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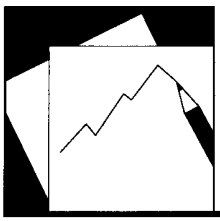

IMF Working Paper

Can Domestic Policies Influence Inflation?

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Abstract

Globalization operates not only by reducing domestic pressures on inflation but also by reducing the scope of domestic authorities to influence the pace of inflation. First, as markets are integrated, the common, cross-border sources of inflation increase, reducing the extent of domestically-generated inflation. Based on a methodology identifying common time and sectoral trends, we find this to be especially the case in the countries of the eurozone, with their longer histories of product market integration. Second, even the domestically-generated component of inflation may be difficult to manipulate. Policies act, especially in the short-run, through managing domestic demand. But the relationship between domestic demand (proxied by the output gap and unit labor cost growth) and inflation has been weak, constrained in part by trade openness. Moreover, the domestic component of inflation contains a country-specific international catch-up process that generates price equalization across countries. The evidence is that catch-up has accelerated with increasing market integration. Thus, for the eurozone economies, there may be limits on the use of fiscal and labor market policies to contain inflation. The new member states may not have policy leverage to meet the Maastricht inflation limit necessary for entering the eurozone. Case-studies show that fiscal consolidation needed to comply with the inflation criterion can be large and sustained only briefly to get under the Maastricht wire.

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I. INTRODUCTION

Does globalization reduce the *level* of inflation? Does it change inflation *dynamics*? The theoretical and empirical answers to these questions remain controversial. Compounding the problems, the mechanism thought to lower the inflation rate appears to stand in contradiction to that influencing the dynamics. Thus, in documenting the "stunning" decline in the level of inflation, Rogoff (2004, 2006) concludes that increased price and wage flexibility now creates more inflation for a given rise in domestic output, which reduces the incentives of policymakers to engineer short-term output gains.[1] But this logic, Ball (2006) notes, goes against the evidence on inflation dynamics: rather than becoming steeper, the short-term Phillips curve has tended to become flatter, i.e., if anything, domestic output increases are now associated with less, not more, inflation (IMF 2006).

If the short-term Phillips curve has become flatter, then is this the consequence of globalization? Once again, Ball (2006) is skeptical. He concedes some merit to the argument that more intense international competition restricts the ability of domestic producers to raise prices when domestic output rises and production capacity becomes tighter. But he argues that the theory underlying this observation is weak and the evidence is not persuasive. With regard to the theory, an increase in domestic output increases marginal product costs and hence prices. Globalization does not change the cyclical relationship between domestic output and marginal costs. Globalization may reduce the mark-up over marginal costs but that should not show up in a cyclical relationship between output and prices. Moreover, to the extent that the Phillips curve has become flatter, alternative explanations are more plausible: monetary policy has become more credible and lower inflation rates imply that producers have less incentive to adjust prices in response to changes in cost conditions. He also argues that at least for the United States, the change in the ratio of trade to GDP has been relatively modest and, hence, both the march of globalization and its empirical influence on the coefficient linking output to inflation are necessarily small.

The controversy continues. On the theoretical front, Woodford (2007) remains persuaded that domestic conditions are paramount in determining inflation dynamics. Even with increased global influences, domestic monetary policy controls domestic demand, and domestic rather than international demand conditions influence domestic prices. In contrast, Razin and Binyamini (2007) believe that the domestic output gap plays a diminished role in generating inflation as goods, labor, and capital markets become more internationally integrated. For this reason, they sympathize with Mishkin's (2007) conclusion that over time inflation has become "more costly to wring out of the system." Razin and Binyamini (2007) find support in the Borio and Filardo (2007) finding that foreign rather than domestic output gaps have had an increasing influence on domestic prices. However, Ihrig et al. (2007) conclude that the Borio and Filardo (2007) conclusions are frail and that the evidence favors a predominant role for domestic output conditions.

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[1] For earlier discussions on the role of international discipline in limiting the scope of short-term gains in output through monetary policy surprises, see Rogoff (1985) and Romer (1993).

In this paper, we pursue the instinct that generalizations are premature—and that globalization, though potent, has been at work through alternative mechanisms. These alternatives imply variation in short-term inflation dynamics across countries (because of structural differences) and over time (because of shifts in the policy framework and trends in globalization).[2] For this reason, we focus our attention on a relatively homogenous region (the European Union) over a recent, and relatively short, time period, 2002 and 2005. While we find a notable influence of globalization, our instinct is confirmed that even within this region, differences exist between the eurozone (economies sharing the euro as a common currency) and the non-eurozone countries. Similarly, the behavior of tradable and non-tradable goods and services differ in expected ways. Even within the short period of time, plausible shifts in inflation dynamics are perceptible.

We highlight, first, that an evident manifestation of market integration is the equalization of prices across nations. Where price convergence has been achieved, prices will tend to move together. We define the common component of consumer price inflation as that due to either common sectoral or time-varying inflation rates, as in Marimon and Zilibotti (1998). The larger the share of the common component, the greater implicitly is the degree of product market integration. In this regard, the comovement of prices is stronger within the eurozone than outside it.

Next, the difference between the overall inflation and the common inflation leaves a country-specific component.[3] If price levels diverge, then the forces of convergence will tend to bring them back closer together. Again, this feature works faster in the eurozone and for traded goods. Thus, the eurozone countries appear tightly integrated with each other and even small deviations in prices are quickly arbitraged away. On the other hand, in the non-eurozone, the catch-up reflects a longer term process. This distinction is reinforced by results that differentiate between tradable and non-tradable goods. While the catch-up speed has been broadly of the same order of magnitude for tradables throughout Europe, it has been significantly slower for non-tradables in the non-eurozone countries. Recently, the catch-up process has accelerated, especially outside the eurozone, reflecting the increasing integration of the new member states into European markets.[4]

Finally, we analyze the determinants of the country-specific inflation rate to assess the possibility of policy influences on domestically-generated inflation. We find that domestic conditions do matter in driving the country-specific component of inflation. The

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[2] Daniels and VanHoose (2006) discuss several product and labor market characteristics that would contribute to differences in inflation dynamics.

[3] At least as a first order of approximation, the methodology adopted also has the advantage that it removes the influence of a country's consumption structure.

[4] These findings also allow more nuanced interpretation of inflation persistence. Some part of this persistence is due to "inherited" inflation, in as much as inflation drivers—the output gap and labor costs—are themselves persistent. However, an important component of persistence is "intrinsic" to the catch-up process, which includes product market integration, the Balassa-Samuelson effect, and quality convergence of consumer baskets (Hanousek and Filer 2004 and Hoffmann 1998).

output gap plays a role mainly in the eurozone. The effects of the output gap and, more significantly, of wage pressures on inflation are weakened by trade openness in the eurozone.[5] However, external conditions have, in general, been more important outside the eurozone. This is observed most clearly in the more pronounced effect of a depreciation of the nominal exchange rate in raising domestic prices.

These results point to the limits of policy actions in modulating inflation. Globalization operates, as the eurozone demonstrates, through a reduction in the quantitative importance of country-specific inflation. But even the country-specific component of inflation is not wholly amenable to policy changes. Greater trade openness of the economy weakens the link between domestic demand and country-specific price setting. Thus, Miskhin's concern about the costs of "wringing" out inflation appears relevant.[6] Moreover, a significant portion of the country-specific inflation is related to the equalization, over time, in price levels, a force that has gained strength in recent years. The quantitative significance of such effects can be large for the poorer European countries, as conjectured by Rogers (2002).

Our paper is related to a literature that has found Europe a fertile ground for analyzing the strength of price convergence. In an early contribution, Froot and Rogoff (1991) found evidence for inflation but not for price level convergence (i.e., though Italy's inflation rate was falling closer to that of Germany, the rate remained higher, implying no convergence in price levels). Similarly, Goldberg and Verboven (2001) found persistently large differences in quality-adjusted car prices across Europe and related these to preferences and local market power, along with such barriers as quotas on Japanese imports. More recently, Goldberg and Verboven (2005) have found a tendency for car prices to converge, though their sample is restricted to five European nations. For a larger sample of products and covering 17 European countries, Rogers (2002 and forthcoming) finds stronger evidence of price convergence, more so within the eurozone than outside it.

Among the determinants of inflation differentials within Europe, Honohan and Lane (2003) find differential movements in the nominal effective exchange rate to be important. Angeloni and Ehrmann (2004), based on a longer period of analysis, are skeptical of this conclusion, and find instead in favor of large differences in the degree of inflation persistence across countries. But what is the source of persistence? Fuhrer (2005) argues that inflation persistence in the United States is not mainly "inherited" from the persistence in "driving variables," such as marginal costs or output gaps. Instead, persistence may be "intrinsic" to the economy. We pursue this insight in our empirical analysis, focusing on the "intrinsic" process of price convergence.

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[5] In contrast, Romer (1993) concludes that trade openness directly lowers inflation. More rapid growth in government expenditure also appears associated with higher inflation, though its high correlation with the output gap and wage inflation renders the estimates imprecise (see Froot and Rogoff 1991).

[6] Even earlier, Ball (1994) cautioned about the potency of demand management in containing inflation. He calculated average sacrifice ratios (total loss in output per one percentage point inflation reduction) for the old EU members of 0.2-2.5 over 1-10 years. The sacrifice ratio increases with wage inflexibility. The ratios for Greece, Portugal, and Spain reported in Section 4 of this paper range from 2.2 to 2.6 over 2-5 years.

The rest of the paper is organized as follows. The next section (section 2) presents the decomposition of inflation in Europe into common and country-specific components. Section 3, then explores the determinants of country-specific inflation. Following a baseline regression, we distinguish between traded and non-traded goods and also report on changes over time. Section 4 illustrates the size of fiscal policy and structural measures undertaken in several European examples of disinflation. A final section highlights the main findings and the policy conclusions.

II. Decomposition of Inflation Into Common and Country-Specific Components

Inflation may be common for two reasons. First, countries may have similar consumption baskets and particular constituents may have common dynamics (e.g., the secular decline in the price of telecommunications). Second, all product groups may have common cycles or trends (reflecting, for example, global energy price movements). We adopt an intuitively transparent decomposition approach proposed by Marimon and Zilibotti (1998) for extracting "external" inflation leaving the remainder as "country-specific" inflation. In turn, Marimon and Zilibotti follow in the tradition of Stockman (1988). In contrast to identifying common elements across sectors and countries through dummy variables, other computationally more intensive approaches have recently been used, including the generalized dynamic factors model (GDFM) (see Cristadoro, Reichlin, Forni and Veronese, 2005, Hahn, 2002). The GDFM isolates "unobserved" common shocks, which, however, are transformed into domestic inflation in a country-specific manner. Thus, an element of what we consider country-specific inflation is treated as "common" inflation in the GDFM methodology. In GDFM, the term "country-specific" inflation refers to the mean-zero white noise.[7]

Following Marimon and Zilibotti (1998), we undertook the following decomposition:

$$\pi(i,n,t) = \sum_{1}^{I} \beta_{j}^{prod}\, prod(j) + \sum_{1}^{T} \beta_{s}^{time}\, time(s) + \sum_{1}^{I}\sum_{1}^{T} \beta_{j,s}^{prod\_time}\, prod\_time(j,s) + \sum_{1}^{I}\sum_{1}^{N} \beta_{j,m}^{prod\_cy}\, prod\_cy(j,m) + \sum_{1}^{N}\sum_{1}^{T} \beta_{m,s}^{cy\_time}\, cy\_time(m,s) + \varepsilon(i,n,t) \quad (1)$$

$i, j = 1,...I, \qquad n, m = 1,...N, \quad t, s = 1,...T,$

$\pi(i,n,t)$ is the overall inflation rate for product "i" in country "n" at time "t," measured as the difference between the log of the price index in a particular month relative to the same month in the previous year. Such inflation rates were computed for 25 member countries of the European Union, using Eurostat's monthly Harmonized Index of Consumer Prices (HICP) from January 2001 to December 2005, for 51 three-digit product groups. The overall

