

Price Adjustment during the Great Recession inside and outside the Eurozone.*

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PRELIMINARY DRAFT

February 15, 2015

Abstract

We compare the adjustment of relative prices to economic shocks in the Eurozone with adjustments between OECD countries outside the currency area, between U.S. states, and between sub-national regions within some Eurozone countries. Adjustment is quite rapid between OECD countries and U.S. states while prices adjust sluggishly, if at all, between Eurozone countries. The common currency, combined with the structure of European economies, appears to be a much larger impediment to adjustment than the common currency shared between the U.S. states.

*The views expressed are those of the authors and do not necessarily reflect the official positions of the Federal Reserve Bank of Boston or the Federal Reserve System.

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1 Introduction

An important argument in favor of floating exchange rates is that relative prices can adjust rapidly through nominal exchange rate depreciation when countries are hit by negative shocks. Friedman (1953) states: “If internal prices were as flexible as exchange rates, it would make little economic difference whether adjustments were brought about by changes in exchange rates or equivalent changes in internal prices. But this condition is clearly not fulfilled.” This provides an argument for flexible exchange rates if they adjust to systematically help offset economic shocks. Depreciation following a shock will instantly make a country more competitive. However, international capital flows, and thus exchange rates under free floating, are highly volatile and may not necessarily lead to exchange rate movements in the direction that stabilize economies. This is why, it is also important to study internal price adjustment.

The Great Recession brought the need for adjustment painfully to the fore. We examine dynamic price adjustment within the Eurozone following shocks to Gross Domestic Product (GDP) or unemployment, and we compare to price adjustment between U.S. states, between non-Eurozone OECD countries, and between regions within Germany, Italy, and Spain. There is a long tradition of using U.S. states as a model for a successful currency union going back to Mundell (1961)’s seminal work on optimal currency areas—see, for example, Eichengreen et al. (1990), Sachs and Sala-i-Martin (1992), Asdrubali et al. (1996). We also compare to regions outside currency unions in order to gauge if exchange rates actually did adjust as expected, and finally we consider adjustment within a selection of Eurozone countries. If countries in the Eurozone adjust less rapidly to shocks than U.S. states, this raises the question of whether country-level constraints are the culprits or whether the economy of, say, Italy is fundamentally more rigid, such that not even regions within the country adjust to regional shocks. Our approach is closely related to that of Beraja et al. (2014) who find that U.S. regional prices adjust rapidly to local unemployment shocks in the Great Recession—we replicate their findings using metropolitan area price indices (which they further show deliver patterns similar to prices obtained from scanner data; we do not utilize scanner data in the present paper).

We replicate the results of Beraja et al. (2014) and find that price adjustment between Eurozone countries is well-below price adjustment between U.S. states, with price adjustment in the countries hardest hit by the recession appearing too modest. Some Eurozone countries, notably Spain and Germany, display perverse price adjustment while prices in Greece only started a relative decline after the sovereign debt crisis hit. Price adjustment (in dollar terms) between countries outside the Eurozone is more volatile, as also found by Berka et al.

(2012), and systematically adjust to the relative intensity of shocks in a stabilizing fashion during the Great Recession.

2 Motivation: Currency Unions and the Great Recession

Mundell (1961) considered a common currency to be optimal in an area with flexible prices and wages, or synchronized business cycles. However, these criteria may themselves be endogenous to the formation of common currency areas as pointed out by Frankel and Rose (1998). In the early 2000s, little adjustment was needed as most countries performed well. This changed dramatically when the subprime bubble burst in 2007–2008. From 2007 to 2010, unemployment soared in the United States from 4.5% to 10%, and even more dramatically in Eurozone’s southern fringe where unemployment jumped from 8% to 26% in Spain and from 7.5% to 28% in Greece. In Germany, however, the unemployment rate fell from 12% to 5%. This large dispersion of economic shocks presented a formidable challenge to the coherence of the common currency area and it is important to gauge if and how countries adjusted. Even within the United States, dispersion was wide with unemployment increasing from 4% to 8% in Texas or Nebraska, while it soared from 4% to 14% in Nevada or California. Within European countries, French regions saw little dispersion in unemployment shocks while in Spain the difference between high and low unemployment regions would reach 8%. The crisis hit the United States hard but since 2010 unemployment has steadily been shrinking while the Eurozone was buffeted by a second calamity when the sovereign debt crisis was triggered by unsustainable debt in Greece with spillovers to Italy and Spain, in particular.

Engel and Rogers (1996) find that price differences converge much faster towards zero within than across countries; however, they do not look at direct responses to economic shocks.

3 Data Description

All country data is from the OECD. We use annual data from 2007 to 2013. The sample of Euro countries are the initial eleven Eurozone members, which joined the Eurozone in 1999, plus Greece, which joined in 2001. The sample of OECD countries is all the non-Eurozone OECD members with the exception of Slovenia, Estonia, the Slovak Republic, Iceland, and Switzerland. Slovenia, Estonia, and the Slovak Republic were dropped because they joined

the Eurozone significantly later than the countries in our Eurozone sample. Iceland is an outlier, due to the scope of the Icelandic financial crisis, and Switzerland is dropped because the OECD reports the Swiss unemployment rate only from 2010.¹

The regional data is collected from the respective country’s national statistical agency. U.S. regional CPI and unemployment data is from the Bureau of Labor Statistics (BLS) at the Metropolitan statistical area (MSA) level; GDP data is produced by the Bureau of Economic Analysis (BEA). Because the BLS provides CPI data for MSAs only, it was matched with appropriate unemployment and GDP data for the same MSA’s. BLS provides the data for 27 MSA’s in the United States.

We also use regional CPI, unemployment and GDP data for France, Spain, Italy, and Germany. The French data covers 8 regions, the Spanish data covers 16 regions, the Italian data covers 22 regions, and the German data covers 12 German states. The regional data was collected from each country’s statistical agency except for Germany where the data was collected from individual states’ statistical agencies. The complete list of each country’s regions as well as the data sources is given in the Appendix.

The main variable of interest is the change in international prices defined as the change in the consumer price index (CPI), $\Delta_i \text{CPI}$, expressed in U.S. dollars—i.e., the change in the CPI in local prices transformed to international prices by multiplying the CPI index by the local currency/USD exchange rate. Because we separately analyze Eurozone countries vs. OECD countries, Eurozone countries’ individual CPIs were not converted into USD since these countries already share a currency.² Growth rates are calculated using log differences.

Real GDP is measured in national currency per inhabitant, transformed from current GDP using the CPI.

3.1 Summary Statistics

Table 1 displays average annual unemployment, inflation, and GDP growth for the Euro countries. Unemployment rates are reported for 2007, 2010, and 2013. Average annual inflation and GDP growth are reported for two sub-periods, 2007–2010 and 2010–2013. Table 2 displays comparable statistics for OECD countries. The Eurozone has lower average inflation compared to the non-Eurozone during both sub-periods. Average annual inflation is 1.63% in the Eurozone and 2.27% in the non-Eurozone during the 2007–2010 period, and 2.14% and 2.5%, respectively, during 2010–2013 period.

