

## INFLATION DIFFERENTIAL BETWEEN PORTUGAL AND GERMANY\*

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*The ratio of non-tradable goods price to tradable goods price has recorded a faster growth in Portugal than in Germany over the past decades. This trend was accompanied by similar developments in the ratio of labour productivity in the tradable goods sector to the non-tradable goods sector. Thus, assuming that relative productivity trends are maintained and that the purchasing power parity (PPP) is verified in the tradable goods sector in the long run, Portugal will likely record an average annual equilibrium real appreciation vis-à-vis Germany. Given Portugal's participation in the euro area, this appreciation implies a positive annual average inflation differential vis-à-vis Germany. The value estimated for this differential stands close to the average of the results obtained by Canzoneri et al (1998) for the main euro area countries. The results obtained must be interpreted with caution. On the one hand, deviations from perfect competition suggest that the real convergence of productivity will unlikely be the single factor to induce inflation differentials. On the other hand, it is reasonable to anticipate that the inflation differential will tend to narrow with the process of real convergence.*

## 1. INTRODUCTION

In Portugal as in several other euro area countries, namely Spain and Italy, the inflation rate declined significantly in the past decade. This trend mainly reflects the behaviour of tradable goods, which are more exposed to foreign competition. The inflation rate of non-tradable goods displayed greater resilience.

The continuing faster growth of the ratio of the non-tradable goods price to the tradable goods price (relative price of non-tradable goods) in the Portuguese economy than abroad has contributed to an appreciation of the real exchange rate<sup>(1)</sup>.

Explanations of price trends on the basis of “supply-side” factors generally build on the works by Balassa (1964) and Samuelson (1964), which suggest that in economies with higher growth rates the relative price of non-tradable goods grows at a faster pace. This reflects higher increases in the ratio of productivity in the tradable goods sector to the pro-

ductivity in the non-tradable goods sector (relative productivity of the tradable goods sector)<sup>(2)(3)</sup>. Explanations based on “demand-side” factors include the work of Frott and Rogoff (1991) and that of De Gregorio *et al* (1994). The former explores the hypothesis that an increase in government expenditure, which typically contains a higher weight of non-tradable goods than private consumption, can

- (1) Changes in the real exchange rate can be broken down into two components, one reflecting the differences in the trend of the relative price of non-tradable goods between the Portuguese economy and the external economy, and another reflecting the trend in the ratio of the tradable goods price in the Portuguese economy to that in the external economy.
- (2) In countries experiencing a process of real convergence, productivity growth tends to be concentrated in the tradable goods sector (since the latter is more capital-intensive it provides wider room for technological improvements). As a result, wages increase in this sector, and this extends to the whole economy if there is labour mobility. Whereas in the tradable goods sector prices remain unchanged on the assumption that PPP holds, in the non-tradable goods sector producers accommodate the increase in labour costs by raising prices. There is therefore an increase in the inflation rate and hence an appreciation of the real exchange rate.

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explain the slow convergence of inflation in some ERM countries to the European Union average. The latter concludes that one of the factors behind the growth of the relative price of non-tradable goods in OECD countries in the period 1970-85 was an increase in the private demand for this type of goods.

The hypothesis that trends in relative prices reflect supply and demand shocks interacting in competitive markets has an implication that can easily be tested. In fact, as mentioned in Canzoneri *et al* (1998), for a technology class, including the Cobb-Douglas production functions, the existence of labour mobility across sectors in each country and marginal cost pricing implies a proportional relation between the relative price of non-tradable goods and the relative productivity of the tradable goods sector.

This paper makes a simplified analysis of the data for the Portuguese economy vis-à-vis the German economy. The aim is to assess whether the relative price trend follows the relative productivity trend and, whether PPP holds for tradable goods in the long run. In the analytical framework used in Canzoneri *et al* (1998), the confirmation of these hypotheses means that Portugal is likely to observe a real appreciation trend in the long run, as supported in several papers on the Portuguese economy, and that such trend can be justified by a faster growth of the relative productivity of the Portuguese tradable goods sector vis-à-vis the corresponding German sector.

Given participation in the euro area, movements in the real exchange rate will have to occur via inflation differentials. Against this background it is possible to determine the inflation differential between Portugal and Germany underlying the long-term changes in the real exchange rate. This is the aim of the present paper. In order for the results to be comparable with those for other countries, the methodology used closely follows the paper by Canzoneri *et al* (1998), which estimates

long-term inflation differentials vis-à-vis Germany for nine European Union countries.

The theoretical model which serves as a reference to the analysis of Canzoneri *et al* (1998) is presented in section 2. Section 3 analyses the data for the Portuguese economy in order to anticipate whether the analytical context described applies to the Portuguese case. Section 4 estimates a value for the inflation differential between Portugal and Germany which would result from the verification of this model. Section 5 qualifies the results and finally, section 6 concludes, highlighting the limitations of this methodology.