[7] Lumsdaine and Prasad (2003) and Gutierrez (2003) suggest that alternative approaches to decompositions lead to qualitatively similar results.

inflation is regressed on a series of dummy variables, representing the components of interest. The inflation component that is common across all countries and product groups (the EU-wide inflation) is proxied by the dummy variables *time(s)*, which take the value 1 at time *s* and zero elsewhere. Next, the product-specific inflation has two parts: *prod(j)* (which takes the value 1 for product *j*, else 0) is the average inflation rate for a product; in addition, a product group may have its own dynamic (distinct from the common EU-wide dynamic), and this is captured by *prod_time(j,s)* (dummy variables with value 1 for product *j* at time *s*, else 0). The rest of the inflation is attributed to country-specific effects, which are in three parts: *prod_cy(j, m)* (dummy variable with 1 for product *j* in country *m*, else 0); *cy_time(m, s)* (dummy variable with 1 for country *m* at time *s*, else 0); and $\varepsilon(i, n, t)$ (error term for product *i* in country *n* at time *t)*. To identify these dummy variables, the product dummy *prod(j)* is left unrestricted and all groups of dummies are restricted to add up to zero, so that they are to interpreted as deviations from the product inflation trends.[8]

$$
\begin{aligned}
&\sum_{1}^{N} \beta_{j,m}^{prod\_cy} = 0 \qquad \forall j = 1,...,I; \\
&\sum_{1}^{T} \beta_{j,s}^{prod\_time} = 0 \qquad \forall j = 1,...I; \\
&\sum_{1}^{I} \beta_{j,s}^{prod\_time} = 0 \qquad \forall s = 1,...T; \\
&\sum_{1}^{T} \beta_{m,s}^{cy\_time} = 0 \qquad \forall m = 1,...N; \\
&\sum_{1}^{N} \beta_{m,s}^{cy\_time} = 0 \qquad \forall s = 1,...,T; \\
&\sum_{1}^{T} \beta_{s}^{time} = 0.
\end{aligned}
\tag{2}
$$

Figure 1 presents the average inflation rates for the 51 commodities, in panel A for "traded" goods and in panel B for "non-traded" goods. On average, the inflation rate of traded goods is lower than of non-traded goods and services. However, there is considerable variation within non-traded goods and services. Telecommunication services, for example, experienced a decline in prices during the sample period. Figure 2 reports the EU-wide time-varying common component (which, as noted above, would be added onto the underlying trend in any product group). This common inflation is related to changes in oil prices, especially till early 2005. In addition, rapid industrial production growth interacts with high oil prices to raise the common inflation rate. The following equation shows the evolution of the common European inflation (standard errors in parentheses):

[8] Absent the restrictions, sets of dummy variables are perfectly collinear. Thus, a linear combination of all *prod(j)* and *time(s)* dummies yields the dummy *prod_time(j,s)*. Of the $2I+2T+N+1$ restrictions imposed below, $2I+2T+N-1$ are linearly independent. One of the $I+T$ restrictions on the averages of *prod_time(j,s)* is a linear combination of the other restrictions and, hence, not linearly independent. The same holds for one of the $N+T$ restrictions on *cy_time(m,s)*.

$$\pi_t = -0.09 + 0.74\pi_{t-1} + 0.28\,oil\ price - 2.0\,industrial\ production\ growth$$
$$(0.03)\ (0.08) \qquad (0.12) \qquad (1.86)$$
$$+12.51\,oil\ price * industrial\ production\ growth$$
$$(6.37)$$
$$R^2 = 0.72$$

Following Marimon and Zilibotti (1998), the useful measure of "virtual" inflation can be constructed for each country. This is the inflation that would have prevailed in a country given only external influences acting on its consumption basket. Thus, *virtual inflation for any product* "*i*" at time "*t*," is the sum of the average product inflation for that product, plus its time-varying component plus the EU-wide time-varying inflation.

$$\pi^{VIRT}(i,t) = \beta_i^{prod} + \beta_t^{time} + \beta_{i,t}^{prod\_time}$$

In turn, the *virtual inflation for the country* is a weighted average of these individual virtual inflations, weighted by the share of consumption of each product in that country. Hence, a country will experience higher virtual inflation if its consumption basket is skewed towards products with higher inflation rates. Country-specific inflation, then, is the difference between actual and virtual inflation rates. Thus, country-specific inflation does not include "excess" inflation due to the structure of the country's consumption basket.

Box 1: Defining Country-Specific Inflation

Country-specific inflation is calculated as headline inflation less overall virtual inflation for each country. For this purpose, the virtual inflation rate for each product in each country is first converted into a virtual price index based on 2001 actual product price indices in each country $P^{VIRT}(n,i,t)$. Then the indices are chainlinked using the country-specific HICP product weights into an aggregate virtual price index $P^{VIRT}(n,m,t,)$ in country *n* in month *m* of year *t* that takes into account the country-specific consumption structure:

$$P^{VIRT}(n,m,t) = P^{VIRT}_{n,Dec,t-1} \sum_{m=1}^{12} \frac{P^{VIRT}(i,n,m,t)}{P^{VIRT}(i,n,Dec,t-1)} w(i,n,t) \quad .$$

Virtual and country-specific inflation rates in country *n* in month *m* of year *t* are, hence, defined as:

$$\pi^{VIRT}(n,m,t) = \ln\left(P^{VIRT}(n,m,t)\right) - \ln\left(P^{VIRT}(n,m,t-1)\right)$$
$$\pi^{CYSPEC}(n,m,t) = \pi^{HEADLINE}(n,m,t) - \pi^{VIRT}(n,m,t).$$

The top panel of Figure 3 reports the average country-specific inflation. The country-specific element of inflation has been relatively low in the eurozone compared with outside it. (This excludes Cyprus and Malta, which, though not yet members of the eurozone during our sample period, had virtually no country-specific inflation, consistent with their progress towards eurozone entry.) Consider first the level of inflation. The "northern" eurozone countries had average country-specific inflation of -0.5 percent a year over our sample period, whereas the "southern" eurozone countries (Spain, Greece, and Portugal) had country-specific inflation of 0.7 percent a year. Outside the eurozone, in the northern (more advanced) countries (the UK, Sweden, and Denmark), country-specific inflation was -1.0

percent a year, whereas the new members of the European Union from Central and Eastern Europe had country-specific inflation of 0.8 percent. The bottom panel of Figure 3 shows the ratio of country-specific inflation to actual inflation.[9] Once again, Cyprus and Malta stand out with their low country-share of inflation. In the eurozone nations, the share of country-specific inflation is between a quarter and one-third of actual inflation; and outside the eurozone, country-specific inflation is about two-thirds of actual inflation. Figure 4 reports the variance decomposition of overall inflation, where, once again, the variance explained by country-specific inflation is relatively low inside the eurozone. The low country-specific inflation within the eurozone presumably indicates that the common monetary policy has been associated with greater market integration and hence more similar inflation rates. The greater integration would be also consistent with the finding that the common currency boosts within-eurozone trade (see Baldwin and Taglioni, 2006, for the most recent estimates) and with the increasing alignment of business cycles within the eurozone.

Figure 5 illustrates an ongoing process of price convergence in Europe. The richer countries (both inside and outside the eurozone), with the higher price levels, have, on average, had negative country-specific inflation whereas the poorer countries, with lower price levels, have had positive country-specific inflation. Thus, pressures at both ends are bringing prices levels into greater alignment.

III. The Determinants of Country-Specific Inflation

The analysis in this section focuses on the determinants of year-on-year country-specific inflation, though, for comparison, we report some results using the conventional overall measure of inflation as the dependent variable. Our data covers four years or 16 quarters, from 2002: I to 2005: IV, and is augmented by the panel dimension. Given the short time period and our interest also in the cross-sectional variation in inflation rates, we use the random-effects model, which exploits the cross-sectional information.[10] In contrast, a fixed-effects model discards the differences in inflation across countries; when such a model is run, the fixed effects are highly correlated with initial price levels (see Rogers 2002). While the relatively short time series weakens the statistical significance of our estimates, those who use longer time series run the opposite risk. There have been important structural changes in the inflation process. Fitting a model that goes back to the 1980s (or even the 1970s) gives a false sense of precision.

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[9] We compute this ratio for each month for each country. Then we average the monthly values over a country and finally compute the average once again for the country group reported.

[10] Cross-country inflation differentials among EMU members narrowed until the creation of the EMU in 1999, then widened again, and have stabilized since 2002. Busetti et al. (2006) identify three clusters of countries with low, medium, and high inflation. The cross-country inflation differentials mainly reflect differentials in nontradables (ECB 2003, Altissimo et al., 2005). They have been attributed to differences in nominal effective appreciation (Honohan and Lane, 2003, Lane, 2006), output gap differentials (Honohan and Lane, 2003, Angeloni and Ehrmann, 2004), structural differences in relative price levels, trade openness, oil intensity, and price and wage rigidities (ECB, 2003, Bulíř and Hurník, 2006).

Our eclectic empirical specification should be treated as a descriptive account of the correlates of inflation. In the baseline regression, country-specific inflation, $\pi_{i,t}$, for country *i*, in time period *t* is thus explained:

$$\pi_{i,t} = \beta_0 + \beta_1 \pi_{i,t-1} + \sum_{s=0,4} \beta_{2,s} \%\Delta NEER_{t-s} + \sum_{s=0,4} \beta_{3,s} \%\Delta ULC_{t-s} + \sum_{s=0,4} \beta_{4,s} \left(y_{i,t-s} - y^*_{i,t-s} \right)$$
$$+ \sum_{s=0,4} \beta_{5,s} \%\Delta ULC_{t-s} * TRADE_{t-4} + \beta_6 TRADE_{t-4} + \beta_7 \Delta VAT + \beta_8 RelP_{2001} + \varepsilon_{i,t}$$

The link between theory and empirical specification remains a matter of debate. The New Keynesian Philips Curve (NKPC) is the dominant paradigm for thinking of inflation, but is being challenged. For a powerful critique, see Mankiw (2001).[11] Relevant for our specification here is the role of inflation persistence. Drawing especially on Fuhrer and Moore (1995), Mankiw notes that the "sticky-price" NKPC does not imply "sticky" or persistent inflation that is observed strongly in the data. Such persistence has continued to be confirmed in recent investigations by Fuhrer (2005, 2006), Linde (2005) and Rudd and Whelan (2005, 2006).[12] Mankiw and Reis (2002) propose instead a "sticky information" model in which agents are rational and forward-looking but because information is costly, they update information and prices only periodically. This gives rise to inflation persistence.

Persistence in the inflationary process is reflected in the lagged inflation term. The lagged term, in turn, reflects transmission lags from cyclical inflation drivers as well as other structural features. We do not include leading inflation into our specification, which, as Rudd and Whelan note, is a black box that soaks up most of the effect of the exogenous variables of policy interest. Possibly for this reason, Honohan and Lane (2003) do not even include the lagged inflation rate in their specification. We follow the strategy of showing the results with and without the lagged inflation rate, providing insight into the persistence process.

Next, we include the output gap, $\left(y_{i,t} - y^*_{i,t} \right)$, in percent of potential GDP based on potential output derived from an HP filter that is applied to the maximum available length of the time series for each country.[13] Empirical specifications of inflation often stop right there, i.e., with the lagged inflation terms and the output gap (see, for example, Dew-Becker and

[11] See also Gertler and Leahy (2006).

[12] Rudd and Whelan are particularly critical of using "leading" inflation as a proxy for "inflation expectations," as in Gali and Gertler (1999). They note that leading inflation is typically instrumented by lagged right-hand side variables, which should belong to the main equation itself rather than be used as instruments. Moreover, if empirically relevant, the instruments only emphasize the importance of lagged and persistent effects rather than of expectations. More fundamentally, Mankiw, Reis, and Wolfers (2004) highlight divergent inflation expectations in the population. The comovement of these disagreements with macroeconomic variables implies a theoretical perspective quite different from the sticky price models.

