Przemysław Woźniak,

Center for Social and Economic Research

EMU and Prices in Poland. The analysis of impact of accession to the Euro Area on the relative price level.

1 Introduction

The temporary inflation rise following the introduction of the euro banknotes by the twelve EU economies in 2002 constitutes one of the strongest association of the public with the new currency. The view became very prominent in the media despite many economists questioning the actual role of the euro itself[1] and the apparent lack of any longer-term effects for the euro area price level. In fact the magnitude of the upward inflation swing was rather limited in EU12 as a whole in 2002 similarly to Slovenia in 2007 and Cyprus and Malta in 2008. In particular the mere inspection of inflation developments suggests that the early 2002 inflation hike has not been strong enough to translate into permanent upward adjustment of the relative price levels between euro and non-euro areas of the EU. On the contrary, there are reasons to expect a downward and permanent effect of EMU on prices in the euro area. These expectations reflect the lack of exchange rate risks and related costs that businesses pass on to consumers, more price transparency due to prices in a single and consequently boosted international trade that introduces fiercer competition in the market for goods and services.

This paper formally investigates the *euro effect* in more detail focusing on the independent role of the EMU in influencing comparative price levels within the environment controlling for relative wealth of countries, varying degree of openness to trade, different taxation levels and exchange rate developments. The impact of the EMU is then determined based on the significance of this variable in the panel model estimated using the data for 26 EU countries during the period of 13 years 1995-2007.

The basic reasoning behind the model of relative price levels presented in this paper is rooted in purchasing power parities (PPP) - their theoretical underpinnings and empirical verifications. The key theoretical conclusion is that perfectly competitive and integrated markets should see prices of identical products converge to the level of the most efficient supplier (*The Law of One Price*). Numerous empirical attempts at verifying this proposition have largely been unsuccessful in finding convincing data in its support. The Law of One Price fails in reality even in sufficiently integrated markets due to the variety of reasons. These include a large variety of

[1] Many authors point to the so-called *menu costs* which made retailers abstain from price adjustments prior to January 1st 2002, i.e. until the actual currency changeover resulting in the sizeable accumulation of upward adjustments in early 2002. This view finds support in the development of annual inflation in the euro area averaged over quarters during the period directly preceding and following January 2002: 2.4%(2001Q3), 2.1%(2001Q4), 2.5%(2002Q1), 2.1%(2002Q2).

issues ranging from barriers to trade, transaction and transportation costs, different tax and legal frameworks to heterogeneous tastes of local consumers and many others (see European Central Bank 2003, HM Treasure 2003, Dreger et al, 2007 and Egert, 2007 for reviews of various factors). It is then these differences that allow firms to charge different prices for the same goods across many markets.

Another focus of the price level literature has been on the correlation between prices and income – the relationship exploited in the empirical part of this paper. The well documented fact that prices are higher in wealthier countries provides clear evidence for the significance of domestic factors in price level determination. These factors are both of supply-side and demand-side nature. The former are best described by the well-known Balassa-Samuelson effect which emphasizes the duality of the economy composed of the tradable and nontradable sector. If poorer countries catch up with the wealthier ones productivity gains in the tradable sector are much higher (relative to the non-tradable one) and push wages up accordingly. Since wages are assumed to equalise across sectors, prices of nontradables rise commensurately shielded from competitive pressures present in the sector of tradables. Resulting are rising price ratios of non-tradables to tradables (domestically) and real exchange rate appreciation[2] vis-à-vis wealthier but less dynamic economies (internationally).

Growing income may also raise prices via the demand side through changing the structure of consumer demand. Bergstrand (1991) noticed that per capita income has a dominant role in shaping the structure of demand and countries while getting wealthier shift their demand towards nontradable goods and services thus pushing up their relative prices. Thus, this effect magnifies the BS-effect-implied positive inflation differential such a shift will increase overall inflation magnifying the productivity (Lein-Ruppert et al, 2007).

The remainder of the paper is organized as follows. Chapter 2 reviews issues related to the distinction between intuitive relative prices, relative inflation and the indicators of *Comparative Price Levels* and summarizes the consequences of the differences in these concepts for the determinants of the latter. Chapter 3 focuses on the variables crucial for understanding cross-country relative price differentials and verifies the theoretical propositions as well as those based on stylized facts in the context of EU27 data. Chapter 4 briefly outlines the models used for estimations, reviews the explanatory variables and presents the results. Finally, chapter 5 provides summary and conclusion.

[2] The appreciation of the real exchange rate within the BS model requires that the PPP holds for tradables.

2 Relative Prices and Comparative Price Levels

Before turning to the specific discussion of determinants of relative price levels it is useful to shed more light on the indicators used to investigate the process. The measure of price levels used in this paper and in fact the only indicator available for the purpose of aggregate cross-country comparisons are Comparative Price Levels (CPL) calculated by the Eurostat and OECD in the framework of the European Comparison Programme for 39 countries worldwide[3]. The data are of annual frequency and are available from Eurostat for the maximum period of 1995-2007.

Fig. 1. Comparative Price Levels of various ESA-95 aggregates in Poland (Euro Area=100)

The CPLs are relatively complex indicators based on prices of a set of both comparable and representative sample of goods and services covering a range of 46 ESA95 aggregates of GDP. Fig. 1 presents the CPLs for Poland relative to euro area (EA=100) for the most important groups of products and services in 2006[4]. Their construction involves the calculation of price ratios at different levels of aggregation (starting from the level of individual products) to which a complex weighting system is applied - making the final indicators very sensitive not only to changes in relative prices but also to weighting structures of both involved countries. The various stages of calculation of CPLs are reviewed in more details in Appendix A1. The conclusions crucial for understanding the dynamics of CPL-based price levels are concisely summarized below.

CPLs are measures of *relative* prices and as such do not convey any information on *absolute* price levels. Therefore the dynamics of CPLs gives no indication as to the direction or magnitude of actual price changes in individual countries compared. As they are defined as ratios of prices expressed in local currencies divided by the average value of bilateral exchange rate, exchange rate movements have a direct and instantaneous impact on the indices.

[3] The group covers all EU27 countries, other EEA countries as well as South-East European countries (since recently), Japan and the US (the latter two to a very limited extent).
[4] Data for 2007 were incomplete at the time of writing this draft.

As with any aggregate measures CPLs rely on weighting. This means that weight shifts may blur the dynamics of aggregate CPLs which may exhibit no change when changes in CPLs for individual categories are accompanied by weight shifts "working" in the opposite direction. Analogously, constant price ratios for all goods and services do not guarantee constant CPLs for broader aggregates. The outcome of changes in both price ratios and weights is even more difficult to predict. In general CPLs for broader aggregates will rise (fall) whenever weights rise (decline) for subaggregates with higher-than-average CPL values. If additionally respective price ratios rise (fall) as well – the effect on aggregate CPL will be amplified. If price ratios move in the opposite direction – then the overall result depends on the relative strength of both processes. Using the CPL data for Poland presented in Fig. 1 as an example we focus on GDP (CPL of 56) and its two components: goods (73) and services (42). Assuming unchanged values of both goods and services in the subsequent year, it is enough for a weight shift towards services (goods) to lower (raise) the GDP CPL. If at the same time individual CPLs for both categories change (a more likely scenario for a NMS) the final joint effect on the GDP depends on the relative magnitudes of the dynamics of all processes.

It is therefore important to keep in mind that CPLs may trend merely because of shifts in the structure of GDP. Working via the weighting effect the rapid rise in the share of services in GDP across NMS means that *ceteris paribus* the observed CPL rise is actually somewhat lower than it would have been with stable weights.

2.1 CPL and higher quality goods

As stated earlier growing income across NMS is likely to influence consumption patterns as wealthier consumers will be choosing higher quality products (Bergstrand, 1991). In principle such a shift should leave the CPL unchanged as it is only inter-country *price ratios* and not *absolute* price levels that impact the index. However, the potential for shifts to higher-quality goods to translate into higher CPL arises due to possible inaccuracies in selecting monitored goods and services. CPLs between two countries at the most disaggregated level (the so-called basic heading, see Appendix A1) are calculated based on two price ratios - one of goods representative for one country and another one – for goods representative for another country. The PPP methodological manual makes it clear that these goods are carefully selected to be both

comparable across countries and representative for overlapping groups of countries at the same time[5].

Theoretically the above guidelines guarantee that products compared are identical or close to identical which leaves no potential for the quality-shift effect. However, in practice these strict rules governing comparability may not always be easy to adhere to and some room for flexibility is left to national offices. Resulting can be the choice of goods that, in spite of being in line with the Eurostat description, does differ across countries in a systematic way, i.e. poorer NMS are more likely to choose lower quality and hence, cheaper, goods. This is particularly likely for generic[6] goods, i.e. those where no brand name or model is specified and the good is described relevant technical parameters. While the Eurostat and OECD constantly refines and improves the multi-iteration process leading to the compilation of the final goods' list, the institutions admit in the Manual that '*in practice, models with the same identifiers in different countries are not necessarily identical or even comparable, while generic specifications, especially those that are too loose or too open-ended, are susceptible to variations in quality.* (p. 67)'.

It is precisely this practical inability to provide descriptions enabling selecting identical products in all countries (and not inherent methodological shortcomings) that creates a potential for choosing products of unequal quality across countries. The selection of such differing products might also be motivated by the fact that national statistical offices are encouraged to monitor representative goods – since at least one such good for each basic heading is necessary for the PPP calculations to be possible. With this motivation in mind and whenever the generic product specification leaves some flexibility they may choose a leading product sold in the country which may very well turn out to be different from other country's selections. If in practice this problem pertains to a sizeable group of monitored goods, there is a high likelihood that CPLs in poorer countries (with richer countries serving as a base) will be underestimating the actual price level disparity due to the fact that price quotations from these countries refer to goods and services of inferior quality. When incomes rise in those countries, households will generally

[5] With respect to comparability, the manual states that '(…) products priced must be comparable across all participating countries pricing them and at all outlets at which the products are priced. If they are not, quality differences will be disguised as price differences leading to biased price relatives. Price levels will be too high for countries pricing superior quality products and too low for countries pricing inferior quality products. To ensure this does not happen, each good and each service selected needs to be defined precisely so that price collectors in participating countries can identify and price a comparable good or service in their domestic markets. If a product cannot be defined precisely, it should not be selected. (EUrostat, 2005, paragraph 4.9, p. 63).

[6] The product specifications used for Eurostat-OECD comparisons are either "brand and model specific" or "generic". A brand and model specification designates the specific brand and model to be priced. A generic specification lists only the relevant technical parameters of the product to be priced. It does not identify any brand or model. (paragraph 4.26 in the Manual, p. 67)

direct their consumption towards more expensive, higher-quality products which means that the potential for pricing different goods is significantly reduced. Consequently, more expensive goods will be chosen for PPP comparisons which will raise price relatives in poorer countries and will lead to faster CPL convergence.

Thus, although changing consumption patterns in NMS has no impact on price convergence of identical goods, there is a potential for these shifts in consumption to translate into higher CPLs. This happens because for some generic goods' specifications (without model or brand) items selected for comparisons by participating national statistical offices turn out to be of unequal quality. Statistical offices in NMS are more likely to choose goods of lower quality (but more representative of their markets) with resulting CPLs pointing to a larger disparity than would be the case if the selections were identical. Consequently, shifts in consumption towards higher quality goods reduce the significance of this bias and are likely to result in rising CPLs.

