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Exploring price and non-price determinants of trade flows in the largest euro-area countries

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Abstract

Since the mid-2000s price-competitiveness indicators for some euro-area countries have been providing conflicting signals. Against a stability of the producer price (PPI)-based measure, the manufacturing unit labour cost (ULCM)-deflated indicator points to a major competitiveness loss in Italy; we argue that the discrepancy mostly reflects a divergence of ULCM and PPI trends in competitor countries. Owing to the fading representativeness of labour on overall costs, price-based indicators appear to be more appropriate than those based on ULCMs to assess external competitiveness. In Italy ULC-based indicators play a less relevant role relative to price-deflated measures in explaining exports; the opposite holds true for Germany and France, whereas in Spain exports are insensitive to prices. Non-price competitiveness proves important in explaining Italian, German and, in particular, Spanish exports. Imports react to price-competitiveness dynamics only in Italy; considering the participation in global value chains is useful to correctly identify import sensitivity to domestic and foreign demand.

JEL codes: F14; F62.

Keywords: price competitiveness, non-price competitiveness, unit labour costs, producer prices.

Non-technical summary

Trends in price competitiveness are usually proxied by the real effective exchange rate (REER), i.e. a weighted geometric average of bilateral exchange rates of a country's main trading partners deflated by a measure of relative inflation. However, the choice of the measure is open to much debate, since no standard indicator is theoretically optimal. According to the adopted deflator, we categorize the REER as price-based when relative consumer prices, producer prices of manufactured goods (PPIs) or GDP deflators are used, and ULC-based when unit labour costs in manufacturing (ULCM) or in the total economy (ULCT) are employed.

In recent years, price- *vs.* ULC-based REERs have displayed an increasing divergence in the main euro-area countries, leading to a difficult assessment of their competitive positions. In particular, since the onset of the European Monetary Union, Italy has lost over 30 percentage points in competitiveness according to the ULCM-based measure against a broad stability shown by the PPI-based indicator. In the same years, Germany has recorded sizeable gains, ranging from 7 percentage points according to the CPI-based indicator to 16 according to the ULCT one. Both France's and Spain's trends in competitiveness are also controversial: the former country has gained 6 percentage points according to the PPI-based measure against a loss of 3 recorded by both ULC-based indicators; Spain has gained 1 point on the basis of the ULCT measure but has lost nearly 12 points according to the PPI one.

A focus on the single deflator trends in each country under investigation sheds light on the dispersion across the corresponding REERs. A cointegration analysis points to PPIs and ULCMs moving hand-in-hand in Italy in the long run, whereas the relationship is unstable in the case of France and recently has shown a structural break in the remaining two countries. In particular, the evidence of an increasing gap between PPI and ULCM in Germany, by far Italy's main trading partner, largely explains why the latter country, despite proving the only one in which PPI and ULCM co-move, records a dramatic divergence between its PPI- and ULCM-based REERs. One possible explanation of the disconnect between PPIs and ULCMs in some euro-area countries is the more intense participation in global value chains, which has occasionally led to a large fall in wage shares, such as in Germany. Accordingly, the relevance of labour on total production costs in manufacturing may have decreased at a varying pace across countries, thus limiting the reliability of ULCM-based measures in assessing price competitiveness.

The ability of the alternative REERs to explain the trade performance of the four largest euro-area countries is tested by estimating standard dynamic equations for merchandise exports and imports over the period 1993-2012. We find that gains in price competitiveness support exports in all economies under study bar Spain, confirming the "Spanish paradox" received by the recent

literature. In Italy price-based measures prove more relevant than ULC-deflated ones, but the same does not hold true for France and Germany. Moreover, the impact of changes in price competitiveness is larger and more persistent in the former economy. As expected, foreign demand is a key determinant of export trends in all four countries, with evidence consistent with stable market shares in the long-run. Regarding imports, they are mostly explained by domestic demand and exports; only in Italy a gain in price competitiveness dampens import demand. The set of our results is robust to an array of checks and extensions.

A more refined export equation includes an experimental measure of non-price competitiveness, namely the relative total factor productivity (TFP) for the whole economy, that is purposely constructed according to the same methodology underlying REERs. This variable captures the relative efficiency in the organization of production processes and the degree of technological progress of a country *vis-à-vis* its main trading partners. Relative TFP trends are particularly gloomy in the case of Italy since the mid-Nineties, while it records a sizeable improvement in Spain and Germany since the late 2000s. Our evidence points to a positive impact of non-price competitiveness on Italian, German and, in particular, Spanish exports, yet a negligible one in France.

Finally, the import equation is re-estimated by adjusting the single demand components by their import content, in order to better take into account of the varying intensity of internationalization across the different production processes. As a result, the import sensitivity to adjusted *vs.* raw domestic demand is honed down in all countries, confirming recent findings in the empirical literature.

In conclusion, the statistical drawbacks of ULCM-based price-competitiveness indicators may lead to a biased assessment of a country's competitive position. This is found to be the case for Italy, where ULC-based measures are also less correlated to exports than the price-based measures. The informative content of alternative REERs is however different across countries, leading to no emergence of an optimal price-competitiveness indicator. This paper also highlights the role of non-price factors in driving exports, as well as the need to take into account the effects of global value chains on trade flows.

1. Introduction and main conclusions[1]

The issue of a sound assessment of a country's price competitiveness has recently returned to the core of the international academic and institutional debate. In particular, the information content of standard indicators of relative costs and prices has been questioned because: *i)* alternative price-competitiveness indicators have not always provided consistent signals in a given country; *ii)* their trends have often shown a weak correlation with external performance, more prominently regarding the increasing current account imbalances within the euro area in the decade prior to the eruption of the global financial crisis.

Focusing on trends in the four largest countries in the euro area, we observe a widening dispersion of alternative price-competitiveness measures in recent years, in particular in Italy. The issue of the divergence between the various indicators has been debated at the international level. For example the European Commission has warned about the uncertainty surrounding the size of Italy's real exchange rate appreciation until the outbreak of the global financial crisis, stressing the larger loss in external competitiveness when considering ULC-deflated indicators relative to those based on prices (European Commission 2012, pp. 13-14; 2014, pp. 30-31). Also a study by IMF bluntly states "*[w]hile Italy's competitiveness does appear to have eroded [since 1995], the size of this effect is, frankly, anyone's guess*" (Bayoumi et al. 2011, p. 5).

The first part of the present paper shows that the conflicting signals coming from unit labour cost in manufacturing (ULCM)- and producer price (PPI)-based indicators is not due to a diverging behaviour of the two deflators in Italy; it therefore does not signal an unsustainable behaviour of profit margins of Italian firms, unlike what is usually implicitly assumed. A simple cointegration framework in fact shows a stable long-run relationship between PPIs and ULCMs in Italy in the last two decades. Rather, the divergent developments of Italy's competitiveness indicators are mostly due to the increasingly different trends in ULCMs and PPIs in some of Italy's main trading partners, and particularly in Germany. This is likely not to reflect differences in the total costs of production but to be related to the varying extent to which the share of intermediate inputs in production functions changed across countries, largely as a result of the different intensity in offshoring.

These findings signal that ULCM-based indicators may provide unreliable insights into competitiveness trends in the euro-area countries, even more so in Italy[2]. A similar risk has long been recognized for Germany by the Bundesbank (which already fifteen years ago raised concern in adopting the ULCM-deflated indicators to portray price competitiveness of German exporters; Deutsche Bundesbank 1998; 2004) and by the ECB, according to which "*the German ULCM-based indicator suggests the need for a rather cautious interpretation of ULCM-based REERs*" (European Central Bank 2003, p. 71). These considerations ought to be extended to Italy's ULCM-based REER, as its diverging behaviour relative to the other indicators largely hinges on changes in its competitors' production processes, namely the role of inputs other than labour in determining production costs.

After assessing the possible statistical drawbacks underlying the ULCM-based measure, in the second part of the paper we explore the different explanatory power of alternative price-competitiveness indicators for the main euro-area countries. For this purpose, we estimate dynamic equations for merchandise exports and imports over the period 1993-2012 for Italy, France,

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[2] An extract of our arguments has been published in Giordano and Zollino (2013).

Germany and Spain. The received literature has not led, thus far, to any strong conclusions in this respect[3].

Our findings for Italy show a less relevant role of ULC-based indicators relative to price-deflated measures, in terms of explained variance, in the export equations. The same result does not hold for Germany and France, whereas Spanish exports do not prove statistically correlated to any price-competitiveness indicator, providing evidence in favour of the so-called "Spanish paradox". In order to explore the role of non-price competitiveness, we experimentally develop a relative economy-wide total factor productivity (TFP) indicator, by which we compare a country's performance in efficiency and ability to innovate against the same basket of competitors included in the price-competitiveness indicators. With the exception of France, we find that relative TFP exerts a significantly positive impact on exports in the countries under analysis, with a particularly strong effect observed for Spain, plausibly in line with the major structural reforms implemented therein in recent years. Our whole set of results is robust to alternative specifications, which include the volume of intermediate goods, domestic demand, linear trends and additive EMU or crisis dummies (on their own or interacted with the other explanatory variables). Furthermore, rolling window regressions on a longer time-span (1980-2012), run only for Italy owing to data availability, point to a stability of the coefficients over time, thereby excluding the presence of significant structural breaks in the estimated relationships.

As regards imports, in line with the existing empirical literature we find a controversial role of price competitiveness, which turns out to be significant only in the case of Italy, possibly due to the changing role of energy, raw material and intermediate inputs as a by-product of the increasing participation in global value chains by the countries considered. Again, robustness checks which include the introduction of industry capacity utilization rates, linear trends and dummy variables in the import equations confirm these findings. Moreover, the significant coefficient of price-competitiveness indicators for Italy proves stable over the long-run in a rolling regression framework. Finally, we also correct the demand components included in the import equations by their import intensity, as in Bussière et al. (2013), in order to better take into account the increasing internationalization of firms' production processes.

The paper is organised as follows. Section 2 reviews the range of most frequently employed price-competitiveness indicators, whereas Section 3 traces their recent trends in the main euro-area countries. Section 4 sheds light on the reasons why ULCM-based indicators may convey biased signals compared with price-based ones, providing both quantitative evidence and a numerical simulation. Section 5 defines the baseline dynamic export and import equations and describes the data used for the four largest euro-area countries; it also presents estimation results concerning external trade performance in Italy, Germany, France and Spain over the period 1993-2012, including some sensitivity analysis, with a particular focus on Italy in the long-run (i.e. since 1980), the only country for which the necessary time series data are available. Section 6 enriches the export equations of the countries under study by including a proxy of non-price competitiveness, whereas Section 7 reassesses the import equations to take into account import intensity-adjusted demand components. Section 8 draws up our main conclusions.

2. A brief survey of price-competitiveness indicators

The price competitiveness of a country is usually approximated by the real effective exchange rate (REER) of its currency, i.e. a weighted geometric average of nominal exchange rates of a country's main trading partners, deflated by relative deflators:

[3] See, for example, European Central Bank (2003), Neary (2006), Ca' Zorzi and Schnatz (2007) and Bayoumi et al. (2011).

(1) $$REER = \prod_{i=1}^{n} \frac{P}{(P_i^* e_i)^{\omega_i}}$$

Given how it is constructed, an increase of the REER implies a loss in competitiveness. The indicator is conditioned on the selected number of trading partners and of outlet markets, on the chosen weighting scheme and, even more so, on the adopted deflator. No consensus on the ideal price-competitiveness measure has been reached from a theoretical standpoint since the seminal contribution by Armington (1969), which derived the optimal weighting system for REERs, leaving however open the choice of the deflator.

According to the type of deflator used, REERs may be either price- or ULC-based. In particular, the following deflators are commonly used, each of which notably has both general advantages and shortcomings as for the measurement of a country's external competitiveness:

- Consumer price indices (CPIs) are available on a monthly basis and are constructed with fairly homogeneous methodologies across countries. They include services, as well as goods, and are available for all advanced and a large set of emerging economies. For these reasons, they have been adopted by the European Commission within the newly set-up Macroeconomic Imbalance Procedure. Yet they focus solely on consumer goods, hence excluding capital and intermediate goods, are subject to distortions owing to fiscal measures and they also include imported goods and services.

- Producer price indices (PPIs) too are monthly indicators and they are less affected by taxes and subsidies than CPIs. They refer to all categories of manufactured goods (consumer, intermediate and capital), focusing therefore solely on tradables, but omit any information on services. Moreover, according to data availability across countries, they may refer solely to goods sold in domestic markets, as opposed to total sales.

- GDP deflators refer to all sectors and to all types of goods and services, but they are not fully comparable across countries due to the controversial measurement of services' activity and are subject to significant composition effects between the public and private sectors. Moreover, they are available on a quarterly basis with a significant delay relative to the reference period and may be subject to significant revisions.

- Unit labour costs in manufacturing (ULCMs) refer solely to one sector, which however produces tradable goods. They ignore additional components of production costs, so that their evolution may be affected by the possible substitution between material inputs, labour and capital. Furthermore, they are available on a quarterly basis mostly for advanced economies, while their publication is either missing or subject to considerable delay for most emerging ones.