## 2. ANALYTICAL FRAMEWORK

The analytical framework presented in Canzoneri *et al* (1998) is rather general, wherefore it may be implicit in a large class of models. Two sectors of activity have been considered: tradable goods (*T*) and non-tradable goods (*NT*). The national price level is defined as a geometrical mean of the prices in both sectors, weighted by the share of each sector in the economy's gross value-added ( $\gamma$ ). Expressions (1) and (2) represent the logs of the national price levels ( $p$ ) in period  $t$ , in Portugal and Germany respectively.

$$p_{P,t} = \gamma_{P,t}^{NT} p_{P,t}^{NT} + (1 - \gamma_{P,t}^{NT}) p_{P,t}^T \quad (1)$$

$$p_{G,t} = \gamma_{G,t}^{NT} p_{G,t}^{NT} + (1 - \gamma_{G,t}^{NT}) p_{G,t}^T \quad (2)$$

The deviation, expressed as a difference of logs (approximately as a percentage), of the nominal exchange rate of the Portuguese escudo against the Deutsche Mark (defined in Deutsche Marks per one Portuguese escudo), vis-à-vis the exchange rate implicit in PPP holding in the tradable goods sector is defined in (3), where  $e$  represents the log of the exchange rate.

$$d_{P,t} = e_{P,t} + p_{P,t}^T - p_{A,t}^T \quad (3)$$

The log of the real exchange rate in Portugal, expressed in units of the German production by output unit in Portugal will correspond to:

$$z_{P,t} = e_{P,t} + p_{P,t} - p_{G,t} \quad (4)$$

(3) In an economy with a capital/labour ratio lower than the steady state value, convergence to this level can justify a growth trend in the relative price of non-tradable goods, even in case of a similar technological progress across sectors. In order to quantify the Portuguese inflation differential associated with this effect in the 1990s, see the article by Brito and Correia, "Inflation Differential and Real Convergence", published in this issue of the *Economic Bulletin*.

Replacing (1), (2) and (3), in expression (4) the real exchange rate can be defined as:

$$z_{p,t} = d_{p,t} + \gamma_{p,t}^{NT} q_{p,t} - \gamma_{G,t}^{NT} q_{G,t} \quad (5)$$

where  $q = p^{NT} - p^T$  represents the log of the relative price of non-tradable goods. Calculating, on the basis of this expression, the cumulative change in the real exchange rate up to the end of the sample period (or the average of the annual changes throughout the sample period), it is possible to break down the percentage change of the real exchange rate into four components, as shown in (6) below:

$$\begin{aligned} \Delta z_p = & \Delta d_p + (\gamma_p^{NT} \Delta q_p - \gamma_G^{NT} \Delta q_G) + \\ & + (q_p \Delta \gamma_p^{NT} - q_G \Delta \gamma_G^{NT}) + (\Delta \gamma_p^{NT} \Delta q_p - \Delta \gamma_G^{NT} \Delta q_G) \end{aligned} \quad (6)$$

where  $\gamma_p^{NT}$ ,  $\gamma_G^{NT}$ ,  $q_p$  and  $q_G$  correspond to the values of the variables at the beginning of the sample period. The first term on the right-hand side represents the contribution of the deviations from PPP in the tradable goods sector, the second term the contribution from changes in the relative prices of non-tradable goods of the Portuguese and of the external economy, the third term the contribution from changes in the shares of non-tradable goods in the gross value-added (GVA) of the Portuguese and the external economy and the fourth is a residual term (which will be ignored).

According to this formalisation, in order for a real appreciation in Portugal against Germany to occur, there will have to be: a widening of the deviation from PPP; a higher growth of the relative price of non-tradable goods weighted by the share of this sector in GVA, in Portugal than in Germany; or an increase in the share of non-tradable goods in GVA, weighted by the relative price of non-tradable goods, higher in Portugal than in Germany.

In determining the long-run solution for changes in the real exchange rate three hypotheses are assumed. First, the relative price of non-tradable goods is proportional to the ratio of average labour productivity in the tradable goods sector to the average labour productivity in the non-tradable goods sector. In fact, in a situation of perfect competition and perfect labour mobility

across sectors, the ratio of sectoral marginal productivities will be equal to the relative price:

$$\frac{\partial Y_t^T / \partial L_t^T}{\partial Y_t^{NT} / \partial L_t^{NT}} = \frac{W_t / P_t^T}{W_t / P_t^{NT}} = \frac{P_t^{NT}}{P_t^T} = Q_t \quad (7)$$

where  $Y$  represents production,  $L$  labour,  $W$  the nominal wage,  $P$  prices and  $Q$  the relative price. In addition, if the production functions are of the Cobb-Douglas' type, the marginal productivity will be proportional to the average productivity in each sector, the proportionality factor being the share of the sector in the economy's GVA, i.e.:

$$\frac{\partial Y_t^T / \partial L_t^T}{\partial Y_t^{NT} / \partial L_t^{NT}} = \frac{\gamma^T (Y^T / L^T)}{\gamma^{NT} (Y^{NT} / L^{NT})} = \frac{\gamma^T \cdot y^T}{\gamma^{NT} \cdot y^{NT}} \quad (8)$$

where  $y$  represents average labour productivity<sup>(4)</sup>. Under such circumstances the log of the relative price of non-tradable goods will depend on the log of the relative average productivity in the tradable goods sector and can be defined as:

$$q_t = \ln Q_t = \ln \left( \frac{\gamma_t^T}{\gamma_t^{NT}} \right) + \ln \left( \frac{y_t^T}{y_t^{NT}} \right) \quad (9)$$

