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THE MINIMUM INFLATION RATE FOR EUROLAND

Hans-Werner Sinn
Michael Reutter*

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CESifo
Poschingerstr. 5
81679 Munich
Germany
Phone: +49 (89) 9224-1410/1425
Fax: +49 (89) 9224-1409
http://www.CESifo.de

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Abstract

As a result of the Balassa effect relative prices change rapidly between and within the euro countries. Thus it is impossible to find a common monetary policy that will result in price stability in all countries. Based on empirical estimates of the Balassa model, the paper calculates a minimum aggregate inflation rate which is compatible with the requirement that no country face a deflation. This minimum aggeragate inflation rate is 0.94% in the euro-11 countries and 1.13% in an extended Europe which incorporates the east European countries.

Keywords: Inflation target, Balassa-Samuelson effect, ECB

JEL Classification: E31, E52, E58

Hans-Werner Sinn
CESifo
Poschingerstr. 5
81679 Munich
Germany
email: SINN@cesifo.de

Michael Reutter
CESifo
Schackstr. 4
80539 Munich
Germany

1. Introduction

What is the European Central Bank's (ECB) appropriate inflation target? Many observers argue that what used to be Europe's most stable currency, the deutschmark, should serve as the benchmark for the euro. The inflation rate in Euroland should be as low as it was in Germany, because only then would the euro be able to replace the deutschmark and successfully compete with the dollar. This paper contrasts this view by pointing to the differences between Euroland and Germany. Euroland is bigger and more diverse than Germany, and for the time being substantial relative price changes have to be accounted for. These relative price changes require an inflation rate for Euroland that is higher than the one appropriate for any single European country if the risk of local deflation is to be avoided. If, say, Ireland needs a price increase relative to Germany, then it makes little sense to prescribe Germany's previous idea of price stability to the average European price index, because it might require deflation for Germany or at least a dangerously low inflation rate. Thus, the Bundesbank's goals should not be taken over by the ECB on a one-to-one basis.

In this paper we try to calculate the minimum average inflation rate for Euroland that prevents deflation in any one of its members. We do not claim that the ECB should target at this minimum inflation rate; however, we argue that the minimum inflation rate is a special component in the calculation of the inflation target that comes in addition to the usual arguments used in the closed economy context.

It is a matter of fact that the single European countries have not, in the past, aimed at price stability in the strict sense of the word, and they may have been wise in not doing so. There are at least four economic reasons why a single country should aim at a positive measured inflation rate.

- There may be situations where a negative real interest rate is required to get the economy going (Summers 1991). However, when the inflation rate is zero, negative real interest rates are impossible, as negative real interest rates would then require negative nominal interest rates, but negative nominal interest rates are excluded by the liquidity trap. The recent example of the Japanese recession has demonstrated the validity of this concern.
- In light of nominal price rigidities some inflation is needed to allow for a decline of relative prices and to provide the economy with the necessary flexibility to accommodate structural change (Akerlof, Dickens and Perry 1996). Experimental studies (Fehr and Falk 1999) as well as interviews (Kahnemann, Knetsch and Thaler 1986, Agell and Lundborg 1995, Bewley 1995, 1999) have demonstrated the importance of such rigidities.

- An inflation tax on the holding of real money balances should be part of an optimal tax system because its distortions balance with the distortions of other taxes (Phelps 1973) at the margin.
- The measured inflation rate may overestimate the true inflation rate by between 0.5 and 2 percentage points, because the available statistics count price increases for quality improvements as inflation. This effect has been frequently emphasised by Alan Greenspan (1998) and others (Boskin et al. 1996, Moulton 1996, Shapiro and Wilcox 1996).

All of these reasons for allowing for some degree of measured inflation in each single European country will remain valid in the future, but they are augmented by an additional reason that results from the need to allow for relative price changes between the European countries, and this is what we analyse in this paper.

Our approach is based on the Balassa-Samuelson effect.[1] There are traded goods and non-traded goods, and there are advanced and less advanced countries. Traded goods have the same price everywhere, but the prices of non-traded goods may differ between the countries. Labour productivity in the traded goods sectors of the less advanced countries tends to grow exceptionally fast, driving up wages in these countries. The wage increase translates into an increase in the price of non-traded goods relative to the price of traded goods and also to an increase in the average price level of these countries relative to the average price level in the more advanced countries. Thus, a stable aggregate price level for all countries taken together requires a deflation in the more advanced countries, and a constancy of the more advanced countries' price level implies that there is inflation in the aggregate.[2]

The Balassa-Samuelson effect is an empirical regularity rather than a theoretical necessity. It was observed in less developed countries and explains why these countries have undervalued currencies if seen from a comprehensive purchasing power parity perspective. While there are no less developed countries according to the usual definition in Euroland, we find that the Balassa-Samuelson effect has nevertheless been very strong in previous years. Some countries display very large differences in productivity growth between the two sectors, others do not. We argue that these differences are likely to result in a divergence of the national inflation rates of up to 2.7 percentage points and estimate a required minimum Euroland inflation rate in the order of 1%. Inflation in Euroland should therefore not be

[1] Balassa (1964) and Samuelson (1964).