2.2 Price level convergence measured by CPL and HICP

Having sketched the basic rules of compiling the CPL we now turn to the difference between price level changes as measured by the change in price indices (such as the HICP) and changes in the CPL. The issue is of crucial importance for appropriate investigation of price convergence but often gets overlooked in empirical contributions. Major problems related to the specificity of price convergence dynamics analyzed by the two indicators are briefly summarized below.

Inflation measured by the HICP - Harmonized Index of Consumer Prices provides a good insight into the developments of purchasing power of local currencies. In contrast to the CPL, the methodology of HICP puts emphasis on the representativity of monitored items for local markets and does not attach any importance to comparability across countries[7]. Thus, whenever consumption patterns differ between EU countries, inflation figures for any specific sub-aggregate will refer to a heterogeneous basket of goods reflecting locally representative items. For example, the HICP inflation figures for meat will be reflecting the changing price of a locally consumed basket of various kinds of meat. Therefore even with identical price developments for all types of meats in any two countries the HICP inflation rates for meat in those countries will generally not be the same owing to different consumption structures. In

[7] The harmonization feature suggested in the name of the index refers to the harmonization of statistical classification used and all procedures related to choosing items and monitoring their prices rather than to the very selection of goods and services to be monitored.

contrast, such a situation should not result in shifts in the CPLs as neither price relatives nor underlying weighting have changed.

Other critical differences between the two indices include quality improvements (discussed in the previous section) as well as the introduction of new products and increase in variety – all of which do not impact a correctly computed HICP index but may lead to higher CPLs (largely as a result of severe practical problems with simultaneously meeting the requirements of representativity and comparability of surveyed goods).

Egert (2007) distinguishes several additional problems such as the dynamics of house prices which feeds into the CPL (as a result of both construction and real estate being important sectors of the GDP) but does not impact[8] the HICP inflation (as house purchases do not enter HICP consumption weights). The author also points to business-cycle-related fluctuations in prices that usually are reflected in inflation but have no impact on the CPL.

Fig. 2 The differences between CPL and HICP-implied relative price trends

Summing up HICPs are not well suited for monitoring price level developments across countries which requires that identical or at least comparable baskets of goods be examined. By their very construction CPLs serve this purpose much better. In fact the developments of relative price levels computed by CPLs and by exchange-rate-adjusted inflation differentials can be quite divergent at times as shown in Fig. 2. The figure plots relative price levels of individual countries vis-à-vis the Euro Area as measured by the conventional CPL and as implied by the differences in inflation adjusted for exchange rate changes for the period 1999-2007. The HICP-implied series are accumulated on the 1999 CPL value so that the departure point is the same for both indicators while the end-observation for 2007 shows the total deviation accumulated in the course of 8 years (2000-2007). The figure makes clear that differences can be quite large especially for some NMS (reaching up to 8 perc. points for Bulgaria in 2007), but are also non-negligble for the UK, Denmark and the Netherlands. Altogether the magnitude of the deviation between the two indicators may be considered partly a reflection of the structural changes of the economy and partly a result purely methodological nature.

[8] The only channel is through rents included in HICP.

3 Determinants of Comparative Price Levels

3.1 Per-capita Income

As argued in the introduction income is the strongest and the best documented source of cross-country differences in the price level. Fig 3 presents the scatter plot of the GDP-CPL pairs for the 26[9] EU countries in 1999 and 2007. Dots for each country are connected by the solid line with the country code beside the 2007 value and all values are expressed as indices such that EA=100. The figure clearly confirms the strong positive correlation between the level of prices and the level of GDP per capita as most points are concentrated around a straight line[10]. Moreover by showing data for two time periods (1999 and 2007) the figure sheds some light on the dynamics of the convergence process. The smooth convergence would imply moving outwards in the North-East direction for poorer countries or inwards towards South-West for wealthier ones. While this is generally true for NMS as evidenced by segments parallel to the line facing outwards, the situation is more complex in the upper section of the graph with some countries moving sideways (Italy, Sweden, France) and several of the formerly poorest EU15 economies (Ireland, Spain) moving outwards – on the back of extended periods of economic growth of upward price trends.

Fig. 3. GDP per capita in PPS and Comparative Price Level (CPL) of GDP in 1999 and 2007 (2007 marked by the country code).

More details are revealed by plots in Fig. 4 which presents continuous trajectories of GDP-CPL pairs for individual countries over the period 1995-2007[11]. Not surprisingly some of the longest and stretched-out trajectories are those of the NMS. However, there is considerable heterogeneity in their shapes and monotonicity suggesting that there is room for additional factors to determine the dynamics of convergence. Some of them were recently surveyed by Egert (2007), Wójcik (2008) and Podkaminer (2008) and are reviewed in the following sections.

[9] Luxemburg excluded from the analysis due to outlier values in most analyzed areas.
[10] The straight line in the figure is a 45 degree line shown for simplicity – the actual incline of the picture data has not been calculated and may be somewhat different.
[11] Due to data problems trajectories start in 1999 for Romania and Malta

Fig. 4 Trajectories of GDP-CPL pairs for EU countries, 1995-2007

3.2 CPL and exchange rate regimes

One of the crucial issues in investigating price level convergence is the behaviour of nominal exchange rates. If prices were perfectly flexible, price changes - not costly and markets - perfectly competitive then the existence of different currencies would not impact cross-country price ratios as at any point in time prices would adjust to match exchange rate movements leaving real exchange rate unchanged. However, in the presence of menu costs prices tend to be sticky making the transmission of exchange rate movements to domestic prices partial and long-lasting. The incomplete pass-through means that exchange rate movements play a role in determining cross-country relative price levels with higher exchange rate volatility introducing more uncertainty in the markets by blurring the price comparisons. Consequently different exchange rate regimes and in particular membership in the euro area may be expected to have a non-neglible impact on the direction and magnitude of cross-country relative price trends.

While all NMS have seen they price levels converged considerably to the EA levels over the last 13 years some authors (e.g. Podkaminer, 2008) ascribe differences in scope and dynamics of the process to different exchange rate regimes. Indeed, as can be seen in Fig. 4 countries with currency boards (e.g. Baltic countries and Bulgaria) share common characteristics of GDP-CPL trajectories, while countries which allowed their exchange rate to fluctuate (freely or within a band) have shapes that are much more heterogeneous. However, the simple division into fixed and floating obviously does not exhaust the variety of exchange rate arrangements across countries CEE. An important distinguishing factor among non-free-float regimes is the extent to which the exchange rate is fixed – quite different in the euro zone, for currency boards, crawling pegs, crawling bands or managed floats.

Fig. 5 Nominal Exchange Rate Developments in non-EA countries (Jan 1995=100)

In essence in fixed exchange rate regimes price level convergence occurs through the Balassa-Samuelson-effect-induced inflation in nontradables accompanied by shifts in the economy's structure towards more goods of higher quality. When nominal exchange rates are free to change in either direction an alternative channel of convergence opens, namely that of nominal

appreciation. Nominal appreciation (depreciation) in the presence of incomplete pass-through to prices means that even with stable domestic prices the price level relative to the EA rises (falls). Of course, floating the exchange rate does not guarantee its nominal appreciation as is clear from fig 5 presenting average monthly exchange rates of 15 non-Eurozone EU members since 1995. For example, Poland, Czech Republic and Romania have gone through extended periods of nominal depreciation during the periods of floating or managed floating which temporarily reversed the convergence trend. However, recent years in non-currency-board countries are generally marked by nominal appreciation[12]. This trend is particularly strong in Poland, the Czech Republic, Hungary and Slovakia which saw their currencies strengthen to record levels and at the same time went through a period of stable CPL convergence (Fig. 4).

Egert (2007) points out that while both Balassa-Samuelson effect and nominal appreciation lead to price level convergence they have rather different effects for the economy. The Balassa-Samuelson effect as a productivity-induced supply side phenomenon produces convergence through raising non-tradable prices which leaves external competitiveness of a country intact. On the other hand, nominal appreciation instantly raises prices of both tradables and nontradables creating a competitive pressure in the goods sector, in particular the exporting sector. While high mark-up sectors may use this buffer to sustain profitability lower mark-up sectors will be hurt very quickly.

The visual inspection of the data (Fig. 4 and 5) suggested some effect of nominal exchange rate developments on the dynamics and magnitude of price level convergence, although any straightforward conclusion as to its strength and direction is rather hard to determine without controlling for other processes. This is confirmed by fig 5 which plots the evolution of GDP CPLs against nominal EUR exchange rate for 15 non-EA EU economies during the period 1999-2007. While the typical trajectory for non-fixed-regime NMS is that of nominal appreciation (depreciation) accompanied by a gradual rise (fall) in the CPL (e.g. Czech Rep., Slovakia after 1999), there are selected countries/periods when trajectories have not followed this pattern and moved ‘sideways’ instead (e.g. Hungary, Slovenia, initial sample period for Romania and Bulgaria). At first sight one can discern certain similarities among countries pursuing same or close exchange rate regimes although upon closer investigation the relationship turns out less

[12] With the exception of Slovenia which prior to entering ERM2 in 2005 pursued a managed float/crawling peg aimed at stabilizing real exchange rate.

obvious and more complex as similar exchange rate regimes often produce very different exchange-rate/CPL paths.

To cast a better look at the dynamics of the process fig 6 plots the change in CPL against changes in the nominal exchange rates in the course of 8 years (1999-2007) for three GDP aggregates (total GDP, consumer goods and consumer services). The relationship seems negative suggesting that on average countries whose currencies strengthened the most have also experienced the biggest price level convergence - but the link is not very strong as suggested by small R^2 from simple bivariate regressions. In line with theoretical predictions the relation is much weaker for consumer services (nontradables) than goods (tradables) both in terms of the coefficient and the goodness of fit – confirming the higher significance of domestic factors in determining price level of services.

Fig. 6 Nominal EUR exchange rate vs. CPLs for GDP, consumer goods and consumer services 1999-2007

Fig. 7 Nominal EUR exchange rate changes and convergence of CPLs for GDP, consumer and consumer services 1999-2007

3.3 CPL and the supply side

Cross-country differences in comparative price levels may also follow from a wide range of supply-side factors including different competition in domestic markets, the concentration of the retail sector, overall openness to trade as well as different tax systems.

There are many different approaches to measuring competition in specific markets. One of the most common is based on the assumption that competition is highly correlated with the intensity of trade flows. Thus openness for trade defined as the total trade (imports + exports) over some production aggregate (such as e.g. GDP) is taken be the indicator of competitive pressures coming from abroad and forcing domestic price levels down. To check for the existence of such a link Fig. 8 plots averages of CPLs and openness (over 1995-2007) in the sector of goods, services and jointly in both sectors for EU economies. While the plots suggest no immediate relationship this, putting the indicator in a multivariate environment and adding a time-dimension to the system may well prove its usefulness as one of the determinants of comparative price levels.

Fig. 8 Openness and CPL – goods, services and goods and services (1995-2007 averages)

Another variable related to the supply-side of potential interest is the size of the market. Although all countries of EU27 constitute a uniform internal market with common customs tariffs and free flow of goods the service sectors accounting for an ever-higher share of GDP remain largely domestic. Moreover there are many obstacles to the truly free flow of goods across EU countries. Some of them relate to language, local tastes and preferences which make a share of theoretically tradable goods practically nontradable or of very limited tradability (e.g. books or some local food specialities). Taking into account these limitations it is reasonable to expect higher competition in larger markets where it pays for more companies to enter and operate as opposed to small markets which often prove insufficiently interesting for larger firms or multinationals.

