

Inflation divergence

SUMMARY

Inflation rates have diverged much more widely than expected among the member states of the EMU. We show that much of this is attributable to the differential impact on different member states of the weakness of the euro on international currency markets in the early months of the union. The Balassa–Samuelson productivity growth effect has not yet played an important role – even in respect of the outlier Ireland – although it will likely be more significant over a longer run, especially as the accession countries join.

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Divergent inflation rates in EMU

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1. INTRODUCTION

Although the European Central Bank (ECB) has done relatively well in achieving its target of medium-term price stability for the euro zone aggregate, regional inflation differentials since the beginning of 1999 have been quite marked. Most notably, Ireland and other peripheral nations have been persistently at the top of the inflation league table. In contrast, German inflation has been below the euro zone average. An expanded economic and monetary union (EMU) with the entry of the accession countries will surely lead to even greater inflation differentials in the future.

Why have inflation rates diverged so much in the member countries of the euro zone since the euro was introduced? Before monetary union, most of the discussion of possible inflation differentials focused on the Balassa–Samuelson effect. The expectation was that sizeable differences in productivity growth might become the main drivers of inflation differentials, since less productive but converging regions would require higher inflation rates to accommodate equilibrating trend real appreciation. After the event, many observers have interpreted the fact that inflation has been

We thank our discussants, the referees, John FitzGerald, Cedric Tille and participants in the Dublin Economics Workshop for comments. Charles Larkin and Paul Scanlon provided valuable research assistance. Lane thanks the Institute for International Integration Studies for financial support.

The Managing Editor in charge of this paper was Paul Seabright.

highest in Ireland, apparently a country with high productivity growth, as proof of the importance of this effect. In contrast, this paper argues that a different – and largely unanticipated – mechanism has been more important in the early years of EMU, namely the differential impact of euro weakness on the different member states.

While there is no suggestion that a narrowing of inflation differentials should be a goal of the ECB, persistently high inflation in any country is a matter of concern – as is persistent deflation. Understanding the sources of these inflation differentials is important to ensure public acceptance of the EMU monetary regime and in facilitating smooth adjustment, since local inflation rates carry many of the standard ‘costs of inflation’ by affecting those on fixed nominal incomes, real returns on savings and investments and private and public wage negotiations. To what extent was the divergence caused by asymmetric nominal shocks? To what extent was it a reflection of transitory factors versus equilibrium long-run real exchange rate adjustment? Would inflation rates have been more stable and differentials lower in the absence of EMU? Gathering initial evidence on these issues can help guide structural and fiscal policy responses not only in member states, but also in future potential joiners.

The structure of the paper is as follows. In Section 2, we ask to what extent it matters that inflation rates differ among members of a currency union. Section 3 describes the empirical inflation experience since EMU began, revealing the important role of exchange rate movements. Section 4 performs a reality check by looking in a little more detail at Ireland, which has been at the top of the inflation table since the launch of the single currency: given what is known about Ireland’s rapid growth, how much can currency depreciation have contributed to its outlying inflation experience? Section 5 addresses the counterfactual of what might have happened under independent national monetary policies. Section 6 assesses the policy implications for prospective new members of the euro zone. Concluding comments are offered in Section 7.

2. DOES DIFFERENTIAL INFLATION MATTER?

The ECB can only attempt to control the area-wide aggregate inflation rate, with no tools at its disposal to address variation in inflation across member countries – nor does it attempt to do so, not even publishing sub-union inflation rates in its *Monthly Bulletin*. In what sense, then, might it matter to understand differential inflation? First, there is the question of the optimal target for euro zone inflation: some have argued that wider inflation differentials should imply a higher target for mean euro zone inflation in order to reduce the possibility of deflation in some regions or countries (see Sinn and Reutter, 2001; Kieler, 2003; cf. Kumar *et al.*, 2003). We do not wish to take a definite view on this proposition, which depends on an assumption about the shape of the costs of inflation function, except to note that its relevance might depend on the reasons for the emergence of differentials.

Second, there is a consideration of political economy. High inflation is unpopular, and politicians in high inflation countries will respond, possibly in damaging ways if they misunderstand the causes.¹ It is futile to complain that politicians should ignore national inflation or suppress national price indices to avoid this effect. Third, to the extent that the inflation differentials reflect transitory shocks, they could engender a boom-bust cycle, if there are persistence mechanisms that lead to overshooting in wage and price dynamics. This last point seems to us the most important: in the absence of a national monetary policy, other national policies may need to be brought into play to dampen real wage-unemployment cycles that might persist to a greater degree than was previously anticipated.

Underlying these observations is the fact that the member states of the EMU are still nation states with separate languages, independent fiscal policies and national wage-setting institutions which makes political decision-making respond to national inflation rates in a way that has no real analogue in (say) regional US decision-making.

Of course, some sources of inflation rate differences within the EMU are entirely innocuous or even benign. One important case, relevant to the empirical work below, is where countries begin with different price *levels*, in which case convergence towards a common price level necessarily entails a deviation in inflation rates.² A variant of this case is when the long-run relative price level across countries is a function of relative incomes, relative wealth levels or relative productivities: a faster-growing country may naturally have temporarily higher inflation in the transition to its new long-run equilibrium relative price level (this is a loose statement of the aforementioned Balassa–Samuelson hypothesis).

But not all inflation differentials are of this harmless variety. Even if long-run inflation rates do indeed converge throughout the union, temporary asymmetric shocks to relative prices can be expected from a variety of sources. In addition, the weaker adjustment mechanisms of a currency union may imply more frequent and prolonged relative price misalignments, or alternating phases of overheating and recession. For instance, if there are short-run supply rigidities, a localized aggregate demand disturbance will feed into domestic inflation and real exchange rate appreciation. Such inflation may be purely transitory but is potentially dangerous if it triggers persistence mechanisms that continue to operate even when the original shock has disappeared or supply responses have kicked in (see EEAG, 2002, ch. 4).

Overshooting may occur through price-wage dynamics if current inflation feeds into the path for future wage growth. It may also occur via balance sheets, if the low real interest rate that is an automatic consequence of high regional inflation inside a currency union leads to excessive debt accumulation on the parts of households or

¹ For example, a country experiencing sustained deflation might opt to unleash an excessive fiscal expansion, violating the rules of the Stability and Growth Pact and potentially disrupting euro zone financial markets.

² Another situation is where, because the basket of goods may differ from country to country, the basket average is different even if all individual prices are the same. For the small price movements that have occurred since EMU began, this is unlikely to have been a serious problem and we will not return to it.

affected businesses. In related fashion, it may also happen via the housing/property markets, by virtue of a run-up in local asset prices. Imperfections in factor and credit markets may mean that the adjustment to such overhangs can be painful. In addition, even a temporary increase in domestic relative prices (i.e. a loss in competitiveness) can lead to a permanent loss in international market share or inward foreign direct investment, if hysteresis effects are important.

As we will show, 'imported' inflation remains a threat even for a currency union, if member countries have different exposures to extra-union trade. Most directly, a member country that consumes imports from a non-member country will experience different inflationary pressures if the euro exchange rate depreciates as compared to a member country that conducts all its trade with other member countries. There are also indirect effects: the within-EMU competitiveness of a firm could be adversely affected if it relied on imported materials from a non-EMU country when its competitors were sourcing from within the EMU. Unless contractual and technical conditions allowed the firm quickly and fully to switch its source of material supplies, its profitability could be badly damaged and perhaps result in layoffs or even bankruptcy. The sharp movements in exchange rates between the euro and the US dollar make this a point of empirical relevance in the present context.

Indeed, inflation differentials in the euro zone could turn out to be larger and more persistent than in some other currency unions. Relative to the United States, inter-regional smoothing mechanisms are absent: migration is weaker and there is no strong federal fiscal system. Domestic fiscal policy is also unlikely to be an effective counterweight. As is increasingly well appreciated, the effectiveness of discretionary fiscal policy is weak and uncertain.³ Moreover, even if fiscal policy could be usefully deployed as a stabilization device, its flexibility is constrained by the Stability and Growth Pact and concerns about long-term fiscal sustainability in several member countries.

3. DIVERGENT INFLATION EXPERIENCE IN PRACTICE

Figure 1 shows the phenomenon that needs to be explained. Both the mean and dispersion of inflation declined in the years running up to EMU, but then suddenly increased again after the first quarter of 1999. Subsequently both mean and dispersion declined somewhat again. This hump-shaped value is strikingly similar to the movement of the exchange rate with the dollar (Figures 2 and 3). In this section we will argue that the relationship is structural.

Actually, while inflation rates diverged, absolute price levels *converged* during the early months of EMU. The correlation between European real price level convergence and episodes of dollar strength is a long-standing but hitherto unnoticed empirical regularity. The dollar movement has differentially affected price movements across

³ See Perotti (2003) and the references therein. However see EEAG (2003) for proposals that could improve the capability of a discretionary fiscal policy to act as a stabilizing force.

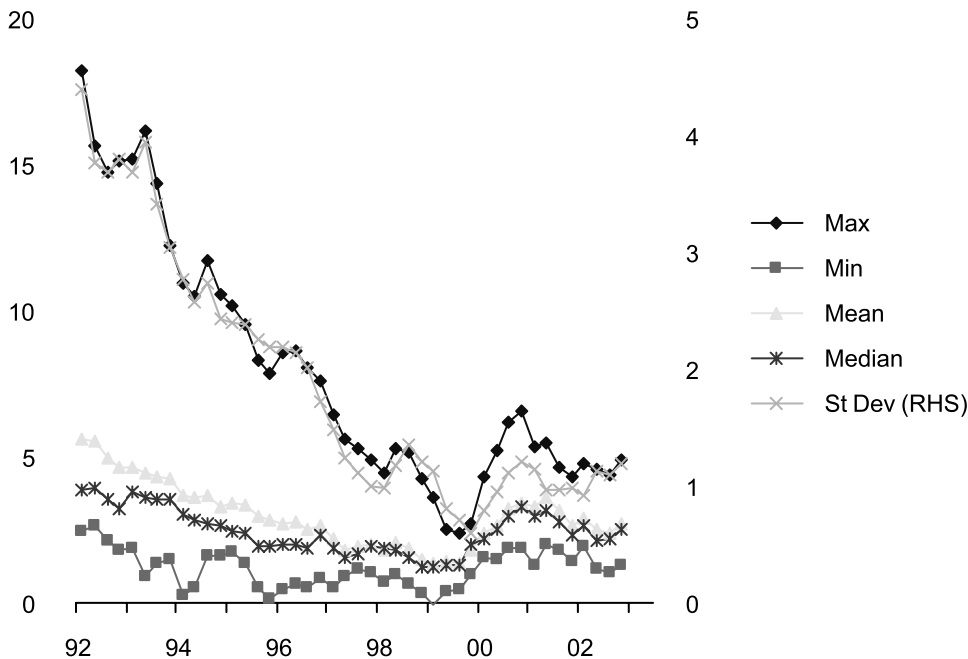


Figure 1. Distribution of euro zone inflation rates, 1992–2002

Source: Calculations based on line 64..X of the IMF's *International Financial Statistics*; quarterly data in per cent per annum.

