

# Analysing non-price competitiveness in euro area countries<sup>1</sup>

November 2009

**Preliminary and  
incomplete draft for  
comments**

Evidence from practitioners and theoretical analysis suggest that price competitiveness is only one of the factors determining export performance, but only recently few empirical studies have started to include non-price competitiveness factors. The objective of this paper is to investigate empirically whether non-price competitiveness factors can improve the estimation of export equations. We focus mainly on “technological” and “structural” competitiveness drivers. The former refers to the role of innovation and quality and the latter to framework conditions and services. A data set of the euro area made of aggregate export data for the period 1995-2008 is employed. The dynamic panel model confirms that understanding better export performance requires going beyond external demand and price competitiveness. In particular, technological competitiveness seems to support real exports. Moreover, our preliminary results point to financial services as having a positive effect on exports.

## 1. Introduction

Despite substantial evidence from international trade practise suggests that price competitiveness is only one of the factors determining export performance few empirical studies include, among the explanatory variables, non-price competitiveness factors. The so-called New Trade Theory, influenced by the theory of industrial organization, has added a new insight into the possible factors affecting the demand for exports and imports, such as foreign direct investment or the quality of the traded goods (see among others Krugman (1979) and more recently Sutton (2007)).

There is not a unique definition of non-price competitiveness. Sometimes it is related to factors other than the real effective exchange rate that impact trade performance. More specifically, it includes a broad range of issues as product quality, technological advantage, industry specialisation, exporting firms' characteristics, business environment,

---

<sup>1</sup> Prepared by J. Monteagudo and F. Montaruli, European Commission, Directorate General for Economic and Financial Affairs. The usual disclaimer applies.

etc.<sup>2</sup> Using only price competitiveness indicators in empirical analyses to explain export performance assumes that underlying factors driving non-price competitiveness are irrelevant.

Against this background, the main purpose of this work is to assess the extent to which some non-price competitiveness factors are important when explaining external competitiveness and in particular export performance. In other words, this study aims at further investigate how the euro area export performance has evolved recently, with particular emphasis on nonstandard factors. These latter may encompass a range of issues, from micro-based such as innovation, quality and service after sale, to broader structural issues related to the economy in general, and to the business environment conditions in particular, such as the availability of skilled labour and characteristics of enforcing contracts. Most of these factors are not fully captured by price-based measures. However, in order to reduce the dimension of the otherwise daunting exercise we decide to focus on a limited parsimonious number of non-price competitiveness factors, also reflecting our current availability of indicators. We focus on “technological” and “structural” competitiveness, the former referring to the role of innovation and quality and the latter to framework conditions and to the role of services as facilitators of exporting activities. Other undoubtedly important aspects such as the sectoral composition of exports and the role of FDI are therefore not covered at this stage of the analysis.

Technological aspects of competitiveness could affect exports behaviour in different ways. It could be argued that high innovative countries (independently of the technological content of their exports) export more. This could be interpreted as a proxy for quality, more efficient interactions, more efficient networks sales, etc. This is the direct causal effect that we preliminary present here. Additionally, the technological/innovation content of exports could also have an impact on the relationship between price and non-price competitiveness and export performance. For example, relative to high-tech products, the export prices of medium-tech products are more exposed to downward pressure from new low-cost export competitors. However, since we use aggregate exports data we cannot at this stage look into this issue.

Following ECB (2005) structural competitiveness could be identified with general and framework characteristics of an economy affecting export performance. These could include traditional characteristics as those related with human capital and the business environment, but also specific characteristics of the services sector seen as an "activity facilitator" in the economy. Since services have become more and more interconnected with manufacturing sectors, well functioning services markets might play a relevant role in facilitating exports. This could be the case, for example, if services are used as a way

---

<sup>2</sup> Recently available micro, firm-level data has made possible analysing the effect of firm-level characteristics on trade. This is a new strand of the literature which insights can change the way we think about international trade and about competitiveness. For example, to understand the deterioration of the French export performance since 2001, and to explain the difference between the French and German export performance, non-price aspects have to be taken into account, in particular the differences in sectoral and geographical structures of French and German exports, but also the behaviour of firms and the variation in the number of exporters (see Artus and Fontagné (2006)).

to differentiate otherwise relatively homogeneous products (e.g. training and after-sales support attached to the sell of a given product).

With respect to the business environment, it is well known that the impact of inappropriate regulation (like for instance the number of documents needed for export and the time and costs to enforcing contract), together with the skill level of the work force can affect profitable export market situations. In general, better regulation and a reduction of administrative burdens have both a direct and an indirect impact on productivity and macro-economic performance.

In this work, we extend a standard exports demand equation to include variables related with the aforementioned non-price competitiveness aspects. That is, apart from considering external demand and real effective exchange rate (the standard explanatory variables) we also include indicators of technological as well as structural competitiveness as defined above. The sample covers euro area countries for the period 1994-2008. The estimation is done using panel data techniques. A main contribution of this work is to simultaneously consider several aspects of non-price competitiveness, and in particular considering the role of services as “facilitators”, a novelty among the non-price competitiveness factors. Additionally, most studies adopt a country perspective while our focus is on identifying key determinants of export performance from a euro area perspective (a paper adopting a euro-area perspective are Anderton et al (2005)).

This is a work in progress and thus the results have to be considered only as tentative and non-conclusive, only a preliminary indication of what to expect and definitely on how to move forward. The preliminary results confirm that understanding export performance requires going beyond traditional variables as external demand and price competitiveness, although standard determinants still explain a large fraction of the overall variance. The relevant question is whether the indicators selected are good proxies for the non-price competitiveness characteristics we wish to capture. A natural extension of the work is therefore to extend and improve those indicators.

According to our findings, technological competitiveness measured by R&D intensity and number of patents matters for exports of goods, although the impact is small. The effect on services is, somehow as expected, smaller as shown by the fact that as the share of services in total exports increases, the positive effects of R&D expenditures on exports decrease. Evidence on quality upgrading as measured by the export deflator yields more mixed results. Turning into the role of services, a high contribution of TFP to value added in the financial intermediation sector (that we consider a key input in the process of exporting) has a very small but statistically significant impact on exports. Finally, structural business conditions related to number of procedures and the cost to export as expected contributes negatively to explaining the volume of exports.

The reminder of the paper is organised as follows. In section 2 we present some related theoretical and empirical references. Section 3 deals with the empirical strategy and presents the results of the basic, standard exports equation. Section 4 presents the indicators used to measure non-price competitiveness in this work and shows the regression results. Finally, section 5 concludes and gives some ideas for future research on this area.