[2] Although the influence of the Balassa-Samuelson effect on inflation differentials in a monetary union is acknowledged by the ECB, the ECB does not infer any consequences for monetary policy from this fact (see European Central Bank, 1999).

compared with the previous inflation in the deutschmark zone without allowing for such a mark-up that captures the prevailing differences in the European productivity growth rates.

2. Some Basic Arithmetic

In this section we set up a two sector model for the area of a currency union. Assume there are $i = 1,..., n$ countries which are members of a currency union. All countries have two sectors, one produces a tradable manufacturing good, the other produces a non-tradable good. Tradable goods have the same prices in all countries:[3]

$$p_i^T = p^T \quad \forall i = 1,...,n\,. \tag{1}$$

The prices of non-tradables, p_i^N, by contrast, can differ between the countries.

Let y_i^T and y_i^N indicate the marginal products of labour in the trading and non-trading sectors of country *i*. Internal competition and free migration of labour between the two sectors imply that

$$y_i^T p_i^T = w_i = y_i^N p_i^N\,, \tag{2}$$

where w_i is the common wage rate of country *i*. Let a hat indicate growth rates. Then it follows from (1) and (2) that the price of country *i*'s non-traded goods grows at the rate

$$\hat{p}_i^N = \hat{p}^T + \hat{y}_i^T - \hat{y}_i^N\,; \tag{3}$$

i.e., it is given by the rate of increase in the common international price of the traded goods plus the difference between country *i*'s productivity growth rates of the traded and non-traded sectors. Equation (3) reveals already the basic mechanism explored in this paper. If the intersectoral growth difference is higher in some countries than in others, the prices of non-traded goods will have to grow faster in these countries, and accordingly the inflation rates of these countries will have to be higher than that in other countries. If deflation in any one of the countries is to be avoided, the aggregate inflation rate for all countries taken together will

[3] All variables depend on time, *t*, but the time index is omitted for the sake of brevity. Unless otherwise stated, all variables of an equation hold for any arbitrarily given point in time.

have to be higher the more diverse the countries are in terms of their intersectoral growth differences as measured by $\hat{y}_i^T - \hat{y}_i^N$.

To explore this further, let us simplify by assuming that aggregate price indices can be written as geometric means of the respective sub-indices. Then the inflation rate of country *i,* π_i, is given by

$$\pi_i \equiv (1-\alpha_i^N)\,\hat{p}^T + \alpha_i^N \hat{p}_i^N \tag{4}$$

where α_i^N is the share in value added produced by country *i*'s sector of non-traded goods, and $1-\alpha_i^N$ is the share in value added produced by its sector of traded goods. Similarly, the aggregate inflation rate of all countries, $\bar{\pi}$, is given by

$$\bar{\pi} \equiv \sum_{i=1}^{n} \beta_i \pi_i, \quad \sum_{i=1}^{n} \beta_i = 1, \tag{5}$$

where β_i is country *i*'s share in aggregate value added. Inserting (3) into (4) we obtain

$$\pi_i = \hat{p}^T + \alpha_i^N (\hat{y}_i^T - \hat{y}_i^N)\ . \tag{6}$$

Equation (6) reveals that country *i*'s inflation rate equals the rate of increase in the price of traded goods plus the share in value added of the sector of non-traded goods times the excess productivity growth of the sector of traded goods. If none of the *n* countries is allowed to experience a deflation,

$$\pi_i \geq 0 \ \ \forall\, i = 1,...,n\,, \tag{7}$$

it is obviously necessary that

$$\hat{p}^T \geq -\alpha_i^N (\hat{y}_i^T - \hat{y}_i^N) \ \ \forall\, i = 1,...,n\ . \tag{8}$$

This inequality gives a lower bound for the rate of increase in the price of non-traded goods. If productivity growth in the sector of traded goods exceeds that in the sector of non-traded goods in all countries, the right-hand side of inequality (8) is negative indicating that a

reduction of the common price of traded goods is compatible with the condition that there be no aggregate deflation in any of the countries. If, on the other hand, there happens to be a country where productivity growth is higher in the sector of non-traded goods than in the sector of traded goods, the right-hand side of the inequality is positive and it follows that the price of traded goods has to increase if a deflation is to be avoided.

