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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?

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Abstract

This study examines the 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 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 HCIs in big euro area countries and Slovakia, where exports of services are also found more sensitive to competitiveness indicators based on broader price measures. Imports of goods and imports of services are quite insensitive to changes in relative prices. Finally, in some cases measures of fit indicate that a large unexplained residuals part is present, implying that other non-price related factors might play an important role in driving foreign trade.

1. 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 developments in real effective exchange rates, constructed by using alternative price and cost deflators. For the euro area member states the ECB is publishing different real effective exchange rates, called Harmonized 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 consumer prices (CPI), domestic sales producer prices (PPI), gross domestic product deflators (GDP), unit labour costs for manufacturing (ULCM) and the total economy (ULCT).[1] There is no agreement on which of them better reflects a country's price and cost competitiveness and is therefore a-priori more effective in driving trade developments of a country since each of them has its own advantages and shortcomings[2].

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

Our findings show that among the cases when price elasticity appears 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 big euro area countries: France, Germany, Italy, the Netherlands and Spain as well as in Slovakia. In these countries exports of services are also found 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 changes in relative prices. For imports of goods, in the cases of Luxembourg, Portugal, Slovenia and Spain, a 1% increase in HCI measures based on ULCT and GDP deflators tend to have a relatively larger and statistically significant impact, whereas in the cases of Austria, Greece and the Netherlands this effect is larger for HCI measures capturing price and cost developments in the manufacturing sector.

It should be mentioned however that the absolute impact of ULC-based HCIs might be higher, because the volatility of ULC-based HCIs is usually greater. Importantly, we did not aim at examining the absolute effect of various HCIs or their contribution to the historical

[1] For the way Harmonised competitiveness indicators (HCIs) are constructed see Schmitz et. al (2012).

[2] For a discussion on the merits and shortcomings of different HCIs see Ca'Zorzi and Schnatz (2007) and Schmitz et. al (2012).

evolution of trade volumes. Marginal price sensitivity is an important indicator of the relevance of price movements for exports and imports and thus of the necessary policy effort 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 competitiveness improvements and exports recovery in the euro area. Alternatively, one needs a somewhat harsher retrenchment of labour costs (due to their low marginal effect) in order to reduce external imbalances, which undermines the feasibility and sustainability of this policy measure.

The foreign demand elasticity of exports of goods and exports of services appears to be 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. Globalization and liberalization of foreign trade might have also played an important role. Pogany et. al. (1998) explain this phenomenon by the growing weight of intra-industry trade in total world trade since the end of the World War II. Rising incomes induce consumers to exercise a larger choice in the variety of goods consumed leading to the rapid increase in intra-industry trade and thus total global trade (in excess of income level itself). Barrell and Dees (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, substantial part of exports and imports growth remains unexplained, i.e. the standard approach to modeling 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 et al. (2011), di Mauro and Forster (2008), Benkovskis and Wörz (2014), Antras et al.(2010), Altomonte et al. (2013)). In addition Anderton and Tewolde (2011) found that a large part of imports developments 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 are not captured by standard demand variables. They also suggest that a specification based on different components of total expenditure can better explain imports.

The economic and financial crisis in the euro area might have induced parametric change in standard exports and imports equations. Therefore we test for structural breaks in our models and present the results. Some equations suffer from structural breaks, mainly during the period of the great recession. This finding broadly concurs with Barrell and Velde (1999) who investigated and attempted to explain parametric evolution in traditional imports demand equations for 10 European countries. They broadly attribute this instability of parameters to the omitted variables phenomenon and improve import demand models by including technology and FDI.

We perform a variety of robustness tests. First, the study relies on the framework developed by Esteves and Rua (2013) and considers 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. Secondly, we test

whether our results are robust if we employ alternative estimates of HCIs, i.e. HCIs calculated using as weights data for trade in exports only (for exports equations) and data for trade in imports only (for imports equations) rather than a weighted sum of the former and the latter. Thirdly, 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 when we add exports of goods into equations of exports of services. Fourthly, we control for potential existence of endogeneity, by including only lags of HCIs in our export and import equations. Finally, following recent literature by Bussière et al. (2011) we estimate import equations by using an alternative measure of domestic demand which controls for the import content of domestic demand. The results from this extensive sensitivity analysis remain consistent with our main messages.

The remaining of this paper is structured as follows. Section 2 describes data and methodology used in the study as well as briefly analyses historical developments of different HCIs. Section 3 and 4 provide the estimation results of exports and imports equations respectively. Section 5 concludes with a summary of our findings and possible avenues for future research.

2. Data description, stylized facts, methodology

The dataset we use in this study comprises of 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[3], referring to total (both intra and extra) euro area exports and imports. The HCIs for goods are based on 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, United Kingdom, USA, Hungary, Latvia, Lithuania, Poland, Bulgaria and Romania. The HCIs for services are based on four alternative deflators: CPI, CPI for the services sector, ULCT and GDP deflators, with weights based on 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.[4] Domestic demand comprises of private consumption, gross capital formation and government consumption. The sample period of the study extends from 1995:Q1 to 2013:Q1[5] which corresponds to 73 quarters. Data for earlier periods are not available due to unavailability of foreign demand data. The data source is 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 with structural breaks since some of the variables might suffer from 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

[3] For Ireland only non-seasonally adjusted data are available, so we seasonally adjusted these data using the TRAMO SEATS methodology.

[4] For more information on measuring foreign demand, see Hubrich and Karlsson (2010),

[5] For Greece the sample period starts in 2000:Q1, for Ireland in 1998:Q1 and for Slovakia in 1997:Q1. 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 dataset.

intercept, while those for variables in first differences – only an intercept. The number of lags is selected based on information criteria.

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

$$\Delta logX_t = \alpha_0 + \alpha_{1i} \sum_{i=1}^{p} \Delta logX_{t-i} + \alpha_{2i} \sum_{i=0}^{q} \Delta logFD_{t-i} + \alpha_{3i} \sum_{i=0}^{\mu} \Delta logHCI_{t-i} + \varepsilon_t \qquad (1)$$

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 above outlined relative price and cost competitiveness measures. An increase (decrease) in the measures of HCIs implies worsening (improving) competitiveness of a euro area member state against the remaining 16 euro area countries and the 20 extra euro area main trading partners. α_j s are short run dynamic coefficients, Δ is the first difference operator. Finally, ε_t is an error term satisfying standard assumptions.

