Authors:
DAVID G. MAYES
Department of Accounting and Finance, University of Auckland, New Zealand and ARENA, University of Oslo, Norway
MARITTA PALOVIITA
Bank of Finland, Helsinki, Finland
MATTI VIRÉN
Bank of Finland, Helsinki, Finland and University of Turku, Finland

EMU AND THE ANCHORING OF INFLATION EXPECTATIONS*

ABSTRACT

This paper provides a new way of assessing the credibility of monetary policy by analyzing the dispersion of inflation-unemployment observations over time, which is both simple and free from ambiguities related to the choice of the Phillips curve specification and modelling of inflation expectations. The analysis uses data from eleven EMU countries and nine non-EMU countries for 1984-1998 and 1999-2013. The dispersion measures use alternative weights for inflation and unemployment and also a simple Misery index. We find that dispersion has decreased during the EMU period but this just mirrors experience in the OECD over the same period.

Keywords: Misery-Index, Inflation, Unemployment, Phillips Curve
JEL Classification: E31, E61

RIASSUNTO

L’Unione Monetaria Europea e l’ancoraggio delle aspettative di inflazione

Questo studio presenta un nuovo metodo per la valutazione della credibilità di una politica monetaria, attraverso l’analisi della dispersione delle osservazioni sul rapporto inflazione-disoccupazione. Questo nuovo metodo è semplice e privo di ambiguità relative alla scelta delle specificazioni della curva di Phillips e dei modelli delle aspettative di inflazione. L’analisi si basa su dati relativi a undici paesi UEM e a nove paesi non-UEM per i periodi 1984-1998 e 1999-2013. Le misure di dispersione usano misure alternative per inflazione e disoccupazione e anche un

* We are grateful to Eero Tölö for help in computations. The opinions expressed in this paper do not necessarily reflect those of the Bank of Finland or Eurosystem.
Indice Misery semplice. I risultati indicano che la dispersione è diminuita durante il periodo UEM, ma questo non è che un riflesso di esperienze simili nell’area OCSE nello stesso periodo.

1. INTRODUCTION

The Eurosystem and the European Central Bank have set a lot of store by the credibility of their approach to monetary policy in comparison to that of others, particularly the US. However, the global financial crisis has proven a major strain to any monetary policy. Our purpose in this article therefore is to appraise the credibility of euro monetary policy since its inception in comparison to that of other similar countries.

A big issue for monetary policy is whether it is credible in the sense that it is generally believed that the policy will achieve its objectives despite the unknown future shocks it will have to face. Such credibility would entail that the future response of policy to shocks can be anticipated and, if the policy is linked to some target values, that people behave as if these targets will be attained. Thus, with an inflation target, for instance, credibility would require that this target is reflected in (long-run) inflation expectations. In particular, if inflation expectations are stable or even constant the normal inference would be that inflation expectations are well-anchored (on the inflation target). Thus in assessing this credibility, the question is how sensitive inflation expectations are to actual inflation and other macroeconomic variables that represent the shocks that monetary policy faces. That sensitivity depends on the way in which the general public forms its expectations and in which way the central bank formulates its objectives and communicates with the general public (cf. Orphanides and Williams (2007) who show that successful communication may decrease the sensitivity).

This issue of expectations’ sensitivity to shocks has been studied in several papers by Demertzis and Viegi (2009), Cruijsen and Demertzis (2011) and Demertzis et al. (2008). Their main concern is the role of central bank inflation target: whether agents base their expectations on this target or whether they form the expectations on the basis of other monetary policy related variables (policy objectives, macro-economic shocks and so on). Empirical evidence in Cruijsen and Demertzis (2011) and Demertzis et al. (2008) suggests that inflation expectations are indeed relatively well anchored on the target both in the United States and in the euro area. Some weakening of expectations was, however, found in US inflation expectations in the more recent data samples.
The analyses made use of survey data on expectations, similar to those used in Paloviita and Viren (2009), who found, in a small VAR model for the euro area countries, that inflation expectations seemed to respond to both actual inflation and output, casting some doubt on the idea of well-anchored expectations. A rather different outcome was reached with studies that used data derived from inflation-indexed financial market instruments (see e.g. Gurkaynak et al., 2010 and Levin et al., 2004). Their analysis showed that various differences exist between the US and European countries and between countries with and without a formal inflation target. A general tendency has been for weaker anchoring of expectations in the US compared with euro area countries and stronger anchoring in the countries with a formal inflation target. This result is also reached in the study by Beechey et al. (2011) who tested the importance of monetary policy, using the surprises in monetary policy decisions and macroeconomic news related to data releases as the control variables. The general finding was that longer-term inflation expectations did not react to such news in the euro area but significant linkages were found in the United States. Why these differences between the United States and Europe are observed is hard to say. It may be explained by the existence of a formal inflation target but other explanations cannot be excluded.

