

# From Hero to Zero? The Role of the Euro in the Current Crisis: Theory and some Empirical Evidence

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**Abstract** A simple theoretical model of monetary unification and data from 11 euro members are used to investigate the common currency's role in the macroeconomic performance of these countries. Euro membership has been typically accompanied by lower (or steady) inflation, but also by higher business-cycle volatility. In addition, synchronization of cyclical output was substantially affected by the common currency only in Greece (where it declined considerably) and Finland and Ireland (where it increased). Consistent with the theoretical predictions, the empirical evidence shows a strong negative relationship between cyclical synchronizations and volatilities, which however is not much stronger under the euro than it was during the Maastricht period.

**Keywords** Euro · Monetary integration

**JEL** E42 · F36 · F42

## Introduction

In the early stages of the global financial crisis of 2007 through 2009, the consensus was that membership in the euro area was a highly effective way of shielding a European economy, especially a small open one, from the most damaging consequences of the crisis. Conversely, an independent currency was thought to expose an economy to dangers that were, at least partly, avoidable. The classic example then was Iceland—being a small economy out of the euro which was thought to provide a sure way of amplifying the shocks that were destabilizing the economy (Buiter 2008; Economist 2008).

Later on, however, the consensus changed, eventually making a turn of 180 degrees in less than two years. It is now thought that, for a European economy during a crisis, membership in the euro was not only unhelpful—it was actually detrimental (Tully 2010;

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Economist 2010b). The classic example became Greece and the argument was that euro membership was the surest way to lead to a destabilizing trap of reduced competitiveness and high debt. The argument progressed so far that the entire euro architecture was thought to be unstable or undesirable (Brittan 2010; Economist 2010a).

As the 2008 and 2010 vintages of the consensus are diametrically opposed, it is obvious that at least one of them must be wrong. In fact, it is tempting to say that probably both are. As the economic theory we will use in the next section makes clear, adopting a common currency comes with both benefits and costs, and it is only natural to expect that these will be time varying, so that the net benefit may at times be positive and at other times negative. It is not surprising then that looking at isolated instances, membership in a currency union can be made to appear sometimes as an asset and at other times as a liability.

This paper investigates the role of the euro in the recent macroeconomic performance of 11 euro member countries, including Greece. First, a simple theoretical model is used to derive the predicted macroeconomic consequences of adopting a common currency.<sup>1</sup> Then, we use the data to quantify the magnitudes of these effects and the relationships among them. Finally, we ask whether the empirical observations are consistent with the theoretical predictions.

The paper's results suggest that euro membership has been typically accompanied by lower (or steady) inflation, but also by higher business-cycle volatility. Additionally, the synchronization of most countries' cyclical output was not substantially affected by the common currency—except in Greece (where it declined considerably) and Finland and Ireland (where it increased). Consistent with the theoretical predictions, the empirical evidence shows a strong negative relationship between cyclical synchronizations and volatilities, which, however, is not much stronger under the euro than it was during the Maastricht period.

The rest of the paper is organized as follows. [Simple Theory](#) outlines the paper's basic theoretical framework. [The Data](#) introduces the data sources and definitions and presents some basic time series. [Empirical Results and Discussion](#) presents the empirical evidence, beginning with simple measurement of macroeconomic costs and benefits, correlations of each country's cyclical output with the entire euro area, and the relationships among these variables. [Conclusions](#) concludes the paper.

## Simple Theory

To keep things as simple as possible, the theoretical model builds on (and generalizes) the recent approach of Alesina and Stella (2010).<sup>2</sup> There are  $N$  economies, indexed by  $i$ , and output in each is given by:

$$y_i = \pi_i - \pi_i^e + u_i, \quad (1)$$

<sup>1</sup> This is of course related to the question of the *optimum currency area*, a concept introduced by Mundell (1961), and also treated in the early contributions of McKinnon (1963) and Kenen (1969), who suggested several criteria for its existence and applicability.

<sup>2</sup> Alesina and Stella's (2010) model follows the contributions of Kydland and Prescott (1977) and Barro and Gordon (1983). Alternatively, the theory can be developed in terms of the New Keynesian model of Clarida et al. (1999), as in Karras (2003). As this yields a very similar set of theoretical implications, the simplest of the two approaches is preferred here.

where  $y$  is output,  $\pi$  is inflation,  $\pi^e$  expected inflation, and  $u$  an output shock. We assume that  $u_i \sim iid(0, \sigma_i^2)$ , and trend output has been normalized to zero.

Central Bank preferences are given by the loss function:

$$L_i = \frac{a_i}{2} (y_i - k_i)^2 + \frac{1}{2} \pi_i^2, \quad (2)$$

where  $a$  is the relative weight of missing the output target, and  $k$  is the target level of output.<sup>3</sup> Central Banks are assumed to control the inflation rate. We will now compare Central Bank behavior and macroeconomic performance under two regimes: (i) monetary independence and (ii) a monetary union.

