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The EMU and the anchoring of inflation expectations?

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Matti Viren*

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ABSTRACT

It has been argued that one advantage of EMU in the EU has been an improvement in the credibility of monetary policy. This paper provides a new way of assessing the credibility of monetary policy by analyzing the dispersion of inflation–unemployment observations over time. In this way, we may reveal whether the short run Phillips curves have shifted due to changes in inflation expectations. This way of analyzing the anchoring of inflation expectations is both simple and free from ambiguities that are 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 that are used as points of comparison. The sample periods are 1984-1998 and 1999-2013. The analysis is based on dispersion measures where we use alternative weights for inflation and unemployment and also on a simple Misery index which is just a sum of inflation and unemployment values. The general outcome of the paper is that dispersion (and the Misery index) has decreased during the EMU period. The decrease has, however, been smaller than in control group countries. This implies that while the credibility of monetary policy may have increased under EMU, this just mirrors the general experience in the OECD over the same period.

JEL Classification: E31, E61

Keywords: Misery-index, inflation, unemployment, Phillips curve

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1. Introduction

A big issue in monetary policy is the question of whether the policy is credible. In more concrete terms this means whether the future path of policy can be anticipated and, if the policy is linked to some target values, that these are taken seriously. 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 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 has been studied in several papers by Demertzis and Viegli (2009) and Cruiksen and Demertzis (2011) and Demertzis et al. (2008). The 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 shocks and so on). Empirical evidence in Cruiksen and Demertzis (2011) and Demertzis et al. (2008) suggests that inflation expectations are indeed relatively well anchored 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 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 certain differences exist between the US and European countries and between countries with and without a formal inflation target. A general tendency has been weaker anchoring of expectation 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 recent 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 we find these differences between the United States and Europe is hard to say. It may be explained by the existence of a formal inflation target but other explanations cannot be excluded.

The 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 that 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 and Denmark, 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 have here an alternative testing strategy in our mind. 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 Phillips curve and the conventional vertical long-run Phillips curve illustrated in Figure 1.¹ (The short-run 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>

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 dispersion of inflation--

¹ For ease of exposition we have shown a linearized short-run curve.

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,² (measuring the combined burden of unemployment and inflation on the economy) the dispersion of the values would be even smaller because an decrease in the unemployment rate would be partially offset by an increase in inflation (in fact, if the Misery index used weights for inflation and the unemployment rate and weights which were just equal to the slope of the Phillips curve, the Misery index would in this case be completely constant).³

In this paper, we provide an alternative way of evaluating the credibility of monetary policy and anchoring of expectation 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 behaviour. 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). The inflation is the (national) CPI inflation rate and unemployment the unemployment rate as it is recorded in the OECD data base. Pre-EMU data are illustrated with blue (solid) lines and

² 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 direct citation of where Okun first publicised the idea (<http://what-when-how.com/social-sciences/misery-index-social-science/>).

³ 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).

EMU data with red (dashed) lines. Overall, the inflation rates are rather correlated (the average coefficient of correlation r_π is 0.56) while the unemployment rates are only weakly related over the sample countries ($r_u = 0.21$).

<Figure 2>

<Figure 3>

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 labour market outcomes across Europe is the by-product of interactions between country-specific shocks of varying size and nature, and country-specific labour market institutions.

2.2 *Weights*

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. 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 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.⁴

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):

$$DI = \frac{2}{n(n-1)} \sum_{t \neq t'} \sqrt{w_u(u_t - u_{t'})^2 + w_\pi(\pi_t - \pi_{t'})^2} \quad (1)$$

where u denotes the unemployment rate and π the rate of inflation. w_u and w_π are the corresponding relative weights (scaled to sum to unity) and t and t' are alternative time periods. However, we begin with the case of equal weights.

2.3 *The misery index*

<Figure 4>

<Figure 5>

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

$$M_t = u_t + \pi_t. \quad (2)$$

The path of the Misery index is shown for all countries in Figure 4. There is quite a lot of variety in the performance across the countries, although from Figure 5, 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. From then onwards there was no clear further improvement. Once the global financial crisis hits there is a small up tick 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.

⁴ 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.

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 4 show that the averages can obscure strong movements within the periods.

<Table 1>

<Figure 6>

The outcome of the analysis is quite clear-cut. In the case of equal weights (Table 1 and Figure 6), 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 but that is due to the dramatically falling inflation (Figure 6b and Figure 2).⁵ The case of the US was already mentioned: the US is the only country among the control country group where dispersion index was higher during the EMU period 1999-2013. We can see from Figure 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). Obvious, other explanations, such as changing patterns of regional dispersion of unemployment (cf. Wall and Zoega (2004)) cannot be excluded.

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.)

<Table 2>

⁵ It is easy to detect the nature of the change between the two periods in Figure 6b, 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.

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.

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.

<Table 3>

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 (Table 3). This is even more true, when both cross-section and period fixed effects were introduced into the model. In that case we find 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.⁶ Thus, we have little evidence that would justify an argument that just the EMU membership has stabilized the Phillips curve.