This has strong implications for the aggregate inflation rate of all countries. From (5) and (6) it follows that the aggregate inflation rate is given by

$$\bar{\pi} = \hat{p}^T + \sum_{i=1}^{n} \beta_i \alpha_i^N (\hat{y}_i^T - \hat{y}_i^N) \ . \tag{9}$$

Let $\bar{\pi}_{\min}$ denote the minimum aggregate inflation rate compatible with the requirement that no single country will face a deflation. It is easy to show that (9) and (8) imply

$$\bar{\pi}_{\min} = \sum_{i=1}^{n} \beta_i \alpha_i^N (\hat{y}_i^T - \hat{y}_i^N) - \min_{i=1,\ldots,n} \left[\alpha_i^N (\hat{y}_i^T - \hat{y}_i^N) \right] . \tag{10}$$

This equation will serve as the basis of our empirical estimates. It gives precise meaning to the intuition reported in the introduction.

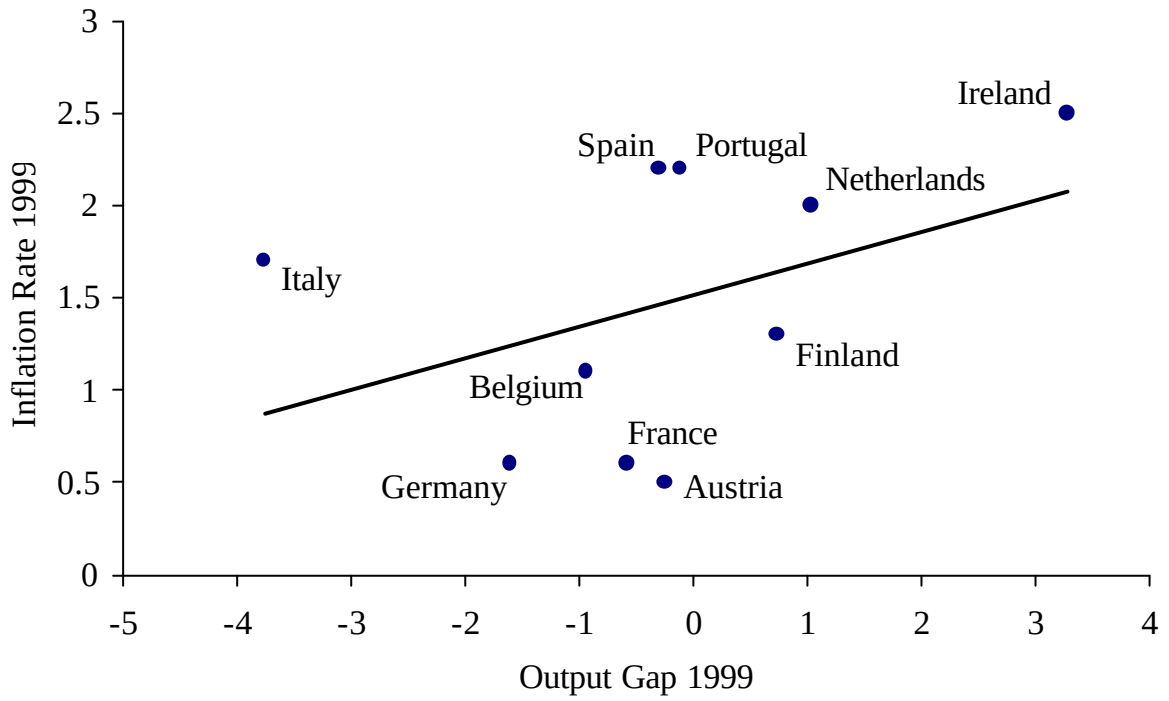
To interpret the equation, suppose first that there is one mature country whose manufacturing sector enjoys no particular productivity gains relative to the sector of non-traded goods and which therefore experiences no change in relative prices, while the relative price of non-tradables is rising in all other countries. In this case, the price of traded goods cannot fall without generating a deflation in the mature country. It follows that the aggregate price level must rise so as the accommodate for the required increases in the relative prices of non-traded goods in the other countries that result from the productivity increases in the traded-good sectors; this is reflected by the first term on the right-hand side of the equation.

