DOCUMENTO DE TRABAJO

PERSISTENT INFLATION DIFFERENTIALS IN EUROPE

Documento de Trabajo nº 0305

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BANCO DE ESPAÑA
SERVICIO DE ESTUDIOS

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(*) This work has greatly benefited of fruitful discussions with Behzad Diba, Matthew Canzoneri, Paco de Castro, Enrique Alberola, Fernando Restoy, Javier Vallés, an anonymous referee and seminar participants at the Bank of Spain and Bank of Canada.

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ISSN: 0213-2710 (print)
ISSN: 1579-8666 (online)
Depósito legal:
Imprenta del Banco de España

Abstract

This paper studies the recent empirical evidence available on the evolution of the real exchange rates within the main European economies in order to understand the possible main determinants of future inflation differentials within the EMU. The real exchange rate is decomposed into that of the traded sector and the differential across countries of the relative price of the non traded sector. Persistent deviations from PPP are found, also in the traded sector. It is also found that the main factor behind the annual bilateral real appreciation with respect to Germany since 1995 has been the differential growth of relative non traded prices across countries. In the case of France, that differential was mainly explained by a different growth of relative labor productivities in the two economies, while in the case of Spain and Italy it was mainly due to the different growth of relative non-traded markups and wages, respectively.

1. INTRODUCTION

In the last decades, inflation rates in the euro area countries have decreased significantly as well as converged to each other. However, inflation differentials across these countries still persist after the start in January 1999 of the European Economic and Monetary Union (EMU). Figure 1 illustrates the national CPI inflation rates in the main EMU economies since 1990.

A significant wealth of literature has dealt in the last years with the issue of the changes in the real exchange rate which are, under a fixed exchange rates regime, international inflation differentials. The aim of this paper is to study the recent empirical evidence available on the evolution of the real exchange rates within the main European economies in order to understand the possible main determinants of future inflation differentials within the EMU.

The real exchange rate is decomposed into that of the traded sector and the differential across countries of the relative price of the non traded sector. The latter is further decomposed into its determinants, namely the cross-country differentials of relative markups, relative labor costs and relative labor productivities across countries. This paper investigates the evolution of these magnitudes and their persistence. Then, attention is paid to the evolution of their annual rates of change. The contribution of each factor to the annual rate of change of the real exchange rate, i.e. the inflation differential under EMU, is computed and particular attention is paid to whether they have changed in the most recent past with respect to earlier periods.

Under the assumption that PPP holds in the long run in the traded sector, the Balassa-Samuelson hypothesis maintains that long-run inflation differentials in a monetary union depend directly on the different long-run evolution in each economy of the relative prices of the non-traded sectors with respect to the traded ones which, in turn, are assumed to mainly depend on the different evolution of productivity in the two sectors. This paper investigates whether such long run hypotheses can be accepted across the main European economies in the last decades. It is found that the PPP cannot be accepted for the sample period available and that deviations from PPP are persistent, although somewhat less than is found typical in the literature. A positive and persistent relative price differential is also found in all cases since mid-eighties, which even accelerated in the years prior to EMU. The driving forces of such relative price differentials have been different in each case and period, but showed persistent divergences from the Balassa-Samuelson predictions in all cases.

It is of special interest to identify whether the factors that have driven real exchange rate appreciations across euro-area countries in the long run are the same as those behind short run real exchange rate changes in the most recent years, since the latter would be the most likely factors causing inflation differentials under EMU. It is found

that the real appreciations in the traded sector account on average since 1995 for less than half of the annual changes in the overall real exchange rate between the main EMU economies, and far less if we exclude the most recent realignments of the Italian lira, as opposed to clearly driving the real depreciation observed in the early nineties. It is found that the main factor behind the annual bilateral real appreciation with respect to Germany since 1995 has been the differential growth of relative non traded prices across countries. In the case of France, that differential was mainly explained by a different growth of relative labor productivities in the two economies, while in the case of Spain and Italy the different growth of relative non-traded markups and wages, respectively, with respect to Germany gained substantial explanatory power as well.

Section 2 presents the analytical framework and the data employed. Section 3 studies the long run evolution of the components of the real exchange rate using both informal graphical inspection of the series and formal unit root tests. Section 4 decomposes the annual real appreciation for each country of our sample and computes the relative contribution of each component, paying special attention into comparing the most recent years with earlier periods. Section 5 concludes.

2. ANALYTICAL FRAMEWORK AND DATA EMPLOYED

The log of the real exchange rate is defined as $p_t - p^*_t - e_t$, where p and p^* denote respectively the logs of the domestic and foreign price levels and e is the log of the nominal bilateral exchange rate, in units of national currency per unit of foreign currency.