First, without a monetary union, each country's Central Bank enjoys monetary independence and, taking inflation expectations as given, behaves in a way that minimizes (2) subject to (1). The first-order condition requires:

$$\pi_i^{IND} = \frac{a_i}{1 + a_i} (\pi_i^e - u_i + k_i), \quad (3)$$

where the IND superscript will indicate outcomes under monetary independence. With rational expectations,  $\pi_i^e = E(\pi_i)$ , it follows that  $\pi_i^e = a_i k_i$ , and thus (3) determines inflation under independent monetary policy as:

$$\pi_i^{IND} = a_i k_i - \frac{a_i}{1 + a_i} u_i, \quad (4)$$

and, substituting in (1), output under independent monetary policy (in deviation from the trend) as:

$$y_i^{IND} = \frac{1}{1 + a_i} u_i. \quad (5)$$

The economy's macroeconomic performance under monetary independence can be captured by the following. Average inflation is given by:

$$\bar{\pi}_i^{IND} = a_i k_i, \quad (6)$$

while output volatility equals:

$$Var(y_i^{IND}) = \left( \frac{1}{1 + a_i} \right)^2 \sigma_i^2. \quad (7)$$

Note that we obtain the usual trade off between average inflation and output volatility: a lower  $a$  (*i.e.*, a more target-conservative Central Bank) reduces the inflation bias given by (6), but raises business-cycle volatility as shown in (7).<sup>4</sup>

<sup>3</sup> Unlike Alesina and Stella (2010), the present model allows the  $a$  and  $k$  parameters to differ across the  $N$  countries. This generates a more realistic source of costs and benefits from joining in a monetary union (see below).

<sup>4</sup> It is easy to see that a similar trade off exists between output volatility and inflation volatility. However, no such trade off exists between inflation and average output: from (5), average output (in deviation from the trend) is given by  $\bar{y}_i^{IND} = 0$ , and it is independent of  $a$ .

Next, suppose the  $N$  economies form a monetary union and delegate monetary policy to a common monetary authority that has a loss function similar to the one specified by (1), but is a function of union-wide values:

$$L_U = \frac{a_U}{2} (y_U - k_U)^2 + \frac{1}{2} \pi_U^2, \tag{8}$$

where a  $U$  subscript will indicate union-wide values. The common Central Bank sets the inflation rate for all economies in the union. Its objective is to minimize (8) subject to the union-wide output equation:

$$y_U = \pi_U - \pi_U^e + u_U, \tag{9}$$

and taking inflation expectations as given. We assume that  $u_i \sim iid(0, \sigma_U^2)$  and define  $\rho_{i,U} \equiv corr(u_i, u_U)$  as the correlation between the output shock of country  $i$  and that of the whole union. The first-order condition implies:

$$\pi_U = a_U k_U - \frac{a_U}{1 + a_U} u_U = \pi_i^{UNION}, \forall i \tag{10}$$

where a UNION superscript indicates outcomes under the monetary union. Note that this means that expected inflation is given by  $\pi_i^e = \pi_U^e = a_U k_U$ . Substituting into Equation 1, this gives the  $i$ th economy's output under the monetary union as:

$$y_i^{UNION} = u_i - \frac{a_U}{1 + a_U} u_U. \tag{11}$$

The economy's macroeconomic performance in the monetary union is now described as follows. Average inflation is given by:

$$\bar{\pi}_i^{UNION} = a_U k_U, \tag{12}$$

while output volatility equals:

$$Var(y_i^{UNION}) = \sigma_i^2 + \left(\frac{a_U}{1 + a_U}\right)^2 \sigma_U^2 - 2\rho_{i,U} \left(\frac{a_U}{1 + a_U}\right) \sigma_i \sigma_U. \tag{13}$$

Comparing (12) and (6) shows the potential macroeconomic benefit of joining the monetary union: if  $a_U$  and  $k_U$  are jointly smaller than  $a_i$  and  $k_i$  (in the precise sense that  $a_U k_U < a_i k_i$ ), then the  $i$ th economy's inflation bias will be reduced under the monetary union. If the common Central Bank is set up in such a way that  $a_U k_U < a_i k_i, \forall i$ , then all economies will end up with a lower average inflation in the union.<sup>5</sup>

Comparing (7) and (13), however, shows the potential macroeconomic cost of joining the union: the  $i$ th economy's volatility of output may increase substantially, especially if its correlation with union-wide output ( $\rho_{i,U}$ ) is not sufficiently high. Intuitively, if output deviations from the trend in Greece are highly correlated with the eurozone's as a whole, then the monetary policy of the ECB will be sufficiently countercyclical and thus stabilizing. If, however, Greece and the eurozone are poorly (or worse, negatively) correlated, then the monetary policy of the ECB could end up destabilizing Greece. This stabilization cost is smaller, the closer  $\rho_{i,U}$  is to 1.

<sup>5</sup> Alesina and Stella (2010) consider the special case when  $k_U=0$  (and  $N=2$ ).