Because non-Eurozone inflation is in international prices (displayed in US dollars), it is more volatile than when looking at simple inflation in local currency. Figure 1 displays

¹For a complete list of countries see Table 1 and 2.

²In the Eurozone, ΔCPI is per definition identical to $\Delta_i \text{CPI}$.

annual price changes of non-euro OECD countries and the higher volatility of international prices is clearly visible. The largest and smallest annual changes in international prices are around 12% positive and 8% negative, while staying around 2.5% when expressed in local currency.

The average change in the unemployment rate is higher in the Eurozone during both sub-periods. While the unemployment rate in the Eurozone was increasing by almost 1 percentage point a year from 2007 to 2013, the unemployment rate in OECD countries increased by 0.63 percentage points per year during the 2007–2010 period and fell by 0.22 points per year during the 2010–2013 period. All OECD countries other than Australia and Poland had falling unemployment rates while, within the Eurozone, only Finland, Germany, and Ireland had declining unemployment.

A similar trend is observed when looking at GDP growth. During the 2007–2010 period both Eurozone and OECD countries exhibit negative growth: GDP fell by almost 2% per year in the Eurozone and 0.39% in the OECD countries. During the 2010–2007 period, GDP continued to decline in the Eurozone, falling at 1.7% annually, while GDP growth in the OECD countries recovered and grew at 1% per year.

One of the objectives of this paper is to observe the adjustment of prices to shocks within countries. Table 3 presents regional summary statistics for a select group of Eurozone countries. From the standard deviations it is clear that unemployment rates moved virtually in lock-step across French regions, while Spain displayed significantly higher cross-region variation than other countries..

4 Graphical Evidence

We study the relation between unemployment (or GDP growth) and price adjustment and the simple bivariate relation is most clearly shown in bivariate or time-series figures. The results are displayed in graphical form in Figure 2 to 11.

First we calculate the difference in unemployment rates between 2007 and 2010 for each country in the Eurozone and OECD, and for each region in the US, Germany, France, Spain and Italy. Then, all countries/regions are sorted – within it’s group/country – and based on the calculated difference, they are placed into high/medium/low unemployment change group. For example, unemployment rate in Hungary went from 7.4% in 2007 to 11.2% in 2010. Hungary’s change in unemployment rate during this period is 3.8 percentage points. Hungary is in the “high” unemployment change group within OECD. On the other hand, unemployment rate in Australia was 4.4% in 2007 and 5.2% in 2010, resulting in .8 percentage point change in unemployment. Australia is in the “low” unemployment change

group within OECD. The only exception to high/medium/low unemployment change groups is the Eurozone, where only high and low unemployment change groups were created. Only 3 countries experienced very high change in unemployment rate: Greece (4.4%), Ireland (9.2%) and Spain (11.7%). These countries were put in high unemployment change group, while the remaining countries are in the low unemployment change group.

Figures 2 and 3 present the evolution over time of the difference in unemployment rate and price levels between high unemployment and low unemployment change groups. It is evident from Figure 2a that the monetary union is facing severe challenges. The gap in unemployment rate between high and low unemployment change countries has been rising steadily, and only leveled in 2012, with average unemployment in the high group increasing by 13 percentage points more than in the low group. At the same time, the difference between price indices between high and low groups did not respond to increasing unemployment differences. Given the huge unemployment gap no systematic adjustment is visible. Only after 2012 did prices in the high group grow slower than in the low group.

Figure 2b present the difference in unemployment and price levels between high and low unemployment change OECD countries. The difference in unemployment growth was smaller, at about 5 percentage points between the high and the low group, but prices adjusted so that cumulative (international price) inflation was 5 percent less in the high unemployment group. For U.S. states, see Figure 2c, the unemployment gap between the high and the low group peaked at about 3 percentage points and is falling back to zero, while inflation in the high group is about two percent lower than in the high group. It seems clear that floating exchange rates help adjustment and that the U.S. currency area is able to adjust better than the Euro currency area.

Figure 3 display similar graphs for within-country regions of Germany, France, Spain, and Italy. With exception of France, the common feature across these countries is that while there is a difference in unemployment rates between high and low unemployment change groups, there is no difference in regional CPIs between the same groups. In France, Figure 3b, there is almost no variation in unemployment and CPI between regions. This suggests all French regions responded to the Great Recession with a similar rise in unemployment rate and change in price level.

Figure 3c shows the differences in unemployment rates and CPI between high and low regions of Spain. The difference has been rising since 2007. By 2012, the unemployment rate in high region is 8.5 percentage points higher than in low region. At the same time, there is no price adjustment as both high and low regions have similar inflation rates. A similar pattern is seen in Italy (Figure 3d), although at less than 3% the unemployment gap between high and low regions is significantly smaller than in Spain.

In Germany (Figure 3a) the gap in unemployment rates between high and low unemployment change states has been falling since 2006. While the Great Recession created a gap in unemployment between high and low regions for Spain and Italy, the unemployment gap in Germany has been closing down. Successful labor market policies reduced unemployment rates in such states as Sachsen-Anhalt or Thüringen from 18.3% in 2006 to 11.2% in 2013, and 15.6% in 2006 to 8.2% in 2013 respectively. However, even in Germany, no difference in CPI between high and low states is observed. Combing Figure 2a and Figure 3 we find that not only is there no price response on the country level between members of the Eurozone, but we do not observe any price adjustment within countries on the regional level.

Figures 4 through 11 focus on the cross-sectional differences between countries. Figure 4 plots, country-by-country (states, for the United States), the change in prices from 2007 to 2013 against the change in unemployment. The slopes in the figures gauges how strongly inflation rates react to unemployment in each country/state. Figure 4a presents the adjustment of prices to change in unemployment between Eurozone countries. It is clear that on average over this period there was no adjustment of prices to the large differences in unemployment. The slope in the figure is highly influenced by Spain and Greece which both suffered very large increases in unemployment but displayed inflation rates similar to the average of the Euro-area.

For the OECD, see Figure 4b, a steep adjustment slope is visible with lower growth in international prices in countries with high unemployment growth. For the U.S. states, the slope is slightly less steep; however, the data points cluster close to the fitted line indicating that the adjustment patterns are common to all states.

The remaining figures break down the information of the previous figure into the 2007–2009 and 2010–2013 periods (except for Italy, where the most recent data are unavailable at the time of writing). Figure 5 considers adjustment between Eurozone countries. Some adjustment is visible when averaged out for the full period. In the early period, displayed in Figure 5a, hard-hit Ireland had significantly lower inflation than other countries (while Greece still had relatively higher inflation) and in the late period, displayed in Figure 5b, Greece suffered the highest increase in unemployment by far and also displayed the lowest rate of inflation.

For OECD countries in Figure 6 prices adjusted in a stabilizing direction during 2007–2010 but during the 2010–2013 period of falling unemployment the fitted line is positive, with Japan being an influential outlier with falling unemployment and falling international prices. In Figure 7, a similar pattern can be seen for U.S. states: during the 2007–2010 period of increasing unemployment, depressed metros, such as Phoenix, had significantly lower inflation than less-affected MSAs, such as Honolulu and Pittsburgh.