## 2. Theoretical and empirical references

This section introduces some references to support the empirical analysis done in the rest of the paper. Firstly, the focus is on the assessment of the contribution of each product differentiation features, i.e. quality, technology, services over export performance. This analysis distinguishes from a standard approach based on foreign demand and the dynamic of the exchange rate since is mainly related to quality, technology and services impact on export. Secondly, the analysis is complemented with the related empirical literature to assess the overall significance of the factors behind export performance.

When analysing non price competitiveness, one of the underlying factors which drives the performance in terms of export market share of a certain country is quality, as perceived by foreign consumers. However, quality implies many different dimensions which affect the competitiveness of the country (according to Hallak and Schott (2008), for example, product quality refers to all the features, tangible and intangible, influencing consumers' economic valuation). Therefore it is not easily directly measured but in a systemic way related to other non-price competitiveness factors as technology, innovation and services for exported goods. In industrial sector analysis some studies have investigated empirically and theoretically the role of quality variation. Already in 1970, Cowlin and Rayner confirm that quality variation is key factor in explaining the different market shares elasticity of UK tractor manufacturers.<sup>3</sup> Motta (1993) analyses on a theoretical ground two vertical product differentiation models, one with fixed and the other with variable costs of qualities, to see how price versus quantity competition paradigms affect the equilibrium solution in presence of quality differentiation. He finds that firms offer distinct qualities at equilibrium. Interestingly, he defines fixed costs of quality improvements as those related to R&D and advertising activities and variable costs of quality improvements as those stemming from more skilled labour or more expansive raw material or inputs.

In this paper we directly look into the effect that R&D and patents may have on export performance. R&D and innovation is crucial in the production of products of higher quality, but also in the development of new varieties of goods and services. Technological advantage could translate into new or better products (product innovation), but also into more efficient ways of producing products (process innovation). Process innovation would then affect indirectly real exports via its impact on prices. A disaggregated empirical analysis for the UK (Greenhalgh, Taylor and Wilson, 1994) using industry level time series data shows a positive role of innovation on export volumes. Empirical findings emerging from the use of firm level data go in the same direction: innovating firms are more internationally oriented and are more likely to export than non-innovators. The more innovations they have the higher the probability of entering the export market. Besides, innovators do not only export more, they also export to more destinations: the geographical markets of innovative European firms are larger and more diversified than those of non-innovative firms (see European Competitiveness Report, 2008).

---

<sup>3</sup> More precisely, their study test empirically the competition among firms and their performance with respect to market shares, considering quality-adjusted prices into the theory of consumer behaviour for branded tractors in the UK.

Strategies for surviving in a competitive market could include innovating and mastering new technologies. But innovation is not the only strategy to gain access to foreign markets. Producers might also accumulate a knowledge-base which is useful for production without engaging in formal innovation activities. This could eventually lead to the development of high-quality and knowledge-intensive products.<sup>4</sup> Thus, considering only formal innovation variables could lead us into an omitted variable problem. The Italian case is traditionally brought up as a good example of restructuring firms in ways to reduce the role of cost-based factors relative to more skill-intensive activities. There is, indeed, some empirical evidence of restructuring in some traditional exports via quality upgrading (Imbriani et al., 2008, Bugamelli, 2007). The empirical challenge is to find a good indicator measuring quality upgrading. Following Lissovolik (2008) we look at the relationship between exports deflator and exports performance, assuming that quality and prices are positively related. This is a simplistic and indirect measure of quality based on its effect on prices, which are influenced by other factors. However, the relation between quality and price seems to hold in the long run (Stiglitz, 1987).

Services account for over 70 percent of value added and total employment in developed economies. Apart from being the largest sector in EU countries, services have become more and more interconnected with manufacturing sectors: i) they are vital intermediate inputs; ii) the increased fragmentation of production processes into parts that can be outsourced, has translated into more complex systems of manufacturing production organisation, making important the role of co-ordination, administration and transportation services; iii) services are increasingly being used to obtain product differentiation as goods also compete on the package of associated services (after-sales service, maintenance, training, etc.). For instance Guerrieri and Meliciani (2005) study the reasons for different countries to specialise in exporting specific producer services and in particular financial, communication and business services. Using a generalised least square estimator on cross-sectional time series they find a relevant interdependence between the manufacturing structure and producer services. Manufacturing industries, especially in the field of information and communication technology, do affect positively trade performance of the service sectors. Consequently, when a country is specialised in ICT industries it has a potential comparative advantage to furnish producer services.

Wolfmayr, (2008) examines the effects of services inputs over the competitiveness of the manufacturing sector for 16 OECD countries and 17 industries from 1995 to 2000. He estimates an export market share function on a panel data set introducing an explicit link between services input and export performance. The empirical evidence confirms a significant positive correlation between international service linkages mainly related to high skilled, technology driven industries and increases in the market shares. However, the impact of in house services is less significant than international service linkages.

Our empirical approach concerning the role of services in export performance makes use of TFP contribution to value added in a number of selected services sectors. These sectors are financial intermediation, transport and communication and real estate and business environment. The selection is justified by our logical assumption on their importance as inputs and business facilitators, as well as by data availability.

---

<sup>4</sup> As recognised by Imbriani et al. (2008) the relationship between innovation and quality depends very much on the sector. For some sectors quality upgrading requires innovation (industries with vertical differentiation), while this may not be the case for other sectors (e.g raw materials).

A wide body of literature explores the impact of regulatory and economic framework conditions under which businesses operate on their individual domestic and export performance. The impact of inappropriate regulation, together with the skill level of the work force, the number of documents needed for export and the time and costs to enforcing contract can affect profitable export market situations. In general, better regulation and a reduction of administrative burdens have both a direct and an indirect impact on productivity and macro-economic performance. The direct impact comes from a reduction in costs and the removal of barriers to penetrate new markets, while the indirect effect operates through the impact of the measures on market efficiency. Nicoletti and Scarpetta (2003) found that entry liberalisation led to productivity gains in all of the OECD countries under consideration, regardless of their position relative to the technology frontier. Brandt (2004) also found that high rates of firm entry coincide with rapid productivity, output and employment growth, especially in the ICT related services sectors and in some business services industries. Regarding product and labour market structural policies, evidence tends to show that they have positive economic effects over the functioning of business environment. Improving education, human capital accumulation and training provision improve fundamental conditions for a well functioning business environment. In a study that investigates the effects of skill shortages on the dynamics of employment at the firm level for UK manufacturing between 1984-94 Stevenson (2005) finds that firms' costs of adjustment will be higher in periods where there are shortages of skilled labour.

Our approach to framework conditions tests the significance on a number of indicators that include number of procedures, time and cost to export on the one hand, and a skill composition indicator on the other.