Each national price level can be in turn expressed in terms of the prices of the traded (T) and non-traded (NT) sectors: $p_t = g_t\, p_t^{NT} + (1-g_t)\, p_t^{T}$, where γ_t is the value-added share of non-tradables in the economy. Then, the real exchange rate can be redefined as:

$$p_t - p^*_t - e_t = (p_t^{T} - p^{*T}_t - e_t) + [\, g_t\, (p_t^{NT} - p_t^{T}) - g_t^*\, (p^{*NT}_t - p^{*T}_t)\,] \qquad [1]$$

where the first term in parentheses expresses the real exchange rate for the traded sector and the rest conforms the differential between appropriately weighted relative prices of non-tradables home and abroad. With fixed nominal exchange rates, inflation differentials in a monetary union can be expressed as the change in the above expression:

$$P_t - P^*_t = D(p_t - p^*_t - e_t) = D(p_t^{T} - p^{*T}_t - e_t) + D[g_t\, (p_t^{NT} - p_t^{T}) - g_t^*\, (p^{*NT}_t - p^{*T}_t)] \qquad [2]$$

The first component, $D(p_t^{T} - p^{*T}_t - e_t)$, expresses departures from PPP in the traded sector. Absolute PPP would mean that the $(p_t^{T} - p^{*T}_t - e_t)$ term is zero, while relative PPP would imply that it is constant, i.e. both its deviation with respect to long run average and its rate of change should equal to zero at all times. Thus, if the real exchange rate for the traded sector is found stationary and converges to parity in the long run, large values of

the $D(p_t^T - p^{*T}_t - e_t)$ term would indicate sizeable deviations from the PPP in a particular moment in time but would not generate permanent inflation differentials. Otherwise, those large deviations from PPP when observed may cause long-run inflation differentials.

The second component in [2] refers to the rate of change of the, appropriately weighted, differences in the relative prices of the non-traded sector in the two countries. Note that here it is not the non stationarity of the relative price in one country that generates persistent inflation differentials, but that of the weighted difference of the non traded relative prices across countries. In order to understand these differences and their rate of change, i.e. their contribution to generate inflation differentials, assumptions have to be made on the price setting process. A very simple and general approach is taken here.

Firms are assumed to be monopolistically competitive in the output market. The price in each sector at date t is set as a gross markup over marginal cost. Cost minimization implies that marginal cost at any date equals the ratio of the nominal wage to the marginal product of labor. In logs, this leads to the following linear relationship for sectoral price determination: $p_t = m_t + w_t - mpl_t$, where p is the log of the price, m is the log of the markup, w is the log of the nominal wage per unit of labor and mpl is the log of the marginal product of labor. Then, the relative prices of the non traded sector with respect to the traded sector can be expressed as

$$p_t^{NT} - p_t^T = (m_t^{NT} - m_t^T) + (w_t^{NT} - w_t^T) + (mpl_t^T - mpl_t^{NT}). \qquad [3]$$

Using expression [3], the bilateral real exchange rate in [1] can be rewritten as

$$p_t - p^*_t - e_t = (p_t^T - p^{*T}_t - e_t) + [g_t (m_t^{NT} - m_t^T) - g_t^* (m^{*NT}_t - m^{*T}_t)] + [g_t (w_t^{NT} - w_t^T) - g_t^* (w^{*NT}_t - w^{*T}_t)] + [g_t (mpl_t^T - mpl_t^{NT}) - g_t^* (mpl^{*T}_t - mpl^{*NT}_t)] \qquad [4]$$

and the change in the real exchange rate in [2] as

$$P_t - P^*_t = D(p_t^T - p^{*T}_t - e_t) + D[g_t (m_t^{NT} - m_t^T) - g_t^* (m^{*NT}_t - m^{*T}_t)] + D[g_t (w_t^{NT} - w_t^T) - g_t^* (w^{*NT}_t - w^{*T}_t)] + D[g_t (mpl_t^T - mpl_t^{NT}) - g_t^* (mpl^{*T}_t - mpl^{*NT}_t)]. \qquad [5]$$

The next section studies the long run evolution of the components of the real exchange rate as in [4]. Both informal graphical inspection of the series as well as formal unit root tests are utilized. If the null hypothesis of a unit root is rejected, the rates of change in [5] should not be interpreted as permanent neither should they be expected to contribute to generate persistent inflation differentials between the EMU countries considered. The opposite would apply if non-stationarity is found.

Then, section 4 decomposes the annual real appreciation, or inflation differential under EMU, for each year and each country of our sample into the annual rate of change of each of its determinants as in [5]. The relative contribution of each component is computed. Special attention is paid to the components of the real appreciations in the most recent period in order to understand future sources of inflation differentials in the EMU.

The data employed comes from the annual sectoral database STAN[2] of the OECD. The countries studied are Germany, France, Italy and Spain. The sample period varies according to data availability. It covers 1970-2001 for Italy and Germany, 1978-1999 for France and 1986-2001 for Spain. The traded sector includes agriculture and manufacturing and the non-traded sector includes market and non-market services[3].

For the empirical study performed in the following sections, measures of the evolution of prices, markups, wages and the marginal product of labor for each sector, traded and non-traded, and country are required. The price has been approximated by the ratio between the nominal and real sectoral value added. Therefore, p_t and p^T_t are the value added deflators for the whole economy and for the aggregation of the traded sectors only, respectively. All price levels are indexes with base year 1995. e_t is the average annual bilateral nominal exchange rate with respect to the DM, obviously fixed since 1999. γ_t and γ_t^* are the shares of the sectors not exposed to external competition into the nominal value added of the whole economy in the two countries.

For each sector, nominal wage per unit of labor (w_t) has been obtained dividing the total compensation of employees by the number of employees[4]. For a general class of production functions, i.e. $y_t = F(k_t)\, l_t^a$, the marginal product of labor is proportional to the average product of labor: $mpl_t = a + y_t - l_t$, where a is the log of the labor share, y_t is the log of real output and l_t is the log of total employment. Real output has been approximated by the real sectoral gross value added.