- Unit labour costs in total economy (ULCTs) on the one side comprehensively include all sectors of the economy, so are less affected by input substitution (as possible changes in sectoral interlinkages become irrelevant); on the other side, they share the remaining drawbacks of ULCMs, in addition to the possible bias due to the tricky measurement of services' activity and to potentially large sectoral composition effects[4].

Although CPIs are available for the largest number of countries, PPI- and ULCM-based REERs are often monitored since they closely track price and cost conditions in industries that are traditionally

[4] A further, theoretically attractive deflator refers to export prices, which by definition are attached solely to traded goods. However, they are subject to significant limitations as they are often measured in terms of export unit values, therefore resulting poorly comparable across partners owing to their dependence on the country-specific pattern of trade (Neary 2006). More recently genuine export price indices are becoming available for some countries, but their number is still limited and the time series are short.

more open to international trade. However, given that services represent an ever larger share of total activity in advanced economies and that they play an increasing role in international exchanges, ULCTs and GDP deflators have also been frequently employed more recently.

Therefore, empirically all indicators have been, and continue to be, used. In normal circumstances, within a reasonably stationary productive environment, they should provide a consistent picture, at least in the long run. If this is not the case, one is bound to conclude that some of the above-mentioned drawbacks has become particularly relevant. In the current context of intense globalization, the issues related to ULCM-based REERs appear to prevail, as we show further on.

3. Recent trends in price-competitiveness indicators in the main euro-area countries

In the four largest economies in the euro area since the late Nineties the difference between alternative REERs has increased, after moving more closely together in the past (Fig. 1). The signals are particularly conflicting for Italy, where ULCM-based REERs diverge from all the other indicators, which instead depict a broadly consistent picture.

For all the countries considered, the size of the dispersion of the different indicators (measured by the yearly standard deviation) is currently above its long-term average (Fig. 2; left-hand side panel); in particular in Italy it has risen incessantly since 2002 and is now standing around its historical high. Notably, when excluding the ULCM-based indicator, the dispersion across Italy's indicators is approximately reduced to a third and currently stands around its long-run average, whereas the impact of this exclusion is more negligible for the other countries (Fig. 2; right-hand side panel); furthermore, the standard deviation computed for Italy becomes the lowest of the four economies considered in recent years.

Policy implications from alternative indicators may be largely different. Concerning Italy's price-competitiveness trends, the ULCM-based REER signals a large loss of 33.9 percentage points since the inception of the EMU, against a deterioration of 2.8 and 2.7 p.p. in France and Spain, respectively, and a gain of 14.1 p.p. in Germany (Table 1). In contrast, a very different picture for Italian exporters may be depicted on the basis of all other indicators. The total unit labour cost (ULCT) measure reveals a smaller loss in price competitiveness in the overall period (7.1 p.p.), although the gap *vis-à-vis* its German partners remains sizeable (over 23 p.p.). According to PPI indicators, since the onset of 1999 Italy's price competitiveness has deteriorated only marginally (by 0.3 p.p.), compared with an 11.7 p.p. loss recorded in Spain and relatively moderate gains of 6.1 and 9.4 in France and Germany, respectively. The overall loss for Italian exporters proves slightly higher based on GDP deflators and on CPIs (1.3 and 2.6 p.p., respectively), yet significantly more contained relative to ULC-based measures.

Turning to the other largest euro-area countries, in Section 1 we have already referred to the Bundesbank's cautious interpretation of unfavourable ULCM-based indicator trends in Germany over the period 1975-1998. In more recent years, captured by Fig. 1, this measure registered a troubling, yet isolated, hike in 2009. Indeed Germany's ULCMs increased in 2009 owing to a strong drop in labour productivity, in turn due to an exceptional contraction in manufacturing value added[5]. The dispersion across price-competitiveness indicators for Germany over the past twenty years is the highest of the four countries, when excluding the ULCM-deflated REER; yet overall all measures point to a substantial gain in price competitiveness in Germany as of 1999, ranging between 7.2 and 16.1 p.p..

[5] In 2009 manufacturing value added in Germany dropped by over 20% y-o-y (relative to about 17 in Italy, 12 in France and 6 in Spain); hourly labour productivity in manufacturing fell by 13% in Germany (against a decline of under 7 in Italy and rises of 1 and nearly 2 in France and Spain, respectively).

France's indicators display the lowest dispersion amongst the four countries under study, with price-based measures however signaling a moderate gain in price competitiveness since the inception of the EMU and ULC-based indicators pointing to a contained loss.

In the ten years after the introduction of the euro, Spain's ULCM-based indicator marked a strong increase (approximately 38 p.p.), distancing itself from the other measures, similarly to the Italian case. However, conversely to Italy, since the global recession in 2008 the strong adjustment process undertaken in the Spanish labour market has led to large labour productivity gains, which in turn have improved the latter country's price competitiveness, measured by the ULCM-deflated indicator[6]. Currently, Spain's ULC-based measures record larger competitiveness gains than the price-based indicators by around 10 p.p..

The diverging signals of alternative price-competitiveness indicators bring on the need to further analyze their drivers. In particular, it is sometimes argued that the conflicting developments of ULCM- and PPI-based REERs in Italy shows that domestic industrial firms have long been squeezing their margins to offset the increasing pressures coming from labour costs; as more pressure is apparently in the pipeline, so the story goes, this could add concern about a dramatic loss in competitiveness in the near future as margin restraints may not be further sustainable. A glance at Italy's institutional sector accounts however suggests that in the years 2003-2007, in which the ULCM-based REER sky-rocketed, the profit rate of non-financial corporations marked only a moderate decrease, of around 2 p.p. in the overall period. In the following sections we put forward further arguments to show that an alarming reading of the ULCM- and PPI-based indicator discrepancy in Italy is not warranted, also by explaining trends in its three main trading partners.

4. Explaining recent developments in Italy's ULCM-based indicator

It can be argued that ULC-based indicators are preferable in that they ideally capture developments of a country's external competitiveness which are sustainable in the medium term, disregarding the temporary adjustments in profit margins that may affect a price-based REER (e.g. see the discussion in ECB 2003, p. 70). However, this argument is correct only if the former indicator can be considered to reliably control for all the main components of production costs. This condition is easily met in a stationary environment in which factor shares do not change significantly. In contrast, the recent intense globalization of production processes has led to major changes in the shares of labour, capital and intermediate goods on the value of industrial output, thus reducing the representativeness of wages in terms of total production costs within a country. Even more relevant for competitiveness measures, which hinge on *relative* trends in both the domestic economy and the main partners, is that the reduction may proceed at a different speed in individual economies: the risk that the ULCM-based REER results in biased assessments of a country's competitiveness hence increases.

In order to assess the economic explanation of the different behaviour of ULCM- versus PPI-based REERs, it is useful to gauge the long-run correlation between producer prices and labour costs in each country's manufacturing sector. A visual inspection of the two series shows different results within each country: over the last two decades, they move very closely in Italy and, to a large extent, in Spain, less so in France and appear to be unrelated in Germany since at least the mid-2000s (Fig. 3)[7].

[6] Over the 2008-2013 period Spain's hourly labour productivity in manufacturing increased by 24% against rises of 14 in France, 6 in Germany and 2 in Italy.

[7] As ULCMs are usually calculated as the ratio of the wage bill to value added and PPIs refer to gross production, it could be argued that the discrepancy between the two deflators may reflect the different treatment of intermediate inputs (excluded and included in the respective measure of activity). However, as shown in research in progress within the

A more formal test is presented in Table 2, which reports the results of simple cointegrating regressions for each country. A sound long-run relationship between PPIs and ULCMs shows up only for Italy, where the cointegration hypothesis cannot be rejected with reasonable confidence. Besides Spain, for which the short time-span may affect the results as data on ULCMs are available since 2000, a long-run co-movement is rejected for Germany and France. In fact, a glance at residuals points to a deterioration in the relationship between PPIs and ULCMs in the latter two countries since the mid-2000s, while in Spain the discrepancy widened after the start of the global crisis (Fig. 4).

Secondly, we ran a simple numerical simulation in order to shed light on why Italy's ULCM- and PPI-based REERs diverge so significantly, notwithstanding the co-movement of the underlying domestic deflators in the long run. In particular, we built artificial price-competitiveness indicators for a limited number of trading partners, namely country A, B and the Rest of the World (RoW), under the following assumptions: *(i)* nominal exchange rates are fixed; *(ii)* country B is a major trading partner of country A, whereas the weight of country A in country B's trading basket is much smaller (as is the case of Italy and Germany, respectively); *(iii)* trends in PPIs and ULCMs are broadly similar in country A, whereas the dynamics of ULCMs are more contained than those of PPIs in countries B and RoW (as is again the case of Italy and Germany, respectively); *(iv)* trends in ULCMs are lower in countries B and RoW than in A; developments in PPIs are similar across the three countries (as seen in Fig. 3 again for the cases of Italy and Germany). The assumed growth rates and weights of each country in its counterpart's basket of trading partners are reported in Fig. 5[8].

In this simplified setup the workings of the basic arithmetics of REERs may be clearly shown. Focusing on a comparison between countries A and B, firms in country A suffer from lower ULCM than PPI growth in both their partners (B and RoW), while country B exporters on the one side face only one partner (RoW) with more contained ULCM relative to PPI growth and on the other side directly gain from their lower domestic ULCM dynamics than PPIs. As a result, *i)* the discrepancy in the PPI-based REERs of the two countries is limited, but *ii)* the ULCM- versus PPI-based REERs in the former country show a larger disconnect than in the second country.

What are the reasons for the divergence of PPIs and ULCMs in Germany (the country where it is most evident in recent years among Italy's partners)? A full explanation is beyond the scope of this paper. However, one may conjecture a few alternative stories. On the one hand, there may be a role for an expected convergence in the wage share owing to the initially high levels reached in Germany in the early Nineties, possibly as an effect of the country's reunification. On the other hand, yet partly related to the previous argument, a key factor could trace back to the intense internationalization of production that came hand in hand with an increasing use of intermediate inputs, even more so in relevant manufacturing sectors[9]. Less pronounced offshoring in Italy, and therefore less sizeable changes in Italy's manufacturing shares of wage and intermediate goods can explain the stability of the relation between its prices and labour costs. This is confirmed by the observation that the use of material intermediate goods has increased significantly in Germany from

Bank of Italy, when ULCMs are assessed with respect to *gross* production their trends in countries such as Germany are not particularly different from those based on value added.

[8] The numbers we plugged into the simulation are based on actual deflator trends in Italy, Germany and "Rest of the world" and assumed weights for the same economies. The exercise is robust to alternative growth rates, providing the listed assumptions hold.

[9] This conjecture is consistent with the so-called "bazaar economy" hypothesis advanced by Sinn (2005), according to which "*more and more German industrial firms are shifting labour-intensive portions of their value added chain to foreign subsidiaries (offshoring) or buy intermediate products from subcontractors abroad (outsourcing) in order to escape the high German labour costs. Germany expands its position as world bazaar (…)*". Between the mid-1990s and the eve of the financial crisis, in Germany the share of intermediate inputs in total gross production scored a net increase in leading industrial sectors such as transport equipment (from 71 to about 75%) and chemicals (from 66 to 70%).

1995 to 2005, whereas it has been relatively stable in Italy (Fig. 6)[10]. Wage shares have also witnessed a general fall since the mid-Nineties, that has been particularly impressive in Germany's manufacturing sector, especially in the 2000-2007 period. In Italy the drop in its wage share was more contained with respect to its trading partners, hence pushing up its ULCM-deflated competitiveness measure[11]. Given the comparable trends of PPIs in Germany and Italy, in the former country an offsetting increase of other cost components could be in place, due for instance to the need of advanced managerial skills in the numerous productive plants located abroad.

Given the fading representativeness of labour costs in the manufacturing sectors of advanced economies, relying solely on ULCM-based indicators may provide a biased assessment of price competitiveness. Price-based indicators seem to convey more reliable signals. This assessment is further investigated in the empirical analysis developed in the following sections.

5. The baseline trade flows model: data, results and robustness checks

In order to appraise the respective role of alternative price-competitiveness indicators in explaining trade flows of the four countries under study, we estimated standard reduced-form dynamic trade equations. The standard formulation for the export and import equations is based on the partial equilibrium model of international trade presented in Goldstein and Khan (1985); a more recent review of this modelling approach is Sawyer and Sprinkle (1996).

In particular, the baseline export equation takes the following form:

$$(2)\quad \Delta x_t = \beta_0 + \beta_{1i}\sum_{i=1}^{4}\Delta x_{t-i} + \beta_{2i}\sum_{i=0}^{4}\Delta reer_{t-i} + \beta_{3i}\sum_{i=0}^{4}\Delta fd_{t-i} + \varepsilon_t\,,$$

where real exports *x* are regressed against a selected price-competitiveness indicator (*reer*) and foreign demand (*fd*). A rise in price competitiveness (measured by a decline in the REER) and/or in foreign demand is expected to support export growth.