The two remaining hypotheses consist in considering that PPP holds in the tradable goods sector and that the share of the non-tradable goods sector in GVA is constant, which respectively implies the nullity of the first and third terms of the right-hand side of expression (6). Under these conditions, the change in the real exchange rate in the long run will be determined by the difference between the rates of change in relative productivity in Portugal and Germany, weighted by the respective shares of non-tradable goods in GVA, i.e.:

$$\begin{aligned} \Delta z_p = & \gamma_p^{NT} \Delta q_p - \gamma_G^{NT} \Delta q_G = \gamma_p^{NT} (\Delta \ln(y_p^T) - \Delta \ln(y_p^{NT})) - \\ & \gamma_G^{NT} (\Delta \ln(y_G^T) - \Delta \ln(y_G^{NT})) \end{aligned} \quad (10)$$

If the relative productivity of the tradable goods sector in Portugal is growing at a faster pace than in Germany, the relative price of non-tradable goods will also be growing faster in Portugal and thus, since PPP holds in tradable goods, there

(4) As pointed out in Canzoneri *et al* (1998), the proportionality condition between marginal and average productivities is seen for production functions which are less restrictive than the Cobb-Douglas'.

should be a real appreciation in the Portuguese economy ( $\Delta z_p > 0$ ).

### 3. DATA ANALYSIS

This section compares the data for the Portuguese and German economies with the hypotheses underlying the previously described model. Given the aim to obtain results for Portugal that are comparable with those presented in Canzoneri *et al* (1998) for several European Union countries, the data used closely follow those in that article, namely as regards the composition of tradable goods and non-tradable goods sectors<sup>(5)</sup>. Whereas in Canzoneri *et al* (1998) a calculation is made of inflation differentials both vis-à-vis Germany and European Union country aggregates, in this paper an analysis is only made vis-à-vis Germany. This approach is consistent with the conclusion of Marques *et al* (1996) that, in the long run, prices in Portugal behave in line with Germany's and not with those of its major trading partners. The sample period used was 1977-95, which differs from that of Canzoneri *et al* (1998) (1973-91), for it is deemed more adequate in the Portuguese case to exclude, on the one hand, the period immediately after 25 April 1974 and to include, on the other, a higher number of observations in the period after accession to the European Communities (which was limited to 1995 due to the unavailability of data for Portugal). Table 1, as well as Charts 1 to 7, show the main results.

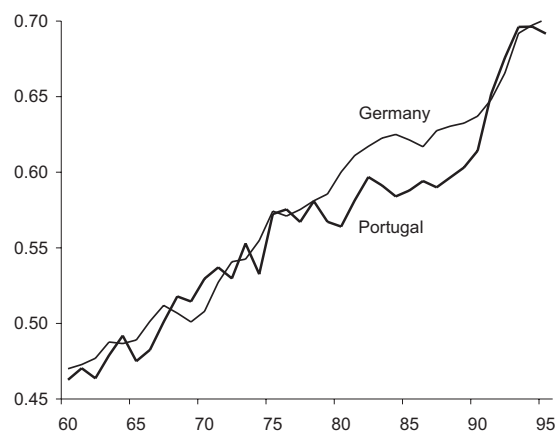
In the period 1977-95 the Portuguese escudo experienced a real appreciation of 1 per cent vis-à-vis

(5) The tradable goods sector includes data on: "manufacturing industry", "agriculture, hunting, forestry and logging" and "fishing". The non-tradable goods sector includes data on: "wholesale and retail trade", "restaurants and hotels", "transport and storage", "communication", "banks and other monetary financial institutions", "insurance", "real estate and business activities" and "services provided for collective use". Sectoral productivities were computed on the basis of GVA data at constant prices and of the number of employees. For the calculation of the sectors' weight, use was made of GVA data at current prices. Sectoral prices correspond to the deflators implied in GVA values. The sources used for these data were the OECD for Germany (National Accounts, Volume II), and Banco de Portugal for Portugal (*Long Series for the Portuguese Economy*). Use was made of IMF data (International Financial Statistics) for the nominal exchange rate in end-period values and for the German GDP deflator.

the Deutsche Mark, in annual average terms, calculated according to expression (4), i.e. using as national price indices geometrical means of tradable and non-tradable goods prices. When making the calculations implicit in (6), it can be concluded that such appreciation resulted from an annual average growth of the relative price of non-tradable goods, weighted by the share of this sector in GVA, 1 percentage point higher in Portugal than in Germany. In fact, since the average inflation differential of tradable goods prices between Portugal and Germany (9.5 per cent) was similar to the average nominal depreciation of the Portuguese escudo vis-à-vis the Deutsche Mark, deviations from the PPP in the tradable goods sector did not contribute to changes in the real exchange rate during this period. Both the contribution from the change in the shares of the non-tradable goods sector and the marginal term are nil, which, in the case of shares, is largely determined by the fact that its increase throughout the sample period was similar in Portugal and Germany (Chart 1).

