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## 1. Introduction

Since the collapse of the exchange rate system of Bretton Woods in the early 1970s nominal exchange rates have fluctuated much more than the price levels in the respective countries, e. g., exchange rates have deviated strongly and almost permanently from purchasing power parity (PPP). This development challenged the economists' profession since the PPP condition represents a key building block in any (traditional) theory of exchange rate determination.

The efforts of economists to better understand the relationship between the exchange rate and PPP have focused on the development of different tests for different versions of the PPP hypothesis. Three factors influenced the various stages of testing PPP: First, the attempt to account for the most recent developments of major exchange rates, in particular of the dollar vis-à-vis the other reserve currencies, second, the availability of data on absolute or relative PPP and, third, the innovations in econometric testing procedures (surveys of the development of research on exchange rates and PPP are to be found in Froot-Rogoff, 1995; Rogoff, 1996; Xu, 2003, and Taylor-Taylor, 2004; Gruber, 2002, elaborates specifically on the interaction between econometric innovations and PPP testing).

In the late 1970s (stage one in the classification of Froot-Rogoff, 1995) the (simple) PPP hypothesis was tested, e. g., the null hypothesis that PPP holds all the time as was implied by the then prevailing "monetary approach" of exchange rate determination (Frenkel, 1976). When running regressions of the form

$$e_t = a + b(p_t - p_t^*) + \varepsilon_t$$

for hyperinflationary economies Frenkel (1976) found – not surprisingly – values of b close to one ($e_t$ denotes the log of the exchange rate, defined as the price of foreign currency in

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units of the domestic currency, $p_t$, $p_t^*$ denote the log of the domestic and foreign consumer price index). However, when similar regressions were estimated for "normal" environments like the post Bretton Woods years one had to soundly reject the hypothesis that the exchange rate follows PPP over the short run (Krugman, 1978; Frenkel, 1981).

In stage two – mainly during the 1980s - tests of PPP as a long-run phenomenon have been developed. Most of these tests were based on time series properties of the real exchange rate $q_t$ (= $e_t$ - $p_t$ + $p_t^*$). If PPP does hold in the long run then the real exchange rate has to converge towards its own mean (note that PPP implies a constant real exchange rate). This is, however, only a necessary condition for long-run PPP. Only if this mean is the PPP real exchange rate, i. e., only if the nominal exchange rate converges towards PPP of internationally traded goods and services (tradables) PPP can be said to hold in the long run.

The PPP tests of stage two focused on the question whether or not the real exchange rate follows a random walk (rejection of the random walk is a necessary condition for mean reversion of the real exchange rate). Most studies used the augmented Dickey-Fuller test for time series stationarity (Dickey-Fuller, 1979). In the context of real exchange rates one needs, however, a large data set to render this test sufficiently powerful if the speed of mean reversion is not fast. If, e. g., the half-life of PPP deviations is 3 years (they decline by roughly 20% per year) then one needs 72 years of monthly data to reject a unit root at a 5 percent confidence interval (Frankel, 1986; Froot-Rogoff, 1995). Hence, researchers tried to expand the data set either by using very long time series or by using cross section data.

Frankel (1986) estimates the following autoregressive process for the real dollar-sterling exchange rate from 1969 to 1984:

$$(q_t - \bar{q}) = \varphi\,(q_{t-1} - \bar{q}) + \varepsilon_t$$

where $\bar{q}$ is the assumed constant equilibrium level of q. His estimate of $\varphi$ is 0.86 which implies that the real exchange rate reverts to its mean by 14% per year (the half-life of deviations from the mean is therefore 4.6 years). Other studies using time series of different exchange rates over different time spans obtained similar results (Edison, 1987; Glen, 1992; Lothian-Taylor, 1996). This is also true for those tests for mean reversion of real exchange rates which are based on panel data (Abuaf-Jorion; 1990; Wei-Parsley, 1995; Frankel-Rose, 1996).

One has, however, to keep in mind that these unit root tests only provide evidence that the real exchange rate does not follow a random walk but rather reverts towards its mean, though rather slowly (the half-lives of deviations are estimated to lie between 3 and 5 years). As already mentioned these results do not imply that the real exchange rate converges towards the level implied by PPP. This can only be tested if one estimates the level of PPP for tradables in the first place. This, however, has not yet been done in a comprehensive manner.

The PPP tests of stage three make use of the cointegration method as developed by Engle-Granger (1987) and Johansen (1988). These tests require only some linear combination of

exchange rates and prices to be stationary. Hence, it is tested whether $e_t - \mu p_t + \mu^* p_t^*$ is stationary for any $\mu$ and $\mu^*$. This means that the restriction of stage-two tests $\mu = \mu^* = 1$ is relaxed.

These cointegration tests could reject the random walk hypothesis for the real exchange rate more successfully than the stage-two tests (see Giovanetti, 1992, and Breuer, 1994, for surveys of cointegration studies on PPP). However, the estimates of $\mu$ and $\mu^*$ vary widely and often lack any economic meaning. For these reasons Froot-Rogoff (1995) conclude that the cointegration tests did not provide new insights which were not already available from stage two tests.

Since the mid 1990s studies on PPP tests based on time series concentrated on the estimation of the speed of mean reversion and the related methodological problems, e. g., biases caused by estimation procedures (O'Connell, 1998; Taylor, 2001; Sarno-Taylor, 2002; Imbs-Mumtaz-Ravn-Rey, 2005). As a consequence, the range of estimated reversion speed widened as well as the respective confidence intervals. Some studies like Cheung-Lai (2000) or Murray-Papell (2002) challenge the "persistence paradigm" of real exchange rates and state that the true speed of mean reversion might be higher than previously estimated. However, these studies also report much wider confidence intervals of the point estimates than former studies. By contrast, more recent papers accounting for different kinds of estimation biases report half-lives of real exchange rate deviations of 5.5 years (Choi-Mark-Sul, 2004), other studies like Chen-Engel (2005) confirm the "consensus view" that it takes between 3 and 5 years for deviations of the real exchange rate to decay by 50%.

Whatever the true estimates of these half-lives might be, the fact that the real exchange rate reverts to its mean was increasingly taken as evidence in favor of long-run PPP (e.g. Papell-Theodoridis, 1998; Koejdik-Schotman-Van Dijk, 1998). This conclusion is, however, not warranted since these studies only show that the real exchange rate does not follow a random walk. They do not show that the level to which the real exchange rate eventually reverts to is the PPP level.

The low speed at which the real exchange rate reverts to its mean posed the following puzzle (Rogoff, 1996). If the volatility of the real exchange rate is dominated by fluctuations of the nominal exchange rate why do other nominal variables like prices and wages adjust so slowly to deviations of real exchange rates from their equilibrium value as implied by half-lives between 3 and 5 years? One approach to solve this puzzle consisted in accounting for possible nonlinearities in the adjustment process of traded goods prices. Due to transaction costs in international trade changes in the real exchange rate might not trigger arbitrage activities in the goods market as long as these changes and the implied price differences in common currency remain too low to cover the transactions costs. Hence, there exist "bands of inaction" which might differ by types of goods. This implies that the more the real exchange rate deviates the more arbitrage activities will take place. Hence, the speed of

mean reversion should increase with the extent of the deviation of the real exchange rate from its PPP level.

In order to account for the hypothesized nonlinearities in the adjustment process researchers made use of models which allow the autoregressive parameter to vary ("threshold autoregressive" or TAR models). Using a smooth version of a TAR model Taylor-Peel-Sarno (2001) report that the half-life of real exchange rate deviations is larger for smaller than for bigger shocks. Their results together with those of related studies by Cheung-Chinn-Fujii (2001) and Sarno-Chowdhury-Taylor (2004) confirm the existence of nonlinearities in the adjustment process of real exchange rates.

These results could be taken as a partial solution to Rogoff's PPP puzzle if the slow speed of the convergence of real exchange rates is actually caused by price stickiness in the goods market as assumed by popular sticky-price models. Two recent studies which estimate the reversion speed of nominal exchange rates and (relative) prices separately cast serious doubts on these assumptions. Engel-Morley (2001) use a state-space model to decompose real exchange rate dynamics whereas Cheung-Lai-Bergman (2003) rely on vector error correction analysis. Irrespective of the method applied, both studies obtain the same result, namely, that goods prices converge significantly faster to their mean than nominal exchange rates.

If this is true, then the nominal exchange rate is not only the driving force for deviations of the real exchange rate from its PPP equilibrium, but also responsible for the low speed at which the real exchange rate reverts to its (unknown) mean. In order to investigate this new exchange rate puzzle it is necessary to estimate the level of PPP for internationally traded goods and services (since the PPP doctrine is built upon the law of one price, PPP is supposed to hold in a strict sense only for tradables). As long as one does not know the level of the goods market equilibrium of the nominal exchange rate one cannot tell when and under which circumstances it is deviating from this level, how long this overshooting lasts, when it starts to revert again, and how long it takes to reach the level of PPP.

An estimation of the level of PPP for tradables might also help to better understand why overall price levels (based on consumer prices or GDP deflators) are higher in rich countries than in poor countries (measured by their real GDP per head). According to Balassa (1964) and Samuelson (1964) rich (faster growing) countries are (increasingly) more productive in the traded goods sector as compared to poor countries while productivity differences in nontradables are negligible. If PPP holds for tradables but not for nontradables (i. e., if prices of tradables are equal in all countries), then productivity growth in rich countries' tradables sector cause wages in the nontradables sector to rise faster then productivity (wages are assumed to be the same in both sectors). As a consequence, prices of nontradables relative to tradables will be higher (increase faster) in rich countries as compared to poor countries. Hence, the overall price level (in common currency) will tend to be higher (increase faster) in rich (fast growing) countries than in poor (slow growing) countries. Kravis-Lipsey (1983) and

Bhagwati (1984) derive the same result from different assumptions, namely, that the production of nontradables is relatively labor intensive, and that poorer countries are endowed with relatively more (and, hence, relatively cheaper) labor.

Both explanations assume that the law of one price applies to tradables but not to nontradables. Hence, the price level of tradables relative to nontradables (mostly services) will be comparatively lower (decline faster) in rich (fast growing) countries as compared to poor (slow growing) countries.

Empirical evidence in favor of the Balassa-Samuelson effect is mixed. When studying the yen-dollar exchange rate Marston (1987) reports some confirmation of this effect. Froot-Rogoff (1991) and Asea-Mendoza (1994), however, find little support for the Balassa-Samuelson effect. De Gregorio-Wolf (1996) arrive at a similar conclusion when decomposing real exchange rate movements into changes in the relative price of nontradables (the Balassa-Samuelson effect) and in the relative price of traded goods (terms of trade effect). They find that the latter effect and, hence, deviations of the nominal exchange rate from PPP for tradables, account for a large part of real exchange rate movements. Cihak-Holub (2003) report results more consistent with the Balassa-Samuelson model (these authors specify additional factors which account for price level differences not explained by the Balassa-Samuelson model).

These results are confirmed by other studies which investigate to which extent deviations of the nominal exchange rate from PPP for all goods and services are due to price differences of nontradables versus deviations from the law of one price of traded goods (Engel, 1993; Roger-Jenkins, 1995; Engel-Rogers, 1996 and 2001). All these studies find significant deviations from the law of one price for different types of internationally traded goods. Roger-Jenkins (1995) select traded and nontraded components out of the CPI and report that the largest part of the variance in the real CPI exchange rate is explained by changes in the relative prices of traded goods (they use food prices as an example for prices of tradables). However, most of these studies rely only on samples of certain types of goods, and none of them do compare price levels. Rather they look at the development of price indices over time (relative, not absolute PPP is investigated).

An exception are Gruber (2002) and Egger-Gruber-Pfaffermayr (2005) who analyze deviations from the law of one price for the whole set of PPPs at the product level (PPPs of basic headings as collected by the International Comparison Project). They find some evidence of convergence of PPPs at the product level towards the country mean (convergence of the structure of relative product prices) but no convergence of the overall real exchange rates (convergence of price levels in common currency). It seems therefore desirable to investigate the reasons for absolute deviations from the law of one price for an overall basket of traded goods and services. This requires an estimation of absolute PPP for tradables as a whole.

The most important results of 30 years of research on the relationship between exchange rates and PPP and thus the "consensus view" on PPP can be summarized as follows (see also Froot-Rogoff, 1995; Rogoff, 1996; Sarno-Taylor, 2002; Taylor-Taylor, 2004):

- PPP does not hold in the short run.
- The real exchange rate reverts to its mean, albeit rather slowly (the half-lives of real exchange rate deviations are estimated to last between 3 and 5 years). This result is interpreted as a confirmation of PPP as long-run equilibrium of exchange rates.
- Movements of the nominal exchange rate (and not of relative prices) are the main reason not only for deviations of the real exchange rate from its long-run mean but also for the slow speed of reversion towards the mean. It is therefore not surprising that PPP held better under fixed exchange rates than under floating rates.
- Relative PPP holds better when relative prices are measured by wholesale price indices as compared to consumer price indices, most probably because the former comprise more nontradables than the latter. For the same reason absolute PPP based on tradables holds better than based on all goods and services.
- Notwithstanding this result there exist substantial deviations from the law of one price also for traded goods (this is documented in studies of the Balassa-Samuelson effect as well as in studies of disaggregated price data for traded and nontraded goods).

If one confronts this "consensus view" with exchange rate instability in practice one gets the impression that the main results of these research efforts are of little help for a better understanding of the concrete exchange rate fluctuations and their impact on price competitiveness, export dynamics and growth (differentials):

Over the past 30 years nominal exchange rates between the most important currencies moved in almost persistent upward and downward trends lasting several years (see, e. g., figure 2 in Rogoff, 1996, or figure 12 in this study). The dollar, e. g., depreciated between 1970 and 1980 against the deutschemark by 50,3%, between 1980 and 1985 the (deutschemark) value of the dollar increased by 62,0%, over the following 10 years the dollar lost 51,3% of its value, between 1995 and 2001 the dollar appreciated again by 52,5% (since 1999 against the Euro), and has since then lost roughly 30% of its (Euro) value.

Since inflation differentials (based on GDP deflators, CPIs or on price indices for tradables) have remained rather low between Germany (since 1999: Euro area) and the US, it is clear that the wide fluctuations of the nominal exchange rate caused almost equally wide fluctuations of the real exchange rate and, hence, of the relative price level between Germany and the US. This in turn had a substantial impact on price competitiveness and, hence, on exports, imports and current account balances.

The main findings of the literature on PPP and exchange rates tell little more than can already be derived from a simple inspection of the data, namely, that any deviations of the real

exchange rate are primarily caused by deviations of the nominal exchange rate from the (unkown) PPP level. Further, that these deviations will come to an end (the real exchange rate does not follow a random walk) and the real exchange rate will revert to its long-run mean, though rather slowly. This implies that the nominal exchange rate fluctuates widely around the (unknown) PPP for tradables. The movements away from PPP are attributed to shocks, the reversion process is interpreted as convergence of the nominal exchange rate towards its long-run equilibrium.

The following questions cannot be answered by the findings of the literature:

- Why do nominal and real exchange rates deviate from their long-run mean/equilibrium in seemingly persistent movements which last for several years? Is it reasonable to attribute these movements to shocks?
- To which level does the nominal exchange rate revert, is this long-run mean also the level of PPP for tradables?
- Does the reversion process represent a convergence towards PPP or does the exchange rate rather "shoot through" the PPP level? In the former case one should observe the exchange rate approaching PPP somewhat smoothly and staying at that level for some time.
- Can the overall process of exchange rate dynamics as a sequence of medium-term upward and downward movements around PPP for tradables be explained as the result of a more complex form of expectations formation of agents in the FOREX market than assumed in rational expectations models (Schulmeister, 1983 and 1988; Goldberg-Frydman, 1996; Frydman-Goldberg, 2005). In this case not only the reversion of exchange rates towards PPP but also their deviations from PPP would be endogenous to the system of interacting goods and asset markets.

As a prerequisite for any investigation into these questions one has to estimate the level of PPP for tradables which represents the goods market equilibrium for the nominal exchange rate (only for tradables is the law of one price supposed to hold, at least in the long run). Even though many studies have investigated the law of one price and, hence, absolute PPP for certain types of traded goods (Isard, 1977; Giovannini, 1988; Froot-Kim-Rogoff, 1995; Cumby, 1996; Engel, 1993, Roger-Jenkins; 1995) PPP at export prices has not yet been calculated for an overall basket of internationally traded goods and services, based on comprehensive and internationally comparable price data.[1]) It is the main objective of this study to develop a

[1]) A first attempt is Crownover-Pippenger-Steigerwald, 1996. They use PPP data from the German Statistical Office which are based on domestic market (not export) prices and which are aggregated using shares in expenditures of German consumers as weights. Another attempt is Schulmeister (2000B) who uses data from the International Comparison Project but does not account for differences between domestic and export prices, as well as for differences between the structure of expenditure on GDP and the structure of export earnings.

data set of the levels of PPP for internationally traded goods and services for a great number of countries.

In their recent survey Taylor-Taylor (2004, p. 149) summarize the challenge for future research on PPP as such. "Thus, questions about the real exchange rate are likely to shift – from not so much 'how fast is it reverting?' to 'how did it deviate in the first place?' and 'what is it reverting to?'". This study aims at providing a data base which might help to investigate these two questions.

Such a data base seems not only useful for theoretical but also for practical reasons. If, e. g., central banks conduct monetary policy not only with respect to reach or retain price stability but also with respect to the external value of the national currency, then they need to know whether current exchange rates are over- or undervalued relative to PPP for tradables. This issue is of particular importance for finding "fair" conversion rates for the new EU member states when entering the European Monetary Union (EMU). At present, only PPP data based on GDP and its demand components are available. Relative to this benchmark the currencies of the new members seem to be substantially undervalued vis-à-vis the Euro. This might, however, not be the case on the basis of tradables.

## 2. Method, data base, and structure of the study

The (absolute) PPP for tradables to be estimated should have the following properties and should be calculated accordingly:

- PPP for tradables is calculated according to the same method which Eurostat and OECD apply within their PPP Programme for the calculation of (absolute) PPP for GDP (e. g., according to the EKS method).[2]) This should ensure the methodological comparability between PPP for tradables at export market prices and PPP for GDP at domestic market prices (comprising all types of goods and services).
- The calculation of PPP for tradables processes, however, different data than the calculation of PPP for GDP. PPP for tradables is derived from the aggregation of relative export prices of internationally traded goods and services using their shares in export earnings as weights. By contrast, when calculating PPP for GDP domestic prices of all goods and services are used and their shares in expenditure on GDP are taken as weights for aggregation.

[2]) The Eurostat-OECD PPP Programme grew out of the ICP coordinated by the UN (see ICP Handbook, Annex I) and is still embedded in this worldwide project. However, the Eurostat-OECD PPP Programme is conducted by these two international organizations for their member countries independently of the ICP (even though there is a regular exchange of information between the UN and Eurostat/OECD concerning the respective comparison projects, particularly with respect to methodological issues.

- The calculation of PPP for tradables comprises the same countries and country groups as the calculation of PPP for GDP within the Eurostat-OECD PPP Programme. There is, however, one exception. For Luxembourg, PPPs for tradables could not be calculated since no separate export data are available for this country (exports of Luxembourg are included in exports of Belgium/Luxembourg). For country groups the standard abbreviations are used like EURO 12 for the Euro area, EU 15 for the "old" EU, EU 25 for the "new" EU, EU 10 for the new EU member countries, and OECD 24 and OECD 30 for two "standard groups" of OECD countries even though Luxembourg is not included (hence, the actual number of countries comprised by these groups is by one smaller than indicated by the abbreviation).
- PPP for tradables is calculated for the ICP benchmark years 2002, 1999, 1996, 1993, and 1990 of the Eurostat-OECD PPP Programme. In order to get longer time series of PPP for tradables and also in order to bridge the gap between benchmark years, PPPs for the most recent benchmark year 2002 are extrapolated into the past using deflators for exports from National Accounts (the use of the most recent benchmark year as base is also justified by the fact that the coverage and quality of data were most advanced due to several revisions undertaken by OECD and Eurostat).
- PPP for tradables is calculated for six categories of final consumer goods (food and beverages, clothing and footwear, furnishings and household equipment, health, transport equipment, recreation, culture and miscellaneous goods), for machinery and equipment as investment goods, for the total of goods, as well as for certain internationally traded services (travel and air transportation) and for the total of tradables (goods and services).

## 2.1 Methodological issues

Since in this study PPP for tradables is calculated according to the method applied by the Eurostat-OECD PPP Programme for the estimation of PPP for GDP, the basic features of this approach shall be summarized. A description can be found in Eurostat-OECD (2005), methodological issues are discussed in the Eurostat-OECD Manual on PPP Methodology (OECD, 2005) as well as in the Handbook of the International Comparison Programme (United Nations, 1992).

For each of the 42 countries covered by the 2002 round of the Eurostat-OECD PPP Programme prices of final consumer and investment goods were collected for each of 281 so-called basic headings. A basic heading (BH) consists of a group of similar well-defined goods or services like "eggs" or "glassware, tableware and household utensilities". The number of items comprised by a single basic heading varies, depending on the degree of homogeneity of the items (e. g., the BH "eggs" comprises much less items than the BH "glassware, tableware and household utensilities"). At the same time BHs are defined as the most detailed product category for which data on final expenditures are available (e. g., the

BH level is the most disaggregated level of expenditure). Hence, the relative price of a certain BH between each pair of countries (BH-PPP) is calculated as an unweighted (geometric) mean over the items which belong to the BH. For higher levels of aggregation (broader categories of investment goods and consumer goods and services up to GDP) PPP is calculated as a weighted mean according to the EKS procedure (see below).

To give a picture of the degree of variety in the collected price data: The 2002 round of the Eurostat-OECD PPP Programme covered 3000 consumer goods and services, 34 types of government, education and health services, around 180 types of equipment goods and 15 types of construction projects.

In order to achieve consistency with the components of National Accounts (which are to be spatially deflated using PPP), the prices collected by the countries participating in the Eurostat-OECD PPP Programme are annual market prices, e. g., purchasers' prices (hence, they include indirect taxes and different types of distribution costs like trade and transportation margins) .

Particular attention is given to two principles in the process of price data collection. First, comparability of the items across countries, and second, representativity of the items for the demand pattern in the single countries. Comparability requires that the collected prices refer to identical or, at least, equivalent products. Representativity requires that the price of a single good is close to the average price of similar goods within the same BH. Usually, purchases of representative products will account for a substantial part of expenditures for all products covered by the respective BH.

Once comparable and representative prices have been collected for the items of each BH, PPPs are calculated in two steps. First, unweighted PPPs are calculated for each BH, second, the BH-PPPs are aggregated up to the level of GDP. Since 1990, the Eurostat-OECD PPP Programme has applied the Elteto-Köves-Szulz or EKS method for both steps.[3])

Unweighted PPPs at the BH level are calculated in the following way:

- For each pair of countries, A and B, two types of PPPs are estimated. The first is the geometric mean of the relative prices representative for country A, the second is the respective mean representative for country B. The single BH-PPP is then calculated as the geometric mean of these two PPPs.
- Applying this procedure to all pairs of countries yields a matrix of binary PPPs. If a direct PPP cannot be calculated due to missing data, then the matrix is made complete by

[3]) Prior to 1990, the Geary-Khamis or GK method had been used. For reasons of comparison the results of PPP calculations based on the GK approach are also reported by OECD (see, e. g., Eurostat-OECD, 2005). It should also be noted that the famous Penn World Tables for international comparisons of price levels and GDP are based on PPP calculations which apply the GK method (Summers-Heston, 1991).

taking the geometric average of the available indirect PPPs.[4]) However, the resulting matrix is not transitive.

- The matrix is made transitive by the EKS procedure: For each pair of countries the direct PPP is replaced by the geometric mean of itself squared and all the indirect PPPs using the other countries as a "bridge". If $PP_{jl}$, ($PP_{kl}$) denotes the (intransitive) price parities between country j and l (k and l), and n the number of countries, then one gets the transitive $EKSPP_{jk}$ according to the following equation:

$$EKSPP_{jk} = [\prod_{l=1}^{n}(PP_{jl}/PP_{kl})]^{1/n} = [PP^2_{jk}\prod_{\substack{l=1\\l\neq j,k}}^{n}(PP_{jl}/PP_{kl}))]^{1/n} \quad (1)$$

The aggregation of BH-PPPs is conducted at each level up to GDP in the following way:

For each pair of countries (A, B) two types of PPPs are calculated as weighted averages. The first ("Laspeyres type") PPP is calculated using expenditure shares in country A as weights, the second ("Paasche type") PPP is calculated using expenditure shares in country B as weights. The geometric mean of both PPPs gives a single ("Fisher type") PPP between A and B.

This procedure results in a matrix of intransitive Fisher PPPs for each level of aggregation. This matrix is made transitive by means of the EKS procedure. Again, each Fisher PPP is replaced by the geometric mean of itself squared and all indirect Fisher PPPs. If $FPPP_{jl}$, $FPPP_{kl}$ denote the (intransitive) Fisher PPP between country j and l, and k and l, respectively, and n the number of countries, then one gets the transitive $EKSPPP_{jk}$ according to the following equation:

$$EKSPPP_{jk} = [\prod_{l=1}^{n}(FPPP_{jl}/FPPP_{kl})]^{1/n} = [FPPP^2_{jk}\prod_{\substack{l=1\\l\neq j,k}}^{n}(FPPP_{jl}/FPPP_{kl})]^{1/n} \quad (2)$$

The EKS procedure minimizes the differences between the intransitive Fisher PPPs and the resulting EKS PPP. Hence, this method provides PPPs for each pair of countries that are close to the PPPs that would be obtained if each pair of countries had been compared separately.

In concluding this section, it should be noted that recently new methods for the calculation of PPPs have been proposed which go beyond the EKS or GK procedure. Sergeev elaborates a new aggregation method based on structural international prices (SS method) which combines the advantages of the EKS and the GK procedure (Statistik Austria, 2001). Hill (2004), e. g., develops methods to construct and reconcile price indices across space and time. Neary (2004) shows that the EKS procedure has a less firm basis in economic theory as

[4]) If, e. g., the PPP between A and B = (A/B) is missing, then the indirect PPP (A/B) can be calculated as (A/C)/(B/C), where (A/C) and (B/C) represent the direct PPPs between A and C, and B and C, respectively.

usually assumed and proposes a modified Geary system (GAIA). However, a discussion of these complex index-theoretical issues is beyond the scope of this study. Here the main aim is the estimation of PPP for tradables in such a way that the results are methodologically comparable to PPP for GDP as calculated in the Eurostat-OECD PPP Programme. It is for this pragmatic reason that the EKS procedure was chosen for calculating of PPP for international traded goods and services.

## 2.2 The data

Two types of data are needed to calculate PPP for a comprehensive basket of tradables at export prices: First, prices for all types of exported goods and services in national currency free of board, e. g., at the border of the exporting country. Second, the corresponding export earnings of the same country in the same year in national currency.

Data on earnings from export of goods are available from the UN Trade Statistics at a highly disaggregated level (SITC 3) for most countries. Data on earnings from exports of services can be taken from the Balance of Payments Statistic of the IMF. However, these data are less disaggregated and probably less reliable than data on goods trade. By far the greatest problem concerns the estimation of export prices since there does not exist any data base which comprises directly surveyed export prices.

There remain two possibilities to approximate "true" export prices. First, one could use unit values from export statistics and, second, one could correct domestic prices at purchasers' value (taken from ICP data) for trade margins and indirect taxes to arrive at producers' prices which are taken as proxies for export prices.

The use of unit values as proxies for export prices is problematic because unit values are rather an indicator for (different) qualities of a certain type of good than for (different) prices. This is so for the following reason: Export unit values simply measure the value of exports per kilo or ton of a specified good (in some cases per unit of that good which biases unit values as price indicators even more). Due to international division of production shirts or suits exported by Italy, e g., will be qualitatively different from those exported by Bulgaria or China (even if they belong to the same well defined position at the most disaggregated level of trade statistics). This applies to all types of goods, in particular also to goods specified by the most detailed 5- to 8-digit position of trade statistics (one ton of middle-class cars exported by Germany is of higher quality and, hence, earn a higher unit value as compared to the same type of car exported, e. g., by Korea; the same is true for special machinery made in USA as compared to those produced in less advanced industrial countries).

Since high developed countries specialize on high quality of a given type of product, there prevails in many cases a positive relationship between GDP per head and the level of export unit values (figure 2 in the annex shows this relationship for different types of products specified at the most disaggregated SITC level). It seems therefore reasonable to interpret

unit values in the first place as indicators for different qualities and not for "true" prices. This interpretation is also confirmed by the extremely wide range of export unit values by countries of origin. For most important types of manufactured goods the highest unit value is several times greater than the lowest unit value (see figure 2 in the annex). The unit value of medicaments (SITC 54293) exported by the U.S. in 2002 was, e. g., 6.4 times higher than the respective unit value of exports by Mexico or Korea (58$ per kilo relative to 9$ per kilo). The export unit value of Japanese medicaments was again roughly three times higher than that of US exports (168$ per kilo). It is not reasonable to assume that these medicaments exported by different countries are of the same kind or quality. Hence, unit values of manufactures should be regarded as some kind of "mixture" between price and quality components whereby the quality component is the more important the more a type of product can be differentiated (the less homogenous products are in international trade), even if they are covered by the same SITC position at the most disaggregated level. [5])

Since it is the main objective of this study to construct absolute PPPs for tradables the comparability and reliability of the data on relative price levels for the various types of traded goods and services across countries is of greatest importance. The Eurostat-OECD PPP Programme and the statistical agencies in the participating countries give these two goals high priority in the process of data collection.[6])

For these reasons the present study follows the second approach. It extracts from the total of BH-PPPs used in the Eurostat-OECD PPP Programme those BH-PPPs which refer to internationally traded goods and services. These BH-PPPs at domestic purchasers' prices are then corrected for those components which are not included in export prices, e. g., indirect taxes and domestic trade and transportation margins (this is done by exploiting information contained in input-output tables). This procedure results in a set of BH-PPPs for a comprehensive basket of tradables at producers' prices which are taken as proxies for export prices.

These single BH-PPPs are then aggregated to PPPs for seven sub-groups of goods and services, as well as for the total of goods and tradables (goods and services). For aggregation the same method is used as in the Eurostat-OECD PPP Programme (EKS), however, instead of expenditures on GDP export earnings are used as weights to calculate Fisher-PPPs. Taking data on BH-PPPs from the Eurostat-OECD PPP Programme and using the same aggregation

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[5]) When discussing the economic plausibility of my estimations of PPP for tradables I come back to the matter of using (alternatively) unit values as indicators for export prices. I will compare the results of this study with those of other research which used unit values for the estimation of PPP for export and import. This concerns a recently published excellent study on the correct spatial deflators (= PPPs) for GDP as national output and as national expenditure (Feenstra-Heston-Timmer-Deng, 2004). This study empirically demonstrates the relevance of this distinction by calculating PPPs for exports and imports using unit values.

[6]) The greatest problems in achieving these goals concern price data for certain types of services, in particular rents and governments services. Since these services are not traded internationally the respective BH-PPPs are not used in this study.

method facilitates a comparison between PPP for GDP as calculated by the Eurostat-OECD PPP Programme and PPP for tradables as calculated by this study.

There are two shortcomings of the Eurostat-OECD data base when used for the estimation of aggregated PPP for tradables. First, BH-PPPs cover only (relative) prices of final goods since the Eurostat-OECD PPP Programme (as well as the ICP in general) calculates PPP for GDP by aggregating BH-PPPs of the components of final demand. Second, the prices used to calculate BH-PPPs refer not only to domestically produced goods but also to imported goods.

The first shortcoming implies that in particular two types of goods are excluded from the basket of tradables as defined in this study, commodities and basic manufactures like steel or organic and inorganic chemicals. Under the (plausible) assumption that the law of one price holds approximately for these standard products one gets a more accurate picture of country-specific price level differences when using PPP for tradables as defined in this study rather than PPP for all products. In addition, the exclusion of commodities from the basket of tradables improves the comparability of PPP for tradables across countries (e. g., between oil exporting countries like the U. K. or Norway and other industrial countries).

Most refined manufactures which represent finished components of final goods are included in the basket of tradables. It is assumed that BH-PPPs for final goods hold also for final inputs of the respective goods. To give a concrete example, it is assumed that BH-PPPs for motor cars apply also for gear boxes or car engines. This assumption is certainly questionable, however, the advantage of greater representativity of the basket of tradables seems to outweigh the disadvantage of potential biases due to this assumption.

The second shortcoming of the Eurostat-OECD data base when used for the estimation of aggregated PPP for tradables is particularly serious, namely, that BH-PPPs refer not only to domestically produced goods but also to imported goods. The extent to which this fact biases domestic market prices (corrected for indirect taxes and distribution margins) as indicators for export prices depends on several factors. First, it depends on the share of imported tradables in overall domestic expenditure on tradables. This share tends to be the smaller the bigger an economy is, it is, however, substantial even in large economies. In the case of the U.S. and the Euro area, e. g., this share amounts to roughly 25%. Second, this potential bias depends on the relative importance of producer currency pricing versus local currency pricing ("pricing to market"). The more the latter prevails, the less biased are domestic prices by import prices. Third, this bias depends, of course, also on the extent of the difference between the "true" producer prices and import prices. If the price level of domestically produced goods and imported goods (in common currency) differ little from each other then the bias is neglectable (note that the domestic price level of tradables represents a weighted average of the price level of domestically produced goods and imported goods). However, if the price level of domestically produced goods and imported goods differs strongly then PPPs calculated from overall domestic prices will systematically underestimate the true differences in the price levels of tradables at export prices.

Since the potential bias of using the BH-PPPs of the Eurostat-OECD PPP Programme valued at producers' prices as proxy for export prices depends on several concrete factors it will be evaluated in section 6 against the background of the estimation results.

The study comprises all countries which participated in the various rounds of the Eurostat-OECD PPP Programme since 1990 (besides Luxembourg). When looking at cross country relationships like relative price levels the study focuses on the year 2002 (in this year the PPP data base of Eurostat/OECD covers 41 countries without Luxembourg – see table 1 in the Annex). This is so for two reasons. First, 2002 represents the most recent benchmark year in the Eurostat-OECD PPP Programme and, second, the quality of the data seems to be better for this year due to several revisions undertaken within the Eurostat-OECD PPP Programme.

When looking at relationships over time like the development of deviations of the nominal exchange rate from PPP for tradables the study focuses on 24 OECD countries and the period since the benchmark year 1990 (only these countries are covered by every round of the Eurostat-OECD PPP Programme since 1990). Data for the benchmark years 1980 and 1985 are not included in this study for three reasons. First, only 17 (22) OECD countries are covered in 1980 (1985). Second, the gap between benchmark years was 5 years (only since 1990 prices are collected every three years). Third, trade data based on SITC 3 are available only since 1987.

## 2.3 Structure of the study

The study proceeds in several steps towards its main objective, the estimation of PPP for a comprehensive basket of internationally traded goods and services at export prices:

- Define the basket of internationally traded goods and services for which PPPs at the basic heading level are available from the Eurostat-OECD PPP Programme.
- Construct a "bridge" between the selected basic headings (COICOP classification) and the corresponding items in the statistic on international trade in goods (SITC classification) and in services (classification of the balance of payments statistic).
- Extract from these data bases the earnings from export of goods and services for each of the selected basic headings.
- Construct a bridge between the selected basic headings and the corresponding sectors of input-output-tables.
- Estimate the share of domestic trade margins and indirect taxes included in domestic prices at purchaser's value using data from input-output tables.
- Correct the BH-PPPs for these components to arrive at PPPs at producers' prices.

- Aggregate these BH-PPPs by means of the EKS procedure to PPPs for 7 groups of goods, one group of services as well as for the total of goods and the total of goods and services (tradables).
- Compare the fluctuations of the relative price levels of tradables (the respective real exchange rates) with the development of export market shares.

The remainder of the study is structured according to these steps. Section 3 discusses the Eurostat-OECD estimation of PPP for GDP and its (demand) components for the most recent benchmark year (2002). It is demonstrated that PPP for tradables at export prices will significantly and systematically deviate from the widely used PPP for all goods and services at domestic prices. Section 4 first documents the differences between the structure of expenditures on GDP (used to calculate PPP for GDP) and the structure of export earnings (used to calculate PPP for tradables). Then PPPs at the basic heading are corrected for trade margins and indirect taxes to arrive at estimates of BH-PPPs at producers' prices. A comparison between the estimated PPPs for tradables (for the benchmark years 1990, 1993, 1996, 1999 and 2002 as well as extrapolated PPPs since 1970) and nominal exchange rates concludes the section. Section 5 provides evidence about the relationship between the fluctuations of relative price levels of tradables (real exchange rates based on tradables) and the development of export market shares in international trade of goods and services since 1970. Thus it is evaluated whether PPPs for tradables as estimated in this study are appropriate benchmarks for "fair" exchange rate levels, e. g., nominal exchange rates at which the overall price competitiveness of countries is roughly the same. Section 6 discusses the shortcomings of the estimations of PPP for tradables at export prices. Section 7 concludes the study with a summary.

## 3. Purchasing power parities for GDP and its components

In this section the concept of absolute PPP shall be explained using the results of the Eurostat-OECD PPP Programme for 2002 as example.

Let $P_{i,k}$, $P_{R,k}$ denote the prices of a basket of goods of type k in country i and in the reference country R (both in national currencies), then absolute PPP for good k between country i and country R is defined as

$$PPP_{i/R,k} = P_{i,k}/P_{R,k} = RP_{i/R,k} \quad (3)$$

Hence, PPP is nothing else than the relative price between two countries of the same type of good or service ($RP_{i/R,k}$). To facilitate the calculation and presentation of PPPs, one country (or a group of countries) is used as the reference or base country (since the EKS procedure provides transitivity at each level of aggregation the results are base country invariant). In this study the U. S. is generally used as the reference country for calculating PPPs and for the presentation of the results.

In 2002, e. g., for one unit of GDP worth 1 $ in the US one had to pay 0.876 € in the Euro area as can be seen in table 1 (the Euro area is labelled EURO 12 in this study).

If one converts $P_{i,k}$ into the currency of the reference country one gets the relative price level for good k as

$$PL_{i/R,k} = PPP_{i/R,k}/ER_{i/R} = P_{i,k}*ER_{R/i}/P_{R,k} \quad (4)$$

where $ER_{i/R}$ is the price of the reference currency in terms of currency i.

The nominal exchange rate amounted to 1.063 € per $ in 2002. This can be seen from table 1 (line "Balance of exports and imports") since the Eurostat-OECD PPP Programme follows the ICP convention to use the nominal exchange rate as PPP for the balance of exports and imports.[7]) Hence, the relative GDP price level between EURO 12 and the U.S. was 0.824, (0.876/1.063) and the inverse is 1.213. In other words one unit GDP was in the Euro area by 17.6% cheaper than in the U.S., and in the U.S. by 21.3% more expensive than in the Euro area, respectively.