The global financial crisis seems to have affected the way in which inflation expectations change over time. Galati et al. (2011) found that in general inflation expectations have become less firmly anchored during the financial and euro crisis. We might expect that once nominal interest rates reach the ‘zero’ lower bound, the credibility of policy might weaken, as people lack experience in the impact of unusual measures such as quantitative easing (zero in inverted commas, because some central banks have effectively encountered their lower bound at slightly positive rates and because some others, Sweden, Denmark and the euro area, for example, have set slightly negative rates.) The process might also be asymmetric as people may be less confident about central banks’ ability to fight deflation than they are about its revealed ability to fight inflation above the target.

Partly because of these cross-country and cross-period differences and several ambiguities in terms measuring inflation expectations (which are well documented in e.g. Mankiw et al., 2004) we employ an alternative testing strategy here. The strategy boils down to using the conventional idea of an expectations-augmented Phillips curve as a starting point. As is well known, if we do not impose (fully) rational expectations on agents we will have a set of short-run

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1 There are clear asymmetries in the way markets react to monetary policy surprises, both according to the sign of the surprise and according to whether the economy is growing or contracting (Mayes and Wang, 2012).
Phillips curves and the conventional vertical long-run Phillips curve, as illustrated in Figure 1. In this model inflation expectations shift over the course of the economic cycle. (The short-run Phillips curves shift in the same direction as inflation expectations, as observed inflation-unemployment outcomes follow a roughly circular path over the economic cycle: moving first up and to the left. As the economy accelerates above its sustainable rate, unemployment falls and inflation rises.)

**FIGURE 1 - Generating Inflation-Output Observations with a Phillips Curve**

If monetary policy were credible, agents would take the inflation target as granted and would not react to economic news by ‘shifting’ the short-run Phillips curve. Economic news/shocks would obviously show up in different unemployment-inflation combinations along the short-run Phillips curve but the curve itself would not shift. The resulting empirical observations would lie in the dotted ellipse shown in Figure 1, labelled ‘well anchored regime’. Moreover, the dispersion of inflation-unemployment observations would remain relatively small because the curve would not shift. In fact, if we computed the so-called Misery index, originally suggested by Arthur Okun (measuring the combined burden of unemployment and inflation on the economy), the

\[\text{Misery Index} = 0.5 \times (\text{Unemployment Rate} + \text{Inflation Rate})\]

For ease of exposition we have shown a linearized short-run curve.

The Misery index was originally labelled the Economic Discomfort Index. While it was popularized in 1971 by Richard F. Jansen in *The Wall Street Journal* it is interesting to note that none of the articles using it appear to offer a
EMU and the anchoring of inflation expectations

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In this paper, we provide an alternative way of evaluating the credibility of monetary policy and anchoring of expectations by computing a Dispersion index that measures the magnitude of short-run shifts of the Phillips curve. For that purpose, we choose the EMU countries as the application. Thus we scrutinize whether the dispersion of the inflation-unemployment observations (or the distribution of the Misery index) has indeed decreased during the EMU period. As a point of comparison, we use nine OECD countries that do not belong to the EMU to help take account of other factors that also lead to differences in behavior. Two equal length 15-year periods are used in the experiment, 1984-1998 and 1999-2013. In addition to the dispersion measures, we also compute simple expectations augmented Phillips curves to see whether the dispersion measures also show up in the Phillips curve estimates.

All analyses are carried out in the following section and some concluding remarks follow in section 3.