## The Data

All data are obtained from the IMF's World Economic Outlook (version of October 2010). Cyclical output is measured by the output gap, expressed as a percent of potential GDP. Inflation is measured by the (average) percent change in consumer prices. The frequency is annual.

The data set consists of the 11 euro countries for which the series are available for each of the years of the 1991 through 2009 period: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain.<sup>6</sup>

Figure 1 plots the output gap series for each of the 11 economies, as well as the euro area as a whole, for the period 2009 through 2011. The last two years, 2010 and 2011, represent IMF estimates and thus are not used in the empirical section. They are included in the Figure, however, to try to capture as much as possible of the latest phase of the business cycle. As Figure 1 demonstrates, our period of reference includes two or three cyclical swings for most of these countries. Nevertheless, the recent cyclical experiences of the euro countries display both similarities and differences, which will be quantified in the next section. The most striking difference appears to be the amplitude of the business cycle, which is quite pronounced for Finland, Greece, and Ireland, but relatively subdued for Austria, Belgium, and Italy.

Figure 2 plots the inflation rates for the 11 countries, over the period 1991 through 2009. It is obvious that inflation has trended downward since 1991 for most of these economies, though this trend has usually been mild. The greatest exceptions are Greece and Portugal, which reduced inflation from double-digit (almost 20 percent for Greece, and 11 percent for Portugal) to virtual price stability.

## Empirical Results and Discussion

### Assessing Macroeconomic Costs and Benefits

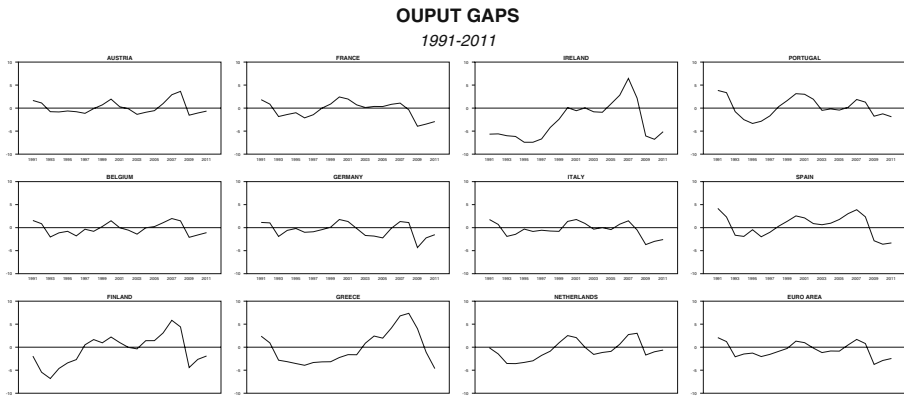
We begin with a simple empirical assessment of the main macroeconomic costs and benefits, as identified in the theoretical section above. To that end, we will compare the average inflation rates and cyclical volatilities of each of the 11 countries in two periods: the pre-euro Maastricht period (1992 through 1998) and the subsequent Euro period (1999 through 2009).

Table 1 reports these inflation rates and the implied inflation benefit, computed as the difference between average inflation during the Euro and Maastricht periods. Figure 3 facilitates this comparison in a scatter plot of the two averages together with the 45 degrees line.

It is readily apparent that, in terms of the magnitude of the inflation benefit, the 11 economies can be broadly classified in three groups. The first group consists of just one country, Greece, which experienced by far the greatest decrease in average inflation (more than 6.5 percent), and thus the largest inflation benefit, since the creation of the euro. The second group, consisting of Portugal, Italy, and Spain,

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<sup>6</sup> Luxembourg is the only one of the 12 original countries to be excluded, because of lack of data on the output gap.



**Fig. 1** Output gaps as a percent of potential GDP. (Data for 2010 and 2011 are IMF estimates)

enjoyed a benefit that was smaller but still sizable (between one percent and two percent). The third and largest group, consisting of the remaining seven economies, is comprised of economies whose inflation benefit (Austria and Germany) or loss (Belgium, Finland, France, Ireland, and the Netherlands) is practically negligible (less than one percent in absolute value).

Table 1 and Figure 3 imply that the benefits in terms of price stability after a decade of euro membership have been either considerably positive or virtually inconsequential.

Table 2 shows each country’s cyclical volatilities and the implied stabilization cost, measured by the difference in the standard deviations of the output gaps between the Euro and Maastricht periods. Figure 4 provides a more visual comparison in a scatter plot with the 45 degrees line.