*Table 1: PPPs for final expenditure on GDP per US dollar 2002*
*USA = 1*

| | Austria | Germany | Portugal | EURO 12 | United Kingdom | EU 15 | Poland | Japan | Mexico | United States | OECD 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Actual individual consumption | 0.867 | 0.909 | 0.630 | 0.829 | 0.573 | 0.852 | 1.688 | 146.1 | 6.216 | 1.000 | 0.886 |
| Food and non-alcoholic beverages | 1.062 | 1.056 | 0.890 | 1.035 | 0.700 | 1.054 | 2.292 | 250.8 | 7.871 | 1.000 | 1.051 |
| Alcoholic beverages, tobacco and narcotics | 0.968 | 0.905 | 0.797 | 0.919 | 1.192 | 1.054 | 2.987 | 129.0 | 7.765 | 1.000 | 0.980 |
| Clothing and footwear | 1.239 | 1.220 | 0.926 | 1.167 | 0.616 | 1.130 | 3.469 | 181.9 | 9.744 | 1.000 | 1.056 |
| Housing, water, electricity, gas and other fuels | 0.708 | 0.902 | 0.311 | 0.787 | 0.413 | 0.768 | 1.090 | 175.3 | 8.819 | 1.000 | 0.853 |
| Household furnishings, equipment and | 1.038 | 0.969 | 0.748 | 0.954 | 0.736 | 0.993 | 2.553 | 149.5 | 6.622 | 1.000 | 0.950 |
| Health | 0.484 | 0.535 | 0.327 | 0.455 | 0.303 | 0.462 | 0.710 | 69.9 | 2.604 | 1.000 | 0.627 |
| Transport | 1.533 | 1.521 | 1.363 | 1.400 | 1.079 | 1.470 | 3.939 | 185.5 | 9.466 | 1.000 | 1.155 |
| Communication | 1.066 | 1.008 | 1.214 | 1.098 | 0.785 | 1.107 | 5.422 | 154.1 | 13.582 | 1.000 | 1.011 |
| Recreation and culture | 1.224 | 1.189 | 0.988 | 1.152 | 0.795 | 1.190 | 2.971 | 150.5 | 9.143 | 1.000 | 1.057 |
| Education | 0.457 | 0.557 | 0.373 | 0.400 | 0.313 | 0.419 | 0.486 | 79.5 | 2.228 | 1.000 | 0.532 |
| Restaurants and hotels | 1.094 | 0.966 | 0.836 | 1.004 | 0.833 | 1.076 | 2.815 | 200.7 | 8.076 | 1.000 | 1.036 |
| Miscellaneous goods and services | 1.014 | 0.989 | 0.731 | 0.897 | 0.618 | 0.931 | 1.809 | 149.9 | 6.955 | 1.000 | 0.933 |
| Actual collective consumption | 0.968 | 1.100 | 0.655 | 0.935 | 0.622 | 0.952 | 1.367 | 131.1 | 4.559 | 1.000 | 0.883 |
| Gross fixed capital formation | 1.109 | 1.154 | 0.822 | 1.062 | 0.799 | 1.098 | 2.837 | 151.3 | 9.568 | 1.000 | 1.015 |
| Construction | 1.013 | 1.092 | 0.575 | 0.952 | 0.791 | 0.997 | 1.813 | 149.0 | 8.935 | 1.000 | 0.957 |
| Machinery and equipment | 1.265 | 1.286 | 1.343 | 1.250 | 0.829 | 1.262 | 4.573 | 153.5 | 10.829 | 1.000 | 1.099 |
| Balance of exports and imports | 1.063 | 1.063 | 1.063 | 1.063 | 0.668 | 1.063 | 4.099 | 125.4 | 9.656 | 1.000 | 1.000 |
| Gross domestic product | 0.912 | 0.959 | 0.658 | 0.876 | 0.610 | 0.899 | 1.825 | 143.7 | 6.585 | 1.000 | 0.906 |

Source: OECD (2004).

[7]) As a consequence, PPP for GDP as calculated within the ICP framework (Eurostat-OECD PPP Programme as well as the Penn World tables) does not represent a correct spatial deflator for output GDP but only for expenditure GDP. However, most researchers use GDP data deflated by these PPPs as indicators for output at constant international prices (see, e. g., Sala-i-Martin, 1997). In a recent paper Feenstra-Heston-Timmer-Deng, 2004, (correctly) criticize this practice and propose a method to calculate correct PPPs for output GDP.

To put it differently: Relative to PPP for GDP the dollar was overvalued by 21.3% vis-à-vis the Euro or the (absolute) GDP real exchange rate of the dollar vis-à-vis the Euro amounted to 1.213. This is so because the real exchange rate based on good k ($RER_{i/R,k}$) is just the inverse of the price level:

$$RER_{i/R,k} = ER_{i/R}/PPP_{i/R,k} = 1/\ PL_{i/R,k} \quad (5)$$

If the nominal exchange rate is equal to PPP then the absolute real exchange rate is 1 and the price level in the two countries is the same when expressed in a common currency. However, PPP for GDP can not be considered a benchmark for the equilibrium exchange rate since the law of one price is assumed to hold only for tradables. Not only does the larger part of final expenditure on GDP consist of services which are mostly not traded internationally like health, education and housing services but these nontradables exhibit also relative prices which differ significantly from PPP for GDP and, hence, from the relative prices of tradables.

Since PPPs are by definition relative prices between two countries the term "relative prices" is reserved in this study for denoting the price ratio between good k (or a group of goods k) and an overall basket of goods (denoted by T), be it the basket of all goods and services (GDP) or the basket of tradables in comparison to the same price ratio in the reference country:

$$RP_{i/R,k/T} = PPP_{i/R,k}/PPP_{i/R,T} = (P_{i,k}/P_{R,k})/(P_{i,T}/P_{R,T}) = (P_{i,k}/P_{i,T})/(P_{R,k}/P_{R,T}) \quad (6)$$

Some concrete examples might clarify the meaning of $RP_{i/R,k/T}$. In 2002, machinery and equipment was - relative to GDP - much more expensive in the Euro area than in the U. S., namely by 42.7% (1.250/0.876). By contrast, goods and services for health and education were comparatively much cheaper in the Euro area than in the U. S., namely by 48.1% and by 54.3%, respectively (table 1). These differences in relative prices are even more pronounced in countries which are economically less advanced than the Euro area like Portugal, Poland or Mexico.[8])

There might be two reasons for these significant differences in the structure or relative prices. First, services tend to become relatively more expensive the more advanced an economy is as explained by Balassa (1964) and Samuelson (1964), as well as (though differently) by Kravis-Lipsey (1983) and Bhagwati (1984). Since GDP per head at PPPs in the U.S. was 37.4% higher than in the Euro area (Eurostat-OECD, 2005, table 1.8), and since the major part of goods and services for health and education consists of services which are only to an insignificant extent traded internationally, the comparatively higher prices of health and education in the U.S. are in line with the above models. Second, the PPPs for actual individual consumption in

[8]) Due to the great number of countries covered in this study the tables refer only to a sample of 10 countries/country groups plus the U. S. as the reference country. The main results of this study, e. g., PPPs for tradables by types of goods and services are reported for all countries in the annex.

table 1 refer not only to consumption expenditures by households but also to the so-called "individual consumption expenditures by governments", e. g., government expenditures on services which households consume individually (in European welfare states these are particularly important in the field of health and education).

To get a clearer picture about the differences in the price structure between differently advanced economies table 2 reports PPPs for goods and services in 2002. The data represent the aggregated PPPs for total goods (differentiated into capital goods and consumer goods, the latter being further differentiated into non durable, semi durable and durable goods) as well as for services (differentiated into consumer services and government services). They stem from the 2002 round of the Eurostat-OECD PPP Programme (Eurostat-OECD, 2005, table 1.2). PPPs for consumer services do not include "individual consumption expenditures by governments" (they are covered by "government services") and, hence, they are not biased by differences in the social security system across countries.

*Table 2: PPPs by type of product per US dollar 2002*
*USA = 1*

| | Austria | Germany | Portugal | EURO 12 | United Kingdom | EU 15 | Poland | Japan | Mexico | United States | OECD 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total goods | 1.156 | 1.161 | 0.925 | 1.105 | 0.791 | 1.138 | 2.975 | 170.0 | 9.194 | 1.000 | 1.048 |
| Consumer goods | 1.185 | 1.163 | 1.007 | 1.131 | 0.787 | 1.161 | 3.078 | 182.8 | 8.989 | 1.000 | 1.062 |
| Non durable goods | 1.230 | 1.235 | 1.053 | 1.191 | 0.873 | 1.233 | 3.035 | 217.0 | 9.061 | 1.000 | 1.106 |
| Semi durable goods | 1.189 | 1.140 | 0.889 | 1.085 | 0.651 | 1.078 | 3.333 | 160.8 | 8.983 | 1.000 | 1.019 |
| Durable goods | 1.061 | 1.005 | 1.020 | 1.011 | 0.722 | 1.045 | 3.405 | 120.3 | 9.452 | 1.000 | 0.982 |
| Capital goods | 1.109 | 1.154 | 0.822 | 1.062 | 0.799 | 1.098 | 2.837 | 151.3 | 9.568 | 1.000 | 1.015 |
| Total services | 0.752 | 0.831 | 0.496 | 0.720 | 0.493 | 0.739 | 1.143 | 128.3 | 4.938 | 1.000 | 0.806 |
| Consumer services | 0.773 | 0.825 | 0.477 | 0.745 | 0.507 | 0.763 | 1.380 | 147.8 | 6.099 | 1.000 | 0.860 |
| Government services | 0.733 | 0.843 | 0.522 | 0.691 | 0.477 | 0.710 | 0.930 | 106.7 | 3.470 | 1.000 | 0.727 |
| Gross domestic product | 0.912 | 0.959 | 0.658 | 0.876 | 0.610 | 0.899 | 1.825 | 143.7 | 6.585 | 1.000 | 0.906 |

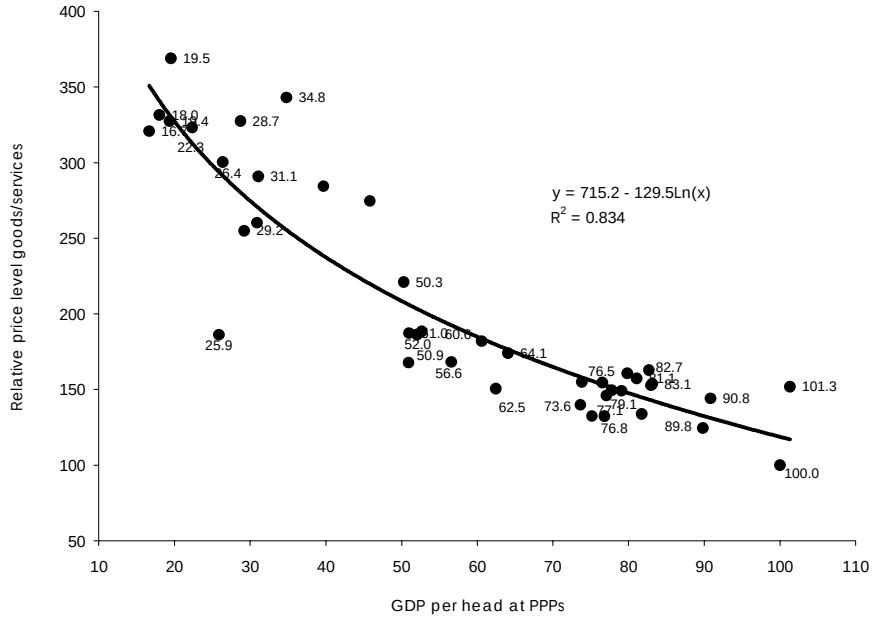
Source: OECD (2004).

However, the differences in relative prices of (consumer) services and goods remain remarkably big. In the Euro area, e. g., consumer services relative to GDP were 2002 15,0% cheaper than in the U. S. In less advanced economies like in Portugal or in Poland consumer services were comparatively even cheaper. By contrast, in all countries covered in table 2 goods were comparatively more expensive than in the U. S. (this observation holds for all types of goods). In the Euro area, e. g., total goods were – relative to GDP - 26.1% more expensive than in the U. S. (consumer goods: +29.1%, capital goods: +21.2%). Table 2 suggests that prices of goods are comparatively higher the less advanced an economy is. In Portugal, Mexico and Poland goods relative to GDP are 40.5%, 39.6% and 63.0% more expensive than in the U. S., in Germany and Japan, however, only 21.1% and 18.4%, respectively.

These observations clearly demonstrate that PPP for GDP does not even approximately represent a benchmark for the equilibrium exchange rate according to the international

goods market. At an exchange rate of 1.063 euro per dollar the price level in the Euro area was 2002 17.6% lower than in the U. S. (0.876/1.063), and, hence, the euro was undervalued by 17.6% relative to PPP for GDP. Relative to PPP for goods, however, the euro was even overvalued by 4.0% (1.105/1.063) since goods relative to GDP were more expensive in the Euro area as compared to the U. S. If one assumes for simplicity that only goods are traded internationally then one could conclude from the results of the Eurostat-OECD PPP Programme that the euro was slightly overvalued vis-à-vis the dollar when PPP for tradables is used as benchmark.

*Figure 1: Price level of goods relative to services 2002*
*USA = 100*




*Notes: This figure shows the inverse relationship between real GDP per head and the price level of goods relative to services for 41 countries in 2002. In countries where GDP per head amounts to less than 20% of GDP per head in the US the relative price level goods/services is by more than 200% higher than in the US (the numbers in the diagram refer to the X-axis)*

Source: OECD (2004).

There are, however, at least two reasons why such a conclusion is not warranted. First, the prices used by the Eurostat-OECD PPP Programme are domestic market prices, e. g., they include domestic trade and transportation margins as well as indirect taxes (both price components are to a large extent not included in export prices). Second, PPPs for goods have been aggregated from BH-PPPs using expenditure shares as weights (and not export earnings). However, the differences between PPPs for goods and for services at domestic market prices are so big that it seems most probable that the "true" PPP for tradables will

significantly differ from PPP for GDP, in particular in the case of countries with very different levels of GDP per head.

Figure 1 depicts the pronounced inverse relationship between the price level of goods relative to services on the one hand and GDP per head on the other hand for the total of 42 countries in 2002 (Eurostat-OECD, 2005, tables 1.2 and 1.8). The price ratio goods/services was in every country higher than in the U. S., in those countries where GDP per head amounts to less than 20% of US GDP the relative price level goods/services was more than 200% higher than in the U. S. The observed inverse relationship between the price ratio goods/services and GDP per head is in line with both models, the Balassa-Samuelson model (Balassa, 1964, and Samuelson, 1964) as well as with the model developed by Kravis-Lipsey (1983) and Bhagwati (1984). This does, however, not necessarily imply that the crucial assumption of both models, namely, that PPP holds for traded goods and services, is actually fulfilled. This has still to be empirically evaluated.

*Table 3: Structure of final expenditure on GDP by type of product 2002*
*Shares in GDP in %*

| | Austria | Germany | Portugal | EURO 12 | United Kingdom | EU 15 | Poland | Japan | Mexico | United States | OECD 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Nominal values | | | | | |
| Total goods | 49.1 | 49.7 | 54.0 | 49.7 | 46.1 | 48.9 | 58.3 | 48.4 | 52.3 | 43.9 | 47.2 |
| Consumer goods | 27.8 | 30.3 | 31.4 | 29.2 | 29.9 | 29.2 | 40.0 | 23.9 | 33.2 | 26.6 | 27.5 |
| Non durable goods | 14.9 | 17.3 | 18.7 | 16.9 | 14.8 | 16.4 | 31.7 | 15.4 | 24.4 | 14.2 | 15.8 |
| Semi durable goods | 6.9 | 6.0 | 6.5 | 6.4 | 7.7 | 6.6 | 4.6 | 4.0 | 5.4 | 5.7 | 5.7 |
| Durable goods | 6.0 | 7.0 | 6.1 | 5.9 | 7.5 | 6.2 | 3.7 | 4.5 | 3.4 | 6.7 | 6.0 |
| Capital goods | 21.4 | 19.5 | 22.7 | 20.5 | 16.2 | 19.7 | 18.4 | 24.5 | 19.1 | 17.2 | 19.7 |
| Total services | 50.9 | 50.3 | 46.0 | 50.3 | 53.9 | 51.1 | 41.7 | 51.6 | 47.7 | 56.1 | 52.8 |
| Consumer services | 30.5 | 28.0 | 25.3 | 28.3 | 31.8 | 28.8 | 23.2 | 32.4 | 35.1 | 41.4 | 34.6 |
| Government services | 18.4 | 20.1 | 19.2 | 20.8 | 19.7 | 21.0 | 17.5 | 17.9 | 12.0 | 14.7 | 17.4 |
| Gross domestic product 1) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| | | | | | | At US prices | | | | | |
| Total goods | 38.8 | 41.1 | 38.5 | 39.4 | 35.5 | 38.6 | 35.8 | 40.9 | 37.5 | 43.9 | 40.8 |
| Consumer goods | 21.4 | 25.0 | 20.5 | 22.6 | 23.2 | 22.6 | 23.7 | 18.8 | 24.3 | 26.6 | 23.4 |
| Non durable goods | 11.0 | 13.4 | 11.7 | 12.4 | 10.3 | 12.0 | 19.1 | 10.2 | 17.7 | 14.2 | 12.9 |
| Semi durable goods | 5.3 | 5.0 | 4.9 | 5.2 | 7.2 | 5.5 | 2.5 | 3.6 | 4.0 | 5.7 | 5.0 |
| Durable goods | 5.2 | 6.6 | 4.0 | 5.1 | 6.3 | 5.3 | 2.0 | 5.3 | 2.3 | 6.7 | 5.5 |
| Capital goods | 17.6 | 16.2 | 18.2 | 16.9 | 12.3 | 16.1 | 11.8 | 23.3 | 13.2 | 17.2 | 17.6 |
| Total services | 61.7 | 58.0 | 60.9 | 61.1 | 66.8 | 62.2 | 66.5 | 57.7 | 63.6 | 56.1 | 59.4 |
| Consumer services | 36.0 | 32.5 | 34.9 | 33.3 | 38.2 | 33.9 | 30.7 | 31.5 | 37.9 | 41.4 | 36.4 |
| Government services | 22.9 | 22.9 | 24.2 | 26.3 | 25.2 | 26.5 | 34.3 | 24.1 | 22.8 | 14.7 | 21.7 |
| Gross domestic product 1) | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

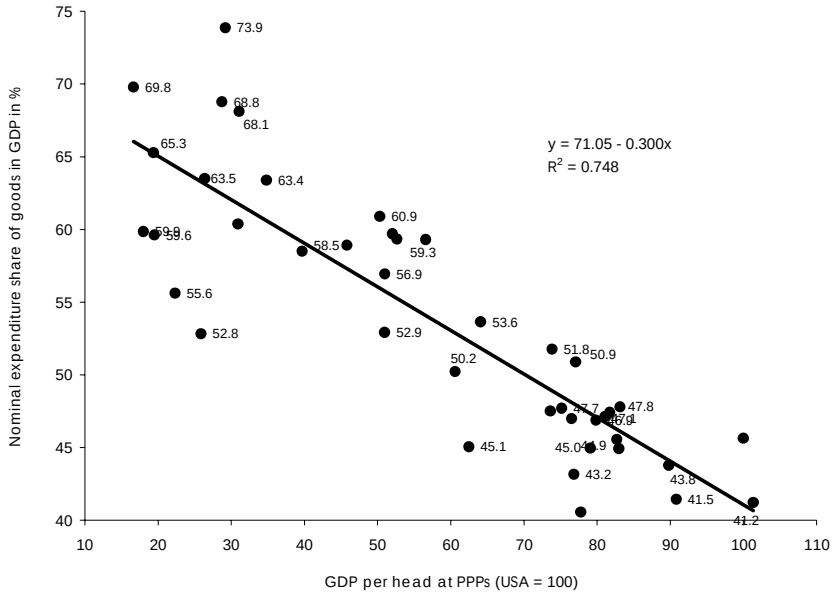
[1]) Without net foreign balance and change in inventories.

Source: OECD (2004).

Table 3 shows the shares of goods and services in GDP for the sample of 11 countries in 2002 (the nominal values are taken from Eurostat-OECD, 2005, table 1.1, the values at U. S. prices are calculated using PPPs from table 1.2). When based on nominal values the share of goods

(services) in overall demand is highest (lowest) in the U. S., in the United Kingdom and in Japan, and it is lowest (highest) in Poland, Portugal and Mexico. This observation seems to confirm a long-term trend towards a "service society", initially asserted by Fisher (1939), Clark (1957) and Fourastie (1949) since the share of services in GDP is much larger in the more advanced economies as compared to economically less advanced countries. At a first glance, the pronounced inverse relationship between GDP per head and the share of goods in (nominal) GDP as depicted in figure 2 for the cross section of all 42 countries covered by the 2002 round of the Eurostat-OECD PPP Programme seems to support the asserted high income elasticity of the demand for services.

*Figure 2: Nominal expenditure share of goods in GDP 2002*



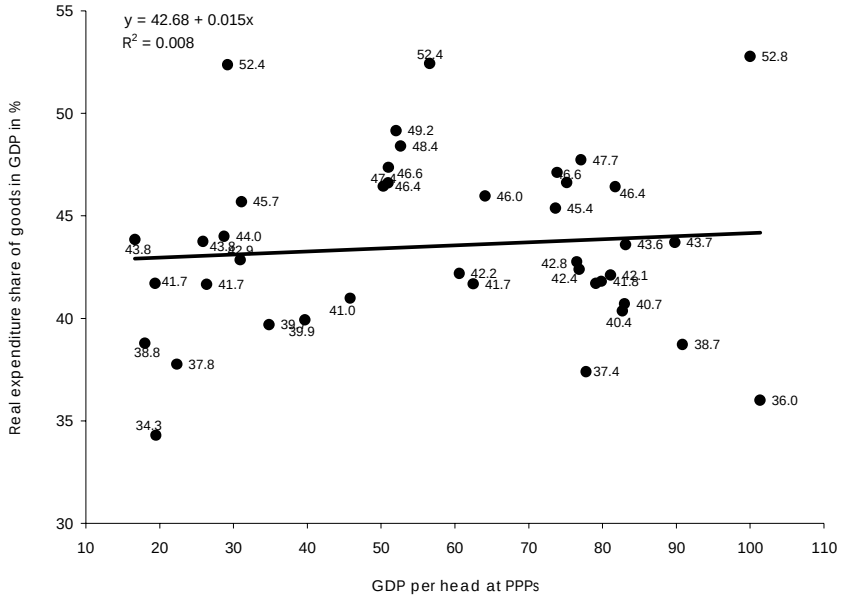

*Notes: This figure shows that the share of nominal expenditures for goods in GDP declines with the level of real GDP per head in a cross section of 41 countries in 2002 (the number in the diagram refer to the Y-axis).*

*Source: OECD (2004).*

However, when the shares of goods and services are calculated at constant international prices, (U. S. = 1), a very different picture emerges. The real share of goods (services) in total demand is highest (lowest) in the more advanced economies like the U. S., Japan or Germany and it is lowest in countries like Poland, Mexico or Portugal (table 2 - only the United Kingdom does not fit into this picture). For the total of 42 countries figure 3 shows that the inverse relationship between GDP per head and the share of goods in total demand (based on nominal values – figure 3) disappears when demand is calculated at constant prices. These observations suggest that the trend towards a service economy is primarily due to shifts in relative prices between goods and services. As a consequence of slower productivity growth in the service sector (as a whole) services become more expensive relative to goods

in the long run (the models of Balassa, 1964, and Samuelson, 1964, as well as the models of Kravis-Lipsey, 1983, and Bhagwati, 1984, are based on this assumption). If the price elasticity of demand for services is relatively low and the income elasticity is smaller than one (as confirmed by Fuchs, 1968, Gershuny-Miles, 1983, and more recently by Falvey-Gemmel, 1996) then the share of services in GDP will increase in the long run at current prices but not at constant prices. The results of the 2002 round of the Eurostat-OECD PPP Programme on expenditure and PPPs for goods and services and (as depicted in figure 2 and 3) are in line with this explanation.

*Figure 3: Real expenditure share of goods in GDP 2002*




*Notes: This figure shows that no clear relationship prevails between the share of real expenditures for goods in GDP and real GDP per head (cross section of 41 countries in 2002).*

*Source: OECD (2004).*

However, these results do not imply that the law of one price holds for international traded goods and services as hypothesized by the models of Balassa (1964) and Samuelson (1964) as well as by the models of Kravis-Lipsey (1983) and Bhagwati (1984). This hypothesis can only be evaluated if one calculates absolute PPP for a comprehensive basket of tradables.

## 4. Purchasing power parities for tradables at export prices

This section consists of two parts. In the first part, PPPs for tradables are estimated using the BH-PPPs of internationally traded goods and services as collected by the Eurostat-OECD PPP Programme for 1990, 1993, 1996, 1999 and 2002. In the second part, long-term series of PPP for

traded goods and for tradables (goods and services) are derived through extrapolation, i. e., the respective PPPs for 2002 are taken as base and indexed with the appropriate export deflators from National Accounts.

## 4.1 Estimation of PPPs for tradables for the benchmark years between 1990 and 2002

In this section I will first describe which types of goods and services are included in the basket of tradables. In the subsequent two sections I shall discuss how PPPs at the basic heading level are corrected for domestic trade and transportation margins as well as for indirect taxes, e. g., how the single PPPs at purchasers' value are transformed into PPPs at producer prices. Finally I present the estimation of the aggregated PPPs for the basket of goods, of goods and services (tradables) as well as for seven subgroups of goods and one subgroup of services (travel and transportation).

### 4.1.1 Structure of tradables by types of goods and services

Table 4 shows that the most recent round of the Eurostat-OECD PPP Programme covered 282 basic headings out of which 136 headings were classified as internationally tradable (table 2 in the annex provides a detailed picture of all single items classified as tradable).

*Table 4: Number of basic headings covered by PPP surveys of Eurostat and OECD 2002*

| | All products | Classified as tradables in this study |
|---|---|---|
| Actual individual consumption | 190 | 117 |
| Food and non-alcoholic beverages | 43 | 43 |
| Alcoholic beverages, tobacco and narcotics | 7 | 4 |
| Clothing and footwear | 11 | 9 |
| Housing, water, electricity, gas and other fuels | 18 | - |
| Household furnishings, equipment and maintenance | 25 | 20 |
| Health | 19 | 4 |
| Transport | 22 | 13 |
| Communication | 2 | - |
| Recreation and culture | 23 | 16 |
| Education | 5 | - |
| Restaurants and hotels | 7 | 3 |
| Miscellaneous goods and services | 8 | 5 |
| Actual collective consumption | 55 | - |
| Gross fixed capital formation | 34 | 19 |
| Construction | 14 | - |
| Machinery and equipment | 20 | 19 |
| Changes in inventories | 2 | - |
| Balance of exports and imports | 1 | - |
| Gross domestic product | 282 | 136 |

*Source: OECD (2004), WIFO.*

Since basic headings of goods always comprise final goods in the ICP, all goods items (except those belonging to construction) were classified as tradables. There are, however, two exceptions to this rule. First, tobacco products are excluded from the basket of tradables for which PPPs are calculated because it was not possible to transform PPPs of tobacco products valued at purchasers' prices into PPPs valued at producer prices (the main reason for that lies in the tax rates on tobacco products which are high on average and differ strongly across countries). Second, for similar reasons trade and transportation margins as well as indirect taxes could not reliably be estimated for the basic headings of the subgroup "Housing, water, electricity, gas, and other fuels" (a subgroup of individual consumption by households).

As regards services only travel services and passenger air transport are included in the basket of tradables. There are three reasons for this restriction. First, the Eurostat-OECD PPP Programme (as well as the ICP in general) does not provide BH-PPPs for intermediate services, e. g., services which are used as input for production like business services. Second, it was not possible to find reliable data on export earnings for certain services which are in part traded internationally like financial services. Third, it is questionable to assume for these services that the BH-PPPs derived from domestic market prices apply also to the export of services. In the case of travel services this assumption is much less problematic (a foreign tourist will pay for a certain hotel accommodation or a certain meal in a restaurant the same price as a domestic consumer).

The classification of basic headings used by the Eurostat-OECD PPP Programme is not exactly the same in the benchmark years between 1990 and 2002. In order to facilitate the calculation the classification used for 2002 is taken as the reference classification. The PPP data for the other benchmark years are adapted to the reference classification in the following way. If a certain product group is comprised by two or more basic headings in 2002 but just by one basic heading in another benchmark year then the respective PPP is used for each of the more disaggregated BHs in the reference classification (the PPP for "beef and veal" is used for the single BHs "beef" and "veal"). In the opposite case, e. g., if the classification in a certain benchmark year is more disaggregated than the reference classification, then the unweighted average over the more detailed BHs is used. If a certain BH contained in the reference classification is missing then the PPP of the most similar BH is taken as substitute.

The earnings from export of goods are taken from the UN COMTRADE data base. To each basic heading of internationally traded goods (mostly COICOP-positions; COICOP= Classification of Individual Consumption according to Purpose) the corresponding SITC-positions are assigned using the CPC classification as a bridge (CPC = Central Product Classification). The complete set of linkages between the COICOP codes of basic headings and the corresponding SITC codes in international trade are documented in table 2 of the annex.

The export earnings from passenger air transport were taken from the respective position in the Balance of Payments statistic of the IMF. The earnings from export of those travel services for which BH-PPPs are available in the Eurostat-OECD data base are estimated in two steps. First, the overall earnings from international travel are taken from the Balance of Payments statistic. Second, the relative share of those types of travel expenditures for which BH-PPPs are available were estimated, using so-called "tourism satellite accounts" which document the expenditure structure in international tourism. This concerns the following basic headings in the Eurostat-OECD PPP data base and the corresponding types of expenditures in "tourism satellite accounts":

- Local passenger transport by railway
- Local passenger transport by bus
- Local passenger transport by taxi
- Restaurant services
- Pubs, bars, cafes, tea rooms and the like
- Hotels, boarding houses and the like

Data on the relative shares of these types of expenditures in overall tourism expenditure were available for Austria, Finland, Sweden, United Kingdom, Norway, Canada, USA and New Zealand.[9]) The six expenditure types for which BH-PPPs are available from the Eurostat-OECD PPP data comprised 1999 48.2% of overall travel expenditures of the above mentioned eight countries (restaurant services and hotel accommodation account for the largest part of these expenditures).[10]) The remaining expenditures cover a great variety of expenditure types which are either not specific to tourism demand like food, beverages, cigarettes, etc. or for which no BH-PPPs are available (e. g., expenditures for cable railway, etc.). For countries for which no data on the structure of tourism expenditures were available the average shares of the six categories in overall tourism expenditures of the eight reporting countries was used as proxy. This procedure is justified by the fact that the structure of tourism expenditure by the above mentioned six categories varies relatively little across the eight reporting countries.

Table 4 shows the break-down of all basic headings and those classified as tradables by the analytical categories used in the Eurostat-OECD PPP Programme. Some of these subgroups

[9]) The data are taken from Tourism Satellite Accounts of the following institutions: WIFO (Austria), Finnish Tourist Board, Swedish Tourist Authority, Department for Culture, Media and Sport (United Kingdom), Statistics Norway, Australian Bureau of Statistics, Tourism Satellite Account, Statistics New Zealand, Statistics Canada, Bureau of Economic Analysis (USA).

[10]) All estimates necessary to complete the data base for the calculation of PPPs for tradables at export prices like the structure of travel expenditures or the share of indirect taxes and distribution margins in domestic expenditures for goods refer to the year 1999 (or a neighboring year). This is so for two reasons. First, some data bases like input-output tables are only available for the late 1990s and, second, when I began with this study the most recent benchmark year of the Eurostat-OECD PPP Programme was 1999.

consist (almost) exclusively of goods and, hence, of tradables like food and beverages, clothing and footwear, household furnishings or machinery and equipment, others are dominated by services which are not traded internationally like health or education. [11])

*Table 5: Expenditure structure of GDP and export earnings structure of tradables 2002*

| | AUSTRIA | | | Germany | | | Portugal | | |
|---|---|---|---|---|---|---|---|---|---|
| | All products | Tradables | | All products | Tradables | | All products | Tradables | |
| | Expenditure on GDP | Expenditure on GDP | Export earnings | Expenditure on GDP | Expenditure on GDP | Export earnings | Expenditure on GDP | Expenditure on GDP | Export earnings |
| Actual individual consumption | 67.1 | 28.9 | 59.5 | 70.2 | 30.9 | 50.2 | 74.0 | 35.5 | 78.6 |
| Food and non-alcoholic beverages | 6.1 | 5.9 | 6.6 | 6.8 | 6.7 | 4.9 | 11.6 | 11.5 | 5.8 |
| Alcoholic beverages, tobacco and narcotics | 1.7 | 0.6 | 0.2 | 2.2 | 1.1 | 0.4 | 2.5 | 1.0 | 2.7 |
| Clothing and footwear | 3.8 | 3.8 | 3.6 | 3.4 | 3.4 | 2.5 | 4.4 | 4.4 | 20.5 |
| Housing, water, electricity, gas and other fuels | 11.2 | - | - | 13.8 | - | - | 6.8 | - | - |
| Household furnishings, equipment and maintenance | 4.6 | 4.4 | 7.3 | 3.8 | 3.6 | 6.8 | 4.6 | 3.9 | 10.4 |
| Health | 6.7 | 1.6 | 6.1 | 8.6 | 3.2 | 4.7 | 8.7 | 1.8 | 1.9 |
| Transport | 7.4 | 2.7 | 11.8 | 8.0 | 3.9 | 21.7 | 10.6 | 4.1 | 19.0 |
| Communication | 1.4 | - | - | 1.6 | - | - | 2.3 | - | - |
| Recreation and culture | 6.7 | 2.9 | 8.3 | 5.6 | 2.8 | 5.1 | 5.1 | 2.0 | 4.7 |
| Education | 5.6 | - | - | 4.0 | - | - | 6.9 | - | - |
| Restaurants and hotels | 6.7 | 4.8 | 14.0 | 2.6 | 2.4 | 2.2 | 6.1 | 4.6 | 12.7 |
| Miscellaneous goods and services | 7.5 | 2.1 | 1.5 | 8.5 | 3.8 | 2.0 | 7.4 | 2.1 | 1.0 |
| Net purchases abroad | -2.3 | - | - | 0.0 | - | - | 0.0 | - | - |
| Actual collective consumption | 7.1 | - | - | 8.0 | - | - | 8.4 | - | - |
| Gross fixed capital formation | 20.8 | 7.6 | 40.5 | 18.6 | 6.5 | 49.8 | 25.0 | 7.1 | 21.4 |
| Construction | 11.5 | - | - | 10.2 | - | - | 13.4 | - | - |
| Machinery and equipment | 8.2 | 7.6 | 40.5 | 7.2 | 6.5 | 49.8 | 7.6 | 7.1 | 21.4 |
| Changes in inventories | 0.1 | - | - | -1.3 | - | - | 0.6 | - | - |
| Balance of exports and imports | 5.0 | - | - | 4.5 | - | - | -8.1 | - | - |
| Gross domestic product | 100.0 | 36.5 | - | 100.0 | 37.4 | - | 100.0 | 42.6 | - |
| Exports of tradables | - | - | 100.0 | - | - | 100.0 | - | - | 100.0 |
| Share of tradables in total exports of goods and services | - | - | 60.6 | - | - | 72.7 | - | - | 69.9 |
| Ratio between exports of final goods and exports of manufactures | - | - | 77.9 | - | - | 91.5 | - | - | 93.2 |

*Source: Wifo calculations using Eurostat, OECD.*

Table 5 reports the structure of expenditures on GDP of all products and of tradables as well as the structure of the respective export earnings, both broken down by types of products in the benchmark year 2002. If one looks at the share of domestic expenditures on tradables in total expenditures (GDP) it turns out that this share is highest in relatively less advanced economies like Mexico (42.7%), Portugal (42.6%) and Poland (42.2%), whereas it is

[11]) Principally, also health and education services are traded internationally, if, e. g., a person gets a medical treatment abroad or if she studies at a foreign university. However, that part of these services which is internationally traded is very small. Moreover, the respective export earnings can hardly be estimated. For a discussion of the (problematic) distinction between tradables and nontradables see Cihak-Holub (2001 and 2003).

comparatively lower in economies like Germany (37.4%), Austria (36.5%) or the Euro area as a whole (36.0%). In the U. S. domestic expenditures on tradables account for only 31.8% of GDP. These observations confirm the pattern already discussed, namely, that the share of services in an economy tends to be the higher the more advanced the economy is.

*Table 5 (continued): Expenditure structure of GDP and export earnings structure of tradables 2002*

| | EURO 12 | | | United Kingdom | | | Poland | | |
|---|---|---|---|---|---|---|---|---|---|
| | All products | Tradables | | All products | Tradables | | All products | Tradables | |
| | Expenditure on GDP | Expenditure on GDP | Export earnings | Expenditure on GDP | Expenditure on GDP | Export earnings | Expenditure on GDP | Expenditure on GDP | Export earnings |
| Actual individual consumption | 69.1 | 28.9 | 61.7 | 78.5 | 33.8 | 51.6 | 75.0 | 33.1 | 67.0 |
| Food and non-alcoholic beverages | 7.7 | 7.6 | 11.6 | 5.9 | 5.8 | 3.9 | 13.3 | 13.1 | 9.7 |
| Alcoholic beverages, tobacco and narcotics | 2.0 | 0.8 | 1.3 | 2.5 | 1.1 | 2.5 | 4.3 | 2.8 | 0.2 |
| Clothing and footwear | 3.7 | 3.6 | 4.9 | 3.8 | 3.8 | 2.3 | 3.0 | 2.9 | 8.0 |
| Housing, water, electricity, gas and other fuels | 12.3 | - | - | 11.4 | - | - | 16.1 | - | - |
| Household furnishings, equipment and maintenance | 3.9 | 3.4 | 7.5 | 3.8 | 3.6 | 4.2 | 3.0 | 2.7 | 20.2 |
| Health | 8.1 | 0.8 | 8.3 | 7.1 | 1.2 | 8.3 | 6.5 | 3.3 | 1.0 |
| Transport | 7.6 | 3.0 | 12.8 | 9.1 | 5.0 | 12.2 | 6.9 | 1.8 | 9.7 |
| Communication | 1.6 | - | - | 1.4 | - | - | 2.1 | - | - |
| Recreation and culture | 5.5 | 2.6 | 6.1 | 8.3 | 4.7 | 6.0 | 5.1 | 2.1 | 7.1 |
| Education | 4.7 | - | - | 4.4 | - | - | 5.7 | - | - |
| Restaurants and hotels | 5.0 | 4.1 | 5.9 | 7.3 | 6.4 | 5.4 | 2.0 | 1.7 | 7.4 |
| Miscellaneous goods and services | 7.7 | 3.0 | 3.4 | 12.5 | 2.3 | 6.8 | 7.2 | 2.6 | 3.8 |
| Net purchases abroad | 0.0 | - | - | 0.0 | - | - | 0.0 | - | - |
| Actual collective consumption | 8.3 | - | - | 7.8 | - | - | 9.5 | - | - |
| Gross fixed capital formation | 20.2 | 7.1 | 38.3 | 16.4 | 6.5 | 48.4 | 19.0 | 9.1 | 33.0 |
| Construction | 10.4 | - | - | 7.8 | - | - | 7.1 | - | - |
| Machinery and equipment | 7.6 | 7.1 | 38.3 | 6.9 | 6.5 | 48.4 | 10.0 | 9.1 | 33.0 |
| Changes in inventories | -0.3 | - | - | 0.2 | - | - | -0.1 | - | - |
| Balance of exports and imports | 2.6 | - | - | -3.0 | - | - | -3.3 | - | - |
| Gross domestic product | 100.0 | 36.0 | - | 100.0 | 40.3 | - | 100.0 | 42.2 | - |
| Exports of tradables | - | - | 100.0 | - | - | 100.0 | - | - | 100.0 |
| Share of tradables in total exports of goods and services | - | - | 83.1 | - | - | 54.2 | - | - | 69.1 |
| Ratio between exports of final goods and exports of manufactures | - | - | 93.0 | - | - | 84.5 | - | - | 114.0 |

*Source: Wifo calculations using Eurostat, OECD.*

This pattern is partly also reflected by the share of earnings from exports of tradables in overall export earnings. In countries like the U. S. or the United Kingdom this share amounts to only 44.2% and 54.2%, respectively (in these countries exports of financial and business services – these could not be included in the basket of tradables as used in this study - account for a comparatively larger share of export earnings). In all other countries tradables comprise a much bigger share of overall export earnings (table 5). In the Euro area as a whole, e. g., tradables comprise 83.1% of total earnings from export of goods and services.