2. ANALYSIS AND RESULTS

2.1 The Basic Data on Inflation and Unemployment

The data are illustrated in Figures 2 (EMU countries) and 3 (control group countries). Inflation is the (national) CPI inflation rate and unemployment, the unemployment rate as it is recorded in the OECD data base. In Figure 2 pre-EMU data are illustrated with blue (solid) lines and EMU data with red (dashed) lines. Overall, the inflation rates are fairly correlated (the average coefficient of correlation $r$ is 0.56) while the unemployment rates are only weakly related over the sample countries ($r_u = 0.21$).

direct citation of where Okun first publicized the idea (http://what-when-how.com/social-sciences/misery-index-social-science/).

4 The Misery index is routinely used in newspapers and other media. In particular, it is used in assessing the political performance of politicians (Barro, 1999) or predicting elections outcomes. Barro (1999) provides an extension of the simple Misery index by adding interest rates and output gap to the formula. A nice exposition of the index and evaluation of its usefulness in different economic regimes is provided by Kuroda (2015).
On the basis of Figures 2 and 3, the following conclusions can be drawn:
- In most countries the dominating feature is the slowdown of inflation which has taken the inflation-unemployment observations closer to the origin.
- There is no common pattern in the unemployment rates. Generally, there has been a decreasing tendency but in Southern Europe the tendency has been strikingly different.
- In the US, the consequences of the financial crisis produce a somewhat similar pattern to that in Southern Europe.

Several countries show the archetypical pattern we might expect of a clockwise circle round a Phillips style relationship in the first period and a flatter relationship in the second period, more along a single line. Germany is a clear example in the euro area and Canada, Denmark, New Zealand, Norway, Sweden and the UK outside it. While on the whole there has been less variance in inflation in the second period, in the euro area there has generally been more variance in unemployment. Changes in unemployment rates may of course reflect factors other than macro variables, i.e. changes in institutions, legislation and structural features. Boeri and Jimeno (2015) provide useful comparisons between EU countries. They suggest that the recent
divergence in labor market outcomes across Europe is the by-product of interactions between country-specific shocks of varying size and nature, and country-specific labor market institutions.

**FIGURE 3 - Inflation-Unemployment Relationships for the Non-EMU Countries**

![Inflation-Unemployment Relationships for the Non-EMU Countries](image)

Note: The unemployment rate in the horizontal and inflation rate in the vertical axis. Scales vary across the countries.

### 2.2 The Dispersion Index

Next, we assess anchoring of inflation expectations by using the Dispersion index, which measures the dispersion of inflation-unemployment observations over time. The index has been computed using the familiar Pythagoras theorem so that distances have been computed for all possible combinations of the observations (cf. (i)). The index value is an average distance between all unemployment-inflation data points. When constructing the index, we do not have to make any assumption how the Phillips curve is specified or expectations formed. The problem
with this measure – and obviously also the problem with the Misery index – is the choice of weights. Do we value inflation and unemployment equally? Assuming equal weights is very arbitrary, rather the weights should be slope of the eventual indifference curve with respect to inflation and unemployment. Some research (Blanchflower et al., 2014) suggests that both variables do indeed lower well-being but unemployment has a much larger effect. In fact, the study suggests that the ratio is as high as 5:1. Thus, from the point of view of preferences, the Misery index is a misleading measure of the well-being effect^5.

In this study, we take this weighting problem into account by adding weights to the Dispersion index (DI) formula so that the all possible combinations between 0 and 1 are calculated. This is done by using (1):

\[
DI = \frac{2}{n(n-1)} \sum_{t \neq t'} \left[ w_u (u_t - u_{t'})^2 + w_\pi (\pi_t - \pi_{t'})^2 \right]
\]

where \(u\) denotes the unemployment rate and \(\pi\) the rate of inflation. \(w_u\) and \(w_\pi\) are the corresponding relative weights (scaled to sum to unity) and \(t\) and \(t'\) are alternative time periods.

In this case \(t\) is 1999-2013 and \(t'\) 1984-1998.

Let us first consider the case where the weights are equal, that is 0.5 and 0.5. Then the outcome of the analysis is quite clear-cut (Table 1 and Figure 4). The value of the Dispersion index was lower in all countries except Ireland, Spain and the US in the second period. Somewhat surprisingly, the measures were also lower in Greece and Portugal due to the dramatically falling inflation (Figure 2)^6. The case of the US was already mentioned: the US is the only country among the control country group where the Dispersion index was higher during the EMU period 1999-2013. We can see from Figures 2 and 4 that there was a clear change in trend in 1998, from a decline through the first period to a rise during the second. Thus one cannot blame everything on the global financial crisis as the rising trend had already been in place for nine years. The US result may be interpreted from the point of view of inflation persistence: if inflation becomes more persistent (inflation is more anchored now than, say, in the early 1980s) the values of the Dispersion index may actually increase (this is what, e.g., Watson (2014) basically argues). It is

^5 There is of course no reason to suppose that the levels of unemployment and inflation totally encapsulate the full extent of economic misery and various attempts have been made to add other factors to the index (Welsch, 2007). However, the original index’s simplicity retains considerable appeal as an indicator.

