.764	0.797
EA12							
OGAP	0.00504***	0.00477***	0.00586***	-0.0793	0.00591	0.00499	0.00413
	(0.002)	(0.002)	(0.002)	(0.138)	(0.004)	(0.003)	(0.003)
GPB	-6.49e-08	-1.46e-07	-8.63e-08	-2.64e-05*	4.11e-07	4.42e-07	1.52e-07
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DNEER_1	-0.000178	-0.000776	-0.000646	-0.0213	0.00117	0.00106	0.000695
	(0.001)	(0.001)	(0.001)	(0.030)	(0.001)	(0.001)	(0.001)
CPL_1	-0.0196	-0.0209	-0.0183	0.852	0.0251	0.0449	0.0330
	(0.019)	(0.019)	(0.022)	(0.690)	(0.050)	(0.050)	(0.043)
Adjusted R^2	0.944	0.924	0.912	0.715	0.730	0.784	0.796

Notes: Models (1), (2), (3), (4), (5), (6) and (7) include as dependent variable the growth rate in *HICP, HICP less Energy*, *HICP less Energy* and *Unprocessed Foods, Wages, GDP Deflator Total Domestic Expenditure Deflator* and *Private Final Consumption Expenditure Deflator*. ***, ** and * denote significance at 1, 5 and 10% levels respectively. Robust S.E., time dummies included.

The results for the EA12 – II.

1. Main findings:
   - The overall results point to the relevance of cyclical factors (as in Hofmann and Remsperger(2005) or Rogers, 2002) and to a lesser extent real convergence factors, since national output gaps come out as the most relevant variable in explaining inflation differentials in the Euro area, followed by a relatively weaker but still non-negligible price level convergence effect.
   - As opposed to Honohan, Lane (2003, 2004), almost no support is found for NEER, a result that can be explained by the extension of the time span used for the analysis. In the wake of this result, it is possible to state that after almost ten years of common currency, exchange rate movements have a diminished impact on inflation differentials, which in turn implies that the policy concern of minimizing the impact of real exchange rate overshooting becomes a second order concern.
2. Robustness check
   - different databases: OECD, Eurostat annual and Eurostat quarterly;
   - reducing number of countries – dropping one country at a time;
   - estimation without the fiscal variable;
   - inclusion of a proxy for income level and a proxy for labour productivity (suggested by Rogers, 2002).

What are the main findings

- Inflation differentials are present and seem to be persistent (long-lasting) in the Euro area. The existence of inflation differentials may be interpreted as proof that the Euro area is not an OCA(?).
- The main determinants of the HICP inflation: cyclical factors.
- decomposition of the total HICP index (five main subindices) shows that the main drivers of dispersion is due to services sector (a proxy for non-tradable sector). Some sectors (tradable goods, industrial goods apart from energy) seem to have relatively low power in determining and explaining dispersion of prices.

What are the main findings

- Relative lower impact show real convergence factors (output gap, comparative price level). Conversely, the impact of the NEER has vanished.
- The ongoing financial crisis seems to have higher impact on inflation and its determinants even for large monetary unions such as the Euro area than it was expected.

That was my last slide. . .

Thank you for your attention!