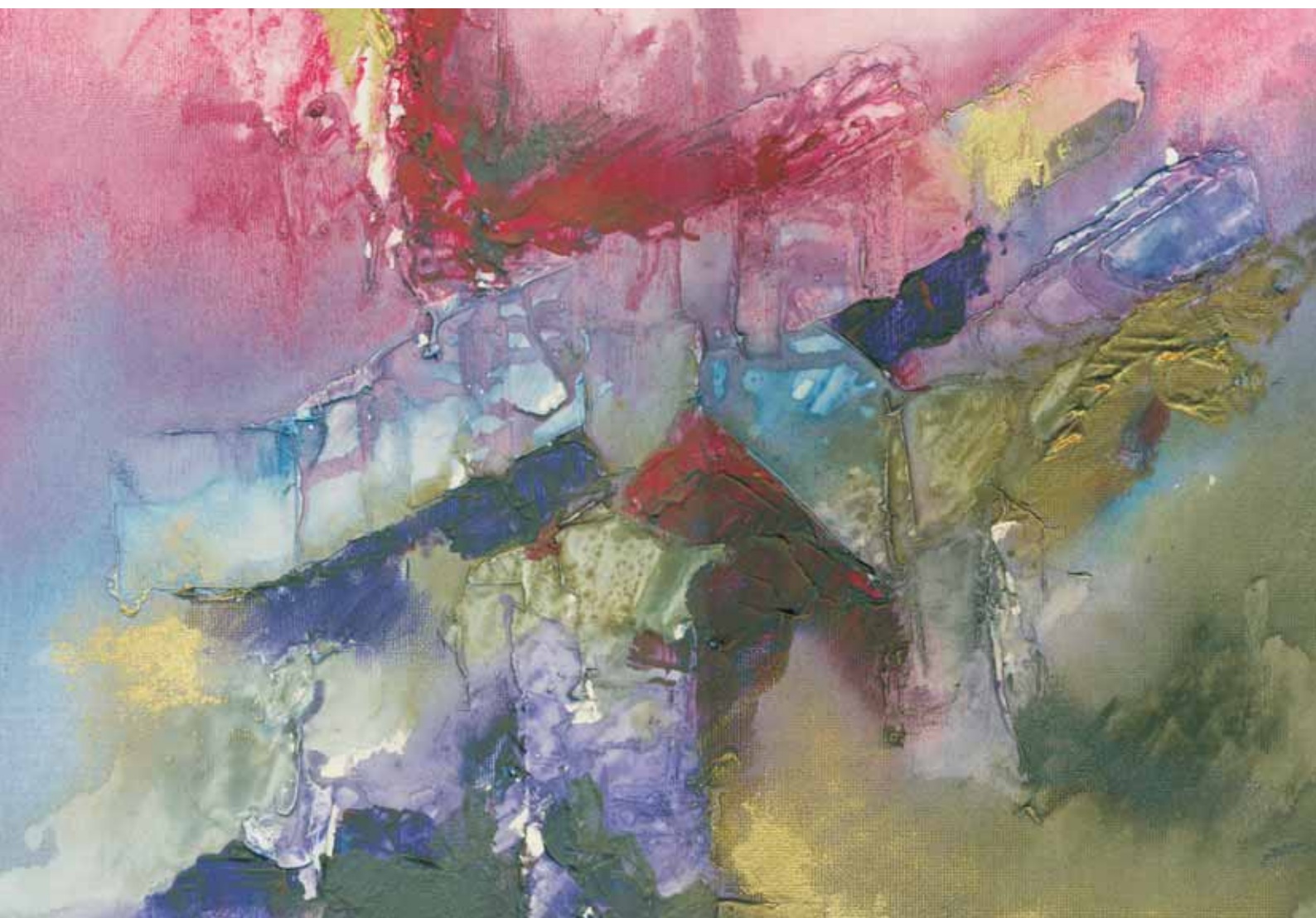


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**WORKING PAPER**  
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**MEASURING THE EFFECTIVENESS OF COST AND PRICE  
COMPETITIVENESS IN EXTERNAL REBALANCING OF EURO  
AREA COUNTRIES: WHAT DO ALTERNATIVE HCIs TELL US?**



## CONTENTS

ABSTRACT	3
NON-TECHNICAL SUMMARY	4
INTRODUCTION	6
1. DATA DESCRIPTION, STYLISED FACTS, METHODOLOGY	8
2. ESTIMATION RESULTS OF EXPORT EQUATIONS	11
2.1 Exports of Goods	11
2.2 Exports of Services	13
2.3 Robustness Analysis	15
3. ESTIMATION RESULTS OF IMPORT EQUATIONS	18
3.1 Imports of Goods	18
3.2 Imports of Services	20
3.3 Robustness Analysis	21
CONCLUSIONS	24
APPENDICES	26
BIBLIOGRAPHY	38

## ABBREVIATIONS

ADF test – augmented Dickey–Fuller test	GR – Greece
AT – Austria	HCI – harmonised competitiveness indicator
CEECs – Central and Eastern European countries	IE – Ireland
CEPR – Centre for Economic Policy Research	IMF – International Monetary Fund
COMPNET – Competitiveness Research Network	IT – Italy
CPI – consumer price index	KPSS test – Kwiatkowski–Phillips–Schmidt–Shin test
CPIS – consumer price index in services sector	LU – Luxembourg
CY – Cyprus	MT – Malta
DE – Germany	NIESR – National Institute of Economic and Social Research
DF–GLS test – Dickey–Fuller GLS test	NL – the Netherlands
ECB – European Central Bank	PP test – Phillips–Perron test
EE – Estonia	PPI – producer price index
ES – Spain	PT – Portugal
euro area – euro area countries till January 2014	RIETI – Research Institute of Economy, Trade and Industry
FI – Finland	SI – Slovenia
FR – France	SK – Slovakia
GDP – gross domestic product	ULC – unit labour costs
GLS – generalised least square	ULCM – ULC in manufacturing
	ULCT – ULC in the total economy
	US – United States of America

## ABSTRACT

This study is devoted to examining marginal effects of traditional determinants of exports and imports with a focus on the role of price competitiveness in restoring external balances. It is a first attempt to compare marginal effects of various harmonised competitiveness indicators (HCIs) on both exports and imports of both goods and services across individual euro area countries. We find evidence that the HCIs based on broader cost and price measures have a larger marginal effect (with some exceptions) on exports of goods. Exports of services are sensitive to the HCIs in large euro area countries and Slovakia, where exports of services are also found to be more sensitive to competitiveness indicators based on broader price measures. Imports of goods and imports of services are quite insensitive to the changes in relative prices. Finally, in some cases the measures of the goodness of fit indicate that a large unexplained residual part is present, implying that other non-price related factors might play an important role in driving foreign trade.

**Keywords:** real exchange rate, exports, imports, price competitiveness, euro area

**JEL codes:** F14, F31, F41

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## NON-TECHNICAL SUMMARY

The ECB publishes various indicators of cost and price competitiveness, i.e. harmonised competitiveness indicators (HCIs), of individual countries on a regular basis. These capture both nominal exchange rate fluctuations and developments in various cost or price indices: consumer price index (CPI), producer price index (PPI) of domestic sales, gross domestic product (GDP) deflator, unit labour costs in manufacturing (ULCM) and unit labour costs in the total economy (ULCT). There is no agreement among researchers as to which of these measures reflects a country's external price competitiveness better and is therefore a priori more effective in driving trade developments. Since restoring price competitiveness is usually regarded as paramount to external rebalancing in the euro area, we conduct an empirical analysis of trade flows seeking to unveil the impact of alternative relative price measures on exports and imports of goods and services of individual euro area countries (euro area countries till January 2014) over the sample period Q1 1995–Q1 2013. More specifically, we estimate standard dynamic equations for exports and imports of goods and services, where each HCI is one of the determinants, and compare the elasticities of exports and imports with respect to alternative HCIs.

Assessment of export equations illustrates that in most countries exports of goods and exports of services are sensitive to changes in at least one indicator of relative prices, and in most cases this sensitivity is relatively small. Estonia, Finland, Spain, France and Malta are the only countries with high reaction of exports of goods to the changes in relative prices. As regards exports of services, such exports appear to be sensitive to the developments in HCIs in the following large euro area countries: France, Germany, Italy, the Netherlands and Spain as well as Slovakia. In the rest of the euro area countries, the effect of HCIs on exports of services is mostly statistically insignificant.

In this study we also show that relative price measures based on cost and price indices of the broad economy (namely the CPI, ULCT and GDP deflator indices) have a somewhat higher marginal effect on exports of both goods and services as compared to those based on manufacturing only (ULCM and PPI). This provides evidence in favour of the developments in a broad range of domestic production costs taken into account in order to explain a country's ability to export (with the exceptions of Estonia and Greece where the ULCM-based HCIs are the only ones identified to exert a statistically significant effect on exports of goods). Among the ULC-based HCIs the one based on wages in tradable and non-tradable sectors (ULCT) rather than just on the wages in manufacturing (ULCM), is ascertained to affect exports of goods more.

It is also apparent from our estimations that non-price competitiveness factors (such as changes in quality of products) are likely to play an important role in driving exports of individual euro area countries, since it is generally impossible to explain more than 60%–70% of export varieties by standard export equations.

The assessment of import equations shows that relative price competitiveness seems to matter less for imports of goods and imports of services, with some of the equations exhibiting a counter-intuitive negative effect of HCIs on imports. The latter is ascribed to an increasing role of the euro area countries in global value chains and a growing share of imports of intermediate goods in the production

process. Thus real appreciation leads to a decline in both exports and imports as a country gets disconnected from the global value chain.

A battery of robustness tests has also been performed within the study. These tests account, inter alia, for the possible effect of domestic demand on exports, potential endogeneity of HCIs and positive correlation between exports of goods and exports of services. Moreover, alternative domestic demand measures and alternative weights of HCIs are employed in the equations. The sensitivity analysis largely confirms the main findings of the study.

Our main policy conclusion is that broad-based structural reforms, including those in the domestic product markets, should accompany the cost moderation efforts in the export sector. This combination would result in across-the-board cuts in costs and prices that would translate into competitiveness improvements and revival of exports in the euro area. That said, the importance of non-price competitiveness factors should not be understated and further improvements in non-price competitiveness factors should also be warranted.



## INTRODUCTION

Since the outbreak of the global economic and financial crisis there has been a persistent call for improving price competitiveness among the euro area countries, in particular among the countries with substantial current account deficits. Increasing price competitiveness has been claimed to be crucial for their ability to unwind external imbalances accrued before the crisis and to ensure sustainable growth of their economies.

The role of price competitiveness in driving exports and imports, and therefore external rebalancing, has long been acknowledged in both theoretical and empirical studies of external trade. Price competitiveness of individual euro area countries is usually assessed by the developments in real effective exchange rates, compiled by using alternative price and cost deflators. For the euro area countries, the ECB publishes different real effective exchange rates, i.e. harmonised competitiveness indicators (HCIs), capturing nominal exchange rate and various price and cost developments of individual euro area countries against their main trading partners. These are deflated by the consumer price index (CPI), producer price index (PPI) of domestic sales, gross domestic product (GDP) deflators, unit labour costs in manufacturing (ULCM) and unit labour costs in the total economy (ULCT).<sup>1</sup> There is no consensus among researchers regarding which of them reflects a country's price and cost competitiveness better and is therefore apriori more effective in driving trade developments of a country since each of them has its own advantages and shortcomings<sup>2</sup>.

This study draws on an earlier working paper by Ca' Zorzi and Schnatz (2007) who have estimated extra-euro area export elasticities with respect to different HCIs for the euro area as a whole and have compared their performance in explaining export developments. The objective of this study is to examine the marginal effects of price and cost competitiveness, measured by alternative HCIs, in reducing external imbalances of all individual euro area countries. To our knowledge, the present study is a first attempt to estimate standard export and import equations by using alternative HCIs for each of the euro area countries, in one study.

In our study exports of goods and exports of services are mostly found to be either insensitive to the changes in relative prices or their sensitivity is small. Estonia, Finland, Spain, France and Malta are the only countries with high reaction of exports of goods to the changes in relative prices. Our findings show that among the cases when price elasticity appears to be a statistically significant determinant of exports of goods the HCIs based on broader cost and price measures, namely ULCT, GDP deflator and CPI, seem to be more accurate measures of price competitiveness, as implied by their marginal impact on exports. Exports of services are sensitive to developments in HCIs in the following large euro area countries: France, Germany, Italy, the Netherlands and Spain as well as in Slovakia. In these countries exports of services are also established to be more sensitive to competitiveness indicators based on broader price measures. At the same time, imports of goods and imports of services are quite insensitive to the changes in relative prices. For imports of goods,

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<sup>1</sup> For the compilation of harmonised competitiveness indicators (HCIs), see Schmitz et al. (2012).