Finally price levels may differ across countries as a result of different tax systems and in particular different tax rates on products such as VAT and excise tax or the overall tax burden.

Fig. 9 plots the CPL of GDP against three tax aggregates: taxes on consumption and imports, VAT and the total tax burden (excl. social security contribution) – all as shares of GDP. Apparently the relationship between the level of taxation and the price level is more complex and some signs of a positive relationship can only be established for the total tax burden indicator. As in the case of the openness variable, despite a weak link in the period average scatter plots the tax rate may reveal its significance in the multivariate environment with added the time dimension.

Fig. 9 Taxes as % of GDP and CPL

4 Estimation of the panel model of the CPL

The presence of the EMU effect on price levels will be investigated in the framework of the multivariate model of comparative price levels. The independent impact of the EMU accession will be isolated by means of the EMU dummy variable placed in the model explaining the CPL by a variety of indicators expected to explain cross-country comparative price levels. In line with the discussion in the previous chapter regarding the determinants of the CPL the model will have the following form:

$$CPL_{it} = \beta_1 gdp_{it} + \beta_2 neer_{it} + \beta_3 opn_{it} + \beta_4 tax_{it} + \beta_5 emu_{it} + \lambda_t + \eta_i + \varepsilon_{it}$$

where

- t is a time subscript
- i is a country subscript
- gdp_{it} is the GDP per capita in PPS
- $neer_{it}$ is nominal effective exchange rate
- opn_{it} is the measure of openness to trade
- tax_{it} is the indicator of the tax burden
- emu_{it} is the EMU participation dummy
- λ_t and η_i are time and country-specific fixed effects, respectively

The above model was first estimated as a panel with 26 individuals (EU27 excl. Luxembourg[13]) over the period of the maximum of 13 years: 1995-2007. Due to unavailability of some indicators (mostly CPL) for individual countries in initial years of the sample the panel is unbalanced.

In order to appropriately isolate the effect of the EMU on price levels all variables must be expressed in reference to the non-EMU country. The perfect "base-country" candidate would have an economy closely liked to that of the EU (to avoid asymmetric shocks), would be growing at a comparable pace and have a moderately stable currency vis-à-vis the euro. Out of a few countries that fulfill those conditions and are covered by the PPP European Comparison Programme Switzerland seems to be the best choice. While the country's economy has retained its specific structure it relies heavily on EU for its trade and has more bilateral free trade

[13] Luxemburg due to its small size and outlier values of CPL and GDP was excluded from the sample.

agreements with EU than any other country[14]. With its currency Swiss franc relatively stable vis-à-vis the euro and a high degree of the homogeneity with the EU trade regime Switzerland was chosen to be a reference country in the CPL study.

The details of the set of explanatory variables[15] used are as follows:

- *gdp* is the GDP per capita in current euro expressed as indices with base country Switzerland =100

- *neer* – The index of nominal effective exchange rate (calculated vis-à-vis 41 main trading partners) to measure the impact of currency appreciation/depreciation on prices. The movements in respective countries' *neer* were deflated by the Switzerland's *neer* index so that the variable takes on a form of the ratio of domestic currencies to the Swiss franc. The rise (decline) in this variable points to the appreciation (depreciation) in excess of the appreciation of the Swiss franc.

- *opn* is the measure of openness to trade defined as trade in goods, services and jointly goods and services to GDP defined as a ratio to the reference Swiss value

- *tax* is the indicator of the tax burden as % of GDP defined as a ratio to the reference Swiss value; four alternative tax aggregates were used: revenues from taxes on production and imports (*tax1*), revenues from VAT(*tax2*), implicit tax rate on consumption (*tax3*) and total tax burden minus social security contribution (*tax4*).

- *emu* is the EMU participation dummy; two variants were used simultaneously: one covering the period of 1999-2007 when official exchange rates were fixed and another one 2002-2007 – reflecting the period of the exclusive use of the euro in all transactions, more commonly associated with the euro-zone formation.

The estimation of the model was performed in Ox with the use of the Dynamic Panel Data (DPD) package. The model was estimated by GMM with the use of two types of instruments: standard GMM instruments for variables likely to be exogenous (all except taxes, openness and exchange rate regime variables) combined with conventional lagged first differences (in the case of taxes and openness).

4.1 Effect of EMU in the full sample

[14] http://ec.europa.eu/trade/issues/bilateral/countries/switzerland/index_en.htm
[15] The source for all variables is Eurostat's New Cronos Database with the exception of the total tax burden (tax4) for which the source is AMECO.

To find the potential effect for the EMU on prices in the postulated CPL model was estimated for three ESA95 aggregates: total GDP, consumer goods and consumer services using the entire sample of 26 EU countries. Estimation of three models explaining the CPL of different GDP aggregates with the same set of regressors was motivated by significant differences in the price-shaping mechanisms of goods and services ensuing potentially distinctive dynamics of their price convergence processes. The complete set of estimation results is presented in Table 1.

The estimated coefficients suggest that for all models *gdp* consistently has the highest explanatory power out of all right-hand-side variables. The coefficient amounts to 0.9 for GDP CPL and 0.69 and 0.86 respectively for CPL of goods and services meaning that a 10% shift of GDP per capita (relative to Switzerland's) yields a 9% shift of the CPL of GDP and a somewhat smaller one in the case of CPL of goods and services. In line with theoretical predictions the link is stronger for services than for goods reflecting higher importance of domestic factors in the determination of nontradables' prices.

Exchange rate came out highly significant and positive confirming the imperfect exchange rate pass-through. The positive sign of the coefficient means that the appreciation of domestic currencies vis-à-vis those of their trading partners relative[16] (rise in *neer*) leads to higher price levels *ceteris paribus*. The magnitude of the coefficient is markedly higher for consumer goods than for consumer services and GDP - a somewhat surprising result indicating lower exchange-rate responsiveness of goods prices compared to that of prices of services and the entire GDP price level.

Openness turned out significant only for goods with the small albeit significant negative sign providing evidence for the claim that greater openness brings prices down. The coefficients suggest that each 10-percentage-point increase in trade openness of goods brings about a 0.4 p.p. decline in the CPL of consumer goods.

The *tax* variable was not significant in the GDP equation, although it came out highly significant for in equations for both consumer categories. A 10-percentage-point increase in the total tax burden (*tax4*) raises prices of goods and services by one-fifth of a percentage point and three-fifths of a percentage point, respectively.

Out of the two EMU Dummies included in the estimations EMU1999 came out significant and *negative* in the GDP and consumer goods equations. The impact of the EMU on price levels suggested by the coefficients (-1.2 and -1.8) points to a negative rather than positive effect of

[16] All conclusions are formulated realetive to respective *Swiss reference values*.

entering the EMU in 1999 while replacing the currencies in 2002 seems to have had no independent effect on the CPLs. Thus irrevocable fix of the exchange rates in 1999 was proved to have exerted a downward pressure on prices in the euro area but no evidence for was found for the much-debated inflation hike in early 2002 to have had a lasting impact on price levels when controlling for a variety of other factors such as income, exchange rate or taxes.

However, the usefulness of the these results for predicting the potential effect of EMU on prices in Poland or any NMS (except Slovenia) is seriously weakened by the fact that countries comprising this group are generally very different from Poland and most NMS, in particular along the income dimension – proven to be the key CPL determinant. During all of the sample period Poland's GDP per capita in PPS has not exceeded 50% of the EA average while the CPL of GDP has risen only to below 60% (see fig. 4). With such a difference in relative wealth and ensuing consequences for the structure of the economy the danger exists that the dynamics of convergence and the likely direction and magnitude of the EMU effect may look different in NMS. While it may not be possible to directly investigate the NMS experience with EMU due to the availability of a single observation for one country only (Slovenia in 2007) splitting the sample along appropriate dimension may shed more light on the potential impact of EMU on prices in a country like Poland.

4.2 Effect of EMU in two sub-samples

In order to better detect the EMU effect the two subsamples were defined taking into account the conventional division into OMS and NMS as well as the income per capita criterion. The first subsample comprises 17 wealthier EU economies: 14 of the OMS (Luxembourg excluded) and three NMS –Slovenia, Malta and Cyprus; the second – the remaining 9 post-communist NMS. The aim of such a grouping was to detect whether price level determinants are different for poorer countries than for wealthier ones.

The group of 17 richer economies contains all 13 countries that were part of the Euro area in 2007 and thus provides a useful sample for measuring the impact of the EMU accession on price levels. However, the group itself is by no means homogenous when it comes to income per capita with four countries standing out in the lower end of the ranking at the time of EMU accession in 1999 as well as at the time of currency changeover in 2002. This lower-income group includes Portugal, Greece, Spain and Italy with GDP per capita relative to the EU average

amounting to 52%, 56%, 68% and 92%, respectively. The so-called Club Med group is suitably complemented by Slovenia with GDP at the time of EMU accession (2007) at 69% of the EU average. The five aforementioned country form the subgroup EU5. Additionally a narrower group was considered in the estimations (EU4) comprising four of the five EU5 countries – without Italy. While Italy is commonly considered part of the lower-income non-core EU country group frequently called Club Med, with its GDP at 92% at the time of accession it is somewhat of an outlier itself in this group being closer to the EU average by over 20 percentage points than all other EU5 member.

The experience of these countries (EU4 and EU5) is therefore expected to be more indicative of the likely price level impact of the EMU accession on prices in the remaining NMS including Poland. To measure this effect the equations estimated on the EU17 sample were augmented by the interaction dummy representing the EMU accession effect in the poorer EU5 group.

The estimation results are presented in table 2. In comparison to table 1 containing results for the full sample there are considerable differences in the coefficients and the key EMU dummy. The GDP coefficients are generally somewhat lower than in the full sample. Also the impact of the nominal effective exchange rate disappears in GDP and consumer services equations and remains positive for consumer goods – albeit with the smaller coefficient value. Openness to trade proved significant for both consumer goods and services (albeit with the "incorrect" positive sign for services), while taxes came out significant only in the case of services with absolute levels somewhat smaller than in table 1.

However, the key difference lies in the EMU variable. When EMU1999 and EMU2002 dummies are included the coefficient on the former comes out significant reaching -0.9 and and -2.0 for GDP and consumer goods, respectively. This is in line with the full-sample results and confirms the negative rather than the positive effect of the creation of the EMU in 1999 with no independent effect of the currency changeover in 2002. Including the interaction dummies (EMU with EU4 and EU5) changes the results in an interesting way. The GDP equations are broadly unchanged with the absolute value of the EMU1999 dummy larger when EU4 dummy was included and smaller if EU5 was included in comparison to no-interation-dummy equations. It is in the consumer goods and consumer services equations that introducing interaction dummies modifies the results significantly. In the case of consumer goods, the original EMU1999 dummy loses its significance which apparently gets "transferred" to the interaction dummy. The interaction dummy is highly significant and higher (lower) in absolute terms in EU4 (EU5) equations in comparison to analogous equations without interaction dummies. Including

interaction dummies in the consumer services equations did not alter previous results leaving both EMU and interaction EMU dummies not significant.