In order for the real exchange rate to be determined in the long run by the behaviour of productivity in both economies, i.e. by expression (10), it is necessary that PPP holds for tradable goods prices. As noted above, in the period under review the nominal average depreciation of the Portuguese escudo vis-à-vis the Deutsche Mark was similar to the inflation differential in the tradable

Chart 1  
SHARE OF NON-TRADABLE GOODS  
IN GVA



Sources: OECD and Banco de Portugal.

Table

## INFLATION DIFFERENTIAL IN PORTUGAL VIS-À-VIS GERMANY

Average of annual rates of change (except shares)

	Including agriculture			Excluding agriculture		
	1977-95	1977-85	1986-95	1977-95	1977-85	1986-95
Portugal - Relative price of non-tradable goods . . . . .	2.5	0.7	4.0	1.6	-1.1	3.8
Portugal - Relative productivity in the tradable goods sector . . . . .	2.1	2.0	2.2	1.1	-0.3	2.3
Germany - Relative price of non-tradable goods . . . . .	0.7	0.7	0.8	0.5	0.4	0.6
Germany - Relative productivity in the tradable goods sector . . . . .	0.0	0.3	-0.2	0.0	0.3	-0.3
Nominal appreciation vis-à-vis the Deutsche Mark . . . . .	-9.5	-15.2	-4.9	-9.5	-15.2	-4.9
Inflation differential vis-à-vis Germany (calculated with the GDP deflator) .	10.5	15.3	6.6	10.5	15.3	6.6
Inflation differential in the tradable goods sector vis-à-vis Germany . . . . .	9.5	15.5	4.7	10.1	17.0	4.6
Real appreciation vis-à-vis the Deutsche Mark (calculated with sectoral GVA deflators) . . . . .	1.0	0.3	1.7	1.4	0.8	1.8
Contributions from:						
Deviation from PPP in the tradable goods sector . . . . .	0.0	0.3	-0.2	0.6	1.8	-0.3
Changes in the relative prices of non-tradable goods . . . . .	1.0	0.0	1.8	0.8	-1.0	2.2
Changes in the shares of non-tradable goods sectors . . . . .	0.0	0.0	0.0	0.0	0.0	-0.1
Marginal term . . . . .	0.0	0.0	0.0	0.0	0.0	0.0
Share of the non-tradable goods sector in:						
Portugal - at the beginning of the period . . . . .	0.57	0.57	0.59	0.66	0.66	0.67
Portugal - at the end of the period . . . . .	0.69	0.59	0.69	0.74	0.66	0.74
Germany - at the beginning of the period . . . . .	0.58	0.58	0.62	0.59	0.59	0.63
Germany - at the end of the period . . . . .	0.70	0.62	0.70	0.71	0.63	0.71
<b>Inflation differential vis-à-vis Germany . . . . .</b>	<b>1.4</b>	<b>0.9</b>	<b>1.7</b>	<b>0.8</b>	<b>-0.4</b>	<b>1.9</b>

Sources: IMF, OECD and Banco de Portugal.

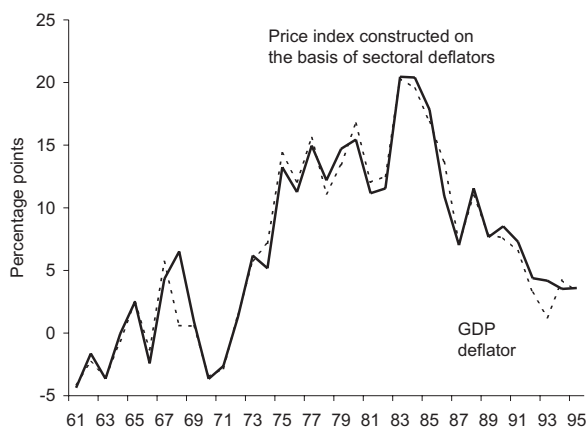
goods sector, whereby Portugal does not seem to have experienced a loss of international competitiveness in this sector. In fact, since the annual average of the inflation differential computed from GDP deflators<sup>(6)</sup> stood at 10.5 per cent, like most results in Canzoneri *et al* (1998), PPP is more clearly verified for tradable goods prices than for overall price indices<sup>(7)</sup>. A stationarity test on the deviations from PPP in the tradable goods sector

(6) Inflation differentials calculated on the basis of GDP deflators and of national price indices (constructed by using the series for prices in the tradable and non-tradable goods sector) are similar, suggesting that the sectoral data used do not bias the results (Chart 2).