<sup>2</sup> For a discussion on the merits and shortcomings of different HCIs, see Ca' Zorzi and Schnatz (2007) and Schmitz et al. (2012).

a 1% increase in the HCIs based on ULCT and GDP deflators tends to have a relatively larger and statistically significant impact in the case of Luxembourg, Portugal, Slovenia and Spain, while, as regards Austria, Greece and the Netherlands, this effect is larger for the HCIs capturing price and cost developments in manufacturing.

It should be mentioned, however, that the absolute impact of ULC-based HCIs might be higher, because the rate of change in ULC-based HCIs is in some cases greater. Importantly, we did not aim at focusing on the absolute effect of various HCIs or their contribution to the historical evolution of trade volumes (although a short discussion of the HCI contribution to export growth has also been provided). Marginal price sensitivity is an important indicator of the relevance of price movements for exports and imports and thus of the necessary policy measure a country should undertake in order to succeed in external rebalancing. Inter alia, our findings confirm the importance of broad-based structural reforms (including reforms in the product markets) for improving price and cost competitiveness in the euro area. These would bring about across-the-board cuts in costs and prices that would more easily translate into the competitiveness improvements and export recovery in the euro area. Alternatively, in order to reduce external imbalances which undermine the feasibility and sustainability of this policy measure, one needs a somewhat harsher retrenchment of labour costs (due to their low marginal effect).

Foreign demand elasticity of exports of goods and exports of services appears to be statistically significant for most euro area countries, with an average value of 1.1 and 0.9 respectively across all equations. The average value of domestic demand elasticity of imports of goods and imports of services is found to be higher than 1. Foreign trade flows might grow faster than income due to a variety of reasons. Anderton and Tewolde (2011) and Crane et al. (2007) attribute this to the rapid increase in global production chains. Globalisation and liberalisation of foreign trade might have also played an important role. Pogany and Donnelly (1998) explain this phenomenon by the growing weight of intra-industry trade in total world trade since the end of World War II. Rising income induces consumers to exercise a larger choice in the variety of goods consumed, leading to a rapid increase in intra-industry trade and thus also in total global trade (in excess of income level itself). Barrell and Déés (2005) claim that this should be a relatively temporary phenomenon since otherwise all income would be spent on exports and all output would be exported.

The differences in statistical fit across different specifications are minor. Furthermore, in some cases a substantial part of export and import growth remains unexplained, i.e. the standard approach to modelling exports and imports is unable to fully capture their developments. This has been confirmed by many previous studies, pointing to the importance of non-price competitiveness in international trade (ECB (2005), Dieppe and Warmedinger (2007), di Mauro and Forster (2008), Benkovskis and Wörz (2014), Antràs et al. (2010), Altomonte et al. (2013)). In addition, Anderton and Tewolde (2011) ascertained that a large part of the developments in imports during the upturn of global trade after the crisis might be ascribed to fiscal and monetary policy measures; these were implemented to boost trade and were not captured by standard demand variables. They also suggest that a specification based on different components of total expenditure can provide a better explanation of imports.

The economic and financial crisis in the euro area might have induced a parametric change in standard equations for exports and imports. Therefore we test the structural breaks in our models and present the relevant results. Some equations have been affected by structural breaks, mainly during the period of the great recession. This finding has been consistent broadly with Barrell and Te Velde (1999) who investigated and attempted to explain parametric evolution in traditional import demand equations for ten European countries. They attribute this instability of parameters broadly to the omitted variables phenomenon and improve import demand models by incorporating the relevant technology and foreign direct investments into the above.

We perform a variety of robustness tests. First, the study relies on the framework developed by Esteves and Rua (2013) and deals with the supply side of export flows. In a manner similar to their study, we include domestic demand as an additional variable to explain exports and to examine the asymmetric effect of domestic demand on exports by distinguishing between periods when domestic demand is growing and when it is contracting. Second, we test whether our results are robust if we employ alternative estimates of HCIs, i.e. the HCIs are calculated, using the data on trade in exports only (for export equations) and data on trade in imports only as weights (for import equations) rather than a weighted sum of the former and the latter. Third, there might be a positive correlation between exports of goods and exports of services, i.e. the former might facilitate a growth in the latter. Therefore we also try to check, whether our results are robust to adding exports of goods into the equations for exports of services. Fourth, we control for the potential existence of endogeneity by including only the lags of HCIs in our export and import equations. Finally, following the recent literature by Bussière et al. (2011), we assess import equations by using an alternative measure of domestic demand whereby an import content of domestic demand is controlled. The results obtained from this extensive sensitivity analysis remain consistent with our main findings.

The present working paper is structured as follows. Section 1 describes the data and methodology used in the study as well as briefly analyses historical developments of different HCIs. Sections 2 and 3 provide the assessment results of export and import equations respectively. Finally we conclude with a summary of our findings and possible avenues for future research.

## 1. DATA DESCRIPTION, STYLISED FACTS, METHODOLOGY

The data set of this study comprises the data on real exports and imports, foreign and domestic demand and various HCIs. Real exports (imports) are calculated as volume indices of goods and services, seasonally adjusted and in most cases corrected for working days<sup>3</sup>, and referring to the euro area total exports and imports (both intra and extra). The HCIs for goods are based on the relative measures of CPI, domestic sales PPI, ULCM, ULCT and GDP deflators against the other 16 countries of the euro area and the 20 most important trading partners of the euro area: Australia, Canada, China, Denmark, Hong Kong, Japan, Norway, Singapore, South Korea, Sweden, Switzerland, Czech Republic, the United Kingdom, the US, Hungary, Latvia, Lithuania, Poland, Bulgaria and Romania. The HCIs for services are based

<sup>3</sup> For Ireland only non-seasonally adjusted data are available, so we adjusted these data seasonally, using the TRAMO SEATS methodology.



on four alternative deflators: CPI, CPI for the services sector (CPIS), ULCT and GDP deflators, with weights based on the services trade data. The foreign demand index is computed as a geometric weighted average of import volumes of a country's main trading partners in the euro area and the same 20 main trading partners mentioned above.<sup>4</sup> Domestic demand comprises private consumption, gross capital formation and government consumption. The sample period of the study extends from Q1 1995 to Q1 2013<sup>5</sup> which corresponds to 73 quarters. The data for earlier periods are not available due to the unavailability of foreign demand data. The data are provided by Eurostat and the ECB. All variables are measured in logarithms.

We carried out a set of unit root tests: the augmented Dickey–Fuller (ADF) test, the Dickey–Fuller GLS (DF–GLS) test, the Phillips–Perron (PP) test and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test for all variables involved both in levels and in first differences. We augmented the set of tests with the Perron test, taking into consideration the possible structural breaks since some of the variables might be affected by a structural break, in particular during the period of the great recession. The auxiliary regressions for variables in levels include a linear trend and an intercept, while those for variables in first differences – only an intercept. The number of lags is selected, based on the information criteria.

Despite the fact that some of the tests provide conflicting evidence, overall, the results (available upon request) confirm that our time series appear to be non-stationary in levels and stationary in the first difference. This enables us to run a dynamic model. The specification of export equations is given by:

$$\Delta \log X_t = \alpha_0 + \alpha_{1i} \sum_{i=1}^p \Delta \log X_{t-i} + \alpha_{2i} \sum_{i=0}^q \Delta \log FD_{t-i} + \alpha_{3i} \sum_{i=0}^{\mu} \Delta \log HCI_{t-i} + \varepsilon_t \quad [1],$$

where  $\Delta \log(X_t)$  stands for the growth rate of real exports at time  $t$ ,  $\Delta \log(FD_t)$  denotes the growth rate of foreign demand at time  $t$ ,  $\Delta \log(HCI_t)$  stands for the growth rate of one of the relative price and cost competitiveness measures outlined above,  $\alpha_j$ 's are short run dynamic coefficients to be estimated,  $\Delta$  is the first difference operator. Finally,  $\varepsilon_t$  is an error term satisfying standard assumptions. An increase (decrease) in the HCIs implies deteriorating (improving) competitiveness of a euro area country against the remaining 16 euro area countries and 20 non-euro area main trading partners.

We present long-term coefficients of the solved static long-run equations, where  $\alpha_2$  is usually expected to be close to unity, since a country is expected to have a stable export market share in the longer-term<sup>6</sup>. However, as mentioned in the Introduction, the income elasticity has quite frequently been found to be different from the one observed in many countries, reflecting the growing role of global production chains, recent globalisation and liberalisation of foreign trade. In turn,  $\alpha_3$  is expected to be negative, with a loss in competitiveness being translated into the decline in exports.

<sup>4</sup> For more information on measuring foreign demand, see Hubrich and Karlsson (2010).

<sup>5</sup> For Greece the sample period starts in Q1 2000, for Ireland in Q1 1998 and for Slovakia in Q1 1997. In the case of Belgium, the breakdown of exports into exports of goods and exports of services is not available; therefore Belgium is excluded from the data set.

<sup>6</sup> For the derivation of the static long-run solution and long-run coefficients, see Appendix A.

Import equations are assessed, using the following specification:

$$\Delta \log M_t = \beta_0 + \beta_{1i} \sum_{i=1}^p \Delta \log M_{t-i} + \beta_{2i} \sum_{i=0}^q \Delta \log DD_{t-i} + \beta_{3i} \sum_{i=0}^r \Delta \log HCI_{t-i} + \beta_{4i} \sum_{i=0}^s \Delta \log X_{t-i} \quad [2],$$

where  $\Delta \log(M_t)$  stands for the growth rate of real imports at time  $t$ ,  $\Delta \log(DD_t)$  denotes the growth rate of domestic demand at time  $t$ ,  $\Delta \log(HCI_t)$  stands for the growth rate of one of the above outlined relative price and cost competitiveness measures,  $\Delta \log(X_t)$  stands for the growth rate of real exports at time  $t$  and is used to control for the effect of the import content of exports. According to the theory, all three variables are supposed to exert a positive impact on imports in the long run, thus long-term coefficients of solved static long-run equations, namely  $\beta_1, \beta_2, \beta_3$  are expected to be positive.

We allow for a dynamic structure by including lags of the dependent and independent variables. The estimation follows the general-to-specific approach and begins with a model including four lags. As long as the estimated model with four lags satisfies the diagnostic tests (of autocorrelation, normality of residuals and heteroscedasticity), these lags are excluded based on their significance. However, we insist a priori on the inclusion of the contemporaneous effect and of the first lag of each variable in the final regression. If the estimated model with four lags does not satisfy the diagnostic tests, we change the number of lags until the problem is solved. If the problem persists, we identify outliers that create heteroscedasticity and normality problems and include dummy variables until we identify a model that satisfies the diagnostic tests, before we eliminate the insignificant lags. The resulting equations could contain different numbers of lags for each combination of a euro area country and a measure of relative price and cost competitiveness.

Figure B1 (Appendix B) shows the developments in various HCIs over the whole period under investigation. Some important conclusions are immediately evident. First, one can observe that across the majority of the euro area countries the HCIs deteriorated in the second half of the 1990s, followed by an improvement in the first decade of the new millennium, albeit declined again thereafter. The HCI dynamics in Estonia, Italy, Portugal and Slovakia, which experienced an upward trend in the second half of the 1990s, has turned out to be an exception to this pattern. For Estonia, Portugal and Slovakia this reflected a catching-up nature of their economies (characterised by the Balassa–Samuelson effect and price convergence), while Italy has been on track to losing its competitiveness steadily since the euro adoption due to a weak labour productivity growth compared to Italy's trading partners, as well as a rapid increase in wages and prices.<sup>7</sup>

Second, in most cases various indices point to the same direction of the developments of external price competitiveness. However, there are exceptions, some of which have already been documented by Bayoumi et al. (2011). In particular, these exceptions (Figure B1 in Appendix B) refer to the ULCM-based HCIs, which have the obvious shortcoming of reflecting only a fraction of total costs of a firm, ignoring distribution costs, taxes, etc., as well as focusing on

<sup>7</sup> For more details on Italian competitiveness, see the European Commission (2013a) or Manasse (2013).

manufacturing only. The ULCM-based HCI in Ireland has depreciated by around one quarter since 1995, while other HCIs point to a deteriorating price competitiveness. Greece has experienced significant cuts in compensation of employees, reflected in a notable decline in the ULCM-based and ULCT-based HCIs as from 2010 and an overall deterioration of the ULCT deflated HCI (by about 1%) observed over the period. At the same time, other HCIs experienced an increase over the whole period. Competitiveness gains, as measured by the CPI-based and GDP deflator-based HCIs, have been muted since the austerity measures implemented by the government of Greece in the context of the economic adjustment programme comprising both wage cuts and indirect tax increases.

