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Is the Euro Sustainable?

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Abstract

It is widely recognised that the "one-size-fits-all" monetary policy of the euro-zone is a potential problem. How much of a problem has not been much investigated. It is argued in this paper that it may result in the euro not being sustainable in the longer term without drastic changes to other aspects of the EU and, in particular, to fiscal policy. The problem is not the fault of the ECB, but is due to having a single nominal interest rate. As a result, the evidence reveals that national price levels are diverging over time which is leading to a permanent and unsustainable loss of competitiveness. A formal theory of inflation in the euro-zone based on an open-economy version of the New Keynesian model is used to analyse the problem. Although the euro system has automatic stabilising mechanisms arising from the changes in competitiveness and from absorbtion effects, these are shown to be not strong enough. The model is then modified to allow for fiscal transfers between countries and the size of the transfers required to produce a euro that may be sustainable are derived. It is shown that, in effect, this is an inflation tax, requiring high inflation countries to make transfers to low inflation countries as often happens within a single country in the form of unemployed benefits to low activity regions. Ultimately, the choice may lie between closer political union and a break-up of the euro-zone.

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1 Introduction

To judge by the success of the European Central Bank (ECB) in attaining its inflation objectives, the euro appears to be a sustainable monetary system. The ECB's self-imposed target range for HICP inflation is $0-2\%$ per annum, with the emphasis on 2%. Over the period 2000-2006, inflation has fluctuated between only $1.6-2.5\%$. This is a considerable achievement, and much to the credit of the ECB. What possible reason could there be, therefore, for questioning the sustainability of the euro?

Wyplosz (2006), reviewing the arguments surrounding the launch of the euro in 1999, observed that the founders largely ignored academic views that the EU was not an optimal currency area and that there are still tensions concerning the Stability and Growth Pact. Nonetheless, his conclusion is that academic opinion now generally recognises that the euro has been a major success, partly due to the pragmatism shown in implementing policy. Wolf (2006), one of his discussants, said that, "to put it mildly", he was not convinced that the euro has been a "'major success', unless one means by a success that it exists". In his view the main problem has been the "less than stellar" performance of the euro-zone economy since 2000 which he notes averaged 1.3% between 2001-2005, according to the IMF.

In this paper the focus is different from that of Wyplosz and is concerned more with the issue raised by Wolf. The problems stem from having a "one-size-fits-all" monetary policy. This may cause fundamental problems for individual country inflation rates and economic activity which could lead to the demise of the euro. Moreover, the ECB is powerless to do anything about this as the problem lies in the system and not in the way that the ECB conducts monetary policy.

The argument is simple. The ECB sets a single nominal interest rate for all euro-zone countries. For high inflation countries this implies a low - even a negative - domestic real interest rate, and for low inflation countries it implies a higher - and positive - domestic real interest rate. The lower is the domestic real interest rate (the single common nominal rate minus domestic inflation), the

greater is the stimulus to domestic economic activity, and hence to domestic inflation. Thus, while aggregate inflation in the euro-zone may be on target, the inflation rates across individual countries seem unlikely to converge, and may even diverge. In either case, high inflation countries would steadily lose their competitiveness and low inflation countries would gain competitiveness. If the divergence in inflation rates and competitiveness were unchecked, the euro system would eventually become unsustainable.

For the euro to be sustainable, offsetting factors must exist and must be strong enough to prevent such divergence. The aim of this paper is to consider whether there are such factors, whether they are automatic, or need to be implemented using discretionary policy, and whether such factors would be likely to prove strong enough in practice.

There are two obvious potential automatic stabilisers for national euro-zone inflation rates. Both arise from intra-euro-zone trade. One is a price effect: competitiveness; the other is an income effect: absorbtion. Persistently high inflation causes a national price level to diverge from the average, and hence results in a loss of competitiveness. As this would reduce domestic demand and output, it may be expected to put downward pressure on domestic inflation thereby acting to offset the higher inflation and correct the loss of competitiveness. A euro-zone country with strong domestic economic activity (caused by low real interest rates which generate high inflation) may be expected to import from countries with weaker economic activity (due to having high real interest rates). This would raise economic activity and hence inflationary pressures in the exporting countries, thereby acting as another corrective.

If these two automatic stabilisers are not strong enough then the internal stability of the euro-zone must either rely on exogenous trade effects, or on internal euro-zone income transfers from high to low activity countries. These could be exogenously determined by, for example, remittances, or more realistically, they could be the result of fiscal policy.

In the absence of such correctives, the sustainability of the euro-zone may depend on a radical change of EU fiscal policy. This, in turn, would almost certainly require an increase in central

political control in the EU, and hence a loss of national political independence. Having a single European currency may not therefore be simply an economic decision; it may have profound implications for the political structures of Europe.