We report long-term coefficients of solved static long-run equations, where α_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[6]. However, as mentioned in the introduction, the income elasticity has quite frequently been found to be different from one in many countries reflecting the growing role of global production chains, globalization and liberalization of foreign trade recently. α_3 in turn is expected to be negative, with a loss in competitiveness being translated into exports decline.

Imports equations are estimated using the following specification:

$$\Delta logM_t = \beta_0 + \beta_{1i} \sum_{i=1}^{p} \Delta logM_{t-i} + \beta_{2i} \sum_{i=0}^{q} \Delta logDD_{t-i} + \beta_{3i} \sum_{i=0}^{\tau} \Delta logHCI_{t-i} + \beta 4ii{=}0s\Delta logXt{-}i \qquad (2)$$

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 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, β_1, β_2 , β_3 are expected to be positive.

We allow 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 4 lags. As long as the estimated model with 4 lags satisfies the diagnostic tests (of autocorrelation, normality of residuals and heteroscedasticity), these lags are excluded based on their significance. However, we impose a priori the inclusion of the contemporaneous effect and of the first lag of each variable in the final regression. When the estimated model with 4 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 heteroskedasticity and normality problems and include dummy variable(-s) until we identify a model that satisfies the diagnostic tests, before we eliminate the insignificant lags. The resulting

[6] For the derivation of the static long run solution and the long run coefficients see Appendix A1.

equations could contain different numbers of lags for each combination of euro area member state and measure of relative price and cost competitiveness.

Figure A1 in the Appendix A2 shows 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 euro area countries HCIs depreciated in the second half of the 1990s followed by appreciation in the first decade of the new millennium and depreciation thereafter. Exceptions to this pattern are HCIs dynamics in Estonia, Italy, Portugal and Slovakia, which experienced an upward trend in the second half of the 1990s. For Estonia, Portugal and Slovakia this reflected a catching-up nature of their economies (characterized by the Balassa-Samuelson effect and price convergence), while Italy has been on track to steadily losing its competitiveness since euro adoption due to weak labour productivity growth as compared to Italy's trading partners, rapid wage and price growth.[7]

Second, in most cases various indices point to the same direction in the developments of external price competitiveness. However, there are exceptions, some of which have already been documented by Bayoumi et. al.(2011). These exceptions (Figure A1 in the Appendix A2) in particular refer to 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 manufacturing sector only. The ULCM-based HCI in Ireland has depreciated by around one quarter since 1995, while other HCIs point at deteriorating price competitiveness. In Greece there have been significant cuts in compensation of employees, which is reflected in a notable decline in ULCM-based and ULCT-based HCIs as from 2010 and an overall depreciation of the ULCT deflated HCI over the period observed by about 1%. At the same time other HCIs experienced an increase over the whole period. Competitiveness gains as measured by CPI-based and GDP deflator-based HCIs have been muted since austerity measures implemented by Greek Government in the context of economic adjustment programme comprised of both wage cuts and indirect tax increases.

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

Since discrepancies between different HCIs have somewhat increased over time (see also Figure A2 in Appendix A2), and each of these indicators have certain advantages and shortcomings in assessing external price competitiveness of a 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 estimation of standard exports and imports equations. A particular focus is given to the various relative price and cost elasticities of exports and imports of both goods and services.

[7] For more details on Italian competitiveness see European Commission (2013a) or Manasse (2013)

[8] Statistics Netherlands (2013)

3. Estimation results of exports equations

Tables 1 to 4 present income and relative price elasticities of exports of goods and exports of services respectively together with their level of statistical significance by employing heteroskedasticity-consistent standard errors. The estimated elasticities are mostly of the expected sign, but the level of significance varies.

3.1. Exports of goods

When significant at the 10% level of significance, the foreign demand elasticity of exports 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 this 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. For these countries, we identified at least one model with insignificant income elasticity of exports.

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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

The price elasticity of exports varies considerably across countries and across price and cost competitiveness measures (see Table 2). An average value of the elasticity (across all countries and price measures and when coefficients with significance level of at most 10% are considered) is close to -0.8. Price elasticity of exports is somewhat higher in this study as compared to those found in 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Exports in general are not sensitive to developments in HCIs in Cyprus, Luxembourg, and Slovenia while in the cases of Austria, Greece, Ireland and Portugal only one out of five HCIs was found to have a statistically significant effect. In the remaining euro area member states, the elasticity of exports to relative prices/costs are mostly statistically significant. Relatively low (albeit statistically significant) sensitivity of exports to HCIs is found in the Netherlands, Germany, Italy and Slovakia. High sensitivity of exports with respect to relative price movements is identified for Estonia, Finland and Malta. The result found for the Netherlands is consistent with ECB (2005) findings, where this country is characterized by the smallest reaction of exports to prices amongst the five largest euro area countries for which macroeconometric Multi-Country Models (MCMs) of the ECB were estimated. The German

exports are relatively less sensitive to HCIs compared to the exports of two other big euro area economies: France and Spain. The rationale might be that German goods are differentiated and they may be less sensitive to exchange rate changes. Thorbecke and Kato (2012) found that price elasticity of German capital goods is small, since these products tend to be of high quality and they compete more on quality rather than on price. The same argument was put forward by Stirbock (2006). Relatively higher price elasticity in the case of 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 exports equations it is difficult to identify the superiority of any HCI with respect to the others in measuring the effectiveness of a country's cost/price competitiveness. Point estimates of price elasticity are quite similar and there is no big variation of the adjusted R^2 across different models for a single country (see Table A1 in the Appendix A3). However, it can be observed that the magnitude of the estimated coefficients in the case of price-based HCIs is higher compared to 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 are found significant. In general, we should go beyond labour cost developments in the tradable sectors to explain a country's propensity to export goods. Accounting for wage developments in the tradable sector should go hand in hand with wage developments in services, since the latter are also a part of the production chain of goods that are exported.[9]

In contrast, in the case of Greece, all HCIs, but ULCM-based HCI, are found to be insignificant as determinants of exports of goods. This finding might be ascribed to the design of the economic adjustment programme in Greece which comprised of both wage cuts and indirect tax increases. The latter counteracted the impact of the former on the broad economy based HCIs. Similarly for Estonia (which also underwent economic adjustment) we found a highly significant effect of labour cost based HCIs on exports while the effect of CPI and PPI-based HCIs is found 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; on average around 0.7 in countries where developments in HCIs is a statistically significant factor of exports. This result is consistent with the recent IMF assessment of the exports growth in euro area countries[10], as well as concurs with the main findings of the Competitiveness Research Network (CompNet) report (ECB(2013)).