The baseline import equation is instead:

$$(3)\quad \Delta m_t = \delta_0 + \delta_{1i}\sum_{i=1}^{4}\Delta m_{t-i} + \delta_{2i}\sum_{i=0}^{4}\Delta x_{t-i} + \delta_{3i}\sum_{i=0}^{4}\Delta reer_{t-i} + \delta_{4i}\sum_{i=0}^{4}\Delta dd_{t-i} + \eta_t$$

where real imports (*m*) are regressed against real exports (*x*), owing to the significant import content of exports, a selected price-competitiveness indicator (*reer*) and domestic demand (*dd*). An increase in exports and/or in domestic demand should boost imports, whereas a rise in competitiveness could have an opposite effect on imports as it makes domestic goods cheaper relative to imported merchandise.

The empirical literature has often focused solely on the export equation (for instance, Ca' Zorzi and Schnatz, 2007; European Commission, 2010; Bayoumi et al., 2011) or on the import equation (for example, Barrell and Dées, 2005; Stirböck, 2006; Bussière et al., 2013) with only a few studies estimating both models (Hooper, Johnson and Marquez, 1995; Allard et al., 2005; Martinez-Mongay and Maza Lasierr, 2009). We estimated both export and import equations over a longer time horizon than many existing studies, in particular including the period subsequent to the

[10] Disaggregated data on intermediate goods (energy, materials, services) come from the EUKLEMS database, where they are only available until 2005 as for the sole materials. We focus on the latter since they might be a close proxy for imported materials as we consider intermediate inputs of the manufacturing sector as a whole.

[11] Between 2000 and 2007 the ratio of gross operating profit to value added for non-financial firms in Germany increased by 6 p.p. (to 42%), starting from a comparatively low value. In Italy it fell from 47 to 43%; in France it remained essentially unchanged.

outbreak of the recent financial crisis, and referring to a four-country sample (Italy, Germany, France and Spain), as opposed to the euro area as a whole[12].

Our dataset is built using quarterly national account data of the volume of exports and imports of goods over the period 1993Q1-2012Q4 (last period for which all variables were available)[13]. Imports of goods for Italy were netted of energy products[14]. We alternately included in our equations the five price-competitiveness indicators from ECB and Bank of Italy sources. Foreign demand of goods for Italy is computed as the weighted average of real imports of goods of Italy's 75 trading partners, where the (rolling) weights represent Italy's export shares in the previous three-year period (Bank of Italy calculations on IMP-WEO, Istat and CPB Netherlands data); for Germany, France and Spain world demand of ECB sources was used[15]. Domestic demand is taken from national accounts data (Istat, Eurostat).

Since we find evidence of non-rejection of the unit root hypothesis for all key variables, first differences were taken as shown in equations (2) and (3). We estimated our export and import equations both separately via Ordinary Least Squares (OLS) and, for a robustness check against a possible endogeneity bias, as a system of two equations via Full Information Maximum Likelihood (FIML). Results were very similar in all cases and, for the sake of brevity, we chose only to present the OLS estimation results[16]. Since variables are expressed in logs, coefficients may be interpreted as elasticities.

Table 3 provides the baseline export equation results. All estimated coefficients present the expected signs and are statistically significant, generally explaining more than half of the variance of the dependent variable, with the exception of the lower fit of the equation for Spain (which has an adjusted R-squared of 0.4). Although four lags of both the dependent and explanatory variables were originally included in the regression, only contemporaneous determinants prove to be significant; the lagged variables, including the dependent variable, were therefore dropped from the model specifications. The sole exception regards price competitiveness in Italy, which shows a more persistent effect than in the other main countries of the euro area and a larger overall size, thus confirming the higher vulnerability of Italian firms to both currency appreciation and to the competitive pressures from emerging countries.

Taking into account that the alternative specifications of the export equation differ only by the selected competitiveness indicator, we find that the difference between the two classes of measures in Italy is statistically significant, with the explained variance marginally higher when the price-

[12] Research currently under way at the ECB (Christodoulopoulu and Tkacevs, 2014) also estimates both equations, considers a time-span only two years shorter than ours and focuses on the complete sample of euro-area countries.

[13] The share of goods on total exports on average over the period 1999-2012 is 85% in Germany, 81 in Italy, 79 in France and 68 in Spain. The higher percentage of service exports in the latter country relative to the former economies is largely due to the significant impact of its tourist industry. The fit of our baseline models is unsatisfactory when service flows are employed as the dependent variable. This result is unsurprising considering the fact that for example price-competitiveness indicators are weighted on the basis of merchandise trade flows. Research under way at the ECB is aimed at building new price-competitiveness indicators, adjusted for service flows; see Christodoulopoulu and Tkacevs (2014) for results concerning trade in services based on these new measures.

[14] In particular, on the basis of Istat monthly trade volume data, available as of 1996, we computed the quarterly share of non-energy imports on total merchandise imports; we assumed the shares from 1993Q1 to 1995Q4 to be equal to the 1996Q1 share in order not to reduce our number of observations. We then multiplied the national account import series by this series. We were not able to conduct the same refinement for Germany, France and Spain, as only series at current prices are available; differences between current and constant price shares for Italy, for which both are available, are large. Possible deflators, such as the import price indices of energy products, are only available since 1999 for France, 2000 for Germany and 2005 for Spain, thereby excessively constraining our time-span.

[15] Since the ECB world demand series are available as of 1995Q1 we backcast the series to 1993Q1 by using CPB Netherlands world trade data.

[16] We adopted the Newey-West estimation method in all our regressions in order to obtain heteroskedacity and autocorrelation (HAC)-consistent standard errors.

based measures are adopted. For a sounder control, we implemented a pair-wise encompassing test, similarly to Clostermann (1998) and Ca' Zorzi and Schnatz (2007). We first included all possible pairs of REERs simultaneously into the estimation, then the ones that had the highest p-value were dropped. In all possible combinations, the ULCM- and ULCT-based measures were over-performed by price-based indicators. According to price-based measures, the long-run price elasticity of Italian exports, roughly computed as the sum of the estimated contemporaneous and lagged coefficients, would be approximately 0.8[17].

These results are not confirmed for the remaining countries. In the case of Germany the explained variance is higher in the ULC-based indicator equations relative to the price-based ones; elasticities range between 0.3 and 0.4. Moreover, price-based indicators are statistically insignificant when included in the export equation together with ULC-based ones, according to a pair-wise encompassing test. In France price-based measures are not significant at a 10 per cent confidence level, whereas ULC-based indicators are significant, with elasticities of approximately 0.4[18].

The case of Spain stands out as an outlier, since export performance appears to be insensitive to both contemporaneous and lagged changes in all price-competitiveness indicators. This finding is consistent with the "Spanish paradox" (see, for example, Cardoso, Correa-Lòpez and Doménech, 2012), according to which over the period 1999-2007 Spain's export market shares remained broadly stable, notwithstanding the deterioration in price competitiveness[19]. Accordingly, non-price competitiveness factors (firm characteristics, market strategy and financial factors) are claimed by the existing literature to have played a key role in driving Spanish exports, thus providing a plausible explanation to the lower fit of our baseline export equation for Spain.

This first piece of evidence therefore suggests that price-competitiveness indicators play a significant role in explaining exports in three out of four countries of our sample, with price-based indicators having a greater explanatory power for Italy, as opposed to a stronger role for ULC-based measures in Germany and France. Potential demand contributed positively to export growth in all four countries, as expected; the coefficients linking these two variables are not significantly different from unity (according to Wald coefficient tests), which would suggest stable export market shares of the countries in our sample, barring changes in REERs. Germany presents a marginally larger elasticity of exports to foreign demand, possibly reflecting its stronger manufacturing vocation[20].

Table 4 provides our baseline import equation results, which point to a larger goodness of fit of the model in the case of France and Spain (the adjusted R-squared is greater than 0.8 for these countries against over 0.6 for Italy and Germany). Owing to the high import content of exports, import growth reacts positively to contemporaneous changes in total exports in all four countries. Whereas elasticities are on average around 0.4-0.5 in Italy, Germany and France, they are higher for Spain (0.7 approximately). This evidence is consistent with computations in Amador, Cappariello and Stehrer (2013), which point to a higher share of foreign value added in exports since 2000 in Spain relative to the other three countries. Domestic demand also plays a key role in activating imports, with an elasticity far greater than unity across all countries. To explain why imports expand more rapidly than domestic demand, Strauss (2000), among others, points to the increasing liberalisation of trade, ongoing international division of labour and the growing significance of intra-industry

[17] This rough computation is possible owing to the fact that the lagged dependent variable is not significant as an explanatory variable.

[18] Hooper, Johnson and Marquez (1998) also confirm lower (below 0.5) price elasticities for Germany and France and a higher (0.9) elasticity for Italy, although their estimation period is prior to ours (1970-1996).

[19] Note however that Cardoso, Correa-Lòpez and Doménech (2012) compute export market shares on the basis of world trade; in our regression analysis we employ potential demand.

[20] Since 2000, year as of which disaggregated Spanish value added data are available, the share of manufacturing value added in total economy output has been on average 21.8% in Germany, 17.7 in Italy, 14.8 in Spain and 12.2 in France.

trade. Some studies have however warned of an overestimation of this coefficient, both in single and panel regressions (see, for example, Strauss, 2003; Barrell and Dées, 2005); we will return to this issue in Section 7.

Also on the import side, the link between REERs and trade performance varies across countries and across indicators. Italian imports react positively to both (lagged) price-based and ULCM-based competitiveness indicators[21]. In Germany and Spain imports are insensitive to REERs[22], whereas in France they are significantly and positively correlated only to the (lagged) ULCM-deflated measure.

Finally, we conducted a wide range of sensitivity analyses on our equations, which confirmed our results were robust to various alterations to our baseline models.

First, we included various additional control variables in our baseline equations. In particular, in the export equation the inclusion of the volume of imports of intermediate goods, as in European Commission (2010), which we constructed employing Eurostat monthly trade data, does not affect our baseline results, since the variable is found to be insignificant across the board. We also introduced domestic demand in the export equation, which could affect export performance from the supply side, conversely to foreign demand which acts on the demand side. This variable is not significant for Italy[23]. It is however significant for Germany and Spain across most price-competitiveness specifications and for France in the case of the ULC-based indicator specifications[24]. In all these cases, the sign of the coefficient is negative, pointing to a possible substitution effect between export and domestic demand growth. In the import equation the capacity utilization rate, measured on the basis of quarterly European Commission survey data, is significant only in the case of France, where it drives up imports (as in Allard et al., 2005).

Secondly, an EMU additive dummy taking value 1 as of 1999Q1 (as in Bayoumi et al., 2011) is not significant in any of the specifications, nor are its interactions with the explanatory variables. A crisis dummy taking value 1 as of 2007Q3 is also not significant, nor are its interactions with the independent variables. Limiting the analysis to the 1995Q1-2012Q4 period to net out possible distortions of the 1992 devaluation does not change our results. Moreover, linear trends do not enter significantly in the equations.

Thirdly, non-price competitiveness factors are not available on a quarterly basis, although their relevance in explaining export dynamics is beyond doubt (in particular in the case of Spain, as mentioned earlier). The lack of non-price indicators would explain why on average the adjusted R-

[21] Owing to the instability of the relative coefficient, according to the number and order of lags considered, we employed a three-term moving average of price-competitiveness indicators for the four countries. All results for Italy's import equation are confirmed when considering total merchandise imports, in analogy to the dependent variable employed for Germany, France and Spain (as mentioned in footnote 14), thereby ensuring comparability of findings across countries in Table 4. In particular, the elasticities of Italian imports to price competitiveness and to domestic demand are slightly smaller in the case of total (against total net of energy) flows; moreover the ULCT-based indicator becomes significant at a 10% level of confidence when total imports are employed as the dependent variable.

[22] In particular, many existing empirical studies confirm an insignificant price elasticity of the German import demand (see Stirböck, 2006 for a review).

[23] This result is in line with the empirical findings based on Italian firm-level data provided in Bugamelli, Gaiotti and Viviano (2014), according to which during the overall period 2001-2012 domestic and foreign sales in Italy were not significantly correlated. However, in the 2001-2007 sub-period the correlation in Bugamelli, Gaiotti and Viviano (2014) is found to be negative, implying binding constraints to production capacity, and in the 2008-2012 period it turns positive, suggesting the relevance of economies of scale or of the presence of credit constraints. Based on our data, domestic demand is confirmed to be insignificant in the two sub-periods 2001-2007 and 2008-2012, but it is found to be significant and with a negative sign in the years 1993-2000.

[24] Martinez-Mongay and Maza Lasierr (2009) also find a significant and negative impact of contemporaneous domestic demand growth on Spanish exports in the longer period 1970-2007, yet find no significant relationship in the case of Italy, Germany and France.

squared measures do not exceed 0.6-0.7 in our exercises. We refer to the next Section in an attempt to tackle this issue.

Finally, we face the question of parameter stability in our international trade equations in the long-run. We provide results only for Italy, for which we can extend our dataset back to 1980. In particular, we joined several vintages of quarterly Istat national accounts data in order to obtain a long-run series of merchandise exports and imports as of 1980. Competitiveness indicators deflated by producer prices are also available since then; conversely, all alternative price-competitiveness measures are not available over such a long time-span.