The significance of the link between a single currency and EU fiscal policy was appreciated prior to the introduction of the euro. Major concerns were expressed by the EC Commission about whether the accompanying fiscal framework was adequate. This was a central reason for establishing the Stability and Growth Pact, the principal aims of which are to lessen political pressures within the EU to monetise debt, and to avoid government defaults on euro-denominated debt which might raise the risk premium for all EU countries. The Pact is therefore concerned with individual country fiscal policy, whereas what may be required to make the euro sustainable is inter-country fiscal policy. Early discussions of EU fiscal policy were contained in the EC's report 'Stable-money - sound finances' (1993), particularly Section V on 'The Economics of Community Public Finance'. One the main conclusions was the need to set up a full stabilisation mechanism such as that in the US. Goodhart (2007a), one of the contributors to the EC report, argues that it is an opportune time to resurrect this report. He suggests that an EU stabilisation scheme could be funded by shifting seignorage receipts from the euro to a central euro area budget. In Goodhart (2007b) he argues for cross-regional transfers within the EU in order to improve the optimal currency area characteristics of the EU.

The paper is set out as follows. First, we consider the evidence on EU country price levels to see whether there really is such a problem. We find that although inflation rates have not diverged markedly since the inception of the euro in 1999, national price levels, and hence competitiveness, have diverged - for some countries markedly. Moreover, economic growth has been far greater in high inflation than low inflation countries. We then present a formal model of inflation in the euro-zone derived from a standard single-country New Keynesian inflation model. This model is modified to include open-economy effects such as the real exchange rate and foreign income. The national models are then combined to form a simple multi-country model of the euro-zone.

This model is able to capture the effects of competitiveness and absorbtion. The implications of a single currency and an optimal common monetary policy for euro-zone and national inflation rates and price levels are analysed. It is shown that, despite the presence of the two automatic stabilisers, there is still a built-in tendency for national price levels to diverge. The model is then amended to include fiscal transfers. In effect, these amount to an inflation tax. It is found that such transfers can in principle prevent national price levels from diverging, and a formula is derived for determining the size of the transfers that are needed to achieve this. This is what commonly occurs within a single country, and takes the form of unemployed benefits to low activity regions. In the concluding section, the political consequences of introducing such transfers are considered. It is argued that, ultimately, the choice may lie between closer political union and a break-up of the euro-zone.

2 EU prices 1999-2006

We wish to see whether or not price levels in the euro-zone have diverged since 1999 when the euro began. We begin by considering EU inflation rates for the original 12 countries. All data are from the OECD. Figure 1 plots the year-on-year inflation rates for each country together with EU inflation (in bold type) for the period 1990-2006. The corresponding UK inflation rate is the dotted line. EU inflation was on a falling trend prior to the launch of the euro in 1999; afterwards the EU inflation rate has fluctuated close to 2%. Convergence of individual country inflation rates seemed to occur until around 1993, but after that inflation has shown no tendency for any further convergence; in fact, since 2005, inflation rates appear to have diverged.

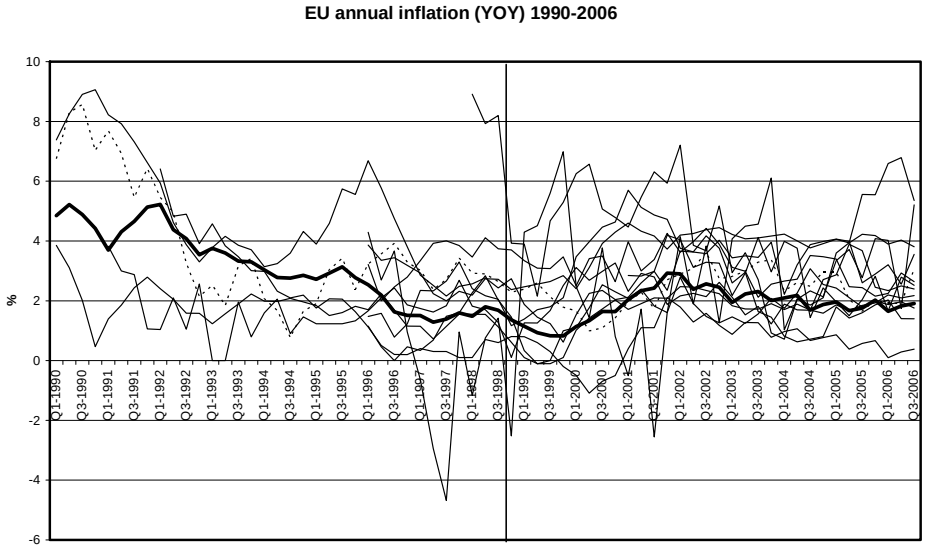

Figure 1

This is confirmed in Figure 2 which plots the standard deviation of year-on-year inflation rates across EU countries for the period 1998-2006. Inflation convergence continued until 2005; since then inflation rates have diverged a little.