For Germany, see Figure 8, inflation rates across states are remarkably similar with the exception of a somewhat higher inflation rate in Mecklenburg-Vorpommern in the 2007–2010 sample. In France, see Figure 9, there are signs of stabilizing inflation in the late, but not the early, sample, but the cross-regional difference in unemployment change is too small to meaningfully inform about potential adjustment patterns. In Spain, on the other hand, unemployment spreads are dramatic with Pais-Vasco (Basque country) increasing unemployment in the recession by a relative moderate 5 percentage points while unemployment increased by about 15 percentage points in Andalucia. Prices did increase less in most severely affected regions but only in the early period, and not by much, considering the dramatic changes in unemployment. For Italy, see Figure 11, data are only available till 2009 and little adjustment is visible except for the small outlier region of Valle D’Aosta.

5 Estimation

We estimate how consumer prices adjust to unemployment and GDP shocks in the period 2007–2013:

$$\Delta_{07-13}CPI = \alpha + \beta\Delta_{07-13}Unempl + \epsilon , \quad (1)$$

and

$$\Delta_{07-13}CPI = \alpha + \beta\Delta_{07-13}GPD_r + \epsilon , \quad (2)$$

for Eurozone, non-Eurozone countries and U.S. MSAs, separately. We perform similar estimations for regions within four Eurozone countries; namely, Germany, France, Spain, and Italy.

We present the results for countries and U.S. MSAs in Table 4. The results are much clearer when shocks are measured by unemployment and we see that although the estimated slope is steeper for OECD countries, the adjustment (taking place via exchange rate changes) is so erratic that the slope is not estimated with statistical significance at the 5- or even 10-percent level. For U.S. MSAs, price adjustment is strong and very precisely estimated.

For regions, in Table 5, the estimated slope is perversely positive for France (for which the unemployment regressor showed little variation) while it is negative and significant for Spain. However, the slope is one twentieth of what was found for MSAs of the United States.

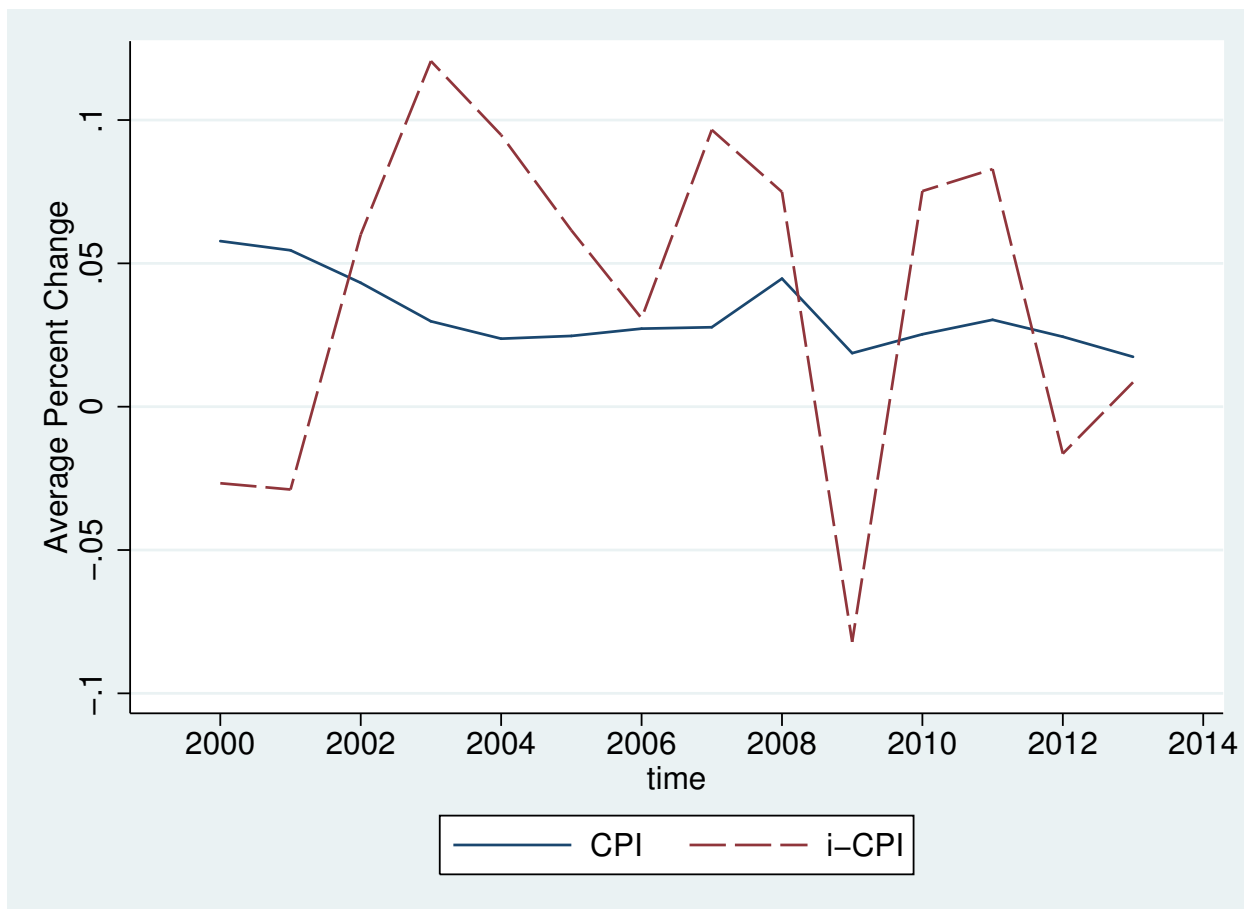
6 Conclusion

(Preliminary). Our results show that OECD countries with fluctuating exchange rates are able to adjust their international prices in stabilizing directions (at least to the extent that the experience of the Great Recession has external validity). Little adjustment takes place within the Eurozone although very severely affected states (Ireland 2007–2010 and Greece 2010–2013) were able to adjust prices in a stabilizing fashion. MSAs within the United States adjusted price level systematically and strongly in the Great Recession. Similar patterns were not found for intra-country adjustment within France, Germany, Italy, and Spain. This indicates that European rigidities are deeply rooted and the common currency is a painful straight jacket until Eurozone countries find ways to be more flexible in the manner of United States.