The equations make clear that prices of consumer goods experienced a non-negligible downward push as a result of EMU accession in particular in poorer EU countries, such as Portugal, Greece, Spain, Slovenia and Italy and in particular in the former four. This impact is much smaller (less than half the value) for the price level of the entire GDP with no distinct effect detected for the poorer countries. No such effect was detected for consumer services at all.

The second subsample covers 9 countries of the former communist NMS except for Slovenia. Due to the fact that none of them has become part of the EMU in the sample period the regression cannot provide the answer to the question about the impact of the euro on prices. However, estimating the equation may reveal potential differences in the CPL determinants in comparison to the wealthier EU countries. The results of estimating the three regressions with the same set of regressors are presented in table 3.

Table 3 reveals several important differences of the EU9 regressions. First, GDP coefficients are markedly higher - in the case of consumer goods almost double the EU17 estimates. This is a clear indication of the higher importance of domestic factors in driving prices up across NMS and hence a clear evidence of the prominence of the catching-up process. Openness to trade was confirmed to have a strong impact on suppressing consumer goods prices with coefficient magnitudes higher than in the 26- and 17-country samples implying larger benefits from trade. Tax levels were found very important for explaining CPLs with coefficients ranging from 0.12 to 0.23 which is significantly higher than in previous regressions pointing to a more direct impact of taxation on price levels, in particular that of consumer goods. Finally nominal effective exchange rate movements were confirmed significant in all equations with obtained coefficients within the range of those in the previous subsamples.

4.3 Conclusions on the EMU effect in Poland

Although the sample period 1995-2007 does not cover sufficient information about the experience of the NMS with EMU in order to provide definite answers to the paper's main research question there are a number of conclusions on the most likely scenarios that can be

discerned from the analysis. First and most importantly the analysis does not provide any evidence supporting the notion of the EMU accession exerting upward pressure on comparative price levels. On the contrary, several equations revealed the existence of the downward pressure on consumer prices and the GDP for the group of EU17 (OMS excl. Luxembourg, Slovenia, Cyprus and Malta) and in particular the members of this group that were relatively poor at the time of accession, i.e. Portugal, Greece, Spain, Italy and Slovenia. This pressure meant that comparative price level of GDP for the latter 5 countries were about 1 percentage point[17] lower due to their membership in the EMU defined since 1999. In the case of consumer goods the downward effect more than doubles and becomes the sole characteristic of the poorer countries suggesting that it is actually the least developed EU members that are likely to benefit most from expanding of the euro area.

A word of caution has to be provided here in order to precisely interpret these results. A downward effect related to the EMU identified by the significant and negative EMU dummy means that price levels are lower than they otherwise would have been – with the conventional caveat implying 'other things being equal'. As usual the effect has to be investigated within the framework of the model in which the EMU dummy is just one variable impacting the CPL. The *downward effect* as such does not necessarily imply actual declines in the CPL of consumer goods; it simply refers to the fact that its value is lower than it would have been for countries outside the euro area.

In addition to estimating the likely impact of EMU on prices the above analysis revealed the importance of other key determinants of price convergence across EU member states. Real convergence defined as relative per-capita GDP growth was confirmed to have the highest impact on price levels – much higher in NMS than among OMS. As mentioned in the previous section this clearly points to the strength of the income channel in price level convergence and indirectly – also to the prevalence of the Balassa-Samuelson effect. The fact that such impact was detected for all considered GDP aggregates proves that real convergence triggers convergence in prices of nontradables as much as that of prices of tradables. This clearly suggests the importance of the non-tradable element in prices of tradables (e.g. wages, rents, transport) as well as other convergence factors mentioned in chapter 2, such as increased quality and reputation of domestic goods coupled with possibly non-substantive methodological factors.

[17] Relative to Switzerland's price level

The analysis confirmed the role of trade openness in keeping prices low as well as the significant impact of taxes on price levels. In both cases regressions revealed that the effect on the CPL is stronger for EU9 than for EU17.

Finally nominal exchange rate movements vis-à-vis main trading partners proved significant in most equations specifications across all samples. Positive coefficients are in line with expectations and point to the imperfect pass-through of exchange rate movements to prices. Interestingly this pass-through is higher for NMS than elsewhere and -somewhat surprisingly- generally higher for consumer services than for consumer goods.

5 Summary and conclusions

The paper attempted to verify the significance of the accession to EMU on price levels for EU as a whole and for two subsamples of EU countries in order to draw the conclusion on the most likely scenario for Poland. Throughout the analysis a clear distinction was made between intuitive individual-product price ratios, those implied by inflation rate differentials and finally those reflected by the indices of Comparative Price Levels. While price shocks commonly associated with the 2002 introduction of the euro banknotes may have affected some individual prices or even temporarily inflation rates they are indeed very unlikely to have had a long-lasting impact of price ratios as measured by the CPLs.

In order to verify the existence of this effect the CPLs were modelled in the framework controlling for key determinants of cross-country price level differences - such as income per capita, nominal effective exchange rate movements, openness to trade and the level of taxation. The model was estimated in the panel form using the data for 26 EU economies over 13 years. Three alternative specifications of the dependent variables were used to check the sensitivity of results to different GDP aggregates. In consumer services equations no impact of EMU on prices was detected in either of the subsamples providing evidence for the lack of the euro-related shock for their comparative prices levels. In the case of consumer goods and GDP regressions confirmed the mild *downward* rather than upward effect of the EMU membership (since 1999)

on CPLs in the range of 0.9-2.0 p.p.[18]. Including the interaction dummy variable for the poorest EU members in consumer goods equations showed that the origins of this effect are developments in these countries (Portugal, Greece, Spain, Slovenia and Italy and in particular the former four). This means that in fact it was the least-wealthy EMU entrants that benefited the most from the formation of the euro in that they saw the new currency curb the comparative price levels of consumer goods. However, all EMU members have seen positive effects of creating the EMU in 1999 in terms of lower price levels of the total GDP and this result held even in the presence of the isolated poorer-EMU member group.

Thus no evidence was found -contrary to common believes- for the claim that introduction of the euro permanently raised prices in countries constituting the union. Comparative price levels of consumer services did not react to either fixing the exchange rates in 1999 and introduction of euro banknotes in 2002 and instead kept moving in line with key fundamental determinants – income, exchange rate movements, competition and taxes. On the other hand, the market for consumer goods seems to have benefited a lot from increased competition brought about by higher price transparency and the elimination of exchange rate risks and experienced a downward shock as a result of the introduction of the euro. This means that -ceteris paribus- prices of consumer goods and to a lesser extent of the entire GDP in the EMU member countries would have been slightly higher if they had retained their own currencies.

Since the effect was confirmed especially for the group of poorer EU countries it may be used in drawing the most likely scenario of the euro impact on the price levels of consumer goods across NMS and in particular in Poland. While the sample period does not allow for representative coverage of actual NMS experience with EMU[19], experiences of other, especially poorer OMS unquestionably confirm the lack of independent euro-related price effect in the market for consumer services and the existence of downward pressure on prices of consumer goods and GDP. As noted before the downward pressure has to be interpreted in the overall context of the CPL convergence that is expected to continue in line with real convergence. Therefore this pressure will more likely mean *slower* comparative price growth rather than price decline.

These effects notwithstanding one can use other conclusions from the estimated models to augment the scenario. The positive coefficient associated with the nominal exchange rate movements means that appreciation (depreciation) of the domestic currency vis-à-vis the euro translates directly into higher (lower) comparative price level. Fixing of the exchange rate

[18] In percent of the Swiss reference value
[19] Except for Slovenia in 2007

implied by the accession to EMU (and ERM2) may thus mean either faster or slower convergence depending on the expected dynamics of domestic currencies. Consequently, replacing the zloty by the euro may raise Polish CPL if the most likely alternative scenario for the zloty would have been that of the nominal depreciation or lower the CPL if zloty hypothetically were to appreciate.

Furthermore confirmed role of real convergence in fostering price convergence means that if accession to euro area brings about faster GDP growth – this will inevitably translate into higher comparative price levels. On the other hand intensified international trade – commonly considered to be the most likely outcome of accession to EMU – will mean that the price-dampening effect of import competition is going to be more significant.

Altogether the overall effect of the EMU on the Polish price level will be the outcome of many different phenomena overlapping and impacting prices in parallel. This analysis in this paper was meant to shed more light on the independent effect of the creation of EMU on prices. Estimation results of numerous alternative models explaining the dynamics of the CPL failed to identify any such effect for the price level of consumer services while it found evidence in support of the downward-push effect of the euro on consumer goods and overall GDP confirming the common currency's role in fostering price transparency and thus increasing competition in the European single market for tradables.

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Appendix A1

Comparative Price Levels (CPLs) are calculated by the Eurostat and OECD in the framework of a European Comparison Programme. The CPLs are based on prices of a set of comparable and representative sample of goods and services covering the various aggregates of GDP in all participating countries. For example, in the case of individual consumption expenditure by households, ICEH (corresponding to the HICP in terms of coverage), CPLs are based on price relatives (relative price ratios) for 148 categories of goods and services, called basic headings, in a two-step procedure:

1) Calculating PPPs for basic headings. Basic headings are fairly detailed expenditure categories, such as *bread*, *pork* or *non-durable household goods*. PPPs for basic headings are obtained[20] from unweighted geometric averages of individual price ratios of goods/services selected by Eurostat to represent the heading. Different basic headings have a different number of representatives, depending on the complexity and the heterogeneity of the commodity/service group. These representative items have been agreed among all participating countries in the course of a long and complex process that takes account of

[20] All the necessary steps are described in detail in charter 7 of the PPP Manual (Eurostat, 2005). In short, computation of PPPs for basic headings for country pairs involves:

1) Calculating geometric mean of price relatives for products representative for country A and an analogous geometric mean for products representative for country B.
2) Calculating the geometric mean of the two means described in 1). Repeating these calculations for all country pairs yields the complete matrix of PPPs (Fisher-type PPPs).
3) To make the matrix transitive all PPPs are recalculated according to the EKS (Esteto-Koves-Szulc) procedure. This involves calculating for each country-pair PPP an unweighted geometric mean of the Fisher-type PPPs calculated between the pair directly squared and all the corresponding indirect PPPs between the pair obtained using the other countries as a bridge.

both cross-country comparability and representativity - with a clear emphasis on the former. The fact that unweighted averages are used for obtaining basic-heading PPPs is significant since it indicates that differences in the relative structure (expenditure weights) within the headings are ignored. For example, if country A consumes more high-quality and more expensive pork products (e.g. ham rather than low-quality sausages) than country B, this has no consequence for the actual relative price ratios of pork in those countries, as all products from these headings enter the geometric mean with equal weights. Analogously, if the process of moving to higher-quality pork products is observed in B this will have no reflection in the final PPP for pork (or any other broader aggregates comprising pork, such as food) between these countries unless of course individual price relatives of specific products in question change. Eurostat does not publish the basic-heading PPPs on a regular basis, but they can be found in specialized publications on an ad-hoc basis.

2) Aggregations of basic-headings PPPs up to the level of ICEH PPPs. In order to aggregate basic-heading PPPs into broader-aggregate PPPs for any pair of countries (country A and base country B) two weighted averages are calculated: a Laspeyres-type PPP (weighted arithmetic average with base-country weights) and a Paasche type PPP (weighted harmonic average with A-country weights). The final PPPs are constructed as geometric means of both types of PPPs[21] that have been additionally made transitive with the use of the EKS procedure.[22] This procedure can be applied at each level of aggregation up to the complete ICEH (or GDP) PPP index. Therefore, the final consumption PPPs are based on weighted PPPs of sub-aggregates, where weights of both countries are taken into account.