Figure 7 presents the coefficients of our baseline export equation for Italy, estimated via a rolling window regression, with a bandwidth of 20 years in order to guarantee a sufficient length of each sample. Our findings point to Italy's exports being more reactive to potential demand since the late 1980s. The long-run price elasticity of exports, roughly computed as the sum of the contemporaneous and lagged coefficients of the price-competitiveness indicator, is instead broadly stable over the whole period, presenting no evident sign of shifts. Figure 8 presents the coefficients of our baseline import equation[25]: the sensitiveness of Italy's imports to the PPI-based competitiveness indicator has only marginally increased over time.

6. Readdressing the export equation in our sample of countries

Non-price factors are known to affect a country's export performance alongside price competitiveness. These factors encompass a wide range of determinants, including product quality, technological advantage, industry specialisation, the efficiency of sales networks, the business environment, after-sales services and export firm characteristics. In the existing empirical literature various yearly technological and structural indicators have been employed to measure non-price competitiveness, for example the share of R&D expenditure in GDP, the number of manufacturing patents, the number and cost of contract enforcement procedures, the share of outward and inward FDI in GDP, services TFP contribution to value added growth (see Fagerberg, 1988; European Commission, 2010; ECB, 2012).

In order to capture the effect of quarterly non-price factors in the export equation, we tested for the significance of (relative) total factor productivity (TFP); in the literature, (absolute) TFP is often employed to proxy the efficiency in the organization of productive factors and, more generally, the efficiency of an economic system in a broader perspective (including the effectiveness of research and innovation). Total economy TFPs were used in our empirical investigation, for two reasons: *a)* in order to control for the quality of productive externalities also in the non-tradable sectors, which weigh on the performance of tradable goods (Barone and Cingano, 2011); *b)* in order to moderate the risk of simultaneity bias that would have derived from using manufacturing TFP, which partly drives both ULCMs and PPIs used in the price-competitiveness measures [26].

We started by linearly interpolating at the quarterly frequency the annual estimates of TFP produced by the European Commission, using a harmonized methodology, for all 26 countries included in the ULCM-based REERS, with the exception of China and Korea. For the latter we adopted the OECD source, whereas a long time series for the former country is unavailable so the country was dropped from the basket[27]. Under the limitation of a somewhat restricted geographical coverage, which adds

[25] Differently to our baseline import equation, given the longer time-span here, we were not able to net imports of energy products.

[26] We therefore excluded the ULCT-based price-competitiveness indicator due to the possible simultaneity bias coming from total economy TFP.

[27] For Italy data from the European Commission track our estimates very closely, differently from figures of OECD source (which adopt the same deflators of ICT investment as in the US for all countries). We also estimated quarterly

to the usual *caveat* regarding the measurement errors affecting the estimates of unobservable TFP, we experimentally built a quarterly relative TFP measure for each of the countries included in our sample. Relative data were obtained by adopting the same methods and weighting schemes used for REER calculations (24 countries considered in our basket; eq. 4).

(4) $$relativeTFP = \prod_{i=1}^{24} \left(\frac{TFP}{TFP_i^{w_i}}\right)^i$$

An increase in relative TFP thus points to an improvement in a country's position with respect to its main trading partners.

Trends in relative TFP for Italy draw an even bleaker picture than absolute TFP. The latter started declining in the early 2000s, as in Spain and differently from France and Germany (Fig. 9, panel A); since 2007 the Italian TFP has roughly followed the same trends as in the other countries with the exception of Spain, where TFP has been increasing since mid-2009, recently reaching its highest level in the period under analysis. By contrast, relative TFP has been declining incessantly since early 2000s in Italy, marking it the worst performing among the largest countries in the euro area (Fig. 9, panel B). France's indicator has only mildly deteriorated, whereas for Spain and Germany relative TFP has picked up in recent quarters.

Table 5 presents our export equations which now include the relative TFP indicator as a proxy of non-price competitiveness. We find that the variable enters significantly and with the expected positive sign, independently of the selected REER and across all countries, except France. In Italy the elasticity of relative TFP is approximately 1, lower than in Germany and, to a much greater extent, in Spain[28]. Notwithstanding the inclusion of this additional variable, the goodness of fit of the model, however, is roughly stable for these three economies, suggesting the need to further refine the measurement of the non-price dimension of competitiveness at a quarterly frequency in future research.

7. Readdressing the import equation in our sample of countries

In order to better understand the link between imports and price-competitiveness indicators, we controlled for changes in the import content of the single components of demand, that reflect the increasing participation of a country to global value chains.

For this purpose, we substitute exports and domestic demand in the baseline import equation with a measure of import-intensity adjusted domestic and external demand (IADD and IAXD, respectively):

(5a) $IADD_t = C_t^{\omega_{C,t}} G_t^{\omega_{G,t}} I_t^{\omega_{I,t}}$

(5b) $IAXD_t = X_t^{\omega_{X,t}}$

(5c) $IAD_t = IADD_t^{\omega_{IADD,t}} IAXD_t^{(1-\omega_{IADD,t})}$

TFP based on labour productivity, but we discarded these results owing to the expectedly pronounced cyclicality of the series.

[28] In the case of Spain, although elasticities to foreign demand have risen in this new model, a Wald test does not reject the null hypothesis of the coefficient being equal to unity in the price-based indicator specifications; the null is instead rejected in the case of the ULCM-deflated indicator equation. In the latter specification, when setting a long-run restriction on the potential demand variable (imposing a unitary coefficient), relative TFP loses significance. Our more reliable estimates of the elasticity of exports to non-price competitiveness, taken from the price-based specifications, are thus about 3.

i.e. weighted averages of total investment (I), private consumption (C), government expenditure (G) and exports (X), where the weights ($\omega_{i,t}$) are the import shares for the final demand component identified by *i*. The import share is given by the sum of a direct import component (the share of imported final goods and services per unit of final demand) and an indirect import component (the share of intermediate imported imports per unit of final demand). In Bussière et al. (2013), the import-intensity adjusted demand (IAD) is proved to explain imports better than standard aggregate demand (AD) in a panel of 18 OECD countries, both in recessionary and expansionary phases of the cycle. We test whether this result holds within the four countries we consider.

Demand component data are taken from Istat and Eurostat; the import contents are computed on the basis of the OECD Input-Output Database following Bussière et al. (2013)[29]. Since I-O tables are available only every five years, we linearly interpolated the weights to obtain quarterly series. For the period after 2005, when the latest vintage was released, we kept the weights fixed. Table 6 presents the average import content of aggregate demand components of the four countries under study over the 1993-2012 horizon. The ranking that emerges is quite intuitive: investment and exports are the most import-intensive components. In the case of the latter variable, this finding partly captures the internationalization of production processes. Government expenditure has a low import content, given that it generally includes goods or services which are not traded internationally.

Figure 10 compares the IAD with a standard measure of AD in the four countries of our sample. The IAD is more volatile, especially during recessions. In all countries and, in particular, in Italy and in Spain the drop in the IAD was significantly sharper than the corresponding fall in the AD in 2008-2009. The Great Trade Collapse of those years is therefore consistent with a strong contraction in domestic IAD, not fully captured by the AD.

Our adjusted import equation, in which we replace the export and domestic demand variables with their import-adjusted counterparts (*iaxd* and *iadd*, respectively), takes on the following form:

$$(6) \qquad \Delta m_t = \delta_0 + \delta_{1i}\sum_{i=1}^{4}\Delta m_{t-1} + \delta_{2i}\sum_{i=0}^{4}\Delta iaxd_{t-i} + \delta_{3i}\sum_{i=0}^{4}\Delta reer_{t-i} + \delta_{4i}\sum_{i=0}^{4}\Delta iadd_{t-i} + \eta_t$$

Differently from Bussière et *al.* (2013)'s results which refer to a panel of OECD countries, the fit of the import model does not improve for any of the four countries under study (Table 7). We find that the role of exports in explaining imports in Italy increases substantially relative to the baseline model. Conversely, domestic demand elasticities decrease across the sample, falling below unity in the case of Germany and Italy. This result is consistent with studies such as Barrell and Dées (2005), which find that by accounting for global integration in production processes the marginal elasticities of imports to domestic demand become smaller. The role of price-competitiveness indicators is confirmed to be significant and positive only for Italy, although the magnitude of the coefficients is slightly smaller than in the baseline import equation. Finally, as a robust check, by including also contemporaneous and lagged (up to four) changes in inventories (OECD source) as a percentage of GDP, these variables mostly prove statistically significant, albeit with negligible coefficients; the elasticities of other variables do not vary.

8. Conclusions

In view of the conflicting signals provided by alternative price-competitiveness indicators for some European countries, namely Italy, in the last twenty years, we show that in Italy PPIs and ULCMs have actually moved hand in hand since 1992, differently from the trends observed in the country's

[29] In this case for all countries we consider total imports, including energy goods.

main trading partners. Less pronounced offshoring in Italian manufacturing, and therefore less sizeable changes in the shares of wages and intermediate inputs on gross output, can explain the broad stability found in the long-run relation between its prices and labour costs. This piece of evidence suggests that the risk of a build-up of cost pressures on Italian firms, which would be forced to progressively squeeze their profit margins in order to keep up with their competitors in a strive to stay on the market, is more limited than suggested by some international commentators.

Next, by testing the alternative price-competitiveness indicators' information content to explain flows of exports and imports of the largest members of the euro area, we find they have a different role across countries. In particular, in Italy ULC-based competitiveness indicators have a significantly smaller impact than price-based ones on export dynamics. This result would confirm that the contribution of the loss of price competitiveness via increasing labour costs to Italy's export performance is likely to be more contained than feared. We also find that non-price competitiveness, proxied by a relative TFP measure, contributes significantly to export growth.

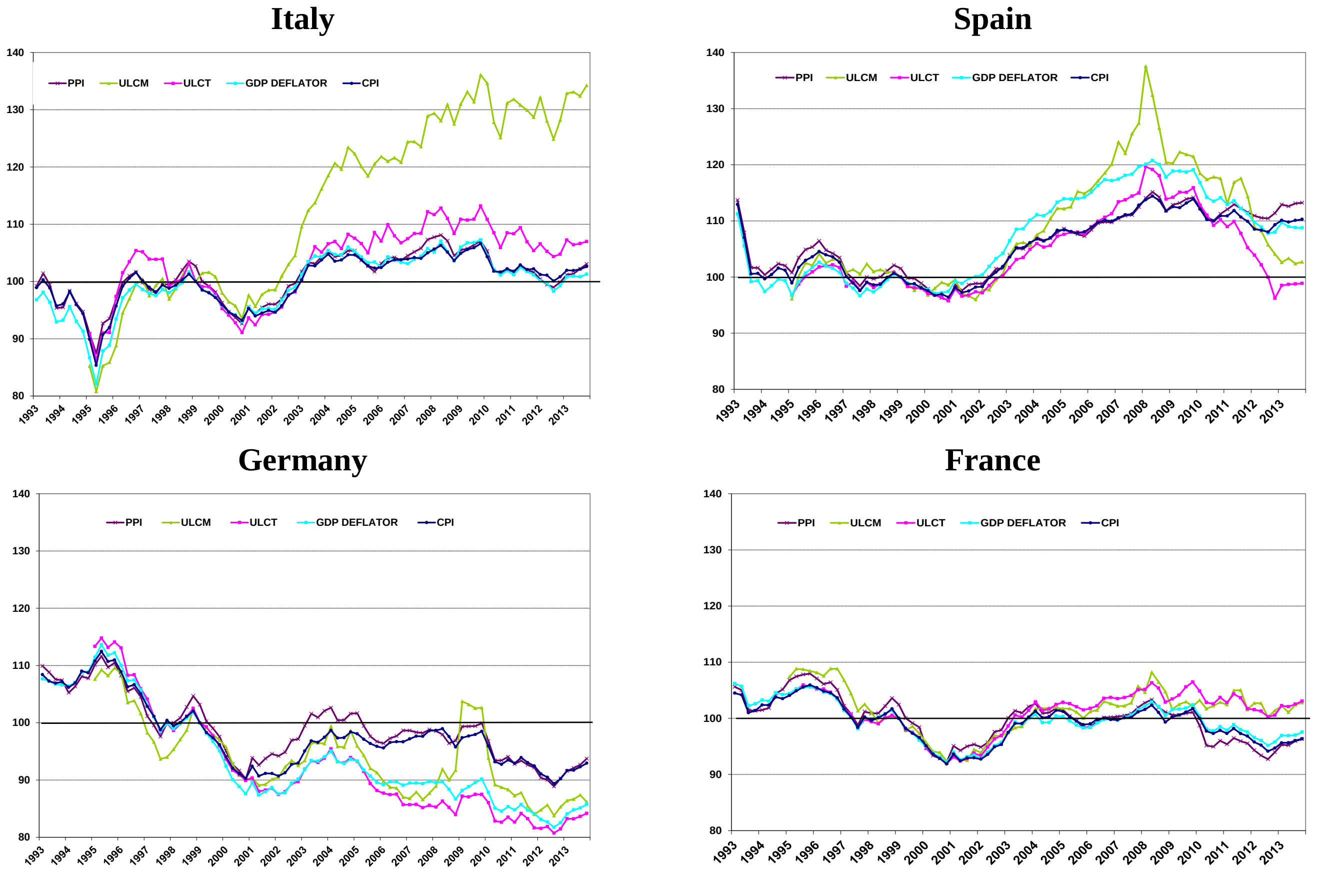
For the other countries under study results are mixed. Whereas all price-competitiveness indicators are equally relevant in explaining German exports, in France only ULC-based measures are statistically significant and none is relevant for Spain ("Spanish paradox"). In the latter country the role of relative TFP is particularly relevant, greater than in Germany, whilst it is irrelevant in France.