In order to provide further evidence on the representativity of the basket of final goods extracted from the Eurostat-OECD data base table 5 displays the ratio between the earnings from exports of these goods to the earnings from export of manufactures (SITC 5-9). Note, that this ratio cannot be interpreted as share since the basket of final goods comprises also goods which belong to SITC 0-4 (primarily food and beverages – see table 2 of the annex). In 2002 the earnings from export of the basket of final goods as used in this study amounted to 70.6% in the case of the U. S. and to 93.0% in the case of the Euro area (in most sample countries comprised by table 5 this ratio was higher than 80%).

*Table 5 (continued): Expenditure structure of GDP and export earnings structure of tradables 2002*

| | Japan | | | Mexiko | | | USA | | |
|---|---|---|---|---|---|---|---|---|---|
| | All products | Tradables | | All products | Tradables | | All products | Tradables | |
| | Expenditure on GDP | Expenditure on GDP | Export earnings | Expenditure on GDP | Expenditure on GDP | Export earnings | Expenditure on GDP | Expenditure on GDP | Export earnings |
| Actual individual consumption | 67.0 | 28.6 | 46.3 | 76.4 | 35.6 | 51.3 | 77.1 | 26.5 | 44.5 |
| Food and non-alcoholic beverages | 8.2 | 8.0 | 0.7 | 16.7 | 16.5 | 4.9 | 5.0 | 4.9 | 7.3 |
| Alcoholic beverages, tobacco and narcotics | 1.6 | 0.8 | 0.0 | 1.8 | 1.4 | 1.4 | 1.6 | 0.7 | 0.3 |
| Clothing and footwear | 2.6 | 2.6 | 0.3 | 2.4 | 2.3 | 6.7 | 3.3 | 3.3 | 1.4 |
| Housing, water, electricity, gas and other fuels | 14.6 | - | - | 9.1 | - | - | 12.6 | - | - |
| Household furnishings, equipment and maintenance | 2.4 | 2.3 | 3.1 | 5.8 | 4.9 | 8.1 | 3.4 | 3.3 | 4.6 |
| Health | 8.2 | 2.8 | 1.7 | 5.4 | 1.2 | 1.2 | 13.8 | 2.2 | 4.6 |
| Transport | 5.9 | 3.1 | 27.8 | 11.7 | 3.0 | 12.4 | 8.1 | 3.9 | 9.2 |
| Communication | 1.5 | - | - | 1.1 | - | - | 1.3 | - | - |
| Recreation and culture | 5.3 | 2.1 | 11.1 | 2.3 | 1.5 | 11.7 | 6.6 | 3.2 | 5.7 |
| Education | 4.2 | - | - | 6.9 | - | - | 6.5 | - | - |
| Restaurants and hotels | 4.1 | 3.2 | 0.6 | 5.4 | 4.2 | 3.4 | 4.2 | 3.7 | 9.4 |
| Miscellaneous goods and services | 7.7 | 3.7 | 0.9 | 8.3 | 0.6 | 1.4 | 10.7 | 1.2 | 2.0 |
| Net purchases abroad | 0.0 | - | - | 0.0 | - | - | 0.0 | - | - |
| Actual collective consumption | 7.8 | - | - | 4.8 | - | - | 8.9 | - | - |
| Gross fixed capital formation | 24.2 | 7.4 | 53.7 | 19.3 | 7.1 | 48.7 | 17.9 | 5.3 | 55.5 |
| Construction | 13.5 | - | - | 10.4 | - | - | 9.5 | - | - |
| Machinery and equipment | 8.1 | 7.4 | 53.7 | 8.7 | 7.1 | 48.7 | 5.9 | 5.3 | 55.5 |
| Changes in inventories | -0.3 | - | - | 1.4 | - | - | 0.1 | - | - |
| Balance of exports and imports | 1.3 | - | - | -1.9 | - | - | -4.1 | - | - |
| Gross domestic product | 100.0 | 36.0 | - | 100.0 | 42.7 | - | 100.0 | 31.8 | - |
| Exports of tradables | - | - | 100.0 | - | - | 100.0 | - | - | 100.0 |
| Share of tradables in total exports of goods and services | - | - | 64.6 | - | - | 82.0 | - | - | 44.2 |
| Ratio between exports of final goods and exports of manufactures | - | - | 71.8 | - | - | 99.2 | - | - | 70.6 |

*Source: Wifo calculations using Eurostat, OECD.*

Since final goods not included in SITC 5-9 (mainly food and beverages) account for only a small share in overall exports these relatively high ratios are due to the fact that most

manufactures are final goods and, hence, are comprised by the basket of final goods extracted from the Eurostat-OECD data base. As a consequence, this basket can be considered representative also for manufactures as a whole even though intermediate goods are not comprised.

The structure of domestic expenditures on all products (GDP = 100) and the structure of earnings from export of tradables as defined in this study (export earnings = 100) by the analytical categories of the Eurostat-OECD PPP Programme differ considerably (table 5). This concerns in particular the categories "transport" and "machinery and equipment" since the respective products are to a large extent traded internationally (motor cars, passenger air transport, all kinds of investment goods). In the U. S., machinery and equipment accounted for only 5.9% of total expenditure on GDP in 2002, yet for 55.5% of total export earnings. In the Euro area the respective shares amounted to 7.6% and 38.3%, respectively. Also the share of goods and services for transport in overall exports is in most countries bigger than the respective share in GDP. In Germany, the category "transport" accounted for 8.0% of expenditure on GDP but for 21.7% of overall export earnings (due to the great importance of motor car exports by Germany).

In countries like Austria or Portugal where international tourism plays an important role the share of the category "restaurants and hotels" in export earnings is roughly twice as big as the share in expenditures on GDP (table 5).

These differences show that PPP for tradables will differ from PPP for GDP not only because of different valuations of prices (PPP for tradables must be calculated using producer prices at export markets whereas PPP for GDP is calculated using purchasers' prices at the domestic market) but also because the composition of a representative basket of tradables differ significantly from the composition of GDP.

### 4.1.2 Correction of PPPs at domestic prices for trade and transportation margins

In order to estimate PPPs at export prices from PPPs at domestic market prices the following procedure was applied. If $MARG_{i,k}$ and $INDT_{i,k}$ denote trade and transportation margins and indirect taxes as components of domestic expenditure on good (BH) k in country I ($DE_{i,k}$). Then PPP for good (BH) k between country I and the reference country R at export prices ($PPPXP_{i/R,k}$) can be derived from the respective PPP at domestic prices ($PPPDP_{i/R,k}$) according to the formula

$$PPPXP_{i/R,k} = PPPDP_{i/R,k}*(1 - MARG_{i,k}/DE_{i,k} - INDT_{i,k}/DE_{i,k})/ (1 - MARG_{R,k} / DE_{R,k} - INDT_{R,k}/DE_{R,k}) \quad (7)$$

Input-output tables provide the appropriate data base for estimating the relative content of trade and transportation margins as well as of indirect taxes in domestic market prices for

each basic heading.[12]) In a first step, each basic heading is assigned to that commodity-sector in I/O-tables for which the production of the respective good is characteristic (table 2 in the annex documents these linkages). Then the share of margin and indirect taxes in overall output of each sector for domestic uses at purchasers' prices is derived from I/O-tables. These shares have to be estimated differently for EU countries, for the U. S. and for Japan due to differences in the construction of the respective supply and use tables.

Eurostat provides a standardized set of I/O-tables for almost every EU country.[13]) Table 15 (supply table) displays the value of trade and transport margins contained in total supply of each commodity sector valued at purchasers' prices (column 65). If one subtracts the respective margins contained in exports of each sector (estimated as the difference between the value of exports at purchasers' prices taken from table 16 and the respective value at basic prices from table 17) one gets an estimate for domestic trade and transportation margins (taken as proxy for $MARG_{i,k}$). Total supply at purchasers' prices from table 15 minus exports at purchasers' prices from table 16 yields domestic supply at purchasers' prices (taken as proxy for $DE_{i,k}$).

For those EU Countries for which no I/O-tables were available it was assumed that the share of distribution costs in domestic supply of each sector/basic heading was the same as in neighboring countries with a similar economic structure. More specifically, it was assumed that ($MARG_{i,k}/DE_{i,k}$) was the same in Cyprus as in Greece, in the Czech Republic as in the Slovak Republic, in Ireland as in the U. K., and in Latvia and Lithuania as in Estonia.

Input-output tables for the U. S. (1997) and for Japan (2000) provide data on trade and transportation margins not only for total supply but also differentiated by demand components (intermediate as well as final demand and its components)[14]). Hence, one can easily calculate the share of domestic margins in domestic supply at purchasers' prices for each sector. These ratios are taken as proxies for ($MARG_{i,k}/DE_{i,k}$).

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[12]) Upon completion of the present study I came across a recent paper which provides a clear conceptual basis for the development of PPPs for industries (van Ark-Timmer, 2005). There is some overlapping between the research of these authors and the present paper. This concerns the calculation of proxies for industry-of-origin PPPs based on expenditure PPPs. Van Ark-Timmer discuss the problems of adjusting expenditure PPPs for distribution margins and indirect taxes as well as for export and import prices within the framework of Supply and Use Tables of national accounts and input-output statistics. These tables are used also in this study for correcting expenditure PPPs of basic headings for indirect taxes and distribution margins

[13]) The Eurostat I/O-tables can be obtained from www.europa.eu.int, Eurostat I/O-tables were available for all EU countries besides Cyprus, Czech Republic, Ireland, Lithuania, Latvia and Luxembourg (the latter is, however, not comprised by this study). The tables used to estimate the content of margins and indirect taxes in domestic prices refer to 2000 and 1999 in most cases. If I/O-tables for 2000 or 1999 were not available, tables for preceding years had to be used (1997, 1996, 1995).

[14]) Input-output tables for the U. S. (1997) and for Japan (2000) are published by the Bureau of Economic Analysis (U. S. Department of Commerce) and by the Statistics Bureau (Japanese Ministry of Internal Affairs and Communications), respectively. The tables can be downloaded from www.bea.gov and from www.stat.go.jp, respectively.

For the remaining countries it is assumed that trade and transportation margins account for the same share in final goods prices as in similar economies for which this share could be estimated.[15]) Even though these assumptions will certainly not hold for every single basic heading they probably won't bias the estimation of PPPs for the whole basket of final goods. This presumption seems plausible for three reasons. First, data on distribution costs could be derived from I/O-tables for the most important economies like the U. S., Japan and almost all EU countries. Second, distribution costs do not differ considerably between those (similar) economies which are taken as substitute for countries for which no data on distribution costs are available (e. g., the average distribution costs for the seven subgroups of goods are similar in Hungary, Poland and Slovakia; this is even more true for the average distribution costs of the whole basket of final goods). Third, PPPs for tradables between two countries/currencies can only be biased considerably if trade and transportation margins are overestimated in one country and underestimated in the other country. It seems unlikely that these estimation errors occur in such a systematic manner.

*Table 6: Domestic trade and transportation margins as percentage of domestic purchasers' prices 1999[1)]*

| | Austria | Germany | Portugal | United Kingdom | Poland | Japan | Mexico | United States |
|---|---|---|---|---|---|---|---|---|
| Food and beverages | 23.5 | 26.1 | 20.6 | 24.9 | 20.0 | 34.9 | 21.3 | 26.4 |
| Clothing and footwear | 36.3 | 43.9 | 28.9 | 45.2 | 41.9 | 50.4 | 35.2 | 46.3 |
| Furnishings and household equipment | 20.2 | 19.6 | 20.2 | 21.2 | 13.4 | 30.5 | 21.0 | 38.1 |
| Health | 29.2 | 21.9 | 21.8 | 17.6 | 16.9 | 35.4 | 19.3 | 30.5 |
| Transport equipment | 13.5 | 10.1 | 9.2 | 16.0 | 3.4 | 28.6 | 13.7 | 16.4 |
| Recreation, culture and misc. goods | 17.2 | 16.3 | 17.5 | 16.6 | 11.5 | 34.9 | 18.8 | 26.1 |
| Machinery and equipment | 16.9 | 12.2 | 16.0 | 13.6 | 8.7 | 21.0 | 16.3 | 18.7 |
| All final goods | 21.4 | 21.4 | 19.2 | 21.9 | 16.2 | 32.8 | 20.5 | 27.9 |

*1) Unweighted average over the respective types of goods (basic headings).*

*Source: Wifo calculations using Eurostat, OECD.*

Table 6 displays the estimates of the share of trade and transportation margins in domestic supply for the sample countries (unweighted averages over all basic headings of goods classified as tradable in this study as well as over the basic headings of seven subgroups of goods).[16]) Distribution costs tend to be the higher the more advanced an economy is (as services in general become more expansive relative to goods in the process of economic

[15]) For Bulgaria, Romania, Turkey and Russia the average share of distribution costs in domestic supply in Poland, Hungary and the Slovak Republic is taken as proxy. Slovenia serves as reference country for Croatia and Macedonia, the U. S. for Canada, Japan for Korea, the U. K. for Australia and New Zealand, Germany for Switzerland, the EU 15 for Israel, and Sweden, Denmark and Finland as country group for Iceland and Norway.

[16]) These estimates do not differ significantly from the results of a recent study on trade and transportation margins (Peterson, 2004). However, due to a different country sample and different sector/goods aggregation the estimates of the present study could be compared to those obtained by Peterson (2004) in only few cases.

growth so does also the most important service component of goods become relative more expansive relative to the "goods component"). In Japan and in the U. S., trade and transportation margins accounted for 32.8% and 27.9%, respectively, of the value of domestic supply of all goods. In Poland, Portugal and Mexico, by contrast, distribution costs comprised a much smaller share of overall costs (table 6). However, the fact that the share of distribution costs is only marginally bigger in more advanced European economies like Austria, Germany or the U. K. indicates that institutional factors might also impact upon the weight of trade and transportation margins in overall costs.

Not surprisingly, the share of distribution costs in domestic supply at purchasers' prices is significantly higher for consumer goods as compared to investment goods. Trade and transportation margins comprise a particularly high share of overall costs in the case of clothing and footwear and a relatively low share in the case of transport equipment (table 6).

### 4.1.3 Correction of PPPs at domestic prices for indirect taxes

The estimation of those indirect taxes which are contained in domestic market prices but not in export prices is more complicated than the estimation of trade and transportation margins. This is so for two reasons. First, the types of indirect taxes differ considerably across countries. As a consequence the extent to which indirect taxes are included in export prices varies across countries with different tax systems. Second, indirect taxes are treated differently in I/O-tables for EU countries on the one hand, and in I/O-tables for the U. S. and Japan, on the other hand.

In EU countries the most important indirect tax is the value added tax (VAT) which is included in domestic market prices of consumer goods but not in export prices. Unfortunately, I/O-tables published by Eurostat report only the total of indirect taxes (less subsidies) which together with trade and transportation margins account for the difference between total supply of each sector at basic prices and at purchasers' prices.[17]) Since the largest part of indirect taxes consists of VAT it is assumed that the total of indirect taxes is deducted from exports of goods. To put it differently, the ratio ($INDT_{i,k}/DE_{i,k}$) is estimated as the share of indirect taxes (taken from table 15 of the standardized Eurostat I/O-tables) in final demand for private consumption and gross investment.[18])

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[17]) Subsidies affect the difference between producers' prices and purchasers' prices primarily in the agricultural sector. For this sector the total "indirect taxes less subsidies" is even negative in most cases. In these cases the total was treated as negative indirect tax (separate data on indirect taxes subsidies were not available). This treatment should not bias the estimated PPPs for food and beverages considerably since only three out of 48 BH-PPPs are corrected for indirect taxes using the share of indirect taxes less subsidies in domestic supply of the agricultural sector (since only final goods are comprised by the basket of tradables).

[18]) For Cyprus, the Czech Republic, Ireland, Lithuania and Latvia the estimates of ($INDT_{i,k}/DE_{i,k}$) for the same reference countries were taken which were used as reference countries for the estimation of trade and transportation margins. These proxies were then adjusted for the different level of standard VAT rates as explained below in more detail.

Conceptually, this procedure implies two types of biases. The first bias results from the fact that indirect taxes on production (and not just the VAT) are treated as if they could be deducted from exports. This bias should overestimate the share of indirect taxes in domestic supply which are not included in export prices. The second bias results from the fact that the estimates of ($INDT_{i,k}/DE_{i,k}$) relate the total of indirect taxes to consumption and investment at purchasers' prices. This bias should underestimate the share of indirect taxes in domestic supply which are not included in export prices since the VAT component of overall indirect taxes is not only related to private consumption but also to gross investment (investment goods at purchasers' prices include only indirect taxes on production but not the VAT).

*Table 7: Indirect taxes as percentage of domestic purchasers' prices 1999[1)]*

| | Austria | Germany | Portugal | United Kingdom | Poland | Japan | Mexico | United States |
|---|---|---|---|---|---|---|---|---|
| Food and beverages | 12.9 | 9.7 | 6.2 | 13.2 | 18.2 | 2.6 | 2.2 | 4.9 |
| Clothing and footwear | 17.0 | 14.5 | 13.2 | 10.8 | 15.3 | 0.7 | 9.2 | 3.4 |
| Furnishings and household equipment | 12.3 | 10.0 | 16.1 | 10.3 | 20.2 | 2.1 | 12.8 | 3.7 |
| Health | 17.3 | 15.7 | 15.7 | 17.3 | 20.9 | 1.5 | 13.7 | 4.0 |
| Transport equipment | 15.0 | 7.1 | 18.8 | 11.8 | 15.8 | 1.3 | 17.6 | 3.6 |
| Recreation, culture and misc. goods | 12.5 | 12.0 | 12.0 | 9.7 | 18.4 | 1.6 | 9.6 | 4.0 |
| Machinery and equipment | 7.6 | 6.6 | 8.8 | 10.2 | 16.7 | 2.1 | 8.5 | 3.9 |
| All final goods | 12.5 | 10.0 | 10.7 | 11.6 | 18.0 | 2.0 | 7.9 | 4.2 |

*[1)] Unweighted average over the respective types of goods (basic headings).*

*Source: Wifo calculations using Eurostat, OECD.*

An inspection of the estimates of ($INDT_{i,k}/DE_{i,k}$) suggests that the second bias might be larger than the first one. If one compares for every EU country the (unweighted) average of the estimates of ($INDT_{i,k}/DE_{i,k}$) across all consumer goods with the standard VAT rate in the same country, then it turns out in most cases (21 out of 24) that the estimated shares are smaller then the general VAT rate (by roughly 3 percentage points on average over all EU countries). If one takes into account that in most countries there exist reduced VAT rates for certain goods (like food or medicaments), one can conclude that the shares of indirect taxes in final domestic demand as estimated from I/O-tables underestimate the true difference between domestic market prices and the respective export prices due to indirect taxes. However, this bias should be relatively small.

In the U. S. and in Japan does not exist a value added tax there, instead, there are different kinds of indirect taxes on production and consumption as, e. g., the cumulative sales tax in the U. S (moreover, in the U. S. most indirect tax rates vary across states). Hence, indirect taxes accumulated at different stages of production cannot be deducted from exports as in the case of a VAT system. Therefore ($INDT_{i,k}/DE_{i,k}$) is approximated by the ratio between total indirect taxes of each sector and total domestic supply of each sector including intermediate output (as in the case of trade and transportation margins). Before calculating these ratios

indirect taxes paid by wholesale and retail trade (sales tax in the U. S., consumption tax in Japan) had to be assigned to the single sectors according to the share of output in total domestic supply.

This procedure underestimates the difference between domestic market prices of final goods and the respective export prices, if the effective indirect tax rate (the share of indirect taxes in output) increases over the stages of production to final sale. This will be the case if taxes on sales and consumption are more important than taxes on production. The estimation results indicate that this is actually the case in the U. S. and in Japan. In the U. S., e. g., the average sales tax rate amounts to 6.25% across the nation (including all county and city taxes) according to "The Sales Tax Clearing House" (www.thestc.com). Hence, indirect taxes not included in export prices should at least amount to 5.9% of purchasers' prices (6.25/106.25). However, my estimate of this ratio derived from input-output data amounts to only 4.2% (table 7). This difference is relatively small because the sales tax in the U. S. is a cumulative indirect tax. This is not true for the consumption tax in Japan which is levied only on final consumption (the tax rate is 5%). For this reason the difference between my estimate for indirect taxes not included in export prices (roughly 2%) and the expected value according to the consumption tax rate (4.8%) is higher than in the case of the U. S (table 7).

For the remaining countries, the shares of indirect taxes in domestic supply which are not included in export prices are estimated in two steps. First, for each of these countries estimates of ($INDT_{i,k}/DE_{i,k}$) for similar economies for which this ratio could be estimated are taken as proxies (the same countries are taken as reference countries as for the estimation of trade and transportation margins). Second, these proxies are adjusted for the differences in average indirect tax rates between the respective countries.[19]) An example might clarify this procedure. For Romania an unweighted average of the estimates of ($INDT_{i,k}/DE_{i,k}$) for Hungary, Poland and the Slovak Republic is taken as proxy for each sector/good. These proxies are then multiplied by the ratio between the indirect tax rate in Romania (19%) and the average tax rate in the three reference countries (22%), i. e., by the factor 1.158 (22/19).

In order to check the plausibility of the estimated differences between domestic prices and export prices caused by indirect taxes the following calculations were carried out. For every country comprised in this study an (unweighted) average of the estimates of ($INDT_{i,k}/DE_{i,k}$) across all consumer goods was calculated. If one compares these proxies for an "effective" indirect tax rate to the standard VAT rate (or the standard sales/consumption tax rates in countries which do not have a VAT system) in the respective countries the following observations can be made. First, estimated "effective" tax rates are in almost all cases (38 out of 42) smaller than the standard tax rate. Second, this difference amounts to 3 percentage points on average over all countries (the respective averages are 12.0% for estimated "effective" tax rates and 14.9% for standard tax rates). Third, these differences are

[19]) A survey on global indirect tax rates is provided by Deloitte (www.deloitte.com).

similar for most countries, in some countries they are, however, significantly higher like in Italy, Greece and Spain (10.3, 7.1 and 6.4 percentage points).

There are two possible reasons for the differences between the "effective" indirect tax rates estimated on the basis of I/O-tables and the standard (legal) indirect tax rates. The first reason concerns the estimation procedure which together with the lack of sufficiently disaggregated data (e. g., with respect to different kinds of indirect taxes) might have biased the estimations systematically (as already discussed). The second reason refers to factors which account for actual tax payments being smaller than expected according to the standard tax rate. This discrepancy can be due to reduced tax rates for certain goods or any kind of tax evasion (in these cases the estimated "effective" tax rates would not be biased).

Even if differences between domestic prices and export prices due to indirect taxes are systematically underestimated PPPs at export prices would not be biased significantly. This is so because the estimated tax rates are in almost all countries smaller than the standard tax rate. This can be shown if one calculates the bias factor as the relation between the biased and the true PPP. Leaving aside the impact of trade and transportation margins on PPPs, the true (biased) PPP at export prices PPPXPT (PPPXPB), between countries i and the reference country R, are

$$PPPXPT_{i/R} = PPPDP^* (1 - TRT_i)/(1 - TRT_R) \quad (8)$$

$$PPPXPB_{i/R} = PPPDP^* (1 - TRB_i)/(1 - TRB_R), \quad (9)$$

where $TRT_{i(R)}$ ($TRB_{i(R)}$) denote the true (biased) indirect tax rate in country i (in the reference country R). The bias factor $PPPBF_{i/R}$ then is

$$PPPBF_{i/R} = PPPXPB_{i/R}/\ PPPXPT_{i/R} = \{(1 - TRB_i)/(1 - TRT_i)\}/\{(1 - TRB_R)/(1 - TRT_R)\} \quad (10)$$

The less the relation between the biased and the true tax rate in country i deviates from the respective relation in the reference country, the smaller is the impact of using biased tax rates on the estimate of PPP (independent of the size of the bias in both countries).

If one calculates the average bias factor for PPPs between all countries included in this study and the U. S. as reference country, under the assumption that the actual effective tax rates are equal to the standard rates (hence, the tax rates derived from I/O-tables are assumed to be biased downwards), one gets the following results. In 37 out of 41 cases (countries) this bias factor is smaller than 1.05. The average bias factor for all countries amounts to 1.017, for the EU countries it amounts to 1.022 and for the Euro countries to 1.038.[20])

One can therefore conclude that even if the shares of indirect taxes in domestic supply, which are not included in export prices, are generally underestimated in this study the

[20]) The relatively higher bias factor for the Euro area is mainly due to the low "effective" tax rates in Italy, Greece and Spain. It seems plausible that these low rates reflect at least in part tax evasion and, hence, are not primarily caused by estimation biases.

estimation of PPPs at export prices would not be significantly affected (biased) by using these "effective" tax rates.

Table 7 reports the estimated "effective" tax rates of all goods which belong to the basket of tradables as defined in this study (unweighted averages over all goods as well as over the items of seven subgroups of goods). As expected, indirect taxes comprise a much bigger share in domestic purchasers' prices in European countries than in Mexico, the U. S. or in Japan (the results are shown only for the standard sample of eight countries). In European countries consumer goods are taxed higher than machinery and equipment (due to the great importance of the VAT). By contrast, in Mexico, the U. S. and in Japan the estimated share of indirect taxes in domestic purchasers' prices is roughly the same for consumer goods and investment goods.

### 4.1.4 Purchasing power parities and comparative price levels for tradables

The estimated shares of distribution margins and indirect taxes enables one to transform BH-PPPs at domestic purchasers' prices into BH-PPPs at export prices according to equation (7). BH-PPPs of services included in the basket of tradables have not to be corrected for domestic margins and indirect taxes since prices paid by foreigners for these services include these components.

The EKS calculations provide PPPs for individual countries. In order to generate PPPs for country groups like the Euro area (EURO 12), the EU 15, the 10 new EU members (EU 10), the EU 25, the OECD 24 and the OECD 30 the same method was applied as used by the Eurostat-OECD PPP Programme (table 1 in the annex reports the composition of country groups). For each group a common currency was nominated, e. g., the euro for EURO 12, EU 15, EU 10, EU 25 and the US dollar for OECD 24 and OECD 30. The U. S. was used as reference country.

PPPs for these country groups are calculated in three steps as follows:

- First, the export earnings of the countries comprising EURO 12, EU 15, EU 10 and EU 25 are converted into nominal export earnings in euro using exchange rates. These nominal export earnings in euro are summed up over the countries belonging to each group. In a similar way nominal export earnings in US dollars are calculated for OECD 24 and OECD 30.
- Second, real export earnings in U. S. dollars (e. g., at U. S. prices) are calculated for each country by using PPPs for conversion of nominal export earnings (instead of exchange rates). Real export earnings are then obtained by summing the real export earnings of their constituent countries.
- Third, the euro/US dollar PPPs for the country groups EURO 12, EU 15, EU 10 and EU 25 are obtained as ratios of nominal export earnings in euros of the respective country groups to their real export earnings in U. S. dollars (e. g., a spatial Laspeyres price index with the U.

S. as base country is calculated). The OECD 30(24) dollar/US dollar PPP is obtained in a similar way, e. g., by dividing nominal export earnings of OECD 30(24) by real export earnings of OECD 30(24).

In order to avoid breaks in the data the euro was used as the national currency for each member country of the Euro area (11 countries since Luxembourg is not covered by this study) also for years prior to 1999 (this procedure is also followed by national account statistics as well as by the Eurostat-OECD PPP Programme). This was done by converting BH-PPPs in national currencies in "national euros" using the euro conversion rates. The nominal dollar exchange rates of national euros are calculated as the current dollar exchange rates of the (original) national currency divided by the conversion rate.

*Table 8: Ratio of PPPs at export prices to PPPs at domestic purchasers' prices 1999 and 2002*
*USA = 100*

| **1999** | Austria | Germany | Portugal | EURO 12 | United Kingdom | EU 15 | Poland | EU 10 | EU 25 | Japan | Mexico | United States | OECD 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Food and beverages | 93.3 | 94.2 | 108.4 | 101.6 | 90.1 | 98.8 | 90.5 | 92.6 | 98.4 | 91.8 | 112.7 | 100.0 | 98.5 |
| Clothing and footwear | 90.9 | 80.3 | 111.5 | 101.7 | 83.1 | 99.2 | 84.8 | 97.0 | 98.8 | 97.1 | 108.5 | 100.0 | 99.1 |
| Furnishings and household equipment | 114.4 | 116.4 | 115.1 | 118.9 | 114.9 | 118.0 | 117.7 | 117.9 | 118.0 | 111.7 | 114.9 | 100.0 | 114.6 |
| Health | 82.0 | 93.4 | 93.3 | 95.6 | 96.1 | 95.3 | 87.0 | 101.8 | 95.5 | 99.8 | 101.8 | 100.0 | 97.0 |
| Transport equipment | 84.7 | 102.8 | 83.9 | 97.4 | 90.5 | 96.6 | 98.8 | 88.8 | 96.2 | 82.6 | 79.9 | 100.0 | 92.7 |
| Recreation, culture and misc. goods | 99.4 | 98.6 | 100.8 | 99.4 | 101.8 | 99.6 | 99.0 | 101.4 | 99.7 | 86.7 | 101.0 | 100.0 | 98.2 |
| Machinery and equipment | 91.9 | 101.9 | 88.4 | 98.4 | 94.2 | 97.4 | 95.3 | 96.6 | 97.4 | 98.1 | 90.0 | 100.0 | 98.1 |
| All final goods | 92.6 | 99.8 | 98.5 | 99.4 | 94.2 | 98.1 | 95.0 | 97.4 | 98.1 | 95.1 | 96.6 | 100.0 | 98.2 |
| **2002** | | | | | | | | | | | | | |
| Food and beverages | 93.8 | 94.7 | 108.4 | 102.3 | 90.8 | 99.6 | 91.0 | 93.4 | 99.2 | 92.6 | 113.6 | 100.0 | 99.2 |
| Clothing and footwear | 90.9 | 80.3 | 111.5 | 101.8 | 83.0 | 99.3 | 84.7 | 98.1 | 99.2 | 97.1 | 108.4 | 100.0 | 99.1 |
| Furnishings and household equipment | 114.5 | 117.5 | 115.2 | 119.6 | 115.4 | 118.7 | 118.4 | 118.7 | 118.7 | 114.0 | 115.2 | 100.0 | 115.2 |
| Health | 82.2 | 93.5 | 93.4 | 94.3 | 96.1 | 94.3 | 87.2 | 101.2 | 94.5 | 101.6 | 101.9 | 100.0 | 96.0 |
| Transport equipment | 83.6 | 102.3 | 82.8 | 96.8 | 90.2 | 96.1 | 98.0 | 88.3 | 95.5 | 81.5 | 78.6 | 100.0 | 91.6 |
| Recreation, culture and misc. goods | 100.3 | 100.6 | 103.0 | 101.5 | 103.5 | 101.5 | 100.6 | 102.3 | 101.6 | 88.4 | 103.0 | 100.0 | 99.4 |
| Machinery and equipment | 91.9 | 102.2 | 88.9 | 98.6 | 93.5 | 97.5 | 96.2 | 96.3 | 97.4 | 98.9 | 90.1 | 100.0 | 98.1 |
| All final goods | 92.7 | 100.7 | 98.4 | 100.0 | 94.6 | 98.7 | 96.2 | 97.9 | 98.6 | 95.2 | 96.6 | 100.0 | 98.5 |

*Source: Wifo calculations using Eurostat, OECD.*

In order to find out to which extent the correction of domestic prices for distribution margins and indirect taxes impact upon aggregated PPPs for tradables the latter were calculated in two ways, first, using BH-PPPs at domestic prices and, second, using BH-PPPs at export prices. The EKS procedure was applied in both cases using export earnings as weights (see section 2.1). Hence, the aggregated PPPs differ only with respect to the valuation of BH-PPPs.[21])

Table 8 reports the ratio of PPP at export prices to PPP at domestic prices for the standard sample of countries and country groups used in this study (USA = 100). PPPs at export prices for the overall basket of final goods are in all cases lower than the respective PPPs at

[21]) For the aggregation of BH-PPPs according to the EKS method the computational scheme as in the Eurostat-OECD PPP Programme was applied. I am very grateful to Sergey Sergeev for adapting this scheme for the purpose of the present study.

domestic prices (even though to a relatively small extent in most cases). This result is due to the fact that on average the higher share of distribution margins in domestic prices in the U. S. as compared to most other countries is overcompensated by the relatively lower share of indirect taxes in the U. S. In the case of Japan the particularly high share of trade and transportation margins in domestic prices is the main reason why PPP for final goods at export prices is by 4.9% lower than the respective PPP at domestic prices (even though the share of indirect taxes in domestic prices is lower in Japan as compared to the U. S.).

For all country groups (except EU 10) shown in table 8 the differences between PPP at export prices and PPP at domestic prices are smaller than 2 percentage points. This observation indicates that the different weights of distribution costs and indirect taxes relative to the U. S. tend to compensate each other. However, this effect holds true only at the aggregated level of all final goods. At the level of subgroups of goods PPPs at export prices deviate significantly from PPPs at domestic prices, primarily due to different weights of trade and transportation margins in domestic prices across countries. Export prices of furnishings and household equipment are in all countries higher than the respective domestic prices (in relation to this price ratio in the U. S.) since distribution margins of these goods are extraordinary high in the U. S (table 6). By, contrast, PPPs for transport equipment at export prices are in all countries (except Germany) lower than PPPs at domestic prices due to relatively low trade and transportation margins in the U. S. (Note, however, that one cannot derive the ratios of PPPs at export prices to PPPs at domestic prices as reported in table 8 from the shares of distribution margins and indirect taxes as reported in tables 6 and 7 since the former are calculated as weighted averages over BH-PPPs according to the EKS procedure whereas the latter are calculated as unweighted arithmetic averages).

The ratios of PPPs at export prices to PPPs at domestic prices as reported in table 8 are almost the same for 2002 as for the reference year 1999. This is so because it is assumed that the shares of trade and transportation margins as well as the shares of indirect taxes in domestic market prices estimated for 1999 are the same in all four other benchmark years between 1990 and 2002 (hence, the slight differences in the ratios of table 8 between 1999 and 2002 are only due to changes in the structure of export earnings by basic headings). Even though this assumption had to be made for lack of data (I/O-tables) it will not bias the results for two reasons. First, indirect tax rates changed only little in most countries over this period. Second, even though the share of distribution costs in domestic prices should have risen slowly (due to services becoming more expensive relative to goods) the increase should be similar in all countries.

The results of correcting PPPs at domestic prices for distribution margins and indirect taxes can be summarized as follows. First, PPPs for the whole basket of final goods are only slightly lower when valued at export prices compared to domestic prices. Second, this difference is particularly small for country groups like EURO 12, EU 15, EU 10 and OECD 30. Third, for

subgroups of goods PPPs at export prices differ from PPPs at domestic prices much stronger than for the aggregate of all final goods.

*Table 9: PPPs for tradables at export prices 1999 and 2002*
*USA = 1*

| 1999 | Austria | Germany | Portugal | EURO 12 | United Kingdom | EU 15 | Poland | EU 10 | EU 25 | Japan | Mexico | United States | OECD 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All final goods | 0.978 | 0.997 | 0.903 | 0.976 | 0.675 | 0.984 | 2.917 | 0.678 | 0.964 | 146.1 | 8.830 | 1.000 | 1.027 |
| Food and beverages | 0.886 | 0.861 | 0.790 | 0.915 | 0.594 | 0.912 | 2.203 | 0.521 | 0.888 | 220.1 | 8.211 | 1.000 | 0.943 |
| Clothing and footwear | 1.374 | 1.138 | 1.134 | 1.292 | 0.790 | 1.277 | 2.919 | 0.738 | 1.192 | 196.0 | 8.742 | 1.000 | 1.074 |
| Furnishings and household equipment | 0.994 | 1.001 | 0.778 | 0.981 | 0.802 | 1.009 | 2.769 | 0.638 | 0.958 | 187.4 | 8.758 | 1.000 | 1.028 |
| Health | 0.847 | 1.051 | 0.614 | 0.779 | 0.517 | 0.796 | 2.523 | 0.467 | 0.785 | 145.2 | 8.254 | 1.000 | 0.909 |
| Transport equipment | 0.835 | 0.930 | 0.937 | 0.907 | 0.683 | 0.920 | 3.344 | 0.720 | 0.908 | 110.3 | 7.042 | 1.000 | 0.924 |
| Recreation, culture and misc. goods | 1.061 | 1.034 | 0.980 | 1.067 | 0.761 | 1.088 | 3.372 | 0.727 | 1.067 | 161.3 | 11.678 | 1.000 | 1.153 |
| Machinery and equipment | 0.983 | 1.014 | 0.915 | 0.974 | 0.675 | 0.979 | 3.320 | 0.757 | 0.969 | 135.4 | 9.124 | 1.000 | 1.025 |
| Travel and transportation services | 1.068 | 1.149 | 0.888 | 1.107 | 1.031 | 1.178 | 2.680 | 0.627 | 1.117 | 220.2 | 6.986 | 1.000 | 1.113 |
| Tradables total | 0.990 | 1.012 | 0.901 | 0.994 | 0.713 | 1.009 | 2.899 | 0.672 | 0.986 | 149.6 | 8.682 | 1.000 | 1.043 |
| 2002 | | | | | | | | | | | | | |
| All final goods | 1.040 | 1.111 | 1.025 | 1.076 | 0.677 | 1.074 | 3.340 | 0.868 | 1.059 | 135.6 | 9.263 | 1.000 | 0.997 |
| Food and beverages | 0.936 | 0.894 | 0.988 | 0.995 | 0.639 | 0.997 | 2.393 | 0.650 | 0.974 | 203.8 | 9.227 | 1.000 | 0.925 |
| Clothing and footwear | 1.015 | 0.921 | 0.973 | 1.059 | 0.487 | 1.031 | 2.444 | 0.693 | 0.986 | 170.7 | 8.294 | 1.000 | 0.854 |
| Furnishings and household equipment | 1.186 | 1.100 | 0.868 | 1.150 | 0.818 | 1.173 | 3.335 | 0.854 | 1.122 | 180.9 | 9.293 | 1.000 | 1.044 |
| Health | 0.737 | 0.938 | 0.544 | 0.678 | 0.436 | 0.681 | 1.780 | 0.484 | 0.676 | 103.5 | 7.209 | 1.000 | 0.702 |
| Transport equipment | 0.868 | 1.009 | 0.974 | 0.957 | 0.616 | 0.959 | 3.466 | 0.817 | 0.948 | 96.7 | 7.204 | 1.000 | 0.854 |
| Recreation, culture and misc. goods | 1.110 | 1.050 | 0.998 | 1.043 | 0.823 | 1.085 | 3.730 | 0.951 | 1.076 | 111.4 | 9.885 | 1.000 | 0.999 |
| Machinery and equipment | 1.107 | 1.266 | 1.177 | 1.193 | 0.725 | 1.179 | 4.182 | 1.061 | 1.171 | 149.6 | 10.185 | 1.000 | 1.078 |
| Travel and transportation services | 1.188 | 1.023 | 1.008 | 1.069 | 0.813 | 1.111 | 3.477 | 0.880 | 1.092 | 147.5 | 9.345 | 1.000 | 1.020 |
| Tradables total | 1.060 | 1.107 | 1.021 | 1.078 | 0.695 | 1.082 | 3.368 | 0.870 | 1.066 | 137.5 | 9.277 | 1.000 | 1.003 |

*Source: Wifo calculations using Eurostat, OECD.*

Table 9 reports the results of the estimation of PPPs for tradables at export prices for a sample of countries in 1999 and 2002 (a complete data set of PPPs for tradables covering all countries and all benchmark years since 1990 is displayed in table 3 in the annex).