[13] Woodford (1999) identified a proportional relationship between the output gap and real marginal cost under specific assumptions about technology and factor markets.

Gordon, 2005, and Borio and Filardo, 2007). We add also the year-on-year growth rate of unit labor costs in the manufacturing sector, $\%\Delta ULC_{t-s}$.

To examine the role of external influences, output gap and unit labor costs are each interacted with the country's trade openness ((exports plus imports)/GDP), which also appears as an independent variable. The hypothesis that we are trying to test here is that domestic producers are more constrained in their price setting capabilities the more open the economy (Romer, 1993, Rogoff, 2003, Razin, 2004). In addition, in their analysis of intra-European differences in inflation rates, Honohan and Lane (2003) find that a depreciation of the country's nominal effective exchange rate (in turn, reflecting the composition of the country's export destinations) raises the inflation rate. We use the year-on-year percent change in the trade-weighted nominal effective exchange rate against 41 partner countries, $\%\Delta NEER_{t-s}$.

There are probably several country-specific tax and regulatory features with a bearing on inflation. One variable with an obvious implication for short-term price movements is the value-added tax (VAT) rate. We use the year-on-year VAT rate changes as an explanatory variable. Finally, especially in the cross-sectional dimension, there are likely to be structural influences on inflation. Romer (1993), for example, examines the effects of political instability and monetary policy credibility. Choueiri et al. (2007) examine the effects of labor and product market institutions on inflation. We focus on the initial (i.e. 2001) price level relative to the EU-25 to assess if a catch-up process influences the rate of inflation. We do not include global influences in these regressions, since, in principle, we have extracted the common time-varying component of inflation. Thus, oil price movements, which as noted above, are correlated with the global time-varying factor do not belong in this regression; nor, for the same reason, do time dummies. Appendix Table 1 shows in detail the data used and its sources.

Since there may be lags in the transmission mechanism, we include the contemporaneous value and a one-year lag for the output gap, unit labor cost growth, and nominal effective exchange rate appreciation. We did not include intermediate lags because they were strongly correlated with contemporaneous and 4-quarter lagged values. To assess the cumulative effect of each of our explanatory variables, the results are reported for the combined value of each of the variables, with F-tests for joint significance. Also, at the bottom of each table, F-tests are shown for the overall effect of each independent variable, taking into account the interaction terms, assuming average trade openness.

A. The Baseline Regression

In Table 1, we report six main findings for the eurozone countries. First, there is considerable evidence of persistence in country-specific inflation (columns 1-3). Our estimate of inflation persistence for the eurozone, at about 80 percent, is in the range of previous estimates using similar specifications though for earlier sample periods: Borio and Filardo (2007) and Batini (2002) find persistence factors of 90 and 70 percent respectively. Rogers (forthcoming) has a coefficient very close to ours at just below 80 percent for his most recent sample. Second, when the lagged inflation term is included, the output gap and

growth in unit labor costs have the expected positive signs but neither is significant at the conventional 5 percent level (column 1). However, when these variables are interacted with the degree of trade openness, we find that the transmission from these proxies for demand pressures to domestic inflation is dampened by the degree of trade openness (columns 2 and 3).[14] This dampening influence is statistically more important for unit labor cost growth, implying that in a more open economy, a rise in unit labor cost is less easily translated into an increase in prices. However, at the mean value of trade openness, labor cost growth has a positive and significant relationship with domestic inflation.[15] Third, when the lagged term is removed, the partial correlations between, especially, the output gap but also the unit labor cost and domestic inflation increase sharply. The implication appears to be that the so-called inflation persistence reflects, in part, the transmission lag from the output gap and the unit labor cost, or Fuhrer's (2005) "inherited" inflation.

Fourth, the lower the initial price level, the higher is the subsequent inflation. This effect also becomes stronger when the lagged inflation term is removed, once again pointing to structural factors as the source of persistence. With the lagged term removed, the pace of price catch-up implied by our estimates is such that a country with a price level one-third below the EU average will experience an additional one percent a year in price inflation compared to the EU average. Column 4 in Table 1, our most similar specification to theirs, produces an estimate very close to that obtained by Honohan and Lane (2003); Rogers (2002) also obtains a very similar estimate. Fifth, the nominal effective exchange rate has the expected negative sign and is significant in the specifications that also include the lagged inflation term: depreciation raises the inflation rate. Finally, the findings for overall inflation are less informative, especially with regard to output gap, unit labor cost growth, and the nominal exchange rate. In other words, the country-specific right-hand side variables are poorly correlated with overall inflation. This is not surprising since overall inflation, the previous section showed, is largely driven by common international sectoral and time trends.

Inflation in the non-eurozone countries is driven by broadly similar features (Table 2), i.e., the same model provides a good description of the inflationary process.[16] However, the quantitative significance of the inflation drivers is, in some instances, quite different. That said, the persistence coefficient, at about 80 percent, is of the same order of magnitude as in the eurozone. For the noneurozone, the output gap is never statistically significant. It could be that in these relatively open economies (the ratio of trade to GDP is 0.87 outside the eurozone, relative to 0.74 inside), the effect of cyclical demand conditions does not translate into domestic price movements. It could also be that the output gap is

[14] Chen, Imbs and Scott (2006) find a significant effect of the volume of sectoral trade on the *relative* price of goods in that sector (for a sample of seven eurozone countries in the earlier period to 1999). However, they conclude that the effect of openness on overall inflation is probably not significant.

[15] Only for the four most open eurozone economies (Belgium, Netherlands, Ireland, and Luxembourg) unit labor cost growth is entirely offset by trade openness to yield an insignificant overall effect for unit labor cost.

[16] Column 5 shows that the results for Eastern non-eurozone are qualitatively the same but statistically stronger than those for the full non-eurozone sample.

mismeasured in some of the new member states. Labor cost movements are another proxy for local demand conditions. When the lagged price level is included, the interaction of unit labor cost growth with trade is negative and mildly significant, and the overall effect of rising wages at the mean level of trade openness is insignificant, unlike in the eurozone where the corresponding coefficient is positive and significant. In this sense, as with the output gap, domestic wages also exert a smaller influence on inflation in the noneurozone economies. However, when the lagged term is removed, real wage growth is seen to be more potent. The implication may be that in the noneurozone, more than in the eurozone, structural factors, rather than cyclical conditions, have in the past influenced the comovement of wages and prices through longer transmission lags from unit labor cost to inflation. This, as we see below, is changing, however. In contrast to domestic variables, the nominal effective exchange rate has a much greater quantitative influence in the noneurozone than in the eurozone.

Notice also that in the noneurozone, the coefficient on the initial price level is smaller in magnitude than in the eurozone. This is, at first glance, surprising. The scope for catch-up in price levels is much greater in this group of countries differentiated to a much greater degree in terms of income levels than is the case within the eurozone. As we describe below, the catch-up speeds are similar for tradable goods in the eurozone and noneurozone, but lower for non-tradable goods, where, possibly, the noneurozone countries are still somewhat insulated from cross-border effects. Over time, as structural rigidities are weakening in product and labor markets, price catch-up is becoming a more important factor compared to unit labor costs in driving inflation persistence, as in the eurozone.

Finally, administrative decisions strongly influenced inflation. VAT rate changes raised inflation in both the eurozone and outside it. Although the coefficient on VAT rate changes is somewhat lower outside the eurozone than in the eurozone, the VAT rate changes themselves were so much larger outside the eurozone than inside it that they contributed more to inflation outside the eurozone. On average over the sample period, VAT rates changed by 0.32 percentage points outside the eurozone compared to 0.06 percentage points inside it. Applying the two regression coefficients, this implies that, on average, VAT rate changes contributed 0.09 percentage points to inflation outside the eurozone compared to 0.03 percentage points inside it.

We conclude that the country-specific component of inflation in the eurozone is influenced by domestic factors such as the output gap, rising labor costs, and a tendency for mean reversion in price levels. However, external influences are also relevant. Trade openness dampens the influence of rising labor costs and a depreciation of the nominal effective exchange rate raises inflation. Outside the eurozone, where the country-specific component is more substantial, trade openness and, especially, the nominal effective exchange rate play an important role in determining inflation. To the extent that domestic influences operate on inflation, they tend to be of a structural nature. Lags in the transmission of labor costs appear to have been important, on average, during the full sample period. However, as we show below, their importance has declined over time and that of the price catch-up factor has increased.

B. Traded vs. Non-Traded Goods

In the eurozone, the output gap has some cyclical (or contemporary) influence on the inflation of traded-goods prices (Table 3). For both traded and non-traded goods, significant transmission lags are absorbed in the lagged inflation term. The net effect of the output gap (i.e., when the lagged term is excluded) is of the same order of magnitude in both the traded and non-traded sectors. Outside the eurozone, in line with the aggregate results, the output gap does not appear to matter, either for traded or for non-traded goods. In contrast, as the aggregate results also showed, the growth in the unit labor cost is more of a factor outside the eurozone, but with slow transmission lags that are part of inflation persistence.

The evidence is consistent with the expectation that unit labor costs play more of a role in non-traded goods (especially outside the eurozone) where the forces of competition are weaker. As such, the effect of unit labor costs on non-traded goods relative to traded goods is somewhat greater outside the eurozone. This would be consistent with the Balassa-Samuelson effect, which predicts that slower productivity growth in the non-traded sectors would lead to faster growth of non-traded goods prices. However, while the direction of this effect is as expected, the size of the effect is small.[17] The effect of VAT rate increases is also stronger on non-traded goods. In contrast, the nominal effective exchange rate, which plays a much more important role outside the eurozone, does so through traded rather than non-traded goods.

Finally, the price catch-up process has worked faster inside the eurozone than outside it, and this has been so for both traded and non-traded goods. The eurozone countries are apparently more integrated. It is the case that the catch-up is weaker in the non-traded goods sectors in both groups of countries. In particular, the especially low coefficient on the catch-up term noted above for aggregate inflation outside the eurozone is seen to be a reflection of the modest (and statistically insignificant) catch-up in their non-traded sectors. The relative insulation of the non-traded sectors could reflect local differentiation of services combined with the greater difficulty of providing services across borders. For the non-eurozone countries, the differentiation may reflect the historically lower quality services supplied to populations with lower incomes. Thus, in the past, the lack of competition in the non-traded sectors outside the eurozone have limited the scope for price catch-up and allowed more play for wage growth to translate into price increases. But with entry into the European Union and with the more general forces of globalization gathering steam, can this insulation remain? We turn to how things have changed over time and particularly to whether price determination patterns inside and outside the eurozone are converging.[18]

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[17] Based on Balassa-Samuelson effect, Buiter (2004) argued that the inflation rate in the central and eastern European new members of the European Union (the CEE-8) will raise inflation rates up to 2½ percentage points above EU average inflation. Other studies estimate smaller sizes of the Balassa-Samuelson effect (for a recent review, see Egert, Halpern and MacDonald, 2005). While we also project that the CEE-8 will tend to have higher inflation than the EU average, this would be due more to price convergence rather than merely to productivity differences between traded and non-traded goods sectors.

[18] In addition, the scope for efficiency gains in such non-traded sectors as telecommunications and financial services may have been higher. But the one-time gains have likely run their course.