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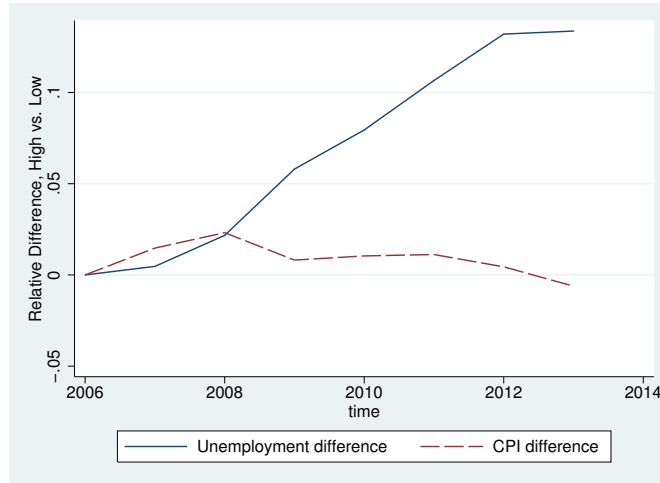
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Figure 1: Average Annual Inflation OECD countries

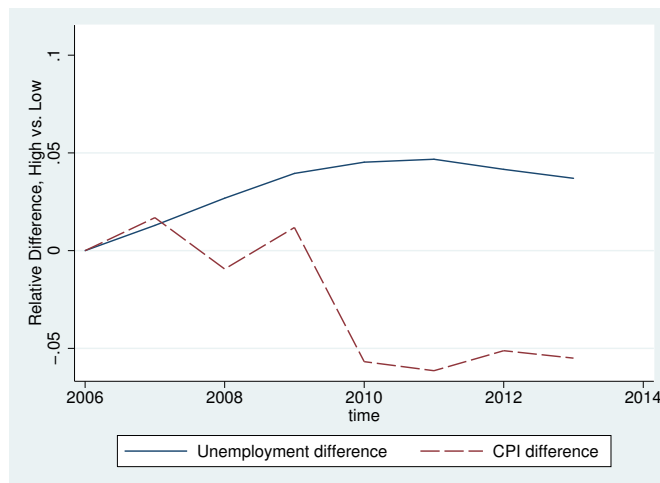


The figure shows average annual change in CPI and i -CPI across the non-euro OECD countries. Δ_i CPI is calculated by dividing local CPI by the exchange rate, measured in local currency per USD.

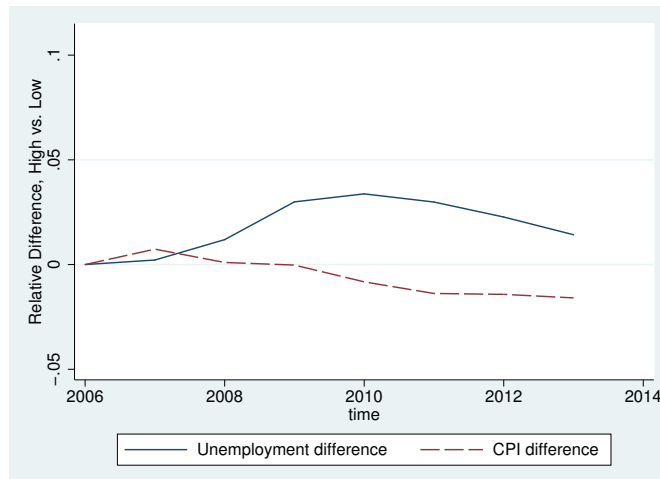
Figure 2: Differential CPI and Unemployment between High and Low Unemployment Countries/MSAs



(a) Differential between high and low unemployment countries, Eurozone



(b) Differential between high and low unemployment countries, OECD



(c) Differential between high and low unemployment MSAs, USA

Figure 3: Differential CPI (or Deflator) and Unemployment between High and Low Unemployment Regions within (selected) Eurozone Countries

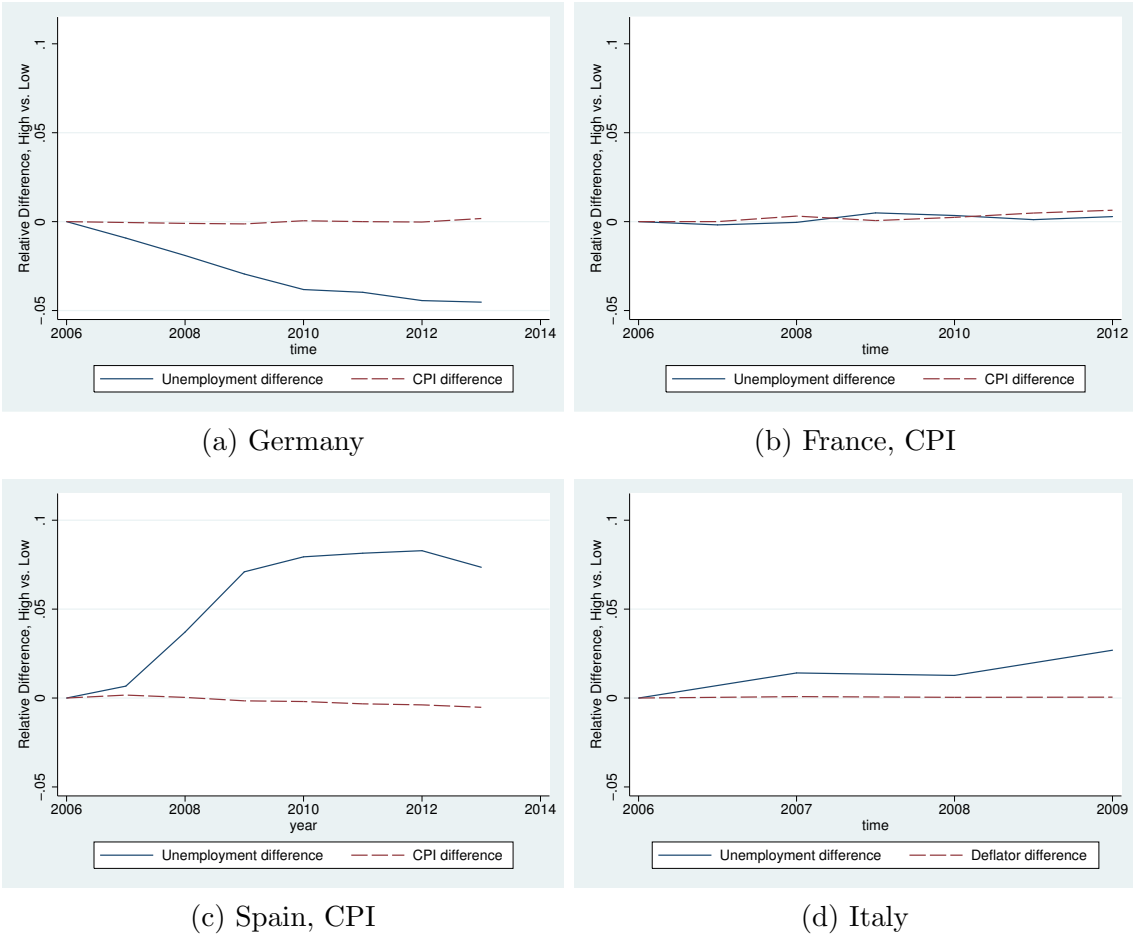
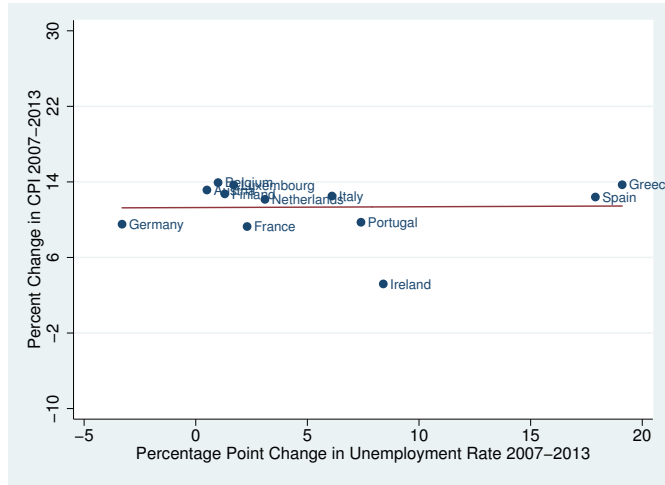