As a second step, we therefore carried out an experiment where we ran a set of regressions

⁶ A somewhat similar effect was obtained with a cross-section regression where the difference of 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.

for the difference between the (unweighted) average value of 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.⁷ 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.⁸

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 *Using the range of weights*

<Table 4>

<Figure 7>

Now we turn to results over the whole range of weights for the dispersion index. It is clear that weighting only makes a difference for the EMU countries, in the sense that the curves in Figure 7 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, as in the cases of Finland and New Zealand, for example.⁹ Thus the ranking of index values for 1984-1998 and 1999-2013

⁷ As an alternative, we used differences of these variables but that did not change the results.

⁸ The estimated regression equation for the relative change of the dispersion index turned out to be: $\Delta(\text{dist}) = -0.51 - 0.07\text{EMU} + 0.01\Delta\text{Debt}$ with $t_0 = 1.71$, $t_1 = 0.04$ and $t_2 = 1.70$, $R^2 = 0.16$.

⁹ Note that because of the form of (1) no complex transitions are possible.

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.

Thus, the general outcome for the EMU countries does not look so favourable compared with the control group countries (Table 3). The dispersion index has decreased much more in the latter set of countries even in the case we use the median values of all the possible combinations of the weights.

2.6 *A simple Phillips curve*

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

$$\Delta\pi_t = \alpha_i u_{it} + \beta_i EMU * u_{it} + \varepsilon_{it}, i = 1, \dots, 20, \quad (3)$$

with the panel data of the two subsamples of countries where EMU is a dummy for years 1999-2004 (for Greece 2002-2013)¹⁰. The idea is simply to scrutinize the impact of the EMU 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 (a bit more clearly for the euro countries). In both cases, the slope of the Phillips curve has decreased a lot making the curve much flatter.¹¹ Of course, the results are conditional to the specific type of the curve and specific way of treating inflation expectations.¹² 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. The recent study by Mavroeidis et al. (2014) gives some indirect evidence of this by demonstrating that the recent estimates of the New Keynesian Phillips curve have very little in common with their predecessors¹³. It is an open question why we get this amount of heterogeneity in

¹⁰ 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 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).

¹¹ For the EMU period, the slope is the sum of the coefficients on u and $EMU * u$, which remains negative in all cases.

¹² Casual empiricism based on Figures 2 and 3 suggests that linearization is a reasonable starting point.

¹³ Over time, there are several other studies that have arrived at the same conclusion (see e.g. Zhu 2005) with

results: are they identification problems or other specification problems or are they data sample (stability) problems?

<Table 5>

<Figure 8>

3. Conclusions

This paper assesses the relative strength of the European Monetary Union 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 labour 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:

Ball, L. and N. G. Mankiw. (2002) "The NAIRU in Theory and Practice." *Journal of Economic Perspectives* 16(4), 115-136.

Barro, R. (1999) Reagan Vs. Clinton: Who's The Economic Champ? *Businessweek Archives*. February 21.

Beechey, M., Johanssen, B., and A. Levin (2011) Are Long-Run Inflation Expectations Anchored more firmly in the Euro area than in the United States? *American Economic Journal: Macroeconomics* 3, 104-129.

quite destructive results.

- Blanchflower, D., Bell, D., Montagnoli, A., and M. Moro (2014) The happiness tradeoff between unemployment and inflation. Forthcoming in *Money, Credit and Banking*.
- Boeri, T. and J. Jimeno (2015) The unbearable divergence of unemployment in Europe. *Documentos de Trabajo*, Banco de España No. 1534.
- Cruijsen, van der C. and M. Demertzis (2011) How Anchored Are Inflation Expectations in EMU Countries? *Economic Modelling* 28, 281-288.
- Demertzis, M., and N. Viegi. (2009). Inflation Targeting—A Framework for Communication, *The B.E. Journal of Macroeconomics* 9(1): 1-32.
- Demertzis, M., Macellino and N. Viegi (2008) A Credibility Proxy: Tracking US Monetary Developments, *The B.E. Journal of Macroeconomics* 12(1): 1-33.
- Galati, C., S. Poelhekke, and C. Zhou (2011) Did the Crisis Affect Inflation Expectations? *International Journal of Central Banking*, 7: 167-207.
- Garnier, G., E. Mertens, and E. Nelson (2015) Trend Inflation in Advanced Economies, *International Journal of Central Banking*, Vol. 11, Supplement 1, 65-136.
- Gurkaynak, R., A. Levin, and E. Swanson. (2010). Does Inflation Targeting Anchor Long-Run Inflation Expectations? Evidence from the U.S., U.K. and Sweden, *Journal of the European Economic Association*, 8 (6): 1208-42.
- Kuroda, H. (2015) Some Reflections on Unemployment and Inflation (*Speech at the ECB Forum on Central Banking Held in Sintra, Portugal*). Available at https://www.boj.or.jp/en/announcements/press/koen_2015/data/ko150524a1.pdf
- Levin, A., F. Natalucci, and J. Piger. 2004. The Macroeconomic Effects of Inflation Targeting, *Review* (Federal Reserve Bank of St. Louis) 86 (4): 51-80.
- Mankiw, G., Reis, R. and J. Wolfers (2004) Disagreement about Inflation Expectations, in *NBER Macroeconomics Annual 2003*, in M. Gertler and K. Rogoff, eds., NBER, 209-248.
- Mavroeidis, S., Plagborg-Møller, M., and J. Stock (2014) Empirical Evidence on Inflation Expectations in the New Keynesian Phillips Curve. *Journal of Economic Literature*, 52(1): 124-188.
- Orphanides, A. and J.C. Williams (2007). Robust monetary policy with imperfect knowledge, *Journal of Monetary Economics*, 54(5): 1406-1435.
- Paloviita, M., and M. Viren (2009) “The role of Expectations in the Inflation Process in the Euro Area, in (P. Sinclair, ed.) *Inflation Expectations*, Routledge, 140-157.
- QREA (2014) *Quarterly Report on the Euro Area* (QREA), Vol. 13, No 3 (2014). http://ec.europa.eu/economy_finance/publications/qr_euro_area/2014/pdf/qrea3_section_2_en.pdf
- Wall, H. and G. Zoega (2014) U.S. Regional Business Cycles and the Natural Rate of Unemployment. Federal Reserve Bank of St. Louis *Review*, January/February 2004, 86(1), 23-31.
- Watson, M. (2014) Inflation Persistence, the NAIRU, and the Great Recession. *American Economic Review* 104(5), 31-36.
- Welsch, H. (2007) “Macroeconomics and Life Satisfaction: Revisiting the ‘Misery Index’”, *Journal of Applied Economics* 10(2), pp.237-51.

