EUROPEAN ECONOMY

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Economic and Financial Affairs
DIRECTORATE-GENERAL

EUROPEAN COMMISSION

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Adjustment in the euro area and regulation of product and labour markets: An empirical assessment

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Abstract

This paper assesses the adjustment mechanism in the euro area. Results show that the real exchange rate (REER) adjusts in such a way to redress cyclical divergences and that after monetary unification REER dynamics have become less reactive to country-specific shocks but also less persistent. It is found that regulations, notably affecting price and wage nominal flexibility and employment protection, play a role in the adjustment mechanism. Indicators of product and labour regulations appear to matter for both the reaction of price competitiveness to cyclical divergences (differences between national and euro-area output gaps) and for the inertia of competitiveness indicators. Moreover, regulations appear to matter also for the extent to which common shocks may end up producing country-specific effects on the price competitiveness, as revealed by their interaction with proxies of unobservable common shocks along the lines of the methodology developed in Blanchard and Wolfers (2000). In light of the tendency towards less stringent regulations in past decades, the results seem consistent with the observed reduction in the persistence of inflation differentials, and has implications for the design of adjustment-friendly product and labour market reforms.

Key words: euro area adjustment; competitiveness; monetary unification; labour and product market institutions; nominal flexibility; regulations.

JEL Codes: E30; F41

1. Introduction

Since the early debate on the European Economic and Monetary Union (EMU), adjustment to asymmetric shocks in absence of a flexible nominal exchange rate was perceived as a major challenge to participating countries. In particular, in the early debate on EMU it was stressed that the euro-area scores less well compared with other monetary unions, notably the US, in terms of wage and price flexibility. In light of the Optimal Currency Area theory (Mundell, 1961; McKinnon, 1963; Kenen, 1969), this has implications for the desirability of monetary unification, since in the presence of asymmetric shocks the slow adjustment of wages and prices would not permit the adjustment in competitiveness necessary to bring back actual output to potential.[1]

After almost a decade of experience with EMU, intra-area adjustment does not seem to imply as dramatic consequences as depicted by euro-pessimists at the onset of the common currency. However, the simultaneous presence of non-negligible inflation and growth differentials across euro area countries, and diverging real exchange rates and current account balances in some euro-zone countries has posed a general issue of the effectiveness of the competitiveness channel as an effective tool for intra-area adjustment. The issue has become even more relevant after the global recession of 2008, since the global financial market shocks had largely country-specific effects and intra-euro-area growth differences widened dramatically.

The aim of this paper is to assess the effectiveness of the euro-area adjustment mechanism and what role is played by regulatory frameworks in product and labour markets. There is indeed wide consensus that structural reforms are the way forward to improve the resilience of the euro area. For instance, the 2006 Commission Annual Progress Report on the Growth and Jobs Strategy, emphasizes that reforms in product and labour markets need to be consistent with an efficient intra-area adjustment mechanism. In spite of the wide agreement on the potential role of structural reforms to improve the resilience of euro-area economies, very few studies have analysed empirically whether, how, and to what extent product and labour market regulations affect the reaction of relative prices to cyclical divergences.[2]

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[1] Although there is a debate whether the nominal exchange rate works efficiently as a shock absorber or is rather a source of shocks to the economy (e.g., Artis and Ehmann, 2000).

[2] The term "regulation" in this paper is used interchangeably with "product and labour market institutions". Strictly speaking regulations refer to binding rules set by the government, such as price control, employment protection legislation and minimum wages. In this paper, it also encompasses other institutions, such as the wage setting mechanisms and institutions (often shaped by the social partners) and the unemployment benefit systems.

Our analysis proceeds as follows. First, we estimate the response of real effective exchange rates (REER) and inflation differences to relative output gaps across euro-area countries along the lines of Honohan and Lane (2003) and Arpaia and Pichelmann (2007). We find that the REER behaves in such a way to dampen country-specific shocks measured as differences between the domestic and the euro-area-average output gap. The estimates also suggest that after monetary unification REER dynamics have become less reactive to cyclical divergences but also less persistent. Using a measure of price competitiveness which abstracts from changes in nominal parities (i.e. the difference between domestic inflation and that of euro-area partners) it is confirmed that inflation differentials have become less persistent after monetary union but their reaction to cyclical divergences has somehow increased. This evidence suggests that while a reduced reaction of the REER to country-specific shocks could be explained by the loss of within euro-area nominal exchange rate adjustment, the reduced persistence of the REER could be related to the fact that inflation differentials between euro-area countries appear to have become less persistent after monetary union.

The second step of our analysis consists of assessing whether indicators of product and labour market regulations matter for the reaction of relative prices to macroeconomic shocks. First, we check whether product and labour market regulations support competitiveness adjustment in the face of country-specific demand shocks. We do that by interacting structural indicators with output gap differentials vis-à-vis the rest of the euro area and with a price competitiveness inertia term. These interactions permit to gauge whether regulatory variables hamper or strengthen the response of price competitiveness to asymmetric demand shocks. Second, we assess whether large differences in regulations across euro-area countries are responsible for a different channelling of common shocks to costs and prices, which may end up having country-specific effects on competitiveness. If this is the case, those asymmetries interfere with the adjustment mechanism. To analyse this aspect, the interaction of regulation indicators is performed with proxies of unobserved common shocks following the approach pioneered in Blanchard and Wolfers (2000).

It appears that regulations, notably affecting the nominal flexibility of prices and wages and that of employment generally hamper the adjustment to idiosyncratic shocks at impact and increase the inertia of the price competitiveness. In light of reduced price and EPL regulations in past decades across euro-area countries, the result is consistent with the reduced persistence of inflation differentials and has implications for the design of adjustment-friendly product and labour market reforms. It also appears that cross-country differences in regulations and

institutions, notably regarding product markets, minimum wages, unions, and wage bargaining structure, play a role for the extent to which common shocks could have country-specific effects.

The remainder of the paper proceeds as follows. The next section describes the analytical approach. Section 3 illustrates the data and the empirical implementation. Section 4 discusses the results regarding the implications of monetary unification for the efficiency of the adjustment mechanism. Section 5 discusses the results concerning the role of product and labour market regulations. Section 6 concludes.