C. Shifts Over Time

Over time, some of the differences inside and outside the eurozone have remained but in other ways the dynamics have become more alike (Tables 4 and 5).[19] The influence of the domestic output gap has remained salient in the eurozone and may even have increased in 2004/2005 relative to 2002/2003. In contrast, the effect of the nominal effective exchange rate decreased in importance inside the eurozone but increased in strength outside (for both traded and non-traded goods), making the differences in this respect starker.[20]

For the rest, the importance of unit labor costs modestly increased in the eurozone (mainly for non-traded goods) and declined outside, and, as such, the difference between the coefficients declined. Notice also, that the price convergence effects in the eurozone and noneurozone countries increased (for both traded and non-traded goods), implying faster price adjustments. This effect, which was shown, on average, to be relatively weak in the noneurozone sample (as reported in Table 1) is now seen to have risen from a negligible effect in the first half of the sample to a more sizeable and statistically significant effect in the last two years of the sample (again, for both traded and non-traded goods, though the effect remains smaller than for the eurozone). This shift may reflect increasing trade integration. The effect of VAT rate changes appears to have declined over time both inside and outside the eurozone, for both traded and non-traded goods. Presumably, in the first half of the sample, the effect was felt as countries harmonized their taxation, but its importance weakened as harmonization matured.

IV. Disinflation Episodes in Europe

The evidence thus is that globalization operates partly through reducing the country-specific component of inflation and partly through the dampening by trade openness of the transmission of domestic demand to country-specific inflationary pressure. Outside the eurozone, domestic demand, manifested either in the output gap or in wage growth, has had limited influence on domestic inflation. For policymakers seeking to reduce their inflation rates—especially to meet the Maastricht reference inflation rate—this reduces the degrees of freedom available. Figure 6 shows the contributions to excess inflation in Lithuania (over the European average) based on our estimates in Table 4 that allow for changes in coefficients over time. Lithuanian inflation came within a whisker of falling below the Maastricht

[19] Studies have found that the business cycles of the Baltics, Latvia and Lithuania, were only weakly correlated with the eurozone cycle while business cycles in Hungary, Slovenia and Poland were closely correlated with that of the eurozone even before their EU accession in May 2004 (e.g., Boreiko, 2003, Fidrmuc and Korhonen, 2004, Artis et al., 2004). With greater integration, the cycles could become more coordinated. There has certainly been convergence in price levels and inflation among the CEE-8 and the EU average.

[20] This may explain the concern expressed by Angeloni e. al (2004) that the Honohan and Lane (2003) results for the eurozone may not be robust. With increasing trade integration in the eurozone, trade baskets have become more similar over time (the standard deviation of nominal effective appreciation across eurozone countries declined, on average, from 0.9 in the first half to 0.4 percent in the second half), leaving limited variability to explain country-specific inflation in the second half of the sample.

reference value. In part, the low inflation in 2002 and 2003 was due to wage restraint. But low inflation was also the result to a large extent of fortuitous factors, particularly an appreciation of its nominal effective exchange rate. Looking ahead, price catch-up pressure will make a significant contribution to Lithuania's inflation rate. In contrast, variations in the domestic output gap will apparently play a modest role.

Past European disinflations also required a concerted policy effort, even in less open economies than the new EU member states. Portugal's disinflation, for example, was supported by a sustained drop in unit labor cost, achieved by tight fiscal and monetary policies as described below. Figure 7 again uses our coefficients in the last column of Table 4 to decompose Portugal's excess inflation relative to the European average. In 1995, despite a sharp compression of wages, Portugal's excess inflation was positive, implying the presence of factors not included in our model. Continued reduction in unit labor costs was necessary to bring inflation to below the European average in 1997. The size of the disinflation effort in the new EU member states will likely be greater. Portugal was a less open economy before euro adoption than the new EU members are now. In 1994, Portugal's trade accounted for 57 percent of GDP, compared with an average of 87 percent of GDP in our noneurozone sample. The greater openness in the new EU member states will dilute policy effort to contain inflation. Moreover, several new EU member states have relinquished monetary policy, increasing the burden of disinflation policy on fiscal policy.

The rest of this section describes disinflation episodes in four countries.[21] Three of these—Spain, Portugal, and Greece—consolidated their fiscal accounts in an effort to meet the Maastricht criterion on both the fiscal position and inflation. While all three countries also attempted restrictive monetary policy to reduce inflation, these proved insufficient without fiscal consolidation and wage restraint. Interest rate increases fed into higher fiscal deficits (Spain and Greece) or fuelled further capital inflows (Portugal) that set back tightening efforts. The disinflation packages also included wage policies. Ireland's disinflation occurred in a period well before EMU accession, but, as in the other three, fiscal consolidation was supported by structural reforms to ease labor market restrictions.

Portugal: In 1995, a concerted stabilization effort was initiated to deal with overheating pressures (Barry 2003). Tight monetary policy was supported by a reduction in the fiscal deficit from 7½ percent of GDP in 1994 to 3½ percent of GDP in 1997, the year in which Portugal was assessed for EMU accession. Rising unemployment in a slower-growth environment supported the effort at disinflation. Following EMU accession in 1999, the policy environment was once again expansionary. Money market rates—now more closely linked to ECB rates—declined to 1½ percent in real terms. With growth strengthening, the decline in the headline fiscal deficit in the two years following EMU accession actually represented a fiscal stimulus of ¼ percentage point of GDP per annum. Inflation rose above the Maastricht reference value by end-1998 and remained above it almost continuously until mid-2005.

[21] The description is based on various reports on Article IV consultations by the International Monetary Fund for these four countries.

Spain: A concerted policy effort was made from about 1994 to meet the Maastricht criteria. Labor market reforms, initiated in 1994, reduced restrictive work practices and firing costs (Balmaseda and others, 2002, Bover, 2000). As a result, unemployment declined and wage growth moderated. The central bank was made independent in 1994 and began an explicit disinflation policy raising real money market rates. Importantly, by cutting mostly public investment, the fiscal deficit was cut by over 4 percentage points of GDP from 6½ percent of GDP in 1994 to 2¼ percent of GDP in 1997, the year for which the fiscal deficit was assessed to achieve EMU accession. The Maastricht inflation criterion was met by January 1998, when Spain's compliance was assessed. However, given that Spain's business cycle was ahead of the European business cycle, the ECB interest rates were too accommodative to maintain low inflation. Also, some of the cuts in public expenditures were reversed, though the resulting increase in the headline deficit was masked by strong growth. Inflation rose again and has been above the Maastricht criterion since mid-1999.

Greece: With inflation running at about 9 percent, not least because of a significant inflow of EU funds, a major policy effort was initiated in 1995 to achieve EMU accession in 2000 (Lazaretou 2005). Monetary policy was reoriented to use tighter exchange rate targets as nominal anchor and money market rates were raised to 9 percent in 1998. The high-interest rates triggered large capital inflows. As such, monetary policy needed fiscal policy support, achieved by fiscal consolidation of almost 7 percentage points of GDP from 10¼ percent of GDP in 1995 to 3½ percent of GDP in 1999, the year it was assessed for EMU accession. Tight fiscal and monetary policies were supported by wage restraint and further financial sector liberalization that improved the effectiveness of monetary policy. As a result, inflation fell from 9 percent in 1995 to 2¼ percent in 1999. Monetary and fiscal policy loosened again after EMU accession. ECB interest rate policy implied near-zero interest rates on treasury bills. Despite the decline in interest cost and a pickup in real GDP growth, the headline fiscal deficit widened by 1¼ percentage point of GDP per annum on average during 2000–01. Within half a year of the assessment date, inflation exceeded the Maastricht reference value and has remained above that level ever since.

Ireland: A fiscal reform package, centered on expenditure cuts, was implemented in 1987 (Detragiache and Hamann, 1999). The fiscal deficit declined from 9¼ percent of GDP in 1987 to 1½ percent of GDP in 1989 and stabilized at 2-3 percent of GDP from 1989 to 1995. The accompanying tax reductions were part of "social partnership agreements" that ensured wage moderation. Unemployment fell but wage growth was moderate. Monetary policy continued to be tight until 1993, with real interest rates in excess of 5 percent. Annual inflation fluctuated in the 2¼ - 3¼ percent range. Further fiscal consolidation was implemented in 1996 although a major push was likely not needed to meet the Maastricht inflation criterion. The headline deficit was brought into balance in 1996 and into surplus in 1997–2001. Inflation declined to 1½ percent in 1997. ECB policy again implied a monetary loosening at EMU accession. This helped sustain rapid real GDP growth until 2000 despite further negative fiscal stimuli. Inflation rose above the reference value for the Maastricht criterion on inflation by January 1999, a year after compliance with the Maastricht criterion for inflation was assessed, and remained above the reference value until mid-2005.

Thus, episodes of rapid disinflation in the EU have been associated with large fiscal adjustments, supported by monetary and structural policies. The new member states seeking to adopt the euro may face similar challenges. Indeed, where, as in the Baltic nations, monetary policy has already been relinquished, the burden on fiscal policy could be huge. Either way, the pace of structural change will need to continue, though with their achievement already of relatively flexible labor markets, no single structural measure is likely to be enough but rather a range of increasingly sophisticated measure to increase economic flexibility will need to be undertaken.

V. CONCLUSIONS

This paper has identified alternative mechanisms linking globalization and inflation that may be of more general interest, despite the focus here on Europe. First, globalization acts through reducing the scope for domestically-generated inflation as product markets become more integrated. We see this in the eurozone economies, with their relatively tight linkages to international product markets within and outside the eurozone. We do find, in these economies, that the domestic business cycle influences the country-specific component of inflation. However, because this domestic component of inflation is small, the relationship between overall inflation and domestic cyclical conditions is weakening over time. Second, globalization may operate through breaking the link between domestic demand conditions and price setting as trading possibilities limit market power. Third, even where country-specific inflation is important, it may well be driven by the force of price catch-up. Countries with differing initial price levels will have their own catch-up speed, but this process is likely to be outside the control of policymakers.

We find that the inflation pressures in countries with low prices are only partly due to the Balassa-Samuelson effect. Consistent with that effect, unit labor cost growth is more potent in raising the prices of non-traded goods than of traded goods, and this force is somewhat more prominent outside the eurozone, where most of the lower-income and lower-price-level countries are. However, the price catch-up process has worked more slowly in the non-traded sectors, which are presumably more insulated because they have historically served local communities. With greater integration, non-traded goods and services will become more contestable across borders. We find evidence that the catch-up process, including in non-traded goods, has accelerated even in the short period covered by this study.