In Portugal wage cuts have also been pronounced, contributing to a downward path of the ULCT and ULCM-based HCIs since the economic adjustment programme has been approved. These measures were complemented by tax increases, thus hampering improvements in external competitiveness when measured by the CPI and GDP deflator-based HCIs. The Netherlands, in turn, has lost its price competitiveness according to the PPI-based HCI which has improved by around 1.5% since mid-2010. Meanwhile, other HCIs have been steadily declining since the beginning of 2010. The loss of competitiveness implied by the PPI-based HCIs could be ascribed to a sharp increase in the producer prices of a relatively large chemical industry of the Netherlands. Prices in this industry depend largely on quite volatile prices of raw materials and have been on track to rise to a larger extent in the Netherlands as compared to other euro area countries.<sup>8</sup>

Since discrepancies between different HCIs have somewhat increased over time (see also Figure B2 in Appendix B) and each of these indicators has certain advantages and shortcomings in assessing external price competitiveness of the relevant country, it is important to know the magnitude of trade response to a marginal change in each of these HCIs. The following Section is devoted to the discussion of the results based on the assessment of standard export and import equations. A particular focus is given to the various relative price and cost elasticities of exports and imports of both goods and services.

## 2. ESTIMATION RESULTS OF EXPORT EQUATIONS

Tables 1 to 4 present income and relative price elasticities of exports of goods and exports of services respectively and their level of statistical significance determined by applying heteroscedasticity-consistent standard errors. The estimated elasticities are mostly of the expected sign, but the level of significance varies across countries.

### 2.1 Exports of Goods

If the level of significance is 10%, foreign demand elasticity of exports of goods appears to be in the range between 0.4 (for Greece) and 1.8 (for Luxembourg), with an average value of 1.1 across all models (see Table 1). In most specifications the above elasticity appears to be statistically significant at 1%, revealing a strong relation between foreign demand and exports, with the exception of Cyprus, Malta and Ireland. We have identified at least one model with insignificant income elasticity of exports for these countries.

<sup>8</sup> Statistics of the Netherlands (2013).

Table 1

**Long-run elasticity of exports of goods with respect to foreign demand**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.94	1.09	1.47	0.96	0.85	1.10	0.75	0.51	1.20	1.79	1.01	0.88	0.88	1.08	1.03	0.61
PPI	0.87	0.87	0.98	1.27	0.84	1.07	0.43	0.74	1.25	1.30	-0.01	0.93	0.92	1.11	0.96	1.05
ULCM	1.01	0.92	1.25	1.55	0.91	1.00	1.45	1.66	1.19	1.34	0.70	0.89	1.06	1.07	1.01	0.98
ULCT	0.90	1.08	1.36	1.44	0.88	1.03	1.16	0.69	1.21	1.37	0.91	0.76	0.98	1.09	1.01	0.95
GDP	0.94	1.10	1.53	1.62	0.83	1.08	0.78	0.83	1.17	1.44	0.88	0.76	1.03	1.04	1.12	0.54
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

The price elasticity of exports varies considerably across countries and across price and cost competitiveness measures (see Table 2). The average value of the elasticity (across all countries and price measures, and taking into consideration coefficients with the significance level of at most 10%) is close to -0.8. The price elasticity of exports is somewhat higher in this study as compared to that found in the study made by Ca' Zorzi and Schnatz (2007).

Table 2

**Long-run elasticity of exports of goods with respect to HCIs**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	-0.77	-2.07	-1.46	-1.42	-0.73	-0.54	-0.86	-0.57	-0.30	-0.14	-2.31	-0.45	-0.65	-0.32	-0.36	-0.80
PPI	-0.36	-1.37	-0.12	-1.85	-0.97	-0.30	1.00	-0.70	-0.55	-0.12	-2.15	-0.31	0.06	-0.33	-0.40	-0.93
ULCM	0.25	0.37	-0.98	-0.75	-0.76	-0.38	-0.46	-0.03	-0.20	-0.12	-0.65	-0.26	-0.23	-0.25	-0.05	-0.30
ULCT	-0.99	-0.66	-1.05	-1.64	-0.89	-0.48	-0.17	-0.67	-0.44	-0.21	-0.82	-0.25	-0.22	-0.32	-0.07	-0.69
GDP	-0.85	-0.03	-0.78	-2.41	-0.79	-0.50	0.55	-0.45	-0.33	0.03	-2.66	-0.39	-1.12	-0.43	0.00	-0.55
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

Exports in general are not sensitive to the developments of HCIs in Cyprus, Luxembourg and Slovenia while with respect to Austria, Greece, Ireland and Portugal only one out of five HCIs is found to have a statistically significant effect. In the remaining euro area countries, the elasticity of exports to relative prices/costs is mostly statistically significant. Relatively low (albeit statistically significant) sensitivity of exports to the HCIs is identified in the Netherlands, Germany, Italy and Slovakia. High sensitivity of exports with respect to the relative price movements is identified in Estonia, Finland and Malta. The result established for the Netherlands is consistent with the ECB (2005) findings, where the above country is characterised by the smallest reaction of exports to prices among the five largest euro area countries for which the macro-econometric multi-country models (MCMs) of the ECB have been estimated. German exports are relatively less sensitive to the HCIs compared to the exports of two other large euro area economies (France and Spain). The rationale might be that German goods are more differentiated and may be less sensitive to the exchange rate changes. Thorbecke and Kato (2012) claimed that the price elasticity of German capital goods is small, since these products tend to be of high quality and compete more on quality than on price. The same argument was put forward by Stirböck (2006). Relatively higher price elasticity in France and Spain (also identified by Natixis (2013)) might indicate that these countries have

weak market positioning in their production and face tighter competition from emerging economies in the same production segments.

Based on the results of export equations, it is difficult to identify the superiority of any HCI with respect to other HCIs in measuring the effectiveness of a country's cost/price competitiveness. Point estimates of price elasticity are quite similar and substantial variation of the adjusted  $R^2$  across different models has not been identified for a single country (see Table C1 in Appendix C). However, it can be observed that the magnitude of the estimated coefficients, given the price-based HCIs, is higher compared to the labour costs-deflated HCIs. Furthermore, exports of goods are relatively more elastic to the ULCT-deflated HCIs than to the ULCM-deflated HCIs in nearly all countries for which both indicators are ascertained to be significant. In general, to explain a country's propensity to export goods, we should go beyond labour cost developments in the tradable sectors. Wage developments in the tradable sector should be considered along with the wage dynamics in the services sector, since the latter is also a part of the production chain of goods that are exported.<sup>9</sup>

In contrast, in the case of Greece all HCIs, excluding the ULCM-based HCI, are ascertained to be insignificant as the determinants of exports of goods. This finding might be ascribed to the design of the economic adjustment programme in Greece which comprised both wage cuts and indirect tax increases. The latter counteracted the impact of the former on the HCIs based on the economy. Likewise with respect to Estonia (which also underwent economic adjustment) we have identified a highly significant effect of the labour cost based HCIs on exports while the impact of the CPI and PPI-based HCIs has been found to be insignificant.

Other factors beyond foreign demand and relative price developments, usually referred to as non-price competitiveness factors, may have an important contribution in explaining exports developments in several euro area countries. This is indicated by the adjusted  $R^2$  being quite low in many cases – of around 0.7 on average in the countries where the developments in HCIs are a statistically significant factor of exports. This result is consistent with the recent IMF assessment of export growth in the euro area countries<sup>10</sup> and the main findings of the Competitiveness Research Network (CompNet) report (ECB (2013)).

## 2.2 Exports of Services

If the level of significance is 10%, foreign demand elasticity of exports of services appears to be in the range between 0.2 (for Luxembourg) and 3.4 (for Malta), with an average value of 0.9 across all models (see Table 3). Compared with exports of goods, foreign demand elasticity of exports of services appears to be statistically insignificant for a larger number of euro area countries. As regards Germany, Finland and the Netherlands, foreign demand is found to be an insignificant

<sup>9</sup> See, for instance, the discussion of the in-depth reviews – part of the Macroeconomic Imbalance Procedure for France presented in Section 3 (European Commission (2013b)). Market services represent 23% of production costs in the industrial sector and 25% in manufacturing. It is estimated that a 10% increase in the wages in the services sector would lead, *ceteris paribus*, to rising costs in the services sector and manufacturing (by 7.7% and 3.9%, respectively).

<sup>10</sup> Tressel and Wang (2013) point to a large unexplained component in the analysis of exports of Greece which might indicate the lack of non-price competitiveness in Greece.



determinant of the growth in services exports across almost all HCIs. It should be noted that exports of services in the euro area were quite immune to the negative demand shock during the crisis and did not follow the path of foreign demand. Borchert and Mattoo (2009) assert the resilience of a range of traded services and their relative independence from external financing. Ariu (2013) mentions essentiality, non-storability and size independency of some types of services as possible explanatory factors of their resilience.

Table 3

**Long-run elasticity of exports of services with respect to foreign demand**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.66	0.56	0.53	0.27	0.70	0.06	0.87	0.87	0.69	0.36	2.58	0.22	0.67	0.51	0.65	1.06
CPIS	0.69	0.38	0.70	(*)	0.54	0.01	0.98	0.88	0.67	0.86	3.43	0.13	0.66	0.35	0.70	0.68
ULCT	0.41	0.43	0.64	0.31	0.67	-0.01	0.68	0.73	0.81	0.21	-0.03	0.10	0.71	1.14	0.63	1.38
GDP	0.40	0.57	0.68	0.27	0.93	0.04	0.78	1.02	0.67	0.39	2.00	0.18	0.68	1.94	0.65	0.67

non-significant at 10%
significant at 10%
significant at 5%
significant at 1%

Sources: ECB and authors' calculations.

(\*) Not able to identify a model with residuals satisfying standard assumptions.

The average value of price elasticity (across all countries and price measures, and taking into consideration coefficients with the significance level of at most 10%) is close to -0.7 (see Table 4). Exports of services are sensitive to the developments in HCIs in the following large euro area countries: France, Germany, Italy, the Netherlands and Spain as well as in Slovakia. The HCIs are mostly statistically insignificant in the rest of the euro area. Low price sensitivity (or insensitivity) of services exports conducted by small countries might indicate that these countries have specialised in the services sector with a relatively minor impact of the price developments<sup>11</sup>. Indeed, exports of services of Germany, France and the Netherlands are among the least concentrated in the euro area<sup>12</sup>.

Table 4

**Long-run elasticity of exports of services with respect to HCIs**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	-0.36	-0.43	-0.08	0.04	-0.55	-0.67	1.68	-0.65	-0.72	0.25	0.72	-0.81	-0.98	-0.58	-0.02	-0.92
CPIS	1.83	-0.12	0.05	(*)	-0.09	-0.75	0.68	0.19	-1.06	1.58	0.45	-0.47	-0.43	-0.35	0.70	-0.58
ULCT	-0.31	-1.29	-0.18	0.14	-0.53	-0.54	1.24	0.00	-0.14	-0.18	-5.83	-0.88	-0.39	-0.59	-0.11	-0.65
GDP	0.64	-0.28	-0.49	0.01	-0.55	-0.58	2.06	-0.82	-0.83	0.10	-1.93	-0.98	-0.40	-1.12	-0.04	-0.76

non-significant at 10%
significant at 10%
significant at 5%
significant at 1%

Sources: ECB and authors' calculations.

(\*) Not able to identify a model with residuals satisfying standard assumptions.

<sup>11</sup> Ireland and Luxembourg, for instance, export mainly *other services*, which include professional, financial, legal, research and development services. If we consider that these types of services are higher value added services compared to the travel and tourism services, low price sensitivity of exports of services might thus be explained for the above two countries.

<sup>12</sup> This is evidenced by the rank of countries according to the Herfindahl index for the last three years.