From sectoral price determination, we can compute time series for sectoral markups defined as the price over marginal cost : $m_t = p_t - [w_t - (a + y_t - l_t)]$. Thus, sectoral markups are not observable and we compute them as a residual given the rest of

[2] This database updates the old International Sectoral Database of the OECD, ISDB, and incorporates all the recent methodological changes such as the conversion of national accounts to the new accounting system ESA95. STAN contains German data for only the Unified Germany. I have extended those series backwards using ISDB West German data. Spanish data has not been completely updated in STAN. The longest sample size available for Spain starts in 1986 and comes from ISDB, expanded after 1995 using growth rates of equivalent variables from OECD National Accounts.

[3] The traded sector includes the OECD subsectors of Manufacturing and of Agriculture, hunting, forestry and fishing. The non-traded sector aggregates Wholesale and retail trade; Restaurants and hotels; Transport, storage and communication; Finance, insurance, real estate and business services and Community, social and personal services. Producers of government services was excluded since they cannot be studied with our basic framework of pricing with a cost minimization perspective.

[4] Note that this measurement embeds the implicit assumption that self-employed earn as much as the average employee.

variables. The evolution of this series in levels might, therefore, include additional aspects such as changes in the level of taxation to firms, approximation errors from using the production function above, or changes in the evolution of the capital-output ratio. Such additional aspects may still be important in the long run evolution of the relative markup of the non traded sector and of its differential evolution across countries. However, they are presumably less important in the short run, when computing and comparing annual changes of relative markups.

3. LONG RUN REAL APPRECIATIONS: THE PPP ASSUMPTIONIN THE TRADED SECTOR AND THE BALASSA-SAMUELSON HYPOTHESIS.

A look is taken first at the overall picture of the long run determinants of the real exchange rate among main European economies. Each real exchange rate is computed, using the dataset described before, as in [1]. Figure 2 represents the real exchange rate of Spain, France and Italy with respect to Germany, $p_t - p^*_t - e_t$, expressed as percentage deviation with respect to the corresponding average for the sample period. The darker lines refer to overall real exchange rates while the lighter lines refer to real exchange rates for the traded sector only (T: $p_t^T - p^{*T}_t - e_t$).

Two main remarks emerge from casual inspection of the series. Firstly, deviations from average real exchange rate in figure 2 are far from being zero and therefore relative PPP seems not to have been fulfilled in the short run during the sample period. Secondly, only for very short periods in each country have the overall real exchange rate and that for the traded sector coincided in their evolution. For most of the period they have differed in a considerable way, leaving space for differences in the relative prices of the non traded sector according to [1], and this has been especially so in the end of the nineties. Next we study with more detail these two remarks.

The empirical literature in international economics has very extensively proved that the law of one price is not a short run phenomenon. Whether deviations from PPP are permanent or just transitory has been subject to more controversy. The evidence provided by Engel (1995), among others, concludes that deviations from PPP even in the traded sector cannot be considered stationary in the long run when considering US dollar exchange rates. Canzoneri, Cumby and Diba (1999) perform different panel unit root tests on the components of the real exchange rate for a set of OECD countries, including the main European economies. They find that the deviations from PPP in the traded sector can be accepted as stationary in the long run when considered at DM exchange rates,

except for the pre-73 era as well as for the EMS crisis in 1992-1993[5]. However, they also find that deviations from PPP in the traded sector cannot be considered stationary in the long run when considering US dollar exchange rates. A more recent work by Imbs, Mumtaz, Ravn and Rey (2003) finds among other things that the deviations from PPP in the real exchange rate for a variety of countries are differently persistent across items of the consumers price index, not necessarily the traded goods having the smaller or shorter lasting deviations. Imbs, Mumtaz, Ravn and Rey find also that once this heterogeneity is taken into account, PPP is accepted to hold in the long run.

The presence of unit roots in the series has been tested by means of the Augmented Dickey Fuller test. It essentially estimates the following regression

$$Dy_t = a + b\, y_{t-1} + \sum_j g_j\, Dy_{t-j} + u_t$$

and tests the null hypothesis of a unit root in y_t by testing $H_0: b=0$, or, equivalently, whether the first order autoregressive coefficient, r, is one ($H_0: r=b+1=1$). Table 1 reports results of the ADF tests, where the number of lags j is selected in each case according to the Akaike Information Criterion. Rejecting the null means that the real exchange rate is accepted to converge to parity in the long run, while deviations from PPP can be temporarily large. Otherwise, the series are non stationary and those deviations from PPP may cause long-run inflation differentials. It is important to note that we only have 16 observations for Spain, 24 for France and 32 for Italy and Germany, and therefore the results of the tests should be interpreted with great care.

Non stationarity is accepted for all real exchange rate series. One measure of how persistent a series is is to compute the half-life of deviations produced by a shock to the series, defined as the time that it takes to reverse half of the shock to a series. This half-life is computed as $ln(2)/ln(r)$, where r is the coefficient obtained form the above unit root testing regression, to which a $(1+3r)/T$ term has been added as in Kendall (1954) in order to correct for downward biases in the r estimations. T is the sample size. The half-life estimated for the overall real exchange rate with respect to Germany is very close to 1 year, lower than the consensus estimate of half-life of deviations from PPP between countries of three to five years.[6] The ADF test statistic lies further from accepting

[5] Although nominal exchange rates against DM and the corresponding PPP exchange rates for traded goods appear to be cointegrated, and therefore a linear combination of both such as $p_t^T - p^{*T}_t - be_t$ is accepted to be stationary, the slopes of the cointegrating regressions (b) vary widely across countries and differ substantially from one, which is what should be found if strict PPP held.