Although the process of arriving at aggregate PPPs is very complex, it is useful to think of $PPP_{A/B}$ (expressing country A prices in terms of country B prices) as being proportional to a square root of the ratio $(L_{A/B}/L_{B/A})$ where the numerator is a weighted arithmetic average of basic heading PPPs (with B country being the base) with the weight structure from country B and the denominator is a weighted arithmetic average of basic heading PPPs (with A country

[21] Due to the relationship between Laspeyres and Paasche PPPs ($L_{A/B}=1/P_{B/A}$ where $L_{A/B}$ is the Laspeyres index with a country B weights and $P_{B/A}$ is a Paasche index with country B weights) this geometric mean collapses to $(L_{B/A}*P_{B/A})^{0.5} = (L_{B/A}/L_{A/B})^{0.5}$

[22] The EKS (Esteto-Koves-Szulc) has been briefly described in the preceding footnote and details can be found in paragraphs 7.11-7.16 of charter 7 of the PPP Manual (EC, 2005).

being the base) with the weight structure from country A. Consequently, country-pair PPPs for any aggregates above basic headings, such as, for example, meat, food, durable goods, services, up to the individual consumption and GDP, can change whenever

- weight systems change in either country or
- price relatives of any pair of goods or services change or
- any combination of the two changes occurs.

Comparative Price Levels (CPLs) that are most typically used in the PPP-related research are computed by dividing the PPP indices by the average value of the bilateral exchange rate of the country pair. It is important to note also that CPLs are based on price relatives and do not convey any information about the absolute level of prices (this information gets lost when basic headings PPPs are calculated). There are many important limitations of the PPP-based CPLs which Eurostat points out (Eurostat, 2005):

- Eurostat encourages the use of the CPLs for monitoring price convergence at higher levels of aggregation rather than for very detailed groups (such as basic headings, or one category up, i.e. classes) and over longer periods of time.
- This is because the selection of monitored goods and services changes every year to ensure that items are representative of consumption patterns – which can introduce substantial volatility especially in the highly disaggregated CPLs
- Exchange rate volatility can be an important factor in fluctuations of CPLs, especially for highly disaggregated indices.

Comparative Price Levels in a given country A are conventionally expressed in terms of indices such that the base country B (or group of countries) is equal to 100. The New Cronos database at Eurostat offers two bases: one of EU15=100 and another one of EU25=100 which allows for changing the base of the CPLs to any other country or group of countries. In essence, the process of convergence in CPLs between A and B implies that the aggregate based on expenditure-weighted CPL values of basic headings moves towards 100. However, due to the multi-step process of the PPP computation this type of convergence differs in many respects from the individual price convergence (i.e. convergence of prices of identical goods). Below we some of the most important features of the CPL-type convergence are identified:

1) It is important to recall that the PPPs for a pair of countries A and B are proportional to the square root of the ratio of two weighted averages of narrower-component PPPs, each calculated with the use of different country's expenditure weights. This creates a potential for varying aggregate CPLs even with stable underlying component CPLs. Through this mechanism we can observe convergence (divergence) in country A towards (away from) country B with stable price relatives and stable weights in country A, but only as a result of weight shifting in the base country B. Likewise, no move in aggregate CPLs can be registered even though price relatives and weights change only if those shifts offset one another in the process of calculating weighted indices.

2) If country A is characterised by lower prices (e.g. can be thought of as one of NMS) and country B is one with higher price level (e.g. one of the wealthier EU15 countries), $CPL_{A/B}$[23] are below 100 for broader aggregates as well as for most disaggregated groups of goods and services. Let us consider a CPL for meat– an expenditure class composed of six basic headings: beef, pork, lamb, poultry, other meats and meat preparations[24]. Other issues[25] notwithstanding we assume that growing income in A will lead to increased consumption of beef at the expense of cheaper pork which will be reflected in rising weight of beef in A. If we assume furthermore that price relatives of all six components of the meat class (incl. beef and pork) remains stable and consumption structure in a richer country B has not changed, what effect will this consumption shift in A have on $CPL_{A/B}$ for meat? Intuitionally, moving away from cheaper to more expensive products should raise country A's CPL for meat and for all aggregates involving meat including ICEH and GDP. However, this will only be the case under very specific conditions. In essence, whether this shift will lead to higher CPLs depends on whether $CPL_{A/B}$ for beef is above or below the aggregate $CPL_{A/B}$ for meat. If we assume the $CPL_{A/B}$ for meat to be 60,[26] then if $CPL_{A/B}$ for beef exceeds 60 the effect will be the rise in the general $CPL_{A/B}$ for meat. If however, $CPL_{A/B}$ for beef is below 60, the effect will be in the opposite direction. Using the same example of countries A and B, we can show that a parallel shift in country B's weight of beef can either re-inforce the effect on CPL (if the beef's weight goes up in B) or counteract it (if beef's weight falls).

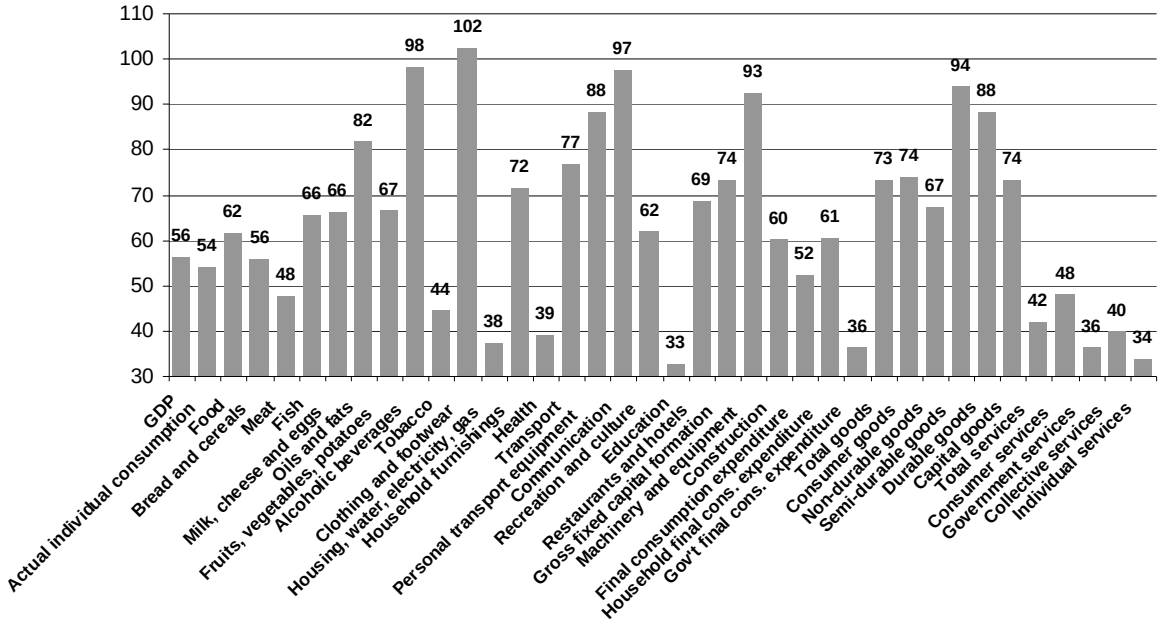
3) If the assumption of stable price relatives is relaxed, the outcome for PPP is even more difficult to predict as it depends on the joint effect of relative price changes and

[23] $CPL_{A/B}$ is a comparative price level of A with country B being a base equal to 100.
[24] Information taken from Annex II of the PPP Manual (Eurostat, 2005)
[25] Local preferences and meat availability may play a role.
[26] which means that meat prices in A are on average 60% of meat price in B.

weight changes in both countries. Due to the complex process of calculating PPPs which involves many types of averaging as well as the EKS procedure, it is very difficult to carry out sensitivity analysis of CPLs to changes in weights and price relatives. It is important, however, to keep in mind that observed CPL convergence or divergence is a joint outcome of weight and price changes and hence it can rarely be attributed to a single isolated process.

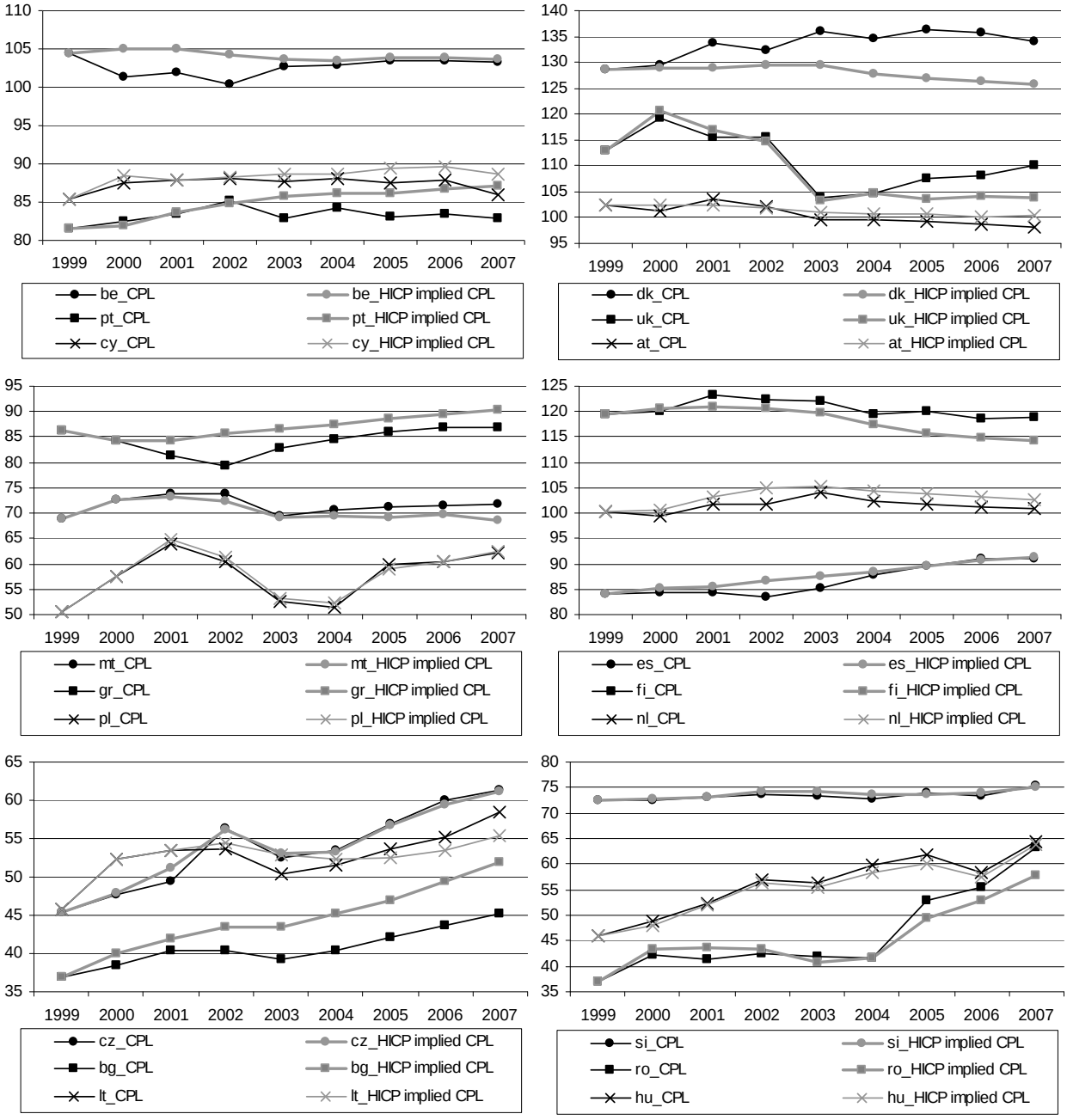
4) Another important consequence of the PPP methodology relates to CPLs of basic headings. As mentioned earlier each of the 148 basic headings of the ICEH CPL or of the 226 of the GDP CPL is based on unweighted geometric averages of price relatives of goods/services chosen to be representatives of the heading in each country while being satisfactorily comparable across all countries at the same time. Because goods are unweighted any shifts of expenditures within basic headings cannot be reflected in the CPLs. If we recall the example of meat and focus on the last basic heading, i.e. meat preparations we can notice that switching from low quality meat products (lard, for example) to higher-quality and more expensive products (like ham or smoked meats) will have no effect on the CPL for meat preparations. Thus, in the case of basic headings it is only changes in price relatives of components constituting the heading that can influence the CPLs.