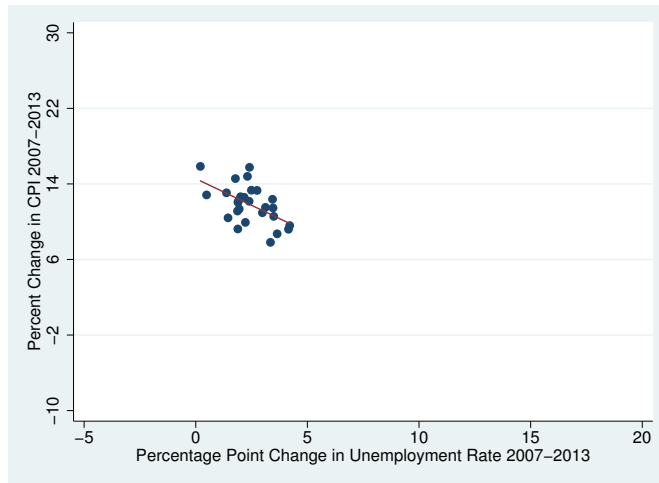
Figure 4: Change in Unemployment vs. CPI



(a) Eurozone

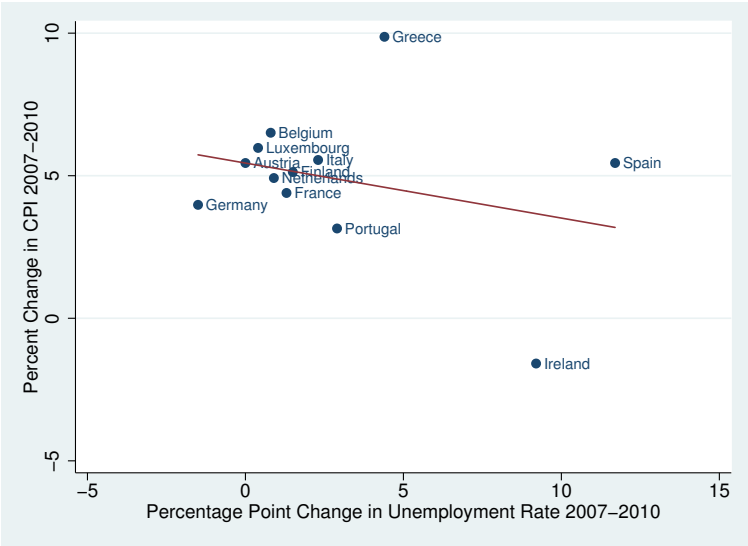


(b) OECD



(c) USA

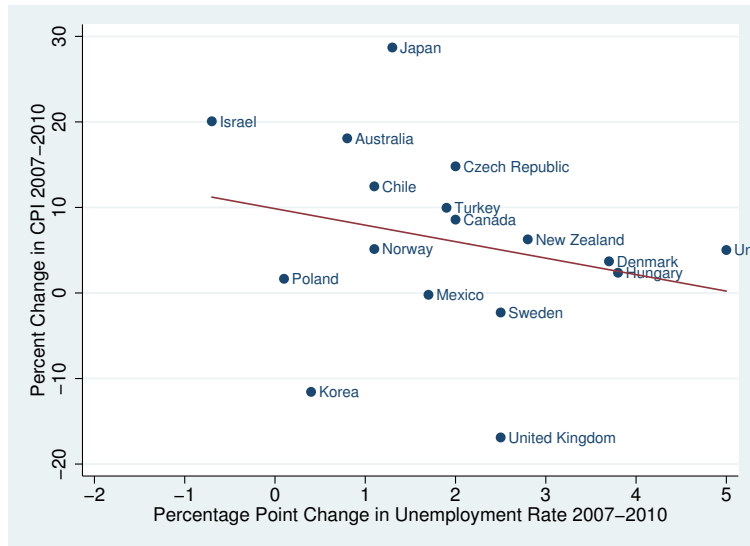
Figure 5: Eurozone Countries



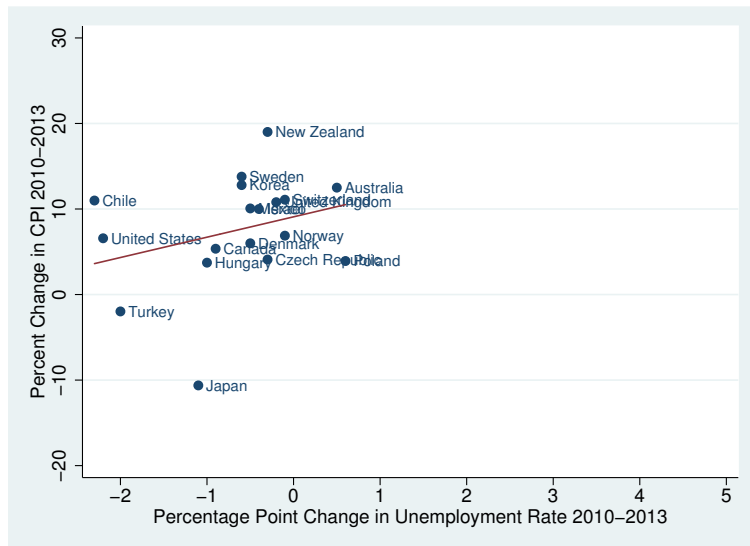
(a) Change in Euro CPI vs. Unemployment, 2007–2010