^6 It is easy to detect the nature of the change between the two periods in the lowest panel of Figure 4, as points on the diagonal show no change in the index, those below show a decrease and those above an increase. Change is limited in most cases but six stand out: rises in Spain and Ireland and falls in Portugal, Finland, New Zealand and Sweden.
obvious that other explanations, such as changing patterns of regional dispersion of unemployment (cf. Wall and Zoega (2004), cannot be excluded).

**Table 1 - Summary of Dispersion and Misery Index Values**

<table>
<thead>
<tr>
<th></th>
<th>AT</th>
<th>BE</th>
<th>FI</th>
<th>FR</th>
<th>GE</th>
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<th>IT</th>
<th>NL</th>
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<tr>
<td><strong>Dispersion index values for different subperiods</strong></td>
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</tr>
<tr>
<td>1 2.774</td>
<td>4.078</td>
<td>2.594</td>
<td>1.504</td>
<td>6.823</td>
<td>3.301</td>
<td>5.852</td>
<td>3.258</td>
<td>1.849</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 1.213</td>
<td>1.591</td>
<td>1.958</td>
<td>0.986</td>
<td>2.065</td>
<td>1.406</td>
<td>1.908</td>
<td>2.021</td>
<td>2.649</td>
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</tr>
<tr>
<td><strong>Mean value of the Misery index values for different subperiods</strong></td>
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</table>

For the Dispersion index, there is equal weighting for inflation and unemployment. In the first column, 1 denotes 1984-1998 and 2 1999-2013.
**FIGURE 4 - Change in the Equal Weights Dispersion Index over Time**
It is interesting to notice that, in Germany, the Dispersion index has been practically the same on average in both periods. From the Phillips curve perspective this could be interpreted as evidence for the argument that the ECB has just been following the Bundesbank policy rule and hence inflation expectations have not changed at all in Germany (the major shift for Finland, Sweden and, to a lesser extent, Norway reflects the consequences of their financial crises in the pre-EMU period.)

If we turn to variability, Table 2, there has been less reduction in the standard deviation for the euro area countries on average between the two periods than there was for the control group. However, the contribution of the more extreme cases is revealed by the comparison of medians, where the decline is now a little greater in the euro area case. Just Greece, Ireland, Portugal and Spain show clear increases in variability in the second period, although Italy also shows greater variation in unemployment.

All previous analyses have been carried out by using equal (0.5, 0.5) weights for inflation and unemployment but how does weighting affect the value of the Dispersion index? It is obvious that weighting only makes a difference for the EMU countries, in the sense that the curves in
Figure 5 cut each other. If they remain uniformly above or below each other, then it does not matter what weights are used, the direction of change is the same, although in some cases the extent of the difference varies considerably - Finland and New Zealand, for example. Thus the ranking of index values for 1984-1998 and 1999-2013 changes along with the weights in Germany, Greece, Italy, Netherlands, Portugal and Spain. If the unemployment rate is weighted more, the recent increase in the unemployment rates dominates the general outcome suggesting that the dispersion has indeed increased.

**FIGURE 5 - Dispersion Index with Different Weight Parameters in Sample Countries**

**EMU Countries**

- **Austria**
- **Belgium**
- **Finland**
- **France**
- **Germany**
- **Greece**
- **Ireland**
- **Italy**
- **Netherlands**
- **Portugal**
- **Spain**

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7 Note that because of the form of (1) no complex transitions are possible.
FIGURE 5 continued

Non-EMU countries

![Figure 5 continued showing various countries](image)

**Table 2 - Change in Dispersion Index Values Over Time**

<table>
<thead>
<tr>
<th></th>
<th>Equal weights</th>
<th>Using all weights between 0 and 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td><strong>Euro area</strong></td>
<td>-0.687</td>
<td>-0.794</td>
</tr>
<tr>
<td><strong>Other countries</strong></td>
<td>-1.770</td>
<td>-1.560</td>
</tr>
</tbody>
</table>

Values are average and median changes in the Dispersion index between 1984-1998 and 1999-2013.