Zhu, F. (2005) “The fragility of the Phillips curve: A bumpy ride in the frequency domain”. BIS Working Paper 183.

Table 1 Summary of Dispersion index values

	Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Neths.	Portugal	Spain
1	1.646	2.440	6.682	2.481	2.395	6.866	3.966	3.030	1.9884	8.137	4.172
2	1.196	1.562	1.997	1.345	2.372	6.046	6.013	2.236	1.726	4.819	6.927
	Australia	Canada	Denmark	Japan	New Z	Norway	Sweden	UK	US		
1	4.078	2.774	2.594	1.504	6.823	3.301	5.852	3.258	1.849		
2	1.591	1.213	1.958	0.986	2.065	1.406	1.908	2.021	2.649		

There is equal weighting for inflation and unemployment. In the first column, 1 denotes 1984-1998 and 2 1999-2013.

Table 2 Values of the standard deviation of the misery index

	Average	Median
Euro area 1984-1998	2.93	2.82
Euro area 1999-2013	2.45	1.80
Other countries 1984-1998	2.09	1.98
Other countries 1999-2013	1.20	1.19

Table 3 Estimates of a misery index equation

	1	2	3	4	EMU*4
c	1.775 (1.88)	3.473 (4.32)	3.953 (3.92)	5.336 (5.47)	
ex rate	0.012 (1.36)	0.029 (3.75)	0.021 (2.56)	0.015 (1.76)	0.243 (6.64)
debt	0.009 (1.92)	0.012 (1.95)	0.018 (3.01)	0.017 (3.32)	0.031 (2.99)
interest rate	0.825 (14.51)	0.472 (9.94)	0.455 (5.38)	0.385 (4.62)	0.245 (1.23)
EMU	3.421 (8.80)	-0.023 (0.07)	0.002 (0.00)	-26.887 (6.83)	..
fixed effects	none	cross section	cross section + period	cross section + period	
R2	0.428	0.745	0.801	0.823	
SEE	3.373	2.528	2.281	2.167	

The last column reports the estimates of the interaction terms of equation 4 (column 4 in the Table). Numbers in parentheses are corrected t-values. “ex rates” variable is indexed so that an increase in ex rate denotes a loss of competitiveness.

Table 4 Decrease in Dispersion index values in the two data sets

	Equal weights		All weights between 0 and 1	
	Mean	Median	Mean	Median
Euro area	0.687	0.794	0.678	0.547
Other countries	1.770	1.560	1.712	1.433

Values are average and median changes in the Dispersion index between 1984-1998 and 1999-2013 (positive values indicate smaller dispersion during the latter period).

Table 5 Some estimates of an expectations augmented Phillips curve

	Euro area	Other countries	All 20
u	-0.060 (5.17)	-0.061 (2.79)	-0.052 (5.55)
EMU*u	0.045 (5.17)	0.055 (1.83)	0.037 (2.13)
R2	0.036	0.0025	0.027
SEE	1.63	1.61	1.62
DW	2.00	2.47	2.19

Corrected t-ratios inside parentheses. According to the Wald test, the two subsample equations 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.