2. Analytical approach

We empirically examine the impact of product and labour market structural characteristics on the working of the competitiveness channel by estimating alternative reduced-form equations for the real exchange rate.

The basic equation estimated links changes in the real exchange rate to measures of cyclical conditions or macroeconomics shocks, while controlling for an inertia element in the dynamics of the real exchange rate and convergence of price levels among the countries sampled. Moreover, in order to control for changes in the real exchange rate associated with changes in the nominal exchange rate due to shifts in the exchange rate regime, central bank interventions, or speculation, the change in the nominal effective exchange rate (NEER) is also included among the regressors.

This basic equation is further augmented in such a way to take into account the role of product and labour market characteristics in shaping the link between changes in competitiveness and macroeconomic conditions. The impact of structural conditions is captured by interacting alternative indicators of product and labour markets characteristics with the variables capturing cyclical conditions or macroeconomic shocks.

We follow three alternative approaches to link empirically real exchange rates to macroeconomic conditions.

2.1. Competitiveness and relative cyclical conditions

First, we relate the real exchange rate to the cyclical condition of the country concerned compared with those of the rest of the euro area. The real effective exchange rate of a given country computed relative to the rest of the area is expected to depreciate (appreciate) whenever the output gap of the country concerned is below (above) that of the rest of the area. Such movements in the real exchange rate in turn affect competitiveness in such a way to bring back the cyclical conditions in single countries in line with those prevailing in the euro area as a whole.

The estimated equation is as follows:

$$\Delta \log REER_{it} = \alpha + \alpha_i + \beta \cdot \Delta \log REER_{it-1} + \gamma \cdot \log REER_{it-1} +$$
$$+ \eta \cdot (GAP_{i,t-1} - GAP_{EA-i,t-1}) + u_{it} \tag{1}$$

where subscripts i and t indicate, respectively, countries and time periods, while h denotes a particular regulatory variable. GAP denotes the output gap, α_i are country fixed effects, while u_{it} are the error terms. The subscript EA-i denotes variables referring to an aggregate composed by all euro area countries except country i.

The coefficient of the relative output gap captures the reaction of the REER to country-specific cyclical imbalances. The inclusion of the lagged change in the REER in specifications (1) permits to take into account an inertia factor in the dynamics of competitiveness. The inclusion of the lagged level of the REER captures a mean reversion effect, i.e., a tendency for the REER level to be stable over time.[3]

As an alternative price competitiveness variable, relative inflation π (π = log$REER$ – log$NEER$) is used instead of the REER. The purpose is to examine if the responsiveness of relative prices abstracting from changes in nominal exchange rates. The change in the intra-area nominal effective exchange rate (NEER) is included as an explanatory variable (which is obviously zero from 1999 onwards). Including the change in the NEER permits to control for the exchange rate regime and to run estimates over a sample including pre-ERM year, ERM years, and post EMU years.

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[3] The inclusion of a per-capita GDP variable to capture "equilibrium appreciation" in line with the Balassa-Samuelson argument turns out being largely insignificant.

Hence, the specification reads as follows:

$$\Delta \pi_{it} = \alpha + \alpha_i + \beta \cdot \Delta \pi_{it-1} + \gamma \cdot \log \pi_{it-1} + \delta \cdot \Delta \log NEER_{i,t}$$
$$+ \eta \cdot (GAP_{i,t-1} - GAP_{EA-i,t-1}) + u_{it} \tag{2}$$

The basic specification in 2 is augmented in such a way to gauge the role of product and labour markets in driving the responsiveness of relative prices. Interaction terms between indicators of labour and product market regulations and both the relative output gap and the persistence variables were added. To avoid the inevitable loss of estimates precision due to high multicollinearity among regulation variables, each type of regulatory variables is introduced one at a time and their interaction with the relative output gap and the relative inflation persistence is estimated separately.

Denoting by X^h_{it} a regulation indicator in the specific field h country i and year t, the empirical specification assessing the role of regulation h in driving the responsiveness to cyclical imbalances is as follows:

$$\Delta \pi_{it} = \alpha + \alpha_i + \beta \cdot \Delta \pi_{it-1} + \gamma \cdot \log \pi_{it-1} + \delta \cdot \Delta \log NEER_{i,t}$$
$$+ \eta \cdot (GAP_{i,t-1} - GAP_{EA-i,t-1}) + \theta^h \cdot (GAP_{i,t-1} - GAP_{EA-i,t-1}) \cdot X^h_{it} + u_{it} \tag{2'}$$

The coefficient of the cycle divergence variable interacted with regulatory variables (coefficient θ^h) represents by how much the reaction of competitiveness is increased or reduced by regulatory variable X^h_{it}.

Likewise, the impact of regulation h on inflation persistence is captured by the following specification (coefficient β^h)

$$\Delta \pi_{it} = \alpha + \alpha_i + \beta \cdot \Delta \log \pi_{it-1} + \beta^h \cdot \Delta \log \pi_{it-1} \cdot X^h_{it} + \gamma \cdot \pi_{it-1}$$
$$+ \delta \cdot \Delta \log NEER_{i,t} + \eta \cdot (GAP_{i,t-1} - GAP_{EA-i,t-1}) + u_{it} \tag{2''}$$

Note that both the reaction of relative prices to the output gap at impact and the persistence of the inflation difference matter for the long-run response of price competitiveness to cyclical divergence (the long-run effect being given by $\eta/(1-\beta)$ in equation (1)).

2.2. Competitiveness and common unobserved shocks

The second approach considers the ability of the real exchange rate to adjust to common shocks affecting all euro area countries but possibly having an asymmetric, country-specific impact.[4] While country-specific shocks measured by the output gap differential capture cyclical divergences, so that positive (negative) values correspond with excess (insufficient) demand as compared with the rest of the euro area, common shocks with country-specific effects could be signalling both demand (e.g. a world demand shock) and supply shocks (e.g. oil price shock). Note that while a stronger response of price competitiveness to common demand shocks with asymmetric impact could have a priori a re-equilibrating effect as in the case of country-specific demand disturbances, this is not necessarily the case for common supply shocks. For instance, a stronger response of price competitiveness to an oil shock could be the manifestation of a stronger reaction of wages and mark ups to the increased price of oil, which would, as a first-order implication, have the effect of magnifying the supply shock.