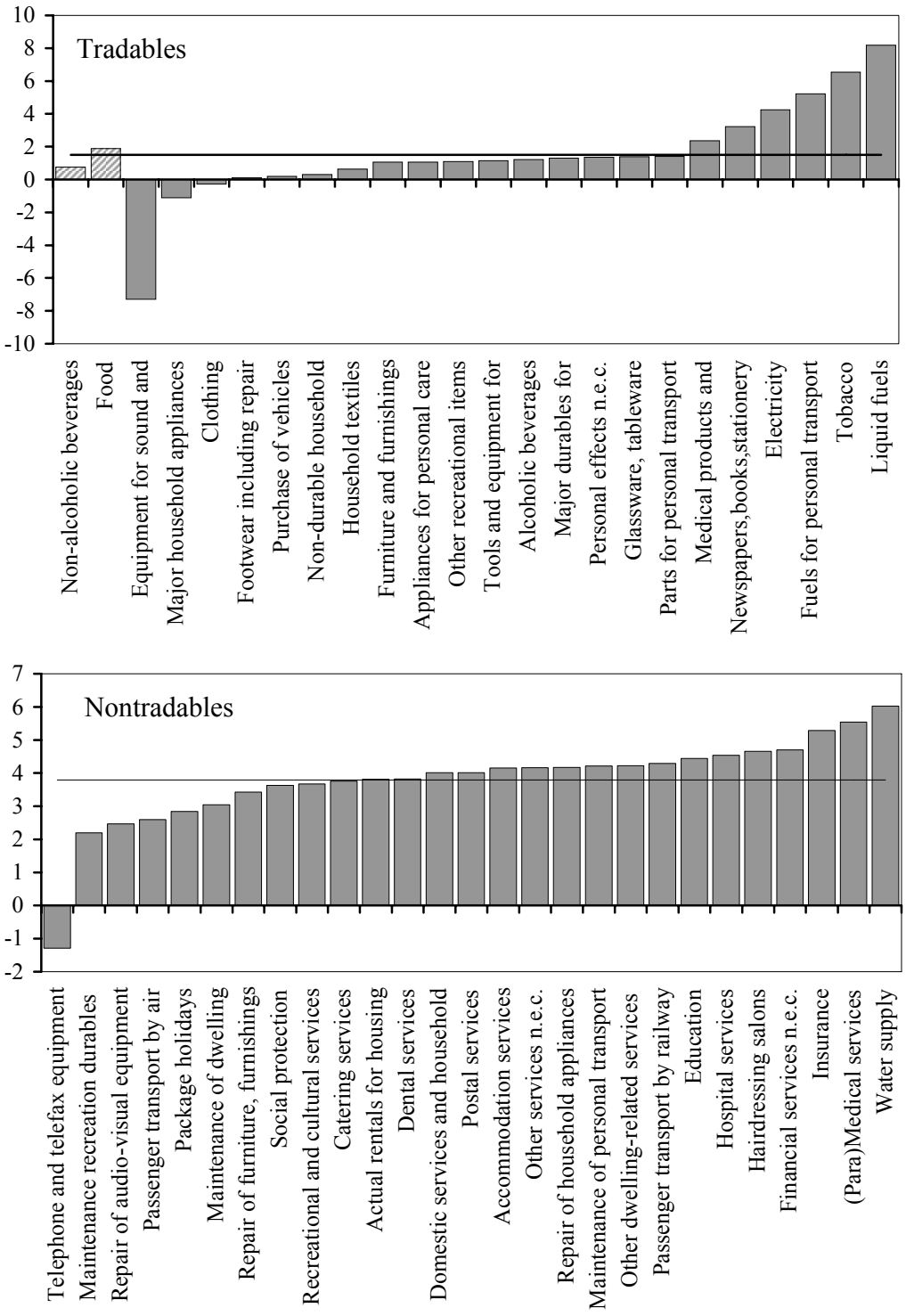
Because of these internationalization forces, domestic policies will have increasingly smaller scope in curbing inflation. Indeed, if the price catch-up process accelerates, policymakers may have limited leverage over it—and, moreover, may have little reason to influence these developments. Catch-up does not contribute to “inefficient” inflation or instability in the same sense as the lack of policy credibility. The case-study evidence is consistent with the conclusion that substantial fiscal consolidations may be needed to reduce inflation by significant margins. Since such consolidations may be difficult to sustain, they may only achieve temporary reduction of inflation.

Appendix Table. Data and Sources

Dependent variable	
Decomposition into country-specific and virtual inflation: Monthly HICP index for January 2001−December 2005 (2005=100). For several commodities, some countries do not report data for either the whole time span or parts of it.[1] If any part of a country-by-commodity series was missing, it was excluded from the sample.	Eurostat
Panel regression: Year-on-year log difference in the actual HICP minus year-on-year log difference in the virtual HICP.	
Independent variables	
Year-on-year growth in nominal unit labor cost in manufacturing (log differences, in percent). Nominal unit labor cost are defined as gross wages and salaries in manufacturing per unit of the volume index of manufacturing production (working day adjusted). The data was rebased to 2000=100. Data was missing for Sweden and Malta, which are both excluded from the panel regressions.	Eurostat
Year-on-year nominal effective appreciation (log differences, in percent). The nominal effective exchange rate (1999=100) in 41 trading partners was used.	Eurostat.
Quarterly output gap (in percent of potential GDP). Potential GDP was estimated using an HP filter on seasonally and working day adjusted (except Luxembourg) quarterly real GDP data from Q1 1996, or earliest available data is after Q1 1996. Real GDP data in 1995 prices (except Latvia and Italy in 2000 prices) in national currency units.	Haver Analytics.
Relative price level (EU25=1) in 2001 for household final consumption expenditure.	Eurostat.
Control variables	
Four-quarter change in standard or reduced VAT rate, whichever was larger.	European Commission
Trade in percent of GDP lagged by four quarters. Exports and imports (in millions of euros) seasonally and working day adjusted in percent of GDP.	Eurostat.

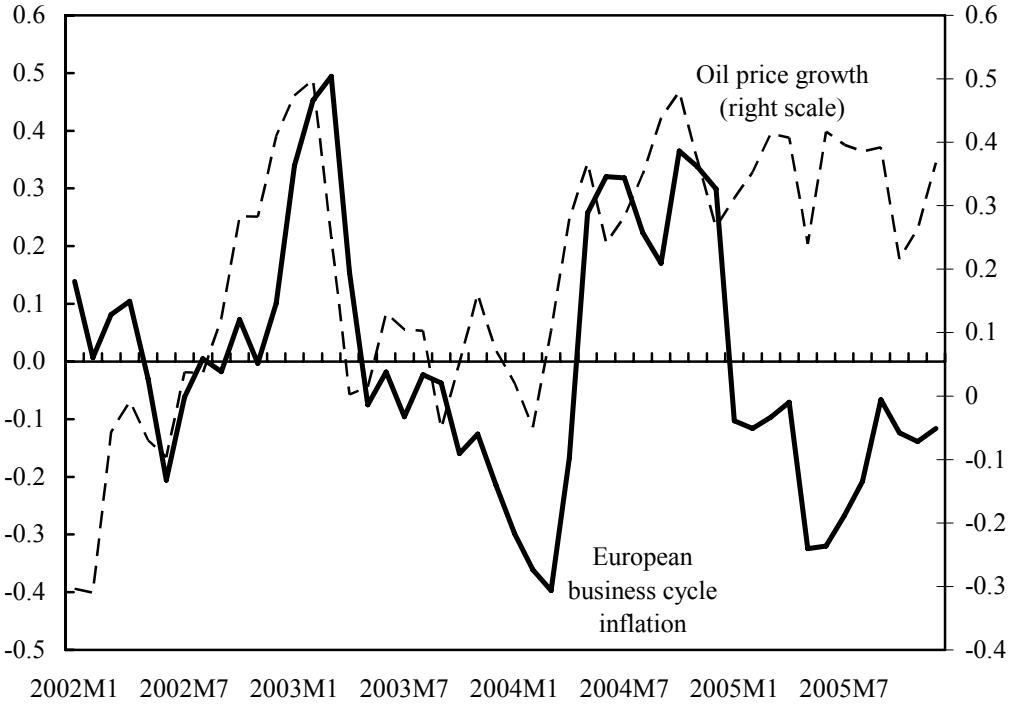
1/ The following data were missing: other service related to dwellings (Begium, Malta, Slovenia, Luxembourg, and the U.K.); water supply, refuse and sewage collection (Slovenia); liquid and solid fuels (Netherlands and Malta); repair of furniture, furnishings and floor coverings (Austria, Belgium, Estonia, Greece, Luxembourg, Malta, Spain, Slovenia, Sweden, and the U.K.); repair of household appliances (Latvia); domestic services and household services (Slovenia); hospital services (Estonia, Hungary, Slovenia, and the Slovak Republic); maintenance and repair of other major durables for recreation and culture (all but Ireland, Lithuania, Luxembourg, Netherlands, Portugal, and Sweden); major durables for indoor and outdoor recreation including musical instruments (Estonia, Spain, and Latvia); social protection (Estonia, Hungary, Latvia, and Lithuania); and other financial services (Cyprus).

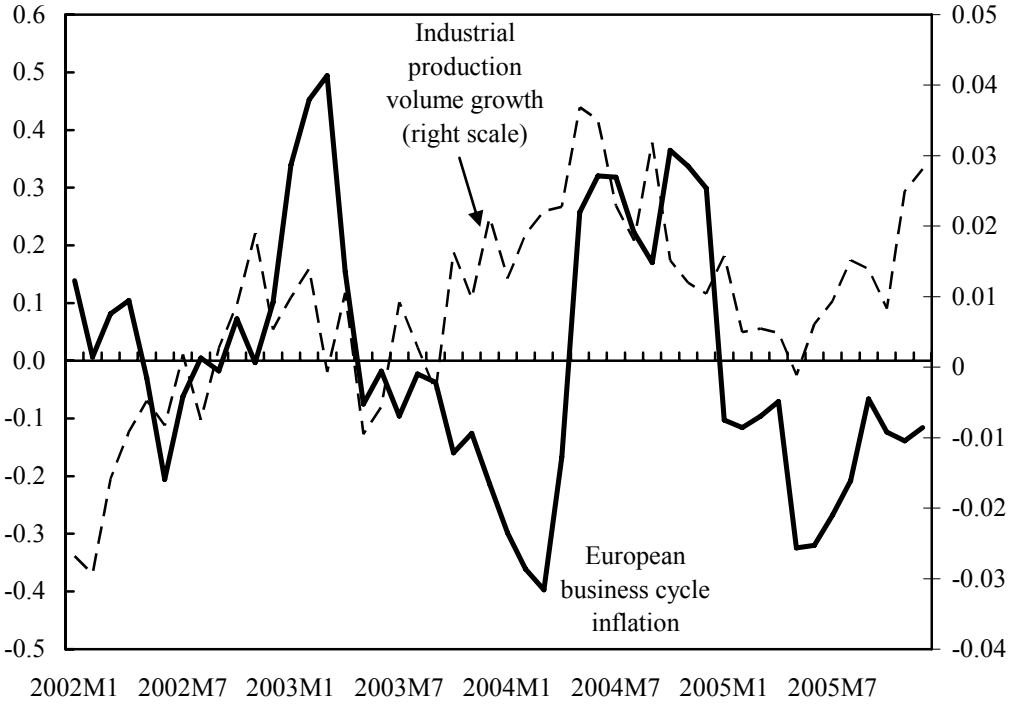
Figure 1. EU25: Average Commodity-Specific Inflation
(In log changes in price levels)



Source: Authors' calculations

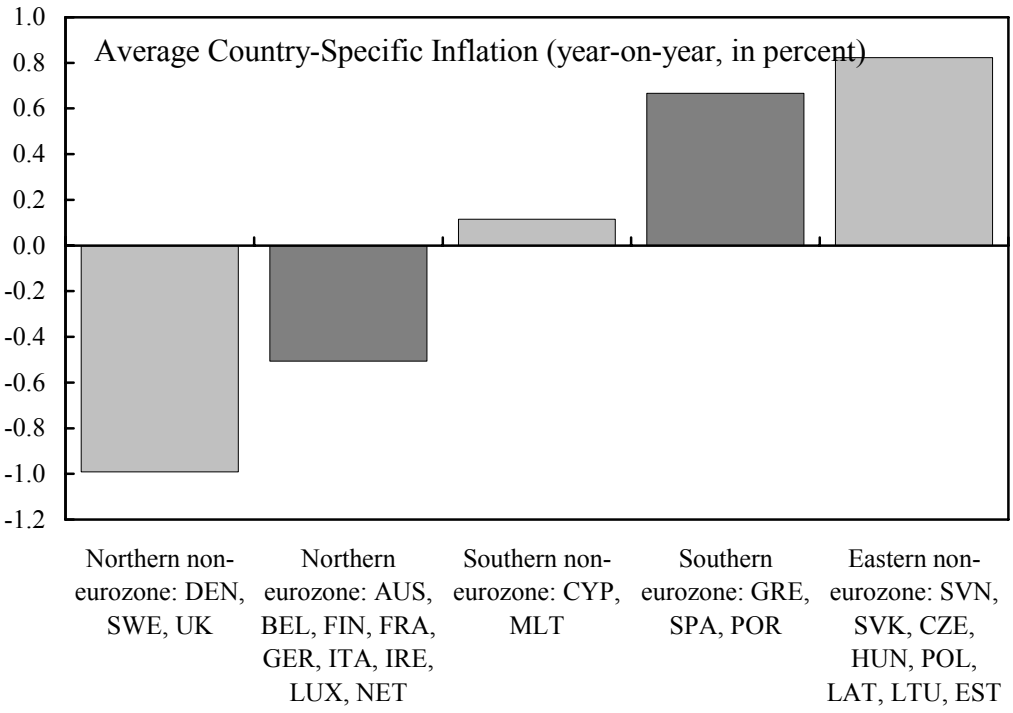
Figure 2. EU25: European Business Cycle Inflation, Oil Price and Unemployment