Figure 1 Generating - inflation output observations with a Phillips curve

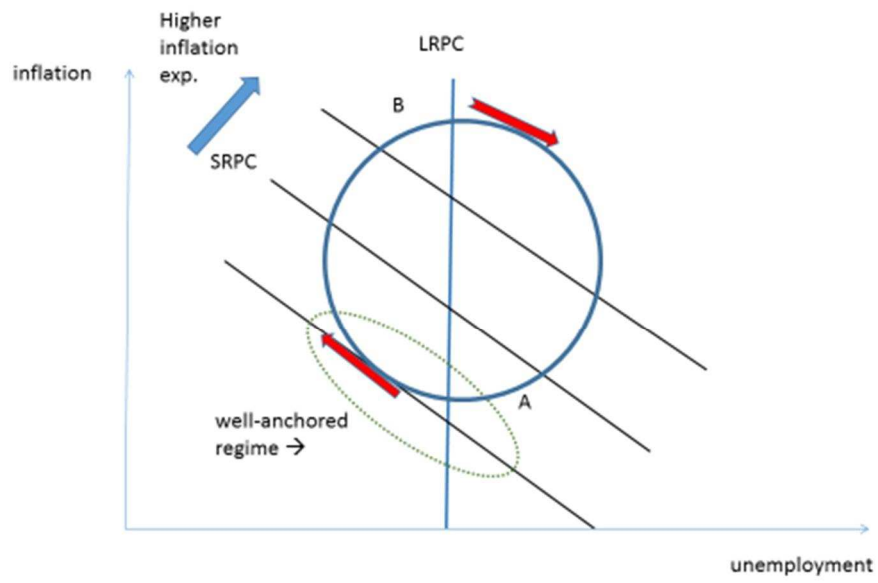
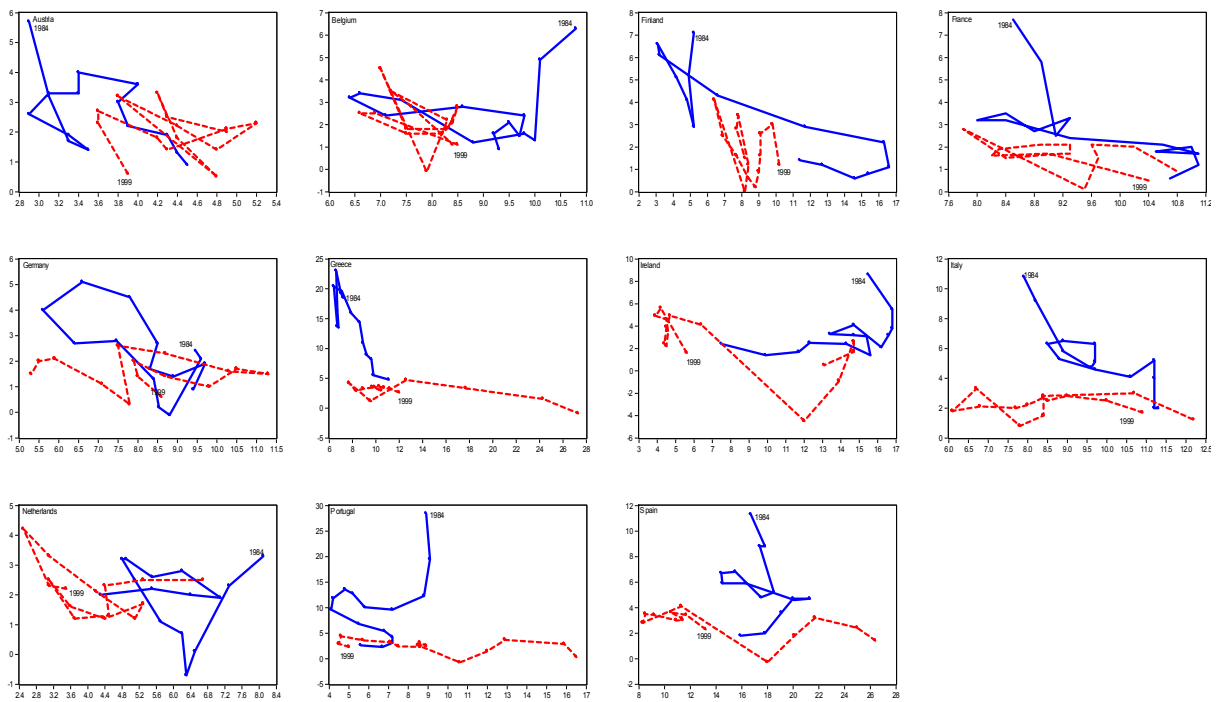
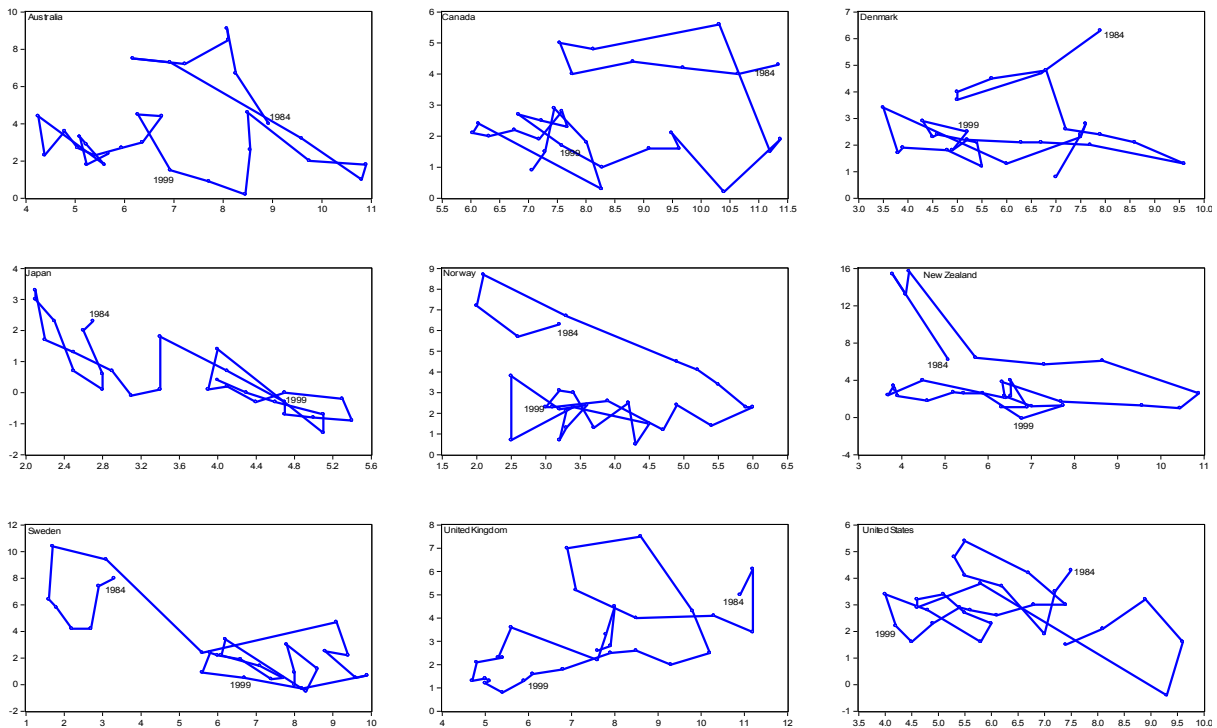