[6] For a discussion of this consensus view see Imbs et al (2003) and references therein.

stationarity, i.e. from rejecting a unit root, for the traded sector real exchange rates in the cases of France and Spain.[7]

Next we turn into the second remark made when inspecting figure 2, namely that the overall real exchange rate and that for the traded sector have differed in a considerable way, for most of the sample periods. From [1], we know that the difference among these two series is the weighted differential across countries of the non-traded relative prices. In all cases, figure 2 suggests that since late eighties the real exchange rate for the traded sector has depreciated in Italy, France and Spain with respect to Germany relative to its long run average[8] more than that of the overall economy and the divergence has grown with time. This means that there has been a positive and growing differential of the relative non-traded prices with respect to Germany that could have generated inflation differentials in the recent past. We now inspect the properties of those differentials in the economies under study as well as those of their components.

Figure 3 represents the differentials with respect to Germany of the non-traded relative prices $(g_t\ (p_t^{NT} - p_t^T) - g_t^*\ (p^{*NT}_t - p^{*T}_t))$ and its components: the relative markups term $(g_t\ (m_t^{NT} - m_t^T) - g_t^*\ (m^{*NT}_t - m^{*T}_t))$, relative wages $(g_t\ (w_t^{NT} - w_t^T) - g_t^*\ (w^{*NT}_t - w^{*T}_t))$ and relative marginal products of labor $(g_t\ (mpl_t^T - mpl_t^{NT}) - g_t^*\ (mpl^{*T}_t - mpl^{*NT}_t))$. All series are represented in percentage deviations with respect to long run average.[9] Table 1 reports the results of conducting the same Augmented Dickey Fuller tests as before and calculating the corresponding half-life estimates for these differential series.

The case of Spain is represented in the top-right panel of figure 3. The upward slope of the relative non-traded prices differential with respect to Germany is due essentially to a faster growth of relative productivity of the traded sector in Spain in the first part of the sample period, very much in the lines of what the catching-up productivity story that the Balassa-Samuelson hypothesis would imply. However, since mid-nineties, the differential in relative prices continues growing despite the reduction in the relative productivities differential, backed by a faster growth of relative non-traded markups and

[7] The same result is found in Imbs et al (2003), who argue that this is due to higher heterogeneity among traded goods than among non-traded ones. They find that the more important aggregation bias in the traded good index accounts for the higher persistence found in the real exchange rate of the traded sector. Whether this higher persistence comes from aggregation cannot be accounted for in this paper, where only aggregate data is used.

[8] Under the assumption that the long run average real exchange rate represented by the sample average is the real exchange rate of the steady state, where PPP holds, the percentage deviations from it depicted in figure 2 can be interpreted as percentage deviations with respect to PPP.

[9] As a reference, the relative non-traded prices and its components for each country are plotted in figure 4, also in percentage deviations with respect to their sample period average. The same ADF tests have been applied to these individual country relative series and are reported in table 1. We find that all series are non-stationary, except for the relative non-traded wages in Spain and in Italy. Same occurs with the German series (not reported), they all have unit roots and shocks to each relative series has a half life in the vicinity of one year.

wages in Spain than in Germany. All differentials Spain-Germany are clearly accepted to have a unit root, with half-life statistics smaller than a year[10].

In the case of France, the differential of relative prices with respect to Germany is almost constant until mid-eighties; it does not contribute to explain the changes in the real exchange rate which are based essentially on the changes in the traded sector real exchange rate. In fact, the rates of change of the overall and traded sector real exchange rates series are highly coincident in that period. Since then, relative prices differential starts growing, essentially associated to the differential in the relative labor productivities, and especially so in the more recent period. In the mid-nineties, just as in Spain but in the opposite direction, the labor productivities differential accelerated because of a higher rise in relative labor productivity in France than in Germany, but it was partly compensated by a sizeable drop in relative non-traded markups in both countries, particularly so in France.[11] Statistically, this evolution since mid-eighties makes all the French differential relative series in figure 3 clearly non stationary, as confirmed by the ADF test statistics reported in table 1.

In the case of Italy, the behavior up to the eighties of the relative price differential with Germany is also different than afterwards. During the seventies, the evolution of relative labor productivities was similar in Italy to that in Germany leaving the differential relative productivities quite stable. The remarkable reduction of Italian relative non-traded wages in the seventies kept Italian relative non-traded prices stable while the German ones were growing according to their relative productivity, as the Balassa-Samuelson hypothesis predicts. This decreasing differential in relative non-traded prices augments the real depreciation in the traded sector and explains the pronounced real depreciation of the lira during that period.

Starting in the early eighties, relative prices share a trend with the relative labor productivity in Italy since relative wages evolution gets compensated by that of relative markups, essentially following the Balassa-Samuelson prediction. Higher relative productivity in Italy than in Germany generates the growing relative prices differential observed since then, although it is not as high as the relative productivities differential because of the relative markups growing more in Germany than in Italy. However, since mid-nineties the relative prices differential departs significantly from the relative productivities differential, due to relative non-traded markups growing more in Italy but, especially, to relative non-traded wages falling more in Germany than in Italy. All in all

[10] According to the ADF test statistic, the closest to stationarity is the differential in relative labor productivities.