For large euro area countries, the HCIs deflated by ULCT and CPIS are on average less effective in driving exports of services (as indicated by the long-run coefficients). Exports of services are more sensitive to the price developments as compared to exports of goods in Germany, Italy, the Netherlands and Slovakia, while the opposite is true for France. This result for Germany, Italy and France is in line with the estimates of exports elasticities reported by Allard et al. (2005). Non-price competitiveness factors may also play an important role in explaining the developments of services exports in these countries. This is indicated by the low value of the adjusted  $R^2$  (0.55–0.60; see Table C2 of Appendix C).

We have also calculated absolute historical contribution of various HCIs to the increase in exports of goods and exports of services both over the long sample (2001–2012) and over a set of shorter sub-periods (see Table D1 of Appendix D)<sup>13</sup>. In contrast to marginal elasticities, absolute contribution is also on account of different magnitudes of changes in the HCIs over time. The degree of absolute contribution varies across countries, sub-periods and HCIs. Nonetheless, we are still able to reach some conclusions.

Over the long sample the contribution of HCIs to export growth is minor (and often with the opposite sign), which is not unexpected though and has already been documented by other studies (see, e.g. Allard et al. (2005)).

The increase in exports of goods in some countries (Estonia, Malta and Slovakia) is relatively more affected by the HCIs due to a larger degree of the HCI variation (Slovakia) or a larger marginal elasticity (Malta) or both (Estonia).

Over the long sample the contribution of ULCT-based HCIs to export growth is one of the largest due to a higher rate of change in the ULCT-based HCIs. The HCIs based on CPIS are characterised by the smallest degree of contribution to the growth of services exports.

Over the most recent sub-period of 2010–2012, characterised by the economic crisis in the euro area, the absolute contribution of various HCIs to the growth of exports of goods has been on average close to each other, although the ULCM-based and ULCT-based HCIs have recorded somewhat smaller contribution than other HCIs.

### 2.3 Robustness Analysis

In this Section we present a sensitivity analysis aimed at assessing the robustness of our baseline results. We focus on the potential endogeneity of HCIs, the role of HCI weights, the possible impact of domestic demand on exports and exports of goods and exports of services.

#### The potential endogeneity of HCIs

To account for the case in which the HCIs and exports are simultaneously affected by a common shock<sup>14</sup> or in which a reverse causality between exports and HCIs is observed, we estimate our models by dropping the contemporaneous effect of HCIs

<sup>13</sup> We have made these calculations for the countries where exports are identified to be sensitive to price competitiveness.

<sup>14</sup> For instance, a productivity shock may simultaneously boost exports and improve competitiveness, thus leading to a bias in the relationship between two variables.

in the equations for exports of goods and exports of services. Our conclusions remain, however, broadly similar to those obtained above (see Tables C3 and C4 in Appendix C). As regards exports of goods, we confirm that wage developments in the tradable sector should be taken into account along with the wage dynamics in the services sector. Besides that, when addressing a possible endogeneity problem, the CPI-deflated HCIs and GDP-deflator deflated HCIs appear to have, on average, a higher impact on exports as compared to the PPI-deflated HCIs. This means that broader price measures are preferred in monitoring competitiveness in the euro area in the context of export developments. As regards exports of services, we were able to confirm a statistically significant relationship between exports and HCIs for the above mentioned set of large euro area countries, with the exception of Germany for which our previous conclusions turned out to be sensitive to the inclusion of the contemporaneous effect of HCIs.

### **The role of HCI weights**

The HCIs used in this study reflect relative price levels as weighted according to the importance of a trading partner in a country's total foreign trade (i.e. exports and imports). One may claim that what matters for exports are relative prices which reflect the structure of exports rather than the structure of a country's total foreign trade. If a trading partner plays an important role in the relevant country's imports and insignificant role in its exports, then the HCIs weighted by both exports and imports might in fact be irrelevant since price competitiveness also accounts for the respective country's exports. To overcome this potential complexity arising from the way the HCIs are compiled, we have also employed alternative HCIs, calculated by applying the weights based on the trade data on exports only to capture a trading partner's importance in the country's exports. For almost all euro area countries the impact of alternative HCIs is similar to that of standard ones (Table C5 of Appendix C). It in turn implies that our previous conclusions remain valid.

### **The role of domestic demand**

We rely on the framework employed by Esteves and Rua (2013) and consider the supply side of export flows by taking into account the impact of domestic demand on exports. In a similar manner, we include domestic demand as an additional explanatory variable in the export equations. We also examine the asymmetric effect of domestic demand on exports by distinguishing between periods when the former is growing and when it is contracting (in which case we have two different variables). As Esteves and Rua (2013) point out, it may be worth paying the sunk entry costs and start exporting when domestic demand is depressed, but it may appear to be too expensive to leave whenever domestic demand is growing since firms try to avoid paying the above costs again upon the re-entry of export market (especially if the economy is flexible enough and capacity constraints are not binding).

Statistically significant negative impact of a falling domestic demand on exports is established in Portugal<sup>15</sup>, thus confirming the findings of Esteves and Rua (2013), and is also evident in Italy and Greece for some of the HCIs. In contrast, in the Netherlands a falling domestic demand is found to be detrimental to exports and this

<sup>15</sup> Results are available upon request.

result is robust to inclusion of different HCIs. The effect of an increasing domestic demand is identified to be positive for exports in Italy and Slovenia. For Italy this shift in the sign of the domestic demand elasticity might imply that there is an asymmetric non-linear relationship between exports of goods and domestic demand. During the period of economic contraction exports appear to be a substitute for a falling domestic demand. However, since the entry costs have already been paid, the economic growth might contribute to the development of exports. A complementary relation (identified for the Netherlands and Slovenia) between exports and domestic sales has been previously studied in the literature and is mainly attributed to the increasing returns or to a short-run liquidity channel<sup>16</sup>. As regards relative price and cost elasticities, these are not affected and remain robust to the inclusion of domestic demand.

### **Accounting for exports of goods in the equations for exports of services**

Another robustness test addresses the possibility that growing exports of goods can facilitate exports of services since some types of services are a necessary component of the production process of goods. We broaden our analysis by incorporating exports of goods into the exports of services equations. In general, our conclusions remain unchanged (Table C6 of Appendix C) and the estimated HCI elasticities do not differ much from the baseline elasticities presented in Table 2 above. Exports of services remain responsive in the five largest euro area economies (albeit less so in the case of Italy) and Slovakia.

### **Instability of parameters in the models**

Table 5 below summarises the frequency of parameter instability in the exports of goods and exports of services equations. It shows for each country how many equations are affected by the parameter instability (as measured by the results of 1-step Chow test) as well as the dates when such instability has been identified. According to the results, Finland and Spain experience structural breaks more frequently in the equations for both exports of goods and exports of services. In the case of Spain, structural breaks have been present during the recession and towards the end of our sample period, whereas in the case of Finland these are present throughout the whole sample period. There are some countries, such as Finland, Germany, Italy, the Netherlands and Portugal, where structural breaks are identified in a larger number of the equations for exports of goods compared to those of exports of services.

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<sup>16</sup> See Berman et al. (2011) for details.

Table 5

**Frequency and dates of parameter instability in the equations for exports of goods and exports of services\***

Country	Exports of goods		Exports of services	
	Number of unstable equations (out of 5)	Dates of structural break	Number of unstable equations (out of 4)	Dates of structural break
Austria	2	Q1 2003; Q3 2008	1	Q4 2000
Cyprus	0		3	Q1 2001; Q4 2001; Q 1 2013
Estonia	1	Q2 2010	0	
Finland	5	Q4 2001; Q2 2004; Q1 2010; Q4 2011	2	Q1 2005
France	0		1	Q1 2001
Germany	4	Q4 1998; Q3 2004; Q 1 2007	0	
Greece	1	Q2 2006	1	Q3 2010
Ireland	0		1	Q2 2007; Q1 2011
Italy	5	Q4 1999; Q2 2001	0	
Luxembourg	2	Q3 1999; Q2 2009	0	
Malta	1	Q 1 2009	1	Q1 2006
Netherlands	5	Q2 2010; Q3 2012	0	
Portugal	4	Q4 2001; Q1 2005; Q2 2011	0	
Slovakia	0		0	
Slovenia	2	Q1 2003; Q4 2008	0	
Spain	4	Q4 2008	4	Q4 2001; Q1 2012; Q3 2012; Q1 2013

\* In this study, parameter instability is identified in each case when the hypothesis of parameter constancy is rejected at the level of 1% according to the 1-step Chow test.

### 3. ESTIMATION RESULTS OF IMPORT EQUATIONS

#### 3.1 Imports of Goods

The elasticity of imports of goods with respect to domestic demand ranges between 0.4 (Slovakia) and 2.4 (France), with an average value of 1.2 across models where this elasticity is found to be statistically significant (see Table 6). This result is in line with previous empirical literature (see, for instance, Barrell and Dées (2005), Bussière et al. (2011))<sup>17</sup>.

Table 6

**Long-run elasticity of imports of goods with respect to domestic demand**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.92	1.81	0.54	1.26	2.35	1.51	1.66	1.02	1.72	1.14	1.14	0.54	1.26	0.43	0.67	1.27
PPI	1.02	1.76	0.59	0.83	1.90	1.56	1.48	1.16	1.67	0.99	0.96	0.66	1.23	0.62	0.77	1.28
ULCM	1.49	1.60	0.66	1.02	1.83	1.54	1.47	0.72	1.57	0.96	1.21	0.58	1.39	0.57	0.67	1.08
ULCT	0.99	1.49	0.75	1.02	1.94	1.57	1.51	0.92	1.61	1.16	0.83	0.51	1.25	0.65	0.80	1.12
GDP	0.86	1.79	0.88	0.71	1.68	1.51	1.68	0.74	1.67	1.06	1.53	0.69	1.35	0.54	0.61	1.23

non-significant at 10%      significant at 10%      significant at 5%      significant at 1%

Sources: ECB and authors' calculations.

<sup>17</sup> For a summary of studies on import equations, where the income elasticity is found to exceed 1.0 or even 2.0, see Barrell and Te Velde (1999).



Imports appear to be largely insensitive to the changes in relative prices, as illustrated in Table 7. In the case of Finland, Germany and Malta, the developments in relative prices have an insignificant impact on imports of goods across all the specifications explored. Austria, Greece, Luxembourg, the Netherlands, Portugal, Slovenia and Spain are the only countries for which an increase in the HCIs (real increase) is found to favour imports in at least one specification. Cyprus, Estonia, France, Italy, Ireland and Slovakia have registered negative and statistically significant elasticities in at least one of the specifications – a result that contrasts economic theory at first glance, but is given some possible explanation later in the study. The insignificance of import price elasticities is not a new finding and is verified by a number of other studies. In particular, Allard (2009) and Allard et al. (2005), estimate export and import equations for the countries of Central Europe and the largest euro area economies respectively. The above researchers' studies show that the indicators of price competitiveness fail to have a statistically significant impact on short-run import equations in some countries (the Czech Republic, Hungary and Italy in particular). Likewise Bojeşteanu and Manu (2012) find no effect of changes in real effective exchange rates on imports of the Baltic States and some other CEECs<sup>18</sup>.

Our analysis of the estimated import equations shows that it is difficult to assess which of the HCIs exhibits a higher marginal effect on imports of goods. Most of the estimated elasticities were ascertained to be insignificant. Among the cases when elasticities were found to be statistically significant and with the theoretically correct sign, the HCIs deflated by ULCT and/or by GDP deflator appeared to have a statistically significant impact on imports in the following countries: Luxembourg, Portugal, Slovenia and Spain. The PPI and/or ULCM deflated HCIs appear to be significant in Austria, Greece and the Netherlands. The adjusted R<sup>2</sup> from the alternative models in each country are close to each other and quite high in most cases (above 0.8; see Table C7 in Appendix C).

Table 7

**Long-run elasticity of imports of goods with respect to HCIs**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.11	-0.83	0.05	0.08	-0.21	0.01	-0.49	-0.40	-0.30	0.55	-0.42	-0.01	0.14	-0.11	0.01	0.15
PPI	0.37	-0.70	0.02	-0.10	-0.20	0.06	-0.01	-0.66	-0.18	0.20	-0.30	0.11	-0.10	-0.15	0.01	0.14
ULCM	0.28	-0.18	0.12	0.07	-0.03	0.10	0.43	0.02	0.13	-0.07	-0.23	-0.06	0.10	-0.13	-0.01	0.21
ULCT	0.15	-0.28	-0.06	0.03	-0.23	0.14	0.34	-0.13	0.13	1.49	0.43	0.02	0.18	-0.02	-0.10	0.27
GDP	0.13	-0.93	-0.57	-0.18	-0.08	0.01	-0.42	0.17	-0.28	0.08	0.12	0.11	0.52	-0.34	0.22	0.40

non-significant at 10%
significant at 10%
significant at 5%
significant at 1%

Sources: ECB and authors' calculations.