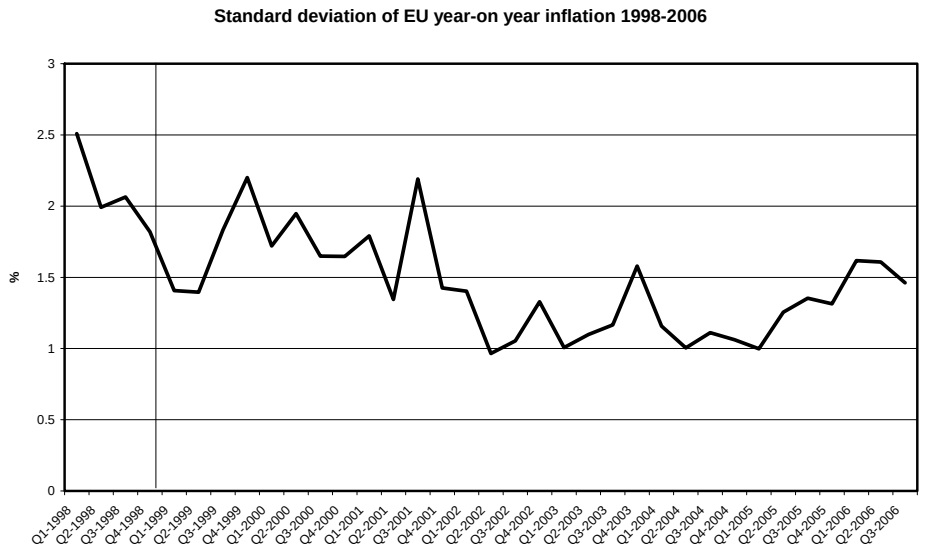

Figure 2

Figure 3 plots the natural logarithms of the price levels of these EU countries from the start of 1999, the base for each series. Since the natural logarithm of the price level for each country is zero in the first quarter of 1999, the data depict cumulative inflation rates since 1999. Again the average EU price level is in bold type and the UK is the dotted line. We are interested in the slopes of the lines which measure the average inflation rates over the period 1999-2006. (The increase in the dispersion of the lines is partly an artefact of the choice of base period. Had the base period been the last period of 2006, the lines would be shown converging at the end and not the start, but the slopes of the lines would still convey the information about average inflation.) The top line is Ireland, which has had the most inflation, and the bottom line is Germany, which has had the least inflation. Thus price levels have steadily diverged implying a relative gain in competitiveness for countries below the EU line and a loss in competitiveness for countries above the EU. In order of the size of the gain in competitiveness we have Germany, France and then Belgium.

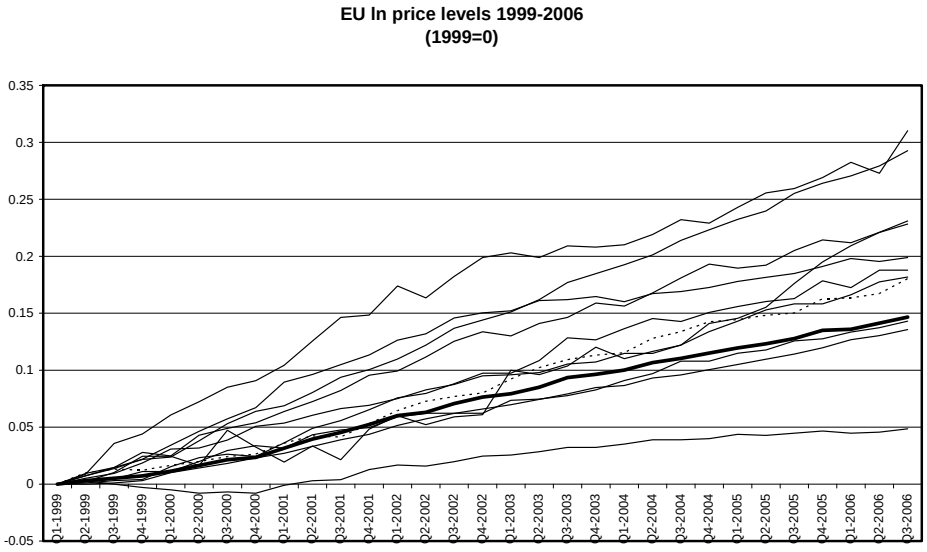

Figure 3

According to our hypothesis, in the absence of stabilisers, countries with higher initial inflation rates are predicted to have higher average annual inflation rates over the whole period due to price level divergence. This is exactly what we find in Figure 4, where we plot the average annual rate of inflation against the initial rate of inflation. A 45^0 line through the origin would indicate the same average inflation rate over the whole period as in 1999. As the data lie roughly parallel to this, but slightly above, this indicates a higher average rate over the whole period than initially.