Suppose next that even the most mature country experiences some extra productivity growth in the sector of traded goods. In this case the price of traded goods can fall without implying a deflation in this country because it is compensated for with an increase in the priced of non-traded goods. The no-deflation constraint is relaxed, and the relative price of non-traded goods can increase in all countries without implying as much inflation as before, because the price of traded goods is falling.

3. Empirical Results for Euroland

In 1999, the first year of the currency union, the inflation differentials between countries in the euro area were quite substantial. In Figure 1 we plot the inflation rates of the 10 major countries against the output gap, according to OECD definition. As can be seen, the state of the business cycle delivers only a partial explanation for the differentials. Large residuals remain which point at the importance of other influences such as the Balassa-Samuelson effect discussed above. If the Balassa-Samuelson effect is robust, a positive minimum inflation rate on average is obviously necessary to prevent deflation in any one country.

Figure 1: Inflation Rates and Output Gap in 1999



Source: Monthly Reports of the German Bundesbank, February 2000 and OECD Statistical Compendium, Economic Outlook.
Legend: Inflation rates are annual HICP inflation in percent. Output gap according to OECD methods.

Finding the minimum aggregate inflation rate is difficult since, naturally, the available data stem from a time where neither a common currency nor a fixed exchange rate prevailed and since it is not clear how traded and non-traded goods should be distinguished empirically. Even the most local good is tradable when tourism and labour migration are taken into account. Our decision of how to separate the sectors was driven mainly by data availability. To construct a complete sample for all members of the currency union, we had to restrict the sector of tradable goods to agriculture and manufacturing and to define the remainder as the

sector of non-tradable goods. Non-tradables according to our definition include construction, services, electricity, gas and water supply.[4] We consider two sample periods, 1987–1995 and 1978–1996. In the first period we have data from all countries except Luxembourg, which is of negligible size. We hope that this period is sufficiently long to eliminate the role of business cycles. To check the validity of this hope we repeat our calculations with the second, much longer period for the subset of those six countries for which data were available.

Table 1: Growth Rates of Labour Productivities and Value Added Prices

Country	**Labour Productivity**		**Value Added Prices**		**Difference**	
	(1)	(2)	(3)	(4)	(5)	(6)
	Traded	Non-traded	Traded	Non-traded	Productivity*	Prices**
Austria	3.21 (2.70)	1.07 (0.90)	1.38 (1.95)	3.41 (4.17)	2.14 (1.80)	2.03 (2.22)
Belgium	3.07 (3.99)	1.74 (1.35)	1.62 (2.16)	3.35 (4.40)	1.33 (2.64)	1.73 (2.24)
Germany	1.90 (1.72)	1.55 (1.27)	1.71 (2.51)	3.25 (3.49)	0.34 (0.46)	1.54 (0.98)
Spain	1.92	-0.36	3.49	5.90	2.28	2.41
Finland	5.98 (4.95)	1.88 (1.73)	1.62 (3.74)	4.45 (6.46)	4.10 (3.22)	2.84 (2.72)
France	3.01 (2.98)	0.97 (1.09)	1.20 (4.54)	2.98 (6.01)	2.04 (1.89)	1.77 (1.47)
Italy	3.79 (4.26)	1.50 (1.13)	3.34 (7.17)	5.79 (9.87)	2.29 (3.14)	2.44 (2.70)
Netherlands	2.91	0.79	0.89	1.90	2.13	1.02
Portugal	3.52	2.00	8.25	10.43	1.52	2.18
Ireland	6.07	1.84	0.23	3.76	4.23	3.52

* Traded minus non-traded

** Non-traded minus traded

Notes: The numbers are arithmetic means of the annual growth rates for the period 1987–1995 and, in parentheses, for the period 1978–1996. Data for Germany refer to West Germany until 1993. The sector of traded goods comprises agriculture and manufacturing, the sector of non-traded goods the remainder. Labour productivity is defined as value added divided by employment. Employment, nominal value added and real value added are taken from the OECD International Sectoral Database and the OECD National Accounts. The exception is Ireland for which data on nominal value added and employment were supplied by the Federal Statistical Office of Germany. Growth in Irish real value added was proxied for the manufacturing sector by using the index of industrial production from the OECD Economic Outlook. Irish agriculture data were taken from the OECD Economic Accounts on Agriculture.

In a first step, we calculate the growth rates of labour productivity, equating the growth of marginal and average labour productivities. The results of this calculation are reported in table 1. As expected we find that productivities grow faster in the sectors of traded goods than in the respective national sectors of non-traded goods. This holds true for all countries in our sample. A formal statistical test firmly rejects (p-value < 0.01) the null hypotheses that, across the countries, the productivity growth rates of the two sectors are identical.