The import content of exports, proxied by the growth of real exports in import equations, has a broad-based positive impact on the growth of real imports, reflecting an increasingly active role of the euro area countries in global value chains and growing share of imports of intermediate goods (see Table 8). This might also

<sup>18</sup> The main difference between our study and the existing empirical literature, which reveals significant and positive relative price effects on imports, might be the time period covered. In this study the estimation extends up to 2012, while in the majority of other studies it mainly ceases before the outset of the economic and financial crisis in 2007–2008.

explain the negative (implausible) sign of relative price and cost elasticities in some cases as reflected in Table 7, if imports have become more sensitive to the factors affecting exports.<sup>19</sup> For example, as a country's HCI increases, its exports become more expensive and it gets disengaged from the global value chain with a corresponding decline in imports. Dieppe and Warmedinger (2007) and Giordano and Zollino (2014) also identify a negative impact of real appreciation on imports in their samples. In particular, a drop in intra-euro area imports following a nominal appreciation of the euro, as documented by Dieppe and Warmedinger (2007), is ascribed to a high import content of exports which, combined with a loss in extra-euro exports, exerts a negative impact on imports.

Table 8

**Long-run elasticity of imports of goods with respect to exports**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.67	0.53	0.64	0.38	0.37	0.58	0.35	0.56	0.37	0.84	0.99	0.76	0.44	0.81	0.76	0.64
PPI	0.61	0.45	0.63	0.64	0.52	0.59	0.34	0.35	0.38	0.68	1.09	0.85	0.48	0.73	0.71	0.63
ULCM	0.59	0.64	0.83	0.55	0.50	0.63	0.28	0.81	0.28	0.67	1.26	0.87	0.39	0.70	0.75	0.73
ULCT	0.67	0.78	0.78	0.53	0.46	0.61	0.37	0.60	0.21	0.99	1.26	0.94	0.49	0.80	0.62	0.85
GDP	0.68	0.55	0.74	0.64	0.60	0.58	0.38	0.74	0.35	0.47	0.95	0.94	0.41	0.76	0.80	0.84
	non-significant at 10%			significant at 10%				significant at 5%			significant at 1%					

Sources: ECB and authors' calculations.

**3.2 Imports of Services**

The elasticity of imports of services with respect to domestic demand ranges between 0.4 (Slovenia and Ireland) and 2.2 (Italy), with an average value of 1.1 across models where this elasticity is found to be statistically significant (see Table 9). This elasticity seems to be lower in value and less significant for imports of services than for imports of goods (with the exceptions of Finland, the Netherlands, Portugal, Slovakia and Spain), when the same HCIs are compared across the import models for goods and services.

Table 9

**Long-run elasticity of imports of services with respect to foreign demand**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	1.46	0.54	0.49	1.37	0.23	0.98	0.30	0.26	0.96	0.10	-0.09	0.70	1.12	1.48	0.39	1.76
CPIS	1.10	0.42	0.60	1.47	0.72	0.77	0.57	0.57	2.23	0.08	-0.01	0.45	1.92	1.37	0.92	1.59
ULCT	0.69	0.76	0.64	1.36	0.02	1.64	0.06	0.40	1.26	0.06	-0.09	1.13	1.56	1.47	0.52	1.69
GDP	0.79	0.84	0.47	0.90	0.08	1.79	-0.07	0.17	0.94	0.07	-0.06	0.43	0.97	1.55	0.54	1.76
	non-significant at 10%			significant at 10%				significant at 5%			significant at 1%					

Sources: ECB and authors' calculations.

Imports of services (similar to imports of goods) appear to be largely insensitive to the changes in relative prices (see Table 10). Real appreciation leads to a rise in import demand for services in Austria (GDP deflator based HCI), Estonia, Slovenia

<sup>19</sup> ECB (2005) and Bussière et al. (2011) document that the relationship between exports and imports has become stronger due to the internationalisation of production processes and dependence of the tradable sector on imported inputs.

(for both – CPI deflated HCI), Malta (CPIS-based HCI) and Italy (CPI-based, ULCT-based and GDP deflator based HCIs).

Table 10

**Long-run elasticity of imports of services with respect to HCIs**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.24	-0.27	1.24	0.11	-0.24	-0.23	0.17	-0.42	0.49	0.00	0.69	-0.42	-0.18	-0.37	0.56	-0.48
CPIS	0.48	-0.16	-0.10	-0.96	-0.23	-0.18	-0.26	-0.33	-1.39	0.48	0.84	-0.34	-0.93	-0.13	0.25	-0.41
ULCT	0.10	0.43	-0.16	0.24	-0.49	-0.25	-0.43	-0.54	0.44	0.19	0.28	-0.70	-0.43	0.04	0.02	-0.36
GDP	1.06	-0.59	0.66	-0.26	-0.23	-0.28	-0.29	0.15	0.45	0.17	0.05	-0.20	-0.07	-0.01	0.27	-0.44
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

The growth of real exports has a broad-based positive impact on the growth of real imports of services (see Table 11). For most of the countries characterised by the insignificant effect of domestic demand (see Table 9), the import content of exports appears to be important. However, this impact seems to be less important for imports of services as compared to imports of goods.

Table 11

**Long-run elasticity of imports of services with respect to exports**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.19	-0.07	0.66	0.01	0.23	0.22	1.12	0.68	0.54	0.97	0.75	0.02	0.18	0.63	0.53	0.33
CPIS	0.31	0.91	0.60	-0.06	0.23	0.29	0.50	0.08	0.37	0.95	-0.44	0.00	0.09	0.65	0.24	0.15
ULCT	0.43	0.43	0.42	0.01	0.28	-0.03	0.73	0.71	0.52	0.96	0.72	-0.27	0.06	0.19	0.61	0.29
GDP	0.28	0.05	0.58	-0.01	0.25	0.01	1.04	0.73	0.56	1.00	0.68	0.33	0.19	0.17	0.53	0.48
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

### 3.3 Robustness Analysis

This Subsection is devoted to the robustness checks of our baseline estimation results of import equations in a manner similar to those of export equations. We address the issue of endogeneity of competitiveness indicators in import equations and the role of HCI weights again, as well as present our estimates using import adjusted domestic demand.

#### The potential endogeneity of HCIs

First we assess the sensitivity of our results to the exclusion of the contemporaneous terms in the specifications to be estimated. The long-run elasticities with respect to relative prices/costs are presented in Appendix C (Tables C9 and C10 respectively). In general, the estimation results are fairly similar to those obtained with the help of the baseline models and our main conclusions that most of the assessed HCIs turn out to be insignificant continue to be valid. We still manage to identify a positive impact of real appreciation on imports of goods in the following countries: Austria, Greece, the Netherlands and Spain, and on imports of services in Austria, Estonia, Malta and Slovenia. As regards Spain, imports of goods appear to be more sensitive to the GDP deflated HCIs.

### **The role of HCI weights**

As noted in Section 2, the HCIs weighted only by the data on exports might be more relevant for exports. Likewise, the HCIs weighted by the data on imports might account for a better contribution to our understanding of the developments in imports. Table C11 (Appendix C) presents the assessment results based on the HCIs which are weighted by the data on imports. The results remain similar to those presented above. The main differences pertain to the Netherlands for which we have been unable to identify any single specification with a statistically significant positive impact of real appreciation and to Austria and Portugal which exhibit a larger number of specifications with statistically significant HCI coefficients now.

### **Import adjusted domestic demand**

Bussière et al. (2011) have shown that an alternative measure of domestic demand that accounts for the import content of demand components performs better than the traditional measures of domestic demand in explaining the great trade collapse during 2008 and 2009. This measure captures the fact that the relationship between imports and exports has become strong due to the internationalisation of production and strong reliance of the production of traded goods on imported inputs. The authors conclude that this specification provides a more accurate estimation of trade elasticities. Following the above literature on the estimation of elasticities in import equations, we conduct our analysis by including the above alternative measure of domestic demand. Following the procedure described by Bussière et al. (2011), we calculate the weights applied to each component of the demand in order to compute the import adjusted domestic demand, by using input-output tables from Eurostat for the euro area countries (for the year 2005).

We can observe that our main result holds; the effect of a 1% increase in different HCIs turns out to be insignificant for most of the estimated specifications (Tables C12 and C13 of Appendix C). However, with respect to Slovenia we fail to identify a positive impact of HCIs on both imports of goods and imports of services.

Overall, our main conclusions about the minor role of the price competitiveness with respect to the developments of imports are fairly robust when considering different specifications. As regards the estimation results for individual countries, the robustness of a positive impact of HCIs on imports of goods is confirmed for Austria, Estonia and Malta and on imports of services – for Austria, Greece and Portugal. Thus across the whole set of different specifications we have provided in this study, real appreciation appears to have a positive effect on both imports of goods and imports of services only in Austria.

### **Instability of parameters in the models**

We present (in Table 12) the frequency and dates on which structural breaks are ascertained to be present in import equations. Given Austria, Estonia and Malta, such structural breaks are evidenced more frequently in the equations for imports of goods as compared to those for imports of services. As regards Austria, the above breaks are present throughout the sample, whereas in Estonia and Malta – during and after the crisis. In the case of services, structural breaks are observed in Luxembourg and the Netherlands in three out of four of the estimated models, with dates identified at various points in the sample. As in the case of exports, structural

breaks seem to be identified in a larger number of equations for goods than for services.

Table 12

**Frequency and dates of parameter instability in the equations for imports of goods and imports of services\***

Country	Imports of goods		Imports of services	
	Number of unstable equations (out of 5)	Dates of structural breaks	Number of unstable equations (out of 4)	Dates of structural breaks
Austria	5	Q2 1999; Q2 2001; Q2 2004; Q2 2007; Q4 2007; Q2 2008; Q2 2009	1	Q3 2006; Q4 2006
Cyprus	1	Q3 2006; Q4 2007	2	Q3 2006; Q1 2008
Estonia	4	Q1 2009; Q2 2009; Q1 2010; Q1 2012	1	Q2 2008
Finland	1	Q1 2002	0	
France	1	Q4 1998	2	Q1 2002
Germany	2	Q4 1999	2	Q2 1999; Q2 2004; Q3 2012
Greece	2	Q4 2008; Q1 2009	0	
Ireland	0		0	
Italy	0		1	Q1 2007
Luxembourg	3	Q4 2006; Q2 2012; Q1 2011	3	Q4 1999; Q1 2011
Malta	4	Q1 2006; Q1 2010; Q1 2011	1	Q3 2006
Netherlands	1	Q2 2009	3	Q4 2004; Q1 2007; Q1 2009; Q1 2012
Portugal	3	Q2 2010; Q3 2010	0	
Slovakia	0		1	Q3 2007
Slovenia	2	Q1 2012; Q1 2013	2	Q3 2007; Q4 2012
Spain	3	Q3 2001; Q3 2008; Q3 2012	1	Q3 2010

\* In the present study, parameter instability has been identified in each case when the hypothesis of parameter constancy is rejected at the level of 1% according to the 1-step Chow test.



## CONCLUSIONS

We address in this study the question of the efficiency of different measures of HCIs in driving exports and imports of goods and services, thereby estimating standard export and import equations for each euro area country. Exports of goods and exports of services are found to be insensitive to the changes in price competitiveness or their sensitivity is relatively small. Estonia, Finland, Spain, France and Malta are the only countries with high reaction of exports of goods to the changes in relative prices. An important finding is that, in general, the marginal effects of the broad economy's price measures on exports are higher than the impact of measures based on manufacturing only. This implies that we should go beyond cost and price developments in the tradable sector to explain a country's exports. Wage developments in the tradable sector should be taken into consideration along with the wage dynamics in the services sector, since the latter is also a part of the production chain of goods that are exported. Exports of services are established to be sensitive to the changes in the HCIs in a limited sample of countries, i.e. in the following large euro area countries: France, Germany, Italy, the Netherlands and Spain as well as in Slovakia. However, in the rest of the euro area, price and cost competitiveness seems to matter much less for exports of services.