In 2002 the PPP for the overall basket of tradables at export prices between the Euro area and the U. S. amounts to 1.078 (one unit of tradables which costs 1 US dollar when exported by the U. S. costs 1.078 euro when exported by the Euro area). This result implies that the euro/dollar exchange rate (1.063) was very close to the level of PPP for international traded goods and services as defined in this study. Tradables were comparatively cheaper in Portugal and Austria, and comparatively more expensive in Germany (in order to simplify the description of the results of this study I use expressions like “tradables in county X” as synonyms for “tradables exported by country X”; I also omit specifications like “at export prices” or “relative to the U. S.” since in this study PPPs for tradables are valued at export prices and the U. S. is used as reference country).

As expected, PPP for tradables between the 10 new EU member countries and the U. S. was significantly lower (0.870 €) than between the EU 15 (1.082) and the U. S. (tradables which cost 1 dollar in the U. S. cost 1.082 € in the EU 15 but only 0.870 € in the EU 10).

As regards PPPs for subgroups of goods and services the following observations can be made. In all countries and country groups covered in table 9 machinery and equipment

were comparatively more expensive, e. g., the respective PPP was higher than PPP for all tradables. In the Euro area all tradables were 1.5% more expensive than in the U. S. (1.078/1.063), machinery and equipment, however, were even 12.3 % (1.193/1.063) more expensive. Hence, machinery and equipment were comparatively more expensive in the Euro area as compared to the U. S., namely by 10.7% (1.193/1.1078). By contrast, health products were in all countries, covered in table 9, comparatively cheaper than in the U. S. (the same is true for food and beverages with the exception of Japan where these products are comparatively more expensive).

The estimates of PPPs for tradables for 1999 differ significantly from the estimates for 2002 (table 9). This concerns in particular PPPs for certain subgroups of goods. E. g., PPP for machinery and equipment between the Euro area and the U. S. amounted to only 0.974 in 1999 as compared to 1.193 in 2002. This difference implies that export prices of investment goods in the Euro area increased over these three years 22.5% faster than in the U. S. By contrast, PPP for clothing and footwear declined from 1.292 in 1999 to 1.059 in 2002 (implying that export prices of these items increased in the Euro area 18.1% slower than in the U. S.).

The main reason for these differences lies in revisions undertaken within the Eurostat-OECD PPP Programme. These revisions refer in particular to price data collection and consistency with national accounts. The first year for which both organizations, Eurostat and OECD, produced PPPs for the whole set of 42 countries according to the revised procedure is the year 2002. In addition, Eurostat revised PPPs also for the years 1995 to 2000 for 31 countries for which Eurostat coordinates the PPP project (EU 25 plus Iceland, Norway, Switzerland, Bulgaria, Romania, Turkey).[22]) However, this was not done by OECD for the 11 countries for which OECD coordinates the PPP project (seven Non-European OECD members plus Croatia, Israel, Macedonia, Russian Federation). For reasons of consistency I used for 1999 the complete (unrevised) data set of BH-PPPs (provided by OECD) instead of mixing revised data for 31 countries (from Eurostat) with unrevised data for 11 countries (from OECD). For 2002 I used the complete data set of BH-PPPs collected according to the revised procedure.

For this reason it seems highly probable that the estimates of PPPs for tradables for 2002 are more reliable than the estimates for previous benchmark years of the Eurostat-OECD PPP Programme. Therefore the year 2002 is also used as base year for the backward extrapolation ("retropolation") of PPPs for tradables (see section 4.2).

PPPs for the whole basket of tradables are less affected by the revisions within the Eurostat-OECD PPP Programme than PPPs for subgroups of goods and services (to a certain extent these revisions compensate each other at the aggregate level). E. g., PPP for all tradables between the Euro area and the U. S. amounted to 0.994 in 1999 as compared to 1.078 in 2002. This difference implies that prices of exports of goods and services increased by 8.5% faster in the Euro area than in the U. S. According to national accounts export prices

[22]) See Stapel (2004), Stapel-Pasanen-Reinecke (2004), Eisenrauch-Sergeev, (2004).

increased by 5.3% faster in the Euro area as compared to the U. S. Hence, the change in the estimated PPP for tradables between 1999 and 2002 is only 3.2 percentage points greater than implied by the changes in relative export deflators.

Table 10 shows exchange rates, PPPs for GDP, for final goods and for tradables as well as the respective price levels for the set of all countries in 2002. In every country of the Euro area PPP for GDP was lower than the exchange rate. Hence, the price level of GDP was in each country lower than in the U. S. (the euro was undervalued and the US dollar overvalued relative to PPP for GDP). In Portugal, Greece, and Spain one unit of GDP was 38.0%, 36.2%, and by 30.1% cheaper than in the U. S. The price level of GDP was highest in economically more advanced countries like Ireland, Finland or Germany. Differences in the price level of GDP were very large. One unit GDP was in Ireland, e. g, 52.2% more expensive than in Portugal (94.3/62.0). In the Euro area as a whole the price level of GDP was 2002 17.6% lower than in the U. S. To put it differently: Relative to PPP for GDP the euro was undervalued by 17.6% vis-à-vis the US dollar and, conversely, the US dollar was overvalued by 21.3% vis-à-vis the euro.

If one (correctly) uses PPP for tradables as benchmark for the (long-run) equilibrium exchange rate a very different picture emerges. This picture can be summarized as follows. First, within the Euro area the price level of tradables was in Ireland, France, Germany and Italy slightly higher than in the U. S., in all other EURO 12 countries it was lower. Second, the differences in the price level of tradables are much smaller than the differences in the price level of GDP. E. g., one unit tradables in Ireland was only 11.2% more expensive than in Portugal. Third, the euro/dollar exchange rate in 2002 was close to PPP for tradables, hence, neither the Euro area nor the U. S. could enjoy a price advantage in international trade due to an undervalued currency. Fourth, PPPs for final goods differ very little from PPPs for overall tradables.

The differences between PPP for GDP and PPP for tradables and, hence, between the respective price levels are particularly pronounced in the new EU member countries. In the EU 10 one unit of GDP was 47.3% (44.6/82.4) cheaper than in the EU 15, whereas one unit tradables was cheaper only by 19.6%. One can therefore conclude that the currencies of these countries are much less undervalued relative to PPP for tradables than relative to PPP for GDP.

The difference between PPP for GDP and PPP for tradables can be explained by the relationship between relative prices of non-traded services and real GDP per head. The less advanced an economy is the cheaper are non-traded services relative to tradables (Balassa-Samuelson effect). Hence, in the least advanced economies covered by the Eurostat-OECD PPP Programme like Mexico, Croatia, Bulgaria, Macedonia, Romania and Russia PPP for tradables is almost twice as big as PPP for GDP. By contrast, in advanced economies like Norway, Switzerland or Japan PPPs for tradables differ much less from PPP for GDP.

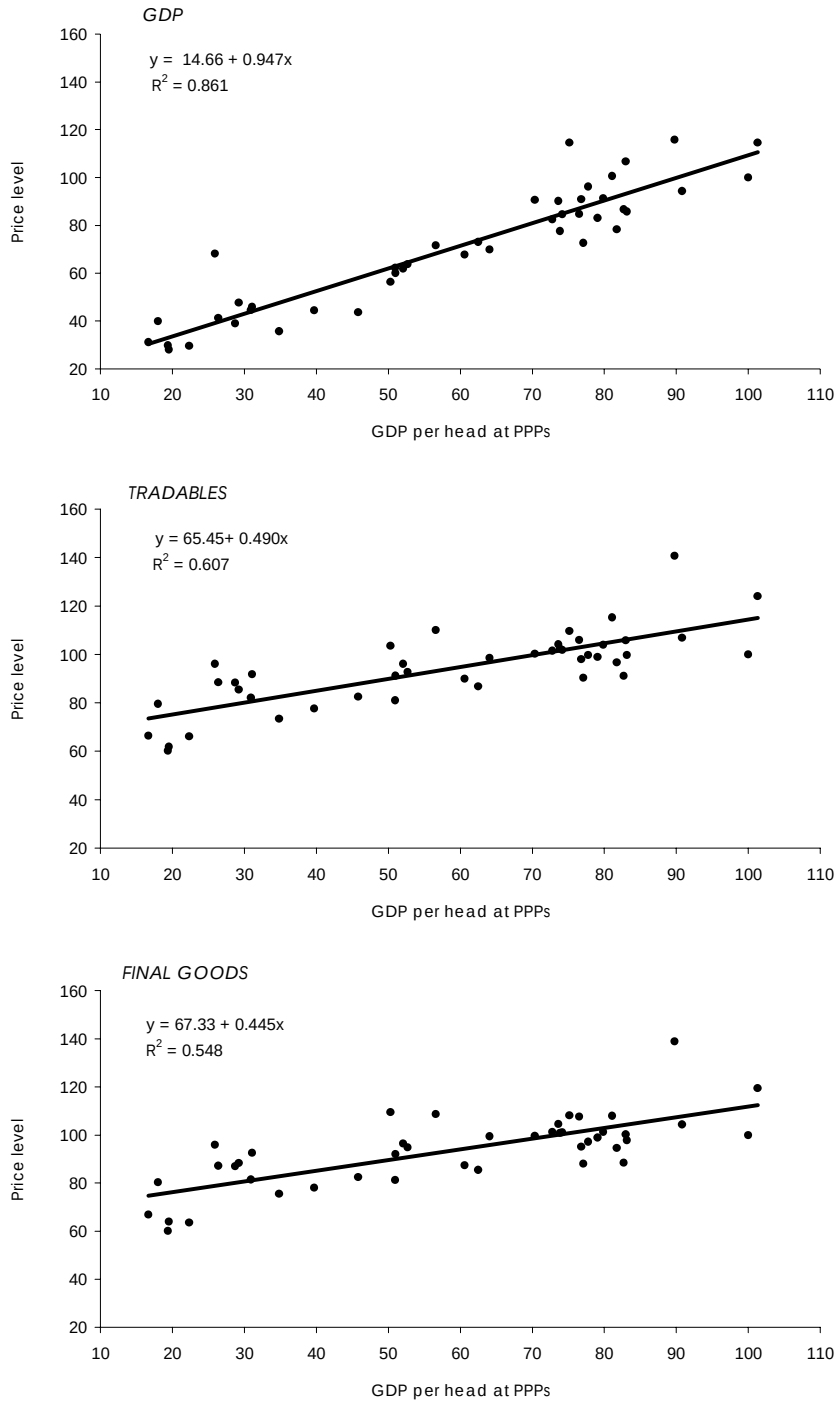
*Table 10: PPPs, exchange rates and comparative price levels 2002*
*USA = 100*

| | Exchange rate per US dollar | GDP | | Tradables | | | |
|---|---|---|---|---|---|---|---|
| | | PPP | Comparative price level | Final goods | | Total | |
| | | | | PPP | Comparative price level | PPP | Comparative price level |
| Austria | 1.063 | 0.912 | 85.8 | 1.040 | 97.8 | 1.060 | 99.7 |
| Belgium | 1.063 | 0.883 | 83.1 | 1.052 | 99.0 | 1.052 | 99.0 |
| Finland | 1.063 | 0.967 | 91.0 | 1.011 | 95.1 | 1.042 | 98.1 |
| France | 1.063 | 0.900 | 84.7 | 1.144 | 107.7 | 1.126 | 106.0 |
| Germany | 1.063 | 0.959 | 90.2 | 1.111 | 104.6 | 1.107 | 104.1 |
| Greece | 1.063 | 0.678 | 63.8 | 1.008 | 94.8 | 0.986 | 92.8 |
| Ireland | 1.063 | 1.002 | 94.3 | 1.108 | 104.3 | 1.136 | 106.9 |
| Italy | 1.063 | 0.825 | 77.6 | 1.072 | 100.8 | 1.087 | 102.3 |
| Netherlands | 1.063 | 0.921 | 86.7 | 0.940 | 88.4 | 0.968 | 91.1 |
| Portugal | 1.063 | 0.658 | 62.0 | 1.025 | 96.4 | 1.021 | 96.1 |
| Spain | 1.063 | 0.743 | 69.9 | 1.057 | 99.5 | 1.048 | 98.6 |
| EURO 12 | 1.063 | 0.876 | 82.4 | 1.076 | 101.3 | 1.078 | 101.5 |
| Denmark | 7.895 | 8.425 | 106.7 | 7.913 | 100.2 | 8.351 | 105.8 |
| Sweden | 9.734 | 9.365 | 96.2 | 9.461 | 97.2 | 9.714 | 99.8 |
| United Kingdom | 0.668 | 0.610 | 91.3 | 0.677 | 101.3 | 0.695 | 104.0 |
| EU 15 | 1.063 | 0.899 | 84.6 | 1.074 | 101.1 | 1.082 | 101.8 |
| Cyprus 1) | 0.611 | 0.438 | 71.7 | 0.664 | 108.6 | 0.673 | 110.1 |
| Czech Republic | 32.73 | 14.27 | 43.6 | 26.99 | 82.5 | 27.03 | 82.6 |
| Estonia 1) | 16.63 | 7.631 | 45.9 | 15.39 | 92.6 | 15.27 | 91.8 |
| Hungary | 258.2 | 114.7 | 44.4 | 201.6 | 78.1 | 200.5 | 77.7 |
| Latvia 1) | 0.617 | 0.255 | 41.2 | 0.539 | 87.2 | 0.546 | 88.5 |
| Lithuania 1) | 3.676 | 1.432 | 38.9 | 3.197 | 87.0 | 3.247 | 88.3 |
| Malta 1) | 0.435 | 0.245 | 56.4 | 0.476 | 109.5 | 0.450 | 103.6 |
| Poland | 4.099 | 1.825 | 44.5 | 3.340 | 81.5 | 3.368 | 82.2 |
| Slovenia 1) | 240.1 | 144.3 | 60.1 | 221.0 | 92.1 | 219.0 | 91.2 |
| Slovak Republic | 45.36 | 16.21 | 35.7 | 34.24 | 75.5 | 33.34 | 73.5 |
| EU 10 | 1.063 | 0.474 | 44.6 | 0.868 | 81.7 | 0.870 | 81.9 |
| EU 25 | 1.063 | 0.863 | 81.3 | 1.059 | 99.7 | 1.066 | 100.3 |
| Iceland | 91.57 | 92.18 | 100.7 | 98.82 | 107.9 | 105.6 | 115.3 |
| Norway | 7.978 | 9.142 | 114.6 | 9.529 | 119.4 | 9.899 | 124.1 |
| Switzerland | 1.559 | 1.804 | 115.8 | 2.166 | 138.9 | 2.193 | 140.7 |
| Turkey | 1529732 | 611482 | 40.0 | 1229273 | 80.4 | 1217018 | 79.6 |
| Australia | 1.841 | 1.337 | 72.6 | 1.621 | 88.0 | 1.664 | 90.4 |
| New Zealand | 2.162 | 1.466 | 67.8 | 1.889 | 87.4 | 1.946 | 90.0 |
| Japan | 125.4 | 143.7 | 114.6 | 135.6 | 108.2 | 137.5 | 109.7 |
| Korea | 1251 | 778.8 | 62.2 | 1016.4 | 81.2 | 1014 | 81.0 |
| Canada | 1.569 | 1.229 | 78.3 | 1.485 | 94.6 | 1.519 | 96.8 |
| Mexico | 9.656 | 6.585 | 68.2 | 9.263 | 95.9 | 9.277 | 96.1 |
| United States | 1.000 | 1.000 | 100.0 | 1.000 | 100.0 | 1.000 | 100.0 |
| OECD 30 | 1.000 | 0.906 | 90.6 | 0.997 | 99.7 | 1.003 | 100.3 |
| Bulgaria 1) | 2.071 | 0.582 | 28.1 | 1.326 | 64.0 | 1.282 | 61.9 |
| Croatia 1) | 7.869 | 3.754 | 47.7 | 6.955 | 88.4 | 6.730 | 85.5 |
| Israel 1) | 4.738 | 3.463 | 73.1 | 4.050 | 85.5 | 4.113 | 86.8 |
| Macedonia 1) | 64.35 | 20.02 | 31.1 | 43.02 | 66.9 | 42.80 | 66.5 |
| Romania 1) | 33226 | 9891 | 29.8 | 19965 | 60.1 | 20006 | 60.2 |
| Russian Federation 1) | 31.35 | 9.274 | 29.6 | 19.96 | 63.7 | 20.75 | 66.2 |

*[1]) No OECD member country.*

*Source: Wifo calculations using Eurostat, OECD.*

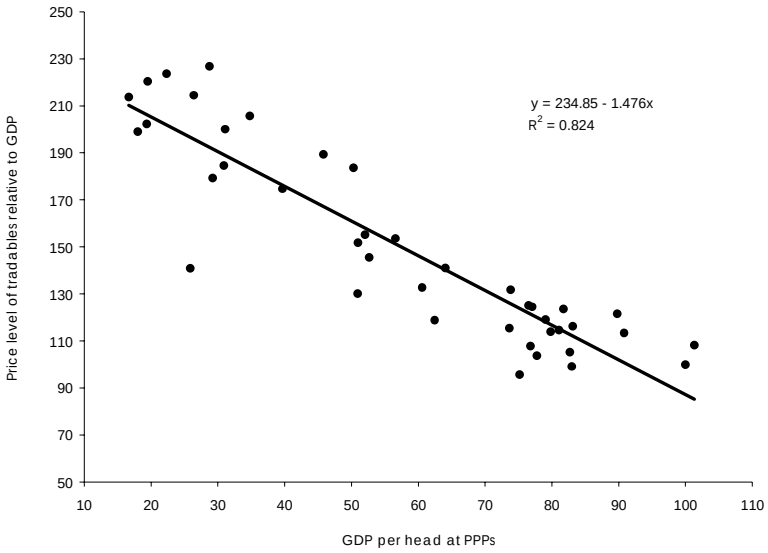
*Figure 4: Price level and GDP per head 2002*
*USA = 100*

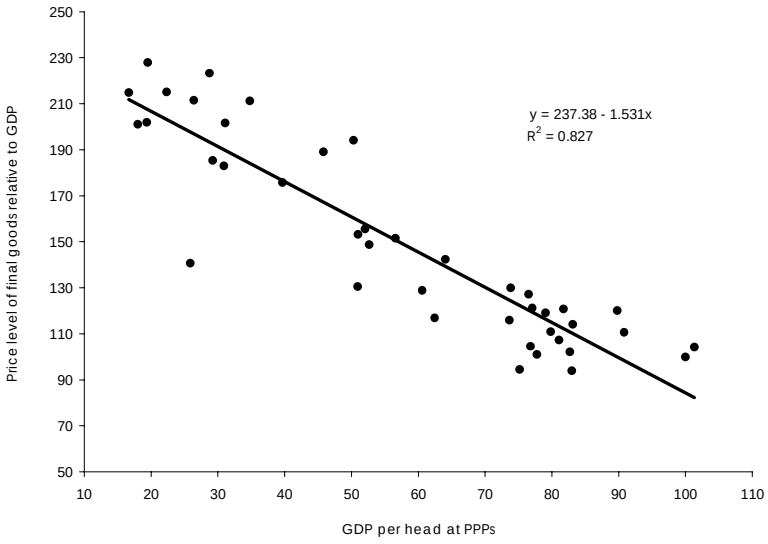



*Notes: This figure shows that the price level of GDP increases with real GDP per head in a cross section of 41 countries in 2002. Contrary to theoretical expectations this relationship also holds for traded goods and services though less pronounced.*

*Source: Wifo calculations using Eurostat, OECD.*

*Figure 5: Relative price level of tradables and GDP per head 2002*
*USA = 100*




*Notes: This figure shows the (pronounced) inverse relationship between the price level of traded goods and services relative to GDP on the one hand, and real GDP per head on the other hand (cross section of 41 countries in 2002).*

*Source: Wifo calculations using Eurostat, OECD.*

Figure 4 illustrates the relationship between real GDP per head on the one hand, and the price level of GDP, of tradables and of final goods on the other hand in 2002 (the cross section comprises 41 countries, e. g., all countries covered by the Eurostat-OECD PPP Programme for 2002, except Luxembourg). Several observations can be made:

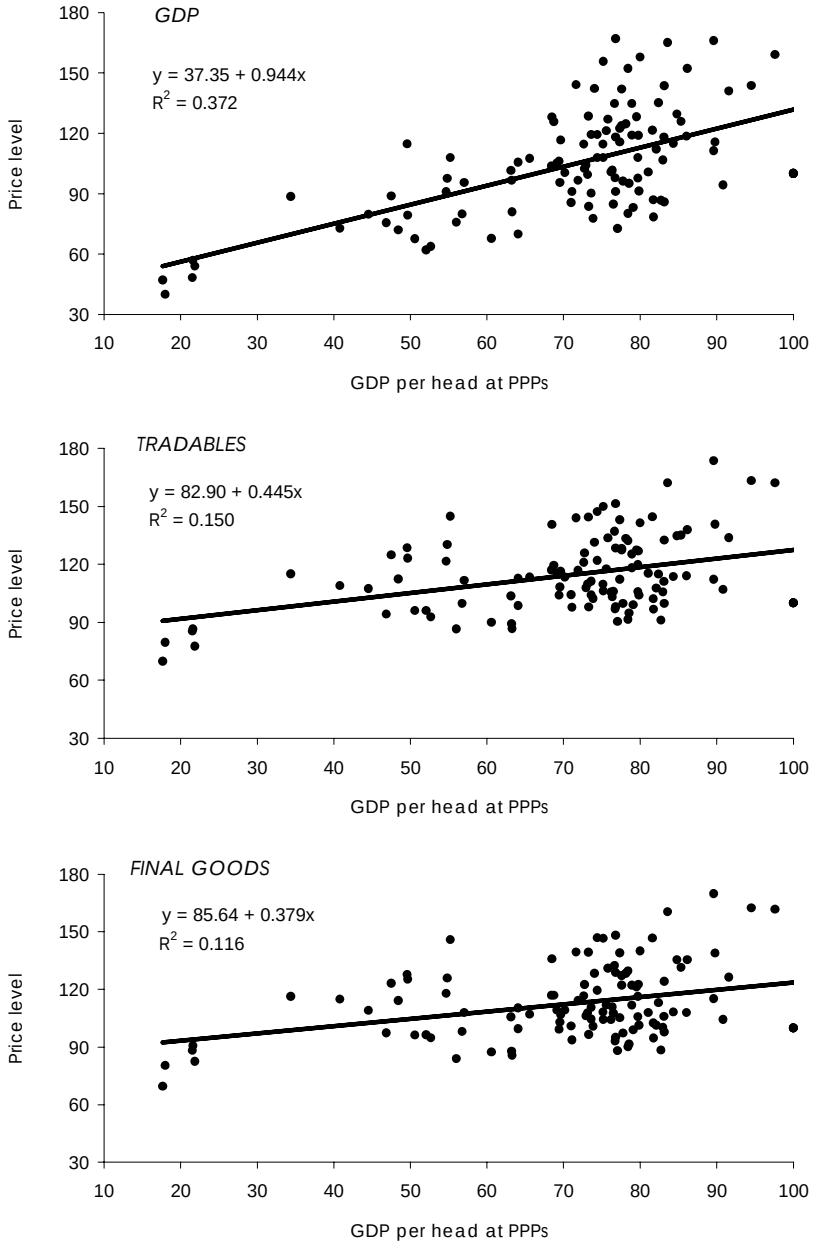
- First, the variation in the price level of GDP level is much greater than the variation in the price level of internationally traded goods and services. E. g., the ratio of the highest to the lowest price level was 4.12 for GDP (Switzerland/Bulgaria) and 2.34 for tradables (Switzerland/Romania).
- Second, there prevails a distinct positive relationship between real GDP per head and the price level of GDP. The slope of the respective regression is close to one. Hence, if GDP per head in country A is by 10 percentage points higher than in country B then also the price level of GDP will be roughly 10 percentage points higher in country A as compared to country B.
- Third, the price level of tradables is positively related to real GDP per head. However, this relationship is less pronounced as compared to the relationship between GDP per head and GDP price level (note the differences in $R^2$ as well as in the slope of the respective regressions).

Three conclusions can be drawn from these observations. First, the overall price level increases with real GDP per head as explained by the models of Balassa (1964), Samuelson (1964), Kravis-Lipsey (1983) and Bhagwati (1984). Hence, nominal exchange rates deviate systematically from PPP for GDP. Second, in contrast to the assumptions of these models PPP does not hold for tradables either (as already reported by Engel, 1993; Rogers-Jenkins, 1995; Engel-Rogers, 1996 and 2001; Cihak-Holub, 2001 and 2003). Third, deviations of nominal exchange rates from PPP for tradables are much smaller than deviations from PPP for GDP. Hence, the law of one price holds approximately better for internationally traded goods and services than for all products.

Figure 5 displays the pronounced inverse relationship between real GDP per head and the price level of tradables relative to the price level of GDP. E. g., in countries where GDP per head amounts to less than 30% of GDP per head in the U. S. tradables are relative to all goods and services roughly twice as expensive than in the U. S. Since GDP per head is greater in the U. S. than in almost all other countries tradables are comparatively cheaper in the U. S. than in almost all other countries (only in Denmark and Japan was the price level of tradables relative to GDP smaller than in the U. S).

More generally, one can derive the following relationship from figure 5. The smaller is GDP per head of a country relative to the U. S., the higher is the "true" real dollar exchange rate of that country (based on PPP for tradables) as compared to the "false" real dollar exchange rate based on PPP for GDP. Hence, if one uses PPP for GDP as a benchmark for the nominal (equilibrium) exchange rate (e. g., for lack of data on PPP for tradables) then one will erroneously consider the actual dollar exchange rate of country i the more overvalued (less undervalued) the smaller is GDP per head in country i relative to the U. S. This estimation bias results from the systematic relationship between GDP per head and the price level of tradables relative to the price level of GDP (figure 5).

*Figure 6: Price level and GDP per head 1990-2002*
*Countries of OECD 24 in 1990, 1993, 1996, 1999, 2002 (USA = 100)*




*Notes: The relationship between real GDP per head and the price level of GDP, of tradables and of final goods is weaker in a panel of 23 OECD countries 1990/2002 as compared to the cross section of 41 countries in 2002 (figure 4).*

*Source: Wifo calculations using Eurostat, OECD.*

Figure 6 shows that the relationship between real GDP per head and the GDP price level is weaker in a panel of 23 OECD countries comprising 5 benchmark years between 1990 and 2002 than in a cross section of 41 countries for 2002 as displayed in figure 4. This observation

holds also true for the relationship between GDP per head and the price level of tradables. There are two main reasons why the relationship between real GDP per head and the price levels is stronger in a cross section of 41 countries in 2002 than in a panel of 23 countries over 5 years between 1990 and 2002. First, the wide fluctuations of nominal exchange rates impact directly upon the rank order of countries according to their price level but not according to their GDP per head. Second, economically less developed countries for which the positive relationship between GDP per head and the price level is particularly pronounced are included in the cross section of countries for 2002 but not in the panel for the 5 benchmark years between 1990 and 2002.[23]) .

Figure 7 displays the dispersion of price levels of GDP, of tradables and of final goods for the countries of OECD 24 in each benchmark year between 1990 and 2002. Two observations are noticeable. First, the divergence between GDP price levels is much greater than between price levels of tradables. E. g., the variance of tradables price levels (measured by the coefficient of variation) is in every year significantly smaller than the variance of GDP price levels. Second, the dispersion of tradables price levels declined between 1990 and 2002 whereas the dispersion of GDP price levels remained almost the same. E. g., the coefficient of variation of tradables price levels declined from 0.133 to 0.084, the coefficient of variation of GDP price levels declined from 0.196 to 0.178 (in both cases the outliers Turkey and Switzerland are not taken into account).

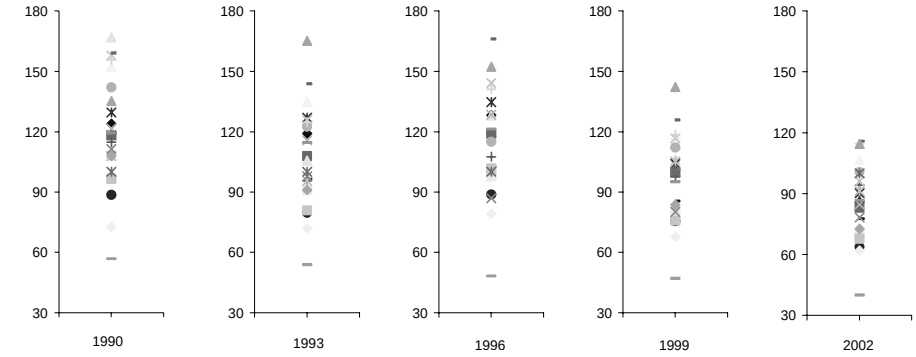
This development does not necessarily reflect a trend towards more PPP conform exchange rates. It might rather be the result of the dollar appreciation against most other currencies since 1995. As shall be shown later the dollar was undervalued relative to PPP for GDP over the first half of the 1990s and even more so relative to PPP for tradables. Hence, the dollar appreciation between 1995 and 2001 caused the dollar to overshoot its GDP PPP level but not its tradables PPP level , e. g., vis-à-vis OECD 24 (see figure 11). For this reason the tradables price levels converged between 1993 and 2002 to a much greater extent than the GDP price levels (see the respective coefficients of variation in figure 7). The strong dollar depreciation between 2001 and 2004 will have increased again the dispersion in price levels and real exchange rates. It is most probable that this time the divergence is greater for tradables price levels as compared to GDP price levels since in 2002 the dollar was still overvalued relative to GDP PPP but slightly undervalued relative to tradables PPP.

Figure 8 shows the relationship between the variance of BH-PPPs of each country and real GDP per head of each country in 2002. The economic meaning of the variance of BH-PPPs as measured by the coefficient of variation can be explained as follows.

[23]) If one excludes these less developed countries from the cross country regression for 2002 then the coefficients $R^2$ decline from 0.86 for all products and 0.61 for tradables (figure 4) to 0.70 and 0.38, respectively.

*Figure 7: Development of the price levels 1990-2002 (Countries of OECD 24 (USA = 100)*

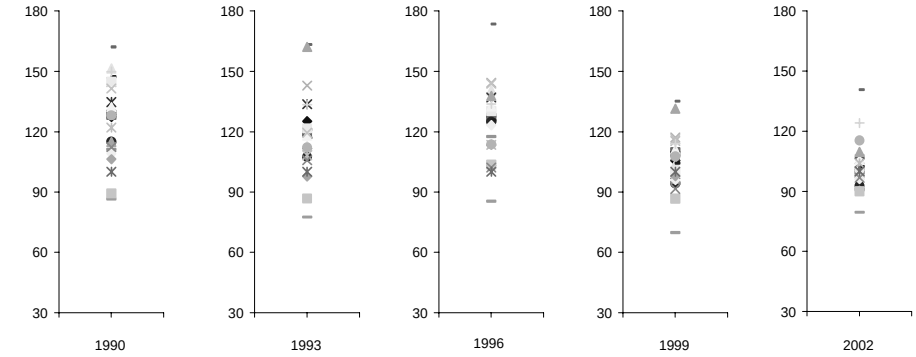
*ALL PRODUCTS*




Coefficient of variation

| | 1990 | 1993 | 1996 | 1999 | 2002 |
|---|---|---|---|---|---|
| 1) | 0.232 | 0.237 | 0.236 | 0.222 | 0.220 |
| 2) | 0.196 | 0.205 | 0.182 | 0.187 | 0.178 |
| 3) | 0.199 | 0.209 | 0.197 | 0.190 | 0.185 |

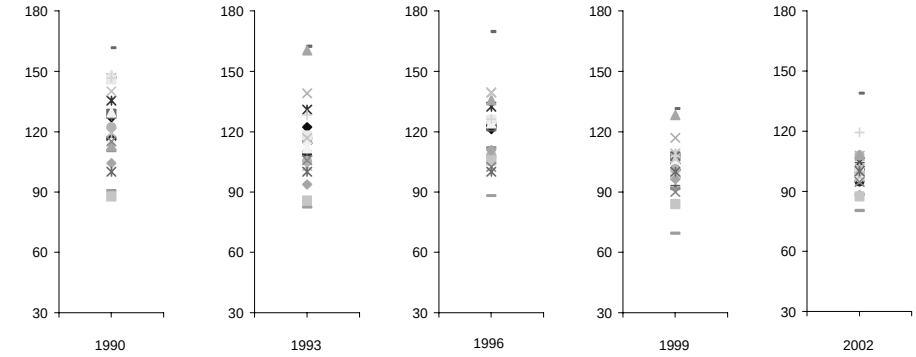
*TRADABLES*




Coefficient of variation

| | 1990 | 1993 | 1996 | 1999 | 2002 |
|---|---|---|---|---|---|
| 1) | 0.157 | 0.171 | 0.149 | 0.137 | 0.124 |
| 2) | 0.133 | 0.137 | 0.107 | 0.102 | 0.084 |
| 3) | 0.141 | 0.154 | 0.132 | 0.116 | 0.115 |

*FINAL GOODS*



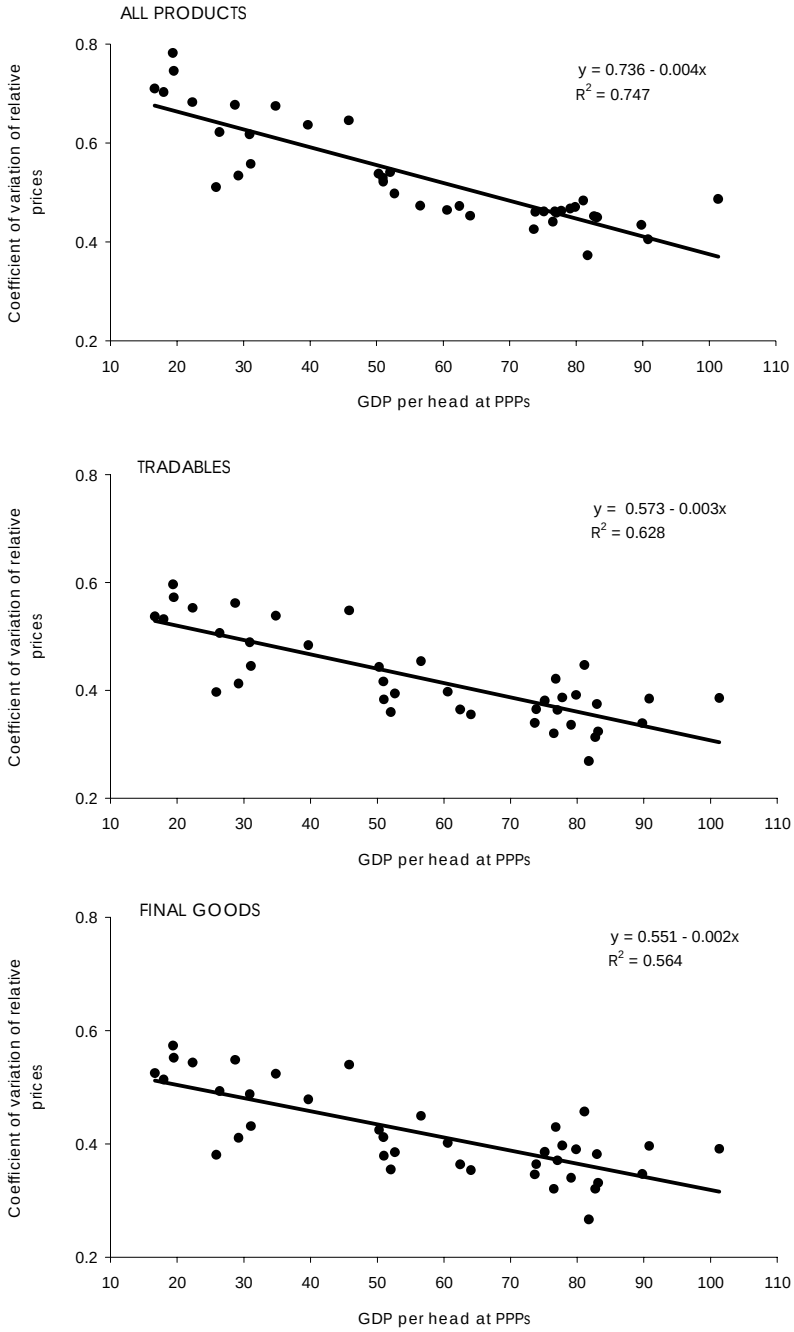

Coefficient of variation

| | 1990 | 1993 | 1996 | 1999 | 2002 |
|---|---|---|---|---|---|
| 1) | 0.152 | 0.170 | 0.139 | 0.132 | 0.120 |
| 2) | 0.131 | 0.139 | 0.096 | 0.097 | 0.078 |
| 3) | 0.140 | 0.159 | 0.125 | 0.112 | 0.113 |

*Notes: This figure documents two tendencies. First, the divergence of national price levels is greater on the basis of GDP as compared to tradables. Second, this divergence declines faster in the former case than in the latter.*

*Source: Wifo calculations using Eurostat, OECD.*

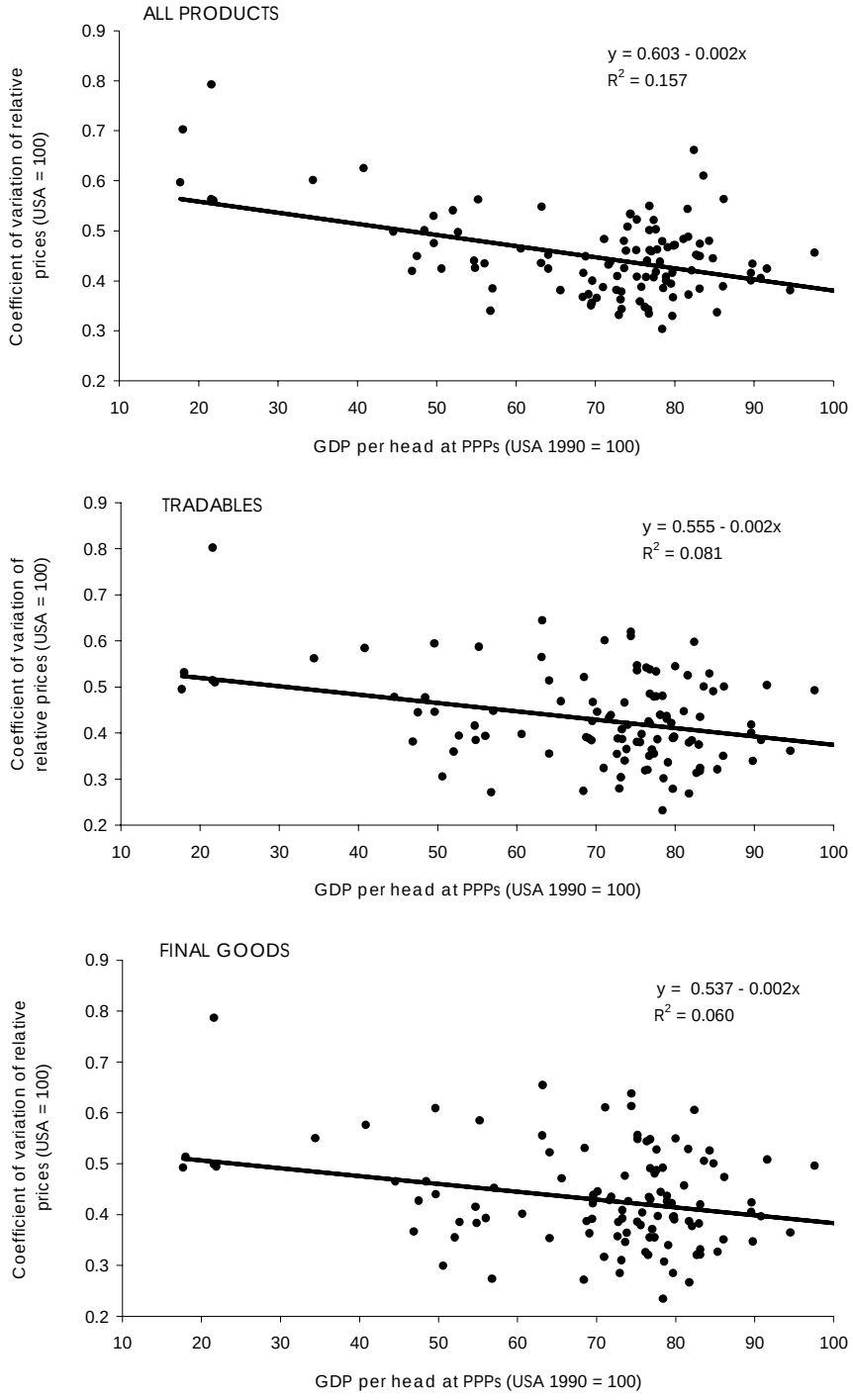
*Figure 8: Variance of relative prices and GDP per head 2002*
*USA = 100*