(7) In the paper by Canzoneri *et al* (1998), the case of Belgium is an exception to this result, revealing a nil inflation differential vis-à-vis Germany in the case of tradable goods, and an inflation differential similar to the nominal appreciation rate in the case of national price indices.

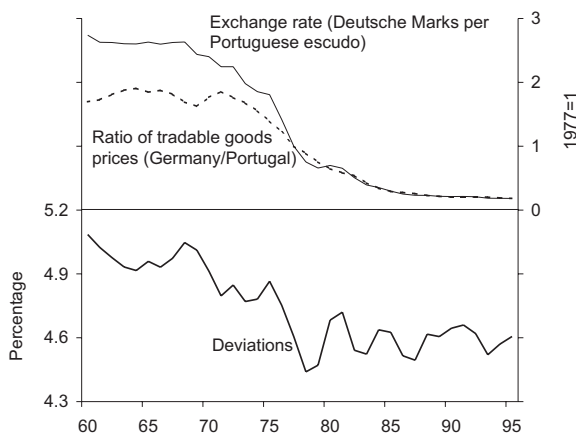


**Chart 2**  
**INFLATION DIFFERENTIAL BETWEEN**  
**PORTUGAL AND GERMANY**



Sources: IFM, OECD and Banco de Portugal.

**Chart 3**  
**DEVIATIONS FROM PPP IN THE**  
**TRADABLE GOODS SECTOR**

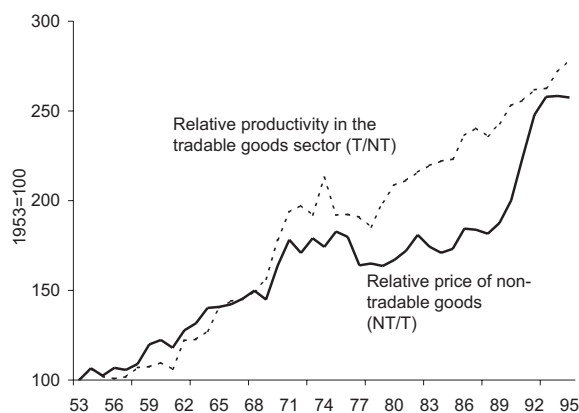


Sources: IMF, OECD and Banco de Portugal.

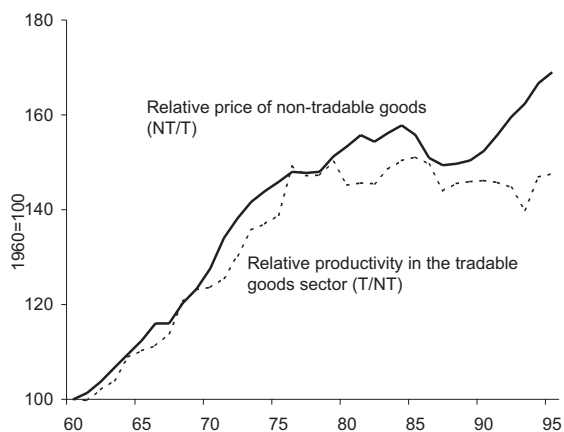
in the period 1977-95 allows the rejection of the existence of a unit root, thereby confirming this result<sup>(8)</sup>.

Another important hypothesis for the long-run specification for the real exchange rate to be valid is that relative productivity coincides with the relative price. According to the tests conducted for the Portuguese case, not only do both series seem to be non-stationary, but also, conversely to what is implicit in expression (9), the non-stationarity of

**Chart 4**  
**RELATIVE PRODUCTIVITY AND PRICE**  
**IN PORTUGAL**



**Chart 5**  
**RELATIVE PRODUCTIVITY AND PRICE**  
**IN GERMANY**



Sources: OECD and Banco de Portugal.

(8) The value of the ADF statistic, for the case in which a constant is included, is -7,793, leading clearly to the rejection of the null hypothesis that there is a unit root in the series of deviations from PPP in the tradable goods sector (the critical value at a significance level of 1 per cent and with 25 observations is -3.75). By contrast, when use is made of the whole sample (1960-95), the ADF test does not allow the rejection of the existence of a unit root (the ADF statistic is -1,398, vis-à-vis a critical value for 50 observations at the 10 per cent significance level of -2.6). In fact, as can be seen in Chart 3, up to the late 1970s deviations show a clearly narrowing trend, given that the Portuguese escudo continues to show a depreciating trend, drawing close to the inflation differential in tradable goods.