(b) Change in Euro CPI vs. Unemployment, 2010–2013

Figure 6: OECD Countries

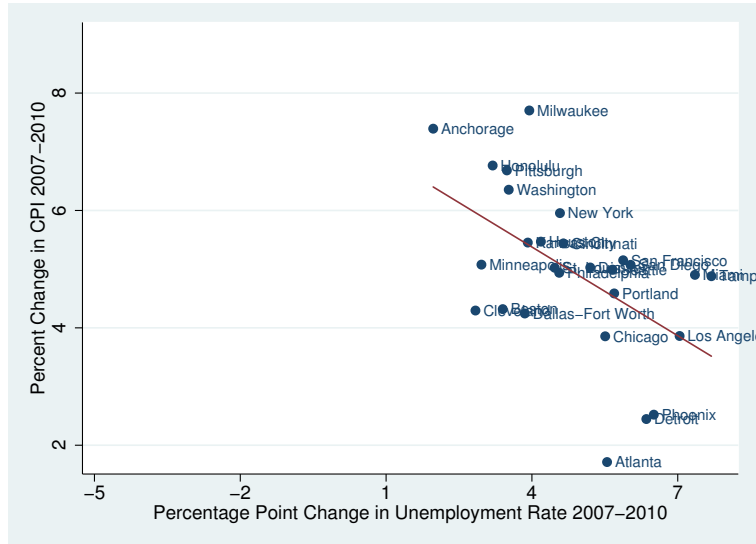


(a) Change in Euro CPI vs. Unemployment, 2007–2010

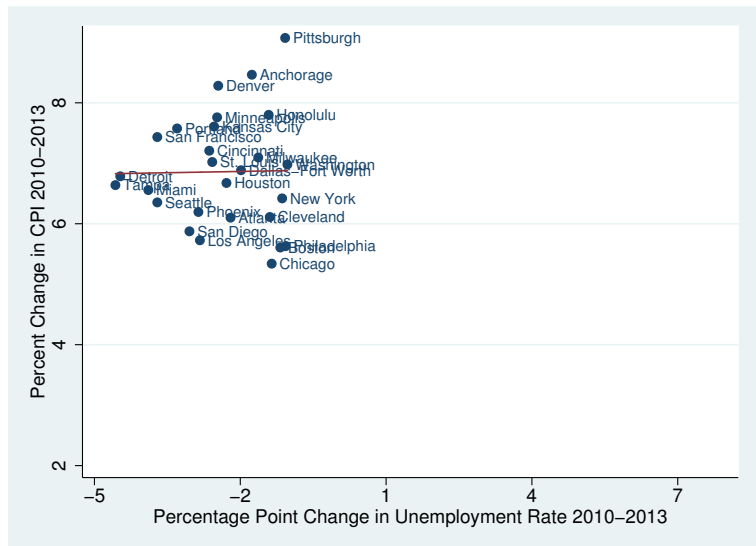


(b) Change in Euro CPI vs. Unemployment, 2010–2013

Figure 7: US MSA's

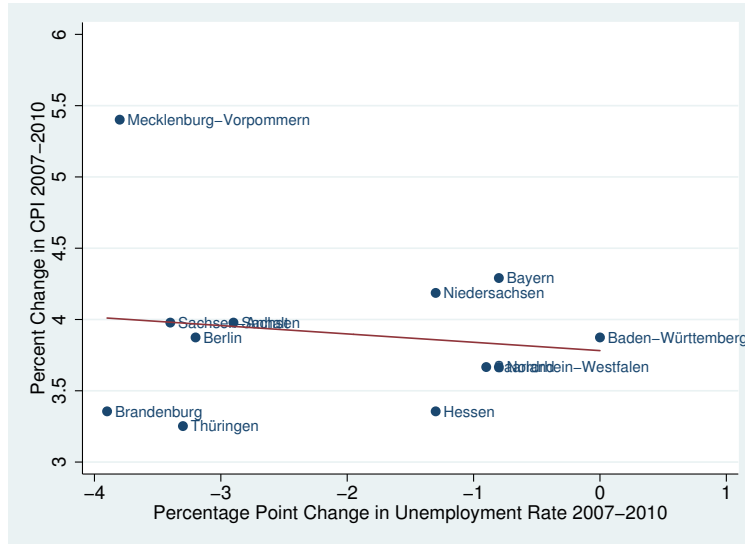


(a) Change in Euro CPI vs. Unemployment, 2007–2010

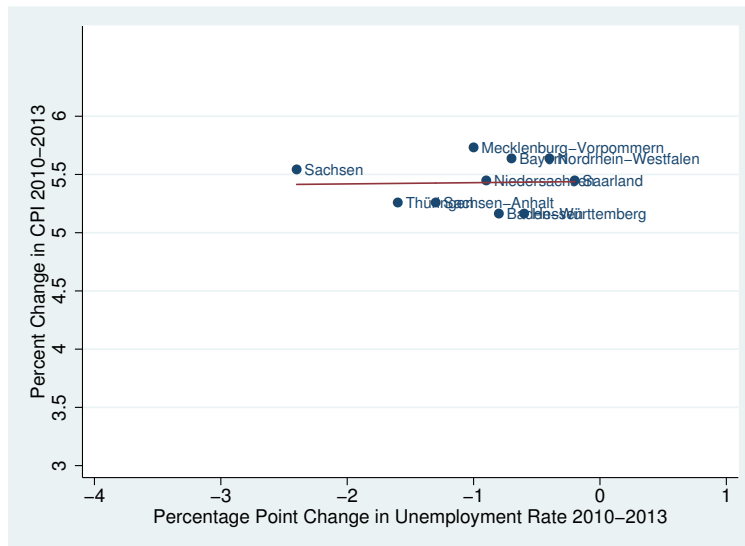


(b) Change in Euro CPI vs. Unemployment, 2010–2013

Figure 8: German regions

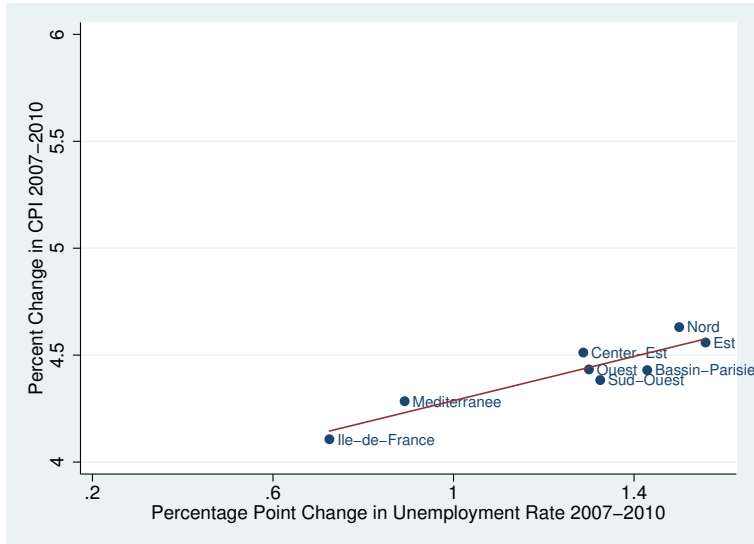


(a) Change in regional CPI vs. Unemployment, 2007-2010

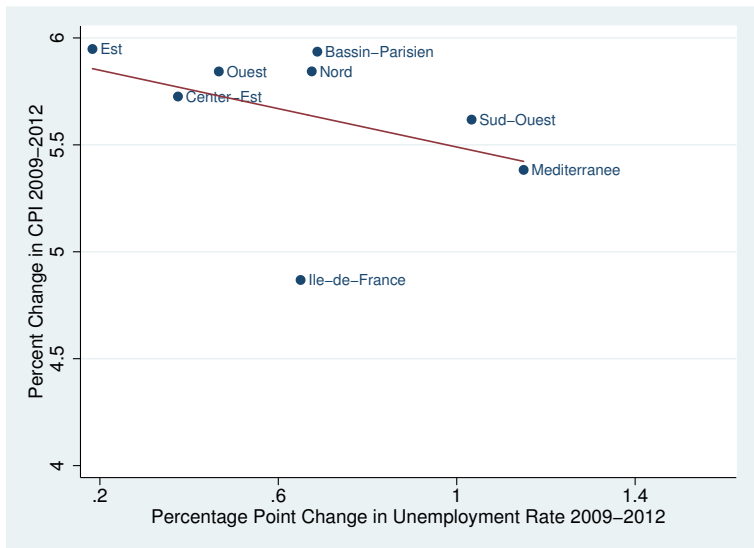


(b) Change in regional CPI vs. Unemployment, 2010-2013

Figure 9: French regions

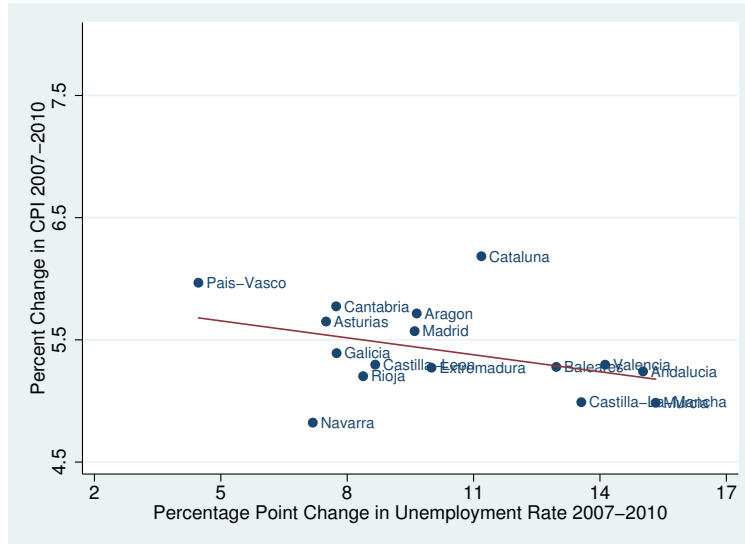


(a) Change in regional CPI vs. Unemployment, 2007-2010.

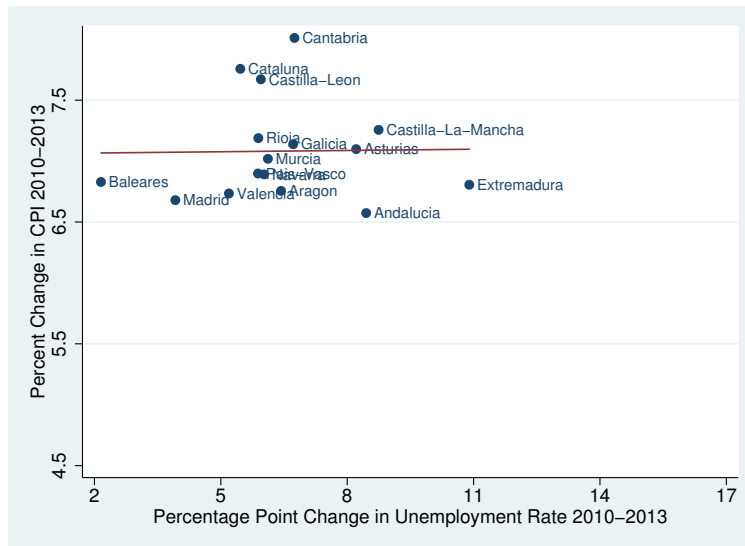


(b) Change in regional CPI vs. Unemployment, 2009-2012.

Figure 10: Spanish regions

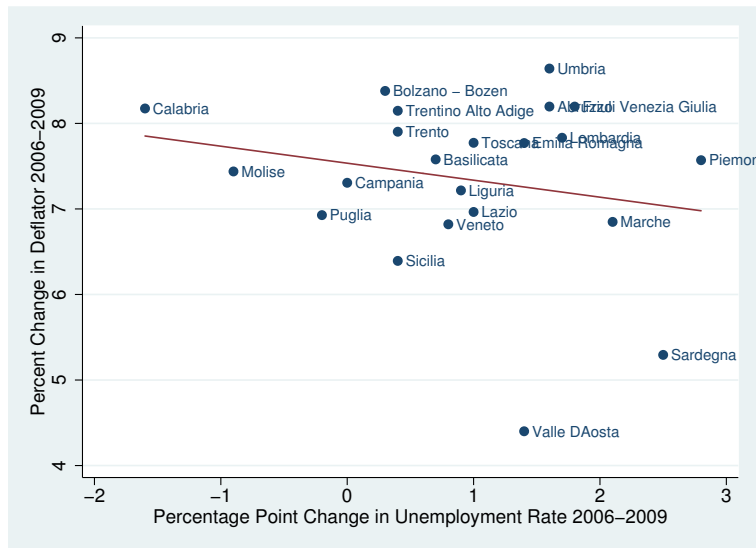


(a) Change in regional CPI vs. Unemployment, 2007-2010



(b) Change in regional CPI vs. Unemployment, 2010-2013.