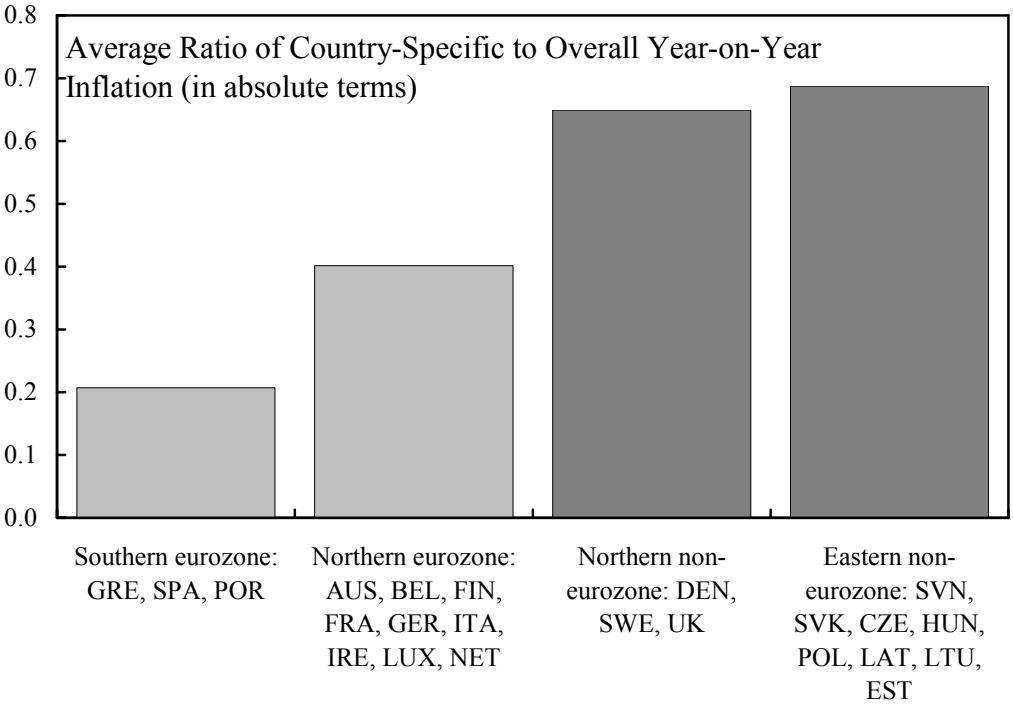




Source: Authors' estimates, Eurostat, IFS.

Figure 3. EU25: Country-Specific Inflation





Source: Authors' estimates.

Figure 4. EU25: Share of Variance of Inflation Explained by Country-Specific Inflation
(In percent)

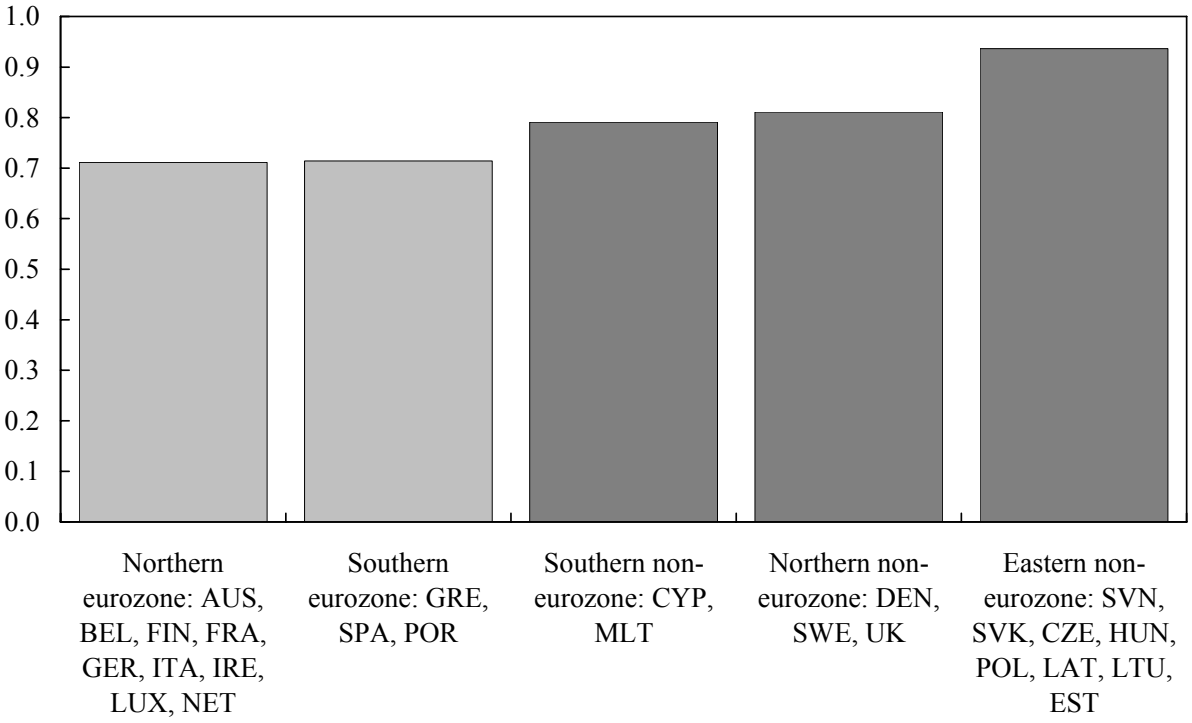


Figure 5. EU25: Average Country-Specific Inflation and Relative Price Level
(Year-on-year percent change 2002-2005, and EU25=100 in 2001)

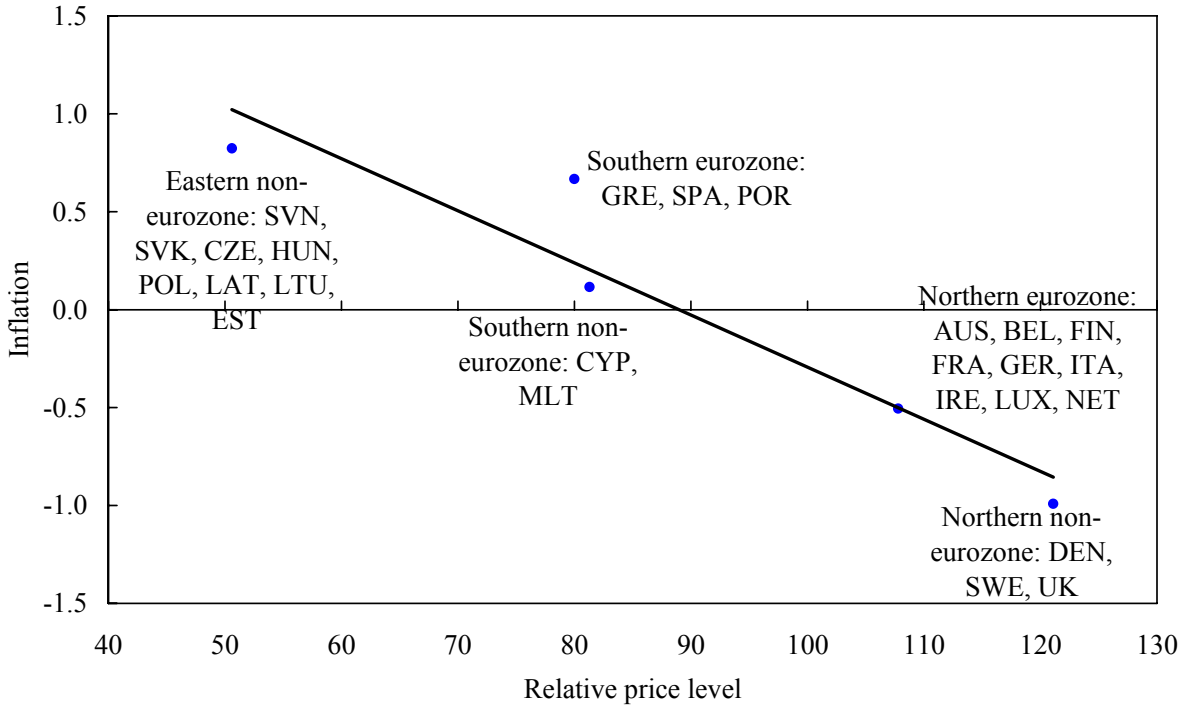
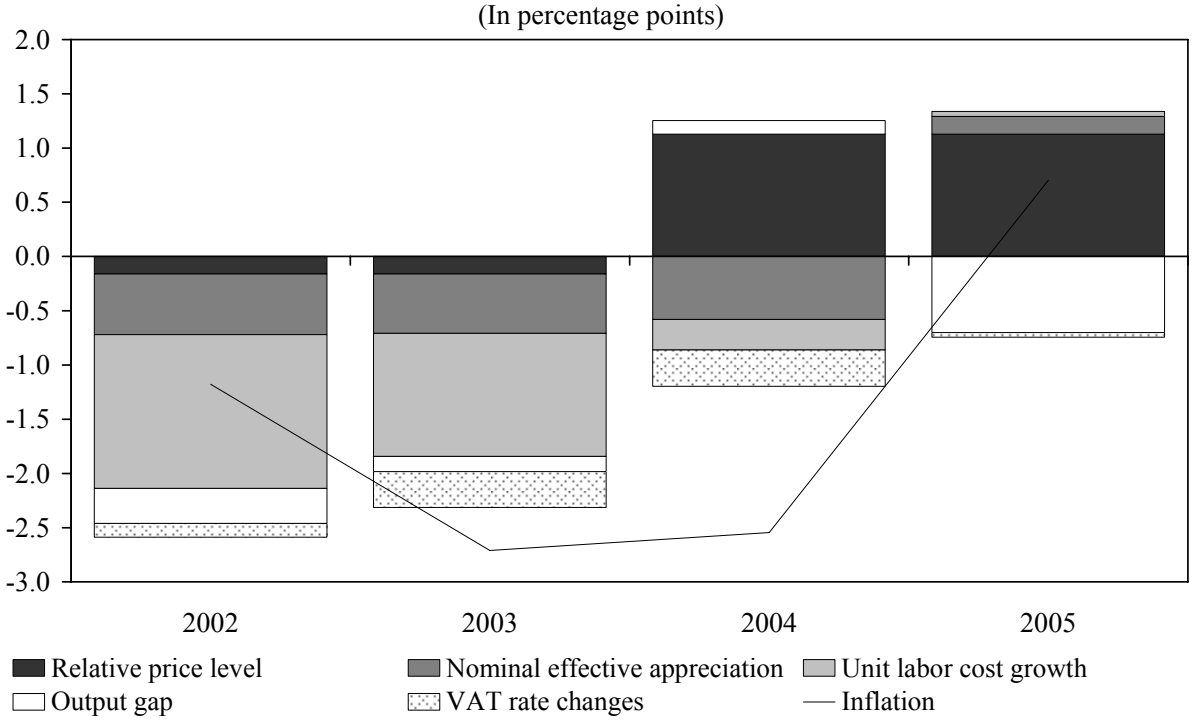
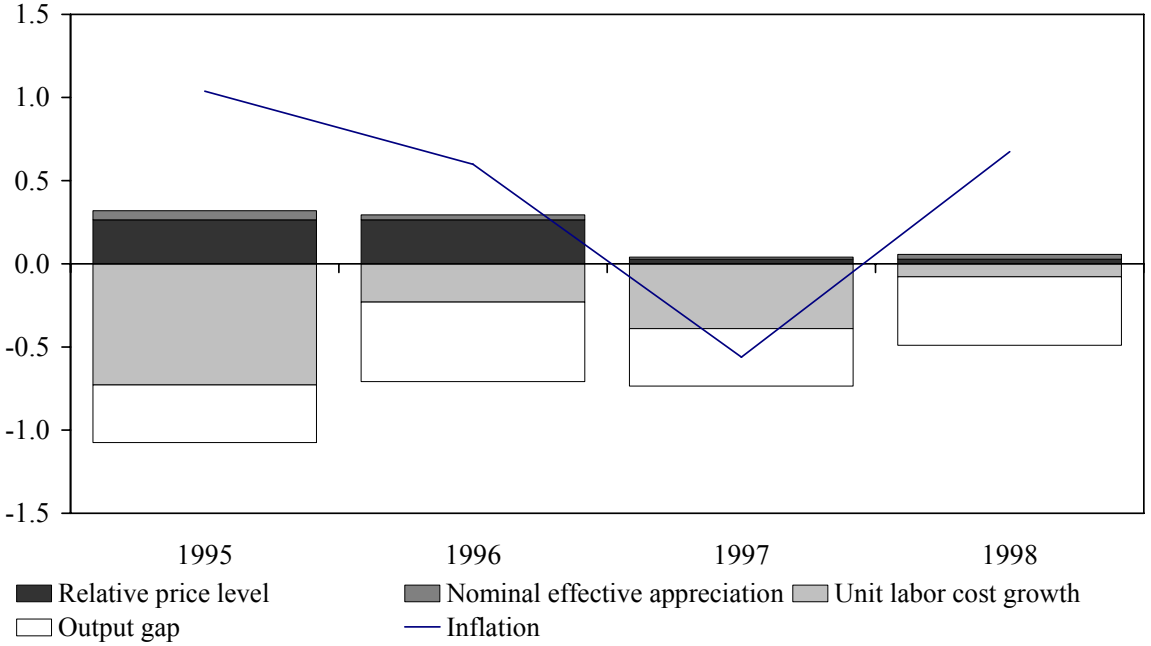