Figure 2. Inflation-unemployment relationships for the EMU countries.

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

Figure 3. Inflation-unemployment relationships for the non-EMU countries.

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

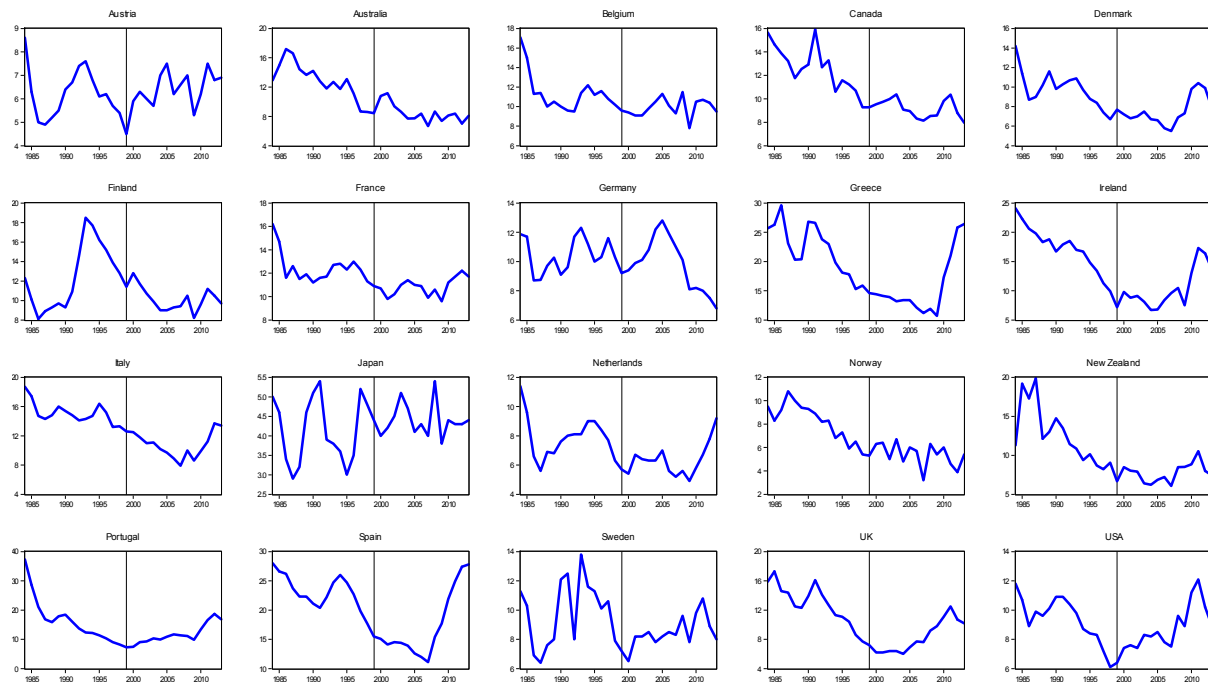
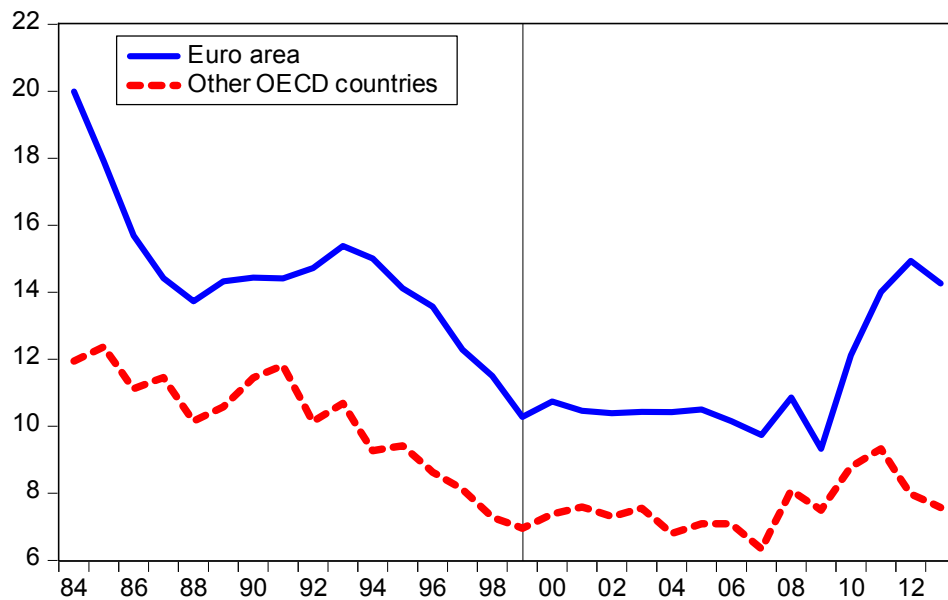
Figure 4 The misery index in the sample countries.**Figure 5 Mean values of misery indices**