*Notes: This figure shows that the variance of relative prices (BH-PPPs) in a country tends to be smaller the higher is its real GPD per head. This inverse relationship holds for the relative price structure of all goods and services (GDP) as well as for the relative price structure of tradables and final goods. It is also shown that the variance of relative prices of goods and tradables is smaller than the variance of all goods and services.*

*Source: Wifo calculations using Eurostat, OECD.*

*Figure 9: Variance of relative prices and GDP per head 1990-2002*

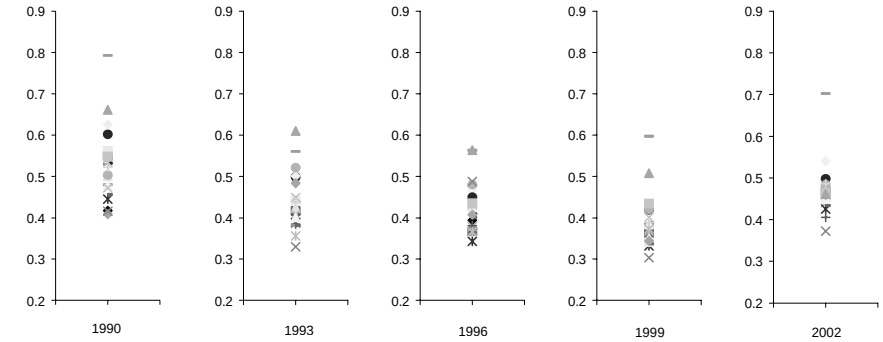



*Notes: This figure shows the slightly inverse relationship between the variance of relative prices of a country (BH-PPPs) and its GDP per head in a panel of 22 OECD countries comprising 5 benchmark years between1990 and 2002.*

*Source: Wifo calculations using Eurostat, OECD.*

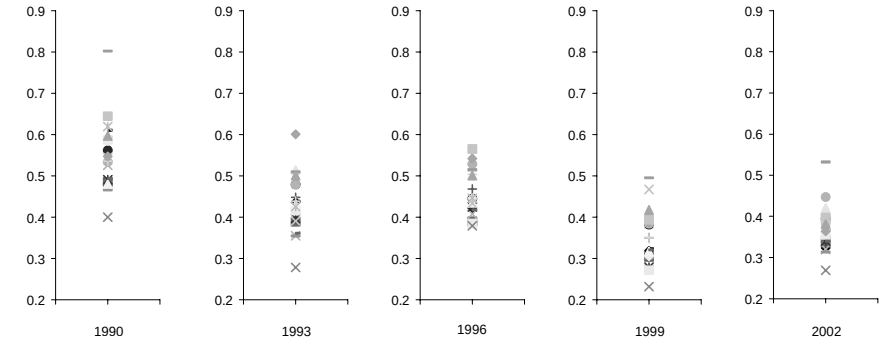
*Figure 10: Development of the coefficient of variation of relative prices 1990-2002*
*Countries of OECD 24 (USA = 100)*

*ALL PRODUCTS*



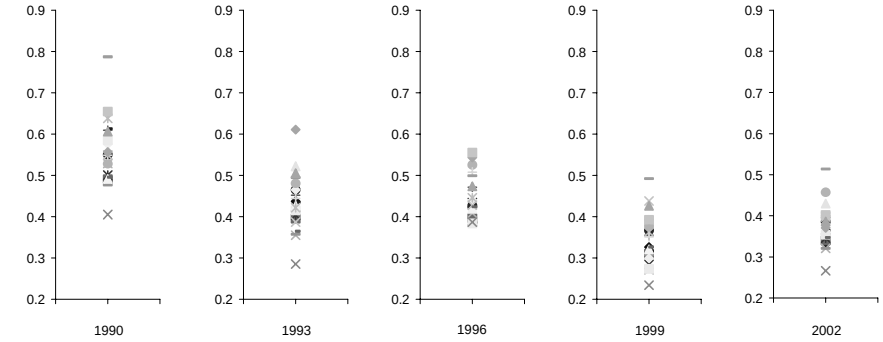

| Average coefficient of variation | | | | | |
|---|---|---|---|---|---|
| 1) | 0.527 | 0.439 | 0.429 | 0.388 | 0.468 |
| 2) | 0.514 | 0.433 | 0.422 | 0.378 | 0.457 |

*TRADABLES*




| Average coefficient of variation | | | | | |
|---|---|---|---|---|---|
| 1) | 0.551 | 0.434 | 0.452 | 0.348 | 0.372 |
| 2) | 0.539 | 0.431 | 0.449 | 0.341 | 0.364 |

*FINAL GOODS*




| Average coefficient of variation | | | | | |
|---|---|---|---|---|---|
| 1) | 0.556 | 0.434 | 0.449 | 0.346 | 0.375 |
| 2) | 0.545 | 0.431 | 0.447 | 0.339 | 0.368 |

1) All countries. 2) Without Turkey.

*Notes: This figure shows that the variance of relative prices (BH-PPPs) of goods and tradables declined between 1990 and 2002. By contrast, the variance of relative prices of all products comprised in GDP remained nearly the same. In 2002 the coefficient of variation of relative prices of all products was on average over 22 OECD countries by roughly 25% higher than the respective coefficient of variation of relative prices of tradables.*

*Source: Wifo calculations using Eurostat, OECD.*

If the law of one price holds for each product (basic heading) k and for each country i the following relation holds:

$PL_{i/R,k} = PPP_{i/R,k}/ER_{i/R} = PPP_{i/R,T}/ER_{i/R} = PL_{i/R,T} = 1$ for all products k (T) and countries i,

where $PPP_{i/R,T}$ denotes PPP for the total of goods (be it GDP or the basket of all tradables).

In this case the structure of relative prices $PPP_{i/R,k}/PPP_{i/R,T} = (P_{i,k}/P_{i,T})/(P_{R,k}/P_{R,T})$ is the same for all goods k (T) and for all countries i. Hence, the variance of $PPP_{i/R,k}$ is zero for each country i if the law of one price generally holds true.

However, a zero variance of BH-PPPs is only a necessary but not sufficient condition for the law of one price and, hence, for PPP to hold for all goods. Even if the structure of relative prices would be identical in all countries the law of one price and PPP will not hold if the nominal exchange rate deviates from (overall) PPP. To see this one can decompose the price level of any good k (relative to the reference country R) in two components, the structure of the relative prices of k ($PPP_{i/R,k}/PPP_{i/R,T}$), and the real exchange rate $RER_{R/i,k}$ ($=PPP_{i/R,T}/ER_{i/R}$):

$PL_{i/R,k} = (PPP_{i/R,k}/PPP_{i/R,T})*(PPP_{i/R,T}/ER_{i/R})$

If relative prices k are identical in country i and country R their absolute levels will be different by the factor ($PPP_{i/R,T}/ER_{i/R}$), e. g., to the extent to which the nominal exchange rate deviates from overall PPP.

The variance of BH-PPPS of a country i can therefore be interpreted as indicator for the similarity of the structure of relative prices in country i and in the reference country R.[24] The smaller these variances are the more similar is the structure of relative prices in the respective countries. If one would observe, e. g., that the variances of BH-PPPs decline over time (indicating convergence in the structure of relative prices) and that the nominal exchange rate deviates progressively from PPP at the same time one could draw the following conclusions. First, goods markets "do their job" by equalizing relative prices through arbitrage. Second, in comparison to goods markets foreign exchange markets work badly insofar as they are unable to equalize absolute prices between countries by moving the exchange rate towards PPP for tradables.

From figure 8 one can draw the following observations:[25])

- First, the variance of relative prices of tradables is significantly lower than the variance of relative prices of all products (the coefficients of variation lie in a range between 0.3 and 0.6 for tradables, and between 0.4 and 0.8 for all products). This observation suggests that the openness of goods markets and, hence, international goods arbitrage tend to reduce the differences in the structure of relative prices between any country and the

[24] For more sophisticated measures of the similarity of price structures see Sergeev, 2001.

[25]) The country sample for variances of relative prices do not cover the U. S. This is so because BH-PPPs for the U. S as reference country amount always to one, hence, its variance of relative prices is zero.

reference country (the coefficient of variation of relative prices of tradables was in every case/country smaller than the coefficient of variation of relative prices of all products.

- Second, the variance of relative prices in country i tends to be the smaller the higher is its GDP per head (this observation holds for all products as well as for tradables). This relationship suggests that international goods arbitrage is the more effective the more advanced an economy is (as approximated by real GDP per head). Input-output linkages between traded and nontraded products might contribute to the fact that the similarity of relative prices of all products increases with real GDP per head.[26])

Figure 9 shows that the inverse relationship between real GDP per head and the variance of relative prices is much weaker in a panel of 22 OECD countries comprising the years 1990, 1993, 1996 1999 and 2002 as compared to the cross section of 40 countries in 2002. There are two reasons for this difference. First, countries where GDP per head is particularly low and where the variance of relative prices is particularly high are included in the cross section for 2002 but not in the panel.[27]) Second, the relationship between real GDP per head and the variance of relative prices was much weaker in the years 1993, 1996 and 1999 as compared to 2002 (as measured by the coefficient $R^2$ of cross section regressions estimated separately for each benchmark year). It remains an open question whether these differences are due to a better quality of the data on BH-PPPs in 2002 as compared to previous benchmark years.

Figure 10 shows that the variance of relative prices of tradables declined considerably between 1990 and 2002. The respective coefficient of variation amounted to 0.551 on average over 22 OECD countries in 1990 and fell to 0.372 by 2002. By contrast, the variance of relative prices of all products remained almost the same, the respective coefficient of variation declined only from 0.527 (1990) to 0.468 (2002).[28]) Hence, the variance of relative prices of all products was 2002 roughly 25% higher than the variance of relative prices of tradables. This difference in the dispersion of relative prices between all products and tradables is even larger for the total of 40 countries in 2002 (the average coefficient of variation was 0.531 for all products and 0.422 for tradables).

The observations made so far can be summarized as follows:

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[26]) Cihak-Holub (2001 and 2003) were the first to address the systematic pattern in the variance of relative prices across countries. They showed that this variance is higher the lower is the GDP price level of a country. Since the overall price level is positively correlated with real GDP per head (figure 4) the relationship desplayed in figure 8 indirectly confirms the results in Cihak-Holub (2001 and 2003).

[27]) If only the 22 panel countries are included in the cross section regression for 2002 the coefficients $R^2$ amount to only 0.63 (all products) and 0.31 (tradables) as compared to 0.75 and 0.63 in regressions over all countries (figure 8).

[28]) Gruber (2002) and Egger-Gruber-Pfaffermayr (2004) find evidence that the variances of relative prices declined between 1980 and 1996 for all products as well as for tradables (they also use data on BH-PPPs from the ICP). However, their results are not strictly comparable to the results of this study since the periods under investigation are different and BH-PPPs are not corrected for distribution margins and indirect taxes).

- First, differences in price levels of tradables across countries are much smaller than differences in the price level of GDP. Hence, deviations of the exchange rate from PPP for tradables are smaller across countries/currencies than deviations from PPP for GDP.
- Second, the price level of tradables relative to GDP is inversely related to real GDP per head in a cross section of countries. The fact that tradables are the cheaper relative to GDP the more advanced an economy is provides the most important explanation why the exchange rate deviates from tradables PPP much less than from GDP PPP.
- Third, the variance of relative prices of tradables in each country is significantly smaller than the variance of relative prices of all products. Hence, the structure of relative prices vis-à-vis a reference country is more similar for tradables as compared to all products.
- Fourth, the variance of relative prices is inversely related to real GDP per head in a cross section of countries (this observation holds for tradables as well as for all products). Hence, the structure of relative prices tends to converge with the level of economic development as approximated by GDP per head.

These observations suggest that the exchange rate deviates from its goods market equilibrium much less when PPP for tradables is used as benchmark as compared to PPP for all products. This presumption concerns both, the dispersion of price levels across countries as well as the dispersion of relative prices within each country vis-à-vis a reference country.

The above observations refer, however, mainly to a cross section of countries in 2002. The following section shall explore how the exchange rate developed over time in relation to PPP for GDP and PPP for tradables.

## 4.2 Extrapolation of purchasing power parities for the period 1970 – 2004

Continuous annual series of PPP for GDP and for tradables were obtained through linear interpolation of the logs of PPPs in the benchmark years 1990, 1993, 1996, 1999 and 2002. This procedure implicitly assumes a constant annual rate of change of PPP between benchmark years. This assumption will not bias the estimates of PPP considerably since the ratio of highly aggregated prices between two countries tend to change smoothly. This holds in particular for the period between 1990 and 2002.

In order to obtain longer time series of PPP a second approach was applied. In this case PPP for 2002 is used as base or reference value (due to revisions of data collection within the Eurostat-OECD PPP Programme the quality of BH-PPP data for 2002 will most probably be higher than for other benchmark years). PPPs for 2002 are then extrapolated backward to 1970 and forward to 2004 using the appropriate deflators from the OECD national accounts data base. More specifically, extrapolated PPP for GDP (EPPPGDP), for tradables (EPPPTR), and for final goods (EPPPFG) are estimated as follows:

$$EPPPGDP_{i/R,t} = PPPGDP_{i/R,2002} * (PGDP_{i,t}/PGDP_{i,2002})/(PGDP_{R,t}/PGDP_{R,2002}),$$

$EPPPTR_{i/R,t} = PPPTR_{i/R,2002} * (PXGS_{i,t}/PXGS_{i,2002})/(PXGS_{R,t}/PXGS_{R,2002})$,

$EPPPFG_{i/R,t} = PPPFG_{i/R,2002} * (PXG_{i,t}/PXG_{i,2002})/(PXG_{R,t}/PXG_{R,2002})$,

Where $PGDP_{i(R)}$, $PXGS_{i(R)}$, and $PXG_{i(R)}$ denote the deflators of GDP, of total exports (goods and services), and of goods exports in country i (in the reference country R).

There are several reasons why extrapolated PPPs will differ from PPPs estimated for benchmark years (other than 2002). First, the methods used in national accounts for deflation across time is not consistent with the methods used in ICP for deflation across space (this problem is analyzed in detail by Hill, 2004). Second, in national accounts "output GDP" is deflated across time whereas in ICP "expenditure GDP" is deflated across space. The ICP convention for treatment of the difference between "output GDP" and "expenditure GDP" , e. g., the use of the nominal exchange rate as PPP for the net balance of goods and services, causes an inconsistency between the development of PPPs and the development of relative GDP deflators (the related problems are investigated by Feenstra-Heston-Timmer-Deng, 2004). Third, original PPPs are based on price structures prevailing in benchmark years whereas extrapolated PPPs are based on the price structure in a (fixed) base year. Hence, the longer the extrapolation period the larger should be the difference between extrapolated PPP and "true" PPP (Stapel, 2004; Stapel gives additional reasons why extrapolated and original PPPs deviate from each other). Fourth, the basket of tradables as defined in this study covers only final goods (no intermediate products) and only a relatively small part of exported services, by contrast national accounts data cover all exports of goods and services.

However, there are two reasons why extrapolated PPPs for tradables might better approximate changes of "true" PPPs for tradables than original PPPs, at least over the short run. The first reason refers to the revisions in data collection within the Eurostat-OECD PPP Programme. These revisions cause changes in PPPs between benchmark years to deviate from changes in relative prices between the countries concerned. More generally, when calculating PPPs main emphasis is laid on comparability of prices across space in order to optimally estimate price level differences between countries. By contrast, when calculating deflators in national accounts priority is given to comparability of prices across time in order to optimally estimate price level changes between different points in time. Hence, experts in PPP statistics advise one not to use PPPs between benchmark years as indicators for changes in relative prices.

The second reason concerns the impact of producer currency pricing (exchange rate pass-through) versus local currency pricing (pricing to market) on PPPs for tradables as estimated in this study. A simple example may help to clarify this issue.

Suppose, there exist only two countries, the U. S. and the Euro area, and suppose further that the dollar appreciates by 10% vis-à-vis the euro. If there is complete producer currency pricing (e. g., the pass-through rate is 100%), then export prices will remain unchanged,

however, import prices in local currency will rise in the Euro area and fall in the U. S. To the extent that this impacts upon domestic market prices (depending on pass-through of import prices to retail prices), export prices as estimated in this study are underestimated for the U. S. and overestimated for the Euro area since domestic market prices (an average over domestic producer and import prices) are taken as proxy for export prices ("bias 1"). If, by contrast, local currency pricing dominates (export profit margins change in response to exchange rate movements) the opposite is the case ("bias 2"). Prices of US exports will actually fall while domestic market and producer prices (taken as proxy for export prices in this study) will remain unchanged (and vice versa for the Euro area).

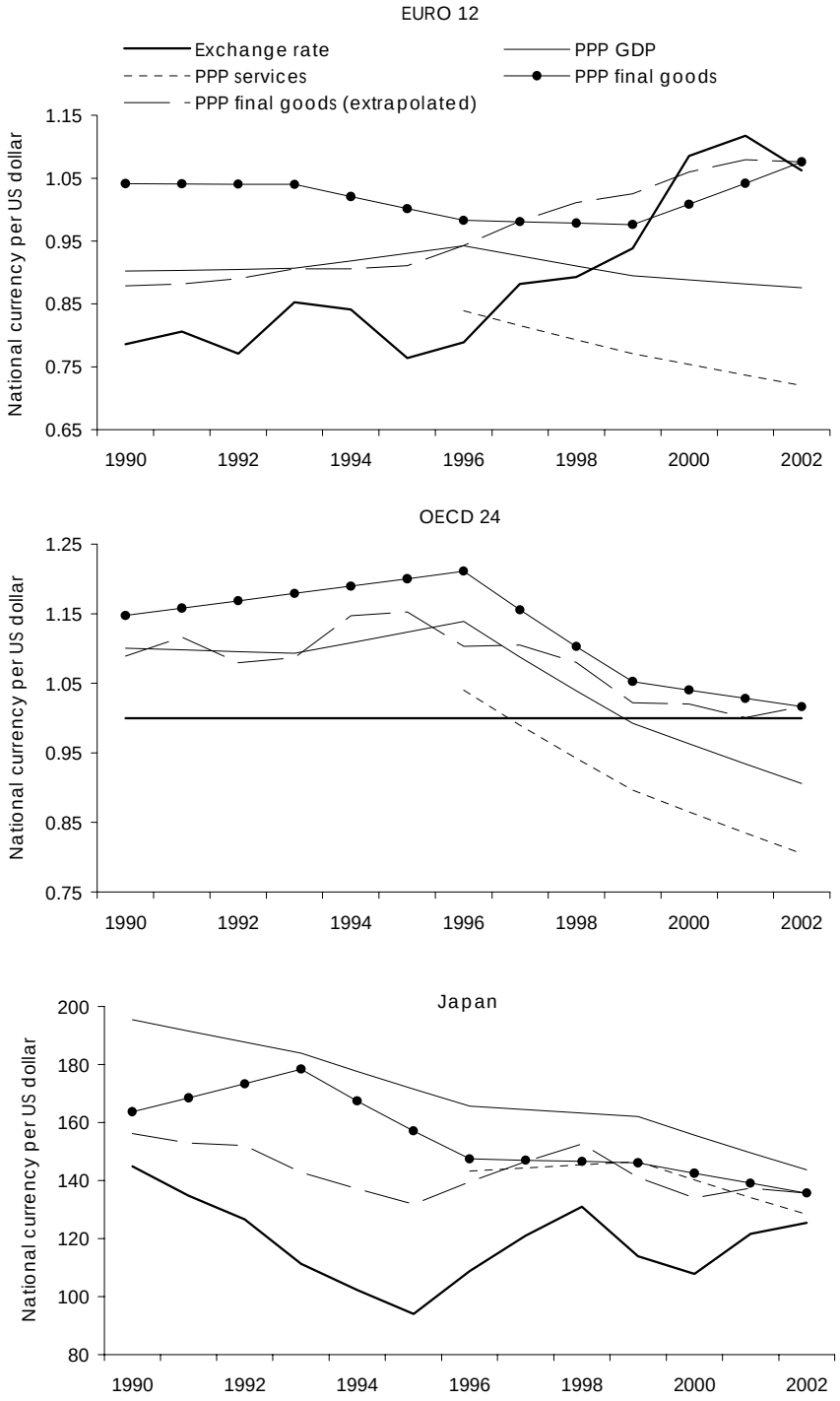
The overall bias depends on the relative importance of producer currency pricing versus local currency pricing. In a recent study Campa-Goldberg (2004) report that producer currency pricing dominates over local currency pricing. According to this study nearly 80% of exchange rate changes are reflected in import prices within a year (cross-country average over a large sample of OECD countries). However, for the U. S. the pass-through rate is only 40%. Moreover, changes in import prices are not completely passed on to retail prices. Hence, "bias 2" could easily dominate "bias 1". Suppose, e. g., the exchange rate pass-through rate to retail prices is 50% in both countries of our example, the share of imports in final demand is 30%, and 20% of exports are priced to the export market. Under these assumptions "bias 1" would result in an underestimation of US export prices by 1.5%, and "bias 2" would result in an overestimation of US export prices by 2%.

Since there is no data base available to empirically evaluate these biases, extrapolated PPPs (which are not affected by these biases) should at least be calculated as complement. If the extrapolated PPPs are to a larger extent correlated with significant exchange rate movements as compared to original PPPs one could presume that the former better describe changes in PPPs for tradables over time than interpolated (original) PPPs estimated for certain benchmark years.

Figure 11 shows the development of the nominal dollar exchange rate and of PPP for GDP, services and final goods (original and extrapolated) for the Euro area, OECD 24, the five largest industrial countries (besides the U. S.), and two smaller countries.[29]) The data for exchange rates as well as for PPP for GDP and services are from the Eurostat-OECD PPP Programme (based on domestic prices), PPP for final goods are estimated in this study.

[29]) In this figure PPP for final goods is displayed rather than PPP for goods and services (tradables) in order to facilitate the comparison between PPP for GDP and PPP of the main components of GDP, e. g., services and (final) goods. However, PPP for final goods differ only little from PPP for tradables due to the small weight of those services which are classified as tradable in this study.

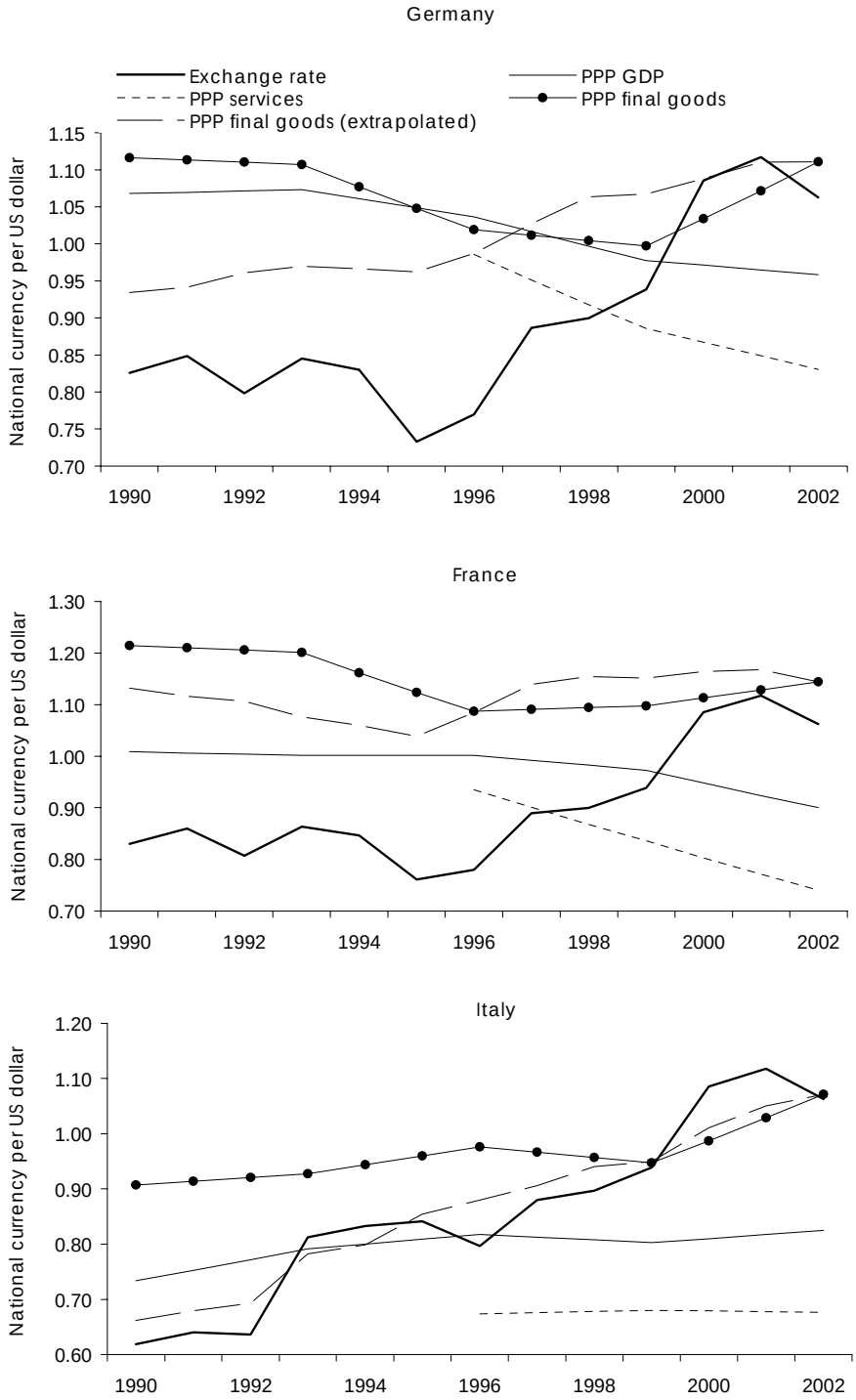
*Figure11: Exchange rates and PPPs*
*USA = 1*




*Notes: This figure shows that US dollar exchange rates were almost permanently undervalued relative to PPP for final goods (or tradables) between 1990 and 2002. Only vis-à-vis the euro was the US dollar overvalued, albeit only in two years (2000 and 2001).*

*Source: Wifo calculations using Eurostat, OECD.*

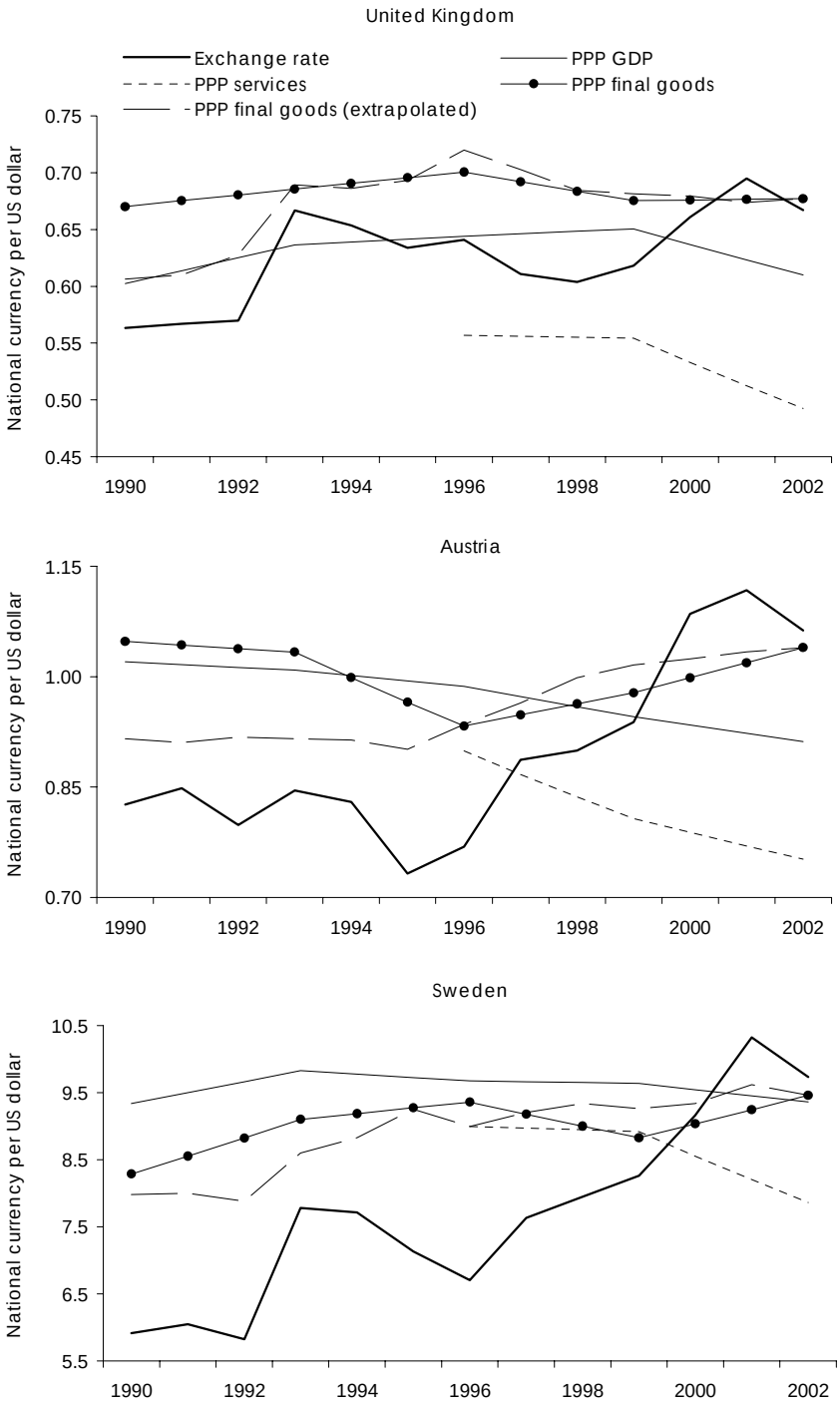
*Figure 11 (continued): Exchange rates and PPPs*
*USA = 1*




*Notes: Over the 1990s the US dollar was permanently undervalued vis-à-vis the 'national' euros of Germany, France and Italy when PPP for final goods (or tradables) is used as benchmark of the nominal exchange rate.*

*Source: Wifo calculations using Eurostat, OECD.*

*Figure 11 (continued): Exchange rates and PPPs*
*USA = 1*




*Notes: Relative to PPP for final goods (or tradables) the US dollar was significantly less undervalued vis-à-vis the British pound as compared to the currencies of Austria and Sweden.*

*Source: Wifo calculations using Eurostat, OECD.*

Relative to PPP for GDP the US dollar exchange rate was significantly overvalued in 2002 vis-à-vis all other currencies comprised in figure 11. However, relative to PPP for final goods the US dollar was by and large "correctly" valued in 2002 (the dollar exchange rate was close to the level of PPP for final goods). This difference is explained by the fact that services are significantly more expensive in the U. S than in other countries so that the level of PPP for services is lower and the level of PPP for final goods is higher than the level of PPP for GDP.[30])

Before discussing the development of exchange rates and PPPs between 1990 and 2002 two clarifications seem appropriate:

- First, the ECU is used as nominal exchange rate for the Euro area prior to 1999. At first, a "virtual" euro was calculated as weighted average of the "national euros" for the period before the introduction of the euro.[31]) It turned out that the differences between the "virtual" euro/dollar exchange rate and the actual ECU/dollar exchange rate were very small (even though both artificial currencies do not comprise exactly the same currencies). Therefore I decided – somewhat pragmatically – to use the ECU as (fictitious) currency for EURO 12 for the years prior to 1999.
- Second, since the US dollar is used as common currency for OECD 24 any change in the exchange rate of the US dollar vis-à-vis the currency of a country which belongs to OECD 24 causes PPP of this country group to also change. E. g., the strong appreciation of the dollar against the currencies of most OECD 24 countries taking place between 1996 and 2001 caused PPPs and hence price levels of OECD 24 to decline relative to the U. S.

Between 1996 and 2001 the US dollar appreciated strongly and persistently against all other currencies covered in figure 11. Since the dollar was extremely undervalued relative to all types of PPPs in 1996 it first did overshoot the level of PPP for services, then the level of PPP for GDP and, finally, the level of PPP for final goods. This sequence can be observed for most currencies with the following exceptions. First, the yen/dollar exchange rate remained undervalued even in 2001 though to a much lesser extent than in 1996. Second, the euro/dollar exchange rate just "touched" the level of PPP for final goods in France but did not exceed it.

The relation between the euro/dollar exchange rate and PPP for GDP and for tradables developed as follows. In 1996 the euro/dollar exchange rate was undervalued by 16.3% relative to PPP for GDP and by 19.7% relative to PPP for final goods. In 1998 the euro/dollar

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[30]) The differences in the valuation of PPP for GDP and for services (at domestic prices) on one hand and for final goods (at export prices) at the other should not matter in this context. As was already shown, PPPs valued at domestic prices differ little from the same type of PPP valued at export prices.

[31]) More specifically, the "virtual" euro/dollar exchange rate was calculated as the ratio between the sum of total export earnings valued in "national" euros over all euro countries and the same sum valued in US dollars (note, that the number of euro countries is 11 since Luxembourg is not comprised in this study).

exchange rate did overshoot the level of GDP PPP, and in 2000 the level of final goods PPP. The dollar remained overvalued in 2000 and 2001 and approached the level of PPP for final goods in 2002. Hence, only in 2000 and 2001 was the euro undervalued vis-à-vis the dollar when final goods PPP is used as benchmark.

If one compares extrapolated PPPs for final goods with the respective original PPPs between 1996 and 2002 one observes that the former increased faster (declined slower in the case of Japan) in most cases/countries during this period of an appreciating US dollar than original PPPs (in other cases extrapolated PPPs and original PPPs rose to roughly the same extent). This observation suggests that extrapolated PPPs might better account for changes in export prices in reaction to significant exchange rate movements as compared to original PPPs (see the above discussion of "bias 1" and "bias 2").

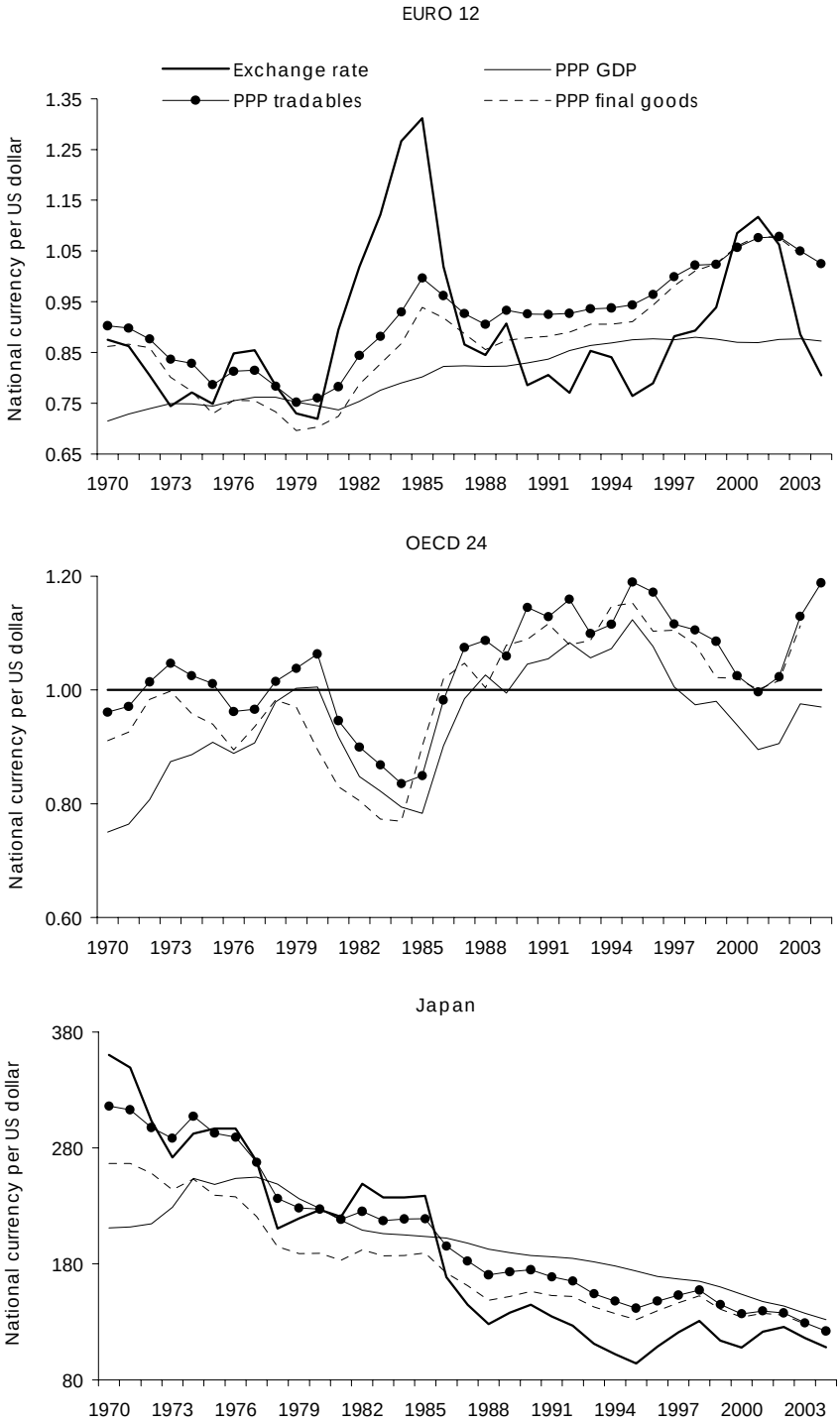
This presumption is confirmed by a comparison between original PPPs and extrapolated PPPs of those countries which experienced a strong rise in their dollar exchange rate between 1992 and 1993 like Italy, the U. K. and Sweden. According to national accounts deflators the significant depreciations of the Lira, the British pound and the Swedish krona caused export prices of the respective countries to strongly increase relative to US export prices. Hence, extrapolated PPPs of these countries also increased between 1992 and 1993. Original PPPs, however, do not reflect this development for two reasons. First, the estimation approach used in this study can not account for pricing to market, i. e., for changes in export profit margins in response to exchange rate changes. Second, the ("original") PPPs for 1992 are obtained only through interpolation of PPPs estimated for the benchmark years 1990 and 1993.