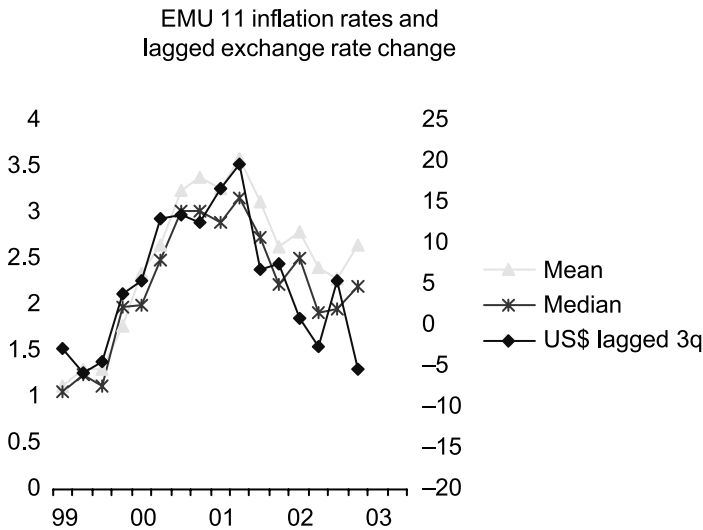


Figure 2. Currency depreciation and inflation: euro zone, 1999–2002

Note: The figure shows the mean and median inflation rates (per cent per annum) across the EMU members (excluding Greece) and, on the right-hand scale, the annual rate of exchange rate change of the euro against the US dollar lagged three quarters (DM before 1999).

Source: Calculations based on line 64..X and line 163..RF of the IMF's *International Financial Statistics*; four-quarter changes.

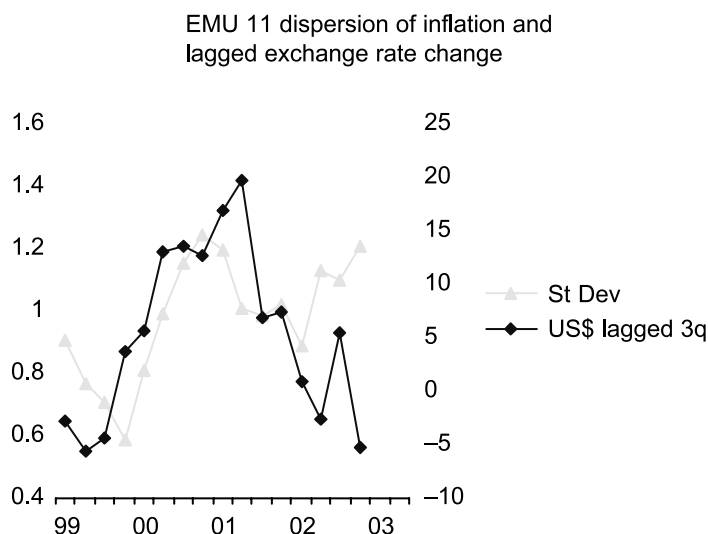


Figure 3. Currency depreciation and inflation dispersion: euro zone, 1999–2002

Note: The figure shows the standard deviation across the EMU members (excluding Greece) and the annual rate of exchange rate change of the euro against the US dollar lagged three quarters (DM before 1999), all in per cent per annum.

Source: Calculations based on line 64..X and line 163..RF of the IMF's *International Financial Statistics*; four-quarter changes.

Europe for several decades and this phenomenon has continued even under EMU.

Exchange rate movements are not the only source of differential inflation. The initial decline in nominal interest rates – a once-off asymmetric shock – does seem to have been associated with differential effects on property price levels. And, contrary to a simplistic view of the price process in a currency union, national output gaps continue to have a significant impact on national inflation rates, although government deficits have no separate effect (apart from their indirect effect on output gaps).

The section begins with a descriptive analysis of these developments and concludes with a formal model of how these factors have interacted jointly to determine national inflation rates.

3.1. Converging inflation rates to EMU ... and then diverging!

After a long period of decline, reflecting the convergence demanded by the Maastricht Treaty, mean and median inflation in the EMU area bottomed out (somewhat ironically perhaps) in the first months of the new currency, namely during the quarter to March 1999; see Figure 1. Since then, there has been a rebound, albeit a modest one, from about 1.25% to between 2 and 2.5%.⁴ By 2002, inflation rates were

⁴ Nevertheless, the rebound in dispersion is striking relative to the sustained and almost complete convergence in bill and bond yields (cf. Adjauté and Danthine, 2002). See also Lane (2003a) on the dynamics of the inflation distribution in Europe.

slowing again in the EMU, giving a generally hump-shape (inverted U-shape) to the plot of inflation rates since 1999 (Greece apart).⁵

Dispersion of inflation rates between member countries, whether measured by the overall spread between maximum and minimum, by standard deviation, or by the coefficient of variation, has also widened since 1999, though it remains well below the figures recorded before 1997.

The major outliers in the years before EMU began were Greece and Portugal. Since the start of EMU the clustering of countries has remained quite tight. In only one country (Ireland) has 1999–2002 inflation differed from the EMU-wide mean by more than one standard deviation. Ireland's mean annual inflation in this period was 4.1%, compared with an EMU average of 2.5. The next highest countries were Greece, the Netherlands, Portugal and Spain with between 3.1 and 3.2%.

3.1.1. Comparing inflation dispersion in EMU to the United States.

Although the dispersion of inflation rates took some observers by surprise, Table 1, reporting summary statistics on the distribution of national/regional inflation rates in the euro zone and the US over 1999–2001, shows that the dispersion, as measured for example by the coefficient of variation (CV), was not dramatically wider in the euro zone during these years. Indeed, the range for inflation is bigger for US regions in each of the years 1999–2001. This table indicates that, at least over this period, the degree of inflation dispersion in the euro zone is not out of line with that occurring in the other major advanced country currency union.⁶

Moreover, if national/regional price levels have a common long-run trend, inflation differentials should diminish over time. Although we do not have a long time series for the euro zone, Table 2 offers some relevant comparisons. For the 'Euro core' countries, the range in average annual inflation rates (measured in a common currency) was only

Table 1. Summary inflation statistics: the euro zone and US regions

	Euro zone			US regions		
	1999	2000	2001	1999	2000	2001
Mean	1.5	2.8	3.0	2.3	3.5	3.1
St Dev	0.8	1.0	1.1	0.8	0.8	0.9
CV	0.51	0.35	0.36	0.34	0.23	0.30
Max	2.5	5.2	5.2	4.2	5.8	5.4
Min	0.5	1.9	1.8	1.0	1.7	1.2
Range	2.0	3.3	3.4	3.2	4.1	4.2

Note: Per cent per annum. In this table, mean inflation rates are unweighted averages across euro zone member countries and US regions respectively. US data are based on 26 regions.

Source: European data from Eurostat's HICP database; US data from Bureau of Labor Statistics.

⁵ Of course, Greece was not a member of EMU until 2001. Much of the empirical work below excludes Greece.

⁶ Note, however, that the US data are considered noisy and this would tend to widen the dispersion.

Table 2. Long-term inflation differentials

			Range
(1)	Euro core	1972–1998	0.20
(2)	US regions	1976–1995	0.61
(3)	US regions	1926–1995	0.95

Notes: Per cent per annum. Euro core is Germany, Austria, Belgium, the Netherlands, France and Italy. In rows (1)–(2), range is in average annual inflation rates (measured in DM for the Euro core). In row (3), it is the mean range for non-overlapping decadal intervals over 1926–95.

Sources: Euro core data adapted from Walton and Deo (1999); US regions calculations adapted from Cecchetti *et al.* (2002).

0.2 percentage points over 1972–98. Indeed, this is lower than the ranges calculated for US regions over various time intervals, as is shown in rows (2) and (3). These data suggest that there is a substantial non-permanent component to inflation differentials. That said, the existing evidence is that inflation differentials are only eliminated slowly: Cecchetti *et al.* (2002) estimate the half-life of convergence for US regions to be nine years.

This comparison with the United States experience is instructive: inflation differentials in the euro zone do not appear to be extraordinary; moreover, differentials should be reversed over time. Even if the distribution of relative inflation rates continues to be similar between the euro zone and the United States, however, inflation asymmetries may be more troublesome for the euro zone than for the United States, for the reasons argued in Section 2.

3.2. Exchange rates are a major factor in explaining inflation divergence

Section 2 already flagged differential import price movements as a possible source of inflation differentials. Shifts in exchange rates are an important source of such movements. The share of each EMU member state's trade that is accounted for by other EMU members differs widely (as does the pattern of extra-EMU trade, see Table 3 below); accordingly the impact of a given movement of the euro on import prices will tend to differ widely, even if member states are price takers in international trade. Furthermore, the importance of international trade in the economy differs greatly between member states. Accordingly, the impact on domestic prices of a given movement in the euro can be quite different.⁷

We illustrate this in column (1) of Table 4. A pooled regression of quarterly changes in national nominal effective exchange rate indices on the euro-dollar exchange rate,

⁷ Even if trade patterns were identical, variation in rates of pass-through could still lead to inflation divergence in response to an exchange rate shock. This has some relevance: a large (albeit declining) share of Irish consumer imports has traditionally been invoiced in sterling, whereas the same goods imported into Germany or France might be invoiced in euro, due to different distribution networks. The determinants of exchange rate pass through are the subject of much current theoretical and empirical work in international macroeconomics. At a broad level, we may expect the introduction of the euro to increase the proportion of imported goods that are priced in euro rather than in foreign currency, which will act to insulate euro zone prices from temporary exchange rate shocks.

Table 3. Direction of trade 2000–2001

	Non-EMU imports as a percentage of GDP	Non-EMU as a percentage of imports
EMU		
Austria	18.4	36.0
Belgium	33.9	40.9
Finland	22.5	66.9
France	12.1	44.7
Germany	19.6	58.1
Greece	17.0	53.1
Ireland	59.2	79.2
Italy	13.7	50.6
Luxembourg	33.0	26.0
Netherlands	36.3	59.9
Portugal	13.6	32.5
Spain	13.8	44.3
Average	24.4	49.4
Non-EMU EU		
Denmark	16.3	49.9
Sweden	19.4	51.4
United Kingdom	15.4	55.9
Average	17.1	52.4
Accession countries		
Bulgaria	32.9	56.3
Cyprus	27.2	60.4
Czech Republic	24.7	34.6
Estonia	51.2	61.2
Hungary	29.2	46.7
Latvia	27.5	60.1
Lithuania	29.4	65.1
Malta	57.7	55.9
Poland	13.0	47.2
Romania	16.1	47.5
Slovak Republic	39.7	54.0
Slovenia	21.5	46.4
Turkey	15.5	64.6
Average	29.7	53.1

Notes: The calculations are based on current membership of EMU.

Source: Trade data are from the IMF's Direction of Trade; GDP from the World Bank's World Development Indicators.

quarterly 1999.1–2002.2 produces an R^2 of 0.85; fixed effects are not significant. The coefficients on the dollar rate, estimated quite precisely, vary widely from 0.07 in Luxembourg and 0.11 for Austria to 0.24 for Finland and 0.35 for Ireland. Thus the impact, during the EMU period, of the change in the euro-dollar rate for the Irish effective exchange rate index was five times that for Luxembourg, taking into account the correlated changes in other exchange rates.