Turning to imports, price-competitiveness indicators prove statistically significant only in the Italian case. Exports and domestic demand are in general more relevant in explaining imports, in line with the existing empirical literature. When we adopt import-intensity adjusted measures of domestic and external demand, the elasticities of imports to domestic demand become smaller, confirming the most recent studies which take into account the internationalization of production processes,

All in all, our results confirm that price and non-price competitiveness significantly affect export performance, to a varying extent across the largest euro-area countries. As for Italy, we find that price-based REERs are better able to explain exports than ULC-based REERs, thus supporting a more cautious reading of the alarming loss in price-competitiveness signalled by ULCM-based measures. At the same time, the relatively dismal performance in Italy's relative TFP would call for an urgent action to lift the structural barriers restraining the ability of domestic firms to compete in the current environment of intense reorganization of production processes at a global level. Amongst the other economies, non-price competitiveness proves a crucial determinant of export growth in Germany and, even more so, in Spain; accordingly, also in these countries enhancing structural reforms would be a key policy action to nurture their export performance.

Figure 1. Alternative price-competitiveness indicators of the main euro-area countries

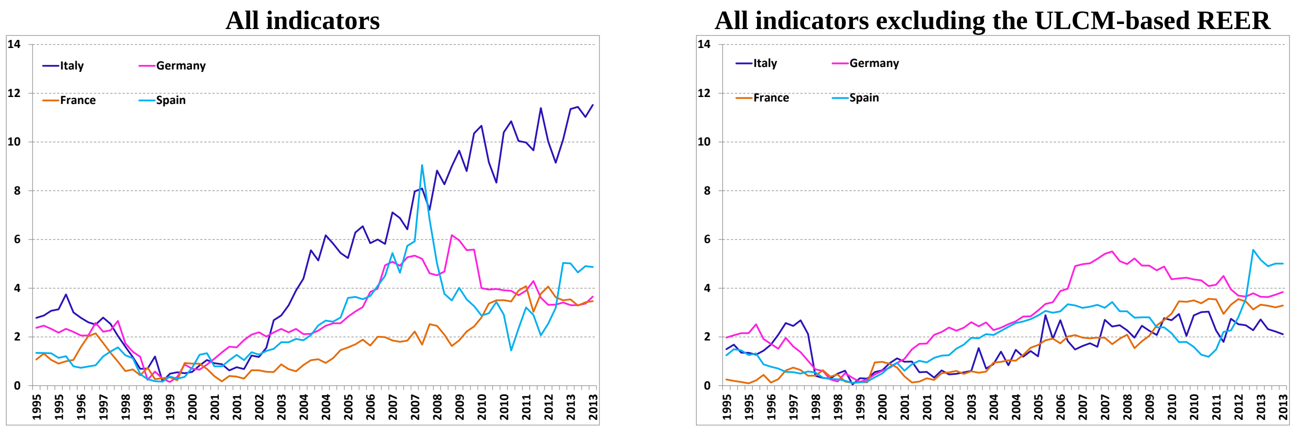
(average quarterly data; indices 1999=100)



Source: ECB and Bank of Italy.

Figure 2. The dispersion of price-competitiveness indicators of the main euro-area countries

(yearly standard deviations computed across the indicators in Fig. 1)



Note: The average standard deviations in the overall period 1995Q1-2012Q4 are: 5.2 for Italy, 2.9 for Germany, 1.7 for France, 2.5 for Spain.
Source: Calculations on ECB and Bank of Italy data.

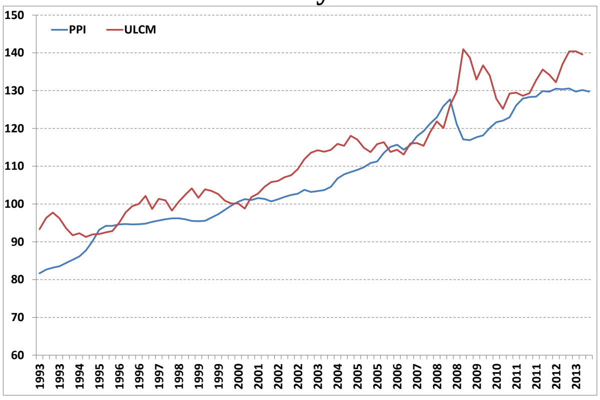
Note: The average standard deviations in the overall period 1995Q1-2013Q4 are: 1.6 for Italy, 2.8 for Germany, 1.5 for France, 2.0 for Spain.

Figure 3. Trends in producer prices and unit labour costs in the manufacturing sector

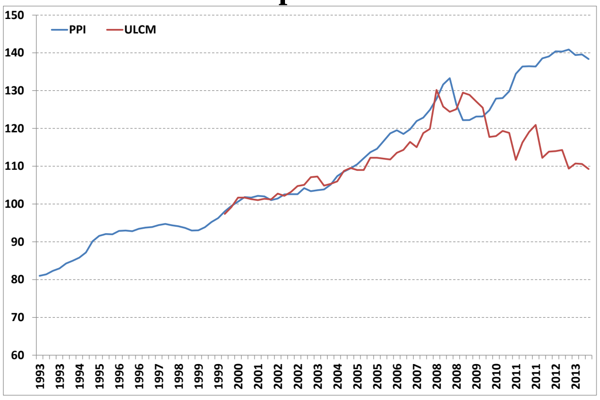
(average quarterly data; indices 2000=100)

Panel A: within countries

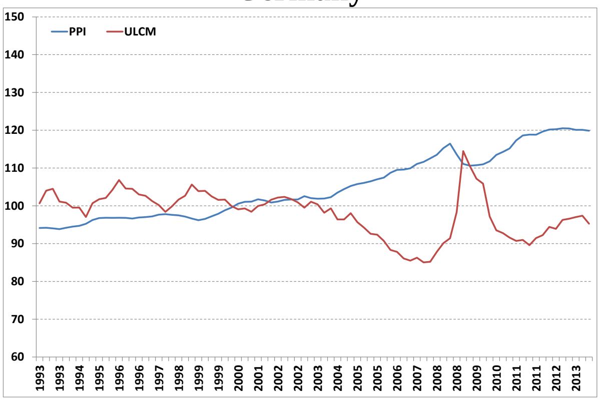
Italy



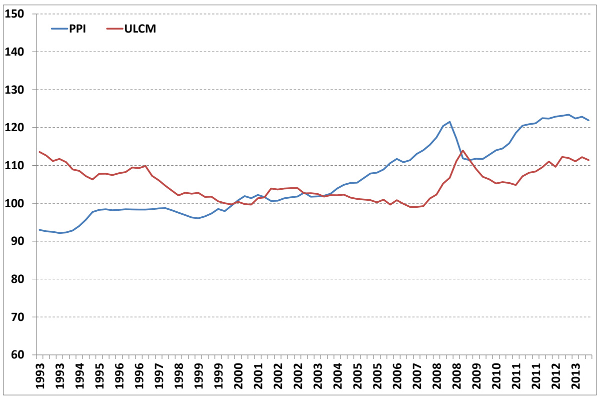
Spain



Germany

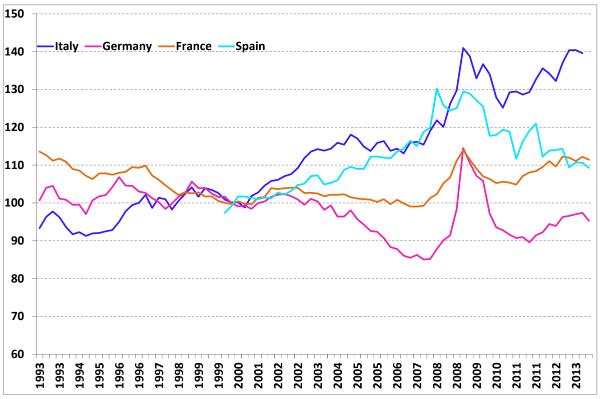


France

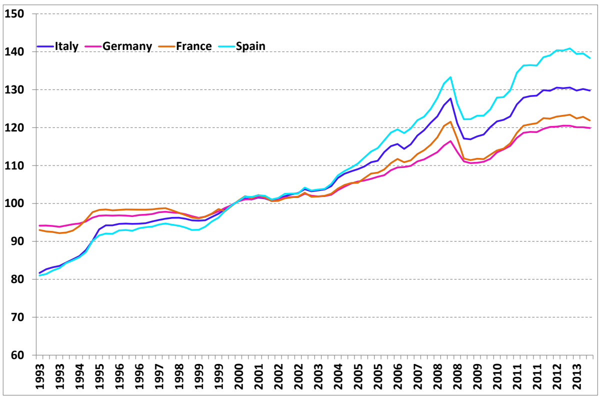


Panel B: across countries

ULCMs



PPIs



Source: ECB and Bank of Italy.

Figure 4. Cointegration residuals between producer prices and unit labour costs in manufacturing

(FMOLS regression of producer prices on unit labour costs; natural logarithms of indices 2005=100)

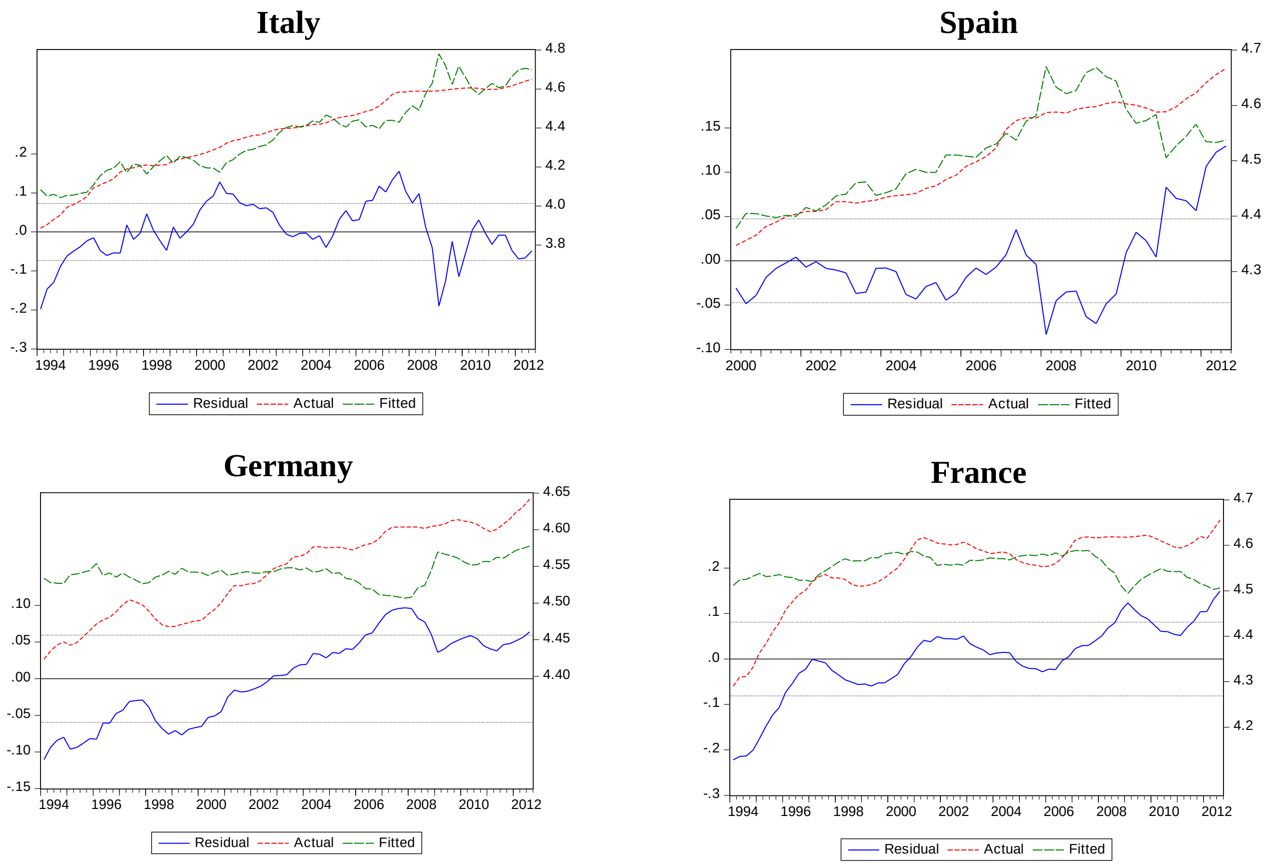
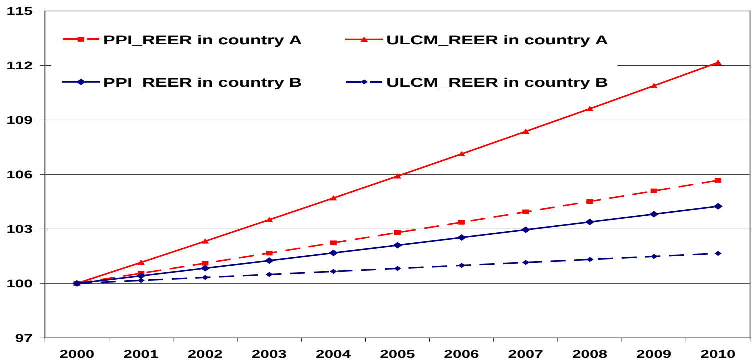