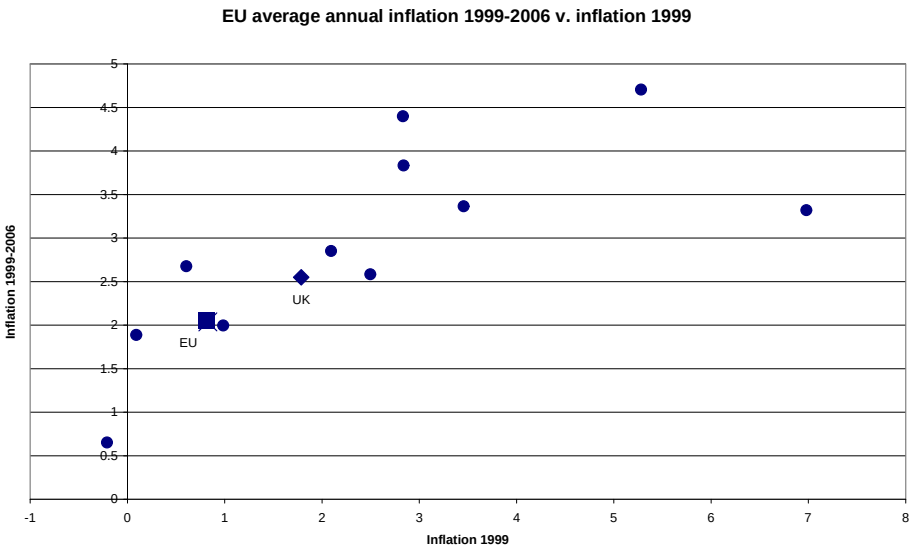

Figure 4

A comparison of the growth of GDP over the same period is shown in Figure 5 which plots the natural logarithm of GDP. Again, the EU is in bold type and the UK is the dotted line. Like the price levels in Figure 3, the top line is Ireland and the bottom line is Germany, suggesting that higher inflation is associated with greater economic activity.

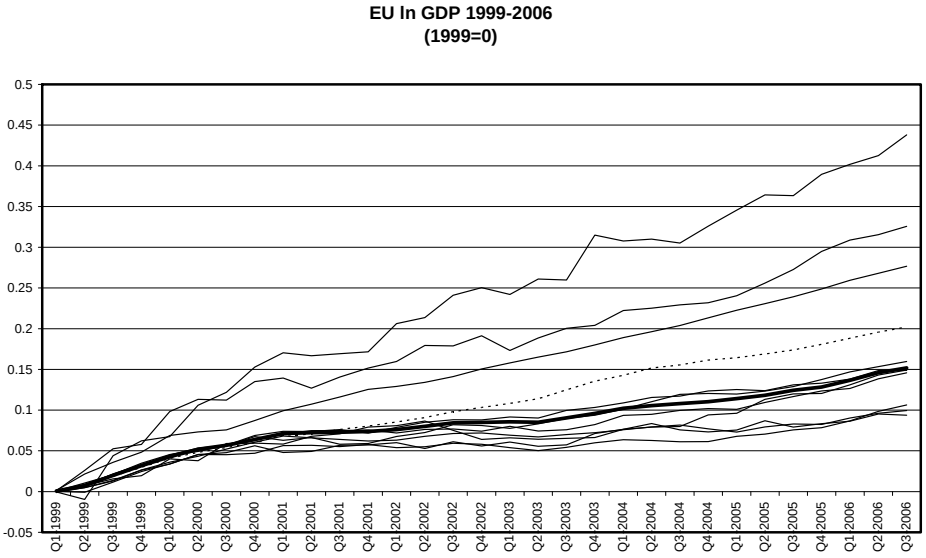

Figure 5

To examine this further, in Figure 6 we plot the log of the price levels against the log of GDP for each country. The individual country data are reported in Table 1. Figure 6 shows a strong positive relation between inflation and economic activity.