As a preliminary bivariate verification and quantification of the relation between exchange rates and price levels, we estimated a panel regression on quarterly data

Table 4. Pass-through and related relationships

Dependent variable	(1) $\Delta neer$		(2) Δcpi		(3) Δcpi	
	Estimate	(<i>t</i> -stat)	Estimate	(<i>t</i> -stat)	Estimate	(<i>t</i> -stat)
a_1	0.000	(0.4)	1.962	(3.5)	1.012	(1.8)
a_2 (at)	-0.110	(5.0)	0.023	(1.3)	-0.134	(0.9)
a_2 (be)	-0.169	(7.7)	0.071	(4.1)	-0.356	(3.5)
a_2 (de)	-0.228	(10.3)	0.037	(2.1)	-0.109	(1.5)
a_2 (fi)	-0.235	(10.7)	0.105	(6.1)	-0.300	(4.6)
a_2 (fr)	-0.192	(8.7)	0.046	(2.6)	-0.244	(2.6)
a_2 (ie)	-0.350	(15.9)	0.103	(5.9)	-0.206	(4.2)
a_2 (it)	-0.186	(8.4)	0.024	(1.4)	-0.100	(1.1)
a_2 (lu)	-0.072	(3.3)				
a_2 (ne)	-0.196	(8.9)	-0.005	(0.3)	0.060	(0.6)
a_2 (pt)	-0.163	(7.4)	-0.000	(0.0)	0.108	(1.1)
a_2 (sp)	-0.162	(7.3)	0.030	(1.7)	-0.144	(1.3)
a_2						
a_3			-0.064	(3.5)	-0.019	(1.3)
a_4 (at)			-0.024	(3.3)	-0.202	(3.4)
a_4 (be)			-0.020	(2.7)	-0.117	(2.6)
a_4 (de)			-0.018	(2.5)	-0.079	(2.5)
a_4 (fi)			-0.026	(3.5)	-0.120	(3.8)
a_4 (fr)			-0.012	(1.6)	-0.073	(1.7)
a_4 (ie)			-0.069	(7.2)	-0.125	(6.2)
a_4 (it)			-0.028	(3.7)	-0.108	(3.2)
a_4 (ne)			-0.045	(5.7)	-0.175	(4.4)
a_4 (pt)			-0.048	(5.8)	-0.196	(5.0)
a_4 (sp)			-0.041	(5.1)	-0.192	(4.6)
$ar(1)$	0.404	(5.2)	0.845	(14.5)	0.831	(11.1)
Countries/obs.	11	143	10	140	10	140
Years	1999:1–2002:2		1999:1–2002:2		1999:1–2002:2	
Method	Unweighted panel		Unweighted panel		Unweighted panel	
RSQ/DW	0.854	2.06	0.925	1.62	0.914	1.75

Note: $ar(1)$ is first order autocorrelation coefficient. Regression (1) is: $\Delta neer = a + b_i \Delta euro$; Variables: $\Delta neer$, $\Delta euro$ are log-change in the nominal effective exchange rate index and in the (reciprocal of) euro/\$ exchange rate. Regression (2) is of the form $\Delta cpi_i = a_1 + a_{2i} \Delta euro + a_3 cpi_i(-1) + a_{4i} euro(-1)$, where cpi is ifs line 64 (rebased); Regression (3) replaces $euro$ with $neer$.

linking national CPI changes to previous exchange rate movements (results of estimating a more fully specified model on annual data are presented later). We include an error correction term to capture the long-run relation between exchange rate and price level trends: we allow the long-run coefficient a_{4i} to vary across countries, to take into account variation in exposure to extra-euro zone trade. The model estimated was:

$$\Delta p_{it} = a_1 + a_{2i} \Delta e_{t-1} + a_3 p_{it-1} + a_{4i} e_{t-2} + \varepsilon_{it} \quad (1)$$

The results of this regression are shown in Table 4 (columns 2 and 3) and display a convincingly close fit, whether it is the dollar-euro exchange rate or the nominal effective index that is used. Moreover, the largest coefficients a_{4i} are for the outlying countries for inflation as a whole (Ireland, Greece, the Netherlands and Portugal).

3.2.1. Price level convergence. Despite the existence of the common currency, it is not correct to interpret inflation differentials between members as implying a deviation from purchasing power parity (PPP) in first differences. For there is the rest of the world to take into account, and to the extent that trading partners differ, then it may be that some of the raw inflation differentials between EMU members have had the effect of reducing deviations from PPP measured on a trade-weighted basis. Moreover, if initial price levels differ, inflation differentials are required for convergence to PPP. This subsection examines the convergence of PPP-adjusted exchange rates (a measure of absolute price convergence).

Figure 4 shows the relation between productivity growth and real exchange rate appreciation for post-EMU and a representative pre-EMU period for a set of European countries.^{8,9} The positive correlation implied by a crude version of the Balassa–Samuelson hypothesis is not present in this short period. Indeed, there is actually a strong negative cross-sectional correlation between productivity growth in 1997–2001 and real exchange rate appreciation in EMU (thanks largely to Ireland and Greece, and also the UK). As a matter of theory, this is not too surprising: Benigno and Thoenissen (2003) and FitzGerald (2003) have recently emphasized that fast productivity growth can lead to real depreciation. One factor is that it may generate a terms of trade deterioration; another is that productivity growth in the non-traded sector should be associated with real depreciation.

Nevertheless, a positive relationship between the price *level* (PPP times exchange rate) and the *level* of GDP per capita has existed consistently for several decades among the EMU members.^{10,11} And the gradual convergence in living standards as between different countries has contributed to some long-term convergence of price *levels* across countries.¹² For example, the dispersion of the price level (measured by the coefficient of variation of PPP times the exchange rate) declined from an average of 19% in the early 1970s to 14% in 2001. But there have been wide fluctuations over the period, with this index going as high as 24% in 1978.

Interestingly, movements in the index of price dispersion have been correlated, not only with the dispersion of per capita income, but strikingly also with the DM/dollar

⁸ We include non-EMU members here since long-run real exchange rate dynamics should be in force regardless of the exchange rate regime.

⁹ See Alesina *et al.* (2001) for a simplified rendition of this explanation. See Obstfeld and Rogoff (1996) for a more comprehensive textbook treatment. Devereux (2000) makes the point that productivity growth may be more important in the non-traded sector in some countries.

¹⁰ The positive relation between output per capita and price levels may reflect the Balassa–Samuelson mechanism but also non-homotheticity in tastes and the importance of quasi-fixed factors (e.g. land) in the non-traded sector.

¹¹ The slope of this line appears to have flattened, however, presumably reflecting closer good market integration (Figure 5). Detailed regression results are not reported.

¹² See also Rogers (2002) who uses a different measure for the price level (from the EIU) and finds that the greatest reduction in price dispersion took place in the early 1990s, rather than being associated with the advent of the single currency. Beck and Weber (2001), Chen (2002) and Imbs *et al.* (2002) study price dispersion across European regions but the focus is on (possibly non-linear) speeds of convergence rather than the determinants of the price gaps.

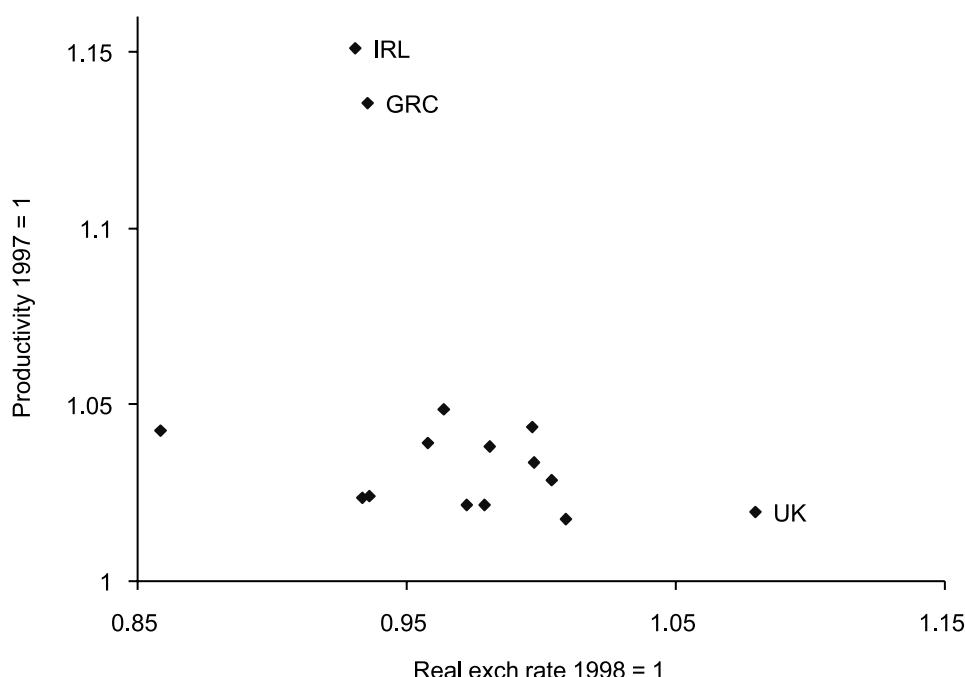


Figure 4. Productivity growth and real appreciation, 1997–2001

Notes: Real exchange rate is ‘Index of relative consumer prices in a common currency’; productivity is ‘productivity index’.

Source: OECD *Economic Outlook*.

market exchange rate.¹³ When the US dollar is strong, prices in Europe converge. Although the empirical relationship has been quite tight, this point does not appear to have been noticed in the literature over the years.¹⁴ It is plausible that whatever forces underlay it in the past are likely to have been the drivers once again of the price level convergence during the first three years of EMU.¹⁵

3.2.2. Other policy factors: fiscal policy and interest rates. In addition to the roles played by effective exchange rate movements and price level convergence, what policy-related factors have contributed to inflation differentials within the euro

¹³ The cross-sectional standard deviation of per capita GDP enters with a negative ‘wrong’ sign if included in this regression on its own on annual data 1970–2001, but this is due to a data discontinuity in 1991 after the unification of Germany enters the statistics. Accounting for this with a slope dummy restores the ‘right’ sign. The fit of the resulting equation is quite good. It implies that a 10% movement in the dollar/DM rate narrows the index by about 0.75%. The regression is:

$$\text{Coeffvar}_i = -0.14 + 0.0169 \text{ GDPpc}_i - 0.0054 \text{ Unification} * \text{GDPpc}_i + 0.075 \$/\text{DM}_i$$

(1.4) (2.9) (7.0) (5.3) $R^2 = 0.811$ $DW = 1.61$

¹⁴ For example, Crucini *et al.* (2001) who stress that nominal exchange rate movements were of little effect in influencing real exchange rates over a five-year interval. But see Papell (2002).

¹⁵ Among possible causes for this empirical relationship we conjecture that episodes of dollar strength might have generated a kind of Dutch disease effect, and that this effect would have been stronger in low productivity-low price countries. Exploring this and other possible explanations is not the purpose of the present paper.

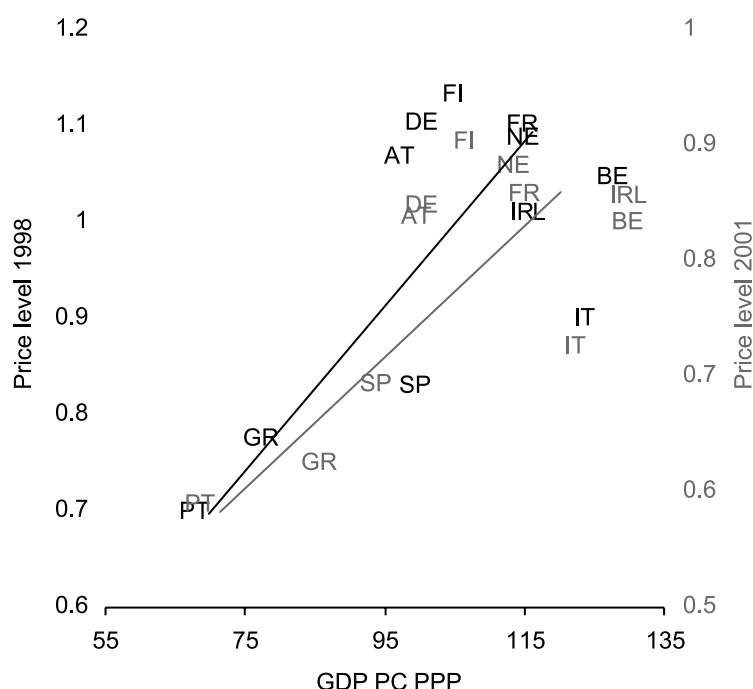


Figure 5. Price levels and GDP per capita, 1998 and 2001

Notes: Price level is purchasing power parity times exchange rate; output is gross domestic product at 1995 purchasing power parities divided by total employment, index based to Germany = 100 in each year.