To conclude: The development of exchange rates, original PPPs and extrapolated PPPs between 1990 and 2002 suggest that the latter might better track "true" changes of PPPs for tradables over time as compared to interpolated values of original PPPs.

Figure 12 displays the development of exchange rates and extrapolated PPPs since 1970 (the same countries as in figure 11 are covered). As regards the Euro area the following observations can be made.

Over the long run the US dollar exchange rate has not deviated significantly from PPP for tradables and PPP for final goods, respectively. Between 1970 and 2004 the Euro(ECU)/dollar exchange rate was slightly undervalued relative to PPP for tradables (by 2.6% on average), and slightly overvalued by just 1.9% relative to PPP for final goods. By contrast, relative to PPP for GDP the US dollar was on average overvalued by 10.3%. This discrepancy is primarily due to tradables being comparatively cheaper in the US than in most other countries (as already discussed). Two conclusions could be drawn from this evidence. First, PPP for tradables (but not for GDP) does hold in the (very) long run. Second, extrapolated PPPs for tradables might approximate "true" PPPs for tradables reasonably well.

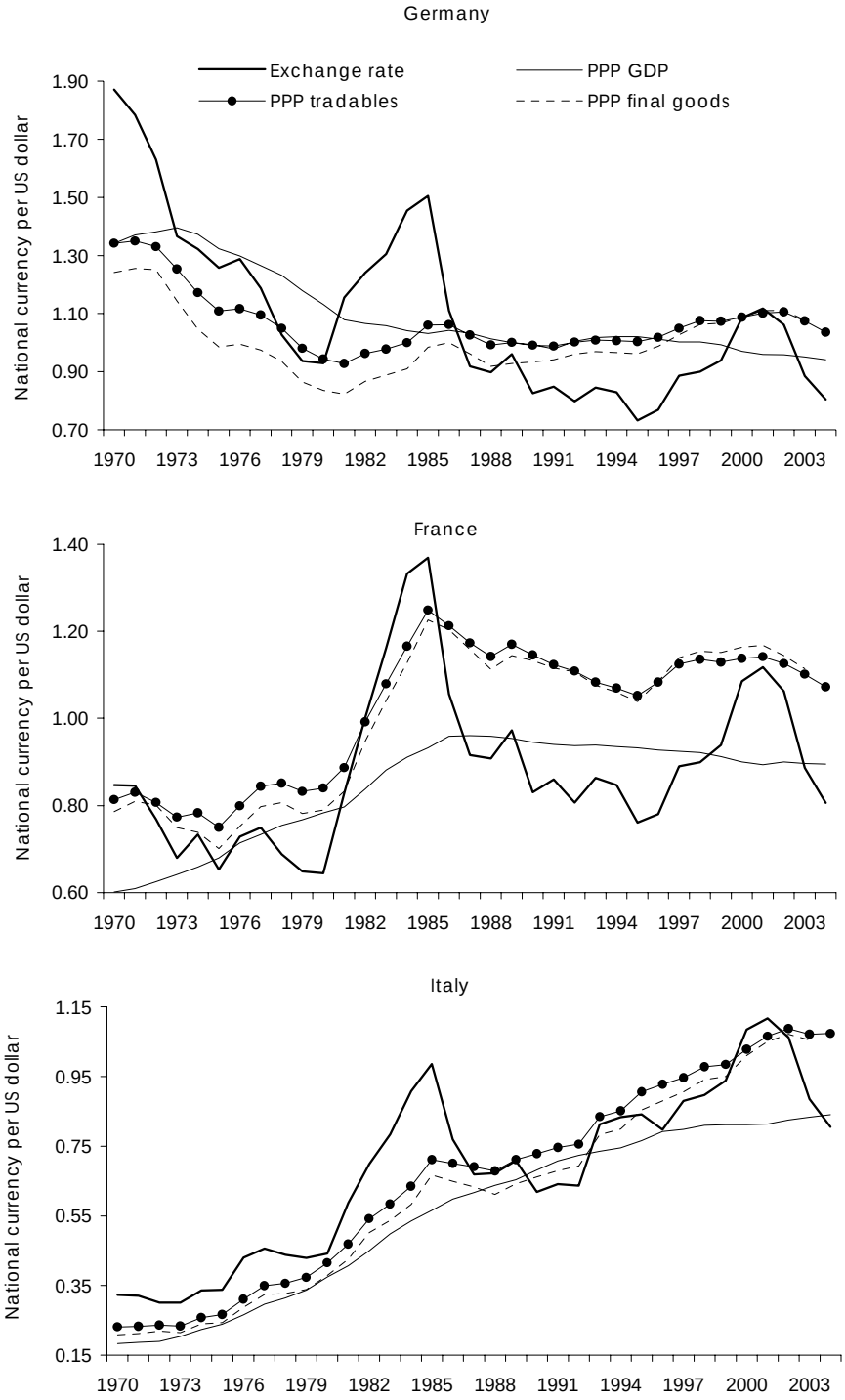
*Figure 12: Exchange rates and PPPs*
*USA = 1*




*Notes: These figures compare the development of US dollar exchange rates and PPPs for different baskets of goods and services since 1970. The figures suggest that the nominal exchange rate fluctuates around PPP for tradables over the long run.*

*Source: Wifo calculations using Eurostat, OECD.*

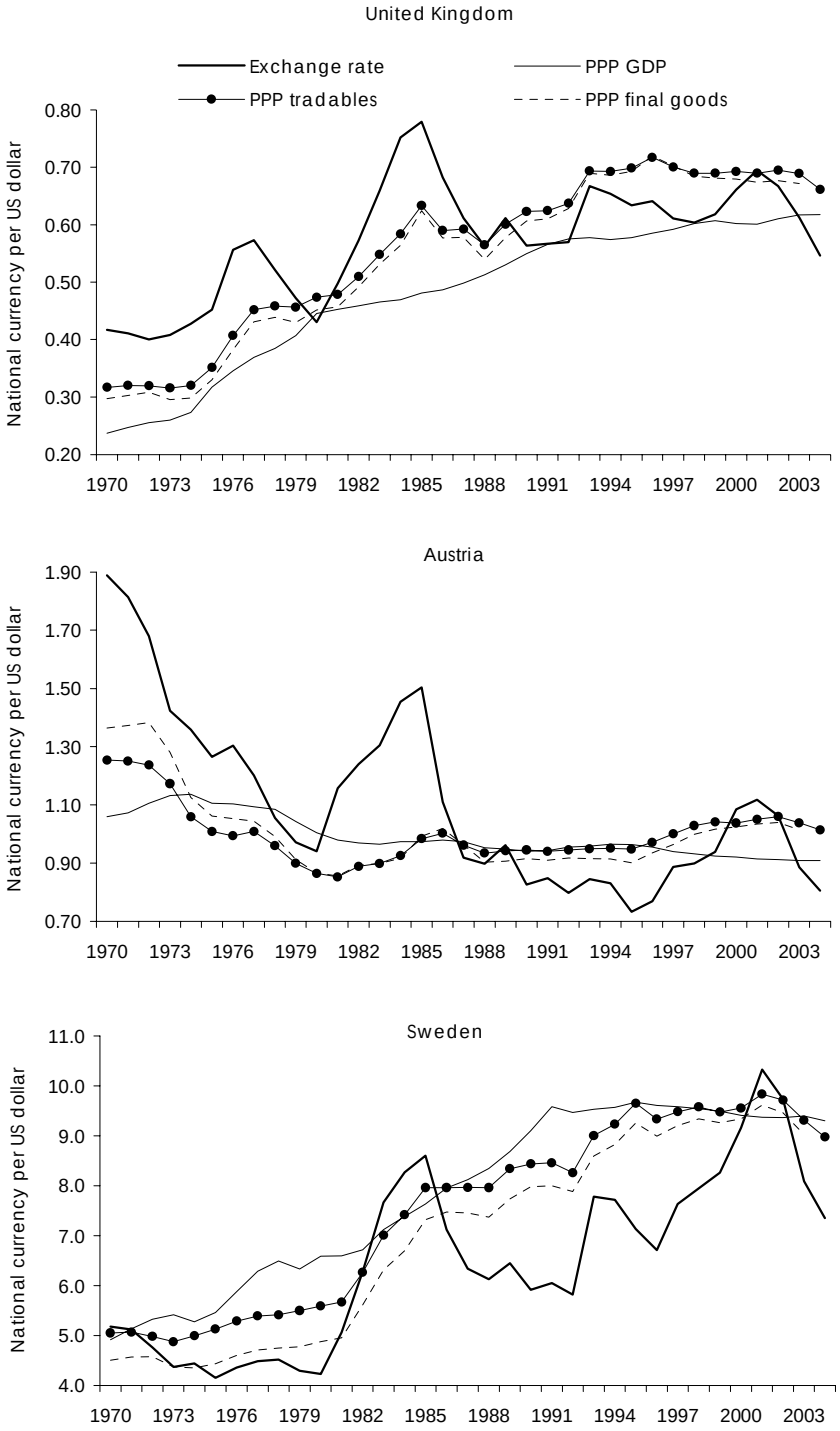
*Figure 12 (continued): Exchange rates and PPPs*
*USA = 1*




*Notes: These figures compare the development of US dollar exchange rates and PPPs for different baskets of goods and services since 1970. The figures suggest that the nominal exchange rate fluctuates around PPP for tradables over the long run.*

*Source: Wifo calculations using Eurostat, OECD.*

*Figure 12 (continued): Exchange rates and PPPs*
*USA =1*




*Notes: These figures compare the development of US dollar exchange rates and PPPs for different baskets of goods and services since 1970. The figures suggest that the nominal exchange rate fluctuates around PPP for tradables over the long run.*

*Source: Wifo calculations using Eurostat, OECD.*

Over several years the nominal Euro(ECU)/US dollar exchange rate moves almost persistently in the same direction as, e. g., 1980/85, 1985/95, 1995/2001 and again since 2001. These movements mostly overshoot the level of PPP for tradables so that periods of an overvalued US dollar as between 1981 and 1986 are followed by periods of an undervalued US dollar as between 1987 and 2000. Hence, figure 12 suggests that PPP for tradables operates as some kind of "attractor" for the nominal exchange rate rather than as an equilibrium towards which the nominal exchange rate converges after a shock.

Movements of the nominal Euro(ECU)/US dollar exchange rate away from PPP for tradables are highly persistent (at least measured at annual data) as , e. g., between 1985 and 1988 or between 2002 and 2004. It seems therefore difficult to attribute these movements (solely) to shocks.

Export prices react much stronger to significant exchange rate changes than GDP deflators. More specifically, export prices of a country with a strongly depreciating currency rise much faster than export prices of the country with the (correspondingly) appreciating currency. By contrast, GDP deflators seem hardly affected by exchange rate changes. Between 1980 and 1985, e. g., prices of total exports of the Euro area rose by 39.0%, those of the U. S. increased by only 6.0%. During the subsequent three years of a falling dollar exchange rate export prices of the U. S. increased by 6.2%, those of the Euro area fell by 3.6%. Similar shifts in relative export prices (as reflected by PPP for tradables) can be observed for the period 1995/2001 (dollar appreciation) as well as for the period 2001/2004 (dollar depreciation).

This pattern suggests that pricing to market contributes considerably to the dynamics of relative export prices in periods of strong and persistent exchange rate movements. If producer currency pricing dominates export pricing behavior PPPs for tradables should not move in the same direction as the exchange rate (figure 12). However, relative export prices are only partially adjusted to exchange rate changes. Hence, nominal exchange rates overshoot PPP for tradables though to a lesser extent than they overshoot PPP for GDP (figure 12). Over the entire period of 35 years the mean deviation of the nominal Euro(ECU)/US dollar exchange rate from PPP (in absolute terms) was 14.1% relative to PPP for GDP, and 11.0% relative to PPP for tradables.

This result is in line with a large body of literature that reports PPP to hold comparatively better when goods price indices are used as compared to CPIs (see Xu, 2003, and Burstein-Eichenbaum-Rebelo, 2004, and the references therein). However, differences in level and development of (export) prices of tradables relative to prices of all goods (GDP) can account for only a small part of the deviations of exchange rates from PPP. This observation holds at least for the Euro(ECU)/US dollar exchange rate as well as for most other dollar exchange rates covered in this study.

The relationship between fluctuations of nominal dollar exchange rates and the comparatively smoother development of PPPs is similar in the case of Japan, Germany, France, Italy, the U. K., Austria and Sweden as already discussed for the Euro area (figure 12).

Even though the results do not seem implausible one has to keep in mind all caveats concerning the extrapolation of absolute PPPs by means of export deflators from national accounts as summarized above.

The main developments of the price levels of all goods, of tradables as well as of final goods in all industrial countries (OECD 24) relative to the U. S. can be summarized as follows (note that PPPs for OECD 24 depict the average price level of OECD 24 relative to the U. S. since the U. S. dollar is used as common currency of the respective countries). Over the 1970s the price level of tradables was roughly the same in OECD 24 as in the U. S. Between 1980 and 1985 tradables in OECD 24 became progressively cheaper relative to tradables in the U. S. due to the strong dollar appreciation. The opposite development took place between 1985 and 1995. In 1995 the price level of tradables was 19.0% higher in OECD 24 as compared to the U. S. The subsequent appreciation of the US dollar reduced this difference to zero in 2001. Since then tradables in OECD 24 have become again more expensive relative to the U. S. due to the strong depreciation of the US dollar between 2001 and 2004.

The following section investigates how shifts in relative price levels of tradables between countries, mainly induced by persistent exchange rate movements, impact upon their relative export performance, e. g., upon their export market share.

## 5. Exchange rates, purchasing power parities and competitiveness in international trade

This section tries to evaluate the plausibility of the PPP estimates by comparing the development of the relative price level of tradables of different countries to the development of their export market shares. For this reason the investigation is kept very simple and does not intend to explain comprehensively the shifts in market shares in international trade of goods and services.

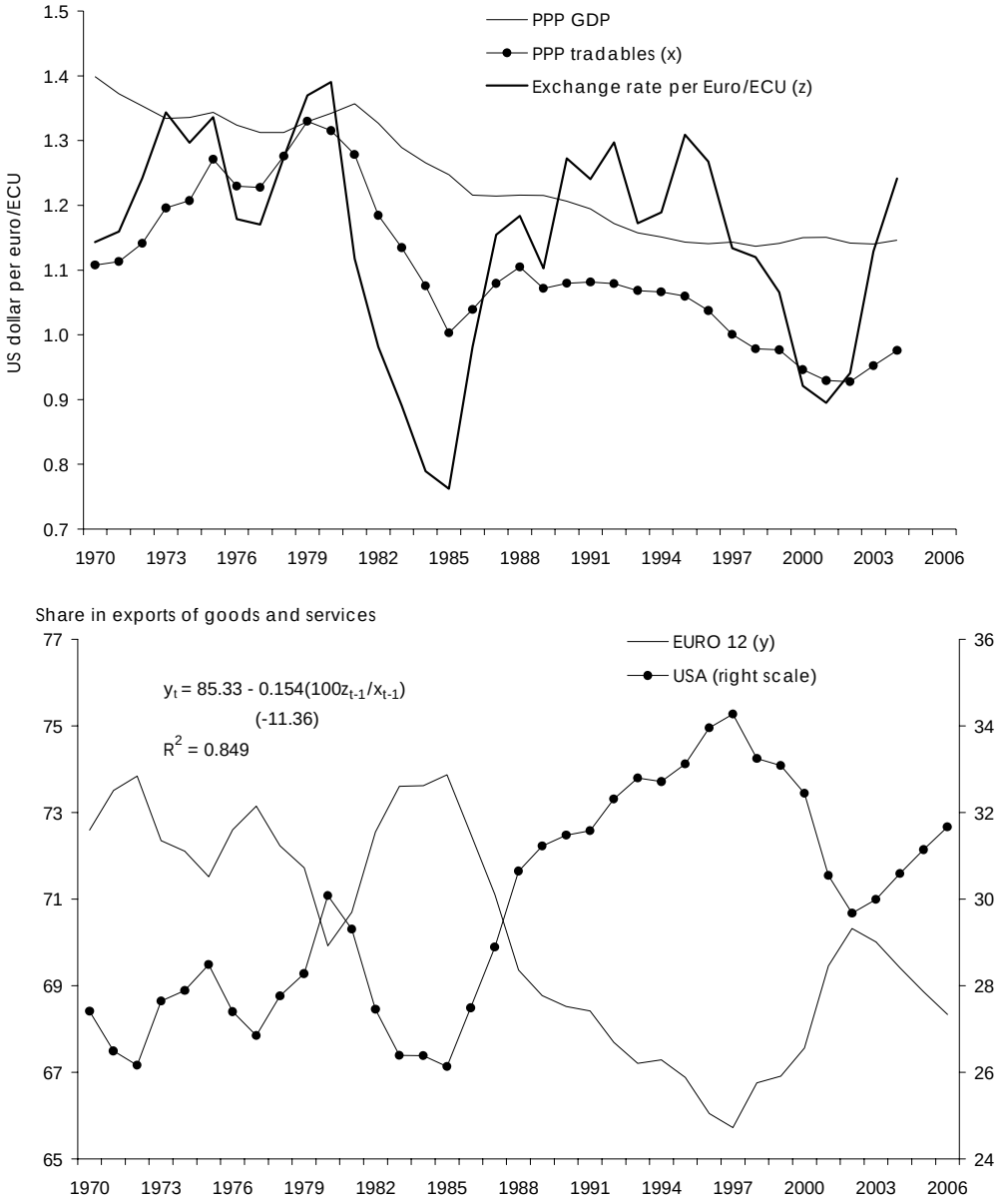
The upper diagram of figure 13 shows the fluctuations of the dollar/euro exchange rate around PPP for tradables. In this and the following figure the nominal exchange rate is expressed as the price of one euro in US dollars (in accordance with standard quotation of euro exchange rates). A comparison between PPP for tradables and PPP for GDP indicates that the former is a much better proxy for goods market equilibrium or attractor over the long run than the latter.

The lower diagram of figure 13 displays the fluctuations of export market shares of the U. S. and of the Euro area. The market is defined as the sum of exports of goods and services of both regions. Hence, the market shares measure the export performance of the U. S. and the Euro area relative to each other.

In figure 13 exports of goods and services of the Euro area cover also intra-trade within the Euro area (exports of services could not be split into the intra-trade and the extra-trade

component). Figure 14 which refers only to goods reports both, total goods exports of EURO 12 (including intra-trade) as well as goods exports to the rest of the world (excluding intra-trade).

*Figure 13: US dollar/euro exchange rate, PPPs and export market share of tradables*




*Notes: This figure compares the fluctuations of the US dollar/euro exchange rate around PPP for tradables (upper diagram) to the shifts in export market shares of the Euro area and the U. S. (the market is defined here as the sum of exports of goods and services of both regions). Note, that ($100z_t/x_t$) is the price level of tradables in EURO 12 relative to the U. S. in percent. The regression is estimated over the period 1980-2002 (t-statistic in parenthesis).*

*Source: Wifo calculations using Eurostat, OECD.*

Market shares are calculated in real terms, e. g., they are derived from exports at constant prices (across time as well as across countries). The latter are calculated as follows. Nominal export earnings in national currency in the base year 2002 are converted into international dollars using PPPs for tradables (or final goods, respectively). These export earnings at US prices are then deflated across time using the appropriate export deflators from national accounts. These real export earnings of single countries are then summed up to real exports of country groups like the Euro area or OECD 24.

When investigating the relative export performance of different industrial countries real exports of OECD 24 are used as market variable, e. g., as denominator when calculating market shares (figure 15).

The strong depreciations of the dollar 1971/73 and 1977/79 are the main reasons for why the dollar/ECU exchange rate was overvalued by 3.7% relative to PPP for tradables on average between 1970 and 1980 (hence, by a greater margin than at the beginning of the decade). The increasingly higher price level of exports from EURO 12 as compared to US exports contributed to a significant shift in markets (the US gained and the Euro area lost 2.7% of their common export market between 1970 and 1980 – figure 13). However, there are also other factors besides the real exchange rate which impact upon relative performance of total exports (e. g., changes in the structure of supply and demand by types of products caused by innovations or supply shocks). During the 1970s these other factors were probably more important for shifts in total export market shares than during the subsequent period due to the impact of the two oil price shocks on changes in the structure of supply and demand in international trade).

Over the first half of the 1980s the Euro area regained these market shares, mainly due to an overshooting depreciation of the dollar/ECU exchange rate. The subsequent and again overshooting appreciation of the ECU induced a strong shift in export market shares from the Euro area to the U. S. Between 1985 and 1997 the Euro area lost and the U. S: gained 8.1% of their common market. The fall of the ECU/euro exchange rate vis-à-vis the US dollar between 1995 and 2001 enabled the Euro area to regain market shares from the U. S. between 1997 and 2002. However, the strong appreciation of the euro since then has again reversed the shifts of export market shares between the U. S. and the Euro area. According to OECD forecasts exports of goods and services of the U. S. will continue to rise significantly faster than those of the Euro area (at least) until 2006 (figure 13).

In spite of the strong increase in US export market shares between 1985 and 1997 and again since 2001 the current account of the U. S. deteriorated almost continuously over these periods. This seemingly contradictory observation is explained by US imports rising still faster than US exports, mainly because GDP grew significantly higher in the U. S. as compared to almost all other industrial countries (the coincidence of a strong undervaluation of the US dollar relative to tradables PPP, the related increase in US export market shares and a strong deterioration of the US current account is discussed in Schulmeister, 2000A).

A simple regression of the market share of EURO 12 on the price level of tradables relative to the U. S. documents the astonishingly tight relationship between both variables (all regressions covered in figures 13, 14 and 15 are estimated over the period 1980 to 2004 and, hence, exclude the period of international turbulences in the 1970s). The coefficient of the relative price variable (0.154 with a t-statistic of -11.36) implies the following relation. If the price level of tradables increases in the Euro area by 10 percentage points faster than in the U. S. then 1.54% of export market shares are expected to shift from the Euro area to the U. S. over the subsequent year (figure 13).

Figure 14 displays the relationship between the overshooting of the US dollar/euro exchange rate relative to PPP for final goods and the relative goods export performance of the Euro area and the U. S. (hence, figure 14 differs from figure 13 only in that it refers to exports of goods and to PPP for final goods, correspondingly). For total goods exports of EURO 12 (including intra-trade) the relationship between exchange rate overshooting and market share dynamics is very similar to total exports of goods and services (compare the respective diagrams and regressions in figure 13 and 14). As expected, market shares of goods exports excluding EURO 12 intra-trade react stronger to changes in relative price levels than market shares including EURO 12 intra-trade. If tradables prices increase in the Euro area by 10 percentage points faster than in the U. S. goods exports of the Euro area to the rest of the world are expected to rise by 2.22 percentage points slower than US goods exports.

Figure 15 compares changes in relative price levels of tradables to changes in export market shares of goods and services. Relative price levels and market shares refer to OECD 24 as a whole. The figure covers the same countries as figures 11 and 12 with the exception of OECD 24 (which serves as reference country), and the U. S., which is separately specified in figure 15.

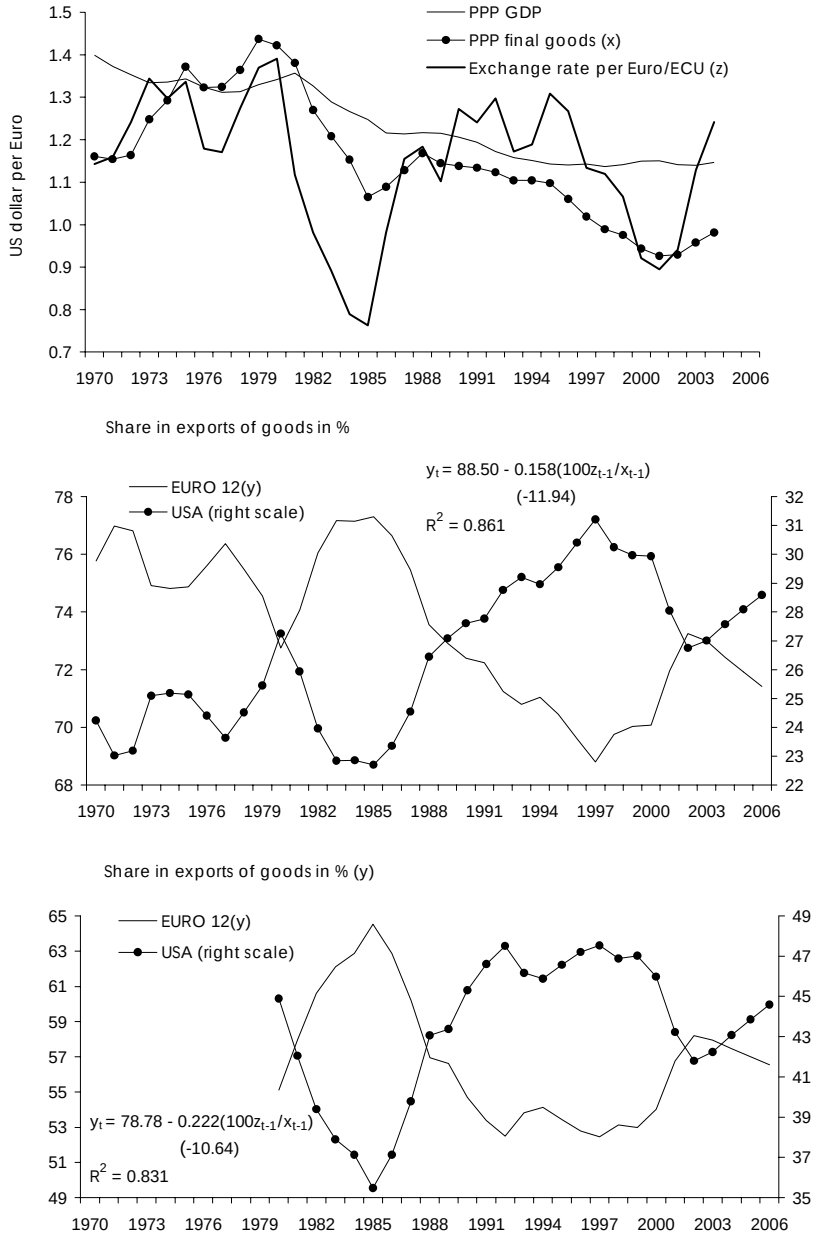
The relationship between relative prices and market shares is in five out of nine countries relatively close. These cases concern EURO 12, U. S., Italy, Austria and Sweden. The fit of a simple regression which explains market shares only by relative price levels is reasonably good for these countries (given the extremely simple specification of the equation). The coefficient of determination ($R^2$) is higher than 0.4 and the t-statistic of the slope coefficient exceeds 4.0 in all cases.

US exports seem particularly sensitive to changes in relative prices of tradables as can be seen from the figure as well as from the (simple) regression (the coefficient of the relative price level is by far highest as is the coefficient of determination). This implies that the US economy profits from an overshooting depreciation of its currency more than other industrial countries.

The Japanese economy lost export market shares almost continuously between 1985 and 2001. This development was most probably related to the strong appreciation of the yen between 1982 and 1994 (among other factors). However, this relationship can not be fully reflected in the simple regression due to the high volatility of the exchange rates of the yen

which caused the relative price level of Japanese tradables to strongly fluctuate from year to year. Hence, the coefficient of determination is comparatively low (figure 15).

*Figure 14: US dollar/euro exchange rate, PPPs and export market shares of goods*

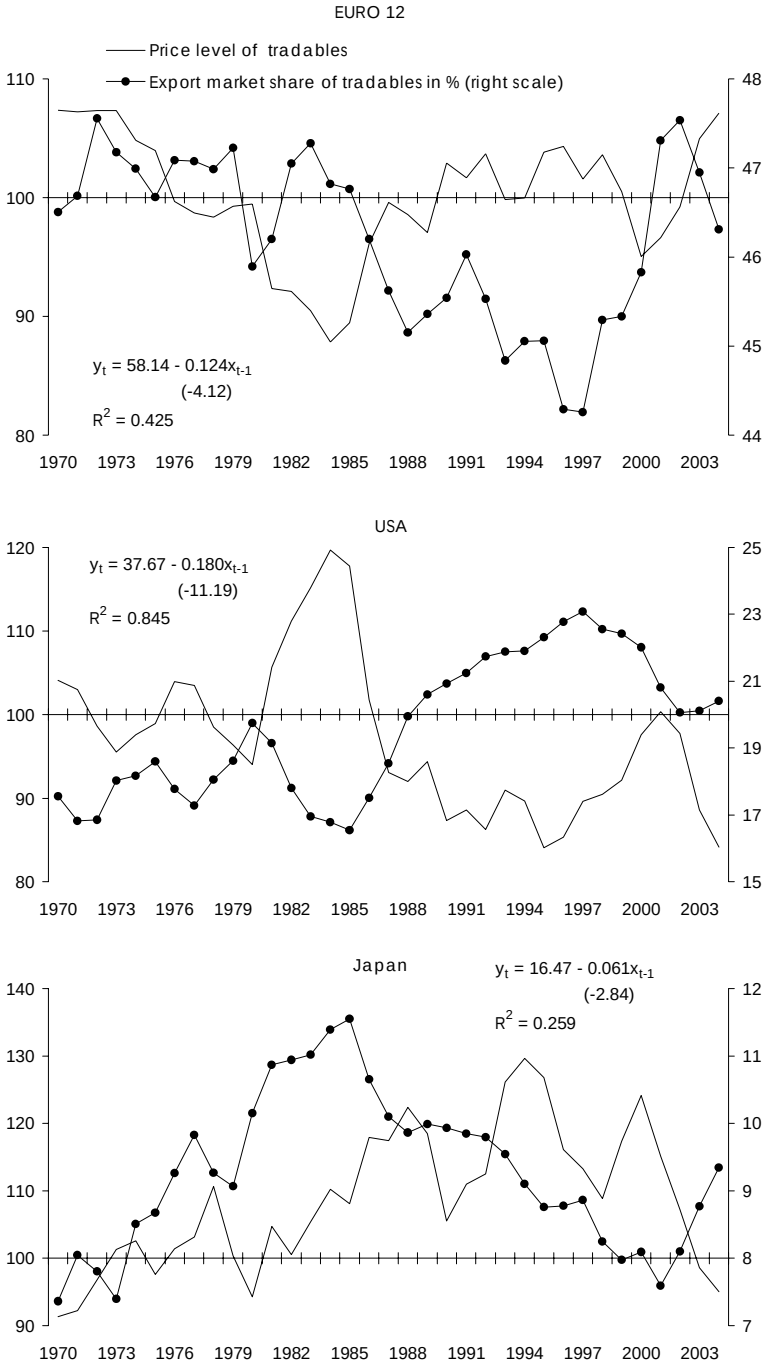



*[1]) Excluding intra – EURO 12 – trade.*

*Notes: This figure is similar to figure 13. It shows the relationship between the overshooting of the dollar/euro exchange rate and relative export performance of the U. S. and EURO 12. The figure differs from figure 13 in that it refers to PPP for final goods and to exports of goods. Note, that ($100z_t/x_t$) is the price level of final goods in EURO 12 relative to the U. S. in percent. The regression is estimated over the period 1980-2002 (t-statistic in parenthesis).*

*Source: Wifo calculations using Eurostat, OECD.*

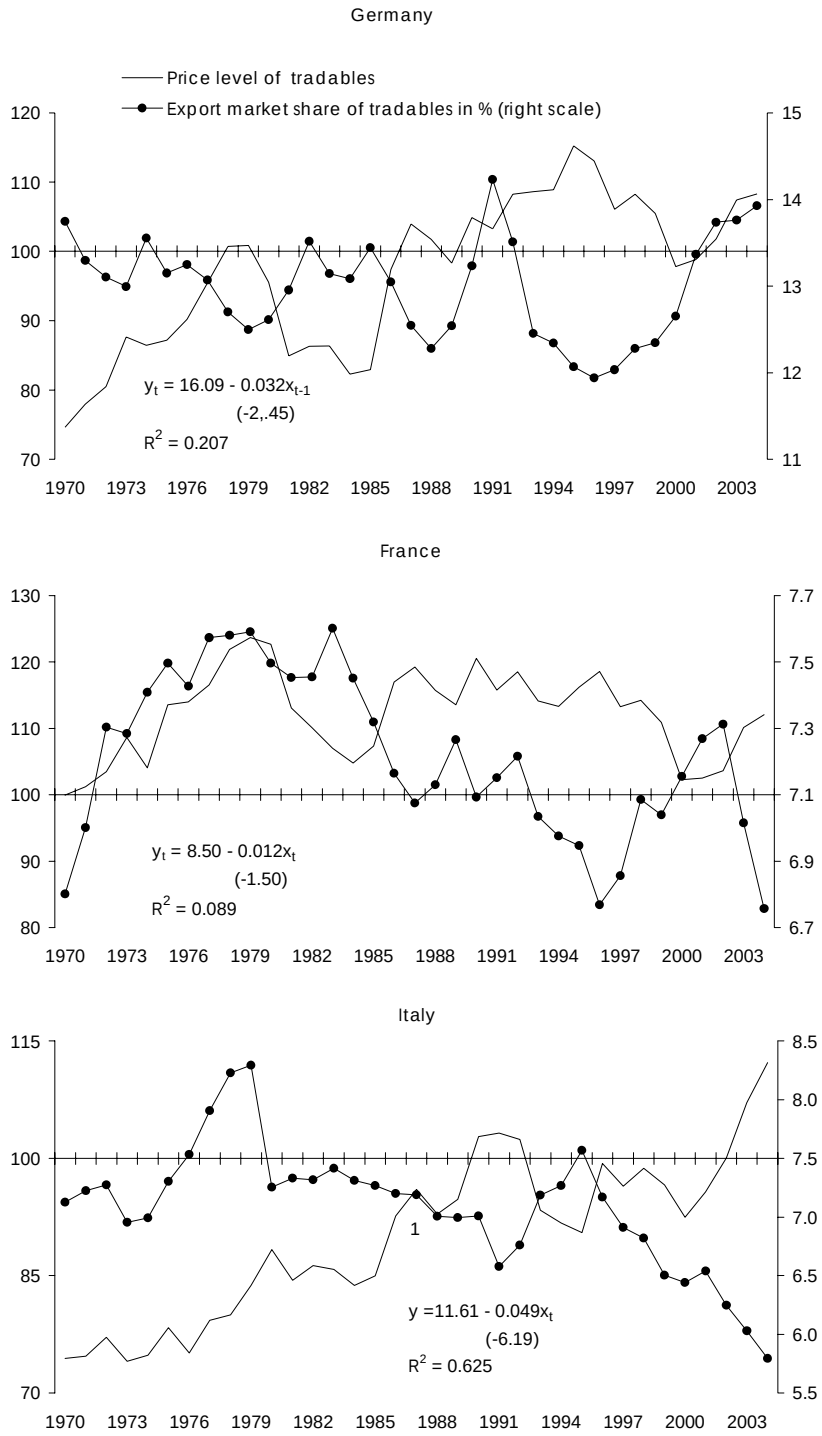
*Figure 15: Price level and export performance of tradables*
*OECD 24 = 100*




*Notes: These figures show the (mostly) inverse relationship between the price level of tradables of a country relative to the OECD 24 average and its export market share. The regressions are estimated over the period 1980 to 2004, t-statistics are given in parenthesis.*

*Source: Wifo calculations using Eurostat, OECD.*

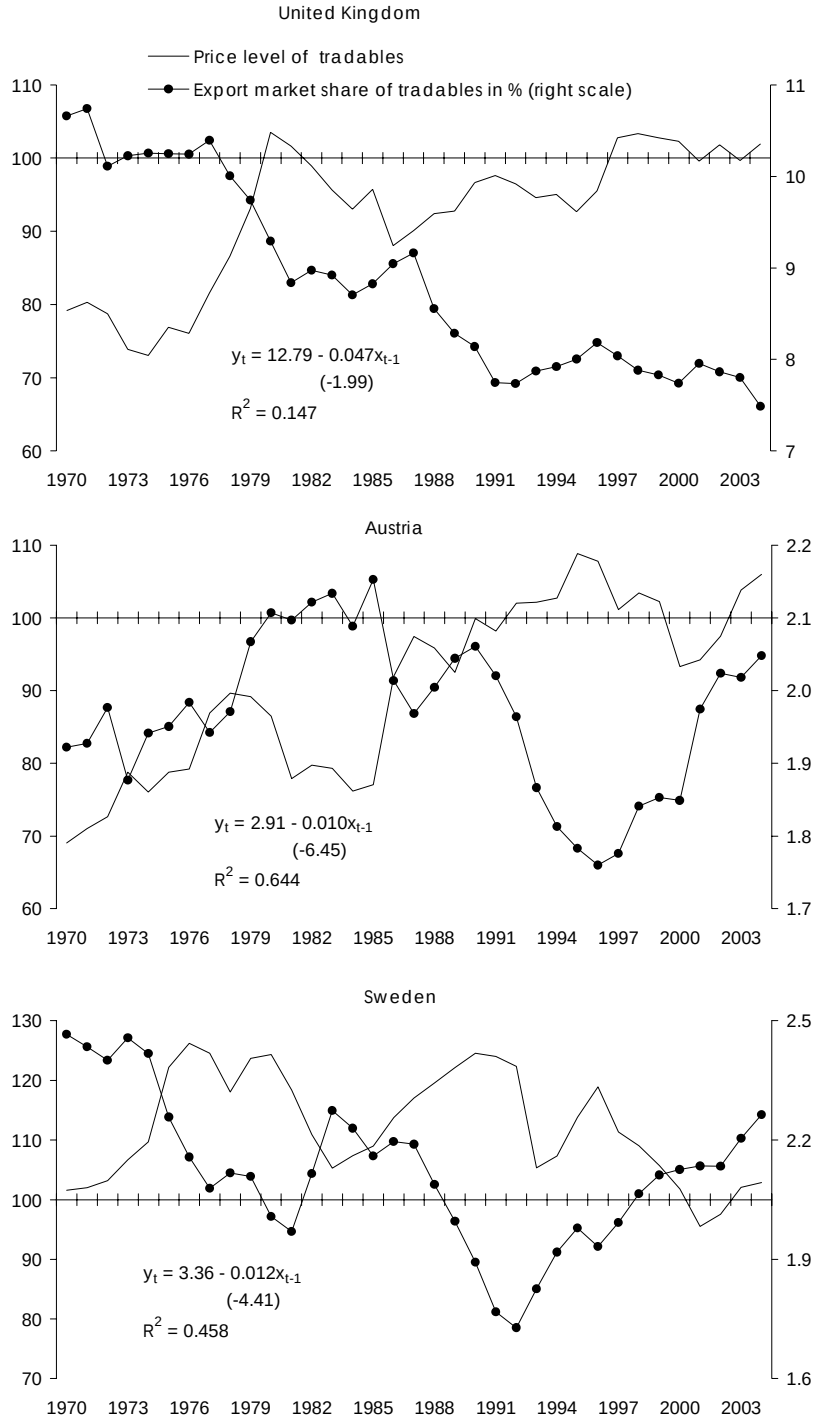
*Figure 15 (continued): Price level and export performance of tradables*
*OECD 24 = 100*




*Notes: These figures show the (mostly) inverse relationship between the price level of tradables of a country relative to the OECD 24 average and its export market share. The regressions are estimated over the period 1980 to 2004, t-statistics are given in parenthesis.*

*Source: Wifo calculations using Eurostat, OECD.*

*Figure 15 (cont.): Price level and export performance of tradables*
*OECD 24 = 100*




*Notes: These figures show the (mostly) inverse relationship between the price level of tradables of a country relative to the OECD 24 average and its export market share. The regressions are estimated over the period 1980 to 2004, t-statistics are given in parenthesis.*

*Source: Wifo calculations using Eurostat, OECD.*

For Germany, the inverse relationship between the relative price level of tradables and export market shares seems closer according to the diagram as compared to the regression. The probably most important reason for this discrepancy concerns statistical biases due to German unification as can be seen from figure 15 (since the figures in this section only aim at providing some rough evidence on the relationship between movements in relative prices of tradables and shifts in export market shares the OECD time series on German exports were not corrected for these biases). If one inserts into the simple regression a dummy variable for 1991 and 1992 then the coefficient of determination increases significantly (from 0.207 to 0.456).