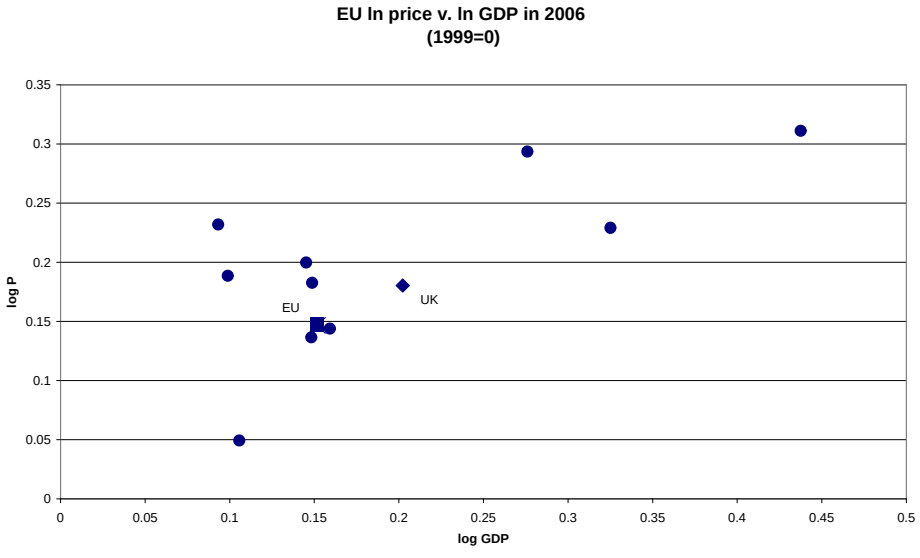

Figure 6

	Bel	Den	Fr	Ger	Ir	It	Lux	Nl	Port	Sp	UK	EU
Price	14.3	18.6	13.6	4.8	31.0	18.8	22.8	19.9	23.1	29.3	18.0	14.7
GDP	16.0	14.9	14.9	10.6	43.8	10.0	32.6	14.6	9.4	27.7	20.2	15.2

Table 1: Percentage Growth of Price and Output 1999-2006

This evidence offers considerable support for our hypothesis of divergence and suggests that the automatic stabilisers are, at best, weak. At one extreme we have Germany whose price level has risen only 5% since 1999; at the other extreme we have Ireland and Spain whose price levels have risen by 31% and 29% respectively, implying that they have lost about 25% in competitiveness, or about 3.5% per annum. Moreover, countries with high inflation rates also have high rates of economic growth: Ireland's GDP has grown by 44% and Spain's by 28%, while Germany's has grown by only 11%. If there are automatic stabilising effects at work - and the differences in price levels of Ireland and Germany suggest a substantial cumulative loss of competitiveness by Ireland - then this evidence appears to suggest that so far they have not been strong enough to offset the effect on growth of real interest rates.

We note that the UK, which is not a member of the euro-zone, has an inflation and growth performance similar that of the EU average over this period. Both EU inflation and growth have been 15% while the corresponding UK rates are 18% for inflation and 20% for growth. It appears, therefore, that by having an independent monetary policy the UK has maintained competitiveness with the EU in the aggregate.

3 Optimal monetary policy in the euro-zone

We have seen that in practice competitiveness and absorbtion effects do not appear to have offset the consequences of having mis-aligned individual country real interest rates. We now examine these issues more formally by constructing a model of the euro-zone with a common

monetary policy and with real interest rate, competitiveness and absorbtion effects. We then derive the optimal discretionary monetary policy for the euro-zone subject to this model. We wish to determine whether in theory competitiveness and absorbtion effects provide the required automatic stabilisers.

The model for the euro-zone is based on a stylised open-economy version of the New Keynesian model. It is sufficient to assume that the euro-zone consists of only two countries. We assume that each economy is described by two equations: open economy aggregate demand and supply functions. These are

$$AD \quad : \qquad x_{it} = -\beta(R_t - E_t\pi_{i,t+1}) + \gamma(p_{jt} - p_{it}) + \phi(s_t + p_t^* - p_{it}) + \delta x_{jt} + z_{it} + e_{xi,t} \quad (1)$$

$$AS \quad : \qquad \pi_{i,t+1} = E_t\pi_{it} + \alpha(x_{it} - x_{n,it}) + e_{\pi i,t+1} \quad (2)$$

for $i, j = 1, 2$, where $0 < \delta, \gamma < 1$, x_{it} is the output of country i at time t, $x_{n,it}$ is its long-run equilibrium (or natural) level of output which is assumed to be exogenous, p_{it} is the price level of country i, $p_{jt} - p_{it}$ is the terms of trade for country i in trade with country j, $s_t + p_t^* - p_{it}$ is the terms of trade for country i in trade with the rest of the world, s_t is the exchange rate which is taken as given, p_t^* is the rest of the world price level and z_{it} is an exogenous variable affecting country i which will be defined more precisely later. $e_{\pi it}$ and e_{xit} are independent serially independent shocks that are unknown to the central bank and are not part of the time t information set, hence $E_t e_{\pi,it} = E_t e_{x,it} = 0$. Thus aggregate demand depends on the real interest rate, the price differential (competitiveness) and foreign demand (absorbtion effects). Output differs between the two countries due to different inflation expectations, price levels, real rates of return, export demand and country-specific shocks. Inflation differs due to different inflation expectations, output gaps and country-specific inflation shocks. We note that taking expectations of equation (2) gives $E_t x_{it} = x_{ni,t}$. Thus output is expected to be at its natural rate.