[4] This is in line with the usual practice in the empirical literature that tests the Balassa-Samuelson hypothesis. See Canzoneri, Cumby and Diba (1999).

Table 1 reveals a rather large international variance in the intersectoral productivity growth differentials (column 5), indicating a potentially important role of the Balassa-Samuelson effect. The two extremes are marked by Germany and Ireland. While Germany experienced a productivity lead of the sector of traded goods over the sector of non-traded goods of only 0.34%, the lead was a remarkable 4.23% in Ireland over the sample period. Given that Germany had a much higher labour productivity than Ireland and that Ireland has become a full member of the EU, it is plausible to observe a rapid catching-up process.

As the numbers in parentheses show, a longer sample does not produce substantially different results. The choice of sample length implies a trade-off between smoothing short run fluctuations (long sample) and keeping track of persistent changes (short sample). We use the short sample results for our subsequent calculations.

The growth rates of the sector-specific prices given in the same table mirror the productivity figures. As expected, in all countries the prices of non-traded goods grew faster than the prices of traded goods. Accordingly, the hypothesis that the cross-country averages of the rates of price increase of tradables and non-tradables are identical is rejected at the five percent level. When different countries are compared, there is a rather close correlation between the intersectoral differences in productivity growth rates and the intersectoral differences in price changes, especially for the long sample. This is documented in columns 5 and 6 of table 1. We conclude that the Balassa-Samuelson effect is indeed an important driving force behind the observed relative price changes in Europe.[5]

We therefore proceed with our model and derive the minimum inflation rates given in equations (6) and (10). The results of the calculations are reported in the first column of table 3 (see further below). The column reports the respective national minimum inflation rates in the euro area and their GDP-weighted averages. This average, 0.94%, is the minimum inflation rate of the euro-11 countries which we sought.

The critical country is Germany. Germany has an intersectoral productivity growth differential of only 0.34%, which is substantially below the differential of 4.23% in Ireland. To prevent Germany from experiencing a general deflation, the price level of manufacturing goods throughout the euro area must not fall by more than 0.26% per year. Given the high rates of price increase for non-tradables in the countries catching up, in particular Finland, Ireland, Italy and Spain, this implies an aggregate minimum inflation rate for all sectors and countries of roughly one percent. This aggregate minimum inflation rate is an average of very different national rates. When Germany's GDP deflator is taken to remain constant in the

[5] This is also confirmed by econometric studies (see Canzoneri, Cumby and Diba, 1999).

calculations, Finland needs an inflation rate of 2.74%, and Ireland needs one of 2.35%. This shows how meaningless the attempt to stabilise the price level in all countries would be.

Comparing the inflation predictions based on our productivity comparisons with the actual inflation rates in 1999 (see Figure 1), we identify two outliers. One is Portugal, which has a much higher inflation rate than we should expect from its rather low productivity differential. The other is Finland, which is far below the top position in the inflation rank that our productivity results predict. The explanation of the high Portuguese inflation rate can be sought in the extraordinary expansion of aggregate demand resulting from generous EU subsidies. Portugal takes the second rank after Israel among all OECD countries with regard to the surplus of imports over exports at 13% of GDP (Sinn and Westermann, 2000). Finland, on the other hand, was hit by a very serious recession in the early 1990s. One of the effects of this recession was a strong increase in unemployment and excess capacities, which made a subsequent growth with very low inflation rates possible (Honkapohja and Koskela 1999). The other countries, however, have inflation rates that are roughly in line with our predictions. Clearly, we cannot expect that our predictions are very precise for any particular year, but the broad ranking of countries and, more importantly, the dispersion in inflation rates is roughly in line with our model. If inflation rate differentials are below productivity differentials, the reason may, among other things, be found in inadequate monetary policies of the (see also Section 5, Conclusions).

In general, there is a noteworthy difference in the inflation rates predicted for the euro countries. Seven out of eleven countries will need an inflation rate which is more than 1.3 percentage points above the rate appropriate for Germany. We do not know what the latter really is. Germany's average inflation rate over the period 1985-1998 was 2.5%. If we assume that this rate will continue to be appropriate for Germany, then the seven countries will need an inflation rate of at least 3.8%, and the average Euroland inflation rate will have to be about 3.5%. If, on the other hand, we accept the Bundesbank's long standing goal of keeping the inflation rate at 1.5%, the average Euroland inflation rate will have to be 2.5%. Both figures are above the 2% target announced by the ECB and might therefore lead to a reconsideration of this target.