In the same vain of the more comprehensive objective of this study a field of empirical literature investigate the overall impact of non-price competitiveness variables on export performance. A study of the ECB task force on competitiveness and export performance of the euro area (2005) indirectly estimates that technological (patenting and R&D data) and structural (mainly educational attainment and business environment conditions) competitiveness factors affect export performance. Exports are modelled primarily as a function of foreign demand and price competitiveness factors. In second step, residuals of the export equations are used to give some indications of other factors explaining export rather than price competitiveness and their analysis confirms this hypothesis for individual countries. However, indicators of these non-price factors appear to have a minor empirical effect at least in the euro area.

Fabrizio, Igan and Mody (2007) investigate the dynamic of product quality and international competitiveness by focusing on the eight new central and east European member states over the time span 1994-2004. Their empirical results, based on Panel regressions with country fixed effects, shows that the increase in export market shares obtained by those countries before the crisis and despite the appreciation of their real exchange rate, could be largely attributed to a shift in product quality and in the technological intensity of exports. The authors also hypothesise that the transition from planned to more competitive economic system was playing a role, benefiting from the effect of restructuring and dismantling trade barriers.

An empirical analysis of non price competitiveness trends in Italy is carried out by Lissovlik (2008). The author emphasises how the restructuring phase of the Italian industries might have only recently favoured a recovery of export performance. During the last decade, Italian industries have been going through a phase of weak growth and

increasing concerns about external competitiveness, mostly attributed to lower productivity and policy/regulatory rigidities. However, the latter trends and some recent publications (Codogno, 2008) suggest that Italy's short-term outlook may not be as poor as expected, thanks to improvements in non-price competitiveness factors as quality upgrading, geographical trade diversification and outsourcing. Still, according to the author, uncertainty as to the reliability of this hypothesis deserves in depth analysis. Therefore, using a cross country data set and estimating time series regressions per countries Lissovolik concludes that Italy's competitiveness has been moderately supported by non-price factors.

### **3. Exports equation and residuals**

Over the recent years export performance has been far from homogeneous across euro-area members. While some countries had experienced annual growth of exports during 1995-2008 of around 7-9% (IE, SI, DE), others have shown rather dismal export performance, with average annual growth rates of around 3-4 % (IT, BE, FR). This disparity can be explained by a number of factors such as relative prices and world demand (the traditional factors), but also technological advantage, the product and geographical composition of countries exports, FDI activity and the related internationalisation of production.

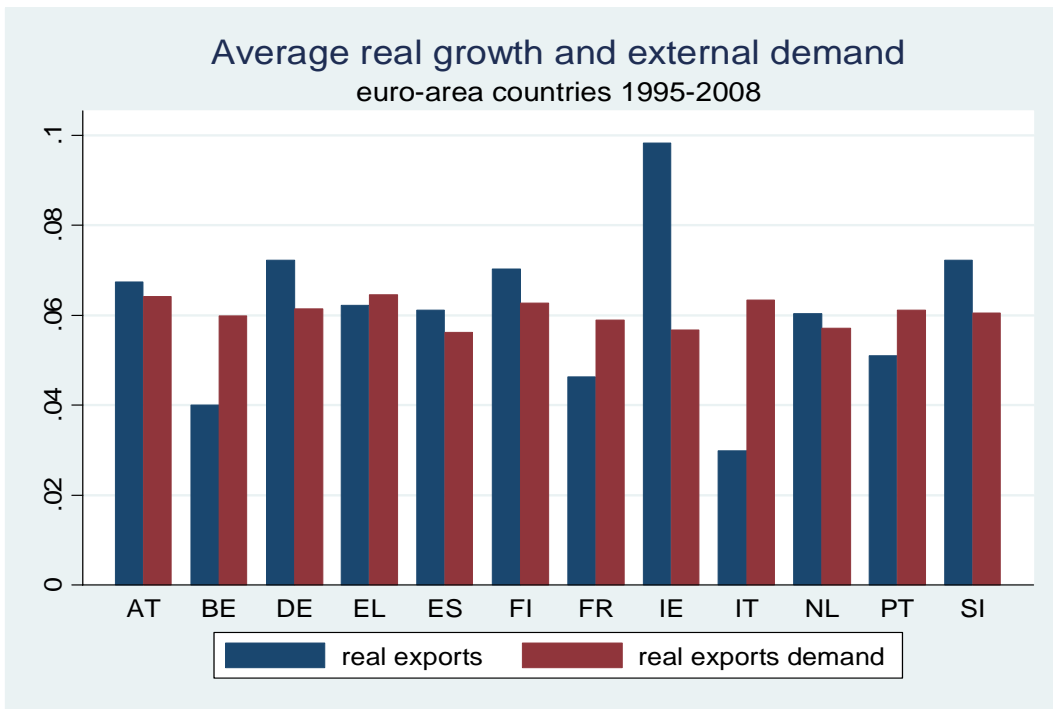
Our empirical approach can be described as follows. After a graphical analysis where growth of exports is shown to be related with growth in foreign demand and changes in the exchange rate, we show the estimation results of a basic standard exports demand equation linking those three variables. We look at the behaviour of the residuals in order to evaluate to what extent the standard determinants can explain exports and to what extent unobservable (or omitted) variables have a say. We estimate the equation in growth because we want to concentrate on the explanatory power of the chosen variables, abstracting from the large persistence effect of the lagged endogenous variable. Once proven that missing variables have a potential role in improving the results, we estimate the new equation adding the non-price competitiveness variables in levels. The reason of this choice is that we are interested in measuring directly the elasticities of price and non-price factors over exports. However, as a robustness check we reestimate the extended equation in changes.

Graph 1 plots average real export growth and external demand across countries, which could be interpreted as the relative ability of countries to exploit their export demand.<sup>5</sup> Particularly IE shows a high "relative" ability to exploit export demand. On the contrary IT and to a lesser extend BE have not taken full advantage from raising exports demand.