Fig. 1. Comparative Price Levels of various ESA-95 aggregates in Poland, 2006 (Euro Area=100)



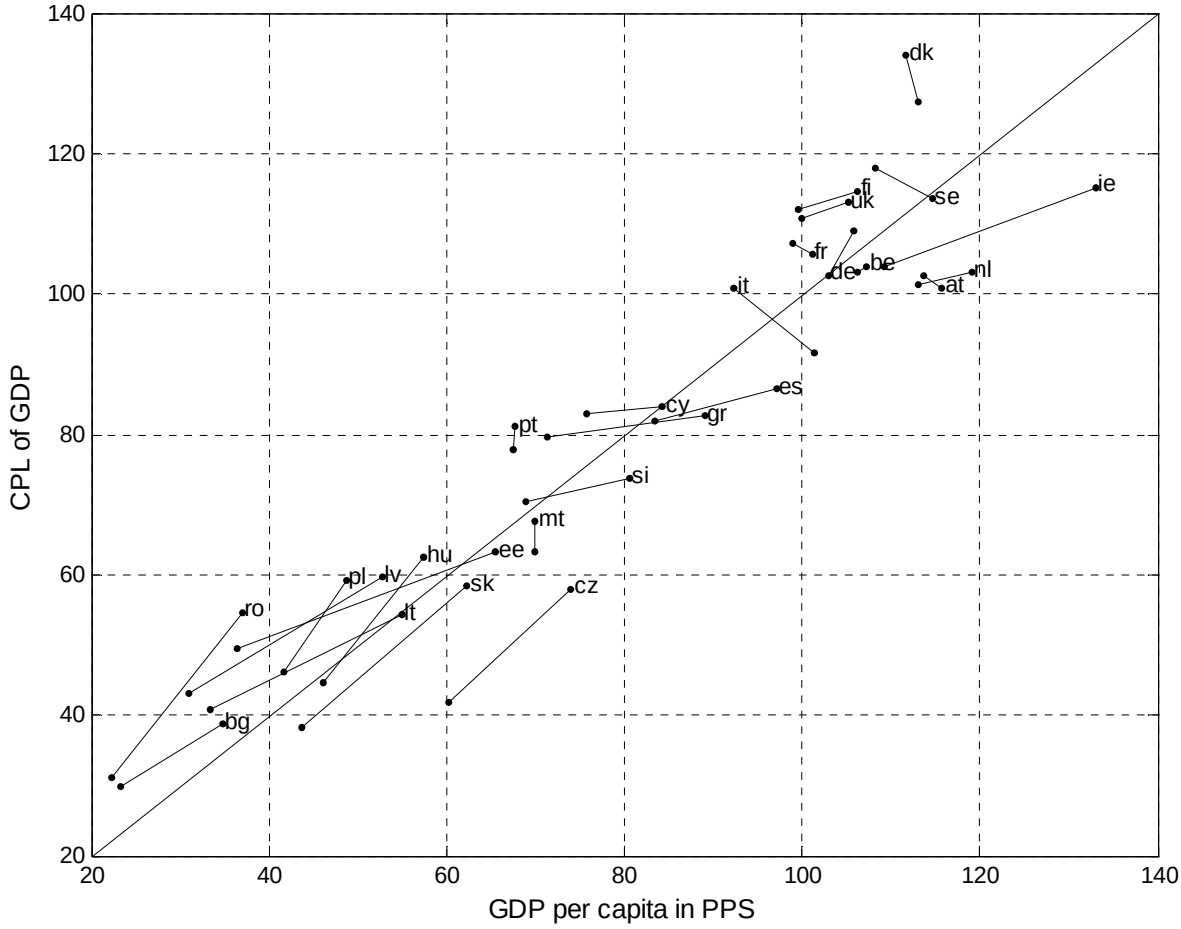
Source: Eurostat

Fig 2. The differences between CPL and HICP-implied relative price trends



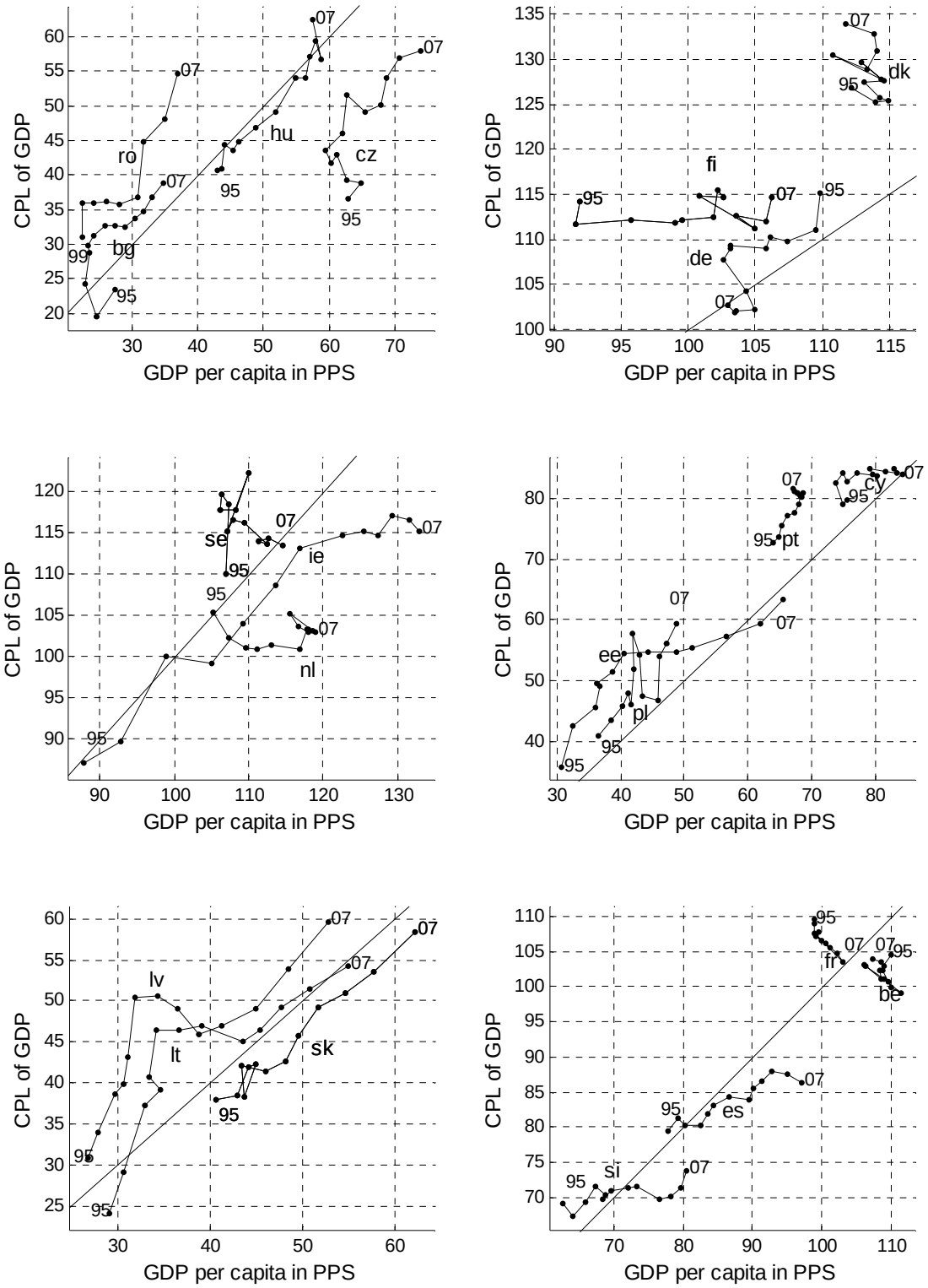
Source: Eurostat

Fig. 3. GDP per capita in PPS and Comparative Price Level (CPL) of GDP in 1999 and 2007 (2007 marked by the country code).



Source: Eurostat

Fig. 4 Trajectories of GDP-CPL pairs for EU countries, 1995-2007



Source: Eurostat

Fig. 5. Nominal Exchange Rate Developments in non-EA countries (Jan 1995=100)