Source: OECD *Economic Outlook*.

zone? In the case of interest rate and fiscal deficit policy, a common rule structure was nominally in effect (much weaker in the case of fiscal policy). But once again, as with the exchange rate, the actual impact of the evolution of interest rate and fiscal variables on inflation rates was, if anything, to contribute to divergence.

In the presence of nominal price or wage stickiness, aggregate demand factors play a role in driving inflation and real exchange rates in the short run and can push output above its long-run potential level. The pairwise correlation between output gaps and inflation rates was 0.50 over 1999–2001.¹⁶

One factor driving aggregate demand in some countries during this period was a sharp decline in real interest rates. The convergence of both nominal and real interest rates in the different member countries was sharp as the start date for EMU approached. But, while nominal rates remained bunched together, the spread between real interest rates widened out again subsequently as inflation diverged. Ironically, this placed some of those countries with previously high real interest rates (such as Ireland, Spain, Portugal and Greece) at the lower end of the range later:

¹⁶ It is beyond the scope of this paper to discuss the empirical failings of the existing measures of output gaps. We employ the OECD measure in this study. See also European Central Bank (1999).

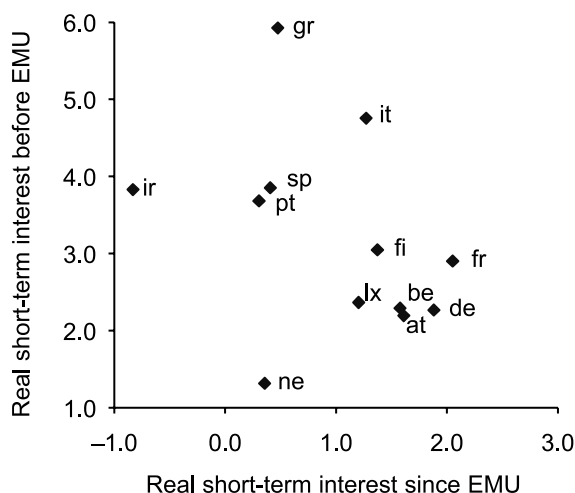


Figure 6. National real interest rates: before and since EMU

Source: *Ex post* real money market interest rates calculated from line 64..X and line 60B of the IMF's *International Financial Statistics*; quarterly data.

Figure 6 clearly shows a negative correlation between pre- and post-EMU real short-term rates.¹⁷ The fall in real interest rates in those countries with higher-than-average inflation is a potentially destabilizing factor. It sustains spending levels and hence upward demand pressure on prices in exactly the countries that already have relatively high inflation, hence working against the factors that tend towards inflation convergence.

The most prominent contribution of a fall in nominal and real interest rates to demand and inflation can be through the property market. There is a fairly strong negative cross-sectional correlation between real interest rate declines in the run-up to EMU and commercial property inflation in 1995–2001 (the correlation is -0.67).¹⁸ Beyond the wealth effect of rising property values on domestic consumption, a boom in the property market may also store up a future adjustment problem.

Turning to another policy influence on the level of domestic demand, fiscal positions are partly endogenous, especially to the business cycle and to interest rates. Furthermore, budget deficits are somewhat constrained by the Stability and Growth Pact, as well as being influenced by the scale and direction of intra-EU transfers. Nevertheless, to a large extent, within the period under review, the cyclically adjusted primary surplus has been largely under the control of national governments, although there may be a policy feedback from observed inflation. However, there appears to be no cross-sectional correlation between inflation and the cyclically adjusted primary surplus during 1999–2001: the bivariate correlation is -0.002 .

¹⁷ This effect thus goes beyond the original Walters' critique of destabilizing capital market effects of a currency peg.

¹⁸ For the eight countries where data is available. There is no cross-sectional bivariate correlation with residential property inflation – Italy, with a sharp fall in interest rates, experienced only modest house price rises in 1995–2001. Starting with 1995 allows anticipatory price movements as discussed (in fact, the correlations for 1998–2001 are not significant).

With respect to another dimension of fiscal policy, changes in the indirect tax burden tend to show up in consumer prices. In principle, this is quite a complex thing to measure. If we take the change in the share of GDP taken in taxes on goods and services as a rough and ready measure, however, we will get some indication of trends in indirect taxation. Interestingly, calculating this change for the period 1998–2001, we find that the correlation with post-EMU inflation is insignificantly negative; even if the outlier Ireland (for which the ratio of consumption to GDP declined sharply during the period) is removed, the correlation, although now positive, is still insignificant.

3.3. Econometric evidence

We ran multivariate panel regressions to establish the relative contributions of some of the key factors discussed above in driving inflation differentials within the euro zone over 1999–2001. A fairly general specification for inflation differentials can be written as

$$\pi_{it} - \pi_t^E = \beta(z_{it} - z_t^E) - \delta([P_{it-1} - P_{it-1}^*] - [P_{t-1}^E - P_{t-1}^{E*}]) + \varepsilon_{it} \quad (2)$$

where π_{it} , π_t^E are the annual national and euro zone inflation rates respectively; z_{it} , z_t^E are national and euro zone variables that exert short-term influence on the inflation rate; P_{it} , P_t^E are the national and euro zone price levels and P_{it}^* , P_t^{E*} are the national and euro zone long-run equilibrium price levels.¹⁹

If we assert that the euro zone countries share a common long-run price level, this expression can be simplified to

$$\pi_{it} - \pi_t^E = \beta(z_{it} - z_t^E) - \delta(P_{it-1} - P_{t-1}^E) + \varepsilon_{it} \quad (3)$$

The assumption of a common long-run price level is plausible for a putative convergence club such as the euro zone, with tight trade and institutional linkages eliminating income and productivity differentials over time.^{20,21} We also experimented with the alternative hypotheses that even long-run price levels may diverge due to productivity or income differences and we report results below for these cases. However, we

¹⁹ We do not include country-fixed effects, since it is implausible that there exist permanent inflation differentials across euro zone member countries. This specification assumes that inflation differentials are stationary; equivalently, that national and euro zone price levels are cointegrated. Clearly, we cannot test these assumptions given the short time interval but these assumptions are firmly grounded in economic theory and so we are comfortable in treating these as maintained hypotheses. We note that much recent empirical work on real exchange rates postulates a non-linear speed of adjustment to the long-run equilibrium. Our short time span does not permit us to investigate such non-linearities. Finally, this specification implicitly assumes a common speed of adjustment at local and European levels: again, more data could allow us to relax that assumption.

²⁰ See also Froot and Rogoff (1995) and the empirical work by Zussman (2003). The latter finds evidence of absolute convergence in price levels among OECD countries.

²¹ We earlier remarked that the degree of price dispersion in Europe appears to co-move with cycles in the euro-dollar (DM-dollar) exchange rate. To allow for this cyclical effect, one could write an expanded specification with, for example, intercept and slope dummies for periods of dollar strength and weakness. As data emerges for alternating periods of dollar strength and weakness, it will become possible to disentangle the long-term and cyclical price convergence effects.

do not find a significant role for these variables and so focus on the more restricted specification in our main discussion.²²

In turn, the euro zone variables can be linearly combined into a time dummy, which allows us to write

$$\pi_{it} = \phi_t + \beta z_{it} - \delta P_{it-1} + \varepsilon_{it} \quad (4)$$

Following our analysis in the previous subsection, we include three variables in our z -vector. These are the rate of change in the nominal effective exchange rate (lagged by one period), the impulse in the cyclically adjusted fiscal surplus and the output gap.²³ This gives us our empirical specification

$$\pi_{it} = \phi_t + \beta_1 \Delta NEER_{it-1} + \beta_2 GAP_{it} + \beta_3 FISC_{it} - \delta P_{it-1} + \varepsilon_{it} \quad (5)$$

where π_{it} is the annual inflation rate, $\Delta NEER_{it-1}$ is the lagged growth rate of the nominal effective exchange rate, GAP_{it} is the output gap, $FISC_{it}$ is the impulse in the cyclically adjusted primary surplus and P_{it-1} is the lagged price level.²⁴ Note that the time dummies in the regression captures EMU-wide common movements in inflation and in the regressors, so that the regression is explaining inflation differentials in terms of idiosyncratic national movements in the determinants.²⁵

Tables 5 and 6 show the results from the panel estimation for each of six inflation measures in turn: Consumer Price Index (based on HICP data); the private consumption deflator; CPI excluding energy; the import price deflator; the GDP deflator; and wage inflation.²⁶ Table 5 displays the pooled OLS equations; GMM estimates are shown in Table 6, where we instrument for the fiscal impulse and the output gap using lagged values of these variables.

In Table 5, the impact of the exchange rate on inflation is significant across columns (1)–(6): a country that experiences a rate of depreciation of its nominal effective exchange rate that is larger than the European average will also have relatively higher inflation.

²² Rogers (2002) also employed a productivity proxy in his empirical work but found it to be insignificant for this period. As is discussed further later in the paper, these variables may become more important once the euro zone is enlarged to incorporate the accession countries. Other factors (such as the net foreign asset position) may also affect long-run relative price levels but we do not include these here due to the short time span (cf. Lane and Milesi-Ferretti, 2002).

²³ Of course, the fiscal position may primarily operate by affecting the size of the output gap. We allow for an additional independent effect, since the fiscal balance may shift the composition of expenditure towards domestically produced goods, exacerbating inflationary pressures even if the output gap is not affected. Fiscal policy may also have longer-run effects by altering unit costs and profitability but we do not pursue these channels here: see Lane and Perotti (2003).

²⁴ Our default inflation measure is based on the Eurostat HICP data; the price level is measured by the consumption price level in the Penn World Tables version 6.1 (this variable is highly correlated with the OECD PPP measure but is conceptually more appropriate); the nominal effective exchange rate, output gap and the fiscal surplus are from OECD sources. We lag the nominal effective exchange rate by one year in recognition of delayed pass-through from exchange rates to consumer prices. The impulse in the cyclically adjusted fiscal surplus is measured by $PRIM_{it} - \sum_{j=t-1}^{j=t-6} PRIM_{ij}/5 = 1$.

²⁵ In Table 5 we have reported, as well as the usual R^2 , a figure for the percentage of the variation explained by factors other than the time dummies.

²⁶ The HICP CPI measure is the official index employed by the ECB; the private consumption deflator is the preferred measure of the Federal Reserve Board; the third measure excludes the volatile energy component; although it includes intermediate goods, the import deflator provides useful information about externally generated inflation; finally, the GDP deflator and wage inflation should be more highly influenced by domestic inflationary pressures.