---

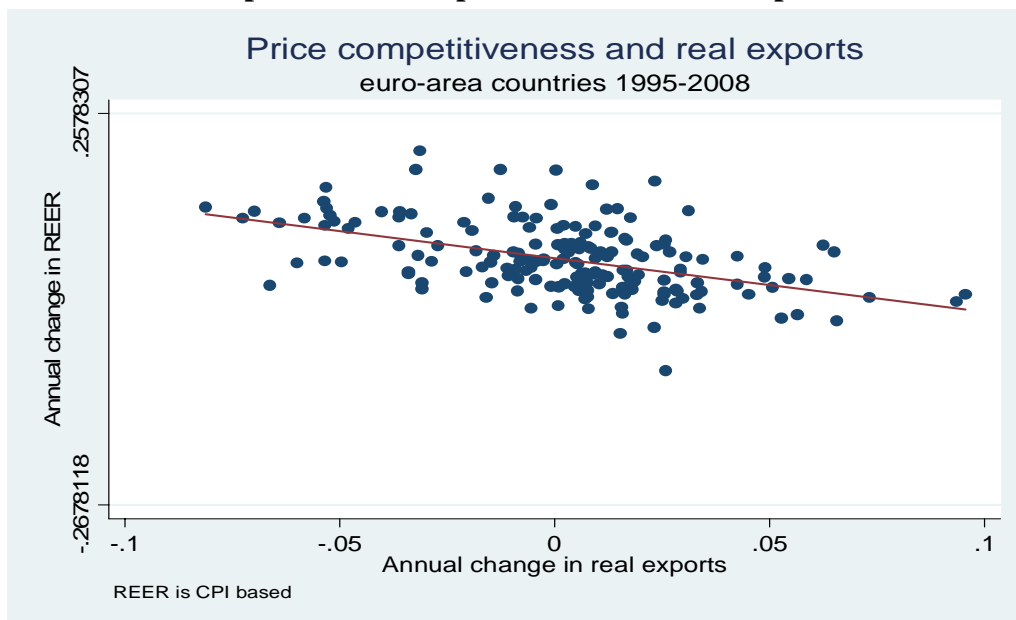
<sup>5</sup> Exports-weighted growth of real imports of EU27 plus other industrialised countries plus emerging economies. See Annex for data description.

**Graph 1. Exports and external demand**



Graph 2 relates growth of real exports with growth of REER over the period 1994-2008. Although the graph show the existence of a significant negative correlation (-0.47) between the two variables, it also shows that “residual” factors other than the exchange rate need to be taken into account.

**Graph 2. Price competitiveness and real exports**



Our aim is to tackle this problem by analysing the role of additional factors beyond demand and relative prices. Underpinning our empirical analysis is the basic exports demand equation (1):<sup>6</sup>

$$\ln(\text{exports}_{it}) = \alpha_i + \gamma \ln(\text{exports}_{it-1}) + \beta \ln(\text{demand}_{it}) + \delta \ln(\text{REER}_{it}) + \varepsilon_{it} \quad (1)$$

for  $t = 1, \dots, T$ , where  $\text{exports}_{it}$  is the volume of exports from country  $i$  at time  $t$ , demand measures world demand, REER is the real effective exchange rate. Country-specific fixed effects ( $\alpha_i$ ) capture unobserved influences that remain constant over time. All other influences are contained in the error term  $\varepsilon_{it}$ . The equation would be estimated in levels and in first differences. Levels have the advantage of a straightforward interpretation of the parameters (elasticities), while the estimation in first differences allow us to concentrate on the explanatory power of the chosen variables, abstracting from the large persistence effect of the lagged endogenous variable in the levels equation.<sup>7</sup>

Our sample covers most euro area countries over the period 1994-2008.<sup>8</sup> Given the low time dimension of the series we decide to pool the data rather than estimating country-specific export equations, although we allow for country-specific fixed effects. It could be argued that it is restrictive to impose the same parameters, apart from fixed effects, to all countries in the sample. However, this is an accepted methodology in the trade literature and numerous papers have imposed the same parameters across somewhat heterogeneous countries (see among others Egger (2001), Anderton et al. (2005)). Furthermore, we are interested in obtaining results which approximate the parameters of the euro area and therefore we need to pool the data across countries.

It could be argued that analysis using aggregate exports rather than sectoral data could be misleading. That would be the case if some products with relatively low price elasticities display at the same time a large variation in prices. Then, the estimated aggregate price elasticity would be biased downwards (see Camarero and Tamarit, 2003). This could be the case for example of services as it can be argued that, compared to goods, services are more heterogeneous and customized showing a low demand elasticity and enabling providers to exercise some degree of market power. Another factor reinforcing this hypothesis emerges from the incompleteness of the Single Market for services, as less market integration translates into less competition pressures and some degree of firms' market power. In order to test whether or not services are less sensitive to relative prices, we look at the effect of a variable interacting (multiplying) the exchange rate variable

---

<sup>6</sup> The model assumes that domestic and foreign products are imperfect substitutes, that price homogeneity holds, and that trade elasticities with respect to relative prices and income are constant over time. Although this approach has been predominant in the empirical literature, it has remained controversial (problems are related with parameter instability (see Hooper et al. 1998) or the non-stationarity of the data).

<sup>7</sup> Typically, export equations represent long-run relationships among the variables, since many empirical studies suggest the exports demand equation is a cointegration relationship. But unit root and cointegration tests have a low power in small samples (our case) and we therefore consider that a panel cointegration approach may not be appropriate and proceed by estimating a dynamic panel adding a lag endogenous variable to the basic equation. Our regressions are estimated using the Arellano-Bond estimator with the robust variance option. In all cases a test for the lack of first order serial correlation of the errors is carried out as well as a Sargan test for the validity of the instruments (lagged variables).

<sup>8</sup> CY, LU and SE are not covered due to data limitations. The panel is an unbalanced panel due to missing observations for some countries and variables.

with the share of services in a country's total exports.<sup>9</sup> When the share of services over total exports is very small the effect of the exchange rate on exports is captured by the coefficient on the real effective exchange rate only. However, for the opposite case the effect of relative prices is given by the two combined coefficients (that is the real effective exchange rate plus the interaction effect). If services are indeed less reactive to relative prices than goods, the interaction effect should decrease the total price elasticity.

Table 1 displays the results of the basic exports equation (1) linking real exports with demand and relative prices (both in levels and in first differences). External demand and the real effective exchange rate changes explain around 55% of the variance of exports growth in the euro area over the period 1995-2008. Both variables show a statistically significant relationship with the growth of real exports (elasticities of 1.02 and -0.54, respectively).<sup>10</sup> The high estimated parameter for the lagged dependent variable (persistence) in the levels specification suggests a high degree of stability in export performance. As expected, the persistence is much smaller in the equation in first differences. Interestingly, the interaction effect measuring services lower elasticity to relative prices turns out to be statistically non-significant. A possible explanation for this finding could be the fact the services that are traded are relatively homogeneous services and thus intense international price competition also applies to them. In reality, most services are still sold only domestically (or locally) and aspects related to the production technology and the need to have a personalised, direct contact are factors behind the relative low tradability of many services.

**Table 1. Real exports in the euro area**  
Dynamic panel regression. Dependent variable is total real exports

|                    | Levels  | First difference<br>s |
|--------------------|---------|-----------------------|
| Persistence        | 0.82**  | 0.17**                |
| REER               | -0.25** | -0.45**               |
| Demand             | 0.13**  | 0.85**                |
| Interaction effect | 0.17    | 0.51                  |

Sample covers 12 euroarea countries for the period 1996-2008 (it excludes LU, CY, MT, SK). The interaction effect is the REER times the share of services in total exports. The variable tests whether services are less reactive to relative prices. All variables are in logs. \*\* Means significant at 5%.