[11] As can be seen in figure 4, in both countries the relative non-traded price followed closely the evolution of the relative traded productivity, in the Balassa-Samuelson spirit, until the nineties where in both cases the relative productivities grew faster than relative prices and there was a drop in relative markups. But the rise in relative productivity was stronger in France and the offsetting mechanism of the relative markups evolution had milder effects, thus generating the relative price differential between the two countries observed in figure 3.

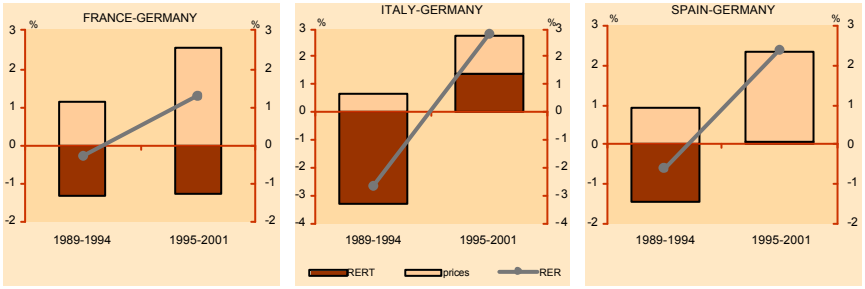
these Italy-Germany differentials are found to have unit roots, with half-lifes somewhat higher than in the French and Spanish case.

The positive slope of the differentials in relative non-traded prices in all three economies with respect to Germany, especially in the last years prior to EMU, indicates that positive inflation differentials in those years were in part due to differences in the rates of change of the components of the relative non-traded prices across countries. In order to further investigate how much each component of the real exchange rate has contributed to generate inflation differentials across the main European economies, the next section computes the annual change in the real exchange rate and its breakdown.

4. DECOMPOSING THE ANNUAL REAL APPRECIATION

Expressions [2] and [5] decomposed the rate of change of the real exchange rate between two countries, which equals the inflation differential under a monetary union, into the rate of change of the real exchange rate for the traded sector and that of the differential across countries of relative price of the non traded sector, which in turn was decomposed into its relative markups, wages and marginal labor products terms. These annual rates of change have been computed for each year and pair of countries and represented in figures 5 and 6. They are all found stationary, except for the Spain-Germany overall real exchange rate and that for the traded sector, as reported in table 1.

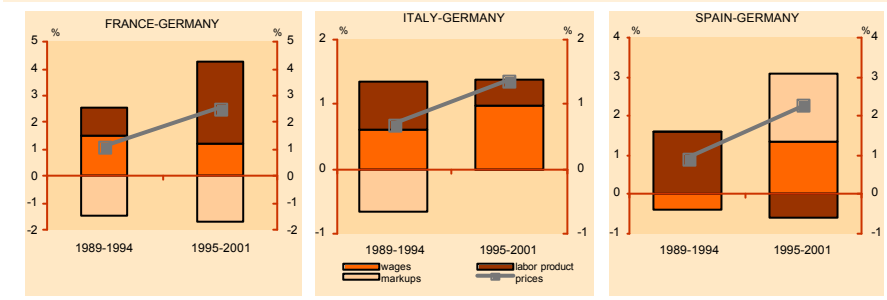
The following graph summarizes how the breakdown of the annual real appreciation for Spain, France, Italy with respect to Germany, has evolved in the last years. It reports averages for the most recent period (1995-2001) and the years before (1989-1994). The line shows the evolution of the average real appreciation in the two sub periods while the bars represent the contribution of its two components: the real appreciation in the traded sector (RERT) and the differential growth of the relative prices of the non-traded sector with respect to the traded one in the two countries (Prices).



It is very remarkable how the explanatory power of different components of the real appreciation changes dramatically in the last years. Irrespective of the fact that the long run average real appreciation in the traded sector differs from that of the overall economy, the two real exchange rate series evolved in a more similar fashion all throughout the sample period available, as can be seen in figure 5, and in the early nineties, as can be seen in the graph above, than in the last years, immediately prior to and including the EMU.

The divergence observed since mid-eighties was even bigger in the late nineties, yielding a smaller explanatory power for the traded sector real appreciation (of even opposite sign than the overall real appreciation in the case of France) versus that of the relative price differential, which gained weight in the more recent years.

It is interesting to note the source of the recent heavier importance of the relative price differential in each case. Figure 6 represents the breakdown of its annual growth rate in its three components, markups, wages and labor product, for the whole sample period. The following graph summarizes, as before, that breakdown in the last decade by comparing the average annual growth rates of the corresponding differentials with respect to Germany in the period 1989-1994 with the more recent period, 1995-2001.



As noticed when studying the evolution of the level differentials, in the last years the relative labor product in the traded sector in Spain reduced its growth rate and thus lowered the trend in the differential relative productivity with Germany, reaching an average annual fall of that differential since 1995 of -0.6 per cent. Despite this fact, relative prices even accelerated due to a faster growth of relative markups in Spain than in Germany. The above graph shows that the differential of relative markups has grown faster in the most recent period, compensating the average negative growth of the differential relative productivities. The relative markups differential has therefore gained substantial explanatory power, and so has the relative wages differential, due to the end in Spain in mid-nineties of the downward trend in relative non-traded wages.