3.2. Exports of services

When significant at most at 10%, the 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 the foreign demand elasticity of exports of services appears to be statistically insignificant for a larger number of

[9] See for instance the discussion in Section 3 of the in-depth reviews part of the Macroeconomic Imbalances Procedure for France (European Commission (2013b)). Market services represent 23% of production costs in industrial sector and 25% in manufacturing sector. It is estimated that a 10% increase in wages in the services sector would lead, *ceteris paribus*, to increases of 7.7% and 3.9% in the cost for services and the manufacturing sector, respectively.

[10] Tressel and Wang (2013) point at large unexplained component in the analysis of Greek exports which might indicate the lack of non-price competitiveness in Greece.

euro area countries. In the case of Germany, Finland and the Netherlands, foreign demand is found to be an insignificant determinant of export growth of services across almost all HCI measures. It should be noted that exports of services in the euro area were quite immune to negative demand shock during the crisis and did not follow the path of foreign demand. Borchert and Mattoo (2009) assert the a-cyclicality of a range of traded services and their relative independence on external financing. As possible explanatory factors of the former Ariu (2013) mentions essentiality, non-storability and size independency of some types of services.

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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff 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 when coefficients with significance level of at most 10% are considered) is close to -0.7 (see Table 4). Exports of services are sensitive to developments in HCIs in the big euro area countries: France, Germany, Italy, Netherlands and Spain as well as in Slovakia. In the rest of the euro area HCIs are mostly statistically insignificant. Low price sensitivity (or insensitivity) of services exports of small countries might indicate that these countries are specialized in services sectors for which price developments have a relatively minor impact[11]. Indeed exports of services of Germany, France and the Netherlands are among the least concentrated in the euro area[12].

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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations
(*) Not able to identify a model with residuals satisfying standard assumptions

For the big 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 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 Allard et.al. (2005) reported estimates

[11] Ireland and Luxembourg, for instance, export mainly *other services*, which include professional, financial, legal, R&D services. If we consider these types of services to be higher value added compared to travel and tourism services, this might explain the low price sensitivity of exports in services for these two countries.

[12] This is evidenced by the rank of countries according to the Herfindahl index for the last three years

of exports elasticities. Non-price competitiveness factors may also play an important role in explaining developments of services exports in these countries. This is indicated by the low value of the adjusted R squares (0.55 - 0.60, see table A2 of the Appendix A3).

3.3. Robustness analysis

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

The potential endogeneity of HCIs

To account for the case in which both HCI and exports are simultaneously affected by a common shock[13] or in which there is reverse causality between exports and the HCI, we estimate our models by dropping the contemporaneous effect of HCIs in the equations for exports of goods and exports of services. Our conclusions though remain broadly similar to those obtained above (see Tables A3 and A4 in Appendix A3). In the case of exports of goods we confirm that accounting for wage developments in the tradable sector should be accompanied by taking into consideration wage developments in services. Besides that, when addressing possible endogeneity problem, CPI-deflated HCIs and GDP-deflator deflated HCIs appear to have, on average, a higher impact on exports as compared to PPI-deflated HCIs. This means that broader price measures are preferred in monitoring competitiveness in the euro area in the context of exports developments. In the case of exports of services we were able to confirm statistically significant relationship between exports and HCIs for the above mentioned set of big euro area countries, with the exception of Germany for which our previous conclusions turned 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 might claim that what matters for exports are relative prices that reflect exports structure rather than the structure of a country's total foreign trade. If a trading partner plays an important role in a country's imports but is insignificant in its exports, then the HCIs weighted by both exports and imports might in fact be irrelevant as price competitiveness measures shaping country's exports. To overcome this potential complexity due to the way the HCIs are constructed, we have also employed alternative HCIs, calculated using weights based on trade data on exports only to capture a trading partner's importance in a country's exports. For almost all euro area countries the impact of alternative HCIs is similar to that of standard ones (Table A7 Appendix A3). This in turn implies that on average our previous conclusions remain valid.

The role of domestic demand

[13] For instance a productivity shock may simultaneously raise exports and improve competitiveness, thus introducing bias in a relationship between two variables

We rely on the framework employed by Esteves and Rua (2013) and consider the supply side of export flows, by accounting for the impact of domestic demand on exports. In a similar manner, we include domestic demand as 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 too expensive to leave whenever domestic demand is growing as firms try to avoid paying sunk costs again in the future (especially if an economy is flexible enough and capacity constraints are not binding).

Statistically significant negative impact of *falling domestic demand* on exports is found in the case of Portugal[14], thus confirming the findings of Esteves and Rua (2013), but also appears evident in the case of Italy and Greece for some of the HCIs. In contrast in the Netherlands falling domestic demand is found to be detrimental for exports and this result is robust to inclusion of different HCIs. A *growth in domestic demand* is found to be positive for exports in Italy and Slovenia. For Italy this shift in a sign of the domestic demand elasticity might imply that there is an asymmetric nonlinear relationship between exports of goods and domestic demand. During the period of economic contraction exports appear to be a substitute for falling domestic demand. However since the entry costs have already been paid economic growth might contribute to exports developments. A complementary relation (identified for the Netherlands and Slovenia) between exports and domestic sales has been previously studied in the literature and was mainly attributed to increasing returns or to the short-run liquidity channel[15]. As regards relative price and cost elasticities, these are not affected and remain robust to inclusion of domestic demand.

Accounting for exports of goods in equations of 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 including exports of goods in exports of services equations. In general, our conclusions remain unchanged (Table A6 Appendix A3) and the estimated HCI elasticities are not too different from baseline elasticities presented in Table 2 above. Exports of services remain responsive in the 5 largest euro area economies (albeit less so in the case of Italy) and Slovakia.