We adopt a standard formulation of optimal discretionary monetary policy under inflation targeting - see for example Barro and Gordon (1983), Walsh (2003) or Woodford (2003). We

assume that the central bank - which we refer to as the ECB - chooses the common interest rate R_t to minimise a single period quadratic cost function which is defined for the entire euro-zone as

$$E_t(Q_t) = \frac{1}{2}\lambda E_t(\overline{x}_t - \overline{x}_{nt} - k)^2 + \frac{1}{2}E_t(\overline{\pi}_{t+1} - \pi^*)^2 \tag{3}$$

where the average EU value is denoted by

$$\overline{a}_t = \theta a_{1t} + (1-\theta)a_{2t}$$

θ is the relative size of the economies. Thus the aim is to choose the common nominal interest rate R_t to minimise the deviations of inflation from the target level π^* and output from the level $\overline{x}_{nt} + k$, $k \geq 0$. If the ECB were a strict inflation targeter then $\lambda = 0$.

First we derive the optimal common nominal interest rate for this model and the implications for expected EU inflation and output. We then derive the inflation and price level differentials between euro-zone countries and examine whether the model implies that either or both diverge. By specialising the model through removing the two potential automatic stabilisers in the aggregated demand function - namely the effects of competitiveness and absorbtion - we examine what happens to inflation and price level divergence in the absence of these two effects.

For convenience, we assume that the two economies are of equal size, hence $\theta = \frac{1}{2}$. Average EU inflation and output are then

$$\begin{aligned} \overline{\pi_t} &= \frac{1}{2}(\pi_{1t} + \pi_{2t}) \\ \overline{x}_t &= \frac{1}{2}(x_{1t} + x_{2t}) \end{aligned}$$

Target EU inflation is π^*. The aggregate model for the euro-zone is therefore

$$\overline{x}_t = -\frac{\beta}{1-\delta}(R_t - E_t\overline{\pi}_{t+1}) + \frac{\phi}{1-\delta}(s_t + p_t^* - \overline{p}_t) + \frac{1}{1-\delta}\overline{z}_t + \frac{1}{1-\delta}\overline{e}_{xt} \tag{4}$$

$$\overline{\pi}_{t+1} = E_t\overline{\pi}_{t+1} + \alpha(\overline{x}_t - \overline{x}_{nt}) + \overline{e}_{\pi,t+1} \tag{5}$$

which does not involve the price differential. Taking conditional expectations of the aggregate

model

$$E_t\overline{x}_t = -\frac{\beta}{1-\delta}(R_t - E_t\overline{\pi}_{t+1}) + \frac{\phi}{1-\delta}(s_t + p_t^* - \overline{p}_t) + \frac{1}{1-\delta}\overline{z}_t \quad (6)$$

$$E_t\overline{\pi}_{t+1} = E_t\overline{\pi}_{t+1} + \alpha(E_t\overline{x}_t - \overline{x}_{nt}) \quad (7)$$

Hence $E_t\overline{x}_t = \overline{x}_{nt}$.

Choosing R_t to minimise $E_t(Q_t)$ gives the first-order condition

$$E_t(\frac{\partial Q_t}{\partial R_t}) = -\frac{\beta\lambda}{1-\delta}(E_t\overline{x}_t - \overline{x}_{nt} - k) - \frac{\alpha\beta}{1-\delta}E_t(\overline{\pi}_{t+1} - \pi^*) = 0$$

This implies that the optimal rate of inflation for the euro-zone is

$$\begin{aligned} E_t\overline{\pi}_{t+1} &= \pi^* - \frac{\lambda}{\alpha}(E_t\overline{x}_t - \overline{x}_{nt} - k) \\ &= \pi^* + \frac{\lambda}{\alpha}k \end{aligned} \quad (8)$$

Consequently, we obtain the familiar result in optimal inflation targeting that there is an aggregate inflation bias if both λ and k are positive, i.e. if the ECB is a flexible inflation targeter and seeks to achieve a higher level of euro-zone output than the natural level. We note that none of the additional variables in the aggregate demand function has affected this result.