As mentioned when looking at the trends, it is the growth of the real exchange rate in the traded sector that drove the changes in the overall real exchange rate until mid-eighties in the case of France. Since then, the differential of relative prices with respect to Germany drove the evolution of the real exchange rate, and the trend of this differential was essentially governed by that of the differential of relative labor productivities. The different rate of growth of relative labor products in France and Germany became the main explanation of the real appreciation, while the rest of the components compensate each other. However, since mid-nineties the case of France is the opposite of the Spanish case: the relative productivity differential grew more, faster even than the relative price differential, which was possible thanks to the lower relative markups growth.

In the case of Italy, the changes in the traded real exchange rate were the main source of changes in the overall real exchange rate for the whole sample period. Contrary to the case of Spain and France, they remained also high until just before the start of the EMU. The changes in the relative price differential with respect to Germany were very much driven by those of the relative labor product differential but in the more recent years, the changes in the relative wage differential gained substantial explanatory power.

5. CONCLUDING REMARKS

After the start of EMU, inflation differentials have persisted among country members. How persistent should we expect them to be? Which will be the main factors behind those inflation differentials and how persistent are they expected to be in turn?

Under a fixed exchange rate regime, the rate of change of the real exchange rate equals the inflation differential between two countries. This paper studies the recent empirical evidence available on the evolution of the real exchange rates within the main European economies in order to understand the possible main determinants of future inflation differentials within the EMU.

The real exchange rate is decomposed into that of the traded sector and the differential across countries in the relative prices of the non traded sector. The latter is further decomposed into its determinants, namely the differentials of relative markups, relative labor costs and relative labor productivities across countries. The long run properties of these series in the last decades were analyzed by means of graphical inspection as well as formal testing for unit roots and estimation of half-life statistics.

PPP cannot be accepted for the sample period available and deviations from PPP are somewhat less persistent as the ones found typically in the literature. A positive and persistent (non-stationary) relative price differential is also found in all cases, which even accelerated in the years prior to EMU. The contribution of those differentials to explaining real appreciations and inflation differentials in the recent past rose dramatically in all

countries with respect to earlier periods, and the opposite was found for the real exchange rate in the traded sector.

The driving forces of such relative price differentials have been different in each case and period. Despite some evidence in favor of the Balassa-Samuelson hypothesis that relative non-traded prices evolve in each country in the long run according to the evolution of relative traded productivity, these economies have experienced persistent divergences with respect to that hypothesis precisely in the years prior to the start of EMU. This persistent divergence has been caused by different factors in different countries, generating a change in the contribution of the components of the change in the relative price differentials to the real appreciations or inflation differentials in the last years. The differential growth of the relative markups with respect to Germany gained explanatory power recently in the case of Spain, while it was that of relative wages that became more important in the case of Italy. In contrast, the main driving force in the French case seems to have been the relative labor productivity differentials.

To the extent to which persistent changes in relative wages or relative markups could continue being of different intensity or even sign across countries and these differences sustained in time, they could generate future inflation differentials which could not only respond to equilibrating adjustments but could also reflect goods and labor markets rigidities that could affect the relative competitiveness of each economy and therefore its growth capacity.

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Figure 1. **Inflation rates in the main EMU economies.** Average annual national CPI inflation rates, in percentage points.

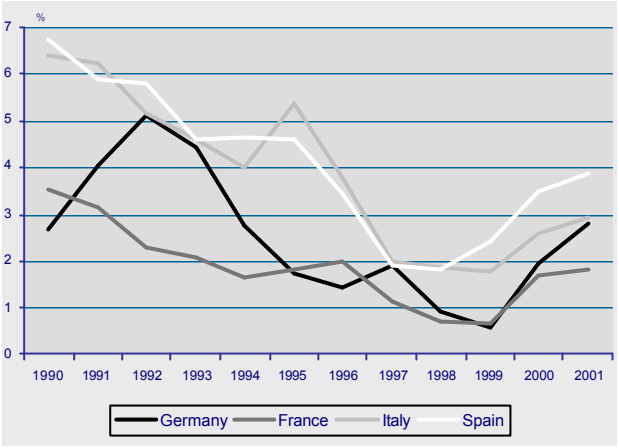

Figure 2. **Real exchange rate with respect to Germany.** Percentage deviations with respect to sample average (Dark line: overall real exchange rate; T: traded sector only).

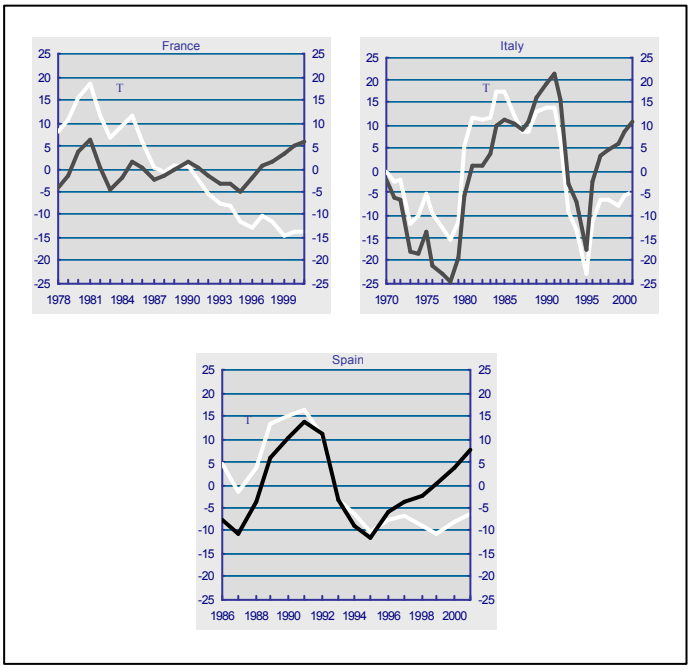

Figure 3. **Differentials of relative non-traded prices and its components.**
Percentage deviations with respect to sample average.