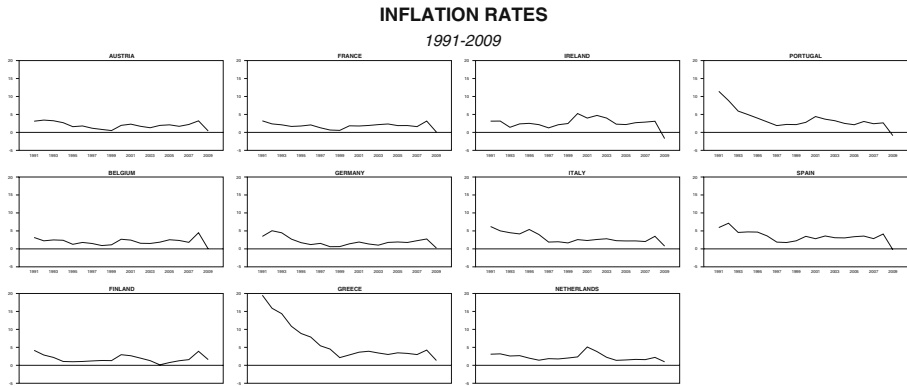
The most striking implication here is that for the overwhelming majority of these 11 countries (and the euro area as a whole) the stabilization cost of euro membership has been positive: all but two experienced an increase in cyclical volatility after the creation of the Euro.<sup>7</sup> Moreover, this cost has been quite sizable for some: Austria, Germany, Greece, and Ireland have seen the standard deviation of their output gap more than double in relation to the period before monetary unification. For France, Italy, and the Netherlands the stabilization cost has been lower, but still sizable; while Belgium and Spain have also seen their business cycle intensify, but by considerably less.

Overall then, the evidence of Table 2 and Figure 4 suggests that membership in the euro has most commonly been accompanied by an increase in business-cycle volatility, that is often substantial.

### Comparing Macroeconomic Costs and Benefits

Assessing whether the first decade of euro membership has been beneficial, and for which of the countries, requires a joint evaluation of costs and benefits. It is instructive, therefore, to investigate the relationship between realized costs and

<sup>7</sup> The two exceptions are Portugal and Finland, where the output gap became more stable after the introduction of the common currency.



**Fig. 2** Inflation rates (average CPI growth rates)

benefits across countries. Figure 5 provides a scatter plot of the two variables to facilitate the comparison.

It is clear that for a large subset of the countries examined, the relationship between realized costs and benefits has been positive; high benefits have often tended to coexist with high costs, while low (or negative) benefits often correspond to low (or negative) costs. The best example of the former case is Greece. It has realized the highest inflation benefit in the sample, but has also suffered the highest stabilization cost. A good example of the latter case is Finland. It has experienced a negative (though slight) inflation benefit, and also a negative (again slight) stabilization cost.

Such a positive correlation between costs and benefits makes it difficult to implement a straightforward cost-benefit calculus for many of these countries, or even proceed with cross-country comparisons. For example, it is impossible to determine whether Italy or Spain have benefited more from their first decade of euro membership: Italy realized a bigger inflation benefit, but also paid a higher price in terms of greater cyclical instability. Similarly, it is impossible to compare the net gains of Germany and France, or Belgium and the Netherlands.

It is still possible, however, to make unambiguous comparisons about countries for which this correlation between costs and benefits is absent, or even negative. It is clear, for example, that the first decade of euro membership has been a net benefit for Portugal<sup>8</sup>. Its economy has experienced both lower inflation (a positive benefit) and greater cyclical stability (a negative cost). At the opposite end of the spectrum, the Irish economy ended up with a net loss; both cyclical volatility and average inflation increased.<sup>9</sup>

Moving on to comparisons between economies, it is clear that Portugal's net benefit has been greater than Spain's; Portugal gained more in terms of inflation reduction and lost less in terms of cyclical variability. Similarly, Spain gained more than France (or Austria, or the Netherlands), while France gained more than Ireland.

<sup>8</sup> Note that Portugal is the only economy for which this statement can be made unequivocally. All other economies have traded off gains in one variable for losses in the other.

<sup>9</sup> The same is true of Finland, though to a much smaller extent.

**Table 1** Average inflation rates by country

<i>i</i>	$\bar{\pi}_i^{MAASTRICHT}$	$\bar{\pi}_i^{EURO}$	Inflation Benefit
1. Austria	2.10	1.75	0.34
2. Belgium	1.79	2.03	-0.23
3. Finland	1.54	1.77	-0.23
4. France	1.70	1.75	-0.04
5. Germany	2.47	1.55	0.91
6. Greece	9.68	3.13	6.55
7. Ireland	2.14	2.89	-0.75
8. Italy	3.84	2.27	1.57
9. Netherlands	2.22	2.25	-0.03
10. Portugal	4.39	2.56	1.83
11. Spain	4.04	2.90	1.14

$\bar{\pi}_i^P$  is country *i*'s average inflation rate over time period *P*. *P* takes the values *MAASTRICHT* (1992–1998) and *EURO* (1999–2009). *Inflation Benefit* is defined as  $\bar{\pi}_i^{MAASTRICHT} - \bar{\pi}_i^{EURO}$

### Correlations with the Euro Area

The previous section makes it clear that cyclical volatility generally increased in the decade after the euro was adopted. This, however, does not necessarily mean that euro membership in itself is actually causing the higher volatility. To demonstrate causality, it needs to be shown that volatility is going up in a way that is consistent with our theoretical understanding of how the loss of monetary independence that accompanies monetary unification can result in higher instability.