Thus, the general outcome for the EMU countries does not look so favorable compared with the control group countries (Table 2). The Dispersion index has decreased much more in the Non-EMU set of countries even in the case we use the median values of all the possible combinations of the weights.
2.3 The Misery Index

The Misery index (MI) is obtained simply by adding the values of inflation and unemployment, i.e.

\[ M_t = u_t + \pi_t. \]  

The Misery index is different from the Dispersion index by construction, the main practical difference being in the fact that the Misery index, unlike to the Dispersion index, does not take into account changes in the inflation–output combinations (Table 3). Thus, the index can have high (or low) values even though inflation and unemployment stayed same for a long period of time.

<table>
<thead>
<tr>
<th>Table 3 - Values of the Standard Deviation of the Misery Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Euro area 1984-1998</td>
</tr>
<tr>
<td>Euro area 1999-2013</td>
</tr>
<tr>
<td>Other countries 1984-1998</td>
</tr>
<tr>
<td>Other countries 1999-2013</td>
</tr>
</tbody>
</table>

It is interesting to compare the sample average values for different countries. The mean values of the Misery index for periods 1 and 2 are rather highly correlated (cor. = 0.93 over all sample countries) while correlation is much lower with the Dispersion index (cor. = 0.48). The two indexes are only weakly correlated: for the pre- and post-EMU period the correlation coefficients for cor(MI,DI) = 0.40 and 0.77. Somewhat surprisingly, changes in the two indexes are negatively correlated (cor. = -0.27) mainly due to the fact that the Dispersion index values for the crisis countries Greece, Spain, Portugal, and Ireland change much more than the corresponding Misery index values. In this respect, it would be advisable to use the Dispersion index as a summary statistic. The problem is that we have only sample average values for the Dispersion index while the Misery index can be easily computed for all periods and frequencies.
The path of the Misery index is shown for all countries in Figure 6. There is quite a lot of variety in the performance across the countries, although it is clear that on average (unweighted) misery fell progressively during the years up to the formation of the euro area, with a slightly bigger decline in the euro area countries. From then onwards there was no clear further improvement (see also the lower panel of Table 1). Once the global financial crisis hits there is a small uptick but in the euro area there is much stronger worsening from 2010 onwards, once the sovereign debt crisis has its effect. The really striking increases in the last period are in Spain and Greece. Clearly there are two concerns here from the perspective of the credibility of monetary policy.
The first is simply, taking the period as a whole, whether misery seems to have fallen. The second is whether it has been more stable and the graphs for each individual country, shown in Figure 7 for the mean value of the Misery index, illustrate that the averages can obscure strong movements within the periods.

2.4 Other Sources of Difference

However, implicitly assigning all the improvement in the second period to the framework for monetary policy is clearly heroic. We could alternatively seek to judge how much the change was due to a difference in the economic conditions to which monetary policy had to respond. Ideally we would be able to test for this using a straightforward difference in differences approach but with our small sample this has to be a rather crude exercise.

As a first step we can provide a simple macro-economic explanation of each value of the Misery index across the whole of our sample of countries in each time period. The values of the Misery index seem to correlate substantially with such macro variables as government indebtedness, level of long-term interest rates, export competitiveness, but, if we use these variables as controls, a dummy variable for EMU membership fails to become significant when both cross-section and period fixed effects are introduced into the model (Table 4).
TABLE 4 - Estimates of a Misery Index Equation