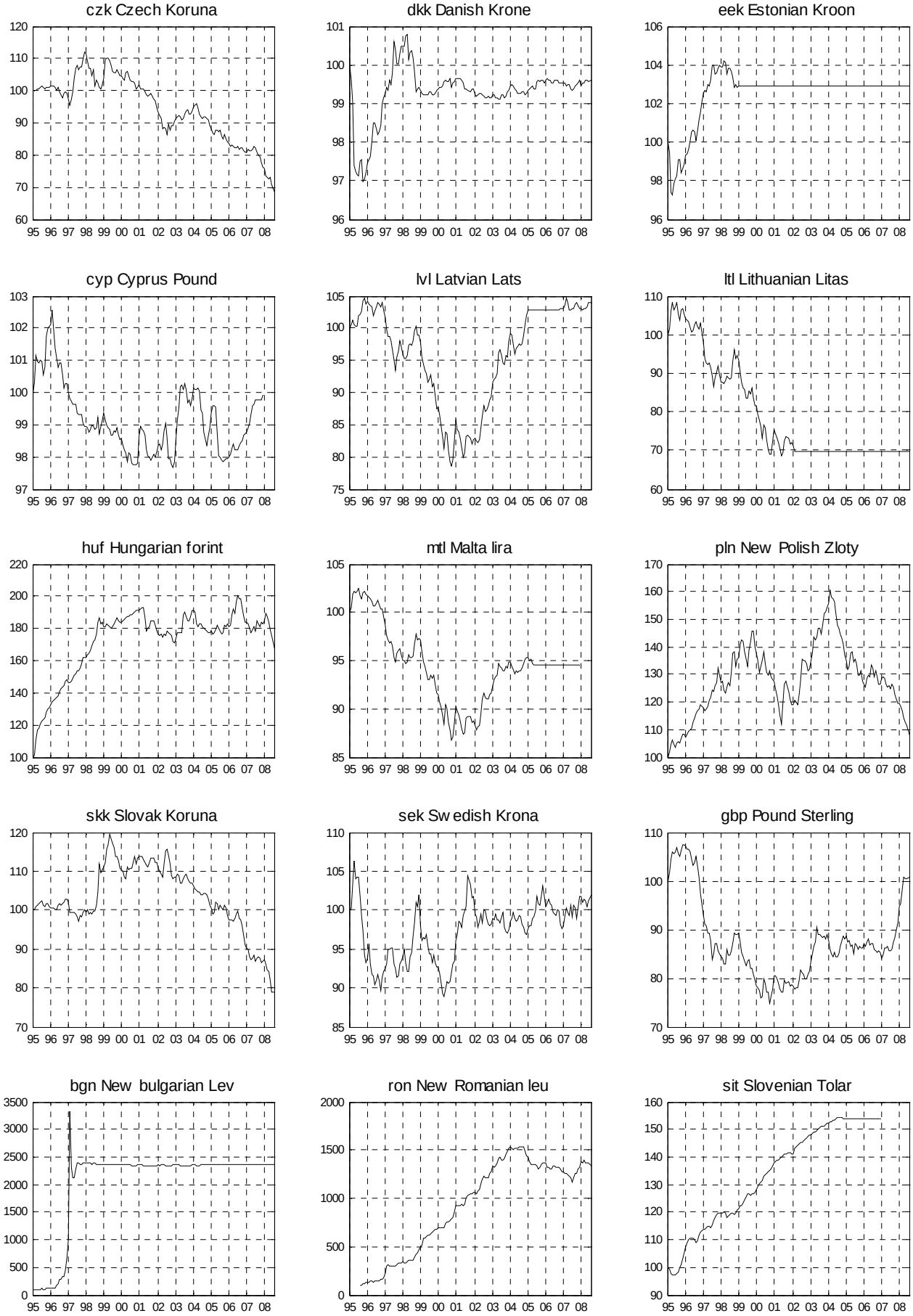
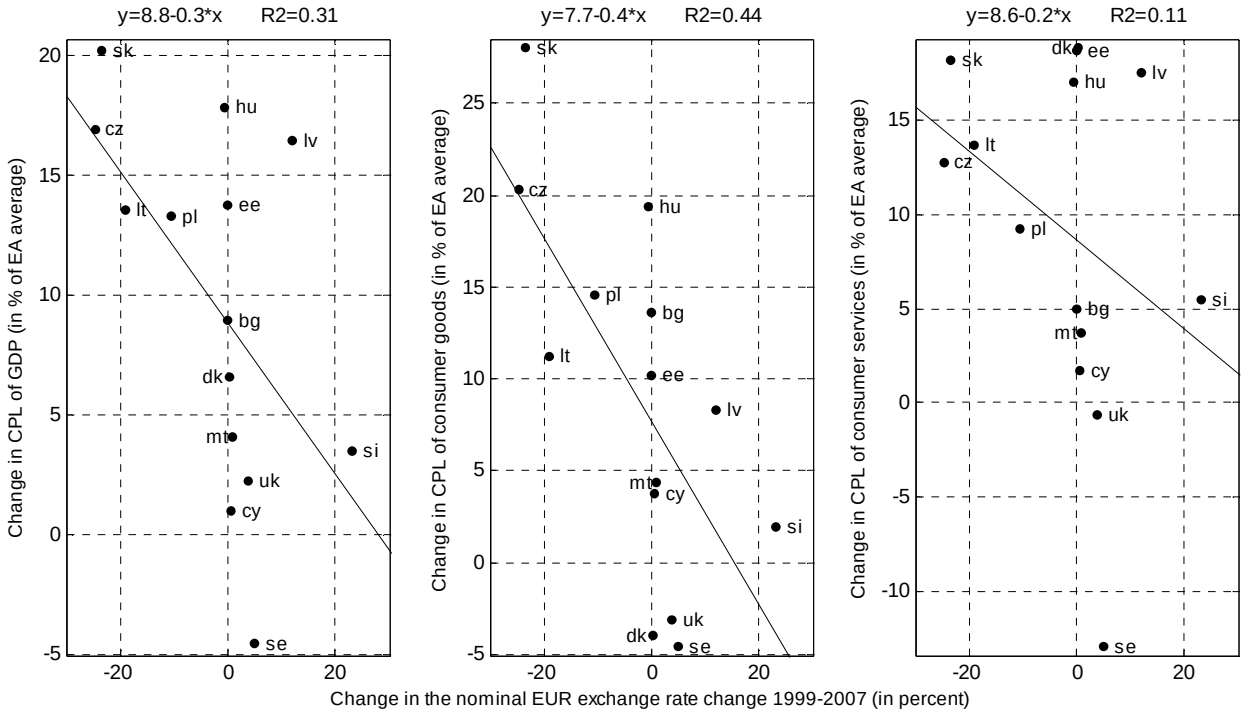


Fig. 6 Nominal EUR exchange rate vs. CPLs for GDP, consumer goods and consumer services 1999-2007



Source: Eurostat

Fig. 7 Nominal EUR exchange rate changes and convergence of CPLs for GDP, consumer and consumer services 1999-2007

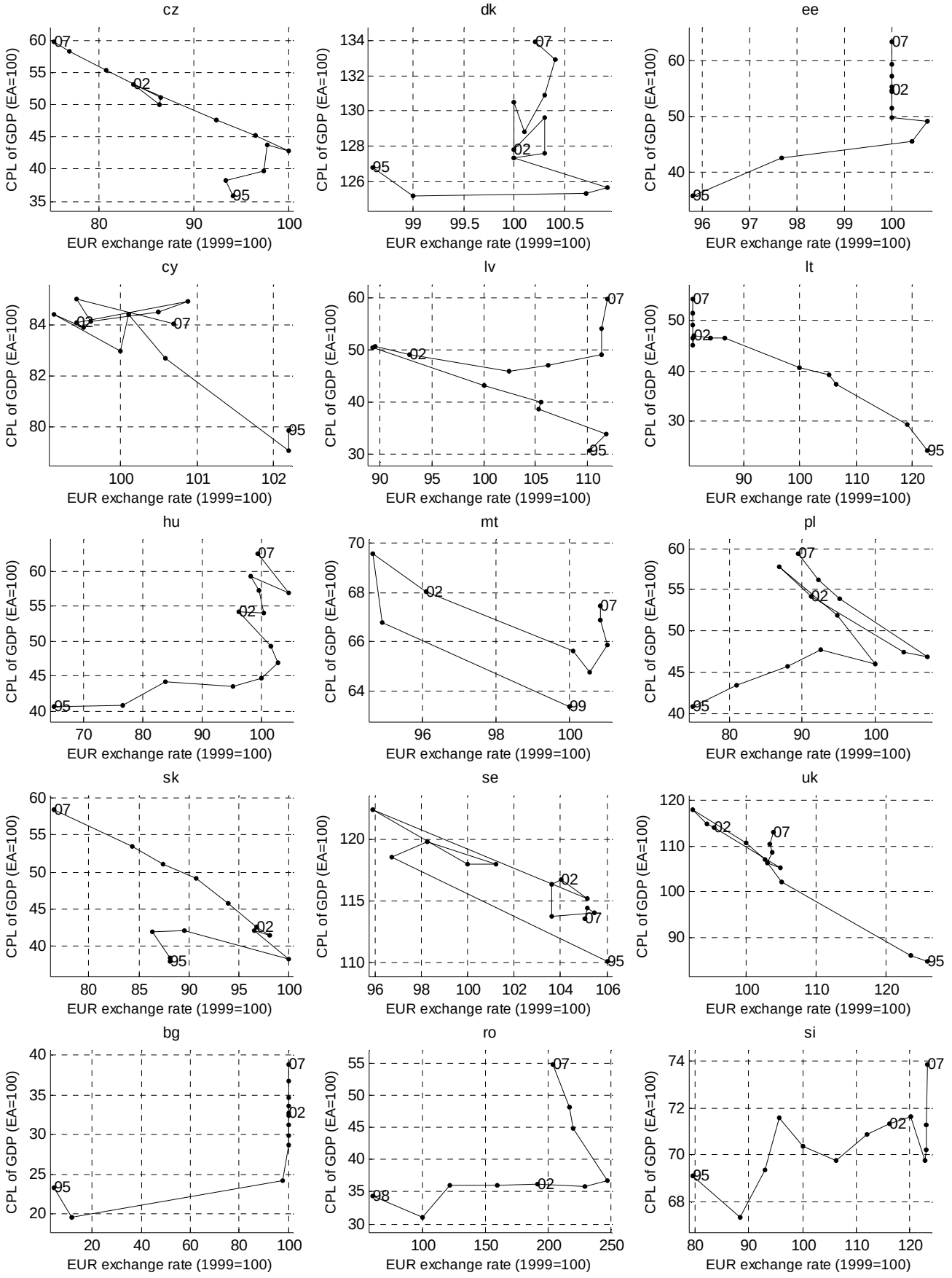


Fig. 8 Openness and CPL – goods, services and goods and services (1995-2007 averages)

