

Response to Referee 2 by Ron Smith and Gylfi Zoega.

We are grateful to the referee for such detailed and thoughtful comments. Some of the issues may arise because our exposition was not clear enough. We shall try to remedy that in this reply.

Before addressing the referee's many comments we would like to clarify the objective of this paper. The main objective is to map some stylised facts about unemployment in the OECD that any proposed theory would have to take into account. The next step would then be to propose theories and models that would fit these facts. We like this approach because the current practice of using the very limited information contained in the unemployment matrix (1-2 long swings of unemployment) to test exactly which of a multiple of global and country variables are important – as suggested by a fairly large number of complicated models – is very difficult and empirical results almost always support each author's priors. Better to establish some stylised facts first, and then consider which theories can account for them.

The main stylised fact established in the paper is that OECD unemployment rates show long swings that dominate shorter business cycles and, most importantly, these long swings show a range of common patterns. The implication is that any theory of these long swings of unemployment has to explain the common patterns, i.e. the long swings are caused by global developments. In particular, we find that the first PC – capturing a global factor – explains 69% of the variation in the (43×21) unemployment matrix. We then find that the long swings of investment also show a range of common patterns that closely resemble those for unemployment. This second finding provides further suggestions to those who are modelling the determinants of the long swings of unemployment. Thirdly, we explore the role of institutions. We find that these affect the short-run as well as the long-run impact of changes in the global factor.

We think it is important to show the close relationship between global changes in unemployment and investment. This relationship has been largely ignored in recent models of persistent unemployment. One prominent macroeconomist (Blanchard, 2000) has gone so far as to call it “the Modigliani puzzle” after Franco Modigliani who drew attention to it. However, this relationship would not have come as a surprise to earlier generations of economists, but, for some reason, it has been forgotten and ignored by many economists trying to explain the problem of persistent unemployment in recent decades. We think it is unfortunate that they did not keep this stylised fact in mind when formulating their models.

It is a basic misunderstanding of our results that, quoting the first paragraph in the report “Overall, institutions seem to influence adjustment to the global factor. However, there is no influence on the natural rate – only the global factor shifts the equilibrium level.” What we find in our exploration of the role of institutions is that employment protection, as well as the unemployment-benefit replacement ratio, affects the long-run impact of changes in the global factor. This is consistent with both the results of Krugman (1994) and Blanchard and Wolfers (1999); countries differ in their institutional setup and these differences determine how they respond to global developments.

We find the apparent relationship between the two PCs (for unemployment and investment), on the one hand, and a measure of global expected returns intriguing. However, we would have preferred our stylised fact to have been among the first findings of the literature on the long swings of unemployment, and the subsequent research to be on the nature of the global developments. We certainly do not intend Figure 2 to be the last word in this literature! It is also not our main result, only a way of showing how a global variable can possibly explain the global changes in unemployment and investment.

We now turn to the specific comments and follow the referee's headings.

Determination of the common factor.

1. Although we were certainly influenced by the PANIC approach, we did not say that we were following that approach and what we did is rather different from the Bai and Ng approach.
2. The first principal components, PC, of investment and unemployment are definitely $I(1)$ and they cointegrate with a unit coefficient as noted in footnote 7. We did not think panel unit root or cointegration tests would be helpful in this case since the nulls (all unit roots in ADF type and all stationary in KPSS type) are not likely to be interesting because some seem to have unit roots and some do not. Similarly for the cointegration tests.
3. The eigenvalues dropped sharply after the fourth, which is why we reported that number. Although we report four, we only use the first PC largely for theoretical reasons: it is common to investment and unemployment and can be interpreted as a rate of return. While information criteria might suggest more, we would be unhappy using more because we cannot give them a theoretical interpretation and we may be introducing more estimation errors as raised in the next point.
4. We would agree that estimated latent factors can be imprecise and estimation itself can introduce errors. We were reassured on this by the fact that the first PC was very close to the cross-section mean and using the cross-section mean gave similar results. The issue as to whether it is better to use a priori weights (e.g. $1/N$ and the cross-section mean) or estimated weights (e.g. PCs) is controversial.
5. While we accept this point in principle, the fact that the correlation is so high and using the cross-section means (which do not require first stage estimates) gives similar results, make us feel that it is not important in practice.
6. We accept the point that it would be more efficient to have imposed a shared factor structure. But we felt that it would be more persuasive to readers if we did not impose that structure and showed that it naturally came out of the data.
7. This is a good question. It is rather difficult to answer because of the large variety of natural rates used in the literature it is difficult to know which estimates to compare the global factor with. The global factor is certainly smoother than national unemployment rates, because of averaging.

8. In earlier versions and in other papers we did give graphs of national unemployment rates and the factors, but they were cut from this version because of space constraints.