Instability of parameters in the models

Table 5 below summarizes the frequency of parameter instability in the exports of goods and exports of services equations. It shows for each country how many equations suffer from parameter instability (as measured by the results of the 1-step Chow test) as well as the dates when instability is 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 are present during the great 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, for which structural breaks are identified in a larger number of cases for exports of goods compared to those for exports of services.

[14] results available upon request

[15] see Berman et. al (2011) for details

Table 5 Frequency and dates of parameter instability in the equations of exports of goods and exports of services

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

* Parameter instability in this study is identified whenever the hypothesis of parameter constancy is rejected at the 1% level according to the 1-step Chow test

4. Estimation results of imports equations

4.1. 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 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 Dees (2005), Bussiere et. al. (2011)) [16].

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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Imports appear to be largely insensitive to changes in relative prices as illustrated in Table 7. In the case of Finland, Germany and Malta, developments in relative prices have an insignificant impact on imports of goods across all the specifications explored. Austria, Greece, Luxembourg, Netherlands, Portugal, Slovenia and Spain are the only countries for which an increase in HCIs (real appreciation) is found to favour imports in at least one specification. Cyprus, Estonia, France, Italy, Ireland and Slovakia registered negative and statistically significant elasticities in at least one of the specifications - a result that contrasts economic theory at first glance, but receives 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 Central European countries and the largest euro area economies respectively. In these studies, for some countries (in particular the Czech Republic, Hungary and Italy) the indices of price competitiveness fail to have a statistically significant impact in the short-run import equations. Likewise Bojesteanu and Manu (2012), find no effect of changes in real effective exchange rates on imports of the Baltic States and some of the CEECs[17].

Our analysis of the estimated import equation shows that it is difficult to assess which of the HCIs exhibits higher sensitivity of imports of goods. Most of the estimated elasticities were found 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 appear to have the statistically significant impact on imports in the case of Luxembourg, Portugal, Slovenia and Spain. The PPI and/or ULCM deflated HCIs appear significant in the cases of Austria, Greece and the Netherlands. The adjusted R^2 from the alternative models in each country are close to each other and quite high in most cases (above 0.8, see Table A3 in the Appendix).

Table 7 Long-run elasticity of imports of goods with respect to HCIs

[16] See Barrell and te Velde (2002) for a summary of studies on import equations, where the income elasticity is found to exceed 1 or even 2.

[17] The main difference between our study and that part of the existing empirical literature, that finds 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 stops before the outset of the economic and financial crisis in 2007-2008.

	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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

The import content of exports, proxied by real export growth in the import equations, has a broad based positive impact on the growth of real imports, reflecting an increasingly active role of euro area countries in global value chains and growing share of imports of intermediate goods (see table 8). This might also 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 factors affecting exports.[18] For example, as a country's HCI appreciates, its exports become more expensive and it gets disengaged from the global value chain with a corresponding decline in imports. Dieppe et al. (2007) and Giordano and Zollino (2013) also find a negative effect of a 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 et. al. (2007) is ascribed to a high import content of exports, which combined with a loss in extra-euro exports, exerts a negative effect 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

4.2. Imports of services

The elasticity of imports of services with respect to domestic demand ranges between 0.4 (Slovenia, Ireland) and 2.2 (Italy), with an average of 1.1 across models where this elasticity is found to be statistically significant (see Table 9). This elasticity seems to be lower in magnitude and less significant for imports of services than for 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

[18] ECB (2005) and Bussière et al. (2011) document that the relationship between exports and imports has become stronger due to the internationalization of production processes and the dependence of the tradable sector on imported inputs.

	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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Imports of services (similarly to the imports of goods) appear largely insensitive to changes in relative prices (see Table 10). Real appreciation leads to a rise in import demand for services in the cases of Austria (GDP-deflator based HCI), Estonia, Slovenia (for both – CPI deflated HCI), Malta (PPI-based HCI) and Italy (CPI-, PPI- 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff 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 characterized by the insignificant effect of domestic demand (see Table 9), the import content of exports appears important. However, this impact seems to be less important for imports of services as compared to the 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

4.3. Robustness analysis

In this section we conduct the robustness check of our baseline estimation results of imports equations in a manner similar to exports equations. We again address the issue of endogeneity of competitiveness indicators in imports equations and the role of HCI weights 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 the Appendix A3 (Tables A9 and A10 respectively). In general, the

estimation results are fairly similar to those obtained with the baseline models and our main conclusions, in particular that most of the estimated HCIs turn out to be insignificant, continue to be valid. We still manage to identify a positive impact of real appreciation in the case of Austria, Greece, the Netherlands and Spain for imports of goods; and in the case of Austria, Estonia, Malta and Slovenia for imports of services. For Spain imports of goods appear to be more sensitive with respect to the GDP -deflated HCIs.

The role of HCI weights

As noted in Section 3 HCIs weighted by exports might be more relevant for exports. Likewise HCIs weighted by imports data might better contribute to our understanding of imports developments. Table A11 of the Appendix A3 presents the estimation results based on HCIs weighted using imports trade data. Results remain similar to those presented above. The main difference concerns the Netherlands for which we were unable to identify any single specification with statistically significant positive impact of real appreciation as well as Austria and Portugal which exhibit now a larger number of specifications with statistically significant HCI coefficients.

Import adjusted domestic demand

Bussière et al. (2011) showed that an alternative measure of domestic demand that accounts for the import content of demand components performs better than traditional measures of domestic demand in explaining the great trade collapse during 2008 - 2009. This measure captures the fact that the relationship between imports and exports has become strong, due to the internationalization of production and the 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 this literature on the estimation of elasticities in import equations, we conduct our analysis by including this alternative measure of domestic demand. Following the procedure described in Bussière et al. (2011), we calculate the weights applied to each demand component, for the computation of the import adjusted domestic demand, by using input-output tables for the euro area countries for the year 2005 from Eurostat.

We can observe that our main result holds; the effect of a 1% increase in the different HCIs turns out to be insignificant for most of the estimated specifications (Tables A12 and A13 of the Appendix A3). However for Slovenia we fail to identify a positive effect of HCIs on both imports of goods and imports of services.