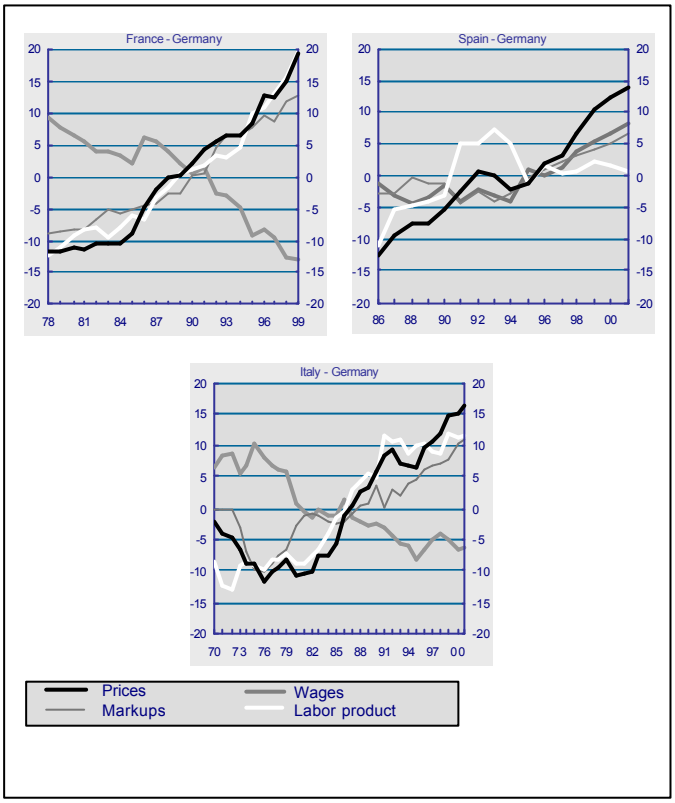

Figure 4. **Relative non-traded prices and its components in each country.** Percentage deviations with respect to sample average.

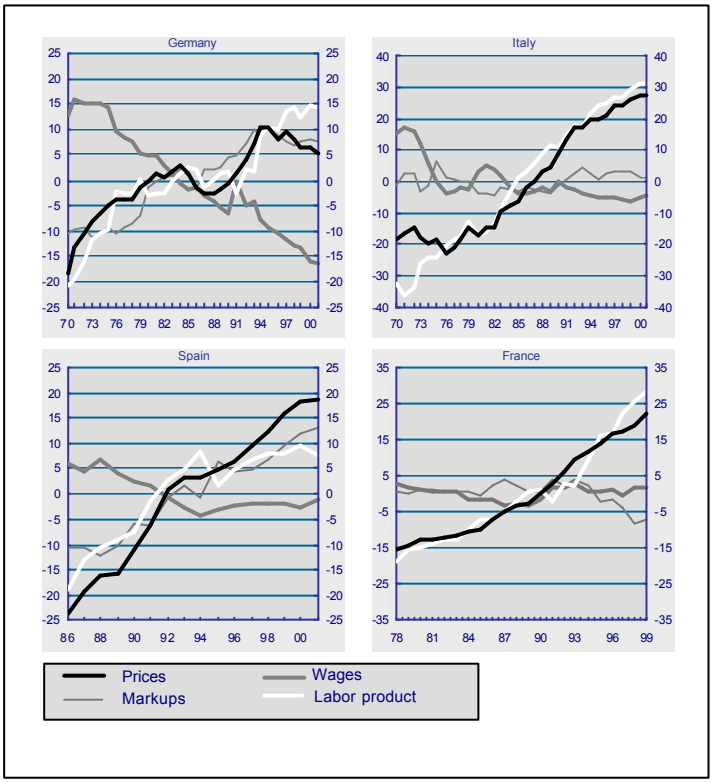

Figure 5. **Annual rates of growth of the real exchange rate with respect to Germany and its two components**: the real exchange rate of the traded sector (RER_TR), and the differential of the relative prices of the non traded sector in the two countries (Price = $\gamma_t (p_t^{NT} - p_t^T) - \gamma_t^* (p^*_t{}^{NT} - p^*_t{}^T)$).

Figure 6. **Annual rates of growth of the differentials with respect to Germany of relative non-traded prices and its components.** Prices refers to $\Delta(\gamma_t\,(p_t^{NT} - p_t^{T}) - \gamma_t^*\,(p^{*NT}_t - p^{*T}_t))$, and its components are: markups, $\Delta(\gamma_t\,(\mu_t^{NT} - \mu_t^{T}) - \gamma_t^*\,(\mu^{*NT}_t - \mu^{*T}_t))$, wages, $\Delta(\gamma_t\,(w_t^{NT} - w_t^{T}) - \gamma_t^*\,(w^{*NT}_t - w^{*T}_t))$ and labor product, $\Delta(\gamma_t\,(mpl_t^{T} - mpl_t^{NT}) - \gamma_t^*\,(mpl^{*T}_t - mpl^{*NT}_t))$.