Turning to imports, the main finding is that imports of both goods and services seem to be insensitive to the changes in the relative price and cost measures used in this study. As regards goods, in the cases where a significant and positive marginal effect of price and cost measures on imports has been identified, the HCI deflated by ULCT and/or by GDP appears to have a statistically significant impact on imports in Luxembourg, Portugal, Slovenia and Spain. However, the PPI and/or ULCM deflated HCIs are identified to be significant in Austria, Greece and the Netherlands. Finally, we have identified cases where real appreciation has led to a decrease in real imports. This counter-intuitive result might be related to the fact that the relationship between imports and exports has become stronger over recent years due to the integration of many euro area economies into global value chains, altering the traditional view about the way prices and costs are affecting import flows. Across the whole set of different specifications we have provided in this study, real appreciation appears to have a positive effect on both imports of goods and imports of services only in the case of Austria, while the results are rather mixed with respect to other countries. However, this result for Austria is subject to various structural breaks identified in the equations for imports of goods. Our main results have been largely confirmed by a variety of robustness checks.

Our findings are important from the perspective of the economic policy since they confirm the importance of broad-based structural reforms (including reforms in the product markets) aimed at improving price and cost competitiveness in the euro area. These would bring about across-the-board cuts in costs and prices that might translate into the competitiveness improvements and revival of exports in the euro area more easily.

The fact that a significant part of exports and imports cannot be explained in some countries by the traditional explanatory factors (demand measures and price competitiveness) as well as a small historical contribution of HCIs to export growth calls for the improvements in the so called non-price competitiveness, i.e. in the quality of products/services traded.

Various extensions of this study are possible in the future. For instance, a variety of empirical trade studies have evidenced that relative price elasticities may differ with respect to the intra-euro area vs extra-euro area trade. Therefore, distinguishing between intra-trade and extra-trade remains an avenue for future research. Finally, the quality of the current results could also be considerably improved in the future as a longer data sample becomes available.

## APPENDICES

### Appendix A

Derivation of long-run coefficients reported in the tables throughout the study.

If we start with a simplified version of equations (1) and (2) by assuming a model with 1 lag for the dependent and independent variable, we get the following specification:

$$\Delta \log Y_t = \alpha_0 + \alpha_{1,0} \Delta \log Y_{t-1} + \alpha_{2,0} \Delta \log FD_t + \alpha_{2,1} FD_{t-1} + \alpha_{3,0} \Delta \log HCI_t + \alpha_{3,1} \Delta \log HCI_{t-1} + \varepsilon_t.$$

This can be rewritten as:

$$\Delta \log Y_t = \frac{\alpha_0}{(1 - \alpha_{1,0})} + \frac{(\alpha_{2,0} + \alpha_{2,1})}{(1 - \alpha_{1,0})} \Delta \log FD_t + \frac{(\alpha_{3,0} + \alpha_{3,1})}{(1 - \alpha_{1,0})} \Delta \log HCI_t + \frac{\varepsilon_t}{(1 - \alpha_{1,0})}.$$

Here:  $\alpha_0^* = \frac{(\alpha_0)}{(1 - \alpha_{1,0})}$  is the long-run constant,

$\alpha_2^* = \frac{(\alpha_{2,0} + \alpha_{2,1})}{(1 - \alpha_{1,0})}$  is the long-run coefficient of foreign demand and

$\alpha_3^* = \frac{(\alpha_{3,0} + \alpha_{3,1})}{(1 - \alpha_{1,0})}$  is the long-run coefficient of the HCI measure.

Appendix B

Figure B1

Harmonised competitiveness indicators (HCIs) of individual euro area countries (index Q1 2001 = 100)

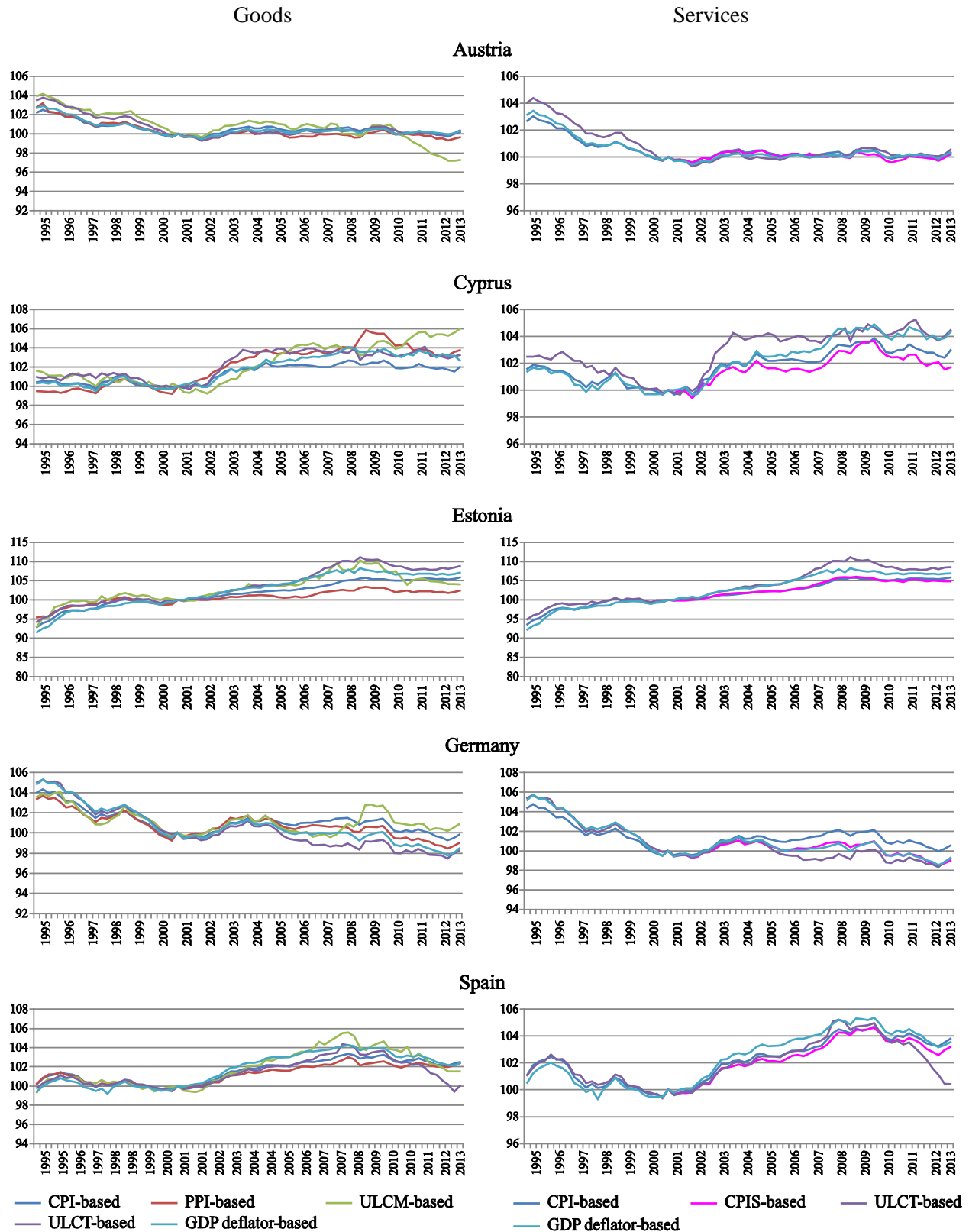


Figure B1 (cont.)

Harmonised competitiveness indicators (HCIs) of individual euro area countries (index Q1 2001 = 100)

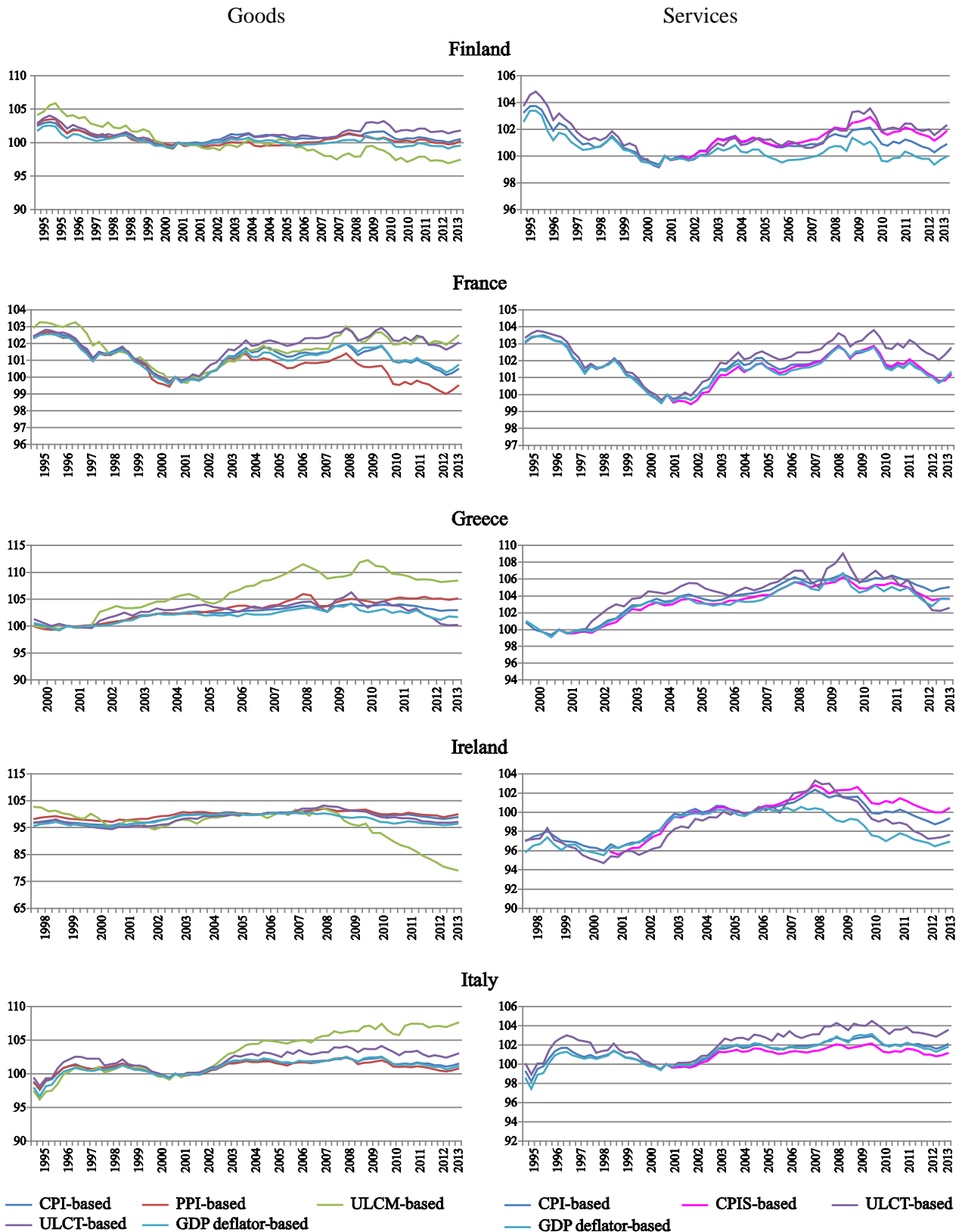


Figure B1 (cont.)