It is clear from the Balassa-Samuelson model that it would be false to impose the ECB target on each single member country. According to our calculations, fast growing countries like Spain, Ireland or Finland have minimum inflation rates of 1.5%, 2.4% and 2.7%. If the ECB adopted a GDP inflation target of 1.5% for Germany it would have to tolerate that the inflation rates of these countries approach 3.0%, 3.9% and 4.2%, respectively. Such rates

would not be a sign of an unsound economic policy but could well be the natural implication of the Balassa-Samuelson effect

Our calculations are rather sensitive with regard to the lowest intersectoral difference in productivity growth rates that one finds among the countries considered. The lower the lowest country's intersectoral difference in productivity growth, the lower is the relative price increase of non-traded goods in this country and the lower the common international deflation rate of traded goods which is compatible with price stability in this country. As mentioned, the critical country is Germany in this regard where the difference in productivity growth is only 0.34%, according to our estimate. Germany is the country with the highest per capita GDP among the countries considered. Thus it is plausible that it has the lowest rate of productivity growth in the manufacturing sector and the lowest lead in productivity growth over the sector of non-tradables.

Over the sample period, the German inflation differential is larger than the productivity differential. This fact could be taken to imply that the relative price effect predicted by the Balassa-Samuelson model leads to an overstatement of the minimum inflation rate for Europe. Note, however, that the sample period covers the time after German unification where the huge artificial wage increase in east Germany implied a rapid price increase of non-traded goods in east Germany which will not be repeated in the future. Our productivity based estimates are free from this distortion and may therefore better predict the minimum inflation rate than a calculation based on prices would have done. It is confirming to see that before unification, during the period 1978-1990, the average intersectoral inflation differential happened to be exactly equal to the 0.34% productivity differential on which our calculations are based. If we used this number for the German intersectoral inflation differential and added the other countries' actual inflation differentials over the whole period, as reported in table 1, a minimum inflation rate of 0.87% would emerge. This is rather close to our Balassa-Samuelson estimate of 0.94% and strengthens the confidence in our result.

4. Expanding the Monetary Union

Euroland may expand in the future. The first new country to join will be Greece. The UK is likely to have a general poll on membership in the year 2002 after the next election, and if the UK joins it is possible that Denmark and Sweden will reconsider. The next step could be the enlargement of Euroland towards eastern Europe. By 2004, the first five east European countries may have joined the EU, and shortly thereafter another five eastern countries may

become EU members. Also, Turkey, Cyprus and Malta are waiting in line. Of course, membership in Euroland will not automatically follow EU membership, but it is likely to do so in the foreseeable future. Thus it may be useful to extend our analysis by incorporating alternative extension scenarios.

We first consider the inclusion of Greece, the UK, Denmark and Sweden. Table 2 shows the intersectoral differences in productivity growth in these four countries. Obviously, the British and Danish values are quite similar to those of the other member countries, but Greece and Sweden have rather high values that even exceed those of Ireland.

Table 2: EU Enlargement

Country	**Labour Productivity**		**Difference**
	Traded	Nontraded	
Denmark	4.10	2.00	2.09
UK	3.07	1.81	1.26
Greece	5.29	-0.84	6.13
Sweden	6.56	1.28	5.28
Turkey	3.34	2.78	0.57
Poland	10.27	3.89	6.38
Hungary	11.07	0.82	10.24
Czech Republic	6.44	1.58	4.86
Estonia	7.67	1.89	5.79
Slovenia	7.28	1.80	5.48

Notes: The numbers are arithmetic means of the annual growth rates. The traded sector comprises agriculture and manufacturing. The sector of non-traded goods is the remainder. Labour productivity is defined as value added divided by employment. The sample is from 1991-1997 for Denmark, UK, Sweden and Turkey, from 1991-1996 for Greece, from 1994-1997 for Poland and Hungary, from 1995-1998 for the Czech Republic, from 1994-1998 for Estonia, and from 1996-1999 for Slovenia. Data sources are the OECD Economic Outlook, World Bank Development Indicators, OECD National Accounts, OECD Annual Labour Force Statistics, the Federal Statistical Office in Germany, IMF country reports and the Slovenian Economic Mirror.

The expansion of EMU membership leads to a further increase in the required minimum inflation rate for Europe as is shown in table 3, second column. The average euro-15 inflation rate that would prevent a deflation in Germany is now 1.05%. The countries with the highest minimum inflation rates would be Sweden and Greece with 3.64% and 4.26% respectively. The UK would experience rather low minimum inflation, below the EU average, while Denmark would be in the middle field of all countries.