Differences in product and, notably, labour market regulations and institutions has been identified as a major source of asymmetry in monetary unions. Shocks that hit symmetrically all countries belonging to the union may end up producing different effects in different countries due to the fact that they are channelled differently throughout the economy via heterogenous institutions (De Grauwe, 2000). The interaction of regulatory variables with common shock proxies permits to evaluate to what extent the country-specific reaction to the common shock depends upon the characteristics of national labour and product markets. Hence, the aim of the exercise is not that of assessing whether a regulation of a given type helps making the response of price competitiveness more likely to reduce country-specific cyclical imbalances, but that of gauging whether there are regulations whose differences across the euro area could be responsible for common shocks producing country-specific

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[4] Existing work has shown that movements in the REER could be significantly related not only to asymmetric shocks but also to the asymmetric impact of common shocks. Notably, Honohan and Lane (2003), analysing inflation divergence in the euro area, observe that shocks in the external value of the euro had a highly idiosyncratic impact on euro area countries, with relevant implication for relative inflation of countries more integrated with non-euro area countries like Ireland.

effects on price competitiveness, thus interfering with the adjustment mechanism. This country-specific effect may either dampen or amplify the common shock.

We use a non-linear econometric specification introduced by the seminal contribution of Blanchard and Wolfers (2000) on unemployment dynamics and used in subsequent empirical work (e.g. Nickell et al. 2003, Bassanini and Duval 2006, Duval, Elmeskov and Vogel 2007). It consists of interacting a time shock variable with an amplification term which depends upon country-specific characteristics of product and labour markets. The estimated regression is as follows:

$$\Delta log\, \pi_{it} = \alpha + \alpha_i + \beta \Delta log\, \pi_{it-1} + \gamma\, log\, \pi_{it-1} + \delta \Delta log\, NEER_{i,t} +$$
$$+ \eta \cdot (GAP_{i,t-1} - GAP_{EA-i,t-1}) + \lambda_t \cdot (1 + \theta^h X^h_{it}) + u_{it} \tag{3}$$

where λ_t is the common shock variable (a year dummy) and the term $\theta^h X^h_{it}$ captures by how much the propagation of common shocks depends on the regulatory variable X_{it}^h (i.e. the amplifying effect of regulations). In other words, the coefficient θ^h encapsulates the effect of regulation X_{it}^h on the country-specific reaction to a common shock. A negative (positive) value of θ^h indicates that regulatory variable X_{it}^h hampers (facilitates) the impact reaction of price competitiveness in country i to a shock that hits simultaneously all countries at time t. Common shocks are therefore defined as an "unobserved" movement in price competitiveness in one particular year, affecting all countries. These could be triggered by various – but undetermined – types of demand and supply shocks (commodity or oil price movements, hikes in the dollar exchange rate, world demand boom, euro area monetary policy stance, etc). This method allows one to be agnostic as regards the nature of the underlying shocks. While one might argue that different shocks might bring about different effects, pooling possibly different shocks remains an empirical necessity to get enough observations and allow for an efficient estimation.

In order the estimate effect of regulations on the persistence of price competitiveness, we interact also the autoregressive term with the regulatory variable and estimate the following regression:

$$\Delta \log \pi_{it} = \alpha + \alpha_i + \beta \Delta \log \pi_{it-1} + \beta^h X^h_{it}.\Delta \log \pi_{it-1} + \gamma \log \pi_{it-1} + \delta \Delta \log NEER_{i,t}$$
$$+ \eta \cdot (GAP_{i,t-1} - GAP_{EA-i,t-1}) + \lambda_t.(1 + \theta^h X^h_{it}) + u_{it} \tag{4}$$

If β^h is positive, the regulatory variable increases the persistence of common shocks. By contrast, a negative value means that the regulation reduces the persistence of common shocks.

3. Data and empirical implementation

Estimates are performed on a panel of euro-area countries ranging from 1970 to 2006.[5] The countries considered are the 12 countries that joined first the monetary union (in 1999), plus Greece, minus Luxemburg. The source of macroeconomic variables is the ECFIN AMECO database.

The REER is calculated on the basis of the GDP deflator. Since the aim of the analysis is to assess the functioning of the within-euro-area adjustment mechanism, the REER is computed with respect to the remaining euro-area countries considered in the sample, using "double" export weights that take into account export competition both on own and third markets. The NEER is computed with respect to the same set of partner countries and is measured in such a way that an increase means appreciation. The relative output gap variable is also constructed with respect to the remaining euro-area countries included in the sample, using GDP weights.

A wide range of indicators of regulations in product and labour markets, mainly developed for OECD countries (Conway and Nicoletti 2006, Conway, Janod and Nicoletti 2005 and Bassanini and Duval 2006), were tested. Those selected for the final results are described in the Appendix. All regulatory variables increase with the strictness of regulations. Most of the regulatory variables vary both across countries and over time. All regulatory variables are standardised in such a way to have zero mean and unit standard deviation. This standardisation facilitates the interpretation of results.

In estimating the empirical specifications (1)-(2") illustrated above, a series of econometric difficulties are encountered. First, residuals might not be well-behaved due to heteroschedasticity and correlation within panels. Second, depending on the dynamic specification of the model, residuals might be auto-correlated. Third, the inclusion of the lagged dependent variable in a panel regression may lead to inconsistent estimates. Fourth, a more general inconsistency problem could arise from the endogeneity of some regressors. In particular, although the relative output gap variable is lagged, an endogeneity issue might still arise if the variable is highly persistent. Moreover, the (insufficient) reaction of competitiveness to shocks may also encourage the policy makers to amend or reform the regulations/institutions, which might also raise an endogeneity issue.