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>1.775</td>
<td>3.473</td>
<td>3.953</td>
<td>5.336</td>
<td>-0.301</td>
</tr>
<tr>
<td></td>
<td>(1.88)</td>
<td>(4.32)</td>
<td>(3.92)</td>
<td>(5.47)</td>
<td>(0.45)</td>
</tr>
<tr>
<td>ex rate</td>
<td>0.012</td>
<td>0.029</td>
<td>0.021</td>
<td>0.015</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td>(1.36)</td>
<td>(3.75)</td>
<td>(2.56)</td>
<td>(1.76)</td>
<td>(4.84)</td>
</tr>
<tr>
<td>debt</td>
<td>0.009</td>
<td>0.012</td>
<td>0.018</td>
<td>0.017</td>
<td>-0.005</td>
</tr>
<tr>
<td></td>
<td>(1.92)</td>
<td>(1.95)</td>
<td>(3.01)</td>
<td>(3.32)</td>
<td>(1.15)</td>
</tr>
<tr>
<td>interest rate</td>
<td>0.825</td>
<td>0.472</td>
<td>0.455</td>
<td>0.385</td>
<td>-0.030</td>
</tr>
<tr>
<td></td>
<td>(14.51)</td>
<td>(9.94)</td>
<td>(5.38)</td>
<td>(4.62)</td>
<td>(0.76)</td>
</tr>
<tr>
<td>EMU</td>
<td>3.421</td>
<td>-0.023</td>
<td>0.002</td>
<td>-26.887</td>
<td>0.205</td>
</tr>
<tr>
<td></td>
<td>(8.80)</td>
<td>(0.07)</td>
<td>(0.00)</td>
<td>(6.83)</td>
<td>(1.07)</td>
</tr>
<tr>
<td>Lagged Misery index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.792</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>(20.02)</td>
</tr>
<tr>
<td>fixed effects</td>
<td>none</td>
<td>cross section</td>
<td>cross section + period</td>
<td>cross section + period</td>
<td>cross section + period</td>
</tr>
<tr>
<td>R²</td>
<td>0.428</td>
<td>0.745</td>
<td>0.801</td>
<td>0.823</td>
<td>0.933</td>
</tr>
<tr>
<td>SEE</td>
<td>3.373</td>
<td>2.528</td>
<td>2.281</td>
<td>2.167</td>
<td>1.275</td>
</tr>
<tr>
<td>DW</td>
<td>0.26</td>
<td>0.46</td>
<td>0.45</td>
<td>0.54</td>
<td>1.75</td>
</tr>
</tbody>
</table>

The estimated equation in column 4 also includes interaction terms with the EMU dummy (the respective coefficients are with the ex rate 0.243 (6.64), debt 0.031 (2.99) and interest rate 0.245 (1.23)). Numbers in parentheses are corrected t-values. The “ex rate” variable is indexed so that an increase denotes appreciation.

The same is true when the lagged Misery index variable is included into the estimating equation. We find however that interaction terms with the EMU dummy are highly significant (the F-statistic for the three interaction terms turned out to be F(3,544) = 17.58 with marginal probability of 0.000). The individual coefficients indicate that in the euro area, all three variables have a bigger effect on the values of Misery index than outside the euro area. In particular, we find the real exchange rate effect very large and highly significant. Thus, we have

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8 A somewhat similar effect was obtained with a cross-section regression where the difference of the dispersion index over the sub-sample periods was explained with these background variables. None of the interaction terms were significant, however (either individual or jointly), and the results are not reported here.
little evidence that would justify an argument that just EMU membership has stabilized the Phillips curve. 
As a second step, we therefore carried out an experiment where we ran a set of regressions for the difference between the (unweighted) average value of the Dispersion index for the second and first period using similar explanatory variables including first period average values of the government debt/GDP ratio, government deficit/GDP ratio, the long-term interest rate, the export competitiveness indicator (the nominal exchange rate in relation to the PPP), and the EMU membership indicator. All of these might have been expected to give an indication of the degree of pressure the economy was under in the two periods and hence help to explain at least some of the change in misery, given the success of the previous model. However, it turned out that none of these variables was statistically significant. Of particular note is that this was true for the EMU dummy itself. When we reversed the procedure and used the remainder of the same set of variables to explain the change of long-term interest rates over these two periods, the coefficient of the EMU dummy was again far from being statistically significant.

Thus while we are able to demonstrate that macroeconomic variables have more of an effect on the Misery index in the euro area than in the control countries, we are not able to use these variables to explain the difference in the Misery index between the periods before and after EMU, or indeed to demonstrate that the differences in the two differences were themselves significantly different.