In a second step it can be envisaged that a number of further countries from eastern and south-eastern Europe become members of the currency union. We therefore extended the calculations to Poland, Hungary, the Czech Republic, Estonia, Slovenia and Turkey, omitting

Cyprus, Bulgaria, Romania, Lithuania, Latvia, Malta, and the Slovak Republic due to data problems.

Labour productivity growth in these countries is also given in table 2. As expected we observe rather high intersectoral growth differences in all of the transition states, but again the pattern is not homogeneous across the countries. While Turkey surprisingly has an intersectoral growth difference like the western European countries, Hungary has one above 10%.

Table 3: Countries Ranked by Minimum Inflation Rates Compatible with the Absence of Deflation in any one Country

EU 11		**EU 15**		**EU 21**	
Euro area	**0.94**	**Euro area**	**1.05**	**Euro area**	**1.13**
Germany	0.00	Germany	0.00	Germany	0.00
Belgium	0.80	UK	0.71	Turkey	0.09
Portugal	0.82	Belgium	0.80	UK	0.71
France	1.34	Portugal	0.82	Belgium	0.80
Austria	1.42	France	1.34	Portugal	0.82
Netherlands	1.43	Denmark	1.39	France	1.34
Italy	1.49	Austria	1.42	Denmark	1.39
Spain	1.53	Netherlands	1.43	Austria	1.42
Ireland	2.35	Italy	1.49	Netherlands	1.43
Finland	2.74	Spain	1.53	Italy	1.49
		Ireland	2.35	Spain	1.53
		Finland	2.74	Ireland	2.35
		Sweden	3.64	Finland	2.74
		Greece	4.26	Czech Rep.	2.88
				Slovenia	3.38
				Sweden	3.64
				Estonia	4.06
				Poland	4.16
				Greece	4.26
				Hungary	6.86

Notes: Minimum inflation rates implied by by equations (6) and (10) based on the estimations of productivity differences between traded and non-traded sectors reported in tables 1 and 2. The table reports three different estimates for different sets of countries. All estimations exclude Luxembourg. The weights of the sectors and countries were based on value added shares in 1995.

As is shown in table 3, column 3, the inclusion of these countries in the monetary union would produce another increase in the minimum aggregate inflation rate from 1.05 to 1.13 %. This is not a dramatic change in light of the high predicted inflation rates in the order of 3-4% for most of the transition countries. The bigger the union, the smaller the weight that a single country has. If the transition economies do not grow at a rate substantially above the EU average, they will not have an important impact on the average inflation rate in Euroland in the foreseeable future.

5. Conclusions

In this article we have argued that the previous inflation targets of the Bundesbank should not be adopted by the European Central Bank because Europe's diversity in national productivity growth rates implies substantial relative price changes among the different countries. To allow for these changes without causing any one country to deflate, the common monetary policy has to be looser than the previous German one. We find that the ECB has to tolerate roughly one additional percentage point of inflation in the aggregate beyond what had been considered appropriate for Germany alone. The Bundesbank traditionally had aimed at an inflation rate of 1.5% to accommodate for Germany's internal structural change. If this target remains valid for Germany within the European currency union, the euro-11 countries need an aggregate inflation target of about 2.5% or more.

This has significant implications for some of the fast growing economies like Spain, Ireland or Finland. If these countries' inflation rates lie far outside the range which the Bundesbank would have tolerated in Germany, there is no reason to complain. Rates of 3%, 3.9% and 4.2%, respectively, would be natural implications of the Balassa-Samuelson effect, indicating, in fact, natural changes in relative prices rather than a dangerous weakening of the euro.

The situation will not change significantly if, at some stage, the new EU members in eastern Europe also join the monetary union. The minimum European inflation rate necessary to prevent deflation in any one country will increase slightly but remain in the neighbourhood of 1%. However, countries like Sweden, Poland or Hungary will then need inflation rates of 3.6%, 4.2% and 6.9%, or if the Bundesbank's 1.5% rule remains valid for Germany, even rates of between 5% and 8%.

Our predictions of Europe's future changes in relative prices are based on the Balassa-Samuelson model. Other models for a prediction of relative price changes are conceivable, including simple extrapolations of previous price changes or sophisticated general equilibrium models of the European economy. We do not want to argue that the Balassa-Samuelson model is the only reasonable approach to the problem we considered. However, we believe that there is a systematic difference among the European countries which can better be detected by looking at the productivity figures rather than the price changes directly. Simply extrapolating previous price changes runs the risk of incorporating the effects of inadequate monetary policies in the past. If European monetary policies were too tight under Germany's monetary leadership, as some authors including Solow (2000) have argued, and if some inflation is

necessary to allow for relative price changes to occur, as the empirical approaches cited in the introduction have shown, then it makes little sense to use the relative price changes of the past to derive appropriate inflation targets for the future. Such an approach would run the risk of severely underestimating the necessary changes in relative prices and hence the minimum inflation rate for Europe.