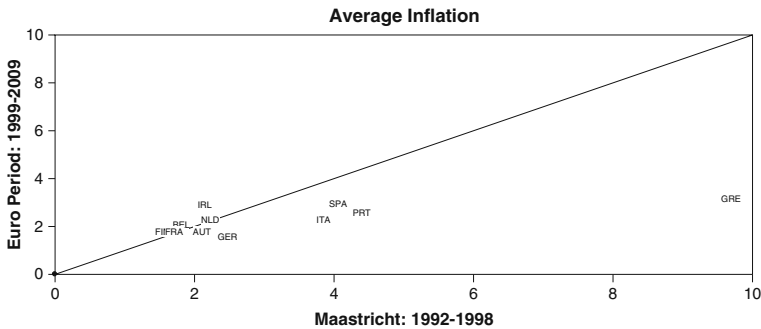
Fortunately, the theory of [Simple Theory](#) above suggests how this can be attempted. The theory suggests that adopting a common currency may increase a member economy's business-cycle volatility if the economy's cyclical correlation with the union as a whole is low. Is the evidence consistent with this prediction?

To investigate this, we first take a look at the estimated  $\rho_{i,EU}$ 's, the correlations of each country's output gap with the output gap of the euro area as a whole, during the full period (1991 through 2009), the pre-euro Maastricht period (1992 through 1998), and the subsequent Euro period (1999 through 2009).

Table 3 reports these correlations and Figure 6 provides a scatter plot intended to facilitate comparison of their values between the Maastricht and Euro periods. Looking at the full period first, the results seem mostly unsurprising. The core countries of Germany and France are very highly correlated with the whole euro area (both with a correlation coefficient of 0.89), but so are the smaller economies of Belgium and Austria. A bit more surprising is that the peripheral countries of Spain, Italy, and Portugal are also very highly correlated with the euro area—and in fact not appreciably less than the core countries. The economies with the lowest correlations with the euro area are Ireland (0.54), Finland (0.50), and Greece (0.34).<sup>10</sup>

For several of the countries, these full-period correlations have been stable in the sense that they have been virtually unchanged between the Maastricht and Euro subperiods. This is the case, for example, for Spain, Belgium, Portugal, France, Germany, and Italy. For other countries, however, the full-period correlations mask sizable differences between subperiods. The two most extreme cases are Greece,

<sup>10</sup> It is worth noting that all full-period correlations are positive.



**Fig. 3** Inflation rates during the Maastricht and Euro periods. (The solid line is the 45° line)

where the correlation with the euro zone fell from 0.91 during the Maastricht period to  $-0.01$  during the Euro period, and Finland, where the correlation coefficient increased from  $-0.10$  during Maastricht to 0.87 after the euro. The correlation also increased for Ireland and the Netherlands, but by less.

Figure 6 makes the same point visually. Again, economies can be classified in three groups in terms of how their correlations with the euro area changed after the common currency was introduced. The first group consists of just one country, Greece, which experienced a substantial drop in its degree of synchronization with the euro area. The second group includes Finland, Ireland, and the Netherlands, countries that became more synchronized with the euro area, while the third group consists of everybody else—countries that stayed more or less on the 45 degrees line.

Is the Euro responsible for the higher volatility?

Now we are ready to turn to the theory and ask whether these  $\rho_{i,EU}$ 's are themselves correlated with the countries' cyclical instability, as suggested by the theory. To that end, Figure 7 plots the standard deviation of the output gap ( $\sigma_i^{FULL}$ ) against the correlation with the euro area ( $\rho_{i,EU}^{FULL}$ ), both measured over the full period, 1991 through 2009. The relationship is shown to be strongly negative and is, in fact, statistically significant.<sup>11</sup> Note that this is consistent with the theoretical prediction that economies with lower correlations (such as Greece, Finland, and Ireland in Figure 7) will suffer greater business-cycle volatilities. Such an interpretation, of course, means that the EMS or the euro bear some of the responsibility of the cyclical volatility, particularly in the least correlated countries. Can the share of this responsibility be quantified? A simple regression gives (with heteroskedasticity-consistent standard errors in parentheses):

$$\sigma_i^{FULL} = 5.62 - 4.45 \rho_{i,EU}^{FULL}, R^2 = 0.81$$

(0.59) (0.72)

The estimated slope has the expected negative sign, its size makes it economically meaningful, and it is highly statistically significant. But perhaps most remarkably,

<sup>11</sup> The correlation between the two variables is  $\text{corr}(\rho_{i,EU}^{FULL}, \sigma_i^{FULL}) = -0.90$ .