Taking account of the above issues, equations (1) and (2) above are estimated using three different methods: fixed effects OLS with robust standard errors, fixed effects GLS with heteroschedastic panels andan AR(1) error autocorrelation structure, , and GMM (Arellano and Bond estimator) to avoid the inconsistency of GLS estimates in a context of dynamic panel and to correct for possible endogeneity of the regressors. When degrees of freedom are sufficient, we split the sample in order to check whether the shift to a monetary union was associated with changes in the determinants of the dynamics of competitiveness and whether the role played by labour and product market regulation changed.

Finally, equations in (3) and (4) are run using a non linear estimation technique as in Blanchard and Wolfers (2000). To check robustness of results arising from the specifications in section 2.2 with respect to the inclusion of the relative output gap term in (3) and (4), an alternative specification is also tested excluding that variable. Such robustness test seems warranted, since country-specific cyclical imbalances may by themselves already capture a large part of the country-specific impact of common shocks. No sample split before and after EMU due to insufficient degrees of freedom.

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[5] To obtain a sample of relatively homogenous countries and avoid a highly umbalanced panel due to missing observations Luxemburg and Slovenia are not included in the sample.

4. Competitiveness adjustment and monetary union

Table 1 reports the estimations for the basic specification in equation (1), without the impact of institutions (i.e., the interaction terms). Separate estimations are provided for the 1970-2006 years and the 1999-2006 (EMU years, except for Greece).

Results appear relatively robust with respect to the estimation method adopted. In particular, the similarity of GLS and OLS estimates, and the small estimated autoregression coefficient for residuals suggest that the autoregressive behaviour of residuals is not a major issue.

The REER appears to be characterised by a significant inertia component over the whole sample, which becomes much lower and insignificant after EMU. The REER appears to converge to a stable level over time, as indicated by the negative and significant coefficient for the lagged REER. Also this element of convergence appears to have somehow weakened after EMU.

The real exchange rate appears to react positively and significantly to differences between the domestic and rest-of-area output gap. Each point of additional output gap induces an increase by about 0.7 per cent per year at impact in the REER. This is in line with expectations and indicates that changes in competitiveness provide an effective channel of adjustment in the euro area. However, it appears that the reaction of the REER to relative cyclical conditions is lower when using a sample that starts after 1998. Although these results should be interpreted with care due to the small sample period following EMU, they suggest that the response at impact of the REER to cyclical divergences may have weakened after the elimination of possible fluctuations in nominal parities. The REER also appears to have become less persistent after 1998.

[Table 1]

Figure 1 simulates the typical response of the REER to a series of country-specific shocks affecting the relative output gap, distinguishing the period before and after EMU. The graph shows that, although before EMU the response of the REER to shocks was stronger, there was also a bigger risk of overshooting - with the REER continuing an appreciation (depreciation) trend even after the occurrence of a positive (negative) shock - associated with the higher persistence of REER developments.

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While the reduced response of REER developments to cyclical divergences after EMU could be seen as consistent with the loss of the nominal exchange rate as a shocks absorber, the fall in the inertia of REER changes after EMU is less obvious. Digging deeper into the determinants of relative price dynamics, abstracting from fluctuations in nominal exchange rates, could help interpreting this result.

Table 2 reports estimates from equation (2), using inflation differences as the dependent variable. Results suggest that relative price dynamics are characterised by an inertia component that is significant and stronger than that of the REER, that mean reversion is weaker compared with that of the REER, and that the changes in relative prices are negatively related to changes in nominal exchange rates. Given that an increase in the NEER is interpreted as an effective nominal appreciation of the currency, the result points to standard inflationary effects of currency depreciations, which, possibly in light of the presence of wage indexation schemes, appear significant in spite of the fact that inflation differences are computed on the basis of GDP deflators (hence, higher prices of imported final goods following nominal exchange rate depreciation are not expected to be reflected in this inflation measure).[6] Regarding the impact response of relative prices to cyclical divergences, as expected, it appears to be smaller than that of the REER, but still significant. As for the role of EMU, it turns out that after 1998 the persistence term falls significantly (thus contributing to explain the reduced persistency of REER developments), while the reaction to output gaps is somehow strengthened. It should, however, be borne in mind that the results obtained for EMU period are based on a fairly limited number of observations.   All in all, the evidence suggests that price competitiveness reacts significantly to cyclical divergences. Although the loss of nominal exchange rate flexibility could have entailed a less effective response to country-specific shocks, the reduced inertia element after EMU suggests that the adjustment mechanism has become more apt to deal with a turbulent environment that requires a prompt response of relative prices to short-lived shocks.

[Table 2]

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[6] Qualitative results in terms of competitiveness adjustment to shocks and competitiveness inertia in Table 2 hold irrespective of the inclusion of the NEER variable.

5. The role of product and labour market regulations for the adjustment mechanism

Table 3 lists the regulation variables considered for interacting the shock and persistence terms and their average values across the sample countries before and after EMU. It appears that, with the exception of the unemployment benefits and the corporatism indicator, all other regulation indicators tend to have lower values after 1998, notably product market regulation indicators. These downward trends make regulations a strong candidate for explaining the reduction in competitiveness inertia after the EMU. The whole section will analyse the impact of regulations on the competitiveness adjustment mechanism.

5.1. Competitiveness and relative cyclical conditions

Table 4 reports the results obtained by estimating the determinants of price competitiveness changes (inflation differentials) and interacting regulation variables with relative output gaps and, subsequently, with persistence terms as in specifications (2') and (2''). The estimation method is the GMM (column 3 in Table 2 reports results of competitiveness determinants with no interactions). Only the value of interaction terms is reported in the Table 4. Results are reported also splitting the sample in such a way to include only the period following the monetary union and only observations where demand shocks are negative (so that the REER should be falling to fulfil its re-equilibrating role). This second check is relevant to gauge the effect of regulations that are a priori likely to have an asymmetric impact on adjustment depending on whether wages or prices are supposed to rise or fall. Recalling that the regulatory variables are standardised so as to have zero mean and one standard deviations, the coefficients displayed in the table represent the change in the reaction of inflation differentials to cyclical cyclical divergences differentials or to the own lagged value – that are associated with a one-standard-deviation change in each regulatory variable.