Table 5. Euro zone inflation differentials: pooled OLS estimates

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged change in effective exchange rate	-0.28 (-2.71)**	-0.46 (-4.64)***	-0.30 (-2.62)**	-0.79 (-1.83)*	-0.39 (-1.97)*	-0.44 (2.23)**
Output gap	0.22 (2.65)**	0.16 (2.97)***	0.28 (3.81)***	-0.14 (-0.66)	0.34 (3.62)***	0.59 (4.14)***
Fiscal stance	0.02 (0.32)	0.14 (1.73)*	0.04 (0.64)	-0.32 (-1.39)	0.08 (0.67)	0.10 (1.13)
Lagged price level	-0.03 (-2.88)**	-0.04 (-4.52)***	-0.04 (-4.86)***	-0.03 (-1.42)	-0.07 (-6.20)***	-0.01 (-1.12)
SE of regression (%)	0.73	0.65	0.62	1.78	0.88	0.88
Adjusted R ²	0.61	0.67	0.75	0.82	0.65	0.68
Percentage explained	0.43	0.54	0.64	0.17	0.63	0.67

Note: The dependent variables in columns (1)–(6) are the inflation differentials based on: (1) HICP; (2) Private consumption deflator; (3) HICP excluding energy; (4) Import price deflator; (5) GDP deflator; (6) Wages. Time-fixed effects included. The *t*-statistics are based on White-corrected standard errors. *, **, *** denote significance at the 10, 5 and 1% levels respectively. Percentage explained is percentage of the variation in the dependent variable explained by factors other than the time dummies, and is measured as one minus the squared residual standard error divided by the squared residual standard error of a regression on the time dummies alone.

Sources: Lagged price level is based on consumption price level from Penn World Tables version 6.1; Private consumption and import price deflator are from European Commission's AMECO database; the effective exchange rate is from the IMF *International Financial Statistics* database; all other data are from OECD *Economic Outlook* database.

Table 6. Euro zone inflation differentials: pooled GMM estimates

	(1)	(2)	(3)	(4)	(5)	(6)
Effective exchange rate	-0.28 (-3.43)***	-0.37 (-4.07)***	-0.26 (-2.88)***	-0.92 (-2.51)**	-0.36 (-2.21)**	-0.35 (-2.40)**
Output gap	0.23 (3.99)***	0.27 (2.95)***	0.34 (6.13)***	-0.34 (-1.49)	0.37 (2.67)**	0.71 (7.59)***
Fiscal stance	0.07 (1.71)	0.25 (3.22)***	0.13 (2.78)**	-0.58 (-3.58)***	0.11 (1.09)	0.21 (2.13)**
Lagged price level	-0.03 (-4.53)***	-0.04 (-5.10)***	-0.05 (-7.37)***	-0.02 (-0.91)	-0.07 (-7.31)***	-0.02 (-1.40)
SE of regression (%)	0.73	0.70	0.65	1.86	0.89	0.92
Adjusted R ²	0.60	0.62	0.73	0.80	0.65	0.65
Percentage explained	0.42	0.47	0.61	0.09	0.62	0.64

Note: The dependent variables in columns (1)–(6) are the inflation differentials based on: (1) HICP; (2) Private consumption deflator; (3) HICP excluding energy; (4) Import price deflator; (5) GDP deflator; (6) Wages. Time-fixed effects included. The *t*-statistics are based on White-corrected standard errors. *, **, *** denote significance at the 10, 5 and 1% levels respectively.

Sources: Lagged price level is based on consumption price level from Penn World Tables version 6.1; Private consumption and import price deflator are from European Commission's AMECO database; the effective exchange rate is from the IMF *International Financial Statistics* database; all other data are from OECD *Economic Outlook* database.

The point estimate of -0.28 in the CPI equation means that a relative depreciation of 3.5% is associated with an additional one percentage point of inflation. This is a large effect: for instance, the Irish nominal effective exchange rate depreciated by a cumulative 11% during 1998–2000, whereas the French exchange rate weakened by only 4%.

The output gap is important except for import prices – more so for the domestically generated inflation measures (the GDP deflator and wages) than for the broader indices. The fiscal surplus is marginally significant only for the private consumption deflator. Even here, the positive sign on this variable is contrary to prior expectations: an increase in the fiscal surplus is associated with relatively higher inflation.²⁷ In view of its fragility, we do not dwell on this result.

Finally, the table shows that the price convergence effect is highly significant for four inflation measures, even if not for import or wage inflation. For CPI inflation, the -0.03 point estimate implies that a country with a price level one-third below the European average would experience an additional one percentage point of inflation.²⁸ This is significant in terms of the inflation variation observed in the euro zone but also implies that the convergence process is quite gradual.

To guard against potential reverse causation whereby the output gap and the fiscal stance are influenced by the inflation rate, we conduct instrumental variables (GMM) estimation in Table 6. It turns out that significance levels for our main variables are typically even higher under this alternative estimation procedure. We note also that the fiscal stance variable is now more significant than in Table 5; however, with the exception of the import price deflator, its sign remains perverse.

These results show that a considerable proportion of the inflation differentials in the euro zone over 1999–2001 can be systematically related to a small number of macroeconomic variables.²⁹ Perhaps the most novel finding is the important role played by the nominal effective exchange rate in explaining inflation differentials: euro zone member countries continue to have quite different trading patterns and hence quite varied exposure to external currency fluctuations.

We may view this source of inflation differentials as temporary along two dimensions. First, there is surely a substantial temporary component to the decline of the external value of the euro during 1999–2001: indeed, recent months have seen a sustained recovery. Second, trade patterns will continue to evolve, with a plausible shift towards a greater proportion of intra-euro zone trade. The importance of external trade will also decline if the euro zone club expands to include the ‘outs’ (especially the United Kingdom) and the accession countries. Moreover, to the extent that some non-joiners track the euro, this will limit the degree of volatility in nominal effective exchange rates (see Honohan and Lane, 1999). Finally, as was already noted, the introduction of the euro should over time alter pricing strategies, with more imports to the euro zone priced in euros rather than in foreign currency, shifting the impact of exchange rate shocks from consumers to producers.

²⁷ A similar positive co-movement is also found by Canova and Pappa (2003), who perform a sophisticated instrumental-variables procedure to guard against reverse causation.

²⁸ In 1998, the Spanish and Portuguese consumer price levels were respectively 25% and 35% below the German level.

²⁹ Regarding the estimation procedure, we note that serial correlation in the residuals is minor. In fact, taking the CPI inflation equation, the correlation between e_{it} and e_{it-1} is negative (-0.30). Moreover, there is no evidence of spatial correlation in the residuals: a regression of $E(e_{it})$ on the log of bilateral distance yields an adjusted R^2 of 0.01 (the correlation is 0.15).

With respect to the other regressors, the importance of the output gap highlights the role of short-run imbalances in generating local inflation pressures. Controlling for the output gap, however, there does not seem to be a strong role for the fiscal impulse in determining inflation. The price convergence effect can be viewed as a long-run constraining factor on inflation differentials: long-run price levels in the euro zone should move together.

Finally, it is too early to make much progress in detecting econometrically the danger, discussed informally above, of the amplitude and duration of price shocks being magnified in particular countries through destabilizing real interest rate and wage rate dynamics. As a longer data set accumulates, this will become a priority for further research.

3.4. Robustness checks

Table 7 reports results for expanded specifications in which productivity or output levels are allowed to affect long-run price level differentials. Since shifts in these variables alter the long-run equilibrium price level, we also allow innovations in these variables to influence the inflation differential in some of the regressions. These

Table 7. Expanded specifications: CPI euro zone inflation differentials, GMM estimation

	(1)	(2)	(3)	(4)
Effective exchange rate	-0.27 (-3.33)***	-0.31 (-3.20)***	-0.26 (-2.73)**	-0.25 (-1.65)
Output gap	0.24 (4.42)***	0.26 (3.13)***	0.24 (4.24)***	0.24 (2.66)**
Fiscal stance	0.07 (1.73)*	0.04 (0.75)	0.07 (1.83)*	0.07 (2.07)*
Lagged price level	-0.04 (-2.64)**	-0.04 (-2.76)**	-0.04 (-2.97)***	-0.04 (-2.80)**
Lagged PROD level	0.004 (0.55)	0.004 (0.62)		
PROD growth rate		-0.07 (-0.43)		
Output per capita level			0.002 (0.60)	0.002 (0.55)
Output per capita growth Rate				0.003 (0.03)
SE of regression (%)	0.75	0.76	0.75	0.76
Adjusted R ²	0.59	0.57	0.58	0.56
Percentage explained	0.40	0.38	0.39	0.37

Note: The dependent variable in columns (1)–(4) are the HICP-based inflation differentials. GMM estimates. Time-fixed effects included. The *t*-statistics are based on White-corrected standard errors. *, **, *** denote significance at the 10, 5 and 1% levels respectively. PROD is the log of labour productivity in the business sector; Output per capita is based on PPP-adjusted GDP.

Sources: Lagged price level is based on consumption price level from Penn World Tables version 6.1; the effective exchange rate is from the IMF *International Financial Statistics* database; all other data are from OECD *Economic Outlook* database.

variables are not significant in any of the specifications. Moreover, despite the reduction in degrees of freedom, the results for the other regressors are largely unaffected. However, the nominal effective exchange rate marginally loses significance when both the level and growth rate of output per capita are included in column (4).

In Table 8, we experiment with alternative measures of the fiscal stance. These variations do not substantially alter the results for the other variables, even if we drop the fiscal variable entirely (column 1). The fiscal variable in levels turns out to be significantly positive (column 2); in first differences, it is not significant (column 3).

The web appendix contains more robustness checks. We report TSLS estimates for each of these specifications. In addition, as another sensitivity check, we report the results for the subsamples obtained by dropping one country at a time. The main results are quite stable: the point estimates and the *t*-statistics vary relatively little. The main exception is the fiscal variable, which turns marginally positive in a couple of subsamples.

3.5. Relation to the existing literature

The empirical contribution that is closest to ours is Rogers (2002). His results are largely complementary to ours; however, he does not include the nominal effective exchange rate as an explanatory variable.³⁰ Moreover, he does not focus specifically on the 1999–2001 period (he provides results instead for 1997–2001 that combine pre-EMU and post-EMU data).³¹ The European Central Bank (1999) also documents a strong bilateral relation between inflation differentials and output gaps but just using cross-sectional data for 1999.

4. THE ‘OUTLIER’: IRELAND’S INFLATION SURGE IN EMU

In light of the broad cross-country evidence that was marshalled in the previous section, Ireland’s experience calls for special attention. Irish inflation, below 5% for almost 15 years and averaging just under 2% per annum in the 5 years prior to EMU membership, suddenly accelerated in late 1999 and has since then been persistently at the top of the EMU inflation league. CPI inflation touched an annual rate of 7% in the 12 months to November 2000, before retreating to the 4–5% range (Figure 7). Conventional wisdom has it that this outlying experience is entirely homegrown, fuelled by an overheating economy, excessive wage claims and fiscal expansion. The rapid apparent productivity growth has suggested to many that Balassa–Samuelson effects are at work.

³⁰ Rogers does include a measure of openness to extra-euro zone trade. However, this variable will not have a stable sign: during periods of euro appreciation, it should have a negative sign; and a positive sign if the euro depreciates. In addition, the composition of extra-euro zone trade also matters in determining exposure to various bilateral exchange rate movements. This consideration is incorporated into the construction of the nominal effective exchange rate.