Figure 5. PPI- and ULCM-based price-competitiveness indicators in an artificial world

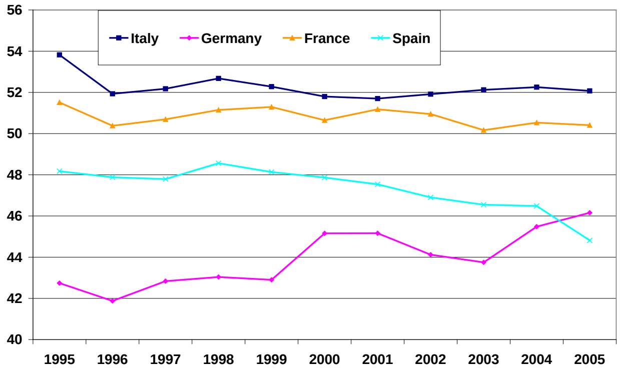
(average yearly data; indices 2000=100)



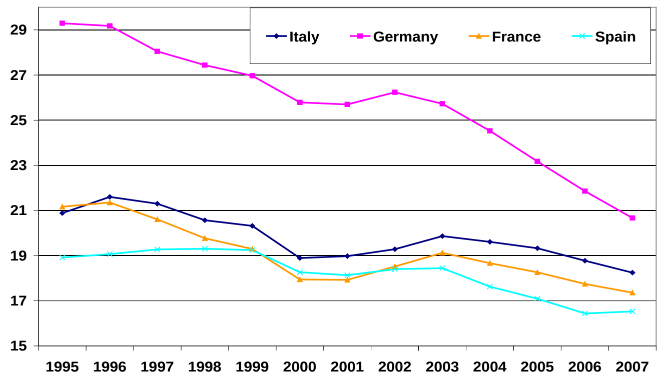
Notes: Assumed average growth rates: PPI_A=2.0%; PPI_B=2.1%; PPI_RoW=1.8%; ULCM_A=2.1%; ULC_B=1.5%; ULC_RoW=1.5%. Weights for country A: 18% country B, 82% RoW; weights for country B: 7% country A and 93% RoW.

Figure 6. Structural changes in the manufacturing sector
(current prices)

Shares of material intermediate inputs in gross output

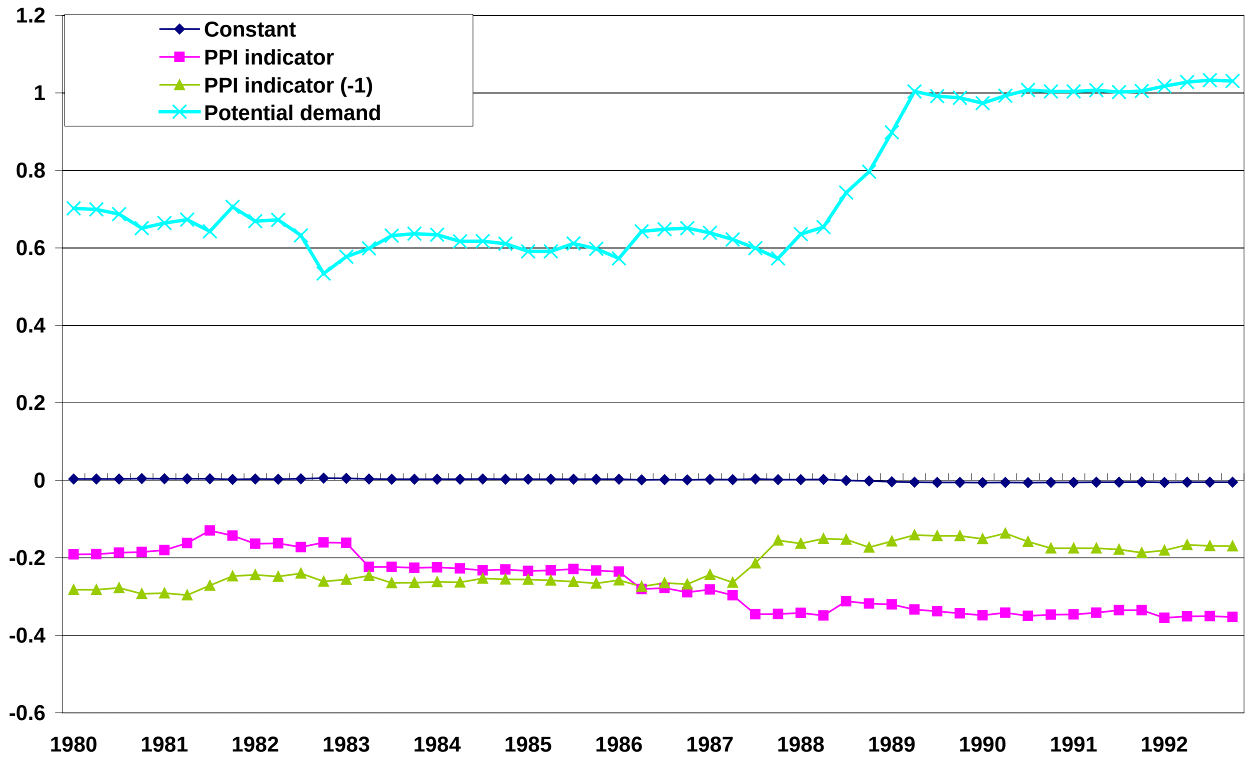


Wage shares (labour compensation on gross output)



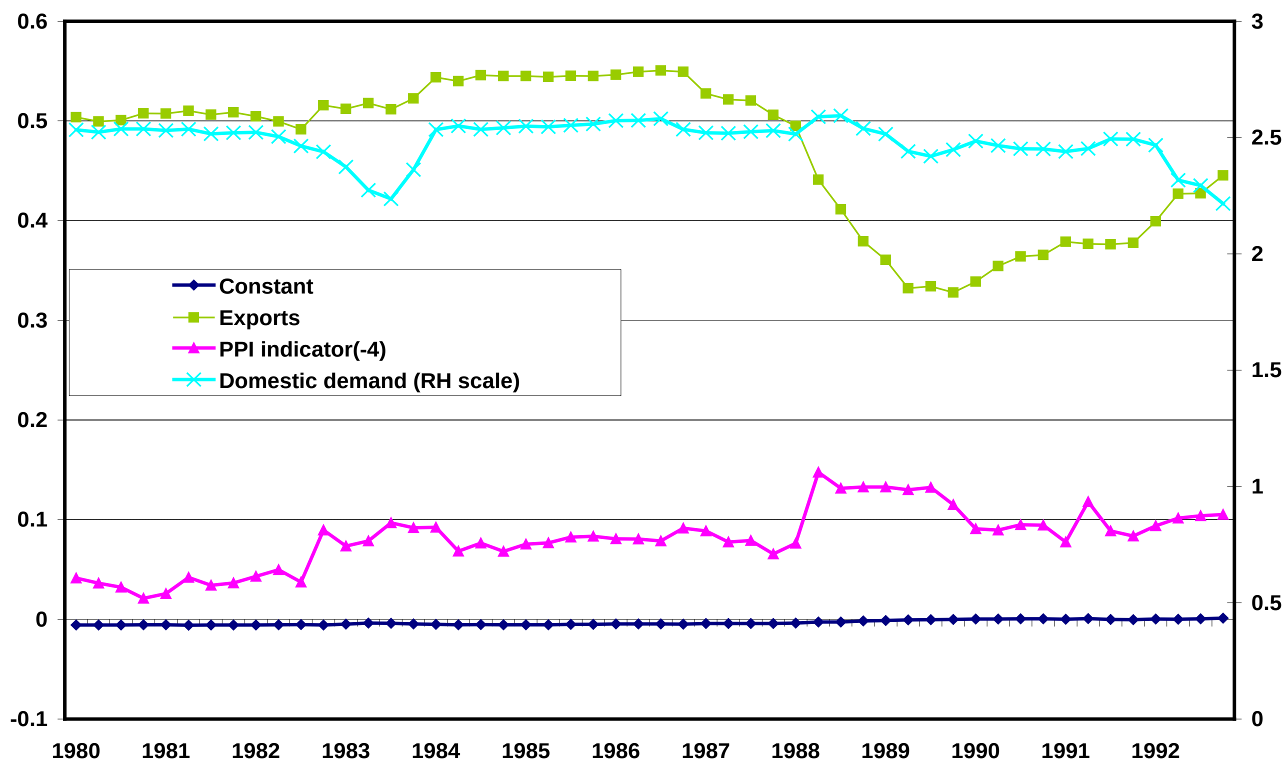
Source: EU-KLEMS data.

Figure 7. Estimating Italy's export equation in the long-run



Note: The series are the OLS coefficients of regressions estimated over 20-year windows; the years indicated on the horizontal axis are the starting dates.

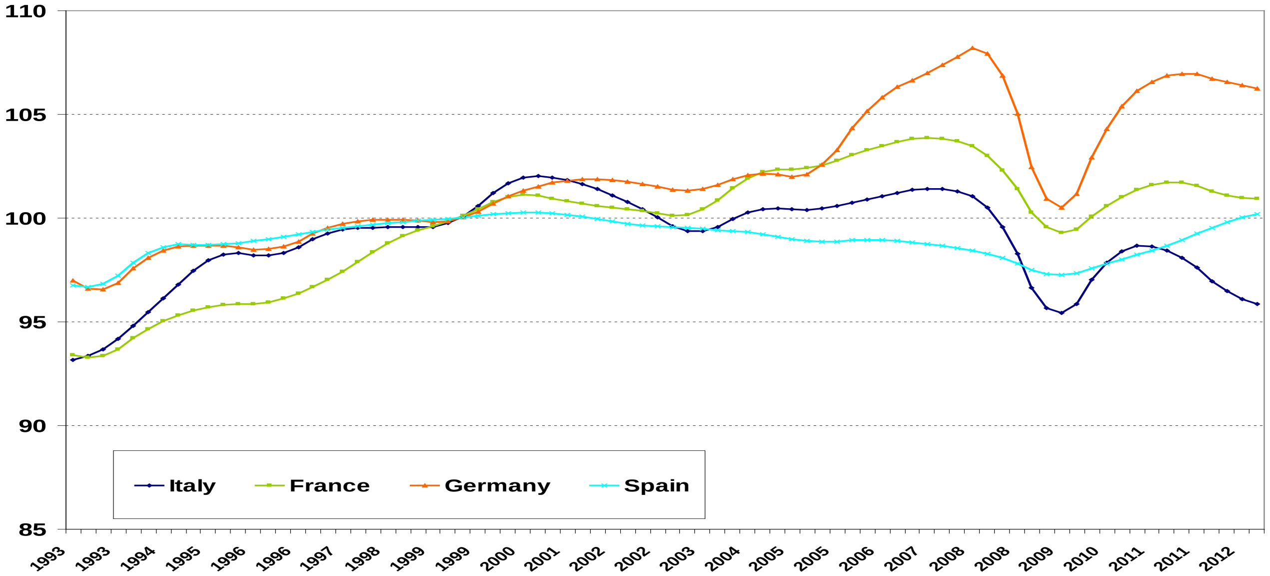
Figure 8. Estimating Italy's import equation in the long-run



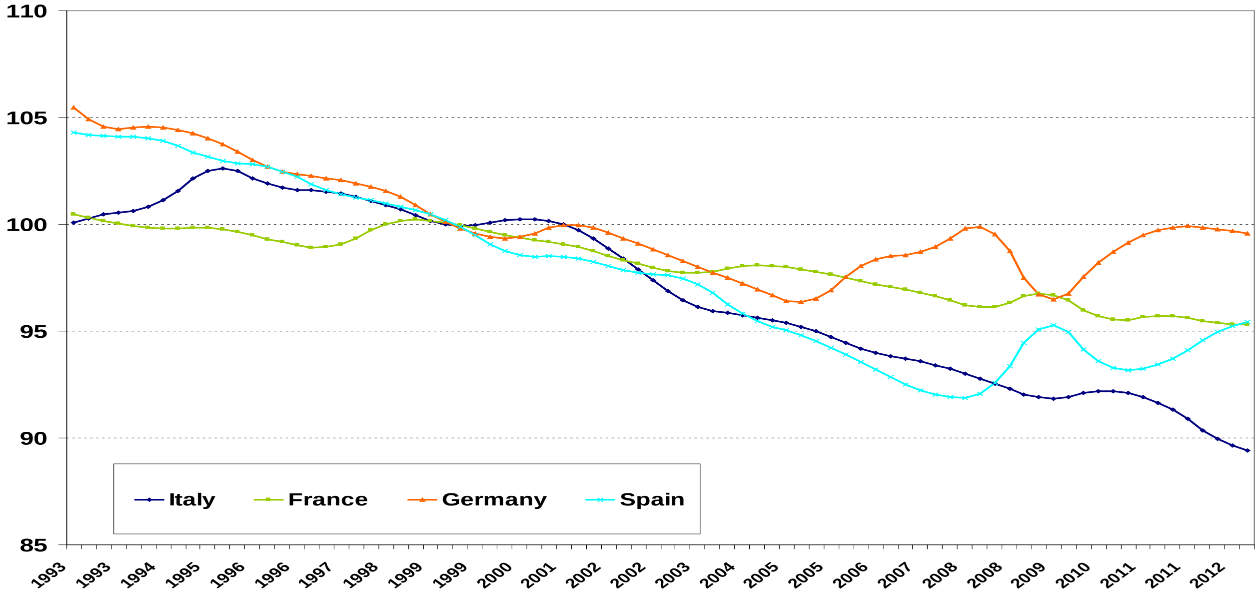
Note: The series are the OLS coefficients of regressions estimated over 20-year windows; the years indicated on the horizontal axis are the starting dates.