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

Instability of parameters in the models

In Table 12 we present the frequency and dates at which structural breaks are found to be present in the imports equations. In the cases of Austria, Estonia and Malta structural breaks appear more frequently in the imports of goods equations as compared to the imports of services. For Austria the breaks are present throughout the sample, whereas for Estonia and Malta during and after the crisis. For services, structural breaks are found for 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 of imports of goods and imports of services

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

* Parameter instability in this study is identified whenever the hypothesis of parameter constancy is rejected at the 1% level according to the 1-step Chow test

5. **Conclusions**

In this study we address the question of how efficient the different measures of HCIs are in driving exports and imports of goods and services by estimating standard export and import equations for each euro area country. An important finding is that, in general, the marginal effects of broad economy price measures on exports are higher than the ones of measures based on the manufacturing sector only. This implies that we should go beyond cost and price developments in the tradable sectors to explain a country's propensity to export goods. Accounting for wage developments in the tradable sector should go hand in hand with wage

developments in services, since the latter are also a part of the production chain of goods that are exported. Exports of services are found to be sensitive to changes in HCIs in a limited sample of countries, i.e. in the big euro area countries: France, Germany, Italy, 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 for both goods and services seem to be insensitive to changes in the relative price and cost measures used in this study. For goods, in the cases where a significant and positive marginal effect of price and cost measures on imports was identified, the HCI deflated by ULCT or by GDP appear to have the statistically significant impact on imports in the case of Luxembourg, Portugal, Slovenia and Spain. However, The PPI and/or ULCM deflated HCIs appear significant in the cases of Austria, Greece and the Netherlands. Finally, we identified cases where real appreciation led to a decrease in real imports. This counterintuitive 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 cost are affecting import flows. Across the whole set of different specifications we have provided in this study only in the case of Austria real appreciation appears to have a positive effect on both imports of goods and imports of services, while for other countries the results are rather mixed. However this result for Austria is subject to various structural breaks identified in the imports of goods equations.

Our main results have been largely confirmed by a variety of robustness checks. The fact that a significant part of export and imports cannot be explained by traditional explanatory factors (scale factor and price competitiveness) in some countries and specifications calls for improvements in the so called non-price competitiveness, i.e. in the quality of products/services traded.

Our findings are important from the perspective of economic policy since they 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 competitiveness improvements and export revival in the euro area.

Various extensions of this study are possible in the future. For instance a variety of empirical trade studies have found that relative price elasticities might differ for intra-euro area vs extra-euro area trade. Therefore distinguishing between intra- 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 longer data sample becomes available.

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Appendix A1

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 the independent variable, we get the following:

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

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

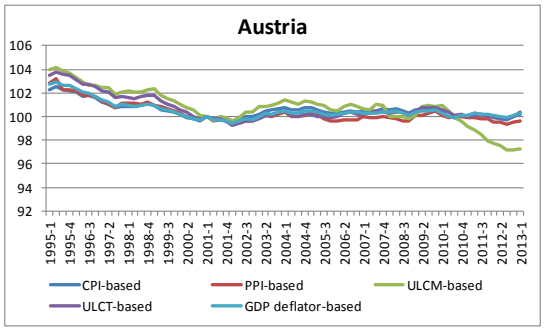
$\alpha_2^* = \frac{(\alpha_{2,0}+\alpha_{2,1})}{(1-\alpha_{1,0})}$ is the long run coefficient of foreign demand

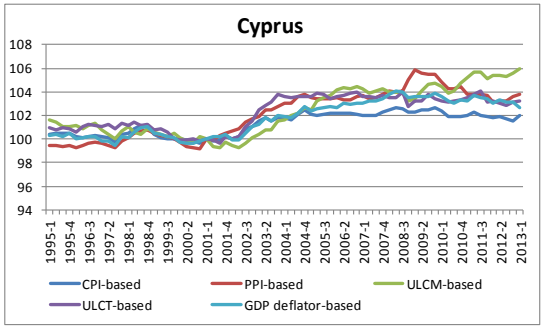
$\alpha_3^* = \frac{(\alpha_{3,0}+\alpha_{3,1})}{(1-\alpha_{1,0})}$ is the long run coefficient of the HCI measure

Appendix A2

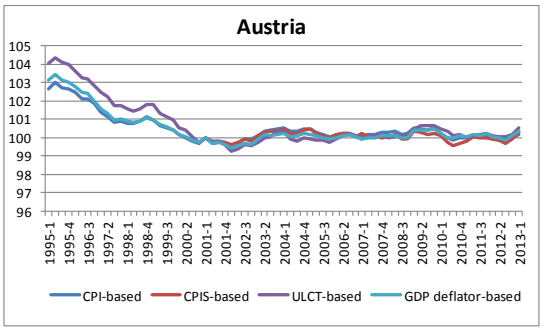
Figure A1 Harmonized competitiveness indicators (HCIs) of individual euro area countries, Index 2001Q1 = 100