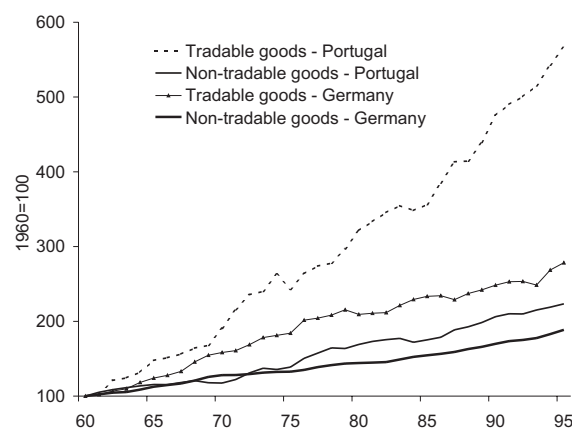
the difference between their logs cannot be rejected<sup>(9)</sup>. However, as can be seen from Charts 4 and 5, both in Portugal and in Germany the trend of the relative price of non-tradable goods seems to reflect, in general terms, the trend of relative productivity in the tradable goods sector. This behaviour, which is in line with the forecasts of the previously described neo-classical model, suggests that the fast growth of the relative price may reflect changes in the underlying conditions of supply and demand. In annual average terms, in the period 1977-95, the relative price of non-tradable goods increased by 2.5 per cent in Portugal and by 0.7 per cent in Germany, and the productivity of the tradable goods sector rose by 2.1 per cent in Portugal, while remaining constant in Germany. These values seem to be in line with the conclusion of Canzoneri *et al* (1998) that countries with higher sectoral inflation differentials are those with a higher growth of relative productivity<sup>(10)</sup>.

As illustrated in Chart 6, the higher growth of relative productivity in the Portuguese tradable goods sector than in the German is determined by higher productivity gains in the tradable goods sector in Portugal (in annual average terms in the period 1977-95, 4.2 per cent in Portugal against 1.8 per cent in Germany), likely reflecting the real convergence with Germany. Productivity in the non-tradable goods sector also recorded a sharper growth in Portugal (in the period 1977-95, it grew 2 per cent in Portugal against 1.7 per cent in Germany).

(9) These results are obtained either by using the whole sample (1953-95) or just the period under review (1977-95). For (1953-95) and (1977-95), ADF statistics are respectively -0.284 and -0.640 for the relative price, -0.602 and -1.001 for relative productivity and -1.262 and -1.805 for the difference between the relative price and the relative productivity, thus always leading to the non-rejection of the null hypothesis of the existence of a unit root. These results are in line with those obtained by Canzoneri *et al* (1998) for each individual country. In fact, the tests conducted in this paper only allow to reject the non-stationarity of the difference between the series of relative productivity and relative price logs when carried out jointly for 10 European Community countries.

(10) According to the results of Canzoneri *et al* (1998) in the period 1973-91, the relative price and productivity recorded respectively, in annual average terms, a growth of 3.1 per cent and 3.8 per cent in Belgium, 3 per cent and 3.2 per cent in Italy and 2.5 per cent and 2.7 per cent in Spain. In the same period in Portugal changes were of 1.3 per cent and 1.6 per cent respectively.

Chart 6  
SECTORAL PRODUCTIVITIES



Sources: OECD and Banco de Portugal.

#### 4. RESULTS FOR THE INFLATION DIFFERENTIAL

The data available do not seem to violate the hypotheses underlying the determination of the long-run solution of the model applied in Canzoneri *et al* (1998). In fact, according to the analysis carried out in the previous section there is no strong empirical evidence against the verification of PPP in the long run for tradable goods, or the existence of common trends for the relative price and productivity. On the other hand, given similar developments in the share of the non-tradable goods sector in GVA in Portugal and in Germany, it is natural to assume that in the long run the contribution (to the change in the real exchange rate) of the difference between the growth of these shares in Portugal and in Germany will be negligible<sup>(11)</sup>. In this context, the change in the real exchange rate in the long run can be proxied by expression (10), i.e. by the difference between the rates of change in relative productivities in Portugal and in Germany, weighted by the respective shares of non-tradable goods in GVA. According to the calculations made, assuming that the sectoral shares recorded in 1995 and the productivity trends are maintained, a real annual average appreciation of 1.4 per cent vis-à-vis the Deutsche Mark is likely to be observed in Portugal in the long run. It should thus be noted that, whereas the

calculation of PPP would lead to the conclusion that the Portuguese escudo was overvalued at end-1995, according to these results, changes in the relative productivities would, on the contrary, have justified a stronger behaviour of the real exchange rate of the Portuguese escudo (annual average appreciation of 1.4 per cent) than the one observed (annual average appreciation of 1 per cent)<sup>(12)</sup>.