Figure 9. TFP indicators for Italy, France, Germany and Spain
(indices, 1999=100)

Panel A. Absolute TFP



Panel B. Relative TFP

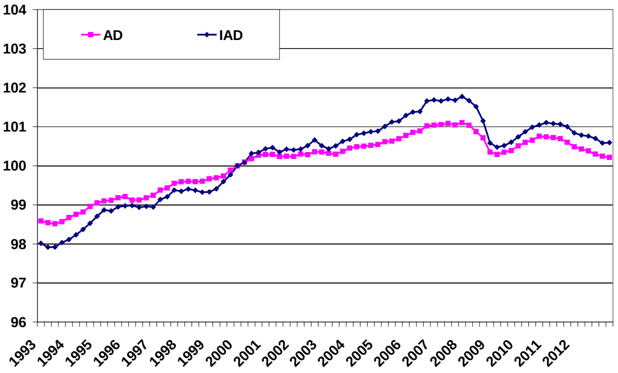


Source: Authors' calculations on European Commission and ECB data.

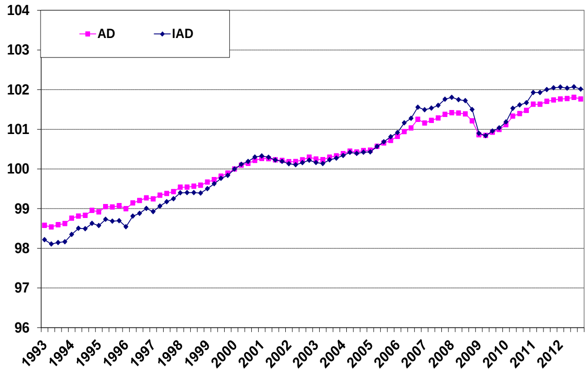
Figure 10. Aggregate demand (AD) and import intensity-adjusted demand (IAD) in the four largest euro-area economies

(natural logarithms; 2000Q1=100)

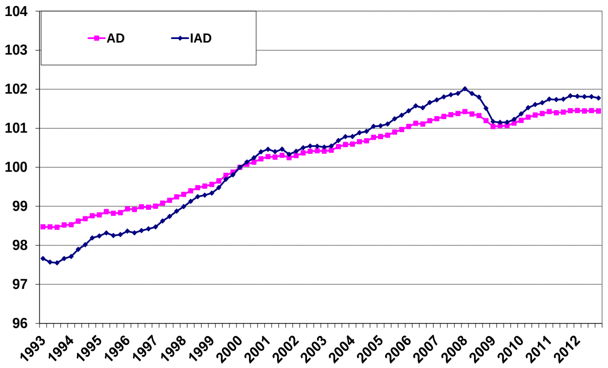
Italy



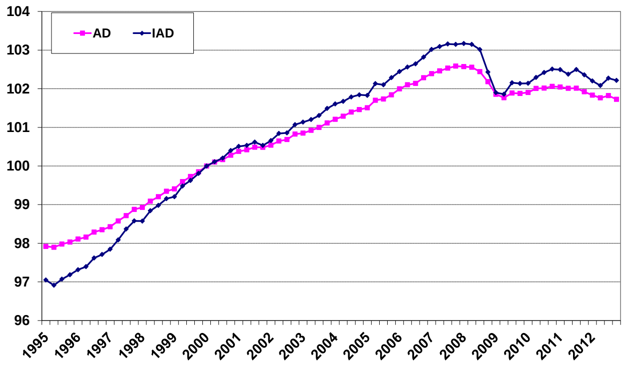
Germany



France



Spain



Source: Authors' calculations on Eurostat, OECD, Bussière et al. (2013) data.

Table 1. Price-competitiveness trends in the four largest euro-are countries

(cumulative growth rates; percentage points)

	A. ITALY					B. GERMANY				
	PPI	GDP defl.	ULCT	ULCM	CPI	PPI	GDP defl.	ULCT	ULCM	CPI
1999Q1 - 2013Q4	0.3	1.3	7.1	33.9	2.6	-9.4	-14.6	-16.1	-14.1	-7.2
2008Q2 -2013Q4	-5.0	-5.8	-5.9	6.1	-3.8	-4.2	-4.0	-2.2	-5.9	-6.1
2008Q2 -2009Q4	*-1.0*	*0.2*	*0.4*	*7.9*	*0.3*	*2.0*	*0.5*	*1.2*	*10.9*	*-0.5*
2009Q4 -2011Q2	*-4.5*	*-4.9*	*-3.8*	*-5.2*	*-3.8*	*-6.6*	*-4.5*	*-3.4*	*-15.0*	*-4.7*
2011Q2 - 2012Q2	*-3.1*	*-2.8*	*-4.2*	*-2.7*	*-1.8*	*-3.3*	*-3.1*	*-2.3*	*-2.2*	*-3.5*
2012Q2 - 2013Q4	*3.6*	*1.6*	*1.8*	*6.1*	*1.5*	*3.7*	*3.2*	*2.4*	*0.5*	*2.5*
	C. FRANCE					**D. SPAIN**				
	PPI	GDP defl.	ULCT	ULCM	CPI	PPI	GDP defl.	ULCT	ULCM	CPI
1999Q1 - 2013Q4	-6.1	-2.5	3.1	2.8	-3.7	11.7	8.9	-1.1	2.7	10.4
2008Q2 -2013Q4	-7.0	-5.5	-3.3	-5.5	-6.1	-1.9	-12.1	-20.6	-30.1	-4.2
2008Q2 -2009Q4	*-2.2*	*-0.5*	*0.1*	*-6.1*	*-0.6*	*-1.0*	*-1.7*	*-3.3*	*-11.1*	*-0.5*
2009Q4 -2011Q2	*-4.6*	*-3.6*	*-2.2*	*2.9*	*-3.6*	*-1.2*	*-5.5*	*-6.1*	*-4.7*	*-2.1*
2011Q2 - 2012Q2	*-3.1*	*-2.9*	*-3.1*	*-2.3*	*-3.0*	*-2.4*	*-4.7*	*-7.8*	*-8.8*	*-3.5*
2012Q2 - 2013Q4	*2.9*	*1.5*	*1.8*	*0.1*	*1.2*	*2.7*	*-0.2*	*-3.3*	*-5.6*	*2.0*

Source: ECB and Bank of Italy.

Table 2. Cointegrating regressions

(average quarterly data; natural logarithm of indices 2005Q1=100)

Dependent variable: PPI
Sample: 1994Q1-2012Q3

A. Italy			**C. Spain****		
FMOLS estimation	Coefficient	P-value	*FMOLS estimation*	Coefficient	P-value
ULCM	1.65	0.000	ULCM	1.08	0.000
*ADF test on residuals**	P-value		*ADF test on residuals**	P-value	
ADF test statistic	0.019		ADF test statistic	0.837	
B. Germany			**D. France**		
FMOLS estimation	Coefficient	P-value	*FMOLS estimation*	Coefficient	P-value
ULCM	0.64	0.248	ULCM	-0.69	0.119
*ADF test on residuals**	P-value		*ADF test on residuals**	P-value	
ADF test statistic	0.682		ADF test statistic	0.118	

* Null hypothesis: the residuals have a unit root.

** The sample period for Spain is 2000Q1-2012Q3 due to data availability.

Table 3. The baseline export equation results

(Dependent variable: exports of goods, 1993Q2-2012Q4, log-differences)

A. ITALY

	Constant	Potential demand	REER	REER(-4)	*N. observations*	*Adjusted R^2*
1. PPI	-0.0055	1.0255	-0.5215	-0.2491		
	(0.0109)	(0.0000)	(0.0000)	(0.0197)	75	0.7204
2. CPI	-0.0054	1.0169	-0.5694	-0.2775		
	(0.0102)	(0.0000)	(0.0000)	(0.0113)	76	0.7284
3. GDPDEFL	-0.0049	0.9972	-0.5101	-0.2430		
	(0.0172)	(0.0000)	(0.0000)	(0.0172)	75	0.7320
4. ULCM	-0.0044	1.0342	-0.2384	-0.1761		
	(0.0550)	(0.0000)	(0.0087)	(0.0318)	68	0.7158
5. ULCT	-0.0062	1.0202	-0.3089	-0.0706		
	(0.0045)	(0.0000)	(0.0034)	(0.4182)	68	0.7081

B. GERMANY

	Constant	Potential demand	REER	REER(-4)	*N. observations*	*Adjusted R^2*
1. PPI	-0.0003	1.1320	-0.2552	-0.0775		
	(0.8890)	(0.0000)	(0.0506)	(0.5286)	75	0.6656
2. CPI	-0.0010	1.1675	-0.3249	-0.0315		
	(0.6502)	(0.0000)	(0.0296)	(0.8319)	76	0.6710
3. GDPDEFL	-0.0010	1.1574	-0.2601	-0.0315		
	(0.6750)	(0.0000)	(0.0647)	(0.8197)	75	0.6632
4. ULCM	0.0014	1.0417	-0.3698	-0.0203		
	(0.5341)	(0.0000)	(0.0006)	(0.8223)	68	0.7388
5. ULCT	-0.0002	1.1530	-0.3169	0.0804		
	(0.9355)	(0.0000)	(0.0176)	(0.5196)	68	0.7174

C. FRANCE

	Constant	Potential demand	REER	REER(-4)	*N. observations*	*Adjusted R^2*
1. PPI	-0.0031	0.9894	-0.1628	-0.1530		
	(0.1253)	(0.0000)	(0.2139)	(0.2279)	75	0.6411
2. CPI	-0.0029	0.9913	-0.2248	-0.1410		
	(0.1468)	(0.0000)	(0.1674)	(0.3581)	77	0.6369
3. GDPDEFL	-0.0031	0.9810	-0.2398	-0.1841		
	(0.1319)	(0.0000)	(0.1591)	(0.2455)	75	0.6434
4. ULCM	-0.0029	0.9604	-0.3530	-0.0749		
	(0.1429)	(0.0000)	(0.0098)	(0.5883)	68	0.6570
5. ULCT	-0.0028	0.9451	-0.4028	-0.1570		
	(0.1591)	(0.0000)	(0.0099)	(0.3087)	68	0.6592

D. SPAIN

	Constant	Potential demand	REER	REER(-4)	*N. observations*	*Adjusted R^2*
1. PPI	-0.0003	1.1585	0.0434	-0.0707		
	(0.6631)	(0.0000)	(0.8760)	(0.8119)	67	0.4129
2. CPI	-0.0008	1.1768	-0.0273	-0.2893		
	(0.8261)	(0.0000)	(0.9288)	(0.3796)	69	0.4147
3. GDPDEFL	0.0012	1.1078	0.1244	-0.1120		
	(0.7520)	(0.0000)	(0.6512)	(0.6771)	71	0.3589
4. ULCM	0.0013	1.1034	0.1580	-0.0422		
	(0.7479)	(0.0000)	(0.3340)	(0.7939)	69	0.3762
5. ULCT	0.0005	1.1569	-0.1417	-0.0591		
	(0.8898)	(0.0000)	(0.5453)	(0.8145)	69	0.3716

Notes: OLS estimates. P-values are reported in brackets.