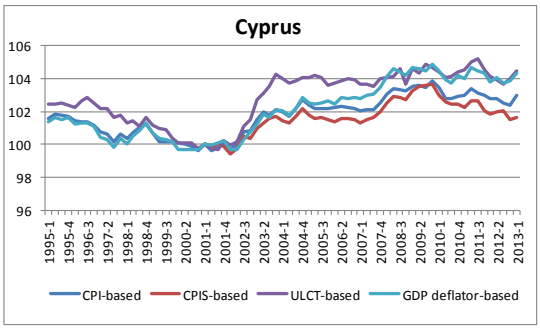
Goods

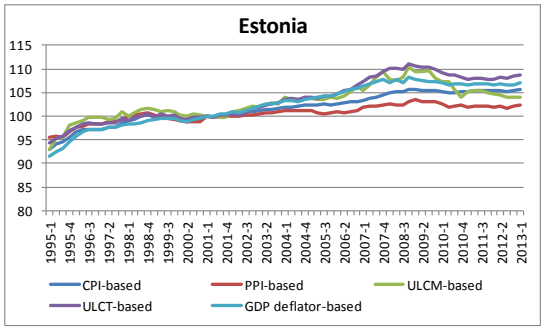




Services



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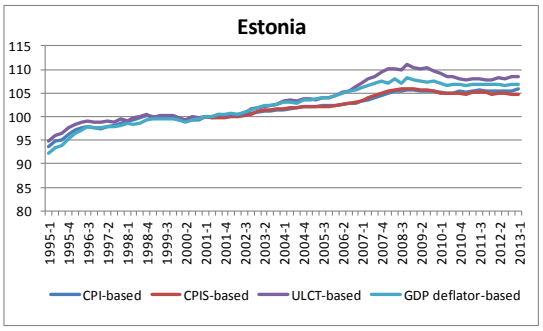
PPI-based
ULCM-based
ULCT-based
GDP deflator-based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CPIS-based
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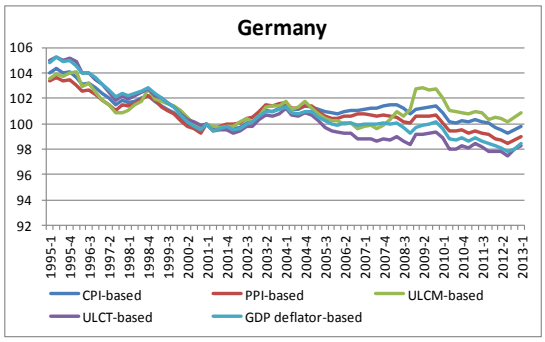
GDP deflator-based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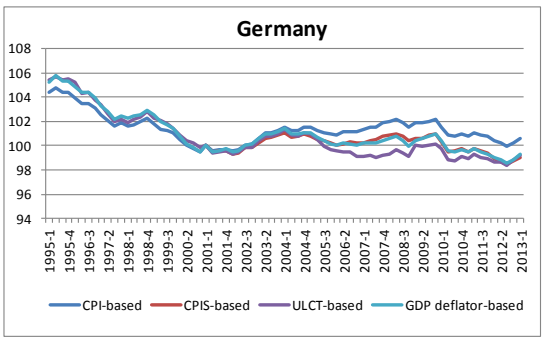
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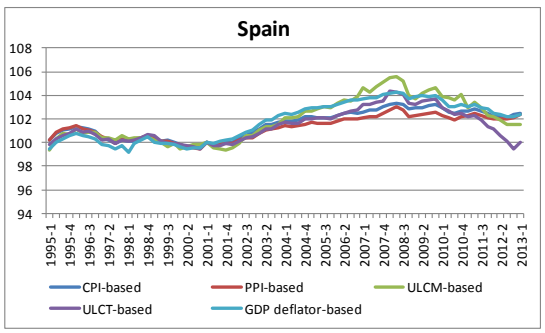
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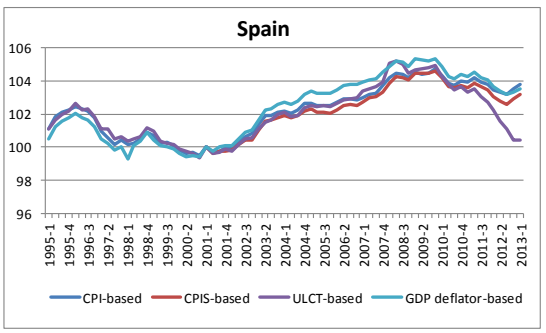
ULCT-based
GDP deflator-based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CPIS-based
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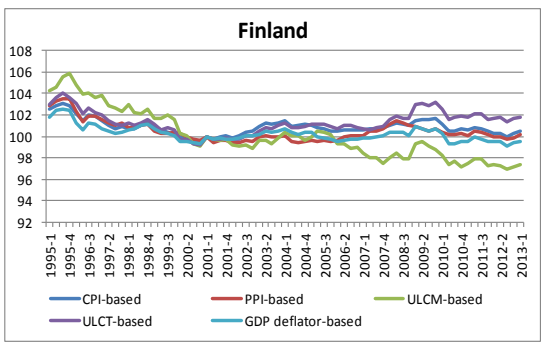
GDP deflator-based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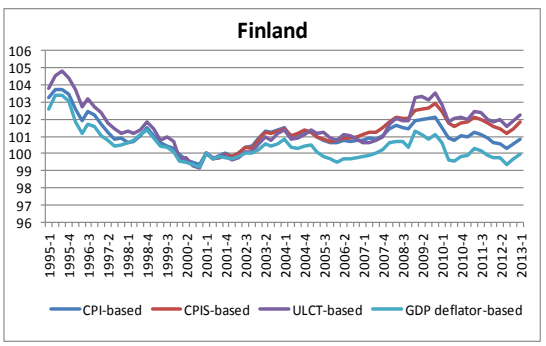
PPI-based
ULCM-based
ULCT-based
GDP deflator-based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CPIS-based
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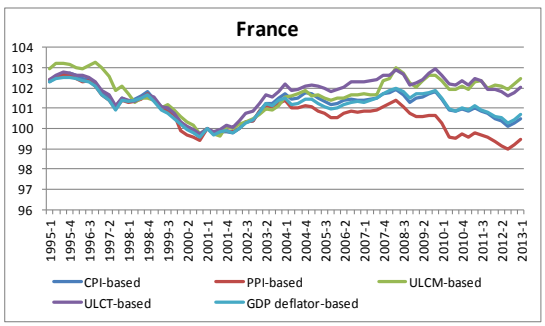
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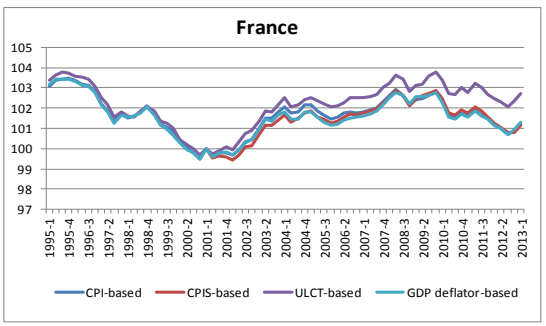
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CPIS-based
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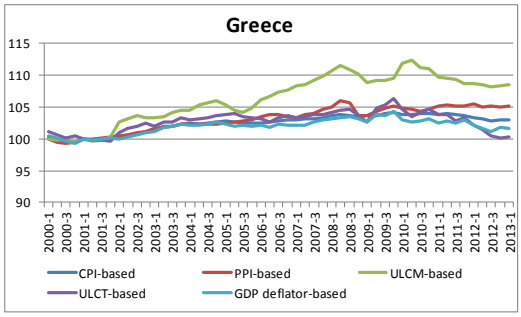