Harmonised competitiveness indicators (HCIs) of individual euro area countries (index Q1 2001 = 100)

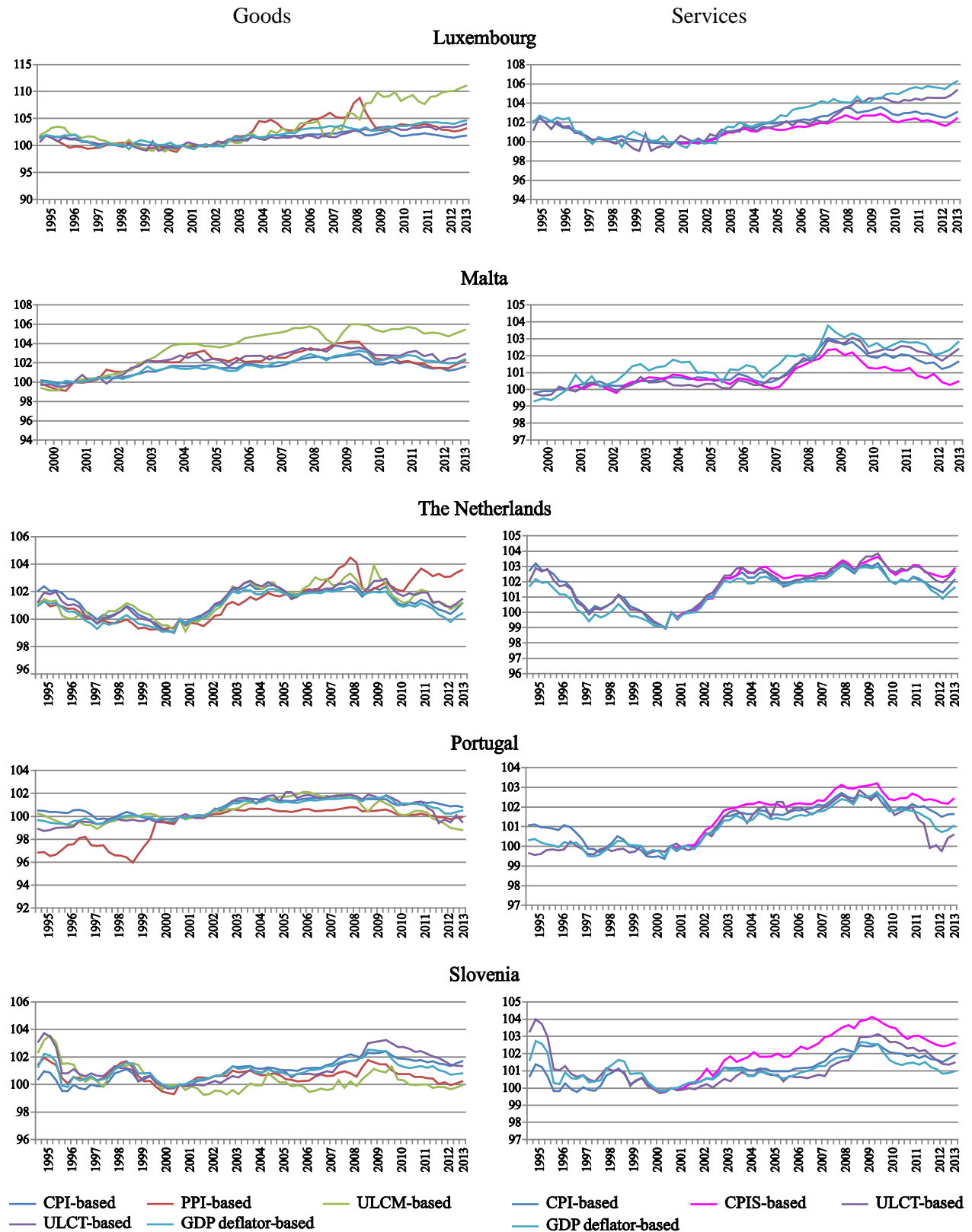




Figure B1 (cont.)

Harmonised competitiveness indicators (HCIs) of individual euro area countries (index Q1 2001 = 100)

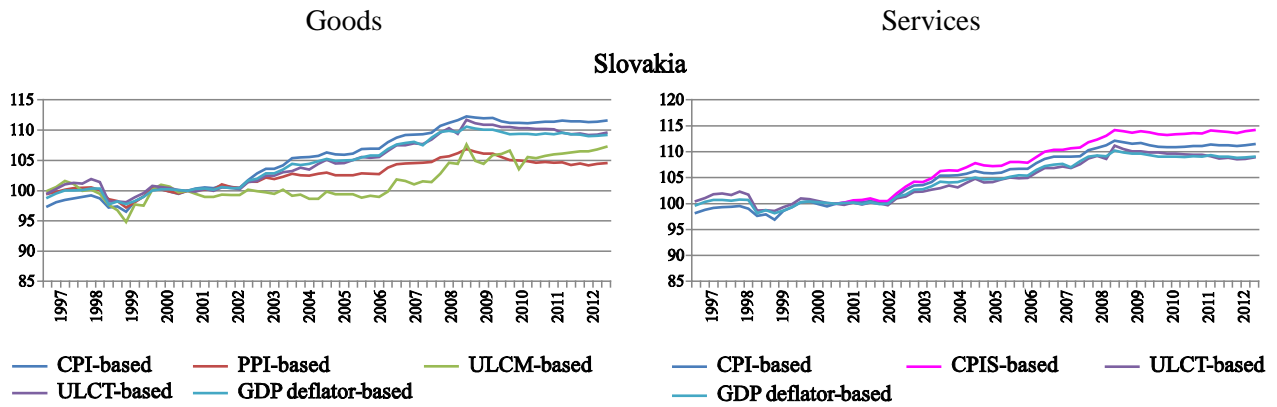
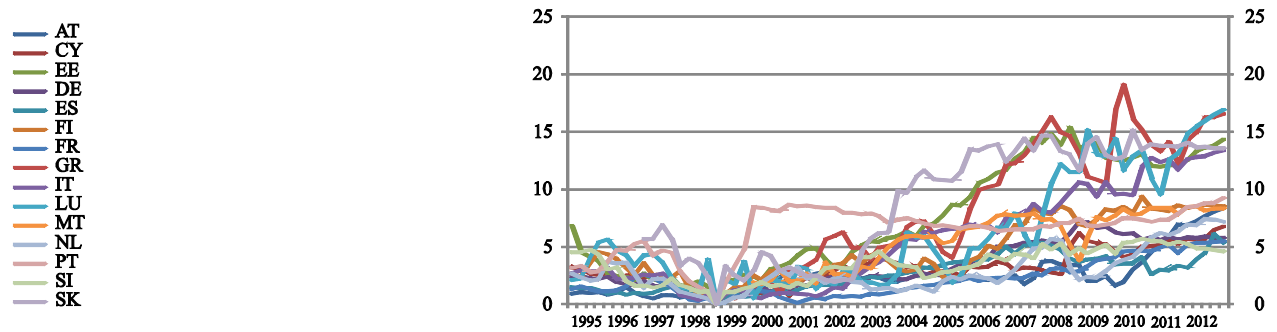


Figure B2

Dispersion of various HCIs



## Appendix C

Table C1

### Goodness of fit (adjusted R<sup>2</sup>) of estimated equations for exports of goods

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.81	0.23	0.56	0.64	0.62	0.75	0.49	0.35	0.73	0.44	0.46	0.77	0.66	0.48	0.71	0.63
PPI	0.78	0.22	0.53	0.73	0.64	0.72	0.44	0.47	0.76	0.60	0.61	0.74	0.55	0.48	0.72	0.57
ULCM	0.78	0.25	0.64	0.53	0.64	0.75	0.71	0.60	0.73	0.57	0.62	0.67	0.66	0.51	0.70	0.53
ULCT	0.81	0.22	0.62	0.64	0.66	0.74	0.50	0.46	0.77	0.56	0.42	0.74	0.63	0.52	0.63	0.60
GDP	0.79	0.17	0.58	0.65	0.63	0.75	0.54	0.52	0.74	0.56	0.58	0.75	0.65	0.50	0.69	0.61
	non-significant at 10%			significant at 10%				significant at 5%			significant at 1%					

Sources: ECB and authors' calculations.

Table C2

### Goodness of fit (adjusted R<sup>2</sup>) of estimated equations for exports of services

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.96	0.48	0.30	0.36	0.80	0.59	0.35	0.82	0.49	0.47	0.40	0.49	0.38	0.38	0.39	0.47
CPIS	0.97	0.41	0.44	(*)	0.77	0.45	0.26	0.87	0.66	0.57	0.51	0.66	0.36	0.45	0.54	0.40
ULCT	0.97	0.72	0.24	0.36	0.78	0.61	0.22	0.82	0.46	0.50	0.50	0.53	0.28	0.24	0.39	0.51
GDP	0.97	0.47	0.31	0.37	0.78	0.63	0.43	0.82	0.50	0.53	0.45	0.49	0.44	0.38	0.39	0.37
	non-significant at 10%			significant at 10%				significant at 5%			significant at 1%					

Sources: ECB and authors' calculations.

Table C3

### Long-run elasticity of exports of goods with respect to HCIs (excluding a contemporaneous effect of HCI)

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	-0.74	-1.55	-1.60	-1.38	-0.58	-0.31	-0.17	-0.43	-0.19	-0.35	-0.96	-0.44	-0.89	-0.08	-0.40	-0.58
PPI	-0.33	-0.88	-0.65	-0.93	-0.83	-0.26	0.26	-0.66	-0.41	-0.30	-0.83	-0.29	0.48	0.04	-0.15	-1.12
ULCM	0.30	1.11	-0.48	0.20	-0.36	-0.18	-0.48	0.16	-0.08	0.03	-0.37	0.06	-0.81	-0.15	0.13	-0.35
ULCT	-0.69	0.41	-0.95	-1.12	-0.82	-0.25	-0.09	-0.02	-0.04	-0.21	-0.31	-0.30	0.07	0.15	0.04	-0.67
GDP	-0.59	0.09	-0.24	-1.45	-0.86	-0.28	0.18	-0.67	-0.14	0.14	-0.58	-0.43	-0.63	0.00	0.07	-0.49
	non-significant at 10%			significant at 10%				significant at 5%			significant at 1%					

Sources: ECB and authors' calculations.

Table C4

### Long-run elasticity of exports of services with respect to HCIs (excluding a contemporaneous effect of HCI)

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.02	0.04	-0.82	0.24	-0.46	-0.06	1.97	-0.81	-0.10	0.13	-0.87	-0.39	-0.20	-0.67	0.13	-0.47
CPIS	0.64	0.09	-0.08	1.02	-0.07	-0.35	(*)	0.24	-0.36	1.00	0.54	-0.24	0.37	-0.42	0.41	-0.55
ULCT	-0.11	-0.53	-0.16	0.11	-0.28	-0.28	0.51	-0.42	-0.13	0.06	-2.64	-0.44	-0.18	-0.28	0.05	-0.69
GDP	0.20	0.04	0.22	0.32	-0.44	-0.10	1.31	-0.61	-0.49	0.29	0.72	-0.42	0.27	-0.33	0.07	-0.43
	non-significant at 10%			significant at 10%				significant at 5%			significant at 1%					

Sources: ECB and authors' calculations.

Table C5

**Long-run elasticity of exports of goods with respect to HCIs (using HCIs weighted by exports only)**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	-0.57	-1.84	-1.32	-1.20	-0.58	-0.49	-0.74	-0.62	-0.46	-0.53	-1.91	-0.54	-0.47	-0.33	-0.26	-0.68
PPI	-0.38	-0.39	-0.12	-1.53	-0.79	-0.27	0.48	-0.76	-0.51	-0.25	-1.59	-0.35	0.05	-0.33	-0.24	-0.78
ULCM	0.08	0.33	-1.00	-0.71	-0.62	-0.34	-0.25	-0.03	-0.20	-0.11	-0.59	-0.33	-0.55	-0.32	-0.04	-0.31
ULCT	-0.73	-0.58	-1.08	-1.51	-0.69	-0.42	-0.75	0.00	-0.42	-0.38	-0.92	-0.27	-0.13	-0.26	-0.05	-0.62
GDP	-0.48	-0.08	-0.82	-1.71	-0.63	-0.45	0.49	0.00	-0.29	-0.35	-2.28	-0.43	-0.82	-0.33	0.22	-0.48
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

Table C6

**Long-run elasticity of exports of services with respect to HCIs (using exports of goods as an explanatory variable)**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.23	-0.48	0.20	0.20	-0.62	0.07	2.27	0.02	0.15	0.17	-0.31	-0.43	-0.98	-0.64	-0.05	-0.94
CPIS	0.50	-0.48	0.39	0.03	-0.15	-0.59	2.68	-0.03	-1.25	1.26	0.28	-0.32	-0.28	-0.48	0.87	-0.29
ULCT	1.85	-0.49	0.13	0.30	-0.35	-0.46	0.58	-0.53	0.26	-0.26	0.07	-0.43	-0.39	-1.03	-0.10	-0.43
GDP	-0.49	-0.99	-0.19	0.25	-0.28	-0.37	2.23	-0.04	-0.07	0.46	-1.93	-0.45	-0.64	-0.49	0.12	-0.74
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

Table C7

**Goodness of fit (adjusted R<sup>2</sup>) of estimated equations for imports of goods**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.94	0.90	0.91	0.64	0.92	0.72	0.77	0.77	0.83	0.73	0.96	0.93	0.86	0.77	0.93	0.94
PPI	0.93	0.91	0.90	0.70	0.92	0.71	0.87	0.80	0.85	0.73	0.96	0.92	0.88	0.72	0.95	0.94
ULCM	0.94	0.90	0.87	0.64	0.92	0.71	0.83	0.77	0.86	0.77	0.96	0.93	0.85	0.74	0.93	0.96
ULCT	0.93	0.92	0.89	0.64	0.92	0.75	0.75	0.76	0.89	0.79	0.96	0.91	0.87	0.79	0.96	0.95
GDP	0.94	0.88	0.88	0.61	0.91	0.72	0.83	0.81	0.85	0.76	0.96	0.91	0.88	0.80	0.92	0.94
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