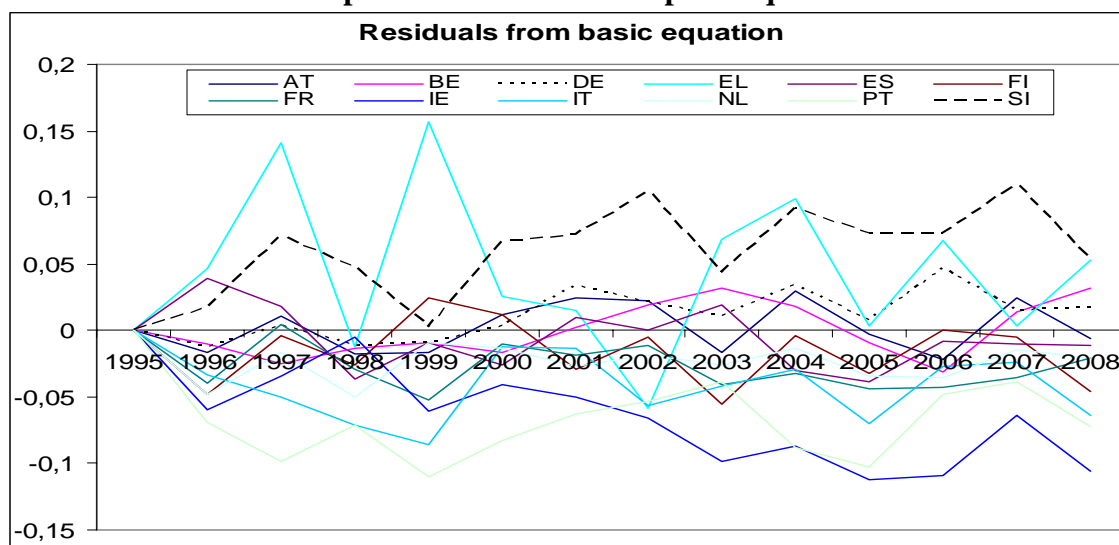
Looking at the residuals of the regression in first differences also gives some indication as to whether exports developments have to be attributed to factors others than foreign demand and price competitiveness. Country intercepts gives some insight into the effect of constant over time, country specific (unobservable or) omitted variables. One group of countries is formed by IT, BE, FR and PT, for which the unknown factors have a

<sup>9</sup> See Brambor et al (2005).

<sup>10</sup> Like in similar studies using a dynamic approach, elasticities refer to long-run effects (thus taking into account the persistence of a given shock over time). See for example Egger (2001) and Anderton et al (2005).

detriment effect on exports when compared to the other euro-area countries.<sup>11</sup> The opposite is true for IE, SI and DE. Graph 3 presents the standardised purely random component of the residuals. Countries for which the error component presents a systematic path over time might be experiencing an improvement or a deterioration of omitted variables (in this case, non-price competitiveness factors driving export performance). According to the information inferred by the residuals paths we could group the countries in three sets (see Annex 2).

**Graph 3. Residuals from exports equation**



The first set of countries is made of the countries which enjoy a systematic upward path of the residuals. For these countries, the effect on exports of omitted/unobservable variables (quality, business environment, sectoral composition, etc.) seems to be an improvement of exports performance over time with respect to what could be achieved only from demand and prices' behaviour. Slovenia and to a lesser extent Germany are showing an acceleration of the potential explanatory power of missing factors in the standard equation.

In the second set are placed the countries presenting a negative systematic path of the omitted variables. Portugal and Ireland show an increasing negative contribution of the omitted non-prices competitiveness variables over time (see Annex 2). This could for example correspond with a decrease of the quality of exported goods.<sup>12</sup> Interestingly in this group, Italy shows initially a negative residual path and then a more slightly positive dynamic. Overall, the Italian path is compatible with a recent shift to higher quality, as suggested by the reviewed literature. The third group contains the countries for which the residual dynamic is almost stable or too volatile (e.g. Greece).<sup>13</sup>

<sup>11</sup> This is consistent with other empirical analysis (see among others Kabundi and Nadal de Simone (2009) for France).

<sup>12</sup> And it should correspond to a potential deterioration over time of export ranking as measured by a fixed effect intercept.

<sup>13</sup> To test the robustness of this interpretation of the residual tendencies per countries we run two different fixed effects regressions for the two sub-periods 1995-2000 and 2001-2008. Then, we compared the country intercepts and checked whether we obtained a different ranking of the countries consistent with

#### 4. Extending the basic equation

A better understanding of exports behaviour requires extending the basic exports demand equation to additional determinants of external competitiveness

$$\ln(\text{exports}_{it}) = \alpha_i + \gamma \ln(\text{exports}_{it-1}) + \beta \ln(\text{demand}_{it}) + \delta \ln(\text{REER}_{it}) + \gamma \ln(\mathbf{Z}_{it}) + \varepsilon_{it} \quad (2)$$

where the vector  $Z$  contains a number of non-price competitiveness indicators, which explanatory role we are analysing. We focus on *technological competitiveness and structural competitiveness aspects*, the latter related to the role of services as facilitators and to framework conditions. Table 2 summarises the main indicators used in the analysis.

Initially, patenting activity and R&D intensity are used as proxies for technological competitiveness. Since producers might also accumulate knowledge which is useful for production without engaging in formal innovation activities, we also consider an index of traded goods (the exports deflator) as a proxy for quality upgrading.<sup>14</sup>

Our exploratory exercise to the role of services in explaining export performance focuses on an admittedly narrow and far from perfect proxy for services sectors efficiency and dynamism: the (percentage) sectoral contribution of TFP to value added in services sectors that we believe have a clear link with exports activities: transport and communication, financial intermediation and (real state) and business activities.

General framework conditions of the economy such as the level of human capital and aspects related to the business environment could also affect export performance. In particular, we focus on the following indicators: i) indicators related to enforcing contracts; ii) skill level of the workforce measured as the percentage of high skill hours worked in the total economy. We also look into more "targeted" framework conditions particularly affecting exporting activities such as number of documents needed for exports, time and costs. The indicators are however only available from 2004 onwards, limiting drastically the number of observations.

---

the dynamic of the time dependent residuals of the previous regression. Not surprisingly the new intercepts ranking from the first to the second sub-sample confirms the improvement of export performance of Slovenia and the deterioration in the position of Ireland. Italian shift to quality seems not enough relevant to improve its position in terms of export performance.

<sup>14</sup> See Lissovolik (2008).