Regarding *product market regulations*, both the Overall Product Market Regulation Indicator and the Price Controls variable turn out to raise significantly the persistence of competitiveness in period of negative cyclical divergences. The result is in line with expectations. The Overall Product Market Regulation Indicator considers a series of regulations and distortions to competition in public utilities, transport, and postal services. It has been shown empirically that firms tend to reset more frequently their prices in markets

more open to competition (see e.g. Fabiani et al. 2006 on evidence for the euro area). The indicator Price Controls instead provides a measure of regulations directly aimed at controlling prices and applies to the whole economy. In such a case, the link between regulation and nominal rigidity is a direct one. The evidence shows that, in addition to increasing competitiveness inertia in periods of negative cyclical differentials, higher Price Controls appear to significantly be associated with a less efficient adjustment to cyclical divergences.

Note that the impact on competitiveness inertia changes sign (and significantly) when the sample is restricted to post-EMU years. A possible explanation may have to do with the fact that the impact of these regulations is non linear, since after 1998 regulations were on average much less stringent (see Table 3). A similar result is found also for other regulations (EPL, minimum wages) that are found to raise competitiveness inertia over the whole period but to reduce it starting from 1999. Also in these cases, the explanation could lie in the fact that these regulations were stringent especially in the years preceding the monetary union.[7]

[Table 3]

Turning to the impact of *labour market regulations*, a stringent employment protection legislation (EPL) appears to both significantly reduce the responsiveness of relative inflation to cyclical divergence and raise its persistence. The estimated impact of EPL on competitiveness adjustment seems to be in line with expectations. EPL could generate labour hoarding during downturns, thus leading to pro-cyclical productivity reductions and hampering the required downward adjustment of unit labour costs. Moreover, in a bargaining setting, a stricter EPL raises the bargaining power of workers and unions ("the insiders"), that are in a better position to avoid wage cuts (e.g. Holden 2004).[8] This is in line with recent evidence for OECD countries suggesting that EPL leads to higher nominal wage rigidity (e.g., Holden and Wulfsberg 2005).

The result concerning minimum wages, which reduce the reaction to cyclical divergences and increase persistence of inflation differentials, also squares with expectations. Minimum wages

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[7] It is to stress that the small size of the sample after 1999 calls for caution when interpreting the results estimated only after the creation of the Monetary Union.
[8] On the other hand, stricter EPL, by contributing to increase the unemployment of the "outsiders", may exert downward pressures on their wages.

appear indeed to hamper the adjustment of the relative inflation mostly when relative inflation has to adjust downward (negative relative output gap). The fact that minimum wages are found to raise competitiveness inertia seems consistent with the presence of indexation clauses which provide that minimum wage developments should, at least in part, follow the development of past inflation.

Union density is found to increase the responsiveness of relative inflation rates to relative slack, but only after the introduction of the euro, while, over the whole sample, the downward inflation adjustment to relative slack seems to have been impeded (albeit not significantly) by the degree of unionisation. This may flag the change in attitude of many trade unions in the run-up to the third stage of EMU, which developed more awareness of the adverse effect of wage inflation on employment, especially in a new context, where the ECB could raise its key interest rates to thwart serious risks of inflationary slippages. However, it is also to note that, very much in line with expectations, union density significantly reduces the response of competitiveness mostly when prices and costs have to adjust downward (negative relative output gap): stronger unions oppose wage cuts in periods of weak demand while allowing wages to raise when the economy is overheating.

The unemployment benefit variable has a different effect before and after monetary unification. While in earlier years the impact is largely insignificant, generous unemployment benefits after EMU are found both to reduce the responsiveness of relative inflation to cyclical divergences and raise its persistence. The finding could be explained by the fact that unemployment benefits rose over time on average (Table 3). The result after 1998 appears in line with what would a priori be expected. Generous unemployment benefits may hinder the downward adjustment of wages during phases of weak labour demand by increasing the reservation wages and thereby the bargaining power of workers, thus hampering also the adjustment of relative inflation. To the extent that firms contribute to the financing of generous unemployment benefit systems, wages could be less reactive to the cycle also because part of the effective remuneration of workers also consists of notional contributions financing unemployment compensation during bad times.

[Table 4]

Finally, Table 4 shows that wage bargaining centralisation and co-ordination (corporatism) reduces the reaction of competitiveness to shocks and raises its inertia, possibly in a non-linear fashion. Highly centralised wage bargaining (high corporatism) significantly reduces the persistence of inflation differences. Decentralised wage bargaining (low corporatism) also has a significant impact on persistence in periods of negative cyclical differentials and enhances the reaction of inflation to differences to cyclical divergences. Intermediate wage bargaining – which normally corresponds to bargaining at the industry level – is instead associated with a significantly higher inertia of price competitiveness. This result seems consistent with the findings by Calmfors and Drifill (1988) that unions' inflationary impact on wages would be stronger for intermediate degrees of centralisation because in this case unions tend not to take into account the broader implications of their wage demands.

5.2. Competitiveness and common unobserved shocks

A role of regulatory variables in the adjustment process of price competitiveness is confirmed, from a different perspective, by adopting a specification in which regulations affect the response to common shocks as in specifications (3) and (4) above.

[Table 5]

Table 5 reports results from the implementation of specification (3). As a robustness check, results excluding the relative output gap are also reported. It turns out that cross-country differences in product market regulations, minimum wages, union density, and the structure of wage bargaining (corporatism) exert a significant role in explaining the country-specific (i.e. asymmetric) effect of common shocks.

While the overall product market regulation indicator exacerbates the impact of common shocks on relative inflation, the price controls appear to dampen the short-term impact of common shocks on competitiveness.

Regarding labour markets, minimum wages and corporatism are found to significantly reduce the response of price competitiveness to common shocks. The impact of minimum wage legislation and wage bargaining centralisation (corporatism) is particularly significant, while EPL is not. The fact that a high degree of wage bargaining centralisation (a low value for the

corporatism variable) results in a lower competitiveness response seems consistent with the presumption that, under economy-wide collective agreements, unions are more concerned about the inflationary consequences of supply shocks (e.g. Bruno and Sachs, 1985)

Table 6 reports the main results from the implementation of specification (4) where both the common shocks term and the inflation differential persistence term are interacted with regulation variables. Overall product market regulations, price control, employment protection legislation and minimum wages appear to make inflation differentials more persistent.