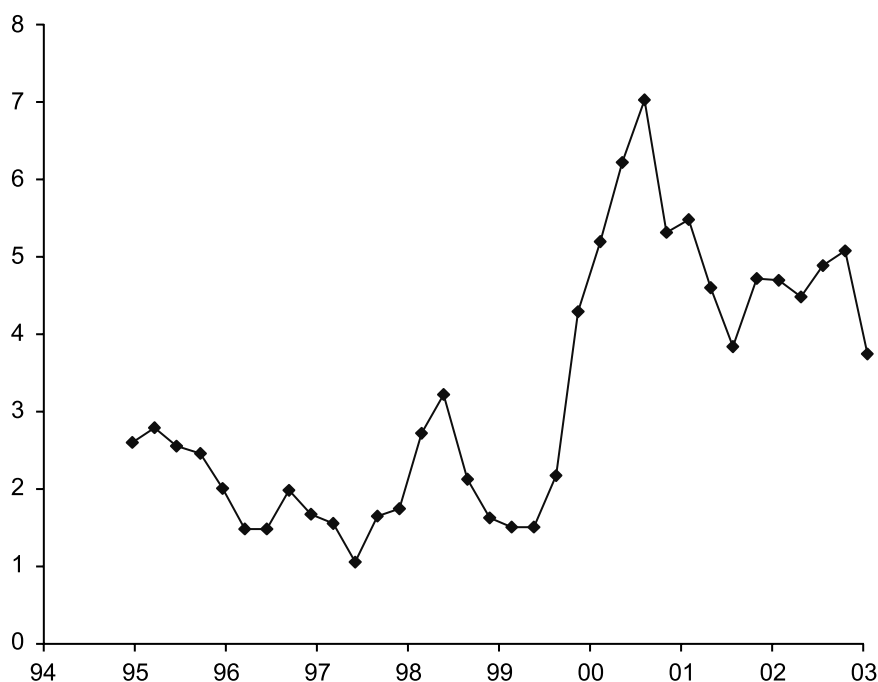
³¹ His measures of the initial price level and the fiscal variables also differ from ours.

Table 8. Euro zone CPI inflation differentials: alternative fiscal specifications

	(1)	(2)	(3)
Effective exchange rate	-0.27 (-2.88)***	-0.23 (-2.81)***	-0.27 (-1.87)*
Output gap	0.21 (3.25)***	0.23 (4.34)***	0.21 (2.81)***
Fiscal stance A		0.11 (2.16)**	
Fiscal stance B			-0.003 (-0.01)
Lagged price level	-0.03 (-4.46)***	-0.03 (-6.00)***	-0.03 (-4.77)***
SE of regression (%)	0.71	0.71	0.73
Adjusted R ²	0.62	0.62	0.60
Percentage explained	0.42	0.45	0.42

Note: The dependent variable in columns (1)–(3) are the HICP-based inflation differentials. GMM estimates. Time fixed effects included. The *t*-statistics are based on White-corrected standard errors. *, **, *** denote significance at the 10, 5 and 1% levels respectively. Fiscal stance A is the primary surplus in levels; Fiscal stance B is the primary surplus in first differences.

Sources: Lagged price level is based on consumption price level from Penn World Tables version 6.1; Private consumption and import price deflator are from European Commission's AMECO database; the effective exchange rate is from the IMF *International Financial Statistics* database; all other data are from OECD *Economic Outlook* database.

**Figure 7. Irish inflation, 1995–2003**

Note: Per cent per annum 12-month moving average plotted quarterly. Last observation is May 2003.

Source: Central Statistics Office of Ireland.

But, in addition to the domestic factors, EMU itself has contributed to the surge in Irish inflation in at least two ways. First, the exchange rate depreciation produced a much larger inflationary impulse because of Ireland's distinctive trade pattern (relatively little trade with EMU countries; much with the UK and the US). Membership of EMU removed the potentially effective national instrument of nominal exchange rate adjustment: dollar strength might well have been offset by an appreciation of the Irish pound, had it remained within the wide EMS band of 1993–8 instead of joining EMU.³² Second, by lowering nominal and real interest rates, EMU added an important demand fillip, especially manifested in soaring house prices.

4.1. Exchange rate

From late 1996 to 2000, Ireland's nominal effective exchange rate depreciated by some 17% (Figure 8). This was much more than in other EMU members, essentially because Ireland has by far the smallest share of its trade with euro-area participants (31%, compared to 54% for the others). Furthermore, the extreme openness of the Irish economy means that almost a third of aggregate demand (almost 60% of GDP) is met by non-euro area imports. Although much of that trade has something of the character of an *entrepôt* business, nevertheless the sharp fall in the value of the currency against the US dollar and sterling from 1997 onwards has implied a much larger cost push factor than experienced by other members. Assuming a lag of several quarters in the pass-through of exchange rate to domestic CPI, Figure 8 points to a simple mechanism, namely that much of Ireland's inflation of 2000–2 can be interpreted as a pass-through effect from the depreciation.³³

Had it not been for adherence to the common currency, historical experience suggests that a surge in the value of the US dollar and sterling would have resulted in appreciation of the Irish pound against the DM.³⁴ To that extent, some of this imported inflation has been due to EMU accession.

4.2. Interest rates and house prices

Given the very high interest rates previously experienced, whether measured in nominal, exchange-rate corrected, or real terms, it was always clear that EMU acces-

³² In recognition of upward pressure on the real exchange rate, Ireland undertook a 3% nominal appreciation against its EMU partners in April 1998. A larger nominal appreciation at that time could have forestalled some of the inflationary pressure that was experienced after the formation of EMU.

³³ The speed of pass-through seems to have slowed in recent years; cf. FitzGerald (2001) and FitzGerald and Shortall (1998) who point to a switch from sterling-based to euro-based pricing by the large UK groups which dominate Irish retailing.

³⁴ For example a typical log-linear regression of the Irish pound/deutsche mark rate on the bilateral rates vis-à-vis the US dollar of the pound sterling and deutsche mark on quarterly data for the wide-band period 1993Q2–1997Q3 produces:

$$e_{DM/IEP} = 2.76 + 0.52e_{\$/\pounds} + 0.62e_{DM/\$} \quad \rho = 0.64$$

(2.9) (2.2) (6.2) (2.6) $R^2 = 0.896$ DW = 1.71

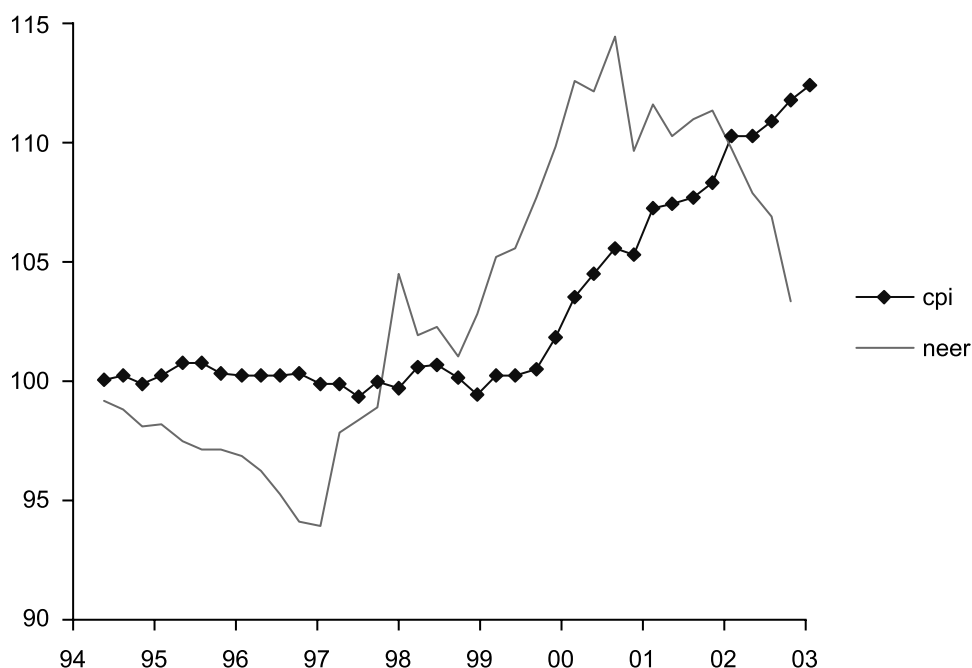


Figure 8. Irish inflation and currency depreciation, 1994–2003

Note: The figure shows CPI level, detrended by the 1994–8 trend, and the nominal effective exchange rate index.

Source: CPI is from Central Statistics Office of Ireland; NEER is from Central Bank of Ireland (trade weighted competitiveness index).

sion would lead to a sizeable step reduction in interest rates and a reduction in their volatility.³⁵ In the event, since EMU began, Irish real interest rates have been the lowest in the union at an average of *minus* 1% (reflecting the higher inflation rate).

This represents a sizeable change in intertemporal prices facing resident households (as well as locally exposed firms *on average*), and this may be taken to influence local asset prices, such as that of housing. The Irish property boom since the late 1990s has pushed *real* house prices to well over 250% of the levels of the early 1970s and mid-1980s. Interest rate declines are implicated in econometric studies of this boom, though the role of demographic pressures, real income growth and a possible non-fundamental (bubble) component are also debated (Bacon *et al.*, 1998; Roche, 1999).

³⁵ The decade from 1983–93, during the narrow-band EMS period, saw real interest rates averaging 7.44% per annum; excess returns on Irish money market instruments were more than 250 basis points relative to Germany during that period. In the wide-band EMS period real interest rates fell to an average of 3.86%, but, with monetary policy holding money market rates as tight as possible it was not in the last couple of months of 1998 that nominal short interest rates (including floating mortgage rates) converged to the EMU average. Most mortgages in Ireland are still at floating rates, but in the run-up to EMU there was a big shift to mortgage interest rates fixed typically for 3–5 years. By early 1999, these accounted for 38% of total mortgages; since then, most new mortgages have reverted to the floating model.

4.3. Productivity

Little, if any, of Ireland's inflation deviation is a reflection of the Balassa–Samuelson effect. Ireland's boom has been largely one of employment growth, and not exceptional productivity gains. Much of the very high apparent productivity growth in Irish manufacturing over the past several decades is an artefact of transfer pricing, and Ireland is already close to the EMU-average of per capita GNP (Honohan and Walsh, 2002).

4.4. Wage behaviour

Partly reflecting moderate centralized wage agreements, and partly attributable to sizeable immigration, real wage rates were remarkably slow to increase during most of the 1990s, despite the rapid growth in employment and a tightening labour market. From 1997, a less restrictive wage agreement and an increasing tendency for local wage rate increases above nationally agreed levels saw the real purchasing power of wages (i.e. deflated the consumer prices) in manufacturing start to increase steadily. Even though by 2002 they had reached only 115% of their 1996 average level, and though this partly reflects a catch-up relative to a period of artificial wage-repression, the change in trend will have added some pressure to domestic consumer prices.³⁶

4.5. Fiscal policy

Fiscal policy has certainly helped sustain high inflation in the last few years, especially with the rapid shift from high and rising surplus (before 2001) to deficit today. Even in the earlier years when revenue buoyancy kept the budget in growing surplus, fiscal policy was not withdrawing demand to the extent that the improved fiscal accounts reflected falling external debt service (as the external debt to GDP ratio declined), and increasing tax payments by foreign firms (exploiting the low tax regime). After 2000, the budget surplus declined rapidly with a turnaround of almost 6% of GDP in just two years, mainly due to autonomous tax reductions and spending policy increases.

4.6. Summary on Ireland

Exchange rate depreciation from 1997 has been a major driver of inflation acceleration in Ireland after 1999. Not only did it raise import prices directly but it improved wage competitiveness, thereby facilitating a sizeable increase in real wages. The fall in interest rates as Ireland joined EMU fuelled a house-price boom whose other causes were likely more important. That CPI inflation persisted after the currency

³⁶ The affordability of these wage increases even by marginal exporters to non-euro countries was, of course, enhanced by the currency depreciation that began about the same time and, as such, part of the real wage increase can be attributed to currency movements.

stopped falling reflects domestic factors (the continued rise in real wages and the sharp relaxation in the budgetary position), in addition to delayed pass-through. Ireland's persistently higher inflation (until May 2003) does not, therefore, cast doubt on the long-run convergence of inflation rates in the union. But to what extent wage and house-price inflation embody overshooting dynamics that may require painful adjustment in the future remains hard to establish with confidence.