Figure 6. Lithuania: Average Contribution to Excess Year-on-Year Inflation 1/
(In percentage points)



1/ Excess over sample average inflation.

Figure 7. Portugal: Average Contribution to Excess Year-on-Year Inflation 1/
(In percentage points)



1/ Excess over sample average inflation.

Table 1. Eurozone: Overall and Country-Specific Inflation

Dependent variable	Country-specific inflation				Overall inflation
Constant	0.67	0.53	0.59	2.71	1.24
	[0.05]**	[0.13]	[0.08]*	[0.00]***	[0.02]**
Lagged dependent variable	0.80	0.80	0.79	...	0.74
	[0.00]***	[0.00]***	[0.00]***	...	[0.00]***
Trade lagged 1 year (share of GDP)					
	...	0.04	0.08	0.34	0.17
	...	[0.78]	[0.53]	[0.19]	[0.33]
Relative price level in 2001 (EU25=1)					
	-0.64	-0.55	-0.65	-3.27	-0.82
	[0.05]**	[0.11]	[0.05]*	[0.00]***	[0.08]*
Maximum change in VAT rate over past year					
	0.37	0.40	0.40	0.63	0.42
	[0.00]***	[0.00]***	[0.00]***	[0.03]**	[0.02]**
Cumulative coefficients for contemporaneous effect and effect lagged 1 year					
Output gap	0.09	0.24	0.09	0.39	0.04
F-test (Prob>F)	[0.11]	[0.04]**	[0.13]	[0.00]***	[0.65]
NEER	-0.04	-0.04	-0.04	0.00	-0.01
F-test (Prob>F)	[0.03]**	[0.02]**	[0.02]**	[0.97]	[0.64]
ULC	0.02	0.06	0.06	0.13	0.04
F-test (Prob>F)	[0.11]	[0.00]***	[0.00]***	[0.00]***	[0.12]
ULC*trade	...	-0.05	-0.05	-0.11	-0.03
F-test (Prob>F)	...	[0.09]*	[0.07]*	[0.11]	[0.49]
Output gap*trade	...	-0.21	...	...	...
F-test (Prob>F)	...	[0.21]	...	...	...
Memorandum items:					
ULC*trade+ULC	...	0.02	0.03	0.05	0.02
F-test (Prob>F)	...	[0.10]*	[0.07]*	[0.09]*	[0.20]
Output gap*trade+output gap	...	0.08	...	...	...
F-test (Prob>F)	...	[0.13]	...	...	...
Observations	179	179	179	191	179
Number of countries	12	12	12	12	12
R-squared (within)	0.67	0.68	0.68	0.25	0.46
R-squared (between)	0.98	0.98	0.98	0.64	0.97
R-squared (overall)	0.85	0.86	0.86	0.47	0.73

Note: Robust P-values in brackets; *** for less than or equal to 0.01; ** for greater than 0.01 and less than or equal to 0.05; and * for greater than 0.05 and less than or equal to 0.10.

Table 2. Non-Eurozone: Country-Specific and Overall Inflation

Dependent variable	Country-specific inflation					Overall inflation
	Non-Eurozone			Eastern Non-Eurozone	Non-Eurozone	
Constant	-0.09	0.09	-0.13	0.57	0.31	0.53
	[0.86]	[0.86]	[0.81]	[0.56]	[0.69]	[0.40]
Lagged dependent variable	0.78	0.78	0.78	0.78	...	0.72
	[0.00]***	[0.00]***	[0.00]***	[0.00]***	...	[0.00]***
Trade lagged 1 year (share of GDP)	0.28	0.17	0.40	0.54	1.05	0.42
	[0.46]	[0.70]	[0.32]	[0.22]	[0.05]*	[0.39]
Relative price level in 2001 (EU25=1)	-0.06	-0.13	-0.09	-1.56	-1.14	-0.12
	[0.84]	[0.65]	[0.75]	[0.20]	[0.02]**	[0.74]
Maximum change in VAT rate over past year	0.27	0.28	0.30	0.26	0.87	0.36
	[0.01]**	[0.01]**	[0.01]***	[0.02]**	[0.00]***	[0.00]***
Cumulative coefficients for contemporaneous effect and effect lagged 1 year						
Output gap	-0.07	0.38	-0.06	-0.11	-0.05	-0.11
F-test (Prob>F)	[0.43]	[0.25]	[0.46]	[0.23]	[0.66]	[0.25]
NEER	-0.10	-0.11	-0.11	-0.14	-0.26	-0.12
F-test (Prob>F)	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***
ULC	0.02	0.11	0.12	0.16	0.29	0.12
F-test (Prob>F)	[0.3]	[0.11]	[0.05]*	[0.04]**	[0.00]***	[0.09]*
ULC*trade	...	-0.10	-0.13	-0.15	-0.09	-0.10
F-test (Prob>F)	...	[0.2]	[0.09]*	[0.06]*	[0.43]	[0.17]
Output gap*trade	...	-0.56	...	...	...	...
F-test (Prob>F)	...	[0.18]	...	...	...	...
Memorandum items:						
ULC*trade+ULC	...	0.02	0.01	0.01	0.21	0.03
F-test (Prob>F)	...	[0.40]	[0.51]	[0.74]	[0.00]***	[0.18]
Output gap*trade+output gap	...	-0.11	...	...	...	...
F-test (Prob>F)	...	[0.25]	...	...	...	...
Observations	165	165	165	120	176	165
Number of countries	11	11	11	8	11	11
R-squared (within)	0.72	0.73	0.73	0.78	0.34	0.67
R-squared (between)	0.98	0.99	0.99	1.00	0.91	0.99
R-squared (overall)	0.86	0.86	0.86	0.89	0.62	0.83

Note: Robust P-values in brackets; *** for less than or equal to 0.01; ** for greater than 0.01 and less than or equal to 0.05; and * for greater than 0.05 and less than or equal to 0.10.

Table 3. Eurozone and Non-Eurozone: Country-Specific Inflation in Tradables and Nontradables

Dependent variable: Country-specific year-on-year inflation								
	Eurozone				Non-Eurozone			
	Nontradables		Tradables		Nontradables		Tradables	
Constant	0.23	1.75	1.00	3.42	-0.53	-1.35	-0.03	1.10
	[0.68]	[0.02]**	[0.00]***	[0.00]***	[0.24]	[0.09]*	[0.97]	[0.24]
Lagged dependent variable	0.81	...	0.73	...	0.71	...	0.80	...
	[0.00]***	...	[0.00]***	...	[0.00]***	...	[0.00]***	...
Trade lagged 1 year (share of GDP)	0.13	0.54	0.01	0.09	0.81	2.53	0.29	0.38
	[0.34]	[0.12]	[0.94]	[0.73]	[0.03]**	[0.00]***	[0.58]	[0.58]
Relative price level in 2001 (EU25=1)	-0.48	-2.96	-0.88	-3.42	0.01	-0.40	-0.11	-1.59
	[0.35]	[0.00]***	[0.01]**	[0.00]***	[0.96]	[0.42]	[0.78]	[0.01]***
Maximum change in VAT rate over past year	0.59	1.26	0.23	0.14	0.43	0.99	0.24	0.82
	[0.01]***	[0.01]***	[0.03]**	[0.48]	[0.00]***	[0.00]***	[0.02]**	[0.00]***
Cumulative coefficients for contemporaneous effect and effect lagged 1 year								
Output gap	0.04	0.39	0.12	0.35	-0.06	0.08	-0.05	-0.10
F-test (Prob>F)	[0.53]	[0.00]***	[0.10]*	[0.00]***	[0.44]	[0.63]	[0.59]	[0.46]
NEER	-0.02	0.03	-0.06	-0.03	-0.11	-0.19	-0.12	-0.29
F-test (Prob>F)	[0.27]	[0.49]	[0.02]**	[0.34]	[0.00]***	[0.00]***	[0.00]***	[0.00]***
ULC	0.05	0.09	0.08	0.15	0.14	0.17	0.11	0.34
F-test (Prob>F)	[0.15]	[0.11]	[0.00]***	[0.00]***	[0.01]**	[0.03]**	[0.15]	[0]***
ULC*trade	-0.02	-0.06	-0.07	-0.14	-0.10	0.07	-0.13	-0.16
F-test (Prob>F)	[0.54]	[0.59]	[0.05]**	[0.01]***	[0.10]	[0.45]	[0.15]	[0.24]
Memorandum items:								
ULC*trade+ULC	0.03	0.05	0.02	0.04	0.05	0.23	0.00	0.20
F-test (Prob>F)	[0.06]*	[0.29]	[0.21]	[0.10]*	[0.05]**	[0.00]***	[0.99]	[0.00]***
Observations	179	191	179	191	165	176	165	176
Number of countries	12	12	12	12	11	11	11	11
R-squared (within)	0.57	0.19	0.60	0.14	0.71	0.35	0.69	0.28
R-squared (between)	0.99	0.46	0.97	0.77	1.00	0.94	0.98	0.79
R-squared (overall)	0.84	0.32	0.79	0.44	0.88	0.69	0.83	0.51

Note: Robust P-values in brackets; *** for less than or equal to 0.01; ** for greater than 0.01 and less than or equal to 0.05; and * for greater than 0.05 and less than or equal to 0.10.