In order to achieve the optimal level of inflation, from equation (6), the ECB must set the common nominal interest rate equal to

$$R_t = \pi^* + \frac{\lambda}{\alpha}k - \frac{1-\delta}{\beta}\overline{x}_{nt} - \frac{\phi}{\beta}(\overline{p}_t - s_t - p_t^*) + \frac{1}{\beta}\overline{z}_t \quad (9)$$

Hence, monetary policy responds negatively to higher aggregate output and to a loss of euro-zone competitiveness with the rest of the world, and positively to exogenous effects such as an increase in euro-zone exports to the rest of the world.

We now consider the implications for the two countries of this choice of nominal interest rate. Substituting the nominal interest rate given by equation (9) into equation (**??**) and taking expectations gives the expected output for country i as

$$E_t x_{it} - \overline{x}_{nt} = -\beta(\pi^* + \frac{\lambda}{\alpha}k - E_t\pi_{i,t+1}) - \gamma E_t(p_{it} - p_{jt}) - \phi E_t(p_{it} - \overline{p}_t) + \delta(E_t x_{jt} - \overline{x}_{nt}) + (z_{it} - \overline{z}_t) \quad (10)$$

Recalling that $E_t x_{it} = x_{ni,t}$ and subtracting from equation (10) the corresponding equation for country j gives the following equation for the expected country inflation differential

$$E_t(\pi_{i,t+1} - \pi_{j,t+1}) = \frac{\phi + 2\gamma}{\beta} E_t(p_{it} - p_{jt}) + \frac{1+\delta}{\beta}(x_{ni,t} - x_{nj,t}) - \frac{1}{\beta}(z_{it} - z_{jt}) \qquad (11)$$

This is our key equation. It identifies the factors that cause the country inflation differential.

Consider first the special case argued at the start of the paper where there are no competitiveness or absorbtion effects so that $\gamma = \phi = \delta = 0$. In this case, the price level and natural output terms vanish and the inflation differential depends only exogenous individual country effects. If these are different (and remain constant) then the inflation differential will persist. The price levels would then diverge over time without bound. This is consistent with our earlier intuition.

Now assume that there are competitiveness and absorbtion effects so that $\gamma, \phi, \delta > 0$. Equation (11) shows that the inflation differential may still persist. A higher initial price level, a higher natural rate of output and a smaller response to world trade all cause inflation in country i to exceed and that in country j. Moreover, the difference is greater, the stronger are the two competitiveness coefficients γ and ϕ, and the absorbtion coefficient δ, and the smaller the response to the real interest rate β. Thus if country i starts with a higher price level than country j then the stronger is competitiveness, the larger is the resulting inflation differential. This indicates that the competitiveness gap is expected to increase over time.

This can be shown more formally by noting that $E_t \pi_{i,t+1} = E_t p_{i,t+1} - p_{it}$. Hence equation (11) can be re-written as

$$E_t(p_{it} - p_{jt}) = \frac{\beta}{\beta + \phi + 2\gamma} E_t(p_{i,t+1} - p_{j,t+1}) - \frac{1+\delta}{\beta + \phi + 2\gamma}(x_{ni,t} - x_{nj,t}) + \frac{1}{\beta + \phi + 2\gamma}(z_{it} - z_{jt}) \quad (12)$$

which is an unstable difference equation. Thus, any initial price differential will grow without bound unless corrected by a reversal in sign, at some point in the future, of the country differentials in the natural output levels or the world trade effects. Consequently, the presence of the competitiveness effect does not prevent the price levels from diverging. And since the other two

variables are assumed to be exogenous, they are unable to alter this - except if, by chance, they offset each other.

We note that if the natural output levels are endogenous and increase due to capital accumulation caused by low real interest rates, then higher inflation countries would have higher natural rates of output. From equation (11) this would raise the country inflation differential.

Despite these problems at the individual country level, euro-zone inflation is unaffected. As its remit is euro-zone inflation, and not inflation in individual euro-zone countries, there would be no incentive for the ECB to react to the problem by changing interest rates. In fact, the ECB is powerless to do anything about widening country price level differentials. Thus, although the euro-system would be achieving its inflation objectives, it would be inherently unstable, and hence unsustainable, due to the widening inflation and price differential between countries.

One way to avoid this is for each country to set its own monetary policy. This would require the country with the higher inflation rate to set its nominal interest rate higher than does the ECB, and the country with the lower inflation rate to set its nominal interest rate lower than does the ECB. Is there, however, a possible solution that does not involve the break-up of the euro-zone? We consider this next.

3.1 Fiscal transfers

It is sometimes argued that the problems arising from a "one-size-fits-all" monetary policy for the EU are little different from those faced by any country with regional differences as they too share a common currency. Does this mean that there is a similar danger of regional divergence? One of the main differences between the regions of a single country and the constituent countries of a monetary union is fiscal policy. In a single country there are usually automatic fiscal transfers between regions. This happens through national tax revenues being redistributed nationally; the successful regions contribute relatively more tax revenues and the less successful regions receive

relatively more transfers. The EU does not have such a system of fiscal transfers between countries. We now consider the implications of including fiscal transfers in the above model.