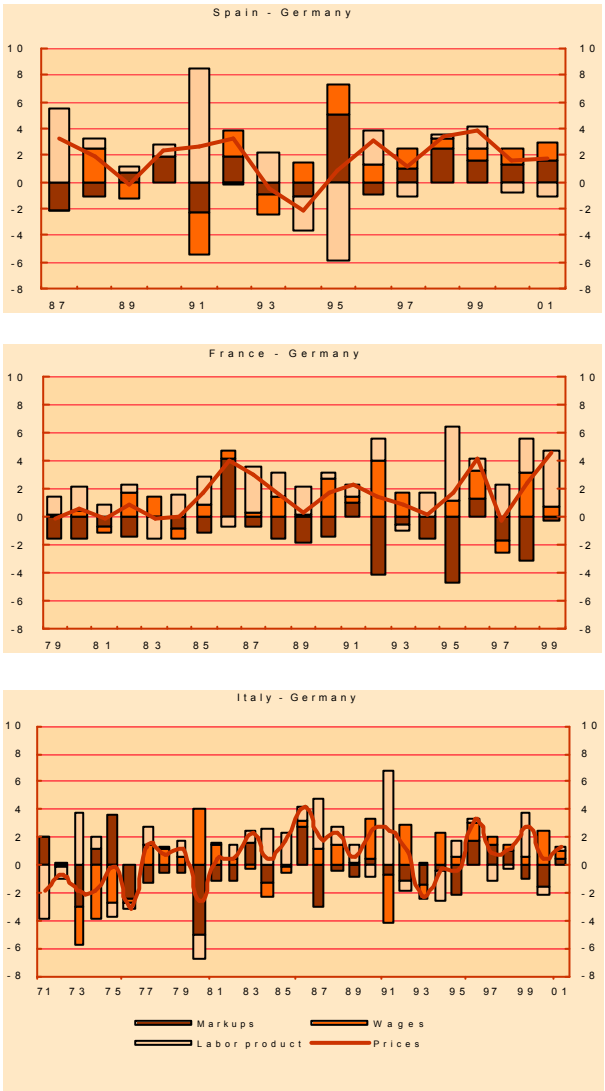

Table 1. **Unit Root tests (Augmented Dickey Fuller with a drift) and half-life estimates.** Series in levels expressed as log deviations with respect to sample average; growth rates are annual growth rates.

	Spain				France				Italy			
	Levels		Growth rates		Levels		Growth rates		Levels		Growth rates	
	ADF	HL	ADF	HL	ADF	HL	ADF	HL	ADF	HL	ADF	HL
Real Exchange Rate	-3.02	1.02	-1.8	0.99	-1.03	0.95	-6.5**	26	-2.1	0.97	-4**	1.93
Real Exchange Rate, Traded sector	-1.92	0.86	-2	1.05	-0.36	0.81	-7.5**	2.7	-2.23	0.98	-3.9**	1.87
Differentials with respect to Germany of the relative prices of the non traded sector and its components:												
Prices	0.56	0.72	-3.1*	3.4	1.12	0.78	-3.6*	1.95	0.35	0.85	-3.9**	1.9
Markups	1.78	0.63	-3.4*	1.64	0.82	0.77	-5.2**	11.5	-0.98	0.9	-5.8**	29.3
Wages	0.76	0.7	-4.2**	8.96	1.02	0.78	-5.8**	3.9	-0.73	0.88	-4.5**	2.6
Labor product	-2.17	1.08	-3.5*	3.17	2.14	0.76	-3.8*	3.5	-0.52	0.87	-6.3**	11.5
Relative prices of the non traded sector and its components in each country:												
Prices	-1.19	0.77	-2.4	1.4	0.17	0.80	-2.57	1.51	-0.12	0.85	-2.66	1.87
Markups	-0.69	0.77	-4.7**	0.23	-0.16	0.82	-4.6**	7.4	-1.35	1	-6.5**	0.8
Wages	-3.6*	0.92	-3.7*	2.7	-1.62	1.01	-4.7**	13.5	-4.1**	1.1	-2.94	1.3
Labor product	-1.98	0.86	-3.7*	6.3	1.63	0.76	-4.5**	6.7	-0.67	0.86	-5**	2.8

Note: Rejection of the null hypothesis of a unit root at 5% significance level is marked with an asterisk, two asterisks indicate rejection at 1% significance level. Appropriate critical values are used in each case, depending on the sample size and the lags included in the regression.

The differentials with respect to Germany refer to the following expressions for the differential of the price of non traded sector with respect to the traded one $(g_t\ (p_t^{NT} - p_t^{T}) - g_t^*\ (p^*_t{}^{NT} - p^*_t{}^{T}))$ and its components: markups $(g_t\ (m_t^{NT} - m_t^{T}) - g_t^*\ (m^*_t{}^{NT} - m^*_t{}^{T}))$, wages $(g_t\ (w_t^{NT} - w_t^{T}) - g_t^*\ (w^*_t{}^{NT} - w^*_t{}^{T}))$ and labor product $(g_t\ (mpl_t^{T} - mpl_t^{NT}) - g_t^*\ (mpl^*_t{}^{T} - mpl^*_t{}^{NT}))$. The bottom panel of the table refers to the following magnitudes in each country: the price of non traded sector relative to the traded one $(p_t^{NT} - p_t^{T})$ and its components, i.e., markups $(m_t^{NT} - m_t^{T})$, wages $(w_t^{NT} - w_t^{T})$ and labor product $(mpl_t^{T} - mpl_t^{NT})$.