In the introduction we summarised several arguments for why very low inflation rates might be harmful for an economy. If the ECB does not increase its current target of two percentage points, Germany may have to live with a measured national inflation rate of only one percent. If the measurement error in connection with overlooked quality improvements is taken into account, this may imply that the actual German consumer price index will stay constant or even shrink. This would be a dangerous situation, because Germany's rigid labour markets are especially prone to suffer from downward nominal wage rigidities pointed out by Akerlof, Dickens and Perry (1996). Cyclical downturns might turn out to be even more harmful to employment than they were in the past. Of course, the damage to Germany should be weighed against the possible advantages of having low inflation in Ireland or Finland. However, as long as the evidence of economic costs of moderate inflation rates remains as weak as it is, we conclude from our analysis that the ECB should tolerate a substantially higher inflation rate in Europe than the Bundesbank used to in Germany.

References

Agell, Jonas, and Per Lundborg (1995), "Theories of Pay and Unemployment: Survey Evidence from Swedish Manufacturing Firms," *Scandinavian Journal of Economics* 97, pp. 295-307.

Akerlof, George A., William T. Dickens, and George L. Perry (1996), "The Macroeconomics of Low Inflation," *Brookings Papers on Economic Activity* 1, pp.1-76.

Balassa, Bela (1964), "The Purchasing Power Parity Doctrine: A Reappraisal," *Journal of Political Economy* 72, pp. 584-96.

Bewley, Truman F. (1995), "A Depressed Labor Market as Explained by Participants," *American Economic Review* 85, pp. 250-54.

Bewley, Truman F. (1999), "Why Wages Don't Fall During a Recession," Cambridge, Mass.: Harvard University Press.

Boskin, Michael J., Ellen R. Dulberger, Robert J. Gordon, Zvi Griliches, and Dale W. Jorgenson (1996), *Toward a More Accurate Measure of the Cost of Living* (The Boskin Commission Report), Final Report to the Senate Finance Committee.

Canzoneri, Matthew B., Robert E. Cumby, and Behzad Diba (1999), "Relative Labor Productivity and the Real Exchange Rate in the Long Run: Evidence for a Panel of OECD Countries," *Journal of International Economics* 47, pp. 245-66.

European Central Bank (1999), "Inflation Differentials in a Monetary Union," *Monthly Bulletin* October 1999, pp. 35-44.

Fehr, Ernst, and Armin Falk (1999), "Wage Rigidities in a Competitive Incomplete Contract Market: An Experimental Investigation," *Journal of Political Economy* 107, pp. 106-34.

Greenspan, Alan (1998), Remarks at the Annual Meeting of the American Economic Association and the American Finance Association, Chicago, Illinois, January 3, 1998. Available at: www.federalservice.gov/boarddocs/speeches/19980103.htm.

Honkapohja, Seppo, and Erkki Koskela (1999), "Finland's Depression: A Tale of Bad Luck and Bad Policies," *Economic Policy* 29, pp. 399-436.

Kahnemann, Daniel, Jack L. Knetsch, and Richard Thaler (1986), "Fairness as a Constraint on Profit Seeking: Entitlements in the Market," *American Economic Review* 76, pp. 728-41.

Moulton, Brent R. (1996), "Bias in the Consumer Price Index: What is the Evidence?," *Journal of Economic Perspectives* 10, pp. 159-77.

Phelps, Edmund (1973), "Inflation in the Theory of Public Finance," *Swedish Journal of Economics* 75, pp. 67-82.

Samuelson, Paul A. (1964), "Theoretical Notes on Trade Problems," *Review of Economics and Statistics* 23, pp. 1-60.

Sinn, Hans-Werner, and Frank Westermann (2000), "Two Mezzogiornos," CESifo Working Paper No. 388.

Shapiro, Matthew D., and David W. Wilcox (1996), "Mismeasurement in the Consumer Price Index: An Evaluation," in: Ben S. Bernanke and Julio Rotemberg (eds), *NBER Macroeconomics Annual*, Cambridge, Mass.: MIT Press, pp. 93-164.

Solow, Robert (2000), "Unemployment in the United States and in Europe: A Contrast and the Reasons," CESifo Working Paper No. 231.

Summers, Larry (1991), "How Should Long-term Monetary Policy be Determined?," *Journal of Money, Credit and Banking* 23, pp. 625-31.