GDP deflator-based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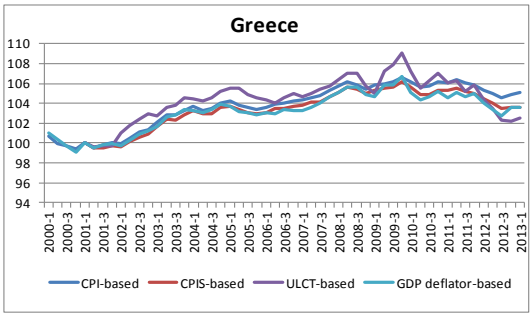
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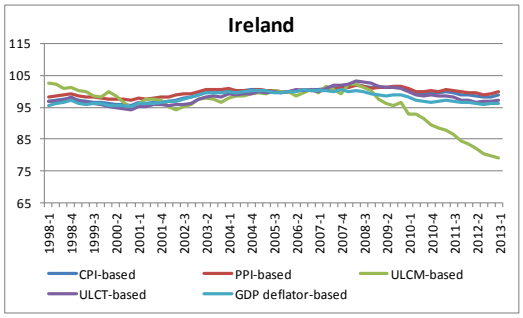
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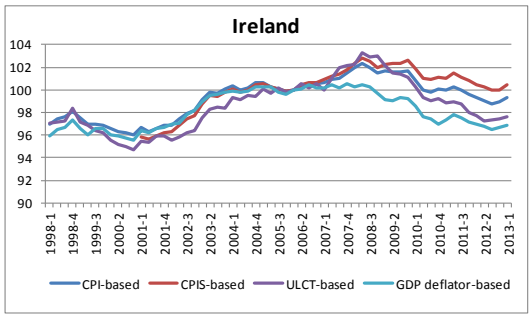
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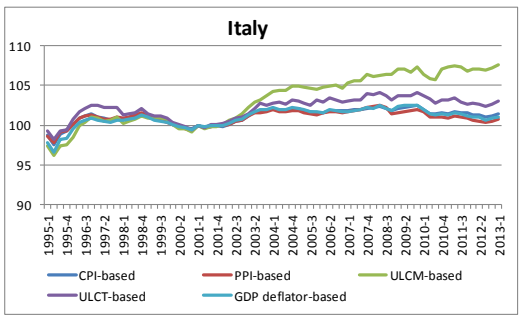
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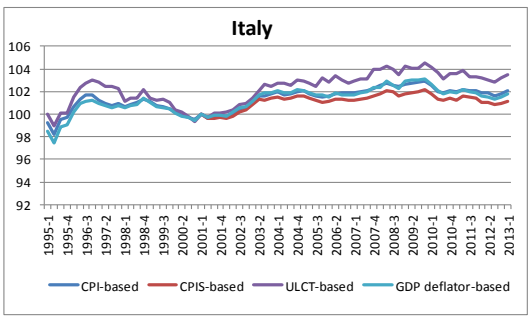
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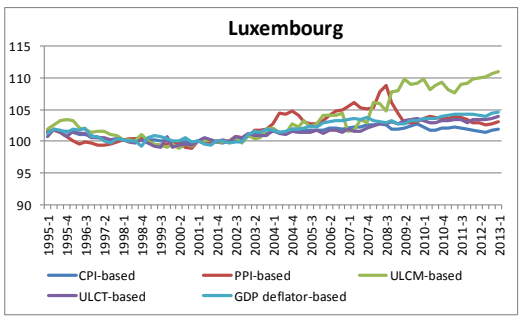
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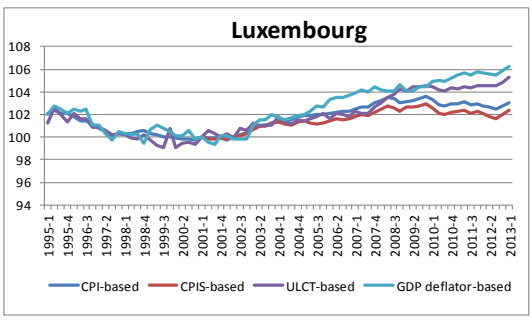
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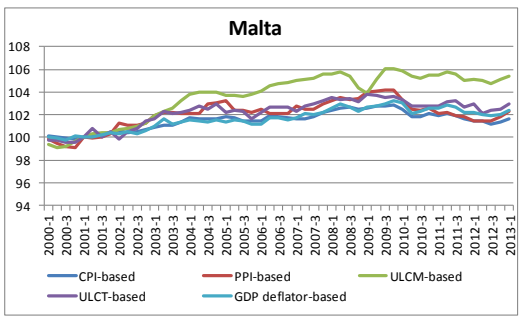
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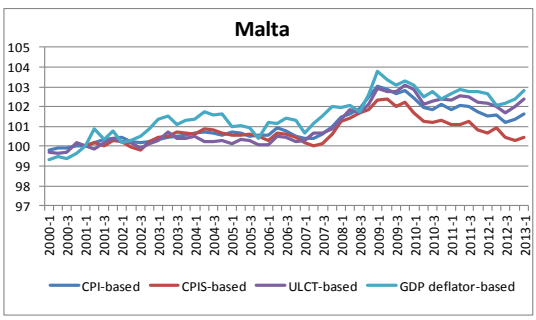
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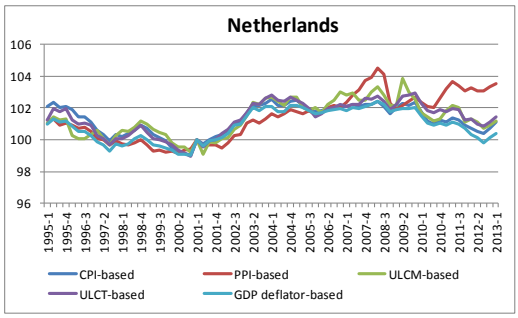
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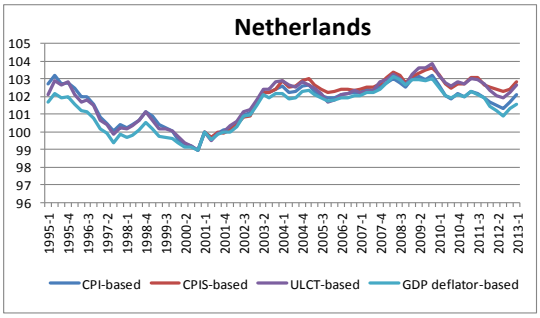
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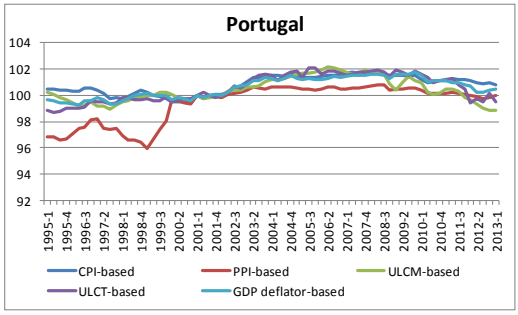
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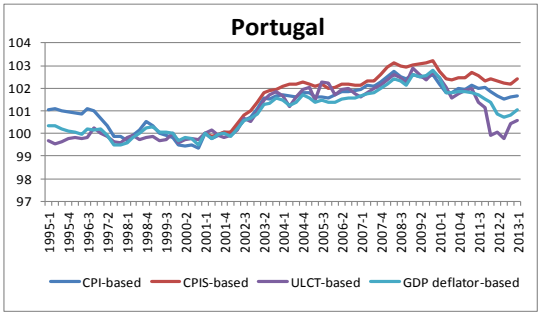
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CPIS-based
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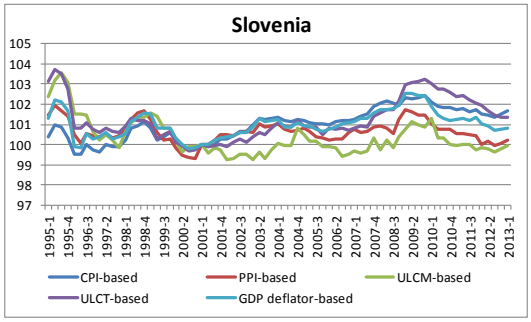
GDP deflator-based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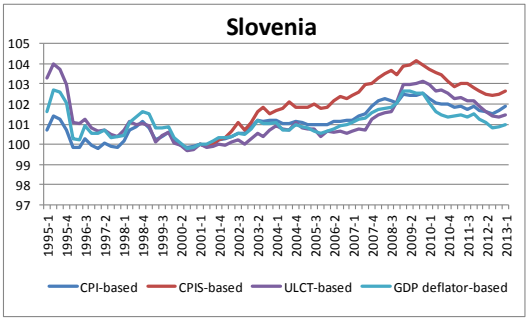