[Table 6]

The findings of this section broadly confirm the results seen in section 5.1, with the notable exceptions of overall product market regulation (which increase significantly the response of price competitiveness to common shocks) and EPL (not significant when interacted with common shocks). These results are not necessarily contradicting one another, as the effect of the relative cyclical position is not tantamount to the impact of common shocks on competitiveness. While the former captures the short-term reaction of competitiveness to asymmetric demand shocks, the latter measures the asymmetric price competitiveness implications of common shocks that could affect both the demand and the supply side.

6. Concluding remarks

This paper analyses the competitiveness adjustment mechanism in the euro area and its link with labour and product market regulations from two alternative perspectives: the reaction to country–specific cyclical imbalances as captured by the difference between the national and the rest-of the-area output gap and the response to common unobserved shocks. Results show that competitiveness in EMU moves towards easing country-specific cyclical imbalances. Results also indicate that, after the monetary union, real exchange rate developments in euro-area countries have become and less reactive to country-specific cyclical imbalances, but also less persistent. Analysing the determinants of inflation differentials (that abstract from changes in nominal exchange rates) as an alternative measure of price competitiveness, it turns out that this measure becomes slightly more reactive to shocks after monetary union and

clearly less persistent. All in all, the evidence suggests that although the loss of nominal exchange rate flexibility could have entailed a less effective response to country-specific shocks, the reduced inertia element after EMU suggests that the adjustment mechanism has become less subject to overshooting and more apt to deal with a turbulent environment where a key desirable feature are prompt responses of relative prices to short-lived shocks possibly hitting in opposite directions.

Changes in product and labour market regulations are a natural candidate for explaining the changing behaviour of price dynamics in response to shocks and their inertia. Our analysis reveals that tight product market regulation, strict employment protection, a high minimum wage, high union density and generous unemployment benefits all appear to either reduce the responsiveness of relative inflation to cyclical divergences or to raise its persistence or both.

When considering the impact response of price competitiveness to common (demand or supply) shocks – rather than cyclical divergences– it turns out that the presence of cross-country differences in product market regulations, minimum wages, unions, and the wage bargaining structure have implications for the extent to which country-level price competitiveness reacts to common shocks. This asymmetric effect of common shocks could generate fluctuations in relative prices that interfere with those that are consistent with the smoothing of country-specific shocks.

The evidence on the impact of regulations on the efficiency of the adjustment mechanism is subject to a series of limitations related to the imperfect measurement of regulatory policies and institutions by means of synthetic indicators, limited sample size, and possible problems with the empirical implementation (specification errors, the standard weak instruments issue with the use of GMM estimators…). Nonetheless, the results exhibit a certain robustness across specifications and estimation methods and deliver messages of possible relevance. The above evidence on the role of regulations seems consistent with the observed falling inertia of price competitiveness dynamics after the monetary union, thereby suggesting that reduced stringency of product and labour market regulations over the past decades could have played a role. Moreover, the findings also help design regulatory reforms in such a way to strengthen the efficiency of the adjustment mechanism.

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Appendix: definition and source of regulatory variables

Overall Product Market Regulation Indicator: Product Market Regulation in the Non-Manufacturing Sectors (REGREF, see Conway and Nicoletti (2006). Definition: OECD summary indicator of regulatory impediments to product market competition in seven non-manufacturing industries: gas, electricity, post, telecoms (mobile and fixed services), passenger air transport, railways (passenger and freight services) and road freight. Data are available for all the 1975 – 2003 period. Years from 1970 to 1975 are assumed to have the same outcome as 1975. Although it does not encompass all economic regulations, the REGREF indicator covers sectors in which anti-competitive regulation tends to be concentrated.

Price Controls: OECD economy-wide indicators of state control on prices for 1998 and 2003. Years before 1998 are assumed to have the same outcome as 1998; year after 2003 are assumed to have the same outcome as 2003. These indicators are described in Conway, Janod, and Nicoletti (2005).

Unemployment benefit replacement rate: index constructed by Bassanini and Duval (2006) reporting the country average replacement rate of unemployment benefits. Data range from 1970 to 2003. Some missing values are present for Germany, Finland and Portugal. No data are available for Greece.

Employment Protection Legislation: index used by Bassanini and Duval (2006) and based on OECD data from 1970 to 2006 considering both permanent and temporary labour contracts. Some missing values are present for Germany, Finland and Portugal. No data are available for Greece. Data range from 1982 to 2002. Data range from 1970 to 2003. Some missing values are present for Germany, Finland and Portugal. No data are available for Greece.

Minimum wage: index used in Bassanini and Duval (2006), minimum wage expressed as a percentage of the median wage. Data are available only for the 1982-2003 period.

Union Density: trade-union members expressed as a percentage of total employees, used by Bassanini-Duval (2006) and based on OECD data. Data range from 1970 to 2003. Some missing values are present for Germany, Finland and Portugal. No data are available for Greece.

Corporatism: indicator of the degree of centralisation/co-ordination of the wage bargaining processes, which takes values 1 for decentralised and uncoordinated processes, and 2 and 3 for intermediate and high degrees of centralisation/co-ordination, respectively. This discrete variable could be split into three dummies "low corporatism", "intermediate corporatism" and "high corporatism". These dummies allow for taking "non-linearities" into account, following the argument of Calmfors and Drifill (1988): both decentralised and centralised bargaining lead to positive outcome in terms of wage moderation, unlike industry-based bargaining. The "low corporatism" dummy variable frequently used in this paper takes value 1 when bargaining is decentralised and uncoordinated and zero otherwise. The "intermediate corporatism" and "high corporatism" are constructed in the same way.

All above indices are increasing in the level of strictness and regulation of each country. The indexes are further standardised in such a way to have zero mean and unit variance.