Table 4. The baseline import equation results

(Dependent variable: imports of goods, 1993Q2-2012Q4, log-differences)

A. ITALY

	Constant	Exports	REER(-4)	Domestic demand	*N. observations*	*Adjusted R^2*
1. PPI	0.0011	0.5386	0.4580	2.2411		
	(0.5540)	(0.0000)	(0.0579)	(0.0000)	74	0.6530
2. CPI	0.0011	0.5275	0.5430	2.2051		
	(0.5256)	(0.0000)	(0.0188)	(0.0000)	74	0.6613
3. GDPDEFL	0.0010	0.5353	0.4903	2.1797		
	(0.5619)	(0.0000)	(0.0255)	(0.0000)	74	0.6605
4. ULCM	0.0007	0.4449	0.3190	2.4261		
	(0.7487)	(0.0000)	(0.0515)	(0.0000)	66	0.6703
5. ULCT	0.0021	0.4614	0.3181	2.3919		
	(0.3238)	(0.0000)	(0.1257)	(0.0000)	66	0.66817

B. GERMANY

	Constant	Exports	REER	Domestic demand	*N. observations*	*Adjusted R^2*
1. PPI	0.0037	0.4421	-0.1750	1.4774		
	(0.0584)	(0.0000)	(0.1389)	(0.0000)	79	0.6337
2. CPI	0.0031	0.4650	-0.1996	1.4925		
	(0.1168)	(0.0000)	(0.1491)	(0.0000)	80	0.6366
3. GDPDEFL	0.0033	0.4500	-0.1937	1.4829		
	(0.0890)	(0.0000)	(0.1350)	(0.0000)	79	0.6340
4. ULCM	0.0033	0.4827	-0.0154	1.5090		
	(0.1332)	(0.0000)	(0.8971)	(0.0000)	72	0.6196
5. ULCT	0.0033	0.4991	0.0452	1.5280		
	(0.1255)	(0.0000)	(0.7428)	(0.0000)	72	0.6201

C. FRANCE

	Constant	Exports	REER(-2)	Domestic demand	*N. observations*	*Adjusted R^2*
1. PPI	-0.0024	0.4489	0.0021	2.2956		
	(0.0998)	(0.0000)	(0.9840)	(0.0000)	77	0.8825
2. CPI	-0.0024	0.4500	0.0318	2.3004		
	(0.0265)	(0.0000)	(0.7958)	(0.0000)	77	0.8826
3. GDPDEFL	-0.0024	0.4493	0.0107	2.2972		
	(0.0264)	(0.0000)	(0.9349)	(0.0000)	77	0.8825
4. ULCM	-0.0026	0.4483	0.2993	2.3822		
	(0.0358)	(0.0000)	(0.0436)	(0.0000)	69	0.8928
5. ULCT	-0.0022	0.4390	0.0303	2.2738		
	(0.1241)	(0.0000)	(0.8371)	(0.0000)	69	0.8832

D. SPAIN

	Constant	Exports	REER	Domestic demand	*N. observations*	*Adjusted R^2*
1. PPI	-0.0092	0.7273	-0.0651	2.0721		
	(0.0001)	(0.0000)	(0.7181)	(0.0000)	71	0.8393
2. CPI	-0.0087	0.7439	-0.0467	2.0263		
	(0.0001)	(0.0000)	(0.8177)	(0.0000)	73	0.8396
3. GDPDEFL	-0.0093	0.7278	-0.0359	2.0768		
	(0.0000)	(0.0000)	(0.8391)	(0.0000)	71	0.8391
4. ULCM	-0.0090	0.7539	-0.0884	2.0529		
	(0.0001)	(0.0000)	(0.3485)	(0.0000)	73	0.8415
5. ULCT	-0.0089	0.7425	-0.0925	2.0604		
	(0.0001)	(0.0000)	(0.5188)	(0.0000)	73	0.8405

Notes: OLS estimates. P-values are reported in brackets.

Table 5. The augmented export equation results

(Dependent variable: exports of goods, 1993Q2-2012Q4, log-differences)

A. ITALY

	Constant	Potential demand	REER	REER(-4)	Relative TFP(-4)	*N. observations*	*Adjusted R^2*
1. PPI	-0.0046	1.0326	-0.5309	-0.2049	1.0436		
	(0.0255)	(0.0000)	(0.0000)	(0.0957)	(0.1031)	75	0.7322
2. CPI	-0.0041	1.0190	-0.5715	-0.2208	1.0114		
	(0.0639)	(0.0000)	(0.0000)	(0.0404)	(0.0915)	76	0.7296
3. GDPDEFL	-0.0036	0.9985	-0.5167	-0.1931	1.0162		
	(0.0962)	(0.0000)	(0.0000)	(0.0640)	(0.0960)	75	0.7330
4. ULCM	-0.0022	1.0350	-0.2264	-0.1515	1.2897		
	(0.4642)	(0.0000)	(0.0100)	(0.0413)	(0.1938)	68	0.7172

B. GERMANY

	Constant	Potential demand	REER	REER(-4)	Relative TFP	*N. observations*	*Adjusted R^2*
1. PPI	0.0022	1.0162	-0.2419	-0.0275	1.3535		
	(0.3605)	(0.0000)	(0.0049)	(0.8193)	(0.0126)	75	0.6809
2. CPI	0.0018	1.0425	-0.3023	0.0097	1.4051		
	(0.4779)	(0.0000)	(0.0020)	(0.9478)	(0.0110)	76	0.6842
3. GDPDEFL	0.0017	1.0395	-0.2396	0.0275	1.3806		
	(0.4786)	(0.0000)	(0.0173)	(0.8320)	(0.0109)	75	0.6792
4. ULCM	0.0032	0.9600	-0.3401	0.0071	1.0007		
	(0.1014)	(0.0000)	(0.0002)	(0.9370)	(0.0533)	68	0.7430

C. FRANCE

	Constant	Potential demand	REER	REER(-4)	Relative TFP	*N. observations*	*Adjusted R^2*
1. PPI	-0.0029	1.0087	-0.1723	-0.1419	0.7453		
	(0.0736)	(0.0000)	(0.1064)	(0.2210)	(0.4575)	75	0.6379
2. CPI	-0.0036	1.0026	-0.2551	-0.1225	-0.8031		
	(0.0424)	(0.0000)	(0.0824)	(0.3728)	(0.3752)	77	0.6340
3. GDPDEFL	-0.0028	1.0001	-0.1723	-0.1419	0.7429		
	(0.0810)	(0.0000)	(0.1064)	(0.2210)	(0.4441)	75	0.6402
4. ULCM	-0.0034	0.9707	-0.3647	-0.0799	-0.5665		
	(0.0703)	(0.0000)	(0.0035)	(0.57524)	(0.5230)	68	0.6529

D. SPAIN

	Constant	Potential demand	REER	REER(-4)	Relative TFP(-1)	*N. observations*	*Adjusted R^2*
1. PPI	0.0002	1.4820	0.1452	0.0325	2.9865		
	(0.9607)	(0.0000)	(0.7064)	(0.9068)	(0.064)	67	0.3975
2. CPI	-0.0008	1.5108	0.0442	0.2297	2.9680		
	(0.8354)	(0.0000)	(0.9068)	(0.3693)	(0.0599)	69	0.3979
3. GDPDEFL	-0.0001	1.5071	0.2509	0.0234	3.1645		
	(0.9793)	(0.0000)	(0.4829)	(0.9206)	(0.0587)	71	0.4035
4. ULCM	-0.0002	1.6373	0.1697	0.1806	3.8050		
	(0.6466)	(0.0000)	(0.3132)	(0.2000)	(0.0318)	69	0.4456

Notes: OLS estimates. P-values are reported in brackets.

Table 6. The import content of demand components in Italy, Germany, France and Spain

(1993Q1-2012Q4 averages)

	G	C	I	X
Italy	0.08	0.25	0.34	0.33
Germany	0.10	0.26	0.35	0.30
France	0.10	0.27	0.32	0.31
Spain	0.11	0.24	0.31	0.34

Source: Authors' calculations on data provided in Bussière et al. (2013).
Notes: The import contents have been normalised to sum to unity.
Legend: G= Government expenditure; C = private consumption; I=investment; X= exports.

Table 7. The adjusted import equation results

(Dependent variable: imports of goods, 1993Q2-2012Q4, log-differences)

A. ITALY

	Constant	Import-Adjusted Exports	REER(-4)	Import-Adjusted Domestic demand	*N. observations*	*Adjusted R^2*
1. PPI	-0.0055	1.1340	0.4095	0.6744		
	(0.1722)	(0.0004)	(0.0961)	(0.0732)	75	0.3832
2. CPI	-0.0055	1.1283	0.5711	0.6459		
	(0.1626)	(0.0003)	(0.0184)	(0.0804)	74	0.4070
3. GDPDEFL	-0.0055	1.1211	0.4758	0.6428		
	(0.1652)	(0.0004)	(0.0321)	(0.0002)	75	0.3990
4. ULCM	-0.0086	1.3957	0.2886	0.6210		
	(0.014)	(0.0000)	(0.1248)	(0.0486)	66	0.5178
5. ULCT	-0.0075	1.4484	0.1962	0.5675		
	(0.0294)	(0.0000)	(0.3253)	(0.0713)	66	0.5068

B. GERMANY

	Constant	Import-Adjusted Exports	REER(-4)	Import-Adjusted Domestic demand	*N. observations*	*Adjusted R^2*
1. PPI	0.0055	0.4929	0.0177	0.6945		
	(0.1413)	(0.0054)	(0.9425)	(0.0001)	73	0.2392
2. CPI	0.0053	0.4913	-0.0717	0.6918		
	(0.1480)	(0.0055)	(0.8112)	(0.0011)	73	0.2390
3. GDPDEFL	0.0053	0.4943	-0.0246	0.6938		
	(0.1582)	(0.0052)	(0.9260)	(0.0010)	73	0.2394
4. ULCM	0.0058	0.5586	0.1396	0.8541		
	(0.1218)	(0.0040)	(0.4931)	(0.0009)	68	0.2908
5. ULCT	0.0063	0.5671	0.1913	0.8521		
	(0.1052)	(0.0036)	(0.4938)	(0.0009)	68	0.2908

C. FRANCE

	Constant	Import-Adjusted Exports	REER(-2)	Import-Adjusted Domestic demand	*N. observations*	*Adjusted R^2*
1. PPI	-0.0003	0.2460	-0.0061	1.6792		
	(0.9027)	(0.0459)	(0.9775)	(0.0000)	73	0.4336
2. CPI	-0.0003	0.2448	0.0241	1.6851		
	(0.9064)	(0.0450)	(0.9294)	(0.0000)	73	0.4337
3. GDPDEFL	-0.0003	0.2456	-0.0163	1.6780		
	(0.9036)	(0.0440)	(0.9548)	(0.0000)	73	0.4337
4. ULCM	-0.0006	0.4025	0.3291	1.5836		
	(0.8019)	(0.0034)	(0.2301)	(0.0000)	68	0.5027
5. ULCT	-0.0003	0.3853	0.2564	1.5338		
	(0.8949)	(0.0046)	(0.3581)	(0.0000)	68	0.4979

D. SPAIN

	Constant	Import-Adjusted Exports	REER(-4)	Import-Adjusted Domestic demand	*N. observations*	*Adjusted R^2*
1. PPI	-0.0066	0.6380	0.0405	1.6721		
	(0.0718)	(0.0001)	(0.8827)	(0.0000)	71	0.6373
2. CPI	-0.0066	0.6357	0.0199	1.6734		
	(0.0742)	(0.0001)	(0.9479)	(0.0000)	73	0.6372
3. GDPDEFL	-0.0064	0.6295	-0.0427	1.6864		
	(0.0789)	(0.0001)	(0.8733)	(0.0000)	71	0.6376
4. ULCM	-0.0065	0.6336	0.0867	1.6503		
	(0.0711)	(0.0000)	(0.5320)	(0.0000)	73	0.6393
5. ULCT	-0.0065	0.6339	-0.0009	1.6760		
	(0.0714)	(0.0000)	(0.9969)	(0.0000)	73	0.6372

Notes: OLS estimates. P-values are reported in brackets.

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Competitiveness Research Network

This paper presents research conducted within the Competitiveness Research Network (CompNet). The network is composed of economists from the European System of Central Banks (ESCB) - i.e. the 29 national central banks of the European Union (EU) and the European Central Bank – a number of international organisations (World Bank, OECD, EU Commission) universities and think-tanks, as well as a number of non-European Central Banks (Argentina and Peru) and organisations (US International Trade Commission).

The objective of CompNet is to develop a more consistent analytical framework for assessing competitiveness, one which allows for a better correspondence between determinants and outcomes.

The research is carried out in three workstreams: 1) Aggregate Measures of Competitiveness; 2) Firm Level; 3) Global Value Chains CompNet is chaired by Filippo di Mauro (ECB). Workstream 1 is headed by Pavlos Karadeloglou (ECB) and Konstantins Benkovskis (Bank of Latvia); workstream 2 by Antoine Berthou (Banque de France) and Paloma Lopez-Garcia (ECB); workstream 3 by João Amador (Banco de Portugal) and Frauke Skudelny (ECB). Monika Herb (ECB) is responsible for the CompNet Secretariat.

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The paper is released in order to make the research of CompNet generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the ones of the author(s) and do not necessarily reflect those of the ECB, the ESCB, and of other organisations associated with the Network.

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