5. COUNTERFACTUALS

In the previous sections we have documented and attempted to explain the inflation differentials among the EMU member countries over 1999–2001. In this section, we ask whether independent monetary policies would have delivered different outcomes.

As a simple illustration of the potential scale of the difference between the actual interest rates observed in the EMU members and what might have been adopted by national central banks, we calculated counter-factual country-specific interest rates using a version of the 'classical' interest rate rule proposed by Taylor (1993). The rule sets

$$R_t = 4.0 + 1.5 * (\pi_t - 2.0) + 0.125 * GAP_t \quad (6)$$

This rule is based on an average real interest rate of 2.0%, an inflation target of 2.0%, π_t is the inflation rate and GAP_t is the OECD's calculated output gap for each country. This specification conforms to the standard principles of Taylor rules: respond aggressively to inflation signals but also take into account deviations of output from its estimated potential level.³⁷ Table 9 presents data on the distribution of the implied country-specific interest rates, expressed as deviations from the German rate.³⁸ The calculation confirms that 'freely-chosen' interest rates would have been considerably dispersed, with the range maximized in 2000 at 5.7 percentage points.³⁹

Table 9. Euro zone interest rate dispersion under independent monetary policies

<i>Year</i>	Mean	StDev	Min	Max
1999	1.36	1.21	-0.19	3.21
2000	1.30	1.67	-0.17	5.52
2001	1.17	1.77	-0.60	4.37

Note: National interest rates as deviations from implied German interest rate. Based on Equation (3).

³⁷ There is a literature on the specification of Taylor rules for open economies. Variation in trade openness may mean that the optimal coefficients in the Taylor rule should vary country by country. In addition, an additional exchange rate term could be added to the rule that would imply interest rate responses to exchange rate fluctuations. However, Leitimo and Soderstrom (2001) find that adding an exchange rate term adds little to performance and the simple rule here is useful for illustrative purposes.

³⁸ Some other authors have implemented similar rules for the aggregate euro zone economy (Faust *et al.*, 2001; von Hagen and Bruckner, 2002). By expressing the constructed interest rates in terms of deviations from the German level, the impact of alternative choices concerning the target nominal interest rate and inflation rate is minimized.

³⁹ France has the lowest implied interest rate in each year; Ireland has the maximum in 1999–2000, with the Netherlands the maximum in 2001.

A complementary approach to addressing this question is to treat the specification in Equation (2) as a regime-independent model of inflation. In this case, monetary policy would operate by affecting the values of the regressors: in particular, country-specific interest rate policies would have meant different values for the output gap and the effective exchange rate.⁴⁰

Taking these in reverse order, it seems likely that at least some of the member countries would have acted to prevent large movements in their effective exchange rates by raising interest rates in response to the dollar appreciation in 1999–2000. For instance, as was noted in Section 4, the historical evidence for Ireland is that it would have acted to eliminate about half of the dollar-DM movement. A combination of higher interest rates and less currency depreciation would have acted to moderate inflation pressures in these countries.

With regard to the output gap, there are several reasons to believe output gaps would have been smaller under national monetary policies. Most obviously, a counter-cyclical monetary policy would have helped to close output gaps. In addition, as was discussed earlier, one source of domestic demand in the high growth economies has been the sharp fall in interest rates relative to pre-EMU levels in these countries: in the absence of EMU, any such interest rate reduction would have been smaller and would have been smoothed out under standard monetary procedures. Another contributor to output gaps has been the exchange rate depreciation in some of the countries: as noted above, the scale of depreciation in several countries would have been muted by interest rate increases under independent monetary policies.

Regarding the other variables included in Equation (2), would fiscal policy have been more restrictive in the high-inflation countries under an alternative monetary regime? With higher interest rates, it seems likely that primary deficits would likely have been lower. However, it is plausible that the price level convergence effect may have been weaker in the absence of a common currency. The common currency has increased the transparency of price differentials (especially since the introduction of notes and coin in 2002) and may have also increased trade integration.⁴¹ In that case, the low-price countries would have experienced lower inflation and the high-price countries faster inflation.

The discussion so far in this section does suggest that a superior inflation performance might have been attainable under independent monetary policies. However, proponents of a single currency can point to some counter-arguments. First, the ongoing integration of European product and factor markets (possibly accelerated by the advent of EMU) will plausibly erode persistent inflation differentials. In line with the price level convergence effect, the scope for dispersion in traded goods prices is falling. Labour markets are also responding, with high-growth countries receiving net

⁴⁰ We take the initial price level as largely independent of monetary policy during this period.

⁴¹ See Rose (2000) and the subsequent empirical literature on this point. However, Rogers (2002) argues that the price level convergence effect is no stronger among the euro zone countries than among the wider EU club.

inflows of migrants, easing pressure on wage rates.⁴² Finally, there are indications of increased portfolio diversification among the euro zone countries that should partially smooth out national income shocks through risk sharing. However, we also note that the absence of a euro zone federal fiscal system means that an important risk-sharing mechanism in the US is not available to the euro zone countries.

6. IMPLICATIONS FOR ACCESSION COUNTRIES

The relevant initial conditions of the accession countries and other prospective euro members differ widely. Accordingly, while there are some general implications, these would have to be interpreted on a country-by-country basis, a task that is not attempted here.

Overall, the experience of the first several years of the system reveals that convergence of inflation rates cannot be expected to be as tight or as quick as had been anticipated by some. We view the 'price convergence' effect as generally benign and self-limiting: some temporary inflation differentials are a necessary part of the transition to long-run real exchange rate equilibrium.

With respect to the divergence in inflation rates that is induced by variation in exposure to shocks to the external value of the euro, policy should not over-react to such dispersion since the nominal exchange rate movements themselves are sure to be limited and largely self-correcting as long as monetary authorities in the leading countries continue to succeed in restraining inflation over the long term.

The accession countries and the member states which have not adopted the euro are, on average, as highly specialized in trade with the current EMU participants as the latter are themselves (Table 3). If we take the non-EMU imports as a percentage of GDP, this is not much higher on average in the accession countries and is actually lower in each of the 'out' countries, by comparison with the 'ins'. There is considerable variation. Estonia and Malta are rather highly exposed to non-EMU trade, although neither to the same extent as Ireland. These countries can be expected to experience wider fluctuations in their CPI inflation, but hardly to an extent that would make a case for delaying EMU membership.

Does CPI volatility from such a source matter for policy? In terms of monetary and exchange rate policy, if a case could be made for augmenting mean EMU-wide inflation with some function of the cross-country dispersion of inflation as the target for EMU policy, then it would follow that the external exchange rate of the euro could act as a useful intermediate objective or indicator of monetary policy. However, the assessment of whether the ECB should stabilize the external value of the euro would surely be much more heavily influenced by other factors than this consideration. On the whole, there seems little reason to over-react.

⁴² The correlation between output gaps and net immigration during 1999–2000 was 0.70.

There is another potential dimension to exchange rate policy, namely the establishment of bilateral arrangements for stabilizing exchange rates between the euro and the currencies of 'fringe' trading partners (Honohan, 2000). With enlargement both of the EU and EMU membership, the potential gains from such arrangements will already be largely secured and, in any case, would have little impact compared to the volatility of bilateral exchange rates vis-à-vis major trading partners such as the US and Japan.

Should national fiscal deficits and surpluses be employed as a tool to damp inflation fluctuations? The standard prescription is that fiscal policy should be more counter-cyclical to compensate for the absence of an independent monetary policy (cf. EEAG, 2003, ch. 2). However, in line with Perotti (2003) and others, we found little econometric evidence of the stabilizing properties of discretionary adjustments to the budget balance beyond those captured in the output gap.⁴³ Moreover, the empirical investigation by Lane (2003b) suggests that governments find it hard for political reasons to push the discretionary component of fiscal policy in a counter-cyclical direction. In combination with the well-known problem of correctly timing fiscal interventions, these results suggest that national fiscal policy does not offer a 'silver bullet' in tackling excessive inflation differentials. It seems to us that further research on the appropriate role for discretionary fiscal policy in regional stabilization must be a high priority for European macroeconomists.

Perhaps the major message is for those involved in wage negotiations. Although we have argued that exchange-rate induced surges in national inflation are likely to be reversed, this view may not be shared by those negotiating on behalf of organized labour. Multi-year wage collective bargaining settlements based on an expectation of continued above-EMU average inflation could be very damaging to the competitiveness of labour in such circumstances. Given that the accession countries can be expected to support higher than average real wage increases on a sustained basis in the years ahead as their level of average productivity converges to the frontier, it will be much more difficult for negotiators in those countries to compute the appropriate and affordable rate of wage increase and the exchange-rate induced effects might easily be ignored or misinterpreted in making such calculations. As we have shown, recognizing the external sources of inflation can be of material significance in this respect.

Macroeconomic conditions at entry also need careful management. We have already seen how a sharp fall in nominal and real interest rates contributed to demand pressure in Ireland, both directly and by permitting a relaxation of fiscal discipline via the easing of budgetary constraints. New entrants should be wary of

⁴³ The point estimates we obtained – though rarely significant – implied a disinflationary effect for expansionary fiscal policy, conditional on the output gap (a result also found by Canova and Pappa, 2003). Indeed, this is the policy prescription of Duarte and Wolman (2002): income tax reductions during a boom can have a moderating impact on inflationary pressures.

allowing their economies to overheat in this way.⁴⁴ Careful attention should be paid to the rate at which currencies are pegged, especially for those countries which will experience a large fall in nominal interest rates. A more appreciated entry rate could help forestall a surge of inflationary pressures upon entry.

7. CONCLUSIONS

Despite the common currency, exchange rate movements have had a substantial impact on inflation differentials in EMU, reflecting the different degrees of exposure of member states to trade outside the euro zone. Our analysis suggests that the recent strengthening of the euro should lead to a much sharper fall in inflation in the externally orientated member countries than in the core countries that largely trade within the euro zone.

Much of the remaining pattern of inflation movements can be explained by national output gaps. The inclusion of fiscal imbalances adds no significant explanatory power. The initial fall in nominal and real interest rates – quite different across countries – likely not only contributed to inflationary pressures via raising aggregate demand in goods markets but may also have contributed to dispersion in property price movements in the run-up to and early years of EMU.

Although the observed differentials seem to have come as a surprise to some observers, they are little larger than those recorded across US regions in the same years. To some extent, inflation differentials may be more persistent within a currency union than outside it in that national inflation rates and real interest rates are inversely related inside a currency union, generating procyclical dynamics. From a policy perspective, finding institutional mechanisms that minimize the risk of real exchange rate overshooting is a high priority.

Finally, while differential productivity growth has not featured centrally in the inflation experience of existing members in the early years, it will surely be a more relevant factor when accession countries join the euro. To the extent that inflation differentials reflect price level convergence and the operation of the Balassa–Samuelson mechanism, one can view such inflation differentials benignly. However, real appreciation inside a currency union also carries risks. With a low common nominal interest rate, real interest rates in the high-inflation countries will be negative. In turn, this could fuel an expenditure boom, generating extra inflationary pressure through an emerging output gap and a rapid run-up in property prices. The potential overhang from such overheating pressures poses a serious risk for the accession countries.

⁴⁴ Current inflation and real interest rate conditions differ widely among candidate countries. The latest 4-quarter mean inflation is almost 10%, though less than 4% for the ten countries expected to join the EU in 2004. Real *ex post* short-term interest rates recently varied from 10–11% in Poland and Romania to negative values in Bulgaria. Real interest rates in Turkey have been extremely volatile.