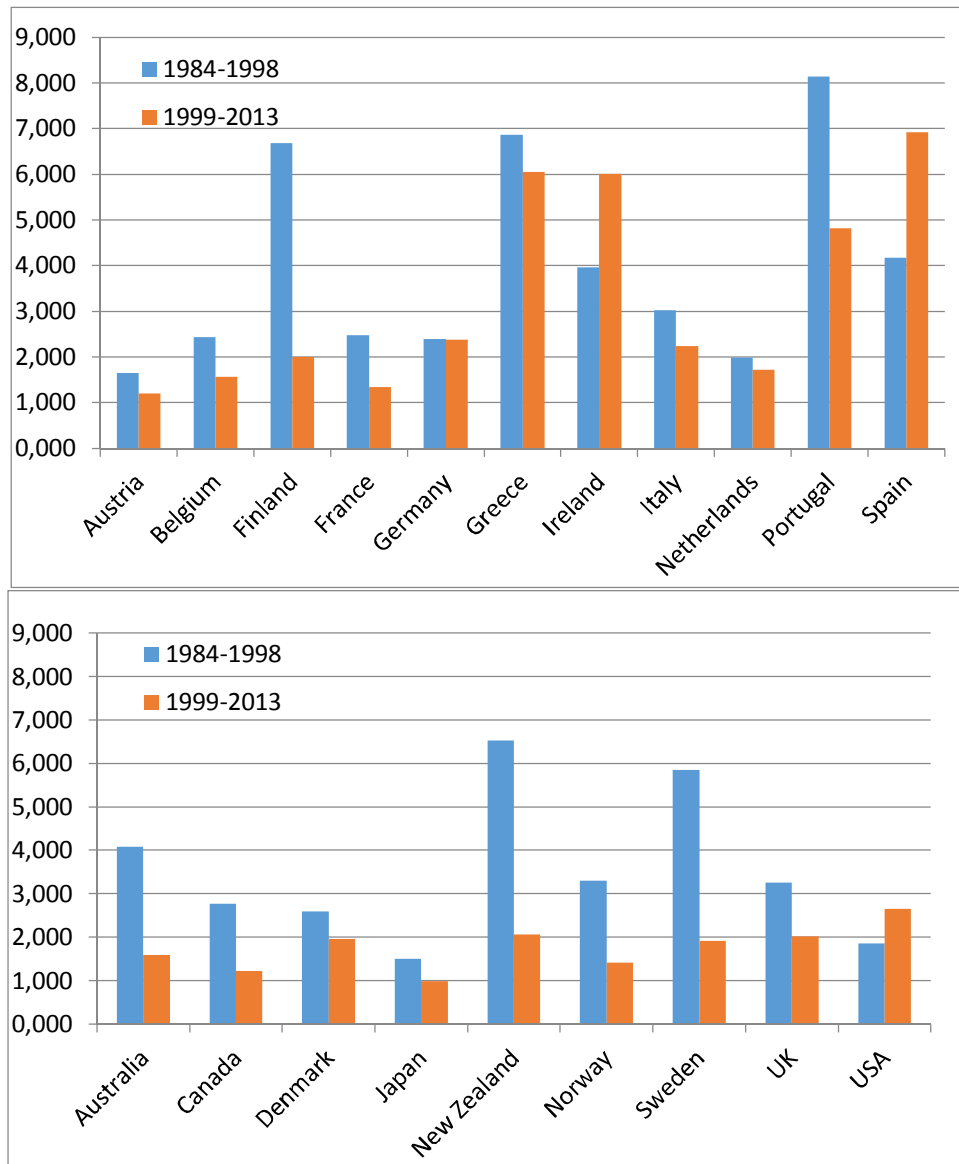
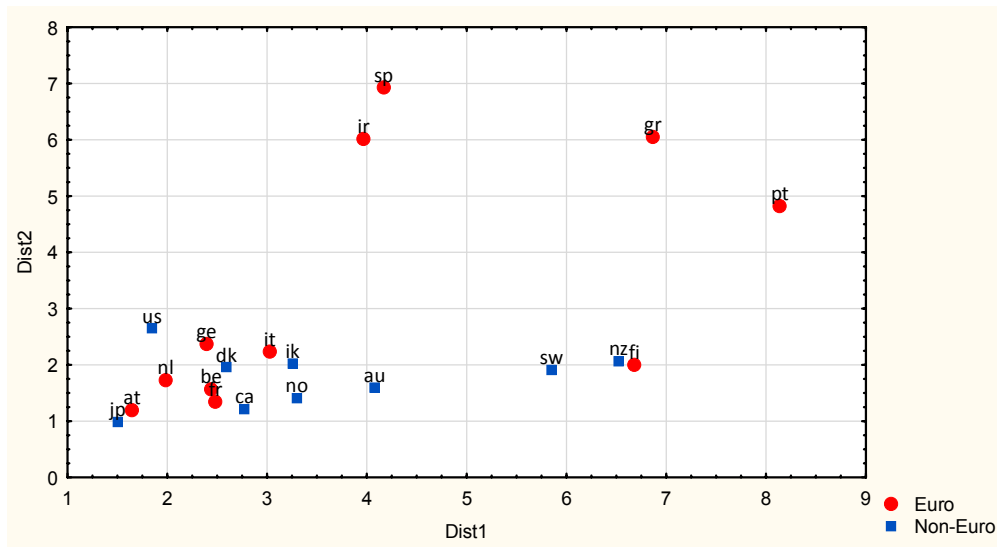
Figure 6a Change in the equal weights dispersion index over time

Figure 6b Scatterplot of the dispersion index with the equal 0.5/0.5 weights



Dist1 (Dist2) is the average dispersion for the first (second) period.