A cross-country comparison of the coefficients of relative price levels in the regressions displayed in figure 15 suggests that the relative export performance of Germany, the United Kingdom, Italy and Japan is less sensitive to changes in relative prices of tradables as compared to smaller economies like Austria and Sweden (the slope coefficient for France is similarly big, however, the regression for this country is the only one where the coefficient of the relative price level is statistically not significant).

Three observations suggest that PPP for tradables estimated in this study can be taken as a sufficiently good approximation of the "true" PPP of internationally traded goods and services. First, the relationship between relative price levels based on tradables PPP and export market shares is clearly inverse in most cases. Second, the coefficients of determination of the respective regressions are relatively high (given their extreme simple form), and the coefficients of the relative price level of tradables is significant in almost all cases (figures 13 to 15). Third, the nominal exchange rate fluctuates around PPP for tradables as its long-run mean (figure 12).

## 6. Evaluation of the estimates of PPP for tradables and final goods

In a recent study Feenstra-Heston-Timmer-Deng (2004) raise an important issue. They demonstrate that the method of calculating PPP for GDP developed within the ICP framework and still applied in projects like the Penn World Tables (PWT) or the Eurostat-OECD PPP Programme does not clearly distinguish between two concepts of real (spatially deflated) GDP. The first is the production or output-side measure of real GDP (real $GDP^o$), the second is the expenditure-side measure of real GDP (real $GDP^e$). The difference between these two concepts lies in the spatial deflation of exports and imports. In order to facilitate the calculation of PPP for GDP the current exchange rate is taken as PPP for the net foreign balance. By this convention the PWT project as well as the Eurostat-OECD PPP Programme actually calculate PPP for $GDP^e$ which is, however, mostly interpreted as GDP for $GDP^o$ (as in Sala-i-Martin, 1997, and similar studies).

In order to demonstrate empirically the importance of distinguishing between PPP for $GDP^e$ and PPP for $GDP^o$, Feenstra et al. (2004) estimate PPPs for exports and imports of goods separately using unit values from trade statistics as proxies for export and import prices. Their results for PPPs of goods exports for 14 EU countries and the U. S. differ significantly from the results of this study.[32]) This can be seen if one compares the price levels of goods exports according to Feenstra et al. (2004) with the price level of (final) goods exports estimated in this study (see table 4 and figure 1 in the annex). The main differences can be summarized as follows:

- First, according to Feenstra et al. (2004) there prevails a tight and positive relationship between real GDP per head and the price level of exports. E. g., prices of US exports reported by these authors are almost 50% higher than those of the least developed countries in the sample (Greece, Portugal, Spain). According to the estimates of this study such a relationship can not be observed for this sample of 15 industrial countries (only if the cross section comprises also less developed countries can such a relationship be observed. However, even in this case is the relationship only slightly positive – see figure 4).
- Second, the dispersion of export price levels across these (industrial) countries is much larger on the basis of the estimates of Feenstra et al. (2004) as compared to the estimates of this study (this difference is related to the strongly positive relationship between real GDP per head and the level of export prices as implied by the data set of Feenstra et al. (2004). This difference implies that the law of one price holds better on the basis of the estimates of this study as compared to the estimates of the Feenstra et al. (2004).
- Third, there prevails a pronounced inverse relationship between real GDP per head and the price level of exports relative to GDP according to the estimates of this study. Such a relationship is in line with the models developed by Balassa (1964), Samuelson (1964), Kravis-Lipsey (1983) and Bhagwati (1984). These models imply that in more advanced economies goods and, hence, also exported goods, are cheaper relatively to services as compared to less advanced economies. According to the estimates in Feenstra et al. (2004), the relationship between real GDP per head and the relative price level of exports to GDP is only slightly inverse and statistically insignificant (annex figure 1). This result is mainly due to the strong positive correlation between export price levels and real GDP per head in the data set of Feenstra et al. (2004).

These different results could be caused either by differences in the estimation method (Feenstra et al.; 2004) use the GK procedure, this study uses the EKS procedure) or by

[32]) It would have been interesting to compare the results of this study also to those obtained by Van Ark-Timmer (2005). However, the (incomplete) version of their paper (as of June 2005) provides only the concept for the estimation of industry-of-origin PPPs but no results.

differences in the data basis (Feenstra et al.; 2004) use export unit values as proxies for "true" export prices, this study uses domestic market prices corrected for indirect taxes and distribution margins).

Differences in estimation methods do not seem to significantly contribute to the differences in results. This conclusion can be drawn from empirical results of using either the EKS or the GK method. If both methods are applied to the same set of BH-PPPs the resulting PPPs differ little from each other. This can be seen from a comparison of aggregated EKS-PPPs to aggregated GK-PPPs as calculated by OECD for the benchmark years of the Eurostat-OECD PPP Programme (Eurostat-OECD, 2005; OECD, 2002, 1999).

However, the different types of price data used in Feenstra et al. (2004) and in this study cause the results to differ significantly. Feenstra et al. (2004) use export unit values as proxies for export prices. A unit value simply measures the average export earning per kilo or ton of a certain class of product. Since products comprised even at the most disaggregated level of trade statistics are not strictly homogenous, any unit value is composed of two components, a price component and a quality component. The dispersion of export unit values across countries for the same class of products (defined at the most disaggregated level of trade statistics) can then be interpreted as an indicator for the inhomogeneity of internationally traded goods comprised in the same product category. Unit values of commodities like a certain type of crude oil or basic manufactures like a certain type of steel will differ little across exporting countries, hence, unit values can in these cases be interpreted as indicator for prices rather than quality. The more a product can be refined and differentiated the greater will be the dispersion of unit values.

Within each product category the most advanced economies will specialize on goods of high quality, less developed economies will specialize on comparatively simpler kinds of goods in the same product category. Hence, export unit values should be the higher the more advanced an economy is. In order to examine this hypothesis export unit values of several products at the 5-digit-level of SITC 3 were selected for the 41 countries covered by this study. These unit values are then compared to real GDP per head of the respective countries (annex figure 2). In order to avoid data mining the product categories were selected according to the following criteria:

- First, select from the UN trade data base for 2002 all SITC-positions at the 5-digit level which refer to a final good comprised by a BH-PPP in the Eurostat-OECD PPP Programme (table 2 in the annex).
- Second, select for each of the six subgroups of goods (except machinery and equipment) specified in this study that SITC-position for which US export earnings were highest in 2002.

For two reasons SITC positions for investment goods were selected differently. First, there are no volume data in UN trade statistics for US exports of investment goods. Second, investment

goods are by far the most important type of product of industrial countries' exports of final goods (see figure 5). Therefore two product groups were selected which represent final inputs to investment goods and for which volume data for the U. S. were available, namely, parts of aeroplanes (SITC 72295) and parts for the internal combustion piston engines (SITC 71391). In addition, 9 SITC positions were selected according to the above criteria but using the rank in German export earnings as selection criterion (instead of US export earnings). These SITC positions include investment goods like goods vehicles (SITC 78219) or machinery having individual functions (SITC 72849) as well as final inputs to investment goods like transmission apparatus (SITC 76432), parts of data processing machines (SITC 75997) or gear boxes (SITC 78434).

Several observations on the relationship between mean and variance of unit values of different types of products and real GDP per head of exporting countries can be derived from annex figure 2:

- If the average unit value of exports covered by a certain SITC position is relatively high (compared to the average over all 17 product groups comprised in annex figure 2) then the variance of the respective unit values across exporting countries is comparatively high, too. This applies to products like digital integrated units (computer chips), turbo-jets (this SITC position refers to certain types of engines, not aircrafts), parts of aircrafts, transmission apparatus, parts of data processing machines or medicaments (in the following I label exports in these five SITC position "high-tech products"). In these product categories the highest unit value is at least roughly 20 times higher than the lowest unit value. The variance of unit values is particularly large in the case of computer chips, parts of data processing machines and turbo-jets. The relationship between the average level of unit values and their variance suggests that products with a high value (added) per kilo are to a larger extent differentiated across exporting countries than technologically less "advanced" products.
- The relationship between real GDP per head and export unit values is closer for "high-tech products" as compared to other products. This conclusion can be derived from the simple regressions displayed in the diagrams annex figure 2. The coefficient of determination as well as the coefficient of real GDP per head as "explaining" variable is in most cases higher for "high-tech products" as compared to the other product groups comprised in the figure. These results suggest that the international division of production is particularly pronounced in (technologically advanced) product categories, characterized by a high value (added) per kilo and a wide range of product differentiation. Within these product categories the most advanced industrial countries specialize on the production of technologically and qualitatively most advanced goods which earn the highest export unit values. The less advanced economies specialize on the production of standard versions of goods which need less human capital and technological knowledge.

- In technologically less advanced (more traditional) product categories the variance of unit values across exporting countries is smaller than in high-tech product categories. However, the highest unit value is still between 5 and 10 times higher than the lowest unit value in product categories like wine, clothing accessories, carpets of nylon, additives for lubricating oils, parts of combustion piston engines, goods vehicles or gear boxes. Even if the extreme values are considered as outliers the differences between the remaining unit values are still too large to be interpreted as price differences (annex figure 2).
- There prevails a positive relationship between real GDP per head and export unit values also in these more traditional product categories albeit it is less pronounced as compared to "high-tech products". Only for one product type (out of our sample) does such a relationship not exist, namely, for additives for lubricating oils.

To conclude: The great variance of export unit values at the 5-digit level of SITC and their positive relationship to GDP per head suggests that export unit values represent rather indicators for the quality of products than for their price. This seems to be more true the more technically advanced a product category is.

One of the major results of the study by Feenstra et al. (2004), namely, that export price levels of a country tend to be the higher the higher is its GDP per head is at least in part due to their use of export unit values as proxies for export prices. According to this study such a relationship is less pronounced for a sample of 41 countries (figure 4), for the sample of 14 EU countries and the U. S. it can hardly be detected (annex figure 1). This difference between the study of Feenstra et al. (2004) and this study implies a further difference. According to this study there prevails a pronounced inverse relationship between real GDP per head and the price level of exports relative to GDP, according to Feenstra et al. (2004) such a relationship is much weaker.

Feenstra et al. (2004) are well aware of the "quality bias" due to using export unit values as proxies for export prices (however, they consider the use of unit values as only potentially biasing their results). They try to mitigate this problem by excluding all product categories for which the unit value was greater than twice or less than half as much as the European average unit value. This procedure has certainly reduced the "quality bias", however, probably at the cost of excluding technologically advanced product categories.

The present study does not suffer from the "quality bias" since BH-PPPs of the Eurostat-OECD PPP Programme refer to products of the same kind and quality in the respective countries. The estimates of this study suffer from a different type of bias which also accounts for differences to Feenstra et al. (2004). This bias concerns the fact that BH-PPPs refer not only to domestically produced goods but also to imported goods ("import bias"). However, the use of domestic prices corrected for indirect taxes and distribution margins might not have biased PPPs for final goods estimated in this study considerably, at least with respect to PPPs of industrial countries relative to the U. S. There are mainly two reasons for this presumption:

- First, export price levels do not differ significantly among industrial countries in the reference year of this study (2002). In the Euro area as a whole, e. g., the export price level was only 1.3% higher than in the U. S. Also the dispersion of export price levels across the single EURO 12 countries was small relative to other benchmark years of the Eurostat-OECD PPP Programme (figure 11). In 8 out of 11 countries export prices deviated from US export prices by less than 5% (figure 11). If one assumes that (cheaper) imports from third countries bias the estimated export price level in both regions to a similar extent (downwards) then PPPs for final goods exports between the Euro area and the U. S. will not be biased considerably.
- Second, even if import prices deviate from prices of domestically produced goods domestic market prices will not necessarily be biased as proxies for export prices. If these price differences are passed over to retail prices to only a small extent (known as the "exchange rate disconnect" puzzle), then using domestic market prices will only be affected little by the “import bias”. Figure 12 provides indirect evidence on the relevance of such a pricing to market behavior on behalf of importers. Even very large exchange rate changes impact very little on the relative price level of all goods and sevices (PPP for GDP) as discussed in section 4.

These arguments are less true for PPPs between less advanced economies and highly industrialized countries. Hence, PPPs for final goods exports of the new EU member countries and of developing countries might be somewhat overestimated in this study. It is, however, not possible to quantify the extent to which export price levels of these countries reported in table 10 exceeds their “true” export price level.

Besides the “import bias” there are other shortcomings of the estimates for PPP of tradables in this study. This concerns in particular two steps in the estimation procedure for benchmark years of the Eurostat-OECD PPP Programme. First, the definition of the basket of tradables and, second, the correction of BH-PPPs for indirect taxes and distribution margins. The extensive discussion of the related problems in section 2.2 and 4.1 made clear that the estimation procedure necessitated many assumptions. Hence, there exists a certain error margin of the estimated PPPs for tradables. There is, however, very little evidence that these assumptions biased the estimates in a systematic and quantitatively considerable manner. The same conclusions apply to the extrapolation of aggregated PPPs as discussed in section 4.2.

Several observations confirm the economic plausibility of the results of this study. First, price levels of tradables vary much less in a cross section of 41 countries than price levels of GDP. Second, the structure of relative prices of tradables is more similar across countries as compared to the price structure of all goods and services (GDP). Third, the variance of relative prices of tradables declines over time, i. e., the price structure of tradables in each country tends to converge (this tendency is much less pronounced for all items of GDP). Fourth, there prevails a clear relationship between the price level of tradables relative to GDP

of a country and its real GDP per head (as expected according to the Balassa-Samuelson hypothesis). Fifth, the very long run mean of the nominal exchange rate deviates much less from the mean of PPP for tradables as compared to PPP for GDP. Sixth, there prevails a clear negative relationship between the relative price levels of tradables as calculated in this study and relative export performance.

## 7. Summary

In this study aggregated PPPs at export prices are estimated for a comprehensive basket of internationally traded goods and services (tradables). Data on PPPs of 136 types of tradables are taken from the Eurostat-OECD PPP Programme (PPPs at the basic heading level/BH-PPPs). These BH-PPPs are corrected for indirect taxes as well as for trade and transport margins to arrive at estimates for BH-PPPs at export prices. These single PPPs are aggregated to PPPs for final goods and for tradables (goods and services) using the EKS method (export earnings are used as weights for BH-PPPs).

The study covers all countries which participated in the Eurostat-OECD PPP Programme (except Luxembourg). These are 41 countries in the benchmark years 1999 and 2002, and at least 23 OECD countries in the benchmark years 1990, 1993, 1996. Taking 2002 as reference year, PPPs for final goods and tradables are extrapolated backward to 1970 and forward to 2004 by use of relative export deflators taken from national accounts. The economic plausibility of the estimates is evaluated by comparing changes in relative export price levels to changes in export market shares.

The main results of the study can be summarized as follows:

- The US dollar/euro PPP for a comprehensive basket of tradables in the benchmark year 2002 is estimated at 0.93. Hence, one unit of tradables which costs 1 euro when exported by the Euro area costs 0.93 US dollars when exported by the U. S. The dollar/euro exchange rate of 0.94 was in 2002 very close to PPP for tradables and, hence, to the equilibrium exchange rate according to international goods markets.
- Between 2002 and 2004 the US dollar/euro PPP for tradables is estimated to have risen to 0.98 due to rising export prices in the U. S. and slightly falling export prices in the Euro area. At the same time the euro strongly appreciated. In 2004 the US dollar/euro exchange rate was 1.24, hence, the exchange rate was overvalued by roughly 25% relative to PPP for tradables.
- The US dollar/euro PPP for GDP is significantly higher than PPP for tradables since nontraded services are comparatively more expensive in the U. S. than in the Euro area.
- Price levels of tradables differ much less across 41 countries in 2002 than price levels of GDP or equivalently, deviations of the nominal exchange rate from PPP for tradables are smaller than deviations from PPP for GDP. Hence, the law of one price holds

comparatively better for internationally traded goods and services than for nontradables. This conclusion is confirmed by the development of the dispersion of price levels over time. Between 1990 and 2002, the variance of tradables price levels across 23 OECD countries declined (albeit only slightly), whereas the variance of GDP price levels remained the same.

- There exists a strong inverse relationship between the price level of tradables relative to the price level of GDP and real GDP per head. The more advanced an economy is the cheaper are tradables relative to nontraded services and, hence, relative to all products comprised in GDP (such a relationship accords to the Balassa-Samuelson effect). The GDP price level in the 10 new EU member countries, e. g., was in 2002 47.3% lower than in the EU 15, whereas the price level of tradables was only 19.6% lower. Hence, the currencies of these countries are much less undervalued relative to PPP for tradables than relative to PPP for GDP.
- The structure of relative prices of tradables is more similar across countries as compared to the price structure of all goods and services. More specifically, the variance of PPPs at the basic heading level is in each country smaller for tradables than for all goods and services. This observation suggests that international goods arbitrage tends to reduce the differences in the structure of relative prices between countries. This conclusion is confirmed by the decline in the variance of relative prices of tradables over time. Such a convergence of the price structures within countries (relative to the reference country) is much less pronounced for all items of GDP.
- The (very) long run mean of the nominal exchange rate deviates much less from the mean of PPP for tradables as compared to PPP for GDP. Between 1970 and 2004 the Euro(ECU)/dollar exchange rate was slightly undervalued relative to PPP for tradables (by 2.6% on average), and slightly overvalued by just 1.9% relative to PPP for final goods. By contrast, relative to PPP for GDP the US dollar was on average overvalued by 10.3%. This discrepancy is primarily due to tradables being comparatively cheaper in the US than in most other countries.
- Over several years the nominal Euro(ECU)/US dollar exchange rate moves almost persistently in the same direction as, e. g., 1980/85, 1985/95, 1995/2001 and again since 2001. These movements mostly overshoot the level of PPP for tradables so that periods of an overvalued US dollar as between 1981 and 1986 are followed by periods of an undervalued US dollar as between 1987 and 2000.
- Movements of the nominal Euro(ECU)/US dollar exchange rate away from tradables PPP are highly persistent as between 1985 and 1988 or between 2002 and 2004. It seems therefore difficult to attribute these movements primarily to shocks.
- The relationship between relative price levels based on tradables PPP and export market shares is clearly inverse for most countries investigated. If the price level of

tradables increases in the Euro area by 10 percentage points faster than in the U. S. (e. g., due to an appreciation of the euro) then 1.54% of export market shares are expected to shift from the Euro area to the U. S. over the subsequent year.

- US exports are particularly sensitive to changes in relative prices of tradables. If tradables made in USA become 10% cheaper relative to the OECD average, then the share of US exports in overall exports of industrial countries increases by 1.80 percentage points. This result implies that the US economy profits more from an overshooting depreciation of its currency than other industrial countries profit from comparable depreciations of their currencies.

It is beyond the scope of this study to provide a comprehensive explanation of the observations summarized above. Such an explanation requires in the first place a thorough evaluation of the functioning of international goods markets and of the foreign exchange market. The convergence of the structure of relative prices of tradables across countries as well as the adjustment of export price levels to overshooting exchange rate movements suggest that arbitrage in international goods markets might work reasonably well. However, the movements of nominal exchange rates are often too strong and too persistent to be fully compensated by movements of goods prices. As a consequence, the nominal exchange rate fluctuates around PPP for tradables as its "attractor". It still remains a puzzle why the exchange rate deviates from tradables PPP in the first place. An explanation of this puzzle requires most probably concrete investigations into expectations formation and trading behavior of actors in the foreign exchange markets. This task is left to future research.

## References


Abuaf, N., Jorion, P., "Purchasing Power Parity in the Long Run", Journal of Finance, March 1990, 45(1), pp. 157-174.

Alberola, E., Cervero, S. G., Lopez, J. H., Ubide, A., Global Equilibrium Exchange Rates - Euro, Dollar, 'Ins', 'Outs', and Other Major Currencies in a Panel Cointegration Framework, IMF Working Paper, 175, December 1999.

Asea, P. K., Mendoza, E. G., "The Balassa-Samuelson Model: A General Equilibrium Appraisal", Review of International Economics, October 1994, 2(3), pp. 244-267.

Balassa, B., "The Purchasing Power Parity Doctrine: A Reappraisal", Journal of Political Economy, 1964, 72(6), pp. 244-267.

Bhagwati, J., "Why Are Services Cheaper in Poor Countries?", Economic Journal, 1984, 94, pp. 279-286.

Breuer, J. B., "Purchasing power parity: A survey of and challenge to recent literature", in: Williamson, J., (ed.), Estimating equilibrium exchange rates, Institute for International Economics, Washington, DC., 1994.

Burstein, A., Eichenbaum, M., Rebelo, S., Large Devaluations and the Real Exchange Rate, NBER Working Paper Series, 10986, 2004.

Campa, J. M., Goldberg, L. S., "Exchange Rate Pass-Through into Import Prices", CEPR Discussion Paper Series, 4391, May 2004.

Chen, S.-S., Engel, C. M., "Does 'Aggregation Bias' Explain the PPP Puzzle?," Pacific Economic Review, February 2005, 10(1), pp. 49-72.

Cheung, Y.-W., Chinn, M., Fujii, E., "Market Structure and the Persistence of Sectoral Real Exchange Rates", International Journal of Finance and Economics, 2001, 6(2), pp. 95-114.

Cheung, Y.-W., Lai, K. S., "On the Purchasing Power Puzzle", Journal of International Economics, 2000, 52(2), pp. 321-330.

Cheung, Y.-W., Lai, K. S., Bergman, M., Dissecting the PPP Puzzle: The Unconventional Roles of Nominal Exchange Rate and Price Adjustment, CESifo Working Paper, 924, April 2003.

Choi, C.-Y., Mark, N. C., Sul, D., "Unbiased Estimation of the Half-Life to PPP Convergence in Panel Data", NBER Working Paper Series, 10614, 2004.

Cihak, M., Holub, T., "Convergence of Relative Prices and Inflation in Central and Eastern Europe", IMF Working Paper, September 2001.

Cihak, M., Holub, T., "Price Convergence to the EU: What Do the 1999 ICP Data Tell Us?", Working Paper Series of the Czech National Bank, 2, 2003.

Clark, C., The Conditions of Economic Progress, London, Macmillan. Revised edition 1957.

Clark, P.B., MacDonald, R., "Exchange Rates and Economic Fundamentals: A Methodological Comparison of BEERs and FEERs", in MacDonald, R., Stein, J. (eds.), Equilibrium Exchange Rates, Kluwer, Boston, 1999, pp. 285-322.

Crownover, C., Pippenger, J., Steigerwald, D. G., "Testing for absolute purchasing power parity," Journal of International Money and Finance, 1996, 15(5), pp. 783-796.

Cumby, R. E., "Forecasting Exchange Rates and Relative Prices with the Hamburger Standard: Is What You Want What You Get With McParity?", NBER Working Paper Series, 5675, 1996.

De Gregorio, J., Wolf, H. C., "Terms of Trade, Productivity, and the Real Exchange Rate," NBER Working Paper Series, 4807, 1996.

Dickey, D. A., Fuller, W. A., "Distribution of the Estimators for Autoregressive Time Series with a Unit Root", Journal of the American and Statistical Association, 1979, 74(366), pp. 427-431.

Edison, H. J., "Purchasing power parity in the long run: A test of the Dollar/Pound exchange rate (1890-1978)," Journal of Money, Credit, and Banking, 1987, 19(3), pp. 376-87.

Egger, P., Gruber, S., Pfaffermayr, M., The Law of One Price: A New Econometric Approach and Evidence from Disaggregated Data, Working Paper, Department of Economics, University of Innsbruck, 2005.

Eisenrauch, W., Sergeev, S., "Kaufkraftparitäten und internationale BIP-Vergleiche für erweiterte EU, Beitrittskandidaten und EFTA", Statistische Nachrichten Österreich, 2004, 12, pp. 1042-1051.

Engel, C., "Real exchange rates and relative prices: An empirical investigation", Journal of Monetary Economics, 1993, 32(1), pp. 35-50.

Engel, C., Morley, J. C., "The Adjustment of Prices and the Adjustment of the exchange rate", NBER Working Paper Series, 8550, 2001.

Engel, C., Rogers, J, H., "Deviations from purchasing power parity: causes and welfare costs", Journal of International Economics, 2001, 55(1), pp. 29-57.

Engel, C., Rogers, J, H., "How Wide Is the Border?", American Economic Review, 1996, 86, pp. 1112-1125.

Engle, R., Granger, C., "Cointegration and error correction: Representation, estimation and testing", Econometrica, 1987, 55, pp. 251-276.

Eurostat-OECD, Purchasing Power Parities and Real Expenditures, 2002 Benchmark Year, 2005. http://new.sourceoecd.org/vl=760632/cl=33/nw=1/rpsv/~6686/v2005n3/s1/p1l

Eurostat-OECD, Manual on PPP Methodology, Eurostat, OECD (draft), 2005. http://forum.europa.eu.int/Public/irc/dsis/palojpi/library?l=/methodological_papers/ppp_manual&vm=detailed&sb=Title

Falvey, R. E., Gemmel, N., "Are Services Income-Elastic? Some New Evidence", Review of Income and Wealth, 1996, 42(3), pp. 257-269.

Feenstra, R. C., Heston, A., Timmer, M. P., Deng, H., "Estimating Real Production and Expenditures Across Nations: A Proposal for Improving the PENN World Tables, NBER Working Paper Series, 10866, 2004.

Fisher, A. G. B., "Production, primary, secondary and tertiary", Economic Record, 1939, 15, pp. 24-38.

Fourastie, J., Le grand espoir du XXème siècle, PUF, Paris, 1949, 4th edition 1958.

Frankel, A., "International Capital Mobility and Crowding Out in the U.S. Economy: Imperfect Integration of Financial Markets or of Goods Markets?", in: How Open is the U.S. Economy?, Hafer, R. W. (ed.), Federal Reserve Bank of St. Louis, Lexington, MA: Lexington Books, 1986.

Frankel, J. A., Rose, A.K., "A Panel Project on Purchasing Power Parity: Mean Reversion Within and Between Countries", Journal of International Economics, 1996, 40(1-2), pp. 209-224.

Frankel, J. A., Rose, A.K., "Empirical Research on Nominal Exchange Rates", Handbook of International Economics, vol. III, edited by Grossmann, G., and Rogoff, K., Elsevier Science, B.V, 1995.

Frenkel, J. A., "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence", Scandinavian Journal of Economics, 1976 ,78(2), pp. 200-224.

Frenkel, J. A., "The Collapse of Purchasing Power Parity During the 1970s", European Economic Review, 1981, 16(1), pp. 145-165.

Friedman, M., "The Case of Flexible Exchange Rates", Essays in Positive Economics, University of Chicago, Chicago, 1953.

Froot, K. A., Rogoff, K., "The EMS, the EMU, and the Transition to a Common Currency", NBER Macroeconomics Annual, 6, 1991, pp. 269-317.

Froot, K. A., Rogoff, K., "Perspectives on PPP and Long-Run Real Exchange Rates", Handbook of International Economics, 1995, 3, pp. 1647-1688.

Froot, K., Kim, M., Rogoff, K., "The Law of One Price Over 700 Years", NBER Working Paper Series, 5132, 1995.

Frydman, R., Goldberg, M. D., "Imperfect Knowledge Expectations, Uncertainty Adjusted Uncertainty-Adjusted Uncovered, Interest Rate Parity, and Exchange Rate Dynamics," in Aghion, P., Frydman, R., Stiglitz, J., Woodford M.,(eds.), Knowledge, Information and Expectations in Modern Economics: In Honor of Edmund S. Phelps, Princeton University Press, Princeton, NJ, 2003, chapter 8, pp. 148-182.

Frydman, R., Goldberg, M. D., Imperfect Knowledge Economics: Exchange Rates and Risk, Princeton University Press, Princeton, New Jersey, forthcoming 2005.

Fuchs, V. R., "The Service Economy", assisted by Leveson, I. F., NBER General Series, 87, 1968.

Gershuny, J., Miles, I., The New Services Economy: The Transformation of Employment in Industrial Societies, Fances Pinter, London, 1983.

Giovannetti, G., "A Survey of Recent Empirical Tests of the Purchasing Power Parity Hypothesis", Banca Nazionale del Lavoro Quarterly Review, 1992, 180, pp. 81-101.

Giovannini, A., "Exchange Rates and Traded Goods Prices", Journal of International Economics, 1988, 24, pp. 45-68.

Glen, J. D., "Real Exchange Rates in the Short, Medium, and Long Run", Journal of International Economics, 1992, 33, pp. 147-66.

Goldberg, M., D., Frydman, R., "Imperfect Knowledge and Behavior in the Foreign Exchange Market," Economic Journal, 1996, 106(July), pp. 869-893.

Goldberg, P. K., Knetter, M. M., "Goods Prices and Exchange Rates: What Have We Learned?", Journal of Economic Literature, 35(3), pp. 1243-1272.

Gruber, S., Purchasing Power Parities: The Evidence from International (ICP) Price Data, Diplomarbeit, Institut für Wirtschaftstheorie, -politik und -geschichte, University of Innsbruck, Innsbruck, 2002.

Hill, R. J., "Constructing Price Indexes across Space and Time: The Case of the European Union", The American Economic Review, 94(5), December 2004, pp. 1379-1410.

Imbs, J., Mumtaz, H., Ravn, M., Rey, H., "PPP Strikes Back: Aggregation and the Real Exchange Rate," The Quarterly Journal of Economics, 2005, 120(1), pp. 1-43.

Isard, P., "How Far Can We Push the "Law of One Price"?," American Economic Review, 1977, 67(5), pp. 942-948.

Johansen, S., "Statistical Analysis of Cointegrating Vectors", Journal of Economic Dynamics and Control, 1988, 12, pp. 231-254.

Jorion, P., Sweeney, R. J., "Mean reversion in real exchange rates: evidence and implications for forecasting", Journal of International Money and Finance, 1996, 15(4), pp. 535-550.

Keynes, J.M., The Collected Writings of John Maynard Keynes, Vol. XXV, Activities 1941-1944, Macmillan - Cambridge University Press, 1980.

Klitgaard, T., "Exchange Rates and Profit Margins: The Case of Japanese Exporters", Economic Policy Review, April 1999, Federal Reserve Bank of New York, pp. 41-53.

Koedijk, K. G, Schotman, P. C., Van Dijk, M. A., The re-emergence of PPP in the 1990s, Journal of International Money and Finance, 1998, 17(1), pp. 51-61.

Kravis, I. B., Lipsey, R. E., Towards an Explanation of National Price Levels, Princeton Studies in International Finance, 1983, 52, Princeton University Press.

Kravis, I.B., Heston, A., Summers, R., World Product and Income: International Comparisons of Real Gross Product, Published for the World Bank, The John Hopkins University Press, Baltimore and London, 1982.

Krugman, P., "Purchasing Power Parity and Exchange Rates: Another Look at the Evidence", Journal of International Economics, 1978, 8, pp. 397-407.

Lothian, J. R., "Some new stylized facts of floating exchange rates", Journal of International Money and Finance, 1998, 17(1), pp. 29-39.

Lothian, J. R., Taylor, M. P., Real Exchange Rates, Nonlinearity and Relative Productivity: The Long and the Short of It, photocopy, 2004, University of Warwick.

Marston, R. C., "Real Exchange Rates And Productivity Growth in the United States and Japan" in Arndt, S., Richardson, J. D. (eds.), Real-financial Linkages in Open Economies, MIT Press, Cambridge, MA, 1987, 71-96.

Murray, C. J., Papell, D. H., "The Purchasing Power Persistence Paradigm", Journal of International Economics, 56(1), 2002, pp. 1-19.

Neary, P., "Rationalizing the Penn World Table: True Multilateral Indices for International Comparisons of Real Income", The American Economic Review, 2004, 94(5), pp. 1411-1428.

O'Connell, P. G. J., "The Overvaluation of Purchasing Power Parity", Journal of International Finance, 1998, 44(1), pp. 1-19.

OECD, National Accounts & Historical Statistics, 2005, 76(1).
http://titania.sourceoecd.org/vl=9916985/cl=50/nw=1/rpsv/~6679/v2005n1/s1/p1l

OECD, Purchasing Power Parities and Real Expenditures, 1996 Results, Edition 1999.

OECD, Purchasing Power Parities and Real Expenditures, 1999 Benchmark Year, 2002 Edition.
http://titania.sourceoecd.org/vl=9916985/cl=50/nw=1/rpsv/~6679/v2002n2/s1/p1l

OECD, Purchasing Power Parities and Real Expenditures, 2002 Benchmark Year, 2004 Edition.
http://titania.sourceoecd.org/vl=9916985/cl=50/nw=1/rpsv/~6686/v2005n3/s1/p1l

OECD, Purchasing Power Parities and Real Expenditures, EKS Results, Volume I, 1990, 1992.

OECD, Purchasing Power Parities and Real Expenditures, EKS Results, Volume I, 1993, 1995.

Papell, D. H., Theodoridis, H., "Increasing evidence of purchasing power parity over the current float", Journal of International Money and Finance, 1998, 17(1), pp. 41-50.

Petersen, E. B., A Comparison of Marketing Margins Across Sectors, Users, and Regions, Paper Presented at the 7th Annual Conference on Global Economic Analysis, Washington DC, United States, June 17 – 19, 2004.

Rogers, J. H., Jenkins, M., ""Haircuts or hysteresis? Sources of movements in real exchange rates", Journal of International Economics, 1995, 38(3-4), pp. 339-360.

Rogoff, K., "The Purchasing Power Parity Puzzle", Journal of Economic Literature, 1996, 34, pp. 647-668.

Sala-i-Martin, X. X, "I Just Ran Two Million Regressions", American Economic Review, Papers and Proceedings, May, 1997, pp. 178-183.

Samuelson, P.A., "Theoretical Notes on Trade Problems", Review of Economics and Statistics, 1964, 46(2), pp. 145-154.

Sarno, L., Chowdhury, I., Taylor, M. P., "Nonlinear Dynamics in Deviations from the Law of One Price: A Broad-Based Empirical Study", Journal of International Money and Finance, 23(1), 2004, pp. 1-25.

Sarno, L., Taylor, M. P., "Purchasing Power Parity and the Real Exchange Rate", IMF Staff Papers, 49(1), 2002, pp. 65-105.

Schulmeister, S., "Currency Speculation and Dollar Fluctuations", Banca Nazionale del Lavoro Quarterly Review, 1988, 167, Rome.

Schulmeister, S., Exchange Rates, Prices and Interest Rates, Economic Research Report, New York University, New York, 1983.

Schulmeister, St. (2000A), "Globalization without Global Money, The Double Role of the Dollar as National Currency and as World Currency and Its Consequences", Journal of Post Keynesian Economics, 2000, 22(3), pp. 365-396.

Schulmeister, St. (2000B), "Kaufkraftparitäten des Dollars und des Euro", WIFO-Monatsberichte, 2000, 73(8), pp. 487-500.

Sergeev, S., Measures of the similarity of the country's price structures and their practical application, Paper presented at the Joint Consultation on the European Comparison Programme (Statistical Commission, Economic Commission for Europe, Conference of European Statisticians), Geneva, 12-14 November 2001. http://www.unece.org/stats/documents/2001/11/ecp/wp.9.e.pdf

Sergeev, S., PPP calculation at the aggregated levels: General description of computational procedures used in the EKS method and the respective VBA program, mimeo.

Stapel, S., Challenging the "snapshot theory" of Purchasing Power Parities: Eurostat's revision of the PPP 1995 to 2000, Paper prepared for the SSHRC International Conference on Index Number Theory and the Measurement of Prices and Productivity, Vancouver, Canada, 2004.

Stapel, S., Pasanen, J., Reinecke, S., "Purchasing Power Parities and related economic indicators for EU, Candidate Countries and EFTA", Eurostat, Statistics in focus, Economy and Finance, 2004, 37.

Statistik Austria, Aggregation Methods on the Basis of Structural International Prices, Paper presented at the Joint World Bank–OECD Seminar on Purchasing Power Parities (author: Sergey Sergeev), Washington D.C., 30 January – 2 February 2001.
http://www.oecd.org/dataoecd/23/19/2424963.pdf

Summers, R., Heston, A., "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-88", The Quarterly Journal of Economics, 1991, 106(2), pp. 327-368.

Taylor, A. M., Taylor, M. P., "The Purchasing Power Parity Debate", Journal of Economic Perspectives, 2004, 18(4), pp. 135-158.

Taylor, M. P., Peel, D. A., Sarno, L., "Nonlinear Mean-Reversion in Real Exchange Rates: Toward a Solution to the Purchasing Power Parity Puzzles", International Economic Review, 2001, 42(4), pp. 1015-1042.

United Nations, Handbook of the International Comparison Project, New York, 1992.
http://unstats.un.org/unsd/methods/icp/ipco_htm.htm

Van Ark, B., Timmer, M. P., Industry-of-Origin Prices and PPPs: A New Dataset for International Comparisons, Paper presented at Workshop on "Estimating Production and Income Across Nations and over Time", Institute of Governmental Affairs, UC Davis, May 31-June 1, 2005.

Wei, S. J., Parsley, D. C., "Purchasing Power Disparity During the Floating Rate Period: Exchange Rate Volatility, Trade Barriers and Other Culprits", NBER Working Paper Series, 1995.

Williamson, J., (ed.), Estimating Equilibrium Exchange Rates, Institute for International Economics, Washington, 1994.

Xu, Z., "Purchasing power parity, price indices, and exchange rate forecasts", Journal of International Money and Finance, 2003, 22(1), pp. 105-130.

*Annex table 1: Countries covered by the different rounds of the Eurostat-OECD PPP Programme*

| | 2002 | 1999 | 1996 | 1993 | 1990 |
|---|---|---|---|---|---|
| Austria | x | x | x | x | x |
| Belgium | x | x | x | x | x |
| Finland | x | x | x | x | x |
| France | x | x | x | x | x |
| Germany | x | x | x | x | x |
| Greece | x | x | x | x | x |
| Ireland | x | x | x | x | x |
| Italy | x | x | x | x | x |
| Netherlands | x | x | x | x | x |
| Portugal | x | x | x | x | x |
| Spain | x | x | x | x | x |
| EURO 12 | x | x | x | x | x |
| Denmark | x | x | x | x | x |
| Sweden | x | x | x | x | x |
| United Kingdom | x | x | x | x | x |
| EU 15 [2)] | x | x | x | x | x |
| Cyprus [1)] | x | x | | | |
| Czech Republic | x | x | x | | |
| Estonia [1)] | x | x | | | |
| Hungary | x | x | x | | |
| Latvia [1)] | x | x | | | |
| Lithuania [1)] | x | x | | | |
| Malta [1)] | x | x | | | |
| Poland | x | x | x | | |
| Slovenia [1)] | x | x | | | |
| Slovak Republic | x | x | x | | |
| EU10 | | | | | |
| Iceland [2)] | x | x | x | x | x |
| Norway [2)] | x | x | x | x | x |
| Switzerland [2)] | x | x | x | x | x |
| Turkey [2)] | x | x | x | x | x |
| Australia [2)] | x | x | x | x | x |
| New Zealand [2)] | x | x | x | x | x |
| Japan [2)] | x | x | x | x | x |
| Korea | x | x | | | |
| Canada [2)] | x | x | x | x | x |
| Mexico | x | x | x | | |
| United States [2)] | x | x | x | x | x |
| OECD 30 | x | x | x | x | x |
| Bulgaria [1)] | x | x | | | |
| Croatia [1)] | x | x | | | |
| Israel [1)] | x | x | x | | |
| Macedonia [1)] | x | x | | | |
| Romania [1)] | x | x | | | |
| Russian Federation [1)] | x | x | x | | |

[1)] No OECD member country. 2) Belongs to OECD 24.