### 2.5 A Simple Phillips Curve

As a final step, we estimated a simple ‘static expectations augmented’ Phillips curve of the type:

\[
\Delta \pi_t = \alpha_i u_{it} + \beta_i EMU^i u_{it} + \varepsilon_{it}, \quad i = 1, \ldots, 20, \quad (3)
\]

with the panel data of the two subsamples of countries where EMU is a dummy for the years 1999-2004 (for Greece 2002-2013). The idea is simply to scrutinize the impact of the EMU

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9 As an alternative, we used differences of these variables but that did not change the results.
10 The estimated regression equation for the relative change of the dispersion index turned out to be: \( \triangle (\text{dist}) = -0.51 - 0.07u_{it} + 0.01\Delta \) Debt with \( t_0 = 1.71, t_1 = 0.04 \) and \( t_2 = 1.70, R^2 = 0.16. \)
11 For the use of this kind of short-cut equation see e.g. QREA (2014). See also Ball and Mankiw (2002) who evaluate the usefulness of this kind of equation from the point of view NAIRU estimates. They point out that if inflation is close to a random walk (as it has been in recent years) forecasting future inflation with past inflation, as is assumed by adaptive expectations, is not far from rational. This difficulty is well documented in e.g. Garnier et al. (2015).
period on the slope of the Phillips curve. The estimates are reported in Table 5 and the coefficients for individual countries in Figure 8. For both set of countries, the EMU period is different but the curves for the EMU countries and non-EMU countries are strikingly similar. In both cases, the slope of the Phillips curve has decreased a lot making the curve much flatter, which has been observed also in numerous other studies\textsuperscript{12}. Of course, the results are conditional on the specific type of the curve and specific way of treating inflation expectations\textsuperscript{13}. Still they open the door to the possibility that the short-run Phillips curves have changed so that we cannot base our argument on the raw figures anymore. Mavroeidis \textit{et al.} (2014) give some indirect evidence of this by demonstrating that the recent estimates of the New Keynesian Phillips curve have very little in common with their predecessors\textsuperscript{14}. It is an open question why we get this amount of heterogeneity in results: are they identification problems or other specification problems or are they data sample (stability) problems?

\begin{table}[h]
\centering
\caption{Some Estimates of an Expectations Augmented Phillips Curve}
\begin{tabular}{lccc}
\hline
 & Euro area & Other countries & All 20 \\
\hline
$u$ & -0.060 & -0.061 & -0.052 \\
 & (5.17) & (2.79) & (5.55) \\
$EMU^u$ & 0.045 & 0.055 & 0.037 \\
 & (5.17) & (1.83) & (2.13) \\
$R^2$ & 0.036 & 0.0025 & 0.027 \\
$SEE$ & 1.63 & 1.61 & 1.62 \\
$DW$ & 2.00 & 2.47 & 2.19 \\
\hline
\end{tabular}
\end{table}

Corrected t-ratios inside parentheses. According to the Wald test, the two county-set equations (columns 2 and 3) do not have different parameters: $\chi^2(2) = 4.4$. EMU is a dummy variable taking the value 1 during 1999-2013 and 0 otherwise; $u$ is the unemployment rate as a percentage.

\textsuperscript{12} For the EMU period, the slope is the sum of the coefficients on $u$ and $EMU^u$, which remains negative in all cases.

\textsuperscript{13} Casual empiricism based on Figures 2 and 3 suggests that linearization is a reasonable starting point.

\textsuperscript{14} Over time, there are several other studies that have arrived at the same conclusion (see e.g. Zhu, 2005) with quite destructive results.
3. CONCLUSIONS

This paper assesses the relative strength of Economic and Monetary Union in Europe in anchoring inflation expectations by comparing changes in the dispersion of inflation-unemployment observations to corresponding changes in non-euro countries within the OECD. This comparison is carried out by allowing different weights for inflation and unemployment in computing the Dispersion index. The fact that the dispersion of inflation and unemployment combinations in the euro area has decreased might seem to support the hypothesis that EMU has improved the anchoring of expectations but the fact that the dispersion has decreased much more in the control group of countries suggests that EMU has achieved nothing unusual in this
regard. We were not able to attribute the change in the Misery index purely to other macroeconomic variables, so this does leave an improvement in the credibility of monetary policy as a possible explanation.

There are many possible explanations for the failure to find a stronger result for the impact of EMU in this analysis. The euro crisis after 2009 is the most obvious one, but there are many others such as structural reforms in the labor markets, changing exchange rate arrangements and so on. These may work through the slopes of the Phillips curves which in turn makes interpretation of empirical findings somewhat difficult. Needless to say, more analysis is needed.

REFERENCES