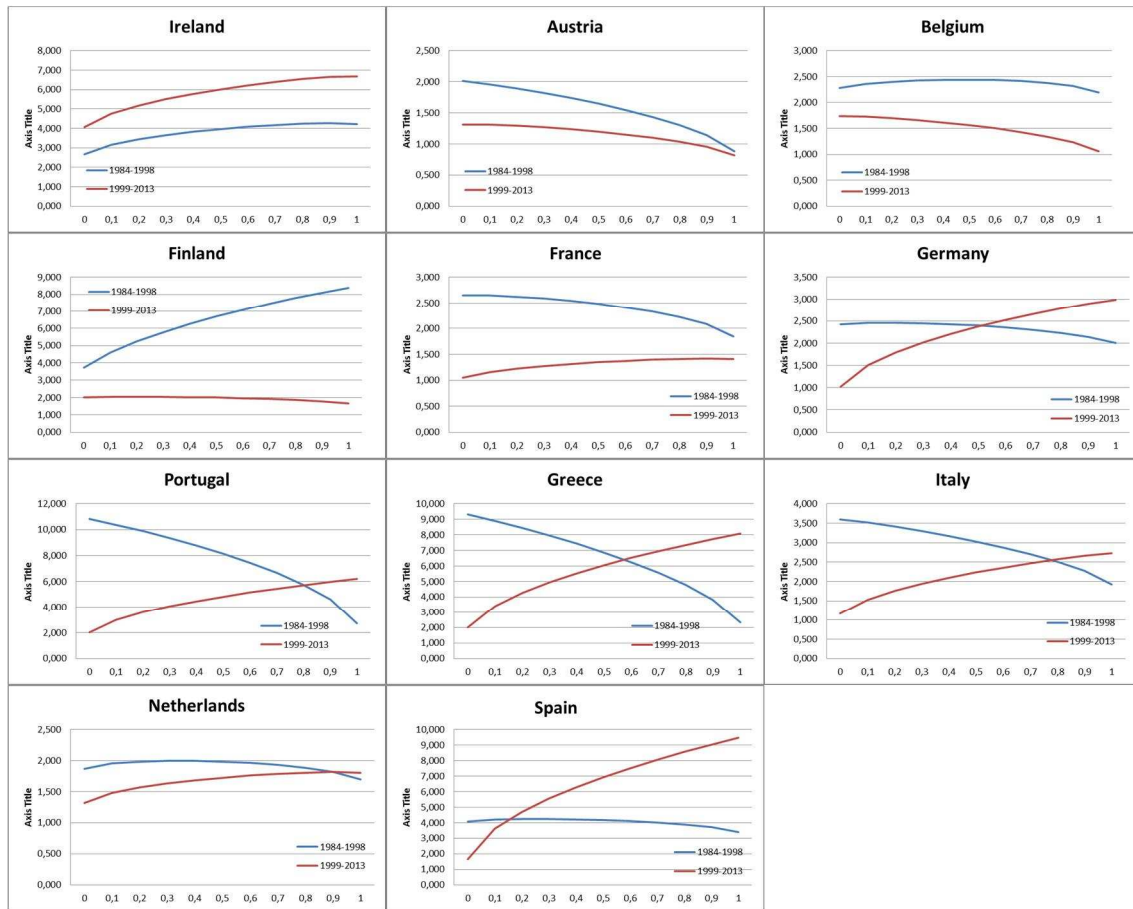
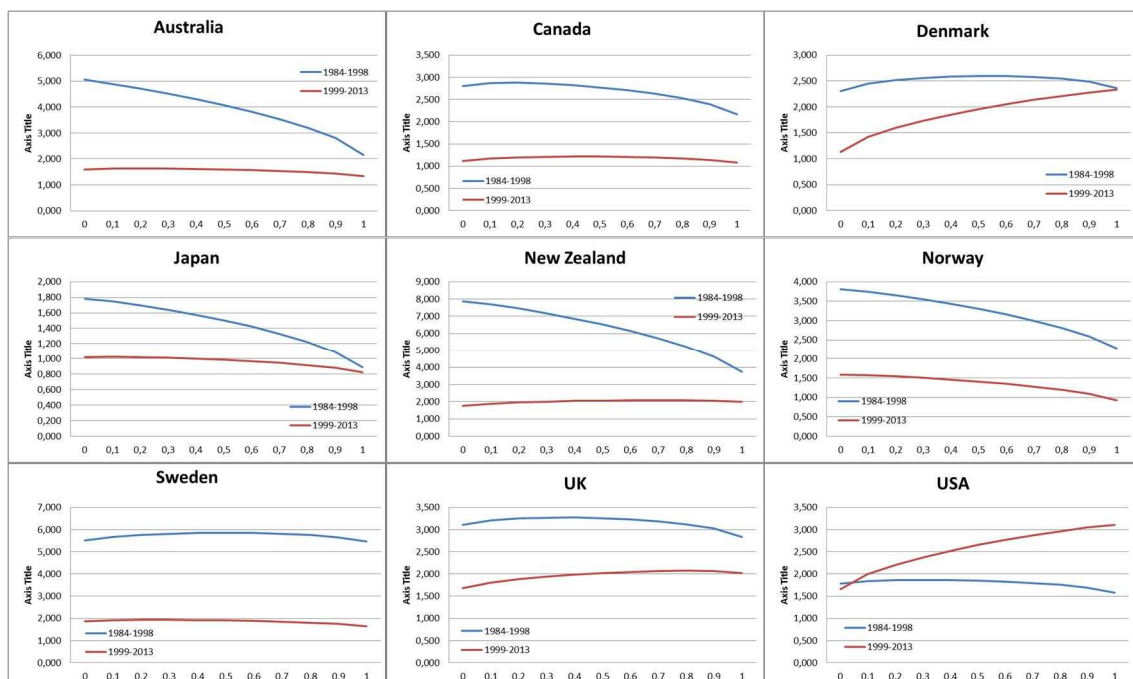
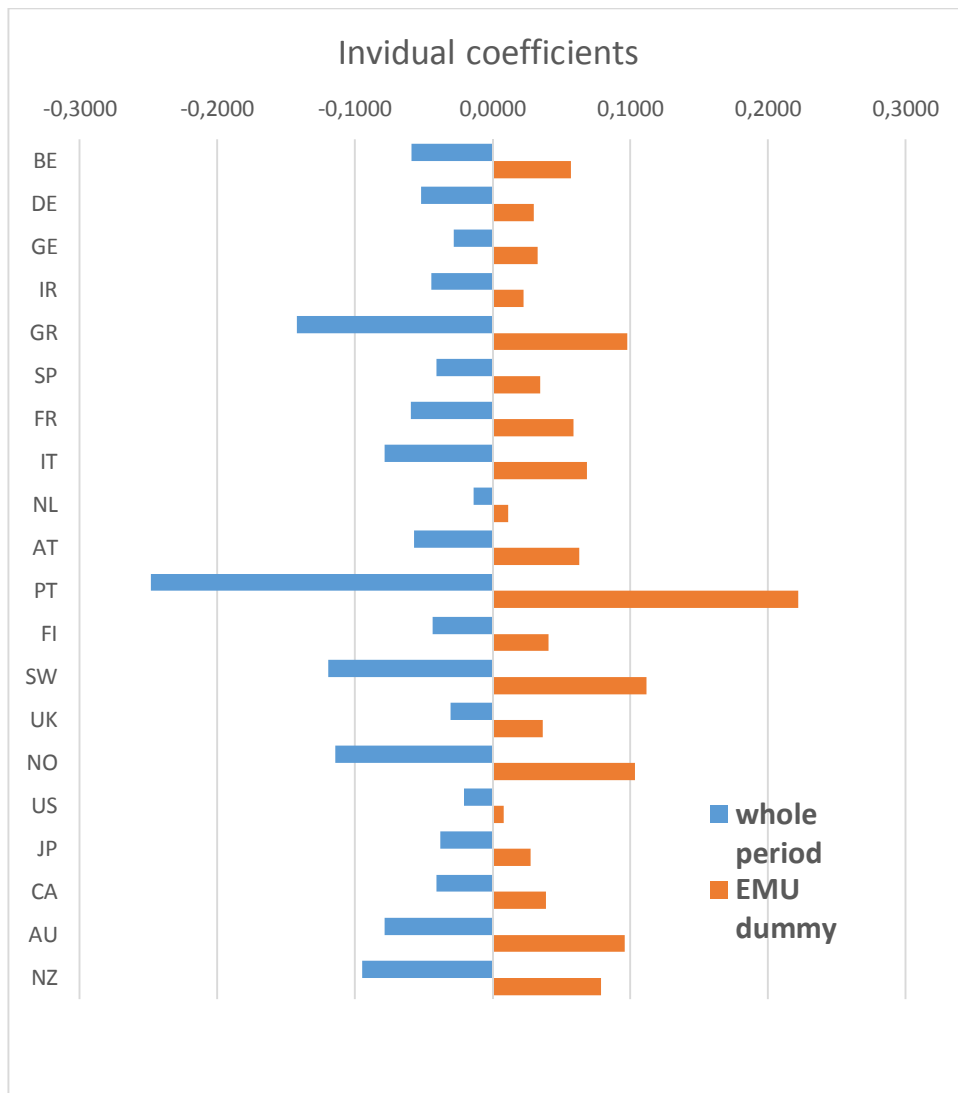
Figure 7 Dispersion with different weight parameters in sample countries**Euro area****Other countries**

Figure 8 Country-specific estimates of an expectations augmented Phillips curve

The **Aboa Centre for Economics (ACE)** is a joint initiative of the economics departments of the Turku School of Economics at the University of Turku and the School of Business and Economics at Åbo Akademi University. ACE was founded in 1998. The aim of the Centre is to coordinate research and education related to economics.

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