Discussion

Jaume Ventura

CREI and Universitat Pompeu Fabra

Inflation rates in the euro zone converged dramatically from the signing of the Maastricht Treaty to the onset of EMU. At the time, most observers thought that inflation convergence was a key prerequisite for the success of the euro. Surprisingly, this process quickly halted and then reversed right after the adoption of the euro. Even more surprisingly, this inflation divergence does not seem to have had much of an effect on the viability of the single currency. How can we explain this turn of events? This paper by Patrick Honohan and Philip Lane provides a new, refreshing and quite convincing answer to this question. To fully appreciate their contribution, it is worth taking a step back and reviewing the state of the debate before their paper.

A popular view is that inflation divergence has been caused by asymmetric shocks. Since the data clearly shows that inflation has been high in fast-growing countries, it seems natural to conjecture that these asymmetric shocks must have been on the demand side. Unfortunately, there is little evidence for the existence of these asymmetric demand shocks. The Stability and Growth Pact and the creation of the European Central Bank have led to a convergence in fiscal and monetary policies. If anything, regulations and expectations about the future have converged across countries. In a nutshell, the search for the asymmetric shocks on the demand side has been futile so far, and I do not expect it to yield anything in the future.

Some have pointed out that we should look for the asymmetric shocks on the supply side. In fact, there is strong evidence suggesting that productivity growth has been quite different among euro zone countries. At first sight, the notion that one can explain inflation divergence with asymmetric supply shocks does not seem very promising. After all, supply shocks tend to generate low inflation in fast-growing countries and this directly contradicts the data. But there is a well-known recipe to 'convert' supply shocks into demand shocks. It is called the Balassa–Samuelson effect, and it goes as follows: assume there are two sectors, traded and non-traded. The former faces a relatively flat demand, while the latter faces a relatively vertical one. A positive supply shock in the traded sector raises income, and leads to a small or negligible decline in the price of non-traded goods. Higher income raises the demand for non-traded goods and this leads to a large increase in the price of non-traded goods. To sum up, if supply shocks (or productivity growth rates) are biased towards the traded sector they can create both growth and inflation in the same way that demand shocks do.

But is this the answer to the mystery of the divergent inflations? I do not believe so. It is true that Ireland and Greece have higher productivity growth than France and the United Kingdom. But these differentials in productivity growth are nothing new. They also existed well before the adoption of the euro during a period when

inflation rates rapidly converged among euro zone countries. This observation raises some difficult questions. Why did inflation rates converge before 1999 when differentials in productivity growth were as high as in the period after 1999? What did really change in the first quarter of 1999? To be fair, the hypothesis that asymmetric shocks have caused inflation divergence has run into a cul-de-sac, and new and fresh hypotheses are badly needed.

This is exactly what the paper by Patrick Honohan and Philip Lane does. The paper argues that the introduction of the euro itself has created the force for diverging inflations. The Honohan–Lane hypothesis goes as follows: euro zone countries have different trading partners and, in particular, the importance of their trade with non-euro zone partners varies substantially. For instance, while almost four-fifths of Ireland's imports come from non-euro zone partners only a quarter of Luxembourg's imports come from non-euro zone countries. Under these conditions, a depreciation of the euro will raise prices more in Ireland than in Luxembourg. To calculate the effects of changes in the nominal exchange rate on inflation, what matters is the nominal *effective* exchange rate and not the nominal exchange rate. As a result of differences in exposure to non-euro zone trade, the former varies substantially across countries even if the latter is the same for all.

The Honohan–Lane hypothesis is simple and original, and it allows us to move away from the fruitless search for asymmetric shocks. Moreover, the authors show that it works empirically. Their estimates suggest that a 3.5% depreciation in the nominal effective exchange rate raises the inflation rate by about 1%. This is enough to explain most of the differences in inflation. For instance, the 2% inflation differential between Ireland and France can be fully explained by the fact that the nominal effective exchange rate depreciated by 11% in Ireland but only by 4% in France. I find these numbers quite convincing.

Despite this positive assessment of the Honohan–Lane hypothesis, we must keep in mind that the key test of its validity is being conducted as I write this discussion. According to the Honohan–Lane hypothesis, the recent appreciation of the euro should reverse the trend once again, and generate a new period of inflation convergence. I look forward to seeing whether events will confirm this prediction.

David Begg

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Within a monetary union, divergent inflation rates are the key channel for changing real exchange rates. Sometimes this is desirable, and part of the adjustment mechanism, but sometimes divergent inflation rates are themselves sources of shocks that then initiate the need for further adjustment.

Whether inflation divergences 'matter' is therefore not a helpful way in which to pose the question. Failure of inflation rates to diverge when real exchange rate adjustment is required may be just as problematic as observed divergences in inflation rates when no other prior shocks are evident.

I therefore see the heart of the paper – its novel and important contribution – not in the discussion of when inflation divergences matter but rather in the empirical verification of the idea that, within a monetary union, different member states will typically have different patterns of external exposure and openness, and hence will be differentially affected by changes in the common external exchange rate. At its simplest, having different bilateral trade weights with third countries, they have different paths for their effective exchange rate.

Stated thus, this is an idea with which we have all long been familiar. Nevertheless, prompted by their familiarity with the Irish experience, the authors have tracked down its empirical implications and argue, convincingly, that the idea is general and consistent with the empirical evidence for the whole panel of member states in the euro zone since its launch in 1999. Ireland, being more open than Germany, experienced larger swings in its effective nominal exchange rate for any given fluctuations in the euro/dollar exchange rate. In turn, this induced differential movements in inflation that acted in the direction of equilibrating real exchange rates again.

More specifically, by encompassing several leading explanations of differential inflation – convergence to a long-run price level, the business cycle effect of output gaps through the Phillips curve, movements in the euro exchange rate, and the effect of fiscal policy – the authors show that the first three effects can clearly be detected, though any independent effect of fiscal policy disappears once the other three effects are included.

Doubtless, others will now try to extend these results. My suggestions for further research include the explicit inclusion of supply shocks (for example, successive monthly reports of the ECB have laid considerable stress on floods and animal disease as adverse shocks to which ECB monetary policy had to respond).

Next, the authors offer us a bonus, a discussion of the counterfactual of what might have happened, country by country, had member states retained an independent national monetary policy. Using a standard Taylor rule to model what national interest rates would then have been, the authors arrive at unsurprising conclusions: Irish interest rates would have been higher if they had been set in Ireland, and German interest rates would have been lower. National output gaps would therefore have been smaller.

Although I have no problem with the conclusion, I wonder if the analysis is terribly convincing. Neither output nor inflation is exogenous to the monetary policy rule. Hence, by using actual paths for output and inflation, the authors describe a hybrid of real and hypothetical rather than a true counterfactual. In such exercises, I see no coherent alternative to general equilibrium or systemic modelling.

What lessons should accession countries draw from all this? While forces for price level convergence remain strong these countries should be expected to have inflation rates above the euro zone average. Once the euro has been adopted this need present no particular problem, but any transitional monetary arrangements should be compatible with our guess about the inflation differentials that are likely on average to

persist. ERM2 is therefore potentially vulnerable to currency crises if markets do not fully understand which inflation divergences are accomplishing adjustment and which are sources of further divergence. Some of us have written all this before. What we need to learn after reading Honohan and Lane is that external movements in the euro will also have predictable effects and should be interpreted accordingly by markets.

Panel discussion

Jordi Galí agreed with the discussants that the authors should focus more on how the *nominal* exchange rate affects inflation differentials. He suggested looking in greater detail at price indices that capture some of the effects the authors are interested in. The price index of imported consumer goods or the price index for domestic final goods should pick up the nominal exchange rate effect and domestic demand effects, respectively. Moreover, the nominal exchange rate hypothesis is universal so that it can be tested on US regions or a cross-section of other countries. Margarita Katsimi argued that the nominal exchange rate hypothesis should have become less relevant after EMU in 1999.

David Miles pointed out that the increase of housing prices is not specific to Ireland since housing prices have increased substantially also in other cities such as London. What could be specific to the Irish case is that much of the mortgage debt is variable rate debt. Omar Licandro asked whether the increase of house prices in Ireland could justify including housing prices into the HICP (see the paper by Cecchetti and Wynne in this volume) given that the effect on real interest rates is important. Patrick Honohan cited an IMF study identifying Ireland's recent house price inflation as close to the highest among industrial countries in the past 20 years. He stressed that the capitalization effect matters for borrowers.

Lorenzo Codogno agreed that the policy relevance of inflation dispersion is small because the market will adjust to absorb these differences. He was interested in further discussion of the structural deviations of inflation rates. Paul de Grauwe thought that inflation differentials and the understanding of their political determinants are important. Marcel Thum asked for more discussion about the politico-economic dimension of the results for accession countries. Steve Cecchetti did not find the results surprising and thought that monetary policy-makers should not care about regional differences. To some extent he found the existence of national data unfortunate because of the resulting public pressure if such differences are not taken into account by monetary policy. Paul de Grauwe was convinced that national information will continue to play an important role for the ECB's monetary policy in the future. Mike Artis added that the importance of inflation differentials stems from the fact that historically national monetary policy has reacted strongly to fluctuations of

the exchange rate in the EMU countries. Margarita Katsimi argued that the importance of inflation differentials depends on the ECB voting mechanism: national differences should matter less if the principle of one-man-one-vote is applied than if national representation matters. Lucas Papademos pointed out that the Greek experience has been very similar to the Irish one. He thought it unlikely that inflation differences exist forever and urged more research on understanding the adjustment mechanism. He considered the implications for monetary policy as far from straightforward since inflation differences can no longer be accommodated by monetary policy. Thomas Moutos argued that the effect of international specialization, fragmentation of production and specialization has an ambiguous effect on inflation differences across countries so that inflation differences may even increase in the future. Apostolis Philippopoulos wondered whether credibility differences of national central banks have become completely unimportant after EMU as a determinant of inflation differences. Patrick Honohan replied that inflation differences across EMU members resulting from nominal exchange rates will become a matter of declining importance in the future compared with inflation differences stemming from productivity growth differences. Hans-Werner Sinn added that the nominal exchange rate channel can be important. He mentioned that for Germany a 10% devaluation increases inflation by 5%.

Omar Licandro asked whether differences in trade patterns among US regions compared with EMU countries can be used to explore the nominal exchange rate hypothesis given the similarity of the inflation differentials for the US and EMU. In particular, it would be interesting to know how much this matters for Ireland. Ernesto Stein added that the analogy between US-regions and EMU member states can be exploited if suitable data exist because states like Florida are more open than Nebraska so that there is variation in trade across regions.

Mike Artis mentioned the 'Procrustes' dilemma of a one-fits-all monetary policy rule for the euro area. For example, Ireland was used to a high interest rate policy and had to bear a substantial policy shock after accession to EMU. Moreover, standard optimum-currency-area criteria suggest that Ireland should never have joined EMU. In this context he missed a discussion of the Irish IT shock in the paper. He concluded by noting the importance of developing policy instruments for the better management of asymmetries among current and also future accession countries in the EMU.

Stijn Claessens asked why the authors did not extend their sample to earlier years. He suggested weighting countries by their degree of openness and controlling for the initial level of the exchange rate. Ignazio Angeloni asked for further explanation of how persistent inflation differentials are and how these differentials are absorbed. Mark Wynne wondered whether measurement error in the US data, the more comprehensive sample on which HICP is based and different baskets and weights used for the construction of the price indices could induce a spurious similarity of the inflation differentials among US regions and EMU countries.

WEB APPENDIX

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