**Table 2. Indicators of non-price competitiveness**

|   | Definition  | Source, coverage          |
|---|---|---------------------------|
| <b>Technology indicators</b>                            |   |                           |
| R&D   | R&D expenditures/ GDP   | EUROSTAT                  |
| Patents   | Number of EPTO patents in manufactures                              | EUROSTAT                  |
| Quality   | Export deflator   | AMECO                     |
|   |   |                           |
| <b>Structural competitiveness: services</b>             |   |                           |
| TFP_TC  | TFP contribution to value added_ transport and communication        | EUKLEMS                   |
| TFP_FI  | TFP contribution to value added_ financial intermediation           | EUKLEMS                   |
| TFP_BA  | TFP contribution to value added_ real state and business activities | EUKLEMS                   |
| <b>Structural competitiveness: framework conditions</b> |   |                           |
| Skills  | Hours worked by labour skill category (%)                           | EUKLEMS                   |
| Enforcing contracts: # procedures                       | Enforcing contracts, (number of procedures)                         | World Bank Doing Business |
| Enforcing contracts: time                               | Time for enforcing contracts (days)                                 | World Bank Doing Business |
| Enforcing contracts: cost                               | Cost for enforcing contracts (% of claim)                           | World Bank Doing Business |

Table 3 displays the estimation results for total real exports as well as for exports of goods and services. Both equations (levels in first differences) yield consistent results in the sense that the explanatory variable keep the expected sign and significativeness. As expected, the augmented equation explains better the total variance of exports. In particular, in the specification in first differences  $R^2$  goes up from 0.55 to 0.68 when technological and services-related factors are included.<sup>15</sup>

#### 4.1 Technological competitiveness

Since we are using three alternative proxies to measure technological competitiveness, we first look at to what extend they are capturing the same phenomenon. A sample correlation between R&D intensity and number of patents of near 0.7, shows that over time the results for R&D intensity are consistent with developments in patenting activity. The exports deflator shows a positive but small correlation with the other two technological proxies, probably indicating that quality upgrading may reflect innovation

<sup>15</sup> Recall that for the fitness evaluation of the estimation results we always refer to the estimation in first differences (to avoid the dominant effect of the inertial variable). Also, when extending the model to non-price factors the sample narrows for some countries. Thus we need to reestimate the basic model using a reduced homogeneous sample in order to make an effective comparison.

efforts but also softer forms of improving the quality of a product. Hence, we decided to introduce the exports deflator simultaneously with the R&D / patents variables.

Given the time span between investing in R&D and innovation output, the patent variable enters the equation contemporaneously while R&D expenditures are lagged. Since R&D investment and patents are concentrated in high and medium-tech manufactures, it is expected that exports of services have a lower elasticity with respect to innovation than exports of goods. Similarly to the interaction effect between exchange rate and services, we try to capture the lower sensitivity of services to R&D by adding a new variable interacting R&D (and patents) with the share of services in total exports. We expect a decrease in the total R&D elasticity as the services share in total exports increases.

The results show that innovative countries export more and the long-run effect of R&D on exports is important: a 10% increase in R&D intensity increases exports of goods by over 2%. Given that the average and standard deviation of R&D intensity for the sample considered of 1.5 and 0.7, respectively, an increase in R&D of 0.15 (10%) seems fairly modest. The positive role of innovation is confirmed by the statistically significant positive long-run effect of number of patents on real exports. A 10% percent increase in the number of patents leads to a 3% increase in real exports of goods. The exports deflator indicator exhibits a positive and statistically significant (long-run) relationship with total real exports, possibly suggesting the role of quality upgrading in supporting real exports. In the goods regression, the impact however is only statistically significant at 12%. However, when the number of patents is used instead of R&D intensity the effect of the exports deflator is always statistically non-significant (and presents a negative sign).<sup>16</sup>

The interaction effect shows that technology/innovation is more important for exports of goods than for exports of services (indeed at the limit, for an economy which exports are highly concentrated on services R&D intensity does not have a positive but rather a negative impact on exports a result that deserves further research). However, the interaction effect turns to be statistically non-significant in the case of patents. Running separate estimations for services (not reported, but available upon request) confirms this finding: technological competitiveness indicators do not seem to play a role in explaining exports of services. As mentioned, this is a somehow expected given that R&D investment is concentrated in high and medium-tech manufactures. Other studies, however, have found a positive long-run effect of R&D on exports of services (see for example Pain and van Welsum, 2004). The different results can be explained by: i) they used stock of R&D as a proxy; ii) the use cumulative R&D effort by country relative to other countries; iii) they disaggregate exports by categories (finding the largest long-run elasticity for receipts of royalties). All these factors point to possible ways to improve our approach. Particularly promising seems to be the disaggregation of services data.

At first sight, by comparing the residuals graphs of equation 1 and equation 2 (adding the technological factors) we observed similar patterns per country, suggesting that there is still a lot of unexplained variance in the data (see Annex 2). However, a closer look into

---

<sup>16</sup> The estimation in first differences shows a positive and statistically significant coefficient for the "quality upgrading" indicator. We consider this as some weak evidence of the role of quality upgrading in exports.

the results shows that the average absolute residual decreases when the new variables are added. Moreover, the residuals are closer to a white noise process than in the basic regression. All these evidence reinforces the idea that technological aspects have a significant, but modest, impact when explaining export performance. As expected, the picture per country is heterogeneous, with some countries showing more sensitiveness to the non-standard variables.

The above results have to be interpreted with caution as a number of caveats apply. First, the link between technological competitiveness and exports is expected to vary across sectors, an aspect not included in the analysis as the data used is aggregate exports. In particular technological innovation is expected to be a more important determinant of high and medium-tech sector's exports. Second, the analysis assumes equal effectiveness of R&D expenditure across countries. Third, a more appropriate indicator of technological competitiveness would be the stock rather than the flow of technological innovation.

**Table 3. Exports, technology and services in the euroarea**  
Dynamic panel regression. Dependent variable is real exports

|                            | Patents and services |                  | R&D and services |                  |
|----------------------------|----------------------|------------------|------------------|------------------|
|                            | Total exports        | Exports of goods | Total exports    | Exports of goods |
| Persistence                | 0.77**               | 0.70**           | 0.76**           | 0.71**           |
| REER                       | -0.32**              | -0.40**          | -0.36**          | -0.38**          |
| Demand                     | 0.10**               | 0.16**           | 0.14**           | 0.19**           |
| Lag R&D                    |                      |                  | 0.24**           | 0.06*            |
| Interaction effect R&D     |                      |                  | -0.8**           |                  |
| Patents                    | 0.06**               | 0.09**           |                  |                  |
| Interaction effect patents | -0.02                |                  |                  |                  |
| Export deflator            | -0.07                | -0.007           | 0.10*            | 0.10             |
| TFP_TC                     | 0.002*               | 0.002**          | 0.001            | 0.001            |
| TFP_BS                     | 0.001                | 0.001            | -0.001           | -0.001           |
| TFP_FI                     | 0.001**              | 0.002**          | 0.001**          | 0.001*           |

Sample covers 12 euroarea countries (it excludes LU, CY, MT, SK). Total sample includes exports of goods and services.