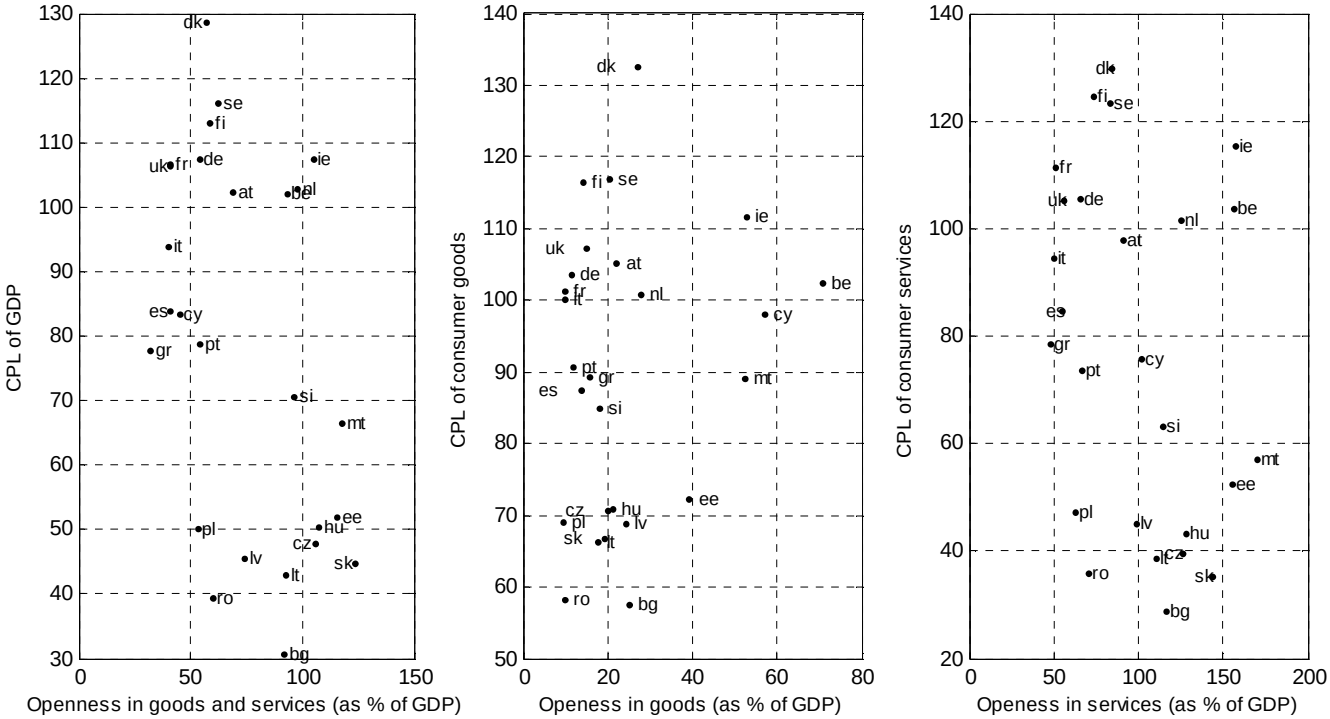


Fig. 9 Taxes as % of GDP and CPL

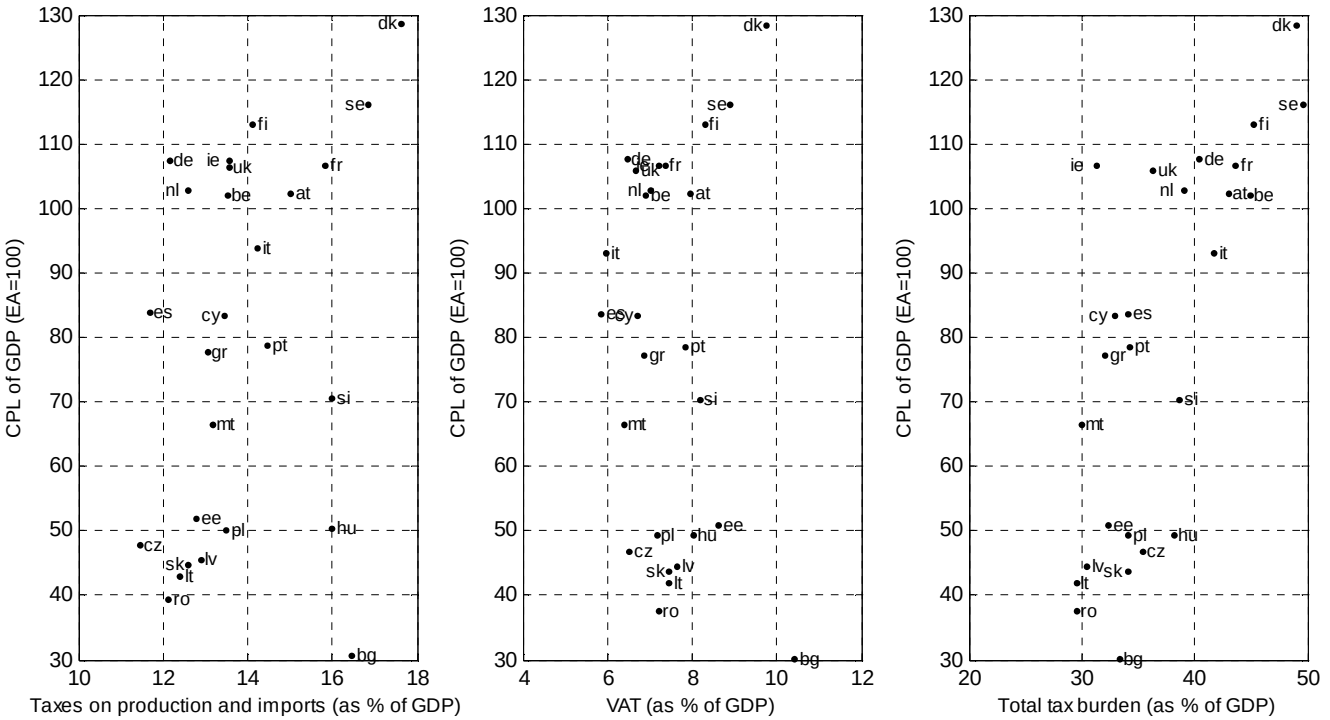


Table 1. CPL equations - 26 EU countries (EU27 excl. Luxembourg)

Explanatory Variables	Dependent Variable					
	CPL of GDP		CPL of consumer goods		CPL of consumer services	
	coeff	p-value	coeff	p-value	coeff	p-value
GDP per capita*	**0.904**	**0.00**	**0.685**	**0.00**	**0.864**	**0.00**
Nominal effective exchange rate[a]	**0.140**	**0.00**	**0.271**	**0.00**	**0.175**	**0.00**
Openness to trade*[b]	-0.006	0.67	**-0.040**	**0.09**	0.003	0.89
Taxes as % of GDP*[c]	0.032	0.23	**0.018**	**0.06**	**0.059**	**0.04**
EMU1999 Dummy[d]	*-1.231*	*0.03*	*-1.813*	*0.07*	*-1.239*	*0.20*
EMU2002 Dummy[d]	*0.170*	*0.70*	*0.162*	*0.86*	*-0.620*	*0.26*
Wald Test (joint)	325.1	0.00	207.7	0.00	162.1	0.00
No. of observations	271		259		244	

Notes:
Source: Eurostat except taxes (AMECO)

The methodology is GMM one-step estimation with the combination of the GMM instruments (variables potentially endogenous) and standard instruments (exogenous variables)

Coefficients statistically significant at a level of 10% or higher in bold

* variables expressed as indices with base country Switzerland equal to 100
[a] The nominal effective exchange rate index of the domestic currency expressed as a ratio of the Switzerland index.
[b] Exports and imports as % of GDP – of goods and services (CPL of GDP equation), goods (CPL of consumer goods) and services (CPL of consumer services)
[c] Total tax burden (excl. social security contributions), source AMECO
[d] EMU dummy equal to 1 if a country is a member of EMU in a given year. Two alternative time thresholds for EMU start are explored simultaneously : 1999 (EMU1999) and 2002 (EMU2002)

Table 2. CPL equations - 17 EU countries**

Explanatory Variables	Dependent Variable											
	CPL of GDP*				CPL of consumer goods*				CPL of consumer services*			
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
GDP per capita*	**0.853**	**0.00**	**0.856**	**0.00**	**0.627**	**0.00**	**0.657**	**0.00**	**0.799**	**0.00**	**0.818**	**0.00**
Nominal exchange exchange rate[a]	0.072	0.35	0.068	0.37	**0.193**	**0.03**	**0.197**	**0.01**	**0.264**	**0.01**	**0.156**	**0.18**
Openess to trade*[b]	-0.009	0.67	-0.011	0.59	**-0.042**	**0.02**	**-0.046**	**0.00**	**0.064**	**0.08**	0.010	0.77
Taxes*[c]	0.024	0.52	0.023	0.55	-0.073	0.11	0.057	0.13	**0.110**	**0.01**	**0.074**	**0.07**
EMU1999 Dummy[d]	***-0.898***	***0.07***	***-0.983***	***0.07***	***-2.030***	***0.02***	*-1.146*	*0.14*	*-0.948*	*0.37*	*-1.305*	*0.18*
EMU2002 Dummy[d]	*0.322*	*0.48*	*0.451*	*0.36*	*0.089*	*0.91*	*0.386*	*0.55*	*-0.820*	*0.41*	*0.115*	*0.87*
EMU1999 x EU4[e] Dummy			*0.345*	*0.65*			***-2.407***	***0.01***			*0.466*	*0.75*
EMU2002 x EU4[e] Dummy			*-0.530*	*0.39*			*-2.023*	*0.22*			*-1.782*	*0.16*
Wald Test	104.50	0.00	125.90	0.00	106.10	0.00	149.90	0.00	260.80	0.00	185.80	0.00
No. of observation	181		181		174		174		174		174	
GDP per capita*			**0.855**	**0.00**			**0.655**	**0.00**			**0.825**	**0.00**
Nominal exchange exchange rate*[a]			0.072	0.34			**0.196**	**0.01**			0.155	0.18
Openess to trade*[b]			-0.010	0.62			**-0.048**	**0.00**			0.010	0.76
Taxes*[c]			0.023	0.53			**0.070**	**0.07**			**0.076**	**0.07**
EMU1999 Dummy[d]			***-0.829***	***0.09***			*-1.276*	*0.11*			*-1.401*	*0.15*
EMU2002 Dummy[d]			*0.309*	*0.55*			*0.355*	*0.58*			*0.177*	*0.81*
EMU1999 x EU5[e]Dummy			*-0.191*	*0.79*			***-1.874***	***0.02***			*0.516*	*0.66*
EMU2002 x EU5[e]Dummy			*0.006*	*0.99*			*-1.446*	*0.30*			*-1.492*	*0.22*
Wald Test			122.60	0.00			145.50	0.00			139.40	0.00
No. of observation	181		181		174		174		174		174	

Notes:
Source: Eurostat except taxes (AMECO)

The methodology is GMM one-step estimation with the combination of the GMM instruments (variables potentially endogenous) and standard instruments (exogenous variables)

Coefficients statistically significant at a level of 10% or higher in bold

* variables expressed as indices with base country Switzerland equal to 100
** EU17 includes 12 EA countries (members in 2007: 11 EA OMS excl. Luxembourg + Slovenia), UK, Denmark, Sweden, Malta and Cyprus

[a] The nominal effective exchange rate index of the domestic currency expressed as a ratio of the Switzerland index.
[b] Exports and imports as % of GDP – of goods and services (CPL of GDP equation), goods (CPL of consumer goods) and services (CPL of consumer services)
[c] Total tax burden (excl. social security contributions), source AMECO
[d] EMU dummy equal to 1 if a country is a member of EMU in a given year. Two alternative time thresholds for EMU start are explored simultaneously : 1999 (EMU1999) and 2002 (EMU2002)
[e] EU4 Dummy is equal 1 for poorer euro-area members: Slovenia, Greece, Portugal, and Spain while EU5 Dummy additionally includes Italy

Table 3. CPL equations - 9 NMS **

Explanatory Variables	Dependent Variable					
	CPL of GDP		CPL of consumer goods		CPL of consumer Services	
	coefficient	p-value	coefficient	p-value	coefficient	p-value
GDP per capita*	**1.108**	**0.00**	**1.085**	**0.04**	**0.716**	**0.00**
Nominal exchange rate[a]	**0.105**	**0.00**	**0.195**	**0.00**	**0.107**	**0.00**
Openess to trade*[b]	-0.018	0.11	**-0.050**	**0.02**	**-0.053**	**0.01**
Taxes*[c]	**0.120**	**0.03**	**0.231**	**0.02**	**0.116**	**0.00**
Wald Test	113.6	0.000	104.9	0.000	184.2	0.000
No. of observation	90		70		70	

Notes:
Source: Eurostat except taxes (AMECO)

The methodology is GMM one-step estimation with the combination of the GMM instruments (variables potentially endogenous) and standard instruments (exogenous variables)

Coeffients statistically significant at a level of 10% or higher in bold

* variables expressed as indices with base country Switzerland equal to 100
** Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia

[a] The nominal effective exchange rate index of the domestic currency expressed as a ratio of the Switzerland index.
[b] Exports and imports as % of GDP – of goods and services (CPL of GDP equation), goods (CPL of consumer goods) and services (CPL of consumer services)
[c] Total tax burden (excl. social security contributions), source AMECO