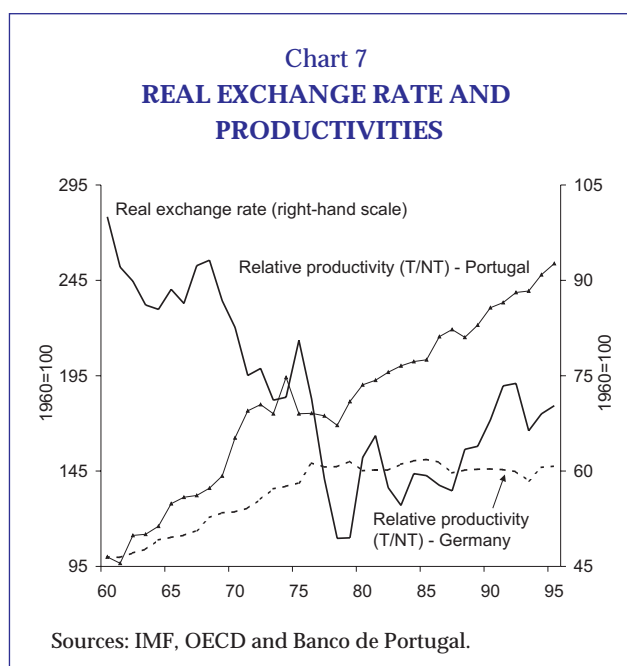
These results seem to be consistent with those from other studies carried out for Portugal. In fact, on the one hand, in Freitas (1992), Manteu and Mello (1992), Luís (1993) and Costa (1998) equilibrium real effective appreciation trends of the Portuguese escudo are detected throughout the period from the early 1980s up to the early 1990s, and the real exchange rate was found to be undervalued for the most part of this period. On the other hand, in several other papers there is empirical evidence linking the real appreciation trend in Portugal with real adjustments in the Portuguese economy<sup>(13)</sup>.

Given the participation in Economic and Monetary Union, real appreciation must occur via a

(11) As referred to in section 2, in Canzoneri *et al* (1998) the nullity of the contribution of changes in the shares results from the hypothesis that the sectors' weights in GVA are constant in the long run, which does not seem to be consistent with the data. In fact, between 1977 and 1995 the share of the non-tradable goods sector in GVA showed an upward trend in both countries, rising from 57 per cent to 69 per cent in Portugal and from 58 per cent to 70 per cent in Germany. However, taking into account this effect does not significantly change the conclusions. In fact, in the long-term solution, when evaluating the third term of the right-hand side of equation (6), for the annual average growth of the share of non-tradable goods in Portugal and in Germany in the period 1977-95 and for the values of the share ratios in GVA and of productivities in 1995, the value obtained is negative (given that the share and the relative productivity in the tradable goods sector in Portugal are lower than in Germany), albeit negligible (-0.00005).

(12) In fact, data available show that up to end-1970s the real exchange rate continued to follow a depreciation trend, thus failing to reflect developments in the relative productivity differential, which were favourable to Portugal, and that from the early 1980s, the real appreciation recorded by the Portuguese escudo does not seem to have shown an upward trend, as in the case of the relative productivity differential (Chart 7).

(13) See Rebelo (1992), Cunha and Machado (1993), Esteves (1993), Gaspar and Pinheiro (1994), Gaspar and Pereira (1995) and the article by Brito and Correia published in this issue of the *Economic Bulletin*.



higher inflation rate in the non-tradable goods sector in Portugal than in Germany, which implies a differential between national inflations of 1.4 percentage points per year. This value stands close to those calculated in Canzoneri *et al* (1998) for Spain and at approximately the average between the maximum and minimum differentials found in that paper for nine EU countries (2.4 percentage points in Belgium, 2 percentage points in Italy, 1.5 percentage points in Spain, 1.4 percentage points in the United Kingdom, 1.2 percentage points in Austria, 1.1 percentage points in France and Denmark, 1 percentage point in Finland and 0.9 percentage point in Sweden)<sup>(14)</sup>. Given the real interest rate parity, this inflation differential will likely imply that the real interest rate in Portugal will be lower than the corresponding German rate, by the same magnitude. In fact, in a situation of integration of financial and goods markets, real interest rates expressed in units of tradable goods must be

(14) Alberola and Tyrvaenen (1998) calculate for seven euro area countries the inflation rates implied by the Balassa-Samuelson model, extended for the case in which there are different wage growths in the tradable and non-tradable goods sectors. The results obtained point to the possibility of an annual inflation differential of approximately 2 percentage points among the countries with higher and lower rates, even if the inflation target of 2 per cent is met. With the exception of Spain, this article finds lower differentials with Germany than in Canzoneri *et al* (1998), ranging between 1.9 percentage points in Spain and -0.2 percentage point in France.



equal across countries. Thus, real interest rates, measured in national output units, must be lower in the countries where the relative price of non-tradable goods records a higher growth.

## 5. SENSITIVITY OF THE RESULTS

It should be expected that if there is a real productivity convergence effect in the Portuguese tradable goods sector vis-à-vis the German, as suggested by the data and by other papers for the Portuguese economy, it should be more marked in the period following accession to the European Community due, for example, to the favourable impact of market liberalisation on technology transfers. When dividing the sample into two sub-periods (1977-85 and 1986-95), a higher inflation differential is in fact obtained in the second half (0.9 percentage point in 1977-85, and 1.7 percentage points in 1986-95). However, contrary to what would be expected, this behaviour was essentially due to unfavourable developments in the relative productivity of the tradable goods sector in Germany (in annual average terms, it grew by 0.3 per cent in 1977-85, and decreased by -0.2 per cent in 1986-95). In fact, in Portugal, in the period following accession to the European Communities, productivity seems to have accelerated in both sectors (from 3.4 per cent to 4.8 per cent in the tradable goods sector, and from 1.4 per cent to 2.5 per cent in the non-tradable goods sector), inducing only a slight increase in the annual average growth of relative productivity from the first to the second period (from 2 per cent to 2.2 per cent).