**Table 2** Cyclical volatility by country

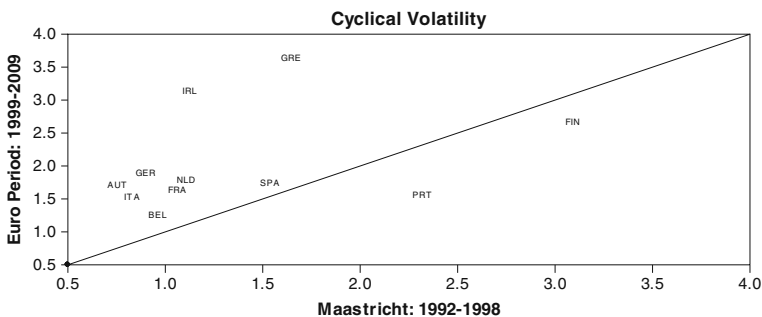
<i>i</i>	$\sigma_i^{MAASTRICHT}$	$\sigma_i^{EURO}$	Stabilization Cost
1. Austria	0.75	1.70	0.95
2. Belgium	0.96	1.25	0.29
3. Finland	3.09	2.67	-0.41
4. France	1.06	1.64	0.58
5. Germany	0.89	1.89	0.99
6. Greece	1.64	3.63	1.98
7. Ireland	1.12	3.14	2.02
8. Italy	0.83	1.52	0.69
9. Netherlands	1.10	1.79	0.68
10. Portugal	2.32	1.56	-0.75
11. Spain	1.53	1.75	0.21
12. Euro Area	1.12	1.51	0.39

$\sigma_i^P$  is the standard deviation of country *i*'s output gap over time period *P*. *P* takes the values *MAASTRICHT* (1992–1998) and *EURO* (1999–2009). *Stabilization Cost* is defined as  $\sigma_i^{EURO} - \sigma_i^{MAASTRICHT}$

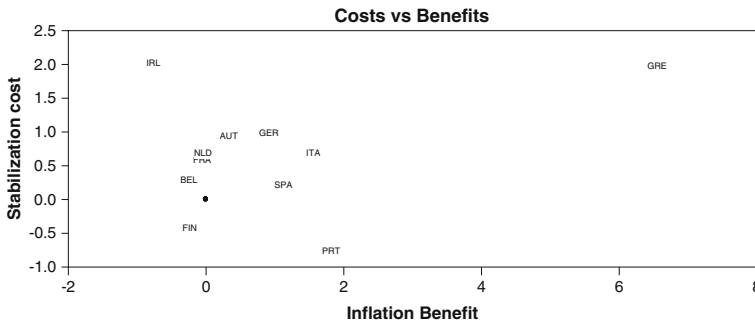
the regression's  $R^2$  suggests that about four-fifths of the sample's variability in  $\sigma_i^{FULL}$  can be explained by the single variable  $\rho_{i,EU}^{FULL}$ .

Figure 7 supports the notion that the loss of monetary independence, whether due to the EMS or the euro, introduces a strong negative relationship between cyclical correlations and volatilities. To clarify the specific role of the euro, however, we need to determine if the same relationship characterizes the two subperiods, and whether it is equally strong. This is addressed by Figures 8 and 9, which plot the standard deviation of the output gap against the correlation with the euro area for the Maastricht and Euro periods, respectively. Once more, both relationships are strongly negative and both are, again, statistically significant. To compare more precisely, the estimated correlation coefficients are:

$$\begin{aligned} \text{corr}(\rho_{i,EU}^{FULL}, \sigma_i^{FULL}) &= -0.90 \\ \text{corr}(\rho_{i,EU}^{MAASTRICHT}, \sigma_i^{MAASTRICHT}) &= -0.65 \\ \text{corr}(\rho_{i,EU}^{EURO}, \sigma_i^{EURO}) &= -0.72 \end{aligned}$$



**Fig. 4** Standard deviation of output gaps during the Maastricht and Euro periods. (The solid line is the 45° line)



**Fig. 5** Stabilization cost equals  $\sigma_i^{EURO} - \sigma_i^{MAASTRICHT}$ , Inflation benefit equals  $\bar{\pi}_i^{MAASTRICHT} - \bar{\pi}_i^{EURO}$

Though neither of the subperiods approaches the precision of the full period’s relationship, the euro period shows a somewhat tighter relationship between cyclical synchronizations and volatilities than Maastricht. This, however, turns out to depend on the very influential observation of Greece (see Figure 9). As Figure 10 illustrates, if Greece is excluded from the sample, the correlation remains negative, but it becomes much smaller (and statistically insignificant):

$$\text{corr}\left(\rho_{i,EU}^{EURO}, \sigma_i^{EURO} \mid \text{Greece excluded}\right) = -0.29$$

It appears, then, that the adoption of the euro has not fundamentally changed the relationship between cyclical synchronizations and volatilities. This remains negative, as predicted by the theory. What has changed, however, is the degree of synchronization with the whole euro area, which has increased for some countries (such as Finland) with stabilizing effects, while decreasing in others (such as Greece) with destabilizing effects.