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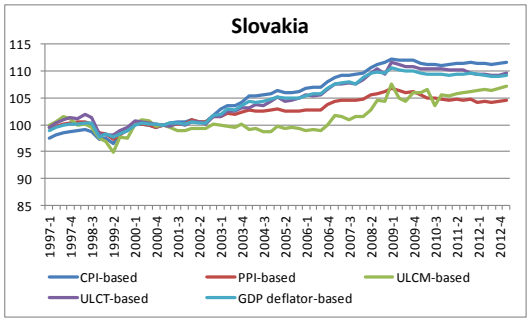
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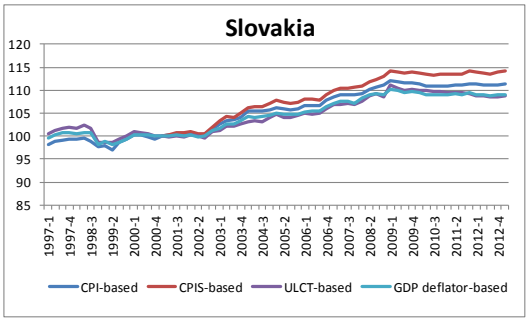
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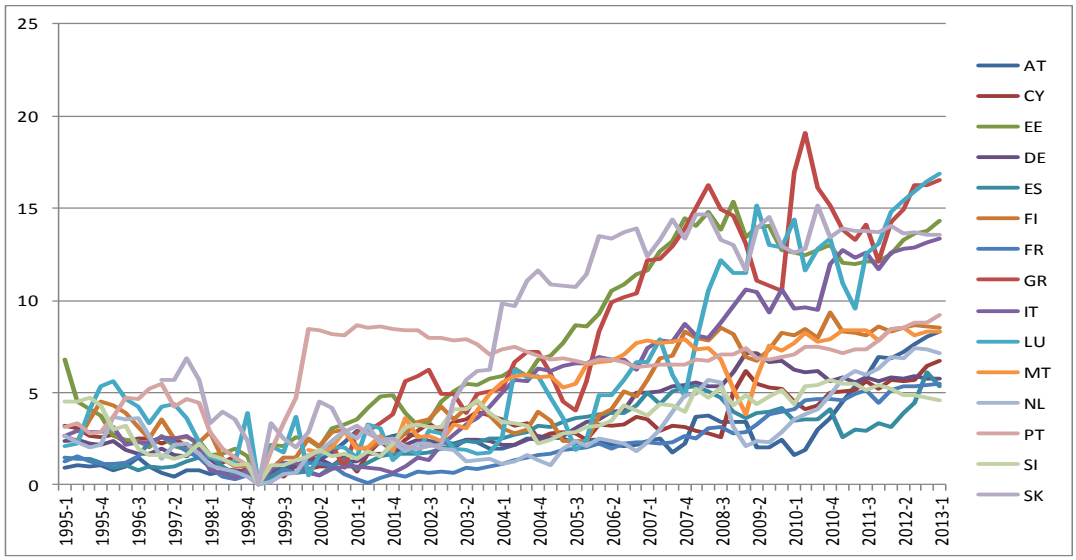
GDP deflator-based

Figure A2 Dispersion of various HCIs



Appendix A3

Table A1 Goodness of fit (adjusted R-squares) 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Table A2 Goodness of fit (adjusted R-squares) 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Table A3 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Table A4 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Table A5 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Table A6 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Table A7 Goodness of fit (adjusted R-squares) 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Table A8 Goodness of fit (adjusted R-squares) 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Table A9 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Table A10 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Table A11 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations

Table A12 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations
(*) no input-output table available

Table A13 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

not sign at 10% | sign at 10% | sign at 5% | sign at 1%

Source: ECB and ECB staff calculations
(*) no input-output table available