The interaction effect is R&D intensity times the share of services in total exports. The variable tests whether services are less sensitive to technological developments.

TFP\_TC/BS/FI measures the contribution of sectoral TFP to value added growth of transport and communication (TC), real estate and business services (BS), and financial intermediation (FI).

All variables are in logs, except the TFP variables (in %).

\*\* Means significant at 5%, \* is significant at 10%.

#### 4.2 Structural competitiveness: services

The ideal approach to test the role of services will require: disaggregated sectoral exports, information on the strength of the interlinkages between services and the rest of the economy, and information on those goods and services more likely to be sold in packages. We consider particularly interesting the latter aspect as this "bundling"

hypothesis is so far empirically untested. As mentioned, in this preliminary work we only use data on TFP for selected services sectors.

As shown in Table 3, higher TFP contribution to value added in the financial sector has a very small, but statistically significant long-term effect on exports. The variable is in percentage contribution thus the coefficient has to be interpreted as a semi-elasticity: a 1 percentage point increase of the TFP contribution to value added in the financial sector yields a meagre 0.006% (for patents, 0.004% for R&D) increase in real exports. Higher TFP contribution to value added in the other two services sectors considered (transport and communication, and real estate and business services) do not have a statistically significant impact in the volume of total exports. The results hold for total exports and exports of goods; exports of services however do not show a significant relationship with TFP contribution to value added in selected services sectors.

#### 4.3 Structural competitiveness: framework conditions

Using the selected business conditions indicators (see Table 2) significantly reduces our sample. We thus estimate the effect of these indicators augmenting the basic equation but not including the technology and services variables. The specification is still a dynamic panel with fixed effects.

Table 4 shows the estimation results: both the number of procedures and cost of enforcing contracts have a high negative effect on exports (particularly damaging is the cost-related variable): a 1% increase in the number of procedures decreases exports in the long-run by almost 0.6%; the long-run impact of a 1% increase in the cost of contracts is a decrease in exports by 1.8%. The results however should be interpreted with caution given the low degrees of freedom.

**Table 4. Exports and framework conditions in the euroarea**

Dynamic panel with fixed effects. Dependent variable is real exports

|                                   |               |
|-----------------------------------|---------------|
| Relative prices                   | -0.45**(0.16) |
| External Demand                   | 0.36**(0.09)  |
| Enforcing contracts: # procedures | -0.29**(0.13) |
| Enforcing contracts: time         | 0.21**(0.04)  |
| Enforcing contracts: cost         | -0.92**(0.30) |
| Persistence                       | 0.50**(0.09)  |

Sample covers 12 euroarea countries (it excludes LU, CY, MT, SK).  
All variables are in logs. Standard errors in parenthesis

Turning into skill composition of the workforce, it turns out that a high percentage on high skill labour in total hours worked does not significantly affect the volume of exports. Given that we are only using aggregate data this result is not surprising and a better understanding of the role of human capital would require a sectoral disaggregation of exports by for example technological or skill content.

## 5. Conclusion

As expected, traditional, standard variables such as exchange rate and external demand still explain a major part of the overall variance of real exports. However, the preliminary results of the analysis carried out in this work seem to confirm that when thinking about exports performance, more attention should be paid to non-price competitiveness factors.

In particular, technological competitiveness, measured as innovation but also as more generally quality upgrading, is an important factor in sustaining real exports. Results show that it takes on average three years for R&D efforts to yield some impact on exports performance. Some arguably weak evidence shows that "soft" quality upgrading (as proxied by the exports deflator) emerging from businesses accumulated knowledge rather than from formal innovation activities (i.e. R&D expenditures and patents) can explain real exports performance. This is an important consideration for quality improving in traditional sectors. These sectors are in general less likely to benefit from R&D and innovation efforts. However, having a better proxy than the export deflator for quality upgrading is essential to properly capture its effects on exports.

Estimation results concerning business environment conditions confirm that administrative burdens have a negative influence on exports. In particular, there might be gains from further streamlining of regulation concerning enforcing contracts.

Our preliminary analysis also points to ways to extend traditional analysis of export performance by looking into the role of services. Even though our proxy for efficient key services markets needs to be extended and improved, our preliminary results point to financial services as having a positive (but very small) effect on the volume of exports. We think that extending the analysis to services is important for several reasons:

- well functioning, efficient and innovative services markets could have a positive impact on export potential and external competitiveness;
- the increasing share of exports of services over total exports could help explaining the dynamic of price elasticity of exports overtime.

Looking forward, we think that the empirical analysis can be improved in a number of directions: i) use sectoral rather than aggregated data. For example, sectors could be classified according to their level of technological content or to their labour force skill distribution; ii) improve indicators used in the text for the services-as-facilitator hypothesis by, for example, identifying which type of goods and services are more likely to be sold in packages; iii) look at other non-price competitiveness factors related to product differentiation and product variety.

## References

- Anderton, R., B. Baltagi, F. Skudelny and N. Sousa (2005): "Intra-and extra-euro area import demand for manufactures, " ECB WP 532.
- Artus, P. and L. Fontagné (2006): "Évolution récente du commerce extérieur français", Rapport du Conseil d'analyse économique, n° 64.
- Baltagi, B.H. and C. Kao (2000): "Nonstationary panels, cointegration in panels and dynamic panels: a survey". Center for Policy Research Working Paper No.16. Maxwell School of Citizenship and Public Affairs, Syracuse University.
- Brambor, T., C.R. Clark and M. Golder (2005): "Understanding interaction models: Improving empirical analyses", *Political Analysis* (2005) 13:1–20.
- Brandt, N. (2004): "Business dynamics, regulation and performance", OECD STI Working Paper Series, DSTI/DOC(2004)3.
- Bugamelli M. (2007): "Export Prices, Product Quality and Firms' Characteristic: An Analysis on a Sample of Italian firms", Economic working papers 634, Bank of Italy.
- Camarerom, M. and C. Tamarit (2003): "Estimating exports and imports demand for Manufactured goods: The role of FDI", *European Economy Group Working Papers*, 22.
- Codogno L. (2009): "Two Italian Puzzles: Are Productivity Growth and Competitiveness Really so Depressed?" Italian Ministry of Economic and Finance working paper n.2
- Cowlin, K. and Rayner A.J. (1970): "Price, Quality, and Market Share" *The Journal of Political Economy*, Vol. 78, No. 6, pp. 1292-1309
- ECB (2005): "Competitiveness and the export performance of the Euro Area", ECB Occasional Paper Series n.30.
- ECFIN (2009a): "Note on price and costs competitiveness of euro-area Member States' exports", Note to File (C1)
- ECFIN (2009b): "Competitiveness developments within the euro area", Quarterly Report on the Euro Area, Special Report, Vol. 8, n.1.
- Egger, P. (2001): "European Exports and Outward Foreign Direct Investment: Dynamic Panel Data Approach," *Weltwirtschaftliches Archiv*, Vol. 137 (3).
- European Competitiveness Report (2008): European Commission, [http://ec.europa.eu/enterprise/enterprise\\_policy/competitiveness/doc/compet\\_rep\\_2008/cr-2008-final.pdf](http://ec.europa.eu/enterprise/enterprise_policy/competitiveness/doc/compet_rep_2008/cr-2008-final.pdf)
- Evren Erdogan Cosar (2002): "Price and income elasticities of Turkish export demand: a panel data application", Turkey, Central Bank Review 2.