**Table 3** Cyclical correlations with the Euro area

<i>i</i>	$\rho_{i,EU}^{FULL}$	$\rho_{i,EU}^{MAASTRICHT}$	$\rho_{i,EU}^{EURO}$
1. Austria	0.82	0.94	0.79
2. Belgium	0.90	0.90	0.87
3. Finland	0.50	-0.10	0.87
4. France	0.89	0.93	0.85
5. Germany	0.89	0.91	0.95
6. Greece	0.34	0.91	-0.01
7. Ireland	0.54	0.41	0.79
8. Italy	0.89	0.83	0.89
9. Netherlands	0.72	0.58	0.86
10. Portugal	0.84	0.83	0.83
11. Spain	0.94	0.95	0.94
12. Euro Area	1.00	1.00	1.00

$\rho_{i,EU}^P$  is the correlation of country *i*’s output gap with the Euro Area’s output gap over time period *P*. *P* takes the values *FULL* (1991–2009), *MAASTRICHT* (1992–1998), and *EURO* (1999–2009)

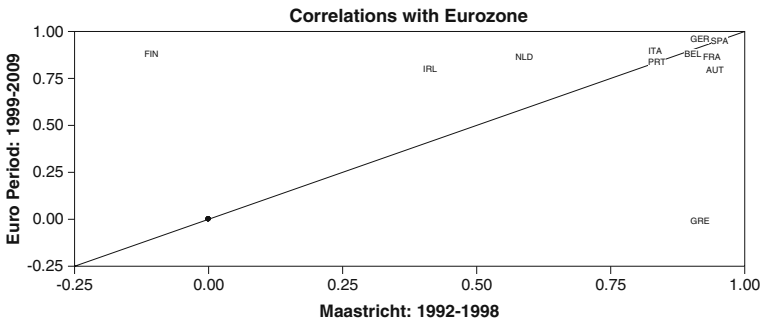


Fig. 6 Correlations of output gaps during Maastricht and Euro periods. (The solid line is the 45° line)

### Conclusions

Perceptions of the euro’s usefulness and desirability have changed dramatically over the last couple of years. The present paper first outlines a simple theoretical model of monetary unification and then uses data from 11 euro members to investigate the common currency’s role in the macroeconomic performance of these countries to determine whether the empirical evidence is consistent with the predictions of the model. The paper’s findings support the following conclusions.

Euro membership has been typically accompanied by either a reduction in inflation (the inflation benefit of monetary integration) or no appreciable change. It has also been generally followed by an increase in business-cycle volatility (the stabilization cost of surrendering monetary independence).

These macroeconomic costs and benefits are often positively related. The best example of this is Greece. It experienced the greatest reduction in inflation since adopting the euro, but also one of the greatest increases in cyclical variability.

The degree of cyclical synchronization with the entire euro area was not greatly affected by the introduction of the euro for the majority of the countries—with the exception of Greece, whose economy became considerably less correlated with the union as a whole. Finland and Ireland also increased their correlation with the euro area.

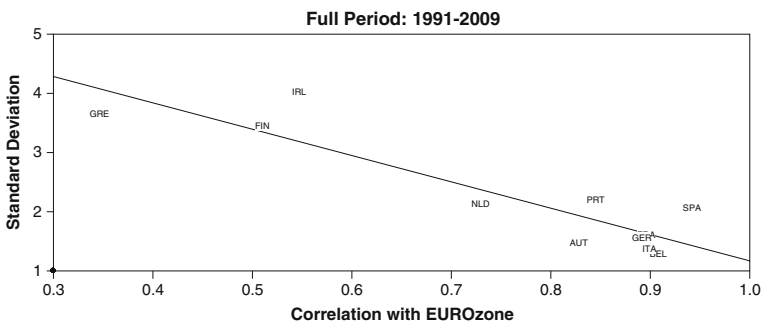


Fig. 7 Volatility vs correlations in the full period. (The solid line is the Regression line)

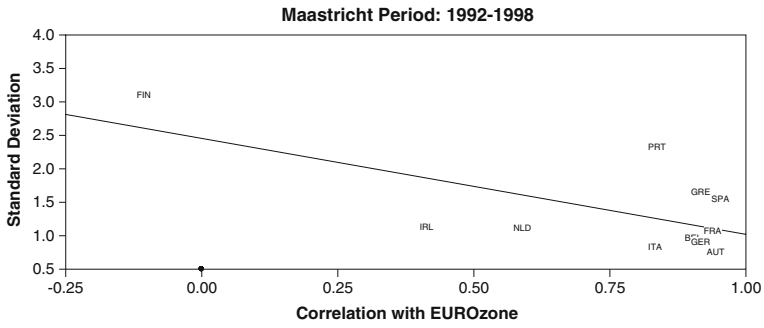


Fig. 8 Volatility vs correlations in the Maastricht period. (The solid line is the Regression line)

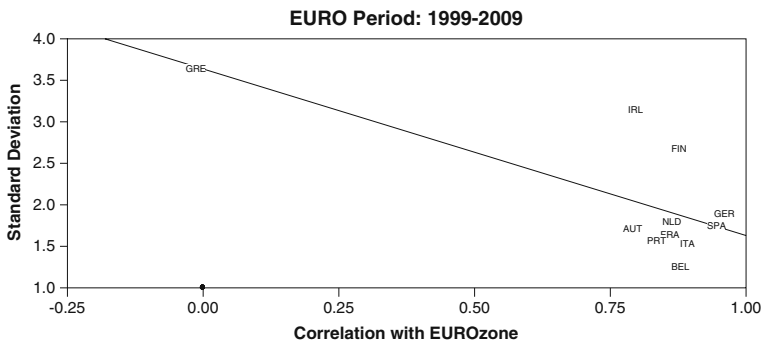


Fig. 9 Volatility vs correlations in the Euro period. (The solid line is the Regression line)