Table 1 : Real effective exchange rate adjustment and cyclical divergence. Basic specification

	1970 - 2006	1999 - 2006				
	Fixed effect OLS	Fixed effect GLS	GMM	Fixed effect OLS	Fixed effect GLS	GMM
	(1)	(2)	(3)	(4)	(5)	(6)
ΔlogREER(-1)	0.232	0.205	0.238	-0.019	-0.083	-0.174
	(5.64)***	(4.40)***	(6.72)***	(0.14)	(0.88)	(1.69)*
log(REER(-1))	-0.129	-0.122	-0.162	-0.007	-0.039	-0.026
	(3.69)***	(6.20)***	(5.03)***	(2.09)**	(1.72)*	(1.06)
Relative output gap(-1)	0.684	0.667	0.714	0.502	0.512	0.603
	(4.89)***	(6.11)***	(5.87)***	(7.43)***	(5.92)***	(11.14)***
Estimated AR error coefficient		0.0678			0.1407	
Observations	385	385	374	88	88	88

Notes: Dependent variable: ΔlogREER, GDP deflator, with respect to rest of euro-area partners. Fixed effect OLS is estimated with standard errors robust with respect to heteroscedasticity and within-panel error correlation. GLS estimates allow country fixed effects and assume residuals' first-order autoregression. GMM estimates are obtained with the Arellano-Bond procedure; relative output gap considered as predetermined and estimated using past values. Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2 : Price competitiveness adjustment and cyclical divergence. Basic specification

	1970 - 2006			1999 - 2006		
	OLS	GLS	GMM	OLS	GLS	GMM
	(1)	(2)	(3)	(4)	(5)	(6)
Δπ(-1)	0.587	0.626	0.546	0.125	0.11	0.182
	(11.80)***	(20.69)***	(8.62)***	(1.50)	(1.22)	(2.18)**
π(-1)	-0.014	-0.017	-0.019	-0.091	-0.063	-0.1
	(3.25)***	(7.54)***	(2.87)***	(2.44)**	(3.01)***	(2.78)***
Relative output gap(-1)	0.242	0.265	0.222	0.356	0.386	0.358
	(3.74)***	(5.53)***	(3.23)***	(5.37)***	(4.92)***	(5.65)***
Δlog(NEER)(-1)	-0.099	-0.093	-0.094			
	(2.79)***	(4.57)***	(2.75)***			
Estimated AR error coefficient		-0.074			0.073	
Observations	385	385	374	88	88	88

Dependent variable: Δπ = ΔlogREER – ΔlogNEER, where REER is computed on the basis of GDP deflator, and both REER and NEER are with respect to rest of euro-area partners. Fixed effect OLS is estimated with standard errors robust with respect to heteroscedasticity and within-panel error correlation. GLS estimates allow country fixed effects and assume residuals' first-order autoregression. GMM estimates are obtained with the Arellano-Bond procedure; relative output gap considered as predetermined and estimated using past values. Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1: Reaction of REER to output gap divergences
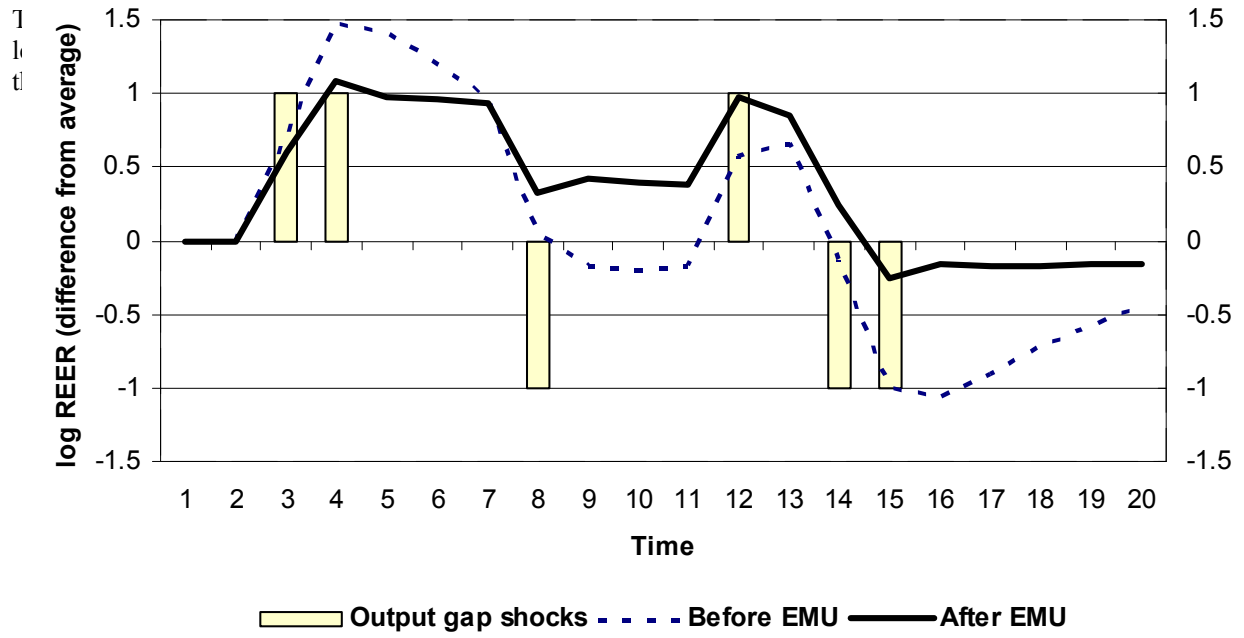
Table 3. Average value of regulatory variables
(regulatory variables are standardized over the whole available sample)

Variable	Average before 1999	Average after 1999
Overall Product Market regulation Indicator	0.3	-1.8
Price controls	0.3	-0.9
EPL	0.0	-0.1
Minimum wage	0.1	-0.4
Union density	0.1	-0.4
Unemployment benefits	-0.1	0.6
Corporatism	-0.1	0.3

Table 4: Competitiveness adjustment, cyclical divergence, product and labour market regulation