Identification of first principal component.

1. The graph of world real interest rate and the global factor is purely for comparison, we are not using the world real interest rate in estimation or explanation.

2 and 3. We think that the interpretation of the factor as reflecting global expected returns is plausible on theoretical grounds (that is what should drive investment and unemployment). We do not think it can be given a formal statistical justification because of the difficulty of finding suitable measures of expected returns as we note. This is why we did not do a formal test with the real interest rate.

A model of unemployment adjustment.

We accept that the Pesaran (1991) model can justify the higher order dynamics we find.

1. The suggested appendix was in earlier versions but was cut for reasons of space.

2. We agree that the institutional variables do not show much variation and this does raise issues of multicollinearity. To a certain extent the use of cross-section variation reduces this problem, but it remains an issue.

3. The possible endogeneity of institutions is a problem and the estimates we presented can only be indicative, we were just trying to indicate that institutions were not well explained either by our dependent or independent variables. Since our preferred model is the heterogeneous panel model without institutions, we do not think this is a major problem. There is a separate problem with the endogeneity of the global factor. Since it is a generated regressor constructed from the dependent variables, there is clearly a potential endogeneity problem. But the covariance of it with the error falls at rate N , the number of countries, since the weights are roughly equal and with 21 countries the covariance will be very small.

4. The importance of time and country heterogeneity is an important one, but there are real bias-efficiency trade-offs in how one allows for it. We tried to show that the heterogeneous panel estimator we adopted, separate equations for each country, was not an unreasonable choice.

5. The estimation technique is just non-linear least squares applied to unemployment measured as deviations from the country mean, to allow for fixed effects. Consider the long-run coefficients determining the natural rates in equation (2): $u_{it}^* = a + bf_t$. We assume that the coefficients may vary, over countries and time with variations in a vector of institutions, x_{it} (the first element being unity) with the form

$a_{it} = a'x_{it}$, $b_{it} = b'x_{it}$ giving an equation with interaction terms of the form

$u_{it}^* = a'x_{it} + b'x_{it}f_t$. Whereas this is linear, when the same procedure is used for the adjustment parameters, the model becomes non-linear. The referee is correct to point out that we assumed a deterministic model for the determination of a_{it} and b_{it} , had we assumed a stochastic model, say $b_{it} = b'x_{it} + v_{it}$ we would have got terms like $v_{it}f_t$ in the error term, introducing heteroskedasticity.

6. The Swamy Random coefficients model is just estimated for the linear cases and not for the non-linear institutions case in Table 4. The Swamy procedure is to estimate the equations for each country and then calculate weighted averages of the individual coefficients. 7. We are sorry that the Tables are not self-explanatory. Table A2b presents the diagnostic statistics corresponding to the equations for which the regression estimates are given in Table A2a. It might have been better to have called it A2 continued. The full estimates of equation 14, with 26 parameters, were rather long and the coefficients were not well determined because of the multicollinearity problem discussed in 2 above. We thought that these estimates were not very informative, but we could provide them.

The Phillips Curve

1. As noted above, we preferred the heterogeneous panel estimator without institutions, which is why it is used here. The point of the section is that it is the same 'natural rate' determined by the global both determines equilibrium unemployment and appears in the Phillips curve. Showing this requires estimating the two equations as a system and testing the cross-equation restrictions on the coefficients of intercept and global factor.

2. Average global inflation has been used in a number of papers as a variable in the Phillips curve, so we did not discuss it in detail. There is a fuller discussion of the role of global inflation in, for instance, *Identification of New Keynesian Phillips Curves from a Global Perspective*, S. Dees, M.H. Pesaran, L.V. Smith and R.P. Smith, available from www.econ.cam.ac/faculty/pesaran/public.htm.

3. Table A3 gives estimates for the unrestricted Phillips Curves. It is true that in only four of the countries is the global factor significant, but it is often difficult to get Phillips curve effects as is widely remarked in the literature. However, the estimates even though individually insignificant in many cases are quite closely clustered, so that the average (Swamy) and fixed effects estimates are significant. When the two equations are estimated as a system, which will increase efficiency, the global factor is significant in 15 of the countries, Table A4.

4. We are sorry Table 5 is not clear. It just gives the reduced form estimates of equation (16) e.g. the coefficient of u_{it} is the average of β_i , etc.

5. $x_{i,t-1}$ are the variables included in the information set used to explain expected inflation. The sensitivity to alternative choices of $x_{i,t-1}$ is discussed below.

6. The main result is that in 15 of the countries we cannot reject the hypothesis that the same natural rate as a function of the global factor appears significantly in both the unemployment adjustment equation and the Phillips curve.