Figure 11: Italian regions



(a) Change in regional Deflator vs. Unemployment, 2006-2009

Table 1: Summary Euro countries

	Unemployment			Inflation (Δ CPI)		GDP growth	
	2007	2010	2013	2007–2010	2010–2013	2007–2010	2010–2013
Austria	4.40%	4.40%	4.90%	1.90%	2.38%	0.30%	0.20%
Belgium	7.50%	8.30%	8.50%	2.08%	2.39%	-0.10%	-0.05%
Finland	6.90%	8.40%	8.20%	1.92%	2.20%	-0.36%	-0.02%
France	8.00%	9.30%	10.30%	1.47%	1.60%	-0.12%	0.07%
Germany	8.50%	7.00%	5.20%	1.57%	1.66%	0.49%	1.61%
Greece	8.40%	12.80%	27.50%	3.20%	2.11%	-2.31%	-8.42%
Ireland	4.70%	13.90%	13.10%	0.81%	0.95%	-5.15%	-0.33%
Italy	6.10%	8.40%	12.20%	1.84%	2.12%	-1.53%	-1.86%
Luxembourg	4.20%	4.60%	5.90%	2.06%	2.48%	0.36%	0.92%
Netherlands	3.60%	4.50%	6.70%	1.63%	2.14%	0.38%	-1.56%
Portugal	9.10%	12.00%	16.50%	1.39%	2.00%	0.47%	-2.36%
Spain	8.20%	19.90%	26.10%	2.06%	2.19%	-1.52%	-3.02%

The table presents average annual unemployment rate for 2007, 2010 and 2013, and average annual inflation and GDP growth for Eurozone countries during 2007–2010 and 2010–2013. Data is from the OECD. Only the initial eleven Eurozone members are considered, plus Greece.