- Fagerberg, J., P. Hansson, L. Lundberg and A. Melchior (Eds) (1997): *Technology and International Trade*, Edward Elgar Publishing Limited, UK.
- Guerrieri, P. and V. Meliciani (2005): "Technology and international competitiveness: the interdependence between manufacturing and producer services", *Structural Change and Economic Dynamics*, 16, 489-502.
- Hallak, J.C. and P.K. Schott (2008): "Estimating Cross-Country Differences in Product Quality", National Bureau of Economic Research, Working Paper no. 13807.
- Imbriani, C., P. Morone and G. Testa (2008): "Exporting quality: is it the right strategy for the Italian manufacturing sector?" MPRA Paper 13327, University Library of Munich, Germany.
- Judson, R.A. and A.L. Owen (1996): "Estimating dynamic panel data models: a practical guide for macroeconomists" Federal Reserve Board of Governors.
- Kabundi, A. and F. Nadal de Simone (2009): "Recent French Export Performance: Is there a Competitiveness Problem?" IMF WP/09/2
- Krugman P. R. (1979): "Increasing returns, monopolistic competition, and international trade" *Journal of international economics* (9) North Holland Publishing Company
- Lissovlik, B. (2008): "Trends in Italy's nonprice competitiveness", IMF Working Paper WP/08/124.
- Martinez-Mongay, C. and L.A. Maza Lasierra (2008): "It is competitiveness, isn't it? The challenges of the Spanish economy in the second decade of EMU", ECFIN.
- Motta, M. (1993): "Endogenous Quality Choice: Price versus Quantity Competition" *The Journal of Industrial Economics*, Vol. 41, No. 2, pp. 113-131
- Nicoletti, G. and S. Scarpetta (2003): "Regulation, productivity and growth: OECD evidence", OECD Working Paper, No. 347.
- Osbat, C. (2004): "Panel unit root and panel cointegration methods": <http://luming.essrc.org/Article/UploadFiles/200607/20060731084427218.pdf>
- Pain, N. and D. Van Welsun (2004): "International Production Relocation and Exports of Services", OECD
- Pain, N. and K. Wakelin (1998): "Export performance and the role of foreign direct investment", *The Manchester School Supplement* 62-88
- Ruscher, E. and G. Wolff (2009): "External rebalancing is not just an exporter's story: real exchange rates, the non-tradable sector and the euro", *European Economy, Economic Papers* 375.
- Stiglitz, J. (1987): "The causes and consequences of the dependence of quality on price", *Journal of Economic Literature*, 25(1).

Stevenson, F. A. (2004): "Skill Shortages and Firms' Employment Behaviour" National Institute of Economic and Social Research, discussion paper 2, Dean Trench Street, Smith Square, London.

Sutton, J.(2007): "Quality, trade and the moving window: the globalization process" The Economic Journal, 117 (November) Blackwell Publishing

Wolfl, A., I. Wanner, T. Kozluk and G. Nicoletti (2009): "Product market regulation in OECD countries 1998-2008," OECD Economics Department Working Paper.

## **Annex 1. Data issues**

### ***A. Data frequency***

Most recent papers looking into exports behaviour in the EU use quarterly data (ECB (2005), Lissovolik (2008), ECFIN (2009a)). Quarterly data are however only available for the basic model regression as most non-price competitiveness variables are only available annually (and some of them as those related with the business environment even at lower frequencies). We therefore use annual data for the period 1994-2008 for the euro area countries.

### ***B. Definition of variables and data***

*Exports* are total real exports to rest of the world. We also use real exports of goods and of services. Data comes from AMECO database that provides total exports in constant prices for the 27MS. Currency used is € except for non-euro-area countries. In this case, the average exchange rate (national currency/€) has been used to transform national currency into €

Different measures of the *real effective exchange rate* are used in the text depending on the deflator used (ULC, CPI or exports-price). They could cover prices or costs for the whole economy such as ULC-based REER (comparing relative wages and relative productivity), and CPI-based REER (comparing relative consumer prices). Differences could arise as for example, it could be argued that ULCs are incomplete measures of the true price competitiveness (as labour costs represent a part of total costs of exporting firms). It could also be narrow measures based on prices in specific segments of the economy such as exports-price-based REER (comparing relative export prices). Differences in broad and narrow measures could be significant (ECFIN (2009b)), for example reflecting the changes in the relative price of tradable and non-tradable goods and services (see Ruscher and Wolff, 2009), changes in export profit margins (exporters could utilise their profit margins in order to mitigate the impact of exchange rate shocks on price competitiveness, which in turn reduces the impact on export volumes (ECB, 2005). Our price indicator is compiled by ECFIN and it is available for different groups of trading partners: EU27+other industrialized countries (Australia, Canada, Japan, Mexico, New Zealand, Norway, Switzerland, Turkey, USA). An alternative indicator (only ULC-based available) calculates the REER against a broader group of countries that also includes China, Brazil, Russia, Hong Kong and Korea.

The *external demand* variable measures the potential size of a country's export markets. We use an indicator provided by AMECO calculated as real total imports of main partners weighted by country's exports to such countries (problem being that only considers 35 industrialised countries as main partners).

*Exports deflator* comes from AMECO. *R&D intensity* and number of *patents in manufactures* both are available from Eurostat structural indicators.

The *contribution of sectoral TFP to value added growth* of the sector (percentage points) is available from EUKLEMS. The data is available for various services sub-sectors that we use in our analysis: retail and wholesale; transport and storage and communication; financial intermediation; and real state and business activities.

*Hours worked by labour skill category* (in %) is available from EUKLEMS for the total economy as well as by subsectors. The following sub-sectors are used for our analysis: real state and business activities; financial intermediation; transport, storage and communication.

The World Bank *Doing Business* database provides a number of indicators and sub-indicators that could be seen as specific to exporting activities. Indicators and sub-indicators follow next. A) *Trading Across Borders* (sub-indicators are: documents for exports; time for exports; cost to export). B) *Enforcing Contracts* (sub-indicators: procedures; time; cost)

## Annex 2. Standardised residuals from basic and R&D regression