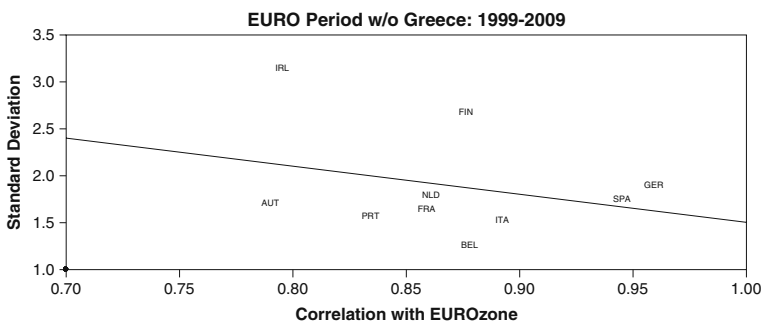


Fig. 10 Volatility vs correlations in the Euro period—Excluding Greece. (The solid line is the Regression line)

Consistent with the theoretical predictions, the empirical evidence shows a strong, negative relationship between cyclical synchronizations and volatilities. This relationship, however, is not much stronger under the euro than it was during the pre-euro Maastricht period.

Overall, the evidence suggests that the introduction of the euro did not fundamentally change the relationship between cyclical correlations with the euro zone and business-cycle volatilities. This remains negative, as predicted by the theory.

What did change, however, is the degree of synchronization with the whole euro area—a change that is theoretically predicted and empirically shown to have serious consequences for economic stability. In particular, this synchronization increased for some countries (such as Finland) with stabilizing effects, while it decreased for others (such as Greece) with obvious destabilizing effects.

A promising avenue for future research would be an exploration of the determinants of this degree of cyclical correlation between individual members of a currency union and the union as a whole.

## Appendix

**Table 4** Variability of output gap by country

$i$	$\sigma_i^{FULL}$	$\sigma_i^{EARLY}$	$\sigma_i^{LATE}$	$\sigma_i^{MAASTRICHT}$	$\sigma_i^{EURO}$
1. Austria	1.47	1.14	1.83	0.75	1.70
2. Belgium	1.27	1.27	1.31	0.96	1.25
3. Finland	3.44	3.16	2.97	3.09	2.67
4. France	1.59	1.60	1.66	1.06	1.64
5. Germany	1.54	1.12	1.93	0.89	1.89
6. Greece	3.63	2.11	3.23	1.64	3.63
7. Ireland	4.01	2.37	3.38	1.12	3.14
8. Italy	1.37	1.18	1.61	0.83	1.52
9. Netherlands	2.11	2.05	1.86	1.10	1.79
10. Portugal	2.19	2.73	1.51	2.32	1.56
11. Spain	2.05	2.14	1.91	1.53	1.75
12. Euro Area	1.51	1.51	1.60	1.12	1.51

$\sigma_i^P$  is the standard deviation of country  $i$ 's output gap over time period  $P$ .  $P$  takes the values *FULL* (1991–2009), *EARLY* (1991–2000), *LATE* (2001–2009), *MAASTRICHT* (1992–1998), and *EURO* (1999–2009)

**Table 5** Cyclical correlations with the Euro area

$i$	$\rho_{i,EU}^{FULL}$	$\rho_{i,EU}^{EARLY}$	$\rho_{i,EU}^{LATE}$	$\rho_{i,EU}^{MAASTRICHT}$	$\rho_{i,EU}^{EURO}$
1. Austria	0.82	0.95	0.77	0.94	0.79
2. Belgium	0.90	0.95	0.86	0.90	0.87
3. Finland	0.50	0.24	0.89	-0.10	0.87
4. France	0.89	0.94	0.85	0.93	0.85
5. Germany	0.89	0.93	0.96	0.91	0.95
6. Greece	0.34	0.83	0.14	0.91	-0.01
7. Ireland	0.54	0.52	0.87	0.41	0.79
8. Italy	0.89	0.91	0.89	0.83	0.89
9. Netherlands	0.72	0.72	0.84	0.58	0.86
10. Portugal	0.84	0.91	0.83	0.83	0.83
11. Spain	0.94	0.97	0.95	0.95	0.94
12. Euro Area	1.00	1.00	1.00	1.00	1.00

$\rho_{i,EU}^P$  is the correlation of country  $i$ 's output gap with the Euro Area's output gap over time period  $P$ .  $P$  takes the values *FULL* (1991–2009), *EARLY* (1991–2000), *LATE* (2001–2009), *MAASTRICHT* (1992–1998), and *EURO* (1999–2009)

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