Table 4. Eurozone and Non-Eurozone: Country-Specific Inflation over Time

Dependent variable: Country-specific year-on-year inflation								
	Eurozone				Non-Eurozone			
	2002/2003		2004/2005		2002/2003		2004/2005	
Constant	0.42	1.92	0.89	3.50	-0.42	-1.47	0.98	2.24
	[0.19]	[0.01]***	[0.23]	[0.00]***	[0.58]	[0.23]	[0.17]	[0.02]**
Lagged dependent variable	0.85	...	0.71	...	0.72	...	0.64	...
	[0.00]***	...	[0.00]***	...	[0.00]***	...	[0.00]***	...
Trade lagged 1 year (share of GDP)	-0.17	0.46	0.33	0.59	0.33	1.44	0.06	0.32
	[0.38]	[0.28]	[0.12]	[0.03]**	[0.58]	[0.14]	[0.90]	[0.60]
Relative price level in 2001 (EU25=1)	-0.11	-2.89	-0.98	-4.00	0.27	0.34	-0.95	-2.40
	[0.76]	[0.00]***	[0.20]	[0.00]***	[0.50]	[0.63]	[0.03]**	[0.00]***
Maximum change in VAT rate over past year	0.47	1.07	0.39	0.17	0.82	1.38	0.27	0.76
	[0.00]***	[0.06]*	[0.00]***	[0.53]	[0.00]***	[0.00]***	[0.00]***	[0.00]***
Cumulative coefficients for contemporaneous effect and effect lagged 1 year								
Output gap	-0.01	0.31	0.13	0.49	0.11	0.03	-0.11	0.02
F-test (Prob>F)	[0.89]	[0.02]**	[0.26]	[0.00]***	[0.25]	[0.84]	[0.36]	[0.93]
NEER	-0.08	0.10	-0.03	-0.06	-0.09	-0.15	-0.19	-0.37
F-test (Prob>F)	[0.10]	[0.20]	[0.24]	[0.06]*	[0.00]***	[0.00]***	[0.00]***	[0.00]***
ULC	0.10	0.18	0.04	0.08	0.04	0.02	0.09	0.23
F-test (Prob>F)	[0.00]***	[0.00]***	[0.22]	[0.03]**	[0.57]	[0.88]	[0.25]	[0.02]**
ULC*trade	-0.09	-0.15	0.00	0.01	0.03	0.33	-0.11	-0.15
F-test (Prob>F)	[0.01]**	[0.17]	[0.94]	[0.93]	[0.7]	[0.02]**	[0.23]	[0.16]
Memorandum items:								
ULC*trade+ULC	0.03	0.07	0.04	0.09	0.07	0.30	-0.01	0.10
F-test (Prob>F)	[0.13]	[0.18]	[0.06]*	[0.00]***	[0.027]**	[0.00]***	[0.76]	[0.01]***
Observations	84	96	95	95	77	88	88	88
Number of countries	12	12	12	12	11	11	11	11
R-squared (within)	0.46	0.10	0.31	0.17	0.70	0.30	0.73	0.56
R-squared (between)	0.99	0.58	0.97	0.74	0.98	0.89	0.97	0.87
R-squared (overall)	0.91	0.43	0.81	0.61	0.92	0.69	0.88	0.75

Note: Robust P-values in brackets; *** for less than or equal to 0.01; ** for greater than 0.01 and less than or equal to 0.05; and * for greater than 0.05 and less than or equal to 0.10.

Table 5. Eurozone and Non-Eurozone: Country-Specific Inflation in Tradables and Nontradables Over Time

Dependent variable: Country-specific year-on-year inflation																
	Eurozone								Non-Eurozone							
	Nontradables				Tradables				Nontradables				Tradables			
	2002/03	2004/05	2002/03	2004/05	2002/03	2004/05	2002/03	2004/05	2002/03	2004/05	2002/03	2004/05	2002/03	2004/05	2002/03	2004/05
Constant	0.12	0.62	1.36	2.79	0.99	1.00	2.33	4.00	-0.59	-0.24	-3.06	-0.59	-0.56	1.42	-0.90	3.39
	[0.78]	[0.56]	[0.23]	[0.01]***	[0.03]**	[0.08]*	[0.00]***	[0.00]***	[0.51]	[0.74]	[0.03]**	[0.61]	[0.57]	[0.13]	[0.56]	[0.00]***
Lagged dependent variable	0.91	0.66	...	...	0.70	0.76	...	...	0.64	0.69	...	...	0.79	0.65	...	...
	[0.00]***	[0.00]***	...	...	[0.00]***	[0.00]***	...	...	[0.00]***	[0.00]***	...	...	[0.00]***	[0.00]***	...	...
Trade lagged 1 year (share of GDP)	0.01	0.42	0.68	1.00	-0.26	0.26	0.25	0.00	0.75	0.77	3.16	2.23	0.33	-0.27	0.73	-0.50
	[0.96]	[0.06]*	[0.26]	[0.00]***	[0.35]	[0.37]	[0.46]	[1.00]	[0.21]	[0.16]	[0.00]***	[0.00]***	[0.68]	[0.66]	[0.55]	[0.53]
Relative price level in 2001 (EU25=1)	0.12	-0.98	-2.67	-4.15	-0.73	-0.94	-3.02	-3.75	0.22	-0.30	0.88	-0.85	0.37	-1.15	0.09	-3.10
	[0.78]	[0.38]	[0.01]**	[0.00]***	[0.18]	[0.12]	[0.00]***	[0.00]***	[0.69]	[0.52]	[0.28]	[0.27]	[0.47]	[0.06]*	[0.92]	[0.00]***
Maximum change in VAT rate over past year	0.33	0.61	1.82	0.23	0.46	0.21	0.47	0.09	0.86	0.37	1.38	0.95	0.78	0.20	1.40	0.69
	[0.05]*	[0.01]***	[0.05]**	[0.49]	[0.01]***	[0.10]	[0.11]	[0.71]	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.02]**	[0.00]***	[0.00]***
Cumulative coefficients for contemporaneous effect and effect lagged 1 year																
Output gap	-0.01	0.04	0.41	0.08	0.03	0.14	0.26	0.69	0.01	-0.05	-0.03	0.26	0.16	-0.14	0.04	-0.07
F-test (Prob>F)	[0.87]	[0.74]	[0.03]**	[0.65]	[0.79]	[0.35]	[0.04]**	[0.00]***	[0.96]	[0.66]	[0.88]	[0.23]	[0.16]	[0.31]	[0.81]	[0.7]
NEER	-0.08	0.01	0.05	0.01	-0.05	-0.05	0.13	-0.11	-0.08	-0.16	-0.08	-0.28	-0.10	-0.20	-0.17	-0.42
F-test (Prob>F)	[0.07]*	[0.82]	[0.63]	[0.85]	[0.49]	[0.10]	[0.03]**	[0.01]***	[0.00]***	[0.00]***	[0.04]**	[0.00]***	[0.01]***	[0.00]***	[0.00]***	[0.00]***
ULC	0.09	0.01	0.15	-0.03	0.11	0.05	0.18	0.15	0.12	0.09	-0.09	0.20	-0.02	0.08	0.00	0.28
F-test (Prob>F)	[0.01]**	[0.86]	[0.07]*	[0.60]	[0.01]**	[0.28]	[0.00]***	[0.01]***	[0.22]	[0.20]	[0.54]	[0.03]**	[0.79]	[0.33]	[0.98]	[0.02]**
ULC*trade	-0.08	0.08	-0.16	0.23	-0.10	-0.03	-0.12	-0.17	0.01	-0.11	0.45	-0.05	0.06	-0.12	0.35	-0.24
F-test (Prob>F)	[0.03]**	[0.30]	[0.3]	[0.01]**	[0.08]*	[0.66]	[0.15]	[0.06]*	[0.93]	[0.15]	[0.01]***	[0.63]	[0.55]	[0.28]	[0.08]*	[0.08]*
Memorandum items:																
ULC*trade+ULC	0.03	0.07	0.03	0.13	0.04	0.02	0.09	0.03	0.13	0.00	0.29	0.16	0.03	-0.02	0.29	0.07
F-test (Prob>F)	[0.17]	[0.02]**	[0.70]	[0.00]***	[0.14]	[0.42]	[0.02]**	[0.54]	[0.00]***	[0.90]	[0.00]***	[0.00]***	[0.40]	[0.63]	[0.00]***	[0.09]*
Observations	84	95	96	95	84	95	96	95	77	88	88	88	77	88	88	88
Number of countries	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11
R-squared (within)	0.56	0.18	0.14	0.06	0.34	0.37	0.07	0.14	0.59	0.76	0.24	0.48	0.64	0.65	0.26	0.51
R-squared (between)	1.00	0.95	0.60	0.54	0.97	0.98	0.71	0.74	0.99	0.98	0.93	0.93	0.98	0.96	0.77	0.77
R-squared (overall)	0.94	0.68	0.39	0.39	0.80	0.79	0.48	0.54	0.91	0.91	0.73	0.77	0.90	0.83	0.59	0.66

Note: Robust P-values in brackets; *** for less than or equal to 0.01; ** for greater than 0.01 and less than or equal to 0.05; and * for greater than 0.05 and less than or equal to 0.10.

Table 6. The EU's Southern Periphery: Selected Economic Indicators in the Runup to EMU Accession

	t-4	t−3	t−2	t−1	t	t+1	t+2
Spain (t=1997) 1/							
Inflation (in percent)	4.6	4.7	4.7	3.5	2.0	1.8	2.3
Real GDP growth (in percent)	-1.0	2.4	2.8	2.4	3.8	4.5	4.7
Real unit labor cost (in percent)	0.8	-2.9	-2.1	-0.4	-1.4	0.0	-0.5
Current account deficit (in percent of GDP)	-1.1	-1.2	-0.3	-0.4	-0.1	-1.2	-2.9
Fiscal deficit (in percent of GDP) 2/	-6.6	-6.4	-5.0	-5.3	-2.3	-0.9	-1.2
Real money market rates (in percent)	7.4	3.0	4.1	4.0	3.4	2.5	0.4
Portugal (t=1997) 1/							
Inflation (in percent)	6.4	5.3	4.2	3.1	1.8	2.8	2.3
Real GDP growth (in percent)	-2.1	0.9	4.3	3.6	4.2	4.7	3.8
Real unit labor cost (in percent)	-1.3	-3.5	-1.3	1.0	-0.4	-0.5	8.1
Current account deficit (in percent of GDP)	0.3	-2.3	-0.1	-4.2	-6.0	-7.1	-8.5
Fiscal deficit (in percent of GDP)	-7.8	-7.4	-5.3	-4.6	-3.4	-3.0	-2.7
Real money market rates (in percent)	6.4	5.1	4.6	4.2	3.9	1.5	0.4
Greece (t=1999) 3/							
Inflation (in percent)	8.9	7.9	5.4	4.6	2.2	2.8	3.7
Real GDP growth (in percent)	2.0	2.4	3.7	3.3	3.4	4.5	4.6
Real unit labor cost (in percent)	1.7	-1.4	2.2	0.8	0.0	-2.0	-2.8
Current account deficit (in percent of GDP)	-2.4	-3.7	-4.0	-3.0	-4.1	-8.6	-8.0
Fiscal deficit (in percent of GDP)	-10.2	-7.4	-6.6	-4.3	-3.4	-4.1	-6.1
Real money market rates (in percent) 4/	6.9	5.5	7.0	9.0	6.0	3.3	0.4

1/ EMU accession assessment year t = 1997 (Fiscal positions were assessed for 1997, interest and inflation rates for 1998).

2/ Based on national classification for 1993-1998 because not available in ESA95 terms until 1995. For 1999, in ESA95 terms because not available in national classification.

3/ EMU accession assessment year t = 1999 (Fiscal positions were assessed for 1999, interest and inflation rates for 2000).

4/ Money market rates not available from 1999, hence use of treasury bill rates for t, t+1 and t+2.

Table 7. Ireland: Selected Economic Indicators During Fiscal Consolidation Period, 1983-1989

	1983	1984	1985	1986	1987	1988	1989
Inflation (in percent)	10.4	8.5	5.5	3.9	3.1	2.2	4.0
Real GDP growth (in percent)	-0.3	4.5	3.0	0.3	4.7	4.2	6.2
Real unit labor cost (in percent)	0.0	-2.1	-2.0	-0.2	-0.9	-0.8	-4.7
Current account deficit (in percent of GDP)	-6.0	-5.2	-3.5	-3.0	-0.2	-0.1	-1.5
Fiscal deficit (in percent of GDP)	-12.4	-10.6	-11.6	-10.8	-9.2	-3.7	-1.5
Real money market rates (in percent)	3.6	4.0	6.1	8.1	7.5	5.5	5.3

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