These results are largely determined by the inclusion of agriculture in the tradable goods sector, which, as referred to in Alberola and Tyrvaïnen (1998), is quite controversial. In fact, due to the existence of production subsidies and administrative pricing, both frequent in the agricultural sector, the behaviour of these components is rather unlikely to be consistent with the model assumed, and the distortions induced are not expected to be common across countries either. By excluding the sector "agriculture, hunting, forestry and logging" from the data for Portugal, a less significant productivity growth is obtained in the tradable goods sector in the first part of the sample and a sharper growth in the second (1.1 per cent in 1977-85 and

4.9 per cent in 1986-95). This determines a clearly more favourable behaviour in the Portuguese relative productivity in the second part of the sample. For Germany the results remain virtually unchanged when agriculture is excluded. Therefore, the trend of relative productivity which is more favourable in Portugal than in Germany become more marked, pointing more clearly to the possibility that the integration in the European Community had a favourable impact on the productivity of tradable goods in Portugal. Excluding agriculture, the inflation differential would be -0.4 percentage point when calculated in the period 1978-85 and 1.9 percentage points when data for 1986-95 is used. For the whole period the exclusion of agriculture determines an inflation differential of 0.8 percentage point.

In interpreting the values obtained for the inflation differential, account should also be taken of the fact that the prices used were measured by sectoral GVA deflators. In fact, by excluding the imported components, these data tend to determine a differential between the Portuguese and the German inflation higher than the one implicit in consumer price indices, which are generally used to measure inflation. In fact, in annual average terms, in the period 1977-95 the Portuguese escudo seems to have recorded a real appreciation of 1 per cent vis-à-vis the Deutsche Mark, calculated by using price indices constructed with sectoral GVA deflators, and of only 0.5 per cent when consumer price indices are used.

## 6. CONCLUSIONS

The main purpose of this paper was to apply the methodology followed in Canzoneri *et al* (1998) to the Portuguese case, so as to obtain results comparable to those of other EU countries (and particularly, euro area countries) for the value of the inflation differential vis-à-vis Germany. According to the analysis carried out, in Portugal the relative price of nontradable goods recorded a faster growth than in Germany, a trend which was accompanied by a similar behaviour of relative average productivity of the tradable goods sector. These more favourable developments in relative productivity in Portugal appear to have been totally determined by the behaviour in the

tradable goods sector, thereby suggesting the existence of a real convergence effect, which justifies a real appreciation in Portugal in the long run. In the context of the participation in the euro area, this long-term appreciation implies the existence of a positive inflation differential between Portugal and Germany. When excluding the sector “agriculture, hunting, forestry and logging” from the sample, one obtains for the period 1977-95, an average inflation differential for Portugal of 0.8 percentage points, measured by the price index constructed using sectoral GVA deflators.

There are several other factors pointing towards the need of a cautious interpretation of these results. First, it is necessary to consider that the methodology followed only allows the detection of inflation differentials resulting from the existence of real divergences between economies that operate in a competitive environment. However, these divergences may not justify a sustainable inflation differential, since they do not necessarily result from effects associated with the real convergence process (as is the case of the Balassa-Samuelson effect), and they can, conversely, be determined by temporary factors such as an increase in the relative demand for non-tradable goods<sup>(15)</sup>. Second, in contrast to the hypotheses of the model, markets show deviations from competition which can justify part of the inflation differentials identified. On the other hand, it must be taken into consideration that the inflation differentials calculated in this paper are measured by price indices constructed from sectoral GVA deflators, which due to the exclusion of import prices are, in the case of Portugal, higher than the differentials measured on the basis of consumer price indices. Finally, the conclusion that the inflation differential found must persist in the future in order for the real exchange rate to be in line with the process of real convergence, is only valid assuming that past trends prevail, which is not necessarily true. In fact, on the one hand, it is possible that the increased competition resulting from Economic and

Monetary Union and the absence of the exchange rate as a potential adjustment mechanism will lead to major changes in the behaviour of both agents and markets, thus contributing to the narrowing of inflation differentials. On the other hand, the velocity of the process of real convergence is expected to slow down over time, thus justifying a narrowing of the “equilibrium” inflation differentials.

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(15) An approach similar to those followed in Rebelo (1992) and in the article by Brito and Correia published in this issue of the *Economic Bulletin* overcomes this limitation by allowing the distinction between effects on the relative prices caused by the process of real convergence and by other types of disturbances.

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