Table 2: Summary OECD countries

	Unemployment			Inflation ($\Delta_i\text{CPI}$)		GDP growth	
	2007	2010	2013	2007–2010	2010–2013	2007–2010	2010–2013
Australia	4.40%	5.20%	5.70%	7.74%	2.56%	1.83%	0.75%
Canada	6.00%	8.00%	7.10%	4.03%	1.77%	0.01%	1.81%
Chile	7.10%	8.20%	5.90%	4.57%	2.37%	2.97%	5.62%
Czech Republic	5.30%	7.30%	7.00%	7.10%	2.00%	-0.50%	-1.01%
Denmark	3.80%	7.50%	7.00%	3.55%	2.04%	-0.99%	-0.03%
Hungary	7.40%	11.20%	10.20%	5.93%	3.97%	-2.60%	-0.34%
Israel	7.30%	6.60%	6.20%	7.16%	2.33%	1.66%	2.25%
Japan	3.80%	5.10%	4.00%	6.88%	-0.17%	-1.11%	0.68%
Korea	3.30%	3.70%	3.10%	-1.60%	2.59%	3.04%	2.31%
Mexico	3.70%	5.40%	4.90%	0.86%	3.81%	-0.07%	2.13%
New Zealand	3.70%	6.50%	6.20%	5.29%	2.11%	0.24%	1.41%
Norway	2.50%	3.60%	3.50%	3.75%	1.61%	0.40%	2.97%
Poland	9.60%	9.70%	10.30%	3.92%	2.79%	4.04%	2.18%
Sweden	6.10%	8.60%	8.00%	2.13%	1.21%	0.83%	1.44%
Turkey	8.80%	10.70%	8.70%	6.97%	7.56%	-0.23%	3.66%
United Kingdom	5.30%	7.80%	7.60%	-1.58%	3.24%	-0.95%	-0.30%
United States	4.60%	9.60%	7.40%	1.98%	2.05%	-0.95%	0.99%

The table presents average annual unemployment rate for 2007, 2010 and 2013, and average annual inflation ($\Delta_i\text{CPI}$) and GDP growth for a sample of OECD countries during 2007–2010 and 2010–2013. $\Delta_i\text{CPI}$ is measured as local inflation adjusted by local currency/USD exchange rate.

Table 3: Annual Summary Statistics

		2007–2010		2010–2013	
		Mean	St.Dev	Mean	St.Dev
Cross-country					
Eurozon	Δ CPI	1.63%	0.87%	2.14%	0.44%
	Δ UNEMP	0.94%	1.30%	0.88%	1.48%
	Δ GDP _{pc}	-1.91%	1.87%	-1.70%	2.49%
OECD	Δ CPI	2.27%	3.69%	2.50%	2.20%
	Δ UNEMP	0.63%	0.48%	-0.22%	0.27%
	Δ GDP _{pc}	-0.39%	1.70%	1.03%	1.40%
Regional					
United States	Δ CPI	1.66%	0.46%	2.29%	0.31%
	Δ UNEMP	1.60%	0.49%	-0.80%	0.35%
	Δ GDP _{pc}	-2.64%	2.02%	-0.47%	1.10%
	Δ GDP	-0.37%	1.98%	2.15%	1.22%
Germany	Δ CPI	1.30%	0.19%	-0.71%	0.14%
	Δ UNEMP _I	-0.71%	0.47%	-0.33%	0.21%
	Δ GDP	-0.91%	0.68%	0.37%	0.61%
France	Δ CPI	1.47%	0.05%	1.88%	0.12%
	Δ UNEMP	0.42%	0.10%	0.22%	0.11%
	Δ GDP	-1.01%	1.19%	1.00%	0.61%
	Δ GDP _{pc}	-1.51%	1.25%	0.53%	0.59%
Spain	Δ CPI	1.80%	0.15%	2.36%	0.14%
	Δ UNEMP	3.40%	1.06%	2.14%	0.67%
	Δ GDP	-0.96%	0.51%	-1.04%	0.40%
Italy (2009 last year)	Δ DEFLATOR	2.45%	0.33%		
	Δ UNEMP	0.30%	0.35%		
	Δ GDP	-1.34%	0.80%		

The table presents cross-country summary statistics for Eurozone and OECD and regional summary statistics for the United States, Germany, France, Spain, and Italy. Mean represents an average growth rate in each country (within the Eurozone or OECD) or within subnational region (within a country) during the indicated period. Standard deviation is calculated cross-country by taking standard deviation of the average growth rates within the Eurozone or OECD, and cross-region by taking standard deviation of an average growth rate of regions within a country.

Table 4: Regression Results, CPI 2007–2013

	USA		Eurozone		OECD	
	(1)	(2)	(1)	(2)	(1)	(2)
$\Delta_{07-13}\text{UNEMP}$	-1.127*** (-4.06)		0.009 (0.09)		-2.217 (-1.28)	
$\Delta_{07-13}\text{GDP}$		0.093 (1.66)		0.011 (0.12)		0.241 (0.78)
Observations	27	27	12	12	17	18

Dependent variable is change in CPI between 2007 and 2013.

$$\Delta_{07-13}\text{CPI} = \alpha + \beta\Delta_{07-13}\text{UNEMP} + \epsilon$$

$$\Delta_{07-13}\text{CPI} = \alpha + \beta\Delta_{07-13}\text{GDP} + \epsilon$$

Table 5: Regression Results, Regional Data, CPI 2007–2013

	Germany		France		Spain		Italy	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
$\Delta_{07-13}\text{UNEMP}$	-0.096 (-0.65)		0.869** (3.25)		-0.064** (-2.47)		-0.199 (-1.11)	
$\Delta_{07-13}\text{GDP}$		0.041 (0.36)		-0.084** (-2.45)		-0.006 (-0.07)		-0.104 (-1.05)
Observations	10	12	8	8	16	16	22	22

Dependent variable is change in CPI between 2007 and 2013.

$$\Delta_{07-13}\text{CPI} = \alpha + \beta\Delta_{07-13}\text{UNEMP} + \epsilon$$

$$\Delta_{07-13}\text{CPI} = \alpha + \beta\Delta_{07-13}\text{GDP} + \epsilon$$

For Italy we use the GDP deflator instead of the CPI, due to data availability. Also, French data ends in 2012 and Italian data ends in 2009.

APPENDIX

USA (27 MSA)

Chicago, LA, New York, Atlanta, Boston, Cleveland, Dallas-Fort Worth, Detroit, Houston, Miami, Philadelphia, San Francisco, Seattle, Washington, Anchorage, Cincinnati, Denver, Honolulu, Kansas City, Milwaukee, Minneapolis, Phoenix, Pittsburg, Portland, St. Louis, San Diego, and Tampa.

Source: Bureau of Labor Statistics and Bureau of Economic Analysis.

Germany (12 States)

Baden-Württemberg, Bayern, Berlin, Brandenburg, Hessen, Mecklenburg-Vorpommern, Niedersachsen, Nordrhein-Westfalen, Saarland, Sachsen, Sachsen-Anhalt, Thüringen.

Source: Statistical offices of each individual German states.

France (8 regions)

Bassin-Parisien, Center-Est, Est, Ile-de-France, Mediterranee, Nord, Ouest, Sud-Ouest.

Source: Institut national de la statistique et des études économiques

Spain (16 regions)³

Andalucia, Aragon, Asturias, Baleares, Cantabria, Castilla-La-Mancha, Castilla-Leon, Cataluna, Extremadura, Galicia, Madrid, Murcia, Navarra, Pais-Vasco, Rioja, Valencia.

Source: Instituto Nacional de Estadística.

Italy (22 regions)

Abruzzo, Basilicata, Bolzano - Bozen, Calabria, Campania, Emilia Romagna, Friuli Venezia Giulia, Lazio, Liguria, Lombardia, Marche, Molise, Piemonte, Puglia, Sardegna, Sicilia, Toscana, Trentino Alto Adige, Trento, Umbria, Valle DAosta, Veneto.

Source: Istituto nazionale di statistica.

³We use all the regions except the small overseas region of Ceuta, Melilla, and Canarias.