Table C8

**Goodness of fit (adjusted R<sup>2</sup>) of estimated equations for imports of services**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.74	0.81	0.49	0.09	0.82	0.33	0.50	0.41	0.47	0.63	0.72	0.45	0.55	0.49	0.60	0.67
CPIS	0.83	0.35	0.49	0.18	0.69	0.50	0.55	0.37	0.75	0.56	0.79	0.33	0.59	0.40	0.55	0.75
ULCT	0.75	0.80	0.45	0.09	0.85	0.31	0.45	0.52	0.54	0.61	0.72	0.56	0.49	0.40	0.64	0.70
GDP	0.76	0.80	0.44	0.11	0.80	0.37	0.35	0.50	0.48	0.57	0.75	0.35	0.64	0.34	0.55	0.68
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

Table C9

**Long-run elasticity of imports of goods with respect to HCIs (excluding a contemporaneous effect of HCI)**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.11	-0.30	-0.41	-0.05	0.09	0.03	0.19	-0.36	0.10	0.35	0.52	0.09	0.05	-0.01	0.06	0.03
PPI	0.23	-0.40	-0.07	-0.17	-0.01	0.10	0.49	-0.50	-0.09	0.14	0.48	0.11	-0.17	-0.02	0.06	0.12
ULCM	0.22	-0.10	0.10	0.02	0.07	0.15	0.39	-0.01	0.02	-0.01	-0.05	-0.02	0.20	-0.06	0.02	0.12
ULCT	0.02	-0.22	-0.25	0.09	-0.03	0.09	0.01	-0.14	-0.05	0.04	0.41	-0.04	0.15	-0.11	-0.06	0.20
GDP	0.14	0.47	-0.17	-0.21	0.08	0.11	-0.30	0.16	0.01	-0.63	0.31	-0.01	0.10	-0.14	-0.13	0.32
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

Table C10

**Long-run elasticity of imports of services with respect to HCIs (excluding a contemporaneous effect of HCI)**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.68	-0.34	1.02	-0.05	-0.15	-0.17	-0.28	-0.10	0.12	-0.04	0.87	-0.20	0.13	-0.03	0.60	-0.23
CPIS	1.63	-0.96	0.27	-0.20	-0.36	0.15	0.54	0.02	-1.37	0.04	-0.10	-0.19	-0.59	0.03	0.33	0.31
ULCT	0.20	-0.21	-0.06	0.14	-0.46	-0.29	-0.26	0.19	-0.11	-0.10	0.73	-0.06	-0.12	0.14	0.10	-0.10
GDP	1.10	-0.66	0.54	0.04	-0.17	-0.33	0.07	0.34	0.19	0.16	1.63	-0.05	0.19	0.16	0.37	-0.10
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

Table C11

**Long-run elasticity of imports of goods with respect to HCIs (using HCIs weighted by imports only)**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.43	-1.02	0.05	-0.25	-0.35	0.06	-0.51	-0.47	-0.37	-0.25	-0.41	0.04	0.13	0.09	0.00	0.16
PPI	0.35	-0.70	0.03	0.11	-0.26	0.03	0.01	-0.64	-0.61	0.17	-0.25	0.08	-0.10	-0.01	0.00	0.14
ULCM	0.26	-0.18	0.22	0.07	0.03	0.15	0.42	0.01	0.02	-0.07	-0.25	-0.05	0.32	-0.12	0.00	0.27
ULCT	0.22	-0.29	-0.12	-0.10	-0.24	0.20	0.35	-0.07	-0.15	1.62	0.57	-0.01	0.31	-0.01	-0.11	0.29
GDP	0.33	-0.23	-0.60	-0.19	-0.22	0.06	-0.32	0.13	-0.15	-0.35	-0.14	0.05	0.62	-0.14	0.24	0.37
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

Table C12

**Long-run elasticity of imports of goods with respect to HCIs (using import adjusted domestic demand)**

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.18	(*)	-0.89	-0.63	-0.13	-0.08	-1.22	-0.44	0.21	(*)	(*)	-0.19	0.25	-0.47	-0.26	0.03
PPI	0.29	(*)	-0.67	0.03	-0.21	-0.23	1.08	-0.64	-0.48	(*)	(*)	0.05	-0.01	-0.53	-0.61	0.14
ULCM	0.25	(*)	-0.21	0.01	-0.03	-0.39	0.16	-0.15	0.17	(*)	(*)	-0.25	0.27	-0.34	-0.08	0.07
ULCT	0.19	(*)	-0.48	-0.30	-0.15	-0.32	0.40	-0.01	0.12	(*)	(*)	-0.15	0.14	-0.31	-0.37	0.17
GDP	0.18	(*)	-0.57	-0.52	-0.10	-0.17	-0.67	-0.42	0.10	(*)	(*)	-0.17	0.42	-0.63	-0.51	0.00
	non-significant at 10%			significant at 10%				significant at 5%				significant at 1%				

Sources: ECB and authors' calculations.

(\*) Input-output table is unavailable.

Table C13

Long-run elasticity of imports of services with respect to HCIs (using import adjusted domestic demand)

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	0.61	(*)	1.35	0.07	-0.33	-0.16	0.11	-0.74	0.53	(*)	(*)	0.27	0.01	-0.45	-0.12	-0.39
CPIS	1.10	(*)	-0.52	-0.09	-0.14	-0.37	0.07	-0.16	0.00	(*)	(*)	-0.33	-0.82	-0.35	0.10	0.16
ULCT	0.59	(*)	-0.03	0.33	-0.33	-0.22	0.99	-0.09	0.45	(*)	(*)	-0.31	0.50	0.05	0.37	0.04
GDP	0.55	(*)	0.02	-0.04	-0.32	0.04	-0.84	-0.85	0.47	(*)	(*)	-0.33	0.44	0.03	-0.26	-0.07

non-significant at 10%

significant at 10%

significant at 5%

significant at 1%

Sources: ECB and authors' calculations.

(\*) Input-output table is unavailable.

## Appendix D

Table D1

### Absolute contribution of different HCIs to goods and services export growth

#### Germany

Goods	2001–2005	2005–2010	2010–2012	2001–2012	Services	2001–2005	2005–2010	2010–2012	2001–2012
Export growth	19.5	16.5	22.7	70.9	Export growth	22.0	50.3	9.4	100.6
Contributions					Contributions				
CPI	-3.5	-0.1	3.8	0.4	CPI	-4.7	-1.9	4.6	-1.7
PPI	-2.0	0.9	2.2	1.4	CPIS	-3.5	0.0	6.5	3.4
ULCM	-3.1	-1.8	3.0	-1.6	GDP-deflator	-2.9	0.4	4.2	1.8
ULCT	-1.9	3.2	2.3	3.7	ULCT	-2.6	2.2	2.2	1.9
GDP-deflator	-2.2	1.9	3.6	3.4					

#### France

Goods	2001–2005	2005–2010	2010–2012	2001–2012	Services	2001–2005	2005–2010	2010–2012	2001–2012
Export growth	6.3	-3.3	15.4	18.7	Export growth	-4.0	-3.7	18.9	9.9
Contributions					Contributions				
CPI	-6.1	-0.2	4.4	4.4	CPI	-5.6	-1.7	3.9	-3.0
PPI	-5.0	1.9	5.0	5.0	CPIS	-0.8	-0.5	0.7	-0.5
ULCM	-6.7	-2.7	0.6	0.6	GDP-deflator	-4.6	-2.5	3.5	-3.3
ULCT	-8.8	-3.5	3.6	3.6	ULCT	-6.1	-3.4	2.5	-6.9
GDP-deflator	-5.5	-1.4	4.1	4.1					

#### Spain

Goods	2001–2005	2005–2010	2010–2012	2001–2012	Services	2001–2005	2005–2010	2010–2012	2001–2012
Export growth	13.8	6.1	25.4	51.5	Export growth	4.5	3.9	12.9	22.5
Contributions					Contributions				
CPI	-8.3	-4.1	2.7	-9.7	CPI	-11.8	-9.2	3.8	-17.5
PPI	-6.9	-4.3	0.7	-10.7	CPIS	-6.1	-6.9	3.7	-9.2
ULCM	x	x	x	x	GDP-deflator	-12.1	-8.0	6.1	-13.5
ULCT	-6.5	-5.5	10.5	-0.1	ULCT	-7.5	-8.0	12.2	-1.2
GDP-deflator	-7.7	-2.8	3.9	-6.4					

#### The Netherlands

Goods	2001–2005	2005–2010	2010–2012	2001–2012	Services	2001–2005	2005–2010	2010–2012	2001–2012
Export growth	15.2	13.1	17.8	53.5	Export growth	13.1	6.7	13.9	37.5
Contributions					Contributions				
CPI	-5.3	0.2	2.4	-2.4	CPI	-10.1	-2.4	4.0	-8.2
PPI	-2.9	-1.1	-1.3	-5.6	CPIS	-6.8	-1.6	1.7	-6.6
ULCM	-3.4	0.1	1.6	-1.5	GDP-deflator	-10.7	-3.4	6.1	-7.4
ULCT	-3.3	-0.3	1.7	-1.8	ULCT	-12.3	-4.1	4.7	-11.4
GDP-deflator	-4.1	0.3	2.8	-0.8					



MEASURING THE EFFECTIVENESS OF COST AND PRICE COMPETITIVENESS IN EXTERNAL REBALANCING OF EURO AREA COUNTRIES: WHAT DO ALTERNATIVE HCIS TELL US?

Italy

Goods	2001–2005	2005–2010	2010–2012	2001–2012	Services	2001–2005	2005–2010	2010–2012	2001–2012
Export growth	1.9	-2.0	19.0	18.9	Export growth	-3.8	-4.3	6.1	-2.3
Contributions					Contributions				
CPI	-3.0	-0.6	1.3	-2.1	CPI	-6.9	-3.1	2.8	-7.1
PPI	-4.9	-0.2	2.9	-2.0	CPIS	-8.3	-2.7	4.9	-5.7
ULCM	-5.0	-2.3	-0.2	-8.1	GDP-deflator	-8.6	-3.7	5.0	-7.0
ULCT	-6.8	-2.0	2.2	-6.5	ULCT	x	x	x	x
GDP-deflator	-3.7	-0.4	2.2	-1.7					

Slovakia

Goods	2001–2005	2005–2010	2010–2012	2001–2012	Services	2001–2005	2005–2010	2010–2012	2001–2012
Export growth	35.1	46.4	34.7	166.4	Export growth	4.3	-7.0	16.7	13.2
Contributions					Contributions				
CPI	x	x	x	x	CPI	-18.0	-19.0	0.7	-41.6
PPI	x	x	x	x	CPIS	x	x	x	x
ULCM	1.5	-10.1	-1.7	-10.1	GDP-deflator	-26.9	-29.6	2.9	-59.0
ULCT	-7.3	-11.3	1.8	-18.1	ULCT	-12.0	-19.4	3.3	-30.2
GDP-deflator	-11.0	-11.9	1.7	-23.2					

Finland

Goods	2001–2005	2005–2010	2010–2012	2001–2012
Export growth	15.0	1.9	0.0	17.2
Contributions				
CPI	-7.7	-3.2	7.3	-3.3
PPI	3.7	-10.1	4.6	-1.4
ULCM	1.2	2.9	4.6	8.3
ULCT	-7.3	-17.8	10.6	-13.7
GDP-deflator	-4.1	-3.4	12.2	5.0

Malta

Goods	2001–2005	2005–2010	2010–2012	2001–2012
Export growth	0.4	-15.8	41.1	19.4
Contributions				
CPI	-18.2	-13.9	13.4	-17.8
PPI	-32.6	-11.0	17.8	-23.8
ULCM	x	x	x	x
ULCT	-11.7	-2.5	2.4	-11.7
GDP-deflator	-19.1	-22.3	10.5	-30.8

Estonia

Goods	2001– 2005	2005– 2010	2010– 2012	2001– 2012
Export growth	11.1	3.1	87.0	114.2
Contributions				
CPI	x	x	x	x
PPI	x	x	x	x
ULCM	-18.7	-20.1	15.9	-19.8
ULCT	-21.3	-32.7	4.8	-53.0
GDP-deflator	-14.3	-14.9	1.1	-30.4

Sources: ECB and authors' calculations.

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