A fiscal transfer of g_i from country i to country j would, in effect, reduce the resources available for private-sector consumption in country i and increase those in country j, whilst leaving equilibrium output in both countries unchanged. As a result we re-specify the aggregate demand function, equation (**??**), as

$$AD : x_{it} = -\beta(R_t - E_t\pi_{i,t+1}) + \gamma(p_{jt} - p_{it}) + \phi(s_t + p_t^* - p_{it}) + \delta x_{jt} + z_{it} + g_{it} + e_{xi,t} \qquad (13)$$

where $g_{jt} = -g_{it}$. Equation (**??**) remains unchanged.

We may use the previous results to analyse this new problem as, in effect, the fiscal transfer is just another exogenous variable like z_{it}. The difference is that $\overline{g}_t = 0$ and $g_{it} - g_{jt} = 2g_{it}$. Thus the expected inflation differential is

$$E_t(\pi_{i,t+1} - \pi_{j,t+1}) = \frac{\phi + 2\gamma}{\beta} E_t(p_{it} - p_{jt}) + \frac{1+\delta}{\beta}(x_{ni,t} - x_{nj,t}) - \frac{1}{\beta}(z_{it} - z_{jt}) - \frac{2}{\beta} g_{it} \qquad (14)$$

In order to eliminate the inflation differential it is therefore necessary to set

$$g_{it} = \frac{\phi + 2\gamma}{2} E_t(p_{it} - p_{jt}) + \frac{1+\delta}{2}(x_{ni,t} - x_{nj,t}) - \frac{1}{2}(z_{it} - z_{jt})$$

The required fiscal transfer from country i to country j is therefore larger, the greater is the price and the natural output differential, and the smaller is the differential trade effect. Further, the stronger the competitiveness and absorbtion effects, the larger the transfer.

Note that the transfer is from the high to the low inflation country. This reduces economic activity in the high inflation country and raises it in the low inflation country. In effect, therefore, an inflation tax is being imposed on the high inflation country, and an inflation subsidy is being given to the low inflation country.

4 Conclusions

We began by arguing - on somewhat intuitive grounds - that a consequence of a "once-size-fits-all" monetary policy in the euro-zone is that country inflation differentials will persist and even grow and that this would be accompanied by a divergence in economic activity with higher inflation countries growing faster than lower inflation countries. We found that these predictions are strongly supported by the data.

We then examined whether a loss of competitiveness of high inflation countries and a gain in competitiveness by low low inflation countries, together with absorbtion by high activity countries of low activity countries' exports, could act to automatically stabilise the euro-zone. Based on a model of the euro-zone derived from the standard New Keynesian model, and the assumption of optimal discretionary monetary policy in the euro-zone, we found that automatic stabilisation does not necessarily occur. Initial differences in country price levels, in natural rates of output and world trade effects appear in theory to cause a permanent inflation differential and diverging price levels between member countries. Endogenising the capital stock, and hence the natural level of output level, so that they respond to real interest rates only seems to make the inflation divergence worse.

The problem is not the fault of the ECB, which is powerless to do anything about it. It is sometimes claimed that this problem is in the nature of monetary unions and is also present within a single country. We have argued that it is usually ameliorated in a single country by fiscal transfers. We therefore examined whether fiscal transfers between euro-zone countries could solve the problem. We find that, in principle, they can. Suitably chosen, they could eliminate both inflation and price level differences between countries. In effect, an inflation tax is required in which high inflation countries make transfers to low inflation countries. In other words, Ireland and Spain would be required to make fiscal transfers to France and Germany. This seems to be what usually happens within a single country. For example, the south east of England, a high

inflation and economic activity area, makes net transfers to the north of England, Scotland and Wales. Within a single country regional fiscal transfers are usually implicit and tied to economic activity, in particular, to unemployment benefits to the low economic activity regions.

In our theoretical model we assumed that the euro-zone countries were of the same size. In practice, of course, there are considerable differences in size. Moreover, the high inflation countries seem in general to be smaller than the low inflation countries. This would suggest that, to be effective, the transfers from high inflation/high economic activity countries might need to be large relative to their GDP.

The political economy implications of this analysis of the euro-zone are potentially profound. If monetary union is not sustainable unless buttressed by fiscal policy, then the solution immediately moves into the political arena. Fiscal transfers from high inflation/high economic activity countries to low inflation/low economic activity countries are likely to require more political co-ordination than at present. It may even presage a more politically integrated EU. Ultimately, therefore, the choice may lie between closer political union and a break-up of the euro-zone.

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