Institution	Interaction term	Sample		
		All years (1970 -2006)	Year>=1999	Relative Output Gap<0
Product Market:				
Overall Product Market Regulation Indicator	Relative Output Gap	-0.121	0.008	-0.13
		(1.23)	(0.05)	(0.92)
	Persistence	0.084	-0.3	0.226
		(0.94)	(2.21)**	(1.80)*
Price Controls	Relative Output Gap	-0.149	-0.281	-0.069
		(2.01)**	(2.08)**	(1.07)
	Persistence	0.067	-0.083	0.096
		(1.44)	(2.68)***	(2.02)**
Labour Market:				
Employment Protection Legislation	Relative Output Gap	-0.118	-0.214	-0.009
		(2.39)**	(1.87)*	(0.15)
	Persistence	0.113	-0.084	0.15
		(10.11)***	(1.46)	(5.76)***
Minimum wage	Relative Output Gap	-0.097	-0.364	-0.448
		(0.68)	(1.21)	(2.08)**
	Persistence	0.213	-0.023	0.211
		(4.25)***	(0.10)	(1.50)
Union Density	Relative Output Gap	-0.055	0.148	-0.3
		(1.52)	(6.38)***	(3.87)***
	Persistence	-0.109	0.002	-0.14
		(1.64)	(0.03)	(1.67)*
Unemployment Benefits Replacement Rate	Relative Output Gap	0.119	-0.305	-0.002
		(0.96)	(4.82)***	(0.02)
	Persistence	0.008	0.265	-0.04
		(0.18)	(2.65)***	(0.73)
High Corporatism	Relative Output Gap	-0.029	0.112	-0.012
		(0.55)	(1.36)	(0.12)
	Persistence	-0.113	0.151	-0.126
		(2.49)**	(1.58)	(1.73)*
Intermediate Corporatism	Relative Output Gap	-0.038	-0.106	-0.036
		(0.63)	(1.36)	(0.34)
	Persistence	0.098	-0.143	0.149
		(2.13)**	(1.58)	(2.18)**
Low Corporatism	Relative Output Gap	0.205		0.096
		(3.75)***		(1.25)
	Persistence	0.012		-0.068
		(0.78)		(2.85)***

Notes: The table reports the value of the coefficient of the interaction of product and labour market institution indicators with the relative output gap and the persistence variable using the same specification as in columns (3) in Table 2 (GMM estimation). Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Competitiveness, common unobservable shocks, and product and labour market regulation

	Overall Product Market Regulation Indicator		Price Control		Employment Protection Legislation		Minimum wage		Union Density		Unemployment Benefits Replacement Rate		Corporatism	
	(1)	(2)	(3)	(4)	(5)	(6)			(7)	(8)	(9)	(10)	(11)	(12)
$\Delta\pi(-1)$	0.53	0.52	0.52	0.51	0.61	0.59	0.53	0.58	0.50	0.46	0.51	0.49	0.54	0.52
	(12.42)***	(12.27)***	(12.93)***	(13.06)***	(15.23)***	(15.05)***	(8.68)***	(9.53)***	(11.06)***	(10.41)***	(11.41)***	(11.24)***	(12.29)***	(12.20)***
$\pi(-1)$	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.05	-0.05	-0.03	-0.04	-0.02	-0.02	-0.02	-0.02
	(5.29)***	(4.58)***	(6.96)***	(5.95)***	(6.53)***	(5.96)***	(5.41)***	(5.17)***	(6.67)***	(7.05)***	(4.35)***	(3.65)***	(5.49)***	(4.73)***
$\Delta\log(NEER)$	-0.10	-0.13	-0.09	-0.12	-0.05	-0.08	-0.11	-0.11	-0.05	-0.08	-0.10	-0.13	-0.07	-0.10
	(3.52)***	(4.54)***	(3.72)***	(4.84)***	(2.15)**	(3.16)***	(2.46)**	(2.58)**	(1.66)*	(2.72)***	(3.49)***	(4.51)***	(2.81)***	(3.86)***
Relative output gap (-1)		0.24		0.26		0.20		0.34		0.32		0.23		0.22
		(3.67)***		(4.31)***		(3.46)***		(3.31)***		(4.44)***		(3.81)***		(3.60)***
Product Market:														
λ * Overall Product Market Regulation Indicator	0.30	0.33												
	(1.90)*	(3.38)***												
λ * Price Controls			-3.29	-2.92										
			(1.95)*	(2.11)**										
Labour Market:														
λ * Employment Protection Legislation					-22.93	-24.42								
					(0.50)	(0.47)								
λ * Minimum wage							-1.24	-0.96						
							(2.89)***	(2.91)***						
λ * Union Density									1.69	2.01				
									(2.11)**	(1.98)**				
λ * Unemployment Benefits Replacement Rate											-20.36	-9.45		
											(0.24)	(0.52)		
Corporatism													-1.78	-1.72
													(4.30)***	(4.56)***
Observations	306	306	374	374	306	306	108	108	293	293	306	306	310	310

Notes: Non linear estimation of equation (3). The vector of shocks λ is a vector of time effects (not displayed). The interaction between common shock and institutions ($\lambda * X^h_{it}$) is the main variables of interest. Odd columns contain the lagged Relative Output Gap as an explanatory variable. Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: The effect of regulations on the response of competitiveness to common shocks and on persistence

	Interaction with common shock (θ^h)	Interaction with persistence of inflation differentials (β^h)
Product Market		
Overall Product Market Regulation	0.33252	0.12491
Indicator	(3.38)***	(1.98)**
Price Control	-2.92128	0.0698
	(2.11)**	(2.07)**
Labour Market		
Employment Protection Legislation	-24.41663	0.13062
	-0.47	(4.33)***
Minimum wage	-0.96138	0.17555
	(2.91)***	(2.22)**
Union Density	2.00961	-0.11306
	(1.98)**	(2.73)***
Unemployment Benefits Replacement	-9.4467	0.02629
Rate	-0.52	(0.74)
Corporatism	-1.71789	-0.11696
	(4.56)***	(2.41)**

* significant at 10%; ** significant at 5%; *** significant at 1%. The specification contains as additional control the lagged Relative Output Gap variable.