Source: OECD (2004).

## *Annex table 2: Basic headings classified as tradable and the corresponding positions in the classification of international trade and of input-output sectors*

| Basic heading in the Eurostat-OECD PPP Programme, 2002 round | | | Corresponding positions in the classification | | | |
|---|---|---|---|---|---|---|
| Code | Description | Classified as tradable | International trade | Input-Output-sectors | | |
| | | | SITC Code | EU25 | USA | Japan |
| | *1 .FOOD* | | | | | |
| 1101111 | Rice | x | 042 | 15 | 3110 | 010 |
| 1101112 | Flour and other cereals | x | 044+046+047 | 15 | 3110 | 010 |
| 1101113 | Bread | x | 04841 | 15 | 3110 | 010 |
| 1101114 | Other bakery products | x | 04842+04849 | 15 | 3110 | 010 |
| 1101115 | Pasta products | x | 0483 | 15 | 3110 | 010 |
| 1101116 | Other cereal products | x | 0481+0482 | 15 | 3110 | 010 |
| 1101121 | Beef | x | 011*.95+01251*.95+01252*.95+01681*.95+0176*.95 | 15 | 1120 | 010 |
| 1101122 | Veal | x | 011*.05+01251*.05+01252*.05+01681*.05+0176*.05 | 15 | 1120 | 010 |
| 1101123 | Pork | x | 0122+01253+01254+0161+0175 | 15 | 1120 | 010 |
| 1101124 | Lamb, mutton and goat | x | 0121+01255+01256 | 15 | 1120 | 010 |
| 1101125 | Poultry | x | 0123+0174 | 15 | 1120 | 010 |
| 1101126 | Other meats and edible offal | x | 0124+01689+0171+0172+0173+0179 | 15 | 1120 | 010 |
| 1101127 | Delicatessen and other meat preparations | x | 0129 | 15 | 3110 | 010 |
| 1101131 | Fresh or chilled fish and seafood | x | 0341+03451+0362+03631+03633+03635 | 15 | 1140 | 010 |
| 1101132 | Frozen fish and seafood | x | 0342+0344+03455+0361+03637+03639 | 15 | 3110 | 010 |
| 1101133 | Preserved or processed fish and seafood | x | 035+037 | 15 | 3110 | 010 |
| 1101141 | Fresh milk | x | 0221 | 15 | 3110 | 010 |
| 1101142 | Preserved milk | x | 0222 | 15 | 3110 | 010 |
| 1101143 | Other milk products | x | 02231+02232+0224 | 15 | 3110 | 010 |
| 1101144 | Cheese | x | 024 | 15 | 3110 | 010 |
| 1101145 | Eggs and egg-based products | x | 025 | 15 | 3110 | 010 |
| 1101151 | Butter | x | 023 | 15 | 3110 | 010 |
| 1101152 | Margarine | x | 091 | 15 | 3110 | 010 |
| 1101153 | Other edible oils and fats | x | 411+421+422 | 15 | 3110 | 010 |
| 1101161 | Fresh or chilled fruit | x | 0571+0572+0573+0574+0575+0576+0579 | 01 | 1110 | 001 |
| 1101162 | Dried fruit and nuts | x | 0577 | 15 | 3110 | 010 |
| 1101163 | Frozen fruit, preserved fruit and fruit-based products | x | 0582+0583+0589 | 15 | 3110 | 010 |
| 1101171 | Fresh or chilled vegetables other than potatoes | x | 0544+0545 | 01 | 1110 | 001 |
| 1101172 | Fresh or chilled potatoes | x | 0541+05611+05661 | 01 | 1110 | 001 |
| 1101173 | Frozen vegetables | x | 0546 | 15 | 3110 | 010 |
| 1101174 | Dried vegetables | x | 0542+05612+05613+05619 | 15 | 3110 | 010 |
| 1101175 | Preserved or processed vegetables,vegetable-based products | x | 0547+0548+0564+05669+0567 | 15 | 3110 | 010 |
| 1101181 | Sugar | x | 0611+0612+0615+0619 | 15 | 3110 | 010 |
| 1101182 | Jams, marmalades and honey | x | 0581+0616 | 15 | 3110 | 010 |
| 1101183 | Confectionery, chocolate and other cocoa preparations | x | 062+073 | 15 | 3110 | 010 |
| 1101184 | Edible ice, ice cream and sorbet | x | 02233 | 15 | 3110 | 010 |
| 1101191 | Food products n.e.c. | x | 075+098 | 15 | 3110 | 010 |
| 1101211 | Coffee | x | 071 | 15 | 3110 | 010 |
| 1101212 | Tea and other infusions | x | 074 | 15 | 3110 | 010 |
| 1101213 | Cocoa, excluding cocoa preparations | x | 072 | 15 | 3110 | 010 |
| 1101221 | Mineral waters | x | 11101 | 15 | 3121 | 010 |
| 1101222 | Soft drinks and concentrates | x | 11102 | 15 | 3121 | 010 |
| 1101223 | Fruit and vegetable juices | x | 059 | 15 | 3121 | 010 |
| | *2. ALCOHOLIC, NON-ALCOHOLIC BEVERAGES & TOBACCO* | | | | | |
| 1102111 | Spirits | x | 1124 | 15 | 3121 | 011 |
| 1102121 | Wine, cider and perry | x | 11211+11213+11217+1122 | 15 | 3121 | 011 |
| 1102122 | Fortified and sparkling wine | x | 11215 | 15 | 3121 | 011 |
| 1102131 | Beer | x | 1123 | 15 | 3121 | 011 |
| 1102211 | Cigarettes | 1) | | | | |
| 1102212 | Other tobacco products | 1) | | | | |
| | *3. CLOTHING, FOOTWEAR* | | | | | |
| 1103111 | Clothing materials | x | 846 | 18 | 3150 | 015 |
| 1103121 | Men's clothing | x | 841+843 | 18 | 3150 | 015 |
| 1103122 | Women's clothing | x | 842+844 | 18 | 3150 | 015 |
| 1103123 | Children's clothing | x | 8451*.80 | 18 | 3150 | 015 |
| 1103124 | Infant's clothing | x | 8451*.20 | 18 | 3150 | 015 |
| 1103131 | Other articles of clothing and clothing accessories | x | 8452+8453+8454+8455+8456+8458+8459+848+8998 | 18 | 3150 | 015 |
| 1103211 | Men's footwear | x | 85*.3333333 | 19 | 3160 | 015 |
| 1103212 | Women's footwear | x | 85*.3333333 | 19 | 3160 | 015 |
| 1103213 | Children's and infant's footwear | x | 85*.3333333 | 19 | 3160 | 015 |
| | *4. ELECTRICITY & HEATING* | | | | | |
| 1104311 | Materials for the maintenance and repair of the dwelling | 1) | | | | |
| 1104511 | Electricity | 1) | | | | |
| 1104521 | Town gas and natural gas | 1) | | | | |
| 1104522 | Liquefied hydrocarbons | 1) | | | | |
| 1104531 | Liquid fuels | 1) | | | | |
| 1104541 | Solid fuels | 1) | | | | |
| | *5. FURNISHING & HOUSEHOLD EQUIPMENT* | | | | | |
| 1105111 | Kitchen furniture | x | 82153 | 36 | 3370 | 017 |
| 1105112 | Bedroom furniture | x | 8212+82155 | 36 | 3370 | 017 |
| 1105113 | Living-room and dining-room furniture | x | 82113+82115+82116+82117+82118+82119 | 36 | 3370 | 017 |
| 1105114 | Other furniture and furnishings | x | 69782+82139+82159+8217+8218 | 36 | 3370 | 017 |
| 1105121 | Carpets and other floor coverings | x | 65891+659+89331+89974 | 17 | 3140 | 014 |
| 1105211 | Household textiles | x | 6583+6584+6585 | 17 | 3140 | 014 |
| 1105311 | Refrigerators, freezers and fridge-freezers | x | 7752 | 31 | 3352 | 050 |
| 1105312 | Washing-machines, dryers and dishwashers | x | 7751+7753+77584 | 31 | 3352 | 050 |
| 1105313 | Cookers, hobs and ovens | x | 6973+77586+77587 | 31 | 3352 | 050 |
| 1105314 | Air conditioners, humidifiers and heaters | x | 77581+77582 | 31 | 3352 | 050 |
| 1105315 | Other major household appliances | x | 7757 | 31 | 3352 | 050 |
| 1105321 | Small electric household appliances | x | 77585+77588+77589 | 31 | 3352 | 050 |
| 1105411 | Glassware,ceramic ware for households, offices, decoration | x | 6354+6359+65899+6652+666+89332 | 26 | 3270 | 050 |
| 1105412 | Cutlery, flatware and silverware | x | 6966+6968 | 28 | 3322 | 045 |
| 1105413 | Non-electric kitchen utensils and household articles | x | 6351+6352+6421+69781+89395+89399+89971 | 28 | 3322 | 045 |
| 1105511 | Major tools and equipment | x | 7784 | 28 | 3322 | 045 |
| 1105521 | Small electric accessories | x | 7781+7782 | 31 | 3352 | 050 |
| 1105522 | Hand tools, garden tools and other miscellaneous accessories | x | 6952+6953+6954 | 29 | 3322 | 045 |
| 1105611 | Household cleaning supplies | x | 5542+5543+591+64245+64293+65892+6974+6975+89972 | 24 | 3256 | 028 |
| 1105612 | Other non-durable household articles | x | 694+89931+89932 | 24 | 3256 | 028 |

*Annex table 2 (continued): Basic headings classified as tradable and the corresponding positions in the classification of international trade and of input-output sectors*

| Basic heading in the Eurostat-OECD PPP Programme, 2002 round | | | Corresponding positions in the classification | | | |
|---|---|---|---|---|---|---|
| Code | Description | Classified as tradable | International trade | Input-Output-sectors | | |
| | | | SITC Code | EU25 | USA | Japan |
| | *6. HEALTH* | x | | | | |
| 1106111 | Pharmaceutical products | x | 5411+5413+5414+5415+5416+54192+54193+54199+542 | 24 | 3254 | 027 |
| 1106121 | Other medical products | x | 54191+6291 | 24 | 3391 | 027 |
| 1106131 | Eye-glasses and contact lenses | x | 88411+88415+88417+8842 | 33 | 3391 | 063 |
| 1106132 | Other therapeutic appliances and equipment | x | 7853+8996 | 33 | 3391 | 063 |
| | *7. TRANSPORT* | x | | | | |
| 1107111 | Motor cars with diesel engine | x | Total export earnings (781) are assigned to these categories according to the respective expenditures in the EUROSTAT-OECD PPP Programme. | 34 | 3361 | 058 |
| 1107112 | Motor cars: petrol engine of cubic capacity of less than 1200cc | x | | 34 | 3361 | 058 |
| 1107113 | Motor cars: petrol engine of cubic capacity of 1200cc to 1699cc | x | | 34 | 3361 | 058 |
| 1107114 | Motor cars: petrol engine of cubic capacity of 1700cc to 2999cc | x | | 34 | 3361 | 058 |
| 1107115 | Motor cars: petrol engine of cubic capacity of 3000cc and over | x | | 34 | 3361 | 058 |
| 1107121 | Motor cycles | x | 7851 | 34 | 3361 | 058 |
| 1107131 | Bicycles | x | 7852 | 35 | 336B | 061 |
| 1107141 | Animal drawn vehicles | x | 7868 | 35 | 336B | 061 |
| 1107211 | Spare parts and accessories for personal transport equipment | x | 625 | 35 | 336B | 061 |
| 1107221 | Fuels and lubricants for personal transport equipment | x | 3341+3343+3345+5972+5973 | 23 | 3240 | 029 |
| | *8. RECREATION & CULTURE* | | | | | |
| 1108211 | Telephone and telefax equipment | x | 76411 | 32 | 334A | 052 |
| 1109111 | Television sets and video recorders | x | 761+76381 | 32 | 334A | 050 |
| 1109112 | Radios, CD-players and other electro-acoustic devices | x | 762+7633+76383+76384+76422+76423+76424 | 32 | 334A | 050 |
| 1109121 | Photographic, cinematographic equipment, optical instruments | x | 881+882 | 33 | 334A | 050 |
| 1109141 | Pre-recorded recording media | x | 8986+8987 | 32 | 3346 | 063 |
| 1109142 | Unrecorded recording media | x | 8984+8985 | 32 | 3346 | 063 |
| 1109211 | Major durables for outdoor recreation | x | 6122+7861 | 25 | 3399 | 063 |
| 1109221 | Musical instruments and major durables for indoor recreation | x | 8981+8982+8989 | 20 | 3399 | 063 |
| 1109311 | Games, toys and hobbies | x | 5933+8942+8943+8944+8946 | 20 | 3399 | 063 |
| 1109321 | Equipment for sport, camping and open-air recreation | x | 6582+65893+8913+8947 | 20 | 3399 | 063 |
| 1109331 | Gardens, plants and flowers | x | 292+8992 | 01 | 1110 | 001 |
| 1109341 | Pets and related products | x | 08 | 02 | 1120 | 002 |
| 1109511 | Books | x | 8921 | 21 | 3230 | 020 |
| 1109521 | Newspapers and periodicals | x | 8922 | 21 | 3230 | 020 |
| 1109531 | Miscellaneous printed matter | x | 6422+6423+64242+64248+8924+8928+89394 | 21 | 3230 | 020 |
| 1109541 | Stationery and drawing materials | x | 895 | 21 | 3230 | 019 |
| | *9. MISCELLANEOUS GOODS* | x | | | | |
| 1112121 | Electric appliances for personal care | x | 7754+77583 | 31 | 3352 | 050 |
| 1112131 | Other appliances, articles and products for personal care | x | 553+5541+64243+64294+64295+6963+6964+74532 | 25 | 3352 | 050 |
| 1112311 | Jewellery, clocks and watches | x | 667+8853+8854+8855+88572+88573+88574+88575+88576 +88577+88578+88579+88591+88592+88593+88596+88597 | 33 | 3399 | 063 |
| 1112321 | Travel goods and other carriers of personal effects | x | 83 | 25 | 3160 | 063 |
| 1112322 | Other personal effects n.e.c. | x | 8941+89933+89934+89935+89937+8994 | 25 | 3399 | 063 |
| | *10. MACHINERY EQUIPMENT* | x | | | | |
| 1501111 | Fabricated metal products, except machinery and equipment | x | 711+7187 | 28 | 331A | 045 |
| 1501121 | Engines and turbines, pumps and compressors | x | 712+714+7165+7181+7189+742+743 | 29 | 3336 | 046 |
| 1501122 | Other general purpose machinery | x | 741+744 | 29 | 3339 | 046 |
| 1501131 | Agricultural and forestry machinery | x | 721 | 29 | 3331 | 047 |
| 1501132 | Machine tools | x | 7281+7283+72841+72842+72844+72846+72847+72849+ 7285+731+733+735+7451 | 29 | 3331 | 046 |
| 1501133 | Machinery for metallurgy, mining, quarrying and construction | x | 722+723+737 | 29 | 3331 | 047 |
| 1501134 | Machinery for food, beverages and tobacco processing | x | 727+72843+7452+74531+74539 | 29 | 3332 | 047 |
| 1501135 | Machinery for textile, apparel and leather production | x | 724 | 29 | 3332 | 047 |
| 1501136 | Other special purpose machinery | x | 725+726+7456+7459 | 29 | 3339 | 047 |
| 1501141 | Office machinery | x | 751+7591+75991+75993+75995 | 30 | 3341 | 049 |
| 1501142 | Computers and other information processing equipment | x | 752+75997 | 30 | 3341 | 051 |
| 1501143 | Electrical machinery and apparatus | x | 771+772+773 | 31 | 3323 | 050 |
| 1501144 | Radio, television and communications equipment and apparatus | x | 76382+76413+76415+76417+76419+76421+76425+76426+ 7643+7648+7649 | 32 | 334A | 052 |
| 1501145 | Medical, precision and optical instruments, watches and clocks | x | 774+871+872+873+874+88571+88594+88595 | 33 | 3391 | 062 |
| 1501151 | Other manufactured goods n.e.c. | x | 82131+82151 | 28 | 3339 | 063 |
| 1501211 | Motor vehicles, trailers and semi-trailers | x | 782+783+784+7862+7863 | 34 | 3361 | 059 |
| 1501221 | Boats, steamers, tugs, floating platforms, rigs | x | 793 | 35 | 336B | 060 |
| 1501222 | Locomotives, rail-cars vans and wagons, other rail equipment | x | 791 | 35 | 336B | 061 |
| 1501223 | Aircraft, helicopters, hovercraft and other aeronautical equipment | x | 792 | 35 | 3364 | 061 |
| | **SERVICES** | | Codes of the IMF Balance of Payments Statistics (BOP) | | | |
| | *11. TRANSPORTATION* | | | | | |
| 1107331 | Passenger transport by air | x | 2211 | | | |
| | *12. TRAVEL* | | 2236 | | | |
| 1107311 | Local passenger transport by railway | x | Total travel export earnings (BOP 2236) are assigned to these categories according to tourism expenditure surveys. | | | |
| 1107321 | Local passenger transport by bus | x | | | | |
| 1107322 | Local passenger transport by taxi | x | | | | |
| 1111111 | Restaurant services whatever the type of establishment | x | | | | |
| 1111112 | Pubs, bars, cafés, tea rooms and the like | x | | | | |
| 1111211 | Hotels, boarding houses and the like | x | | | | |

*[1]) The respective positions are (in part) tradable but are not included in the basket of tradables in this study because export prices could not be estimated.*

*Annex table 3a: Purchasing power parities for tradables and exchange rates 2002*

| | Exchange rate per US dollar | All final goods | Food and beverages | Clothing and footwear | Furnishings and household equipment | Health | Transport equipment | Recreation, culture and misc. goods | Machinery and equipment | Travel and trans-portation services | Tradables total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Purchasing power parities | | | | | | | | | |
| Austria | 1.0626 | 1.0396 | 0.9358 | 1.0152 | 1.1855 | 0.7375 | 0.8683 | 1.1096 | 1.1069 | 1.1880 | 1.0598 |
| Belgium | 1.0626 | 1.0517 | 1.0522 | 1.1470 | 1.2439 | 0.6484 | 0.9285 | 1.0834 | 1.0350 | 1.0191 | 1.0517 |
| Finland | 1.0626 | 1.0110 | 0.9138 | 0.6924 | 1.1652 | 0.7667 | 0.6222 | 1.1576 | 1.1655 | 1.3278 | 1.0422 |
| France | 1.0626 | 1.1442 | 1.1469 | 1.2042 | 1.1858 | 0.6305 | 0.9470 | 1.1086 | 1.2896 | 0.9945 | 1.1262 |
| Germany | 1.0626 | 1.1109 | 0.8941 | 0.9206 | 1.0999 | 0.9385 | 1.0087 | 1.0496 | 1.2661 | 1.0225 | 1.1066 |
| Greece | 1.0626 | 1.0078 | 1.0856 | 0.9785 | 0.9770 | 0.4344 | 0.6151 | 0.9388 | 1.1125 | 1.0039 | 0.9860 |
| Ireland | 1.0626 | 1.1085 | 1.0408 | 0.6953 | 1.2051 | 0.6563 | 1.0961 | 1.1783 | 1.2883 | 1.2848 | 1.1361 |
| Italy | 1.0626 | 1.0715 | 0.9195 | 1.1358 | 1.2073 | 0.8096 | 0.9114 | 1.0733 | 1.1045 | 1.2175 | 1.0873 |
| Netherlands | 1.0626 | 0.9396 | 0.9827 | 0.8427 | 1.0620 | 0.4502 | 0.9352 | 0.8648 | 1.0501 | 1.2072 | 0.9682 |
| Portugal | 1.0626 | 1.0246 | 0.9880 | 0.9729 | 0.8684 | 0.5437 | 0.9740 | 0.9976 | 1.1766 | 1.0083 | 1.0213 |
| Spain | 1.0626 | 1.0571 | 0.9622 | 1.1452 | 1.1658 | 0.6209 | 0.8892 | 1.0175 | 1.1587 | 1.0117 | 1.0475 |
| EURO 12 | 1.0626 | 1.0761 | 0.9953 | 1.0587 | 1.1500 | 0.6780 | 0.9572 | 1.0434 | 1.1933 | 1.0692 | 1.0783 |
| Denmark | 7.8953 | 7.9132 | 7.3074 | 7.6511 | 9.8272 | 5.6498 | 7.0750 | 8.6291 | 7.9539 | 12.3171 | 8.3513 |
| Sweden | 9.7341 | 9.4612 | 9.8357 | 7.6805 | 12.6329 | 5.8383 | 8.7023 | 11.9173 | 9.6669 | 11.9577 | 9.7143 |
| United Kingdom | 0.6682 | 0.6770 | 0.6395 | 0.4866 | 0.8182 | 0.4360 | 0.6156 | 0.8228 | 0.7246 | 0.8128 | 0.6948 |
| EU 15 | 1.0626 | 1.0745 | 0.9973 | 1.0312 | 1.1731 | 0.6808 | 0.9589 | 1.0850 | 1.1786 | 1.1112 | 1.0821 |
| Cyprus | 0.6113 | 0.6641 | 0.7592 | 0.4754 | 0.6822 | 0.5146 | 0.5134 | 0.5710 | 0.5959 | 0.7588 | 0.6728 |
| Czech Republic | 32.730 | 26.991 | 19.308 | 19.225 | 27.093 | 13.045 | 25.761 | 28.899 | 33.390 | 25.790 | 27.027 |
| Estonia | 16.625 | 15.387 | 12.467 | 16.607 | 13.541 | 8.452 | 13.758 | 14.833 | 18.792 | 14.538 | 15.266 |
| Hungary | 258.16 | 201.63 | 150.50 | 169.79 | 180.73 | 100.41 | 193.93 | 228.70 | 244.24 | 183.67 | 200.46 |
| Latvia | 0.6174 | 0.5386 | 0.4522 | 0.5316 | 0.5275 | 0.2786 | 0.5260 | 0.5428 | 0.6513 | 0.5976 | 0.5462 |
| Lithuania | 3.6758 | 3.1971 | 2.3706 | 3.2141 | 2.8512 | 1.7857 | 3.0161 | 3.0235 | 4.0427 | 3.5885 | 3.2473 |
| Malta | 0.4345 | 0.4758 | 0.4624 | 0.4267 | 0.5719 | 0.2950 | 0.3893 | 0.5219 | 0.4954 | 0.3962 | 0.4500 |
| Poland | 4.0987 | 3.3404 | 2.3930 | 2.4443 | 3.3346 | 1.7798 | 3.4664 | 3.7296 | 4.1824 | 3.4770 | 3.3682 |
| Slovenia | 240.10 | 221.04 | 194.19 | 254.46 | 208.57 | 132.58 | 183.39 | 260.66 | 241.73 | 203.16 | 219.01 |
| Slovak Republic | 45.364 | 34.243 | 25.178 | 23.444 | 37.178 | 19.385 | 31.158 | 34.786 | 43.736 | 23.730 | 33.336 |
| EU10 | 1.0626 | 0.8679 | 0.6501 | 0.6928 | 0.8536 | 0.4839 | 0.8169 | 0.9510 | 1.0606 | 0.8802 | 0.8699 |
| Iceland | 91.569 | 98.819 | 91.579 | 76.184 | 136.454 | 65.903 | 78.203 | 140.939 | 126.935 | 159.250 | 105.586 |
| Norway | 7.9783 | 9.5291 | 8.9537 | 7.4789 | 10.8439 | 6.4296 | 8.3657 | 11.0852 | 10.6623 | 13.3054 | 9.8993 |
| Switzerland | 1.5588 | 2.1659 | 2.1327 | 1.7112 | 2.2003 | 1.9523 | 1.6502 | 2.1231 | 2.1235 | 2.3347 | 2.1934 |
| Turkey | 1529732 | 1229273 | 1038234 | 773431 | 1018503 | 751842 | 1360747 | 1441931 | 1934254 | 1134688 | 1217018 |
| Australia | 1.8406 | 1.6206 | 1.5357 | 1.3858 | 1.7516 | 0.9416 | 1.4573 | 1.9277 | 1.7493 | 1.8687 | 1.66 |
| New Zealand | 2.1622 | 1.8894 | 1.7021 | 1.8435 | 2.5064 | 1.0855 | 1.8503 | 2.2755 | 2.1007 | 2.2531 | 1.95 |
| Japan | 125.39 | 135.62 | 203.84 | 170.66 | 180.95 | 103.54 | 96.70 | 111.37 | 149.65 | 147.55 | 137.55 |
| Korea | 1251.1 | 1016.4 | 1043.7 | 750.9 | 977.1 | 317.3 | 887.5 | 947.0 | 1205.1 | 954.1 | 1013.8 |
| Canada | 1.5693 | 1.4845 | 1.4305 | 1.4556 | 1.5935 | 1.3348 | 1.3593 | 1.6751 | 1.4818 | 1.8808 | 1.5186 |
| Mexico | 9.6560 | 9.2631 | 9.2268 | 8.2935 | 9.2926 | 7.2088 | 7.2042 | 9.8851 | 10.1848 | 9.3446 | 9.2765 |
| United States | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| OECD 30 | 1.0000 | 0.9965 | 0.9248 | 0.8537 | 1.0440 | 0.7025 | 0.8542 | 0.9989 | 1.0778 | 1.0204 | 1.0026 |
| Bulgaria | 2.0711 | 1.3265 | 1.0450 | 0.9291 | 1.2638 | 1.1857 | 1.2114 | 1.6483 | 1.7096 | 1.1205 | 1.2818 |
| Croatia | 7.8690 | 6.9545 | 6.4761 | 6.8722 | 6.1816 | 3.6789 | 5.9339 | 7.5719 | 7.9073 | 6.3873 | 6.7303 |
| Israel | 4.7378 | 4.0496 | 4.7155 | 3.6940 | 5.0497 | 3.0981 | 5.3844 | 4.2205 | 4.3370 | 4.9303 | 4.1131 |
| Macedonia | 64.350 | 43.022 | 30.370 | 34.687 | 42.299 | 18.266 | 45.387 | 45.887 | 69.781 | 39.226 | 42.798 |
| Romania | 33226 | 19965 | 17380 | 10991 | 20362 | 12788 | 24192 | 26457 | 31857 | 20062 | 20006 |
| Russian Federation | 31.350 | 19.956 | 13.736 | 16.098 | 20.791 | 9.161 | 20.277 | 14.834 | 26.630 | 23.920 | 20.746 |

*Source: Wifo calculations using data for PPPs at the basic heading level from the Eurostat-OECD PPP Programme.*

*Annex table 3b: Purchasing power parities for tradables and exchange rates 1999*

| | Exchange rate per US dollar | All final goods | Food and beverages | Clothing and footwear | Furnishings and household equipment | Health | Transport equipment | Recreation, culture and misc. goods | Machinery and equipment | Travel and trans-portation services | Tradables total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Purchasing power parities | | | | | | | | | |
| Austria | 0.9384 | 0.9782 | 0.8860 | 1.3742 | 0.9939 | 0.8465 | 0.8354 | 1.0610 | 0.9829 | 1.0676 | 0.9900 |
| Belgium | 0.9384 | 1.0110 | 0.9892 | 1.5266 | 1.0335 | 0.7947 | 0.9118 | 1.1287 | 0.9549 | 1.2368 | 1.0306 |
| Finland | 0.9384 | 0.9311 | 0.8591 | 0.8744 | 0.9334 | 0.9943 | 0.6396 | 1.3073 | 0.9670 | 1.4360 | 0.9756 |
| France | 0.9384 | 1.0978 | 1.0750 | 1.5581 | 1.1233 | 0.8193 | 0.9326 | 1.1660 | 1.1057 | 1.1097 | 1.0990 |
| Germany | 0.9384 | 0.9971 | 0.8608 | 1.1383 | 1.0008 | 1.0506 | 0.9300 | 1.0336 | 1.0141 | 1.1489 | 1.0120 |
| Greece | 0.9384 | 0.9135 | 1.0545 | 1.1899 | 0.8268 | 0.4005 | 0.6868 | 1.0250 | 0.7848 | 0.9054 | 0.8843 |
| Ireland | 0.9384 | 0.8736 | 0.8465 | 0.8848 | 0.9954 | 0.5246 | 1.0214 | 1.0460 | 0.9196 | 1.2973 | 0.9091 |
| Italy | 0.9384 | 0.9473 | 0.8374 | 1.3822 | 0.9086 | 0.7918 | 0.8337 | 1.0135 | 0.9259 | 1.2390 | 0.9792 |
| Netherlands | 0.9384 | 0.8591 | 0.8640 | 1.0289 | 0.9464 | 0.5639 | 0.9312 | 1.0037 | 0.8113 | 1.2012 | 0.8896 |
| Portugal | 0.9384 | 0.9035 | 0.7905 | 1.1343 | 0.7780 | 0.6143 | 0.9368 | 0.9796 | 0.9146 | 0.8876 | 0.9014 |
| Spain | 0.9384 | 0.9207 | 0.8691 | 1.2419 | 0.9257 | 0.7000 | 0.8587 | 1.0274 | 0.9007 | 1.0253 | 0.9359 |
| EURO 12 | 0.9384 | 0.9763 | 0.9149 | 1.2923 | 0.9808 | 0.7788 | 0.9072 | 1.0672 | 0.9739 | 1.1074 | 0.9938 |
| Denmark | 6.9776 | 7.3872 | 6.5402 | 8.6973 | 8.3588 | 6.7977 | 6.9222 | 9.2240 | 7.1082 | 10.9826 | 7.7526 |
| Sweden | 8.2651 | 8.8275 | 8.6294 | 9.2488 | 10.4225 | 9.0865 | 8.5230 | 12.3572 | 8.2811 | 19.2373 | 9.6154 |
| United Kingdom | 0.6182 | 0.6754 | 0.5940 | 0.7896 | 0.8019 | 0.5170 | 0.6829 | 0.7607 | 0.6747 | 1.0308 | 0.7132 |
| EU 15 | 0.9384 | 0.9836 | 0.9124 | 1.2774 | 1.0092 | 0.7959 | 0.9198 | 1.0882 | 0.9792 | 1.1785 | 1.0088 |
| Cyprus | 0.5432 | 0.5593 | 0.5818 | 0.5590 | 0.5393 | 0.6206 | 0.4538 | 0.6261 | 0.4834 | 0.5523 | 0.5401 |
| Czech Republic | 34.615 | 23.982 | 18.087 | 23.278 | 23.777 | 12.930 | 26.582 | 24.504 | 26.832 | 19.470 | 23.468 |
| Estonia | 14.683 | 11.963 | 7.995 | 16.357 | 9.868 | 11.687 | 12.984 | 13.045 | 14.525 | 9.023 | 11.514 |
| Hungary | 237.20 | 162.19 | 119.39 | 186.10 | 143.00 | 105.18 | 174.98 | 169.42 | 185.23 | 145.16 | 160.75 |
| Latvia | 0.5854 | 0.5484 | 0.4464 | 0.9844 | 0.4177 | 0.3510 | 0.5712 | 0.6331 | 0.5421 | 0.4564 | 0.5354 |
| Lithuania | 4.0006 | 3.2870 | 2.6274 | 4.8477 | 2.4766 | 2.1170 | 3.7641 | 3.4844 | 3.4116 | 2.4366 | 3.1416 |
| Malta | 0.3996 | 0.4343 | 0.4583 | 0.6364 | 0.4656 | 0.1911 | 0.3694 | 0.5011 | 0.4357 | 0.4773 | 0.4448 |
| Poland | 3.9671 | 2.9172 | 2.2029 | 2.9190 | 2.7692 | 2.5230 | 3.3442 | 3.3722 | 3.3204 | 2.6801 | 2.8994 |
| Slovenia | 182.50 | 168.95 | 169.75 | 242.58 | 146.03 | 109.00 | 157.02 | 213.11 | 173.93 | 130.26 | 164.42 |
| Slovak Republic | 41.405 | 26.555 | 21.547 | 21.816 | 24.219 | 18.617 | 28.107 | 26.695 | 32.559 | 18.830 | 25.894 |
| EU10 | 0.9384 | 0.6777 | 0.5209 | 0.7376 | 0.6382 | 0.4674 | 0.7196 | 0.7274 | 0.7571 | 0.6270 | 0.6719 |
| Iceland | 72.429 | 73.396 | 68.242 | 98.691 | 94.726 | 77.095 | 68.983 | 111.166 | 82.371 | 118.556 | 78.000 |
| Norway | 7.7986 | 8.4131 | 7.9715 | 9.9137 | 9.0311 | 6.9013 | 8.5015 | 11.4953 | 8.3884 | 13.5074 | 8.8911 |
| Switzerland | 1.5018 | 1.9750 | 1.9740 | 2.2210 | 1.8668 | 2.2764 | 1.7135 | 2.2437 | 1.7614 | 2.4402 | 2.0290 |
| Turkey | 419688 | 291866 | 303771 | 186929 | 257023 | 302223 | 412662 | 445097 | 401603 | 286067 | 292889 |
| Australia | 1.5497 | 1.4952 | 1.3413 | 1.5292 | 1.9423 | 1.4652 | 1.4264 | 1.8597 | 1.5216 | 1.5809 | 1.52 |
| New Zealand | 1.8918 | 1.5878 | 1.3843 | 1.7640 | 2.3125 | 1.7656 | 1.7685 | 2.1786 | 1.6450 | 1.9064 | 1.64 |
| Japan | 113.89 | 146.11 | 220.08 | 195.97 | 187.39 | 145.16 | 110.32 | 161.30 | 135.42 | 220.20 | 149.61 |
| Korea | 1186.7 | 979.1 | 994.8 | 1164.7 | 1042.6 | 431.0 | 731.1 | 1146.2 | 1023.1 | 1178.3 | 1000.3 |
| Canada | 1.4855 | 1.3380 | 1.3980 | 1.6815 | 1.4463 | 1.2497 | 1.2547 | 1.4550 | 1.2767 | 1.5293 | 1.3604 |
| Mexico | 9.5530 | 8.8301 | 8.2111 | 8.7419 | 8.7580 | 8.2542 | 7.0417 | 11.6782 | 9.1236 | 6.9863 | 8.6822 |
| United States | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| OECD 30 | 1.0000 | 1.0269 | 0.9433 | 1.0742 | 1.0284 | 0.9088 | 0.9238 | 1.1534 | 1.0248 | 1.1126 | 1.0425 |
| Bulgaria | 1.8354 | 1.0368 | 0.9150 | 0.9657 | 0.6448 | 2.6263 | 1.2229 | 0.9952 | 1.1596 | 0.6519 | 0.9711 |
| Croatia | 7.1120 | 6.3060 | 5.7795 | 9.7397 | 6.0870 | 3.8081 | 6.3665 | 9.0500 | 5.6151 | 6.1535 | 6.2641 |
| Israel | 4.1396 | 3.8712 | 4.2428 | 4.8097 | 4.9907 | 2.9753 | 5.5083 | 4.5357 | 3.6965 | 6.4166 | 4.1044 |
| Macedonia | 56.902 | 33.818 | 23.855 | 35.816 | 33.594 | 20.621 | 39.690 | 42.681 | 41.294 | 35.969 | 34.051 |
| Romania | 15339 | 7139 | 6976 | 4820 | 6052 | 7903 | 9817 | 7946 | 10780 | 8667 | 7320 |
| Russian Federation | 24.620 | 13.073 | 11.579 | 15.117 | 14.220 | 9.649 | 16.409 | 11.175 | 14.271 | 10.558 | 12.546 |

*Source: Wifo calculations using data for PPPs at the basic heading level from the Eurostat-OECD PPP Programme.*

*Annex table 3c: Purchasing power parities for tradables and exchange rates 1996*

| | Exchange rate per US dollar | All final goods | Food and beverages | Clothing and footwear | Furnishings and household equipment | Health | Transport equipment | Recreation, culture and misc. goods | Machinery and equipment | Travel and trans-portation services | Tradables total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Purchasing power parities | | | | | | | | | |
| Austria | 0.7694 | 0.9331 | 0.9335 | 1.2587 | 1.1078 | 0.8744 | 0.9742 | 1.1264 | 0.8425 | 1.2473 | 0.9799 |
| Belgium | 0.7677 | 0.9413 | 0.9830 | 1.5321 | 1.1955 | 0.7595 | 0.9631 | 1.0729 | 0.7999 | 1.2602 | 0.9741 |
| Finland | 0.7724 | 1.0503 | 0.9109 | 0.9988 | 1.1127 | 0.9803 | 0.7124 | 1.4007 | 1.0993 | 1.2523 | 1.0864 |
| France | 0.7800 | 1.0871 | 1.1038 | 1.7515 | 1.2307 | 0.7421 | 1.0485 | 1.2577 | 1.0045 | 1.4127 | 1.1260 |
| Germany | 0.7694 | 1.0189 | 0.9098 | 1.1688 | 1.1716 | 1.0987 | 0.9984 | 1.0887 | 1.0005 | 1.3363 | 1.0539 |
| Greece | 0.7066 | 0.8701 | 0.9310 | 1.1983 | 0.8794 | 0.4130 | 0.6922 | 0.9847 | 0.7252 | 0.9702 | 0.8826 |
| Ireland | 0.7939 | 0.8500 | 0.8162 | 1.0503 | 1.0807 | 0.5068 | 0.9848 | 1.0150 | 0.8409 | 1.4103 | 0.9005 |
| Italy | 0.7973 | 0.9762 | 0.9019 | 1.3736 | 1.1015 | 0.7282 | 0.9686 | 0.9488 | 0.9526 | 1.1742 | 1.0028 |
| Netherlands | 0.7651 | 0.8567 | 0.8775 | 0.9745 | 0.9908 | 0.9111 | 0.9658 | 0.8521 | 0.8245 | 1.2639 | 0.8996 |
| Portugal | 0.7695 | 0.9644 | 0.8163 | 1.4040 | 0.9786 | 0.5694 | 1.1516 | 1.0264 | 0.8678 | 0.8668 | 0.9481 |
| Spain | 0.7613 | 0.9587 | 0.9146 | 1.2780 | 1.1386 | 0.5628 | 1.0285 | 1.1324 | 0.8860 | 1.1791 | 0.9918 |
| EURO 12 | 0.7750 | 0.9829 | 0.9443 | 1.3214 | 1.1340 | 0.7906 | 1.0034 | 1.0506 | 0.9469 | 1.2429 | 1.0173 |
| Denmark | 5.7994 | 7.2005 | 7.0922 | 8.8751 | 8.4299 | 6.8532 | 7.6710 | 8.9841 | 6.4805 | 12.3741 | 7.6857 |
| Sweden | 6.7098 | 9.3621 | 9.3124 | 9.4617 | 11.1410 | 9.3980 | 9.1696 | 12.3696 | 8.8822 | 11.9604 | 9.6573 |
| United Kingdom | 0.6413 | 0.7004 | 0.6288 | 0.7631 | 0.7878 | 0.5937 | 0.7736 | 0.7865 | 0.7047 | 0.8783 | 0.7274 |
| EU 15 | 0.7750 | 0.9658 | 0.9272 | 1.2700 | 1.1199 | 0.7954 | 0.9977 | 1.0388 | 0.9338 | 1.2174 | 1.0002 |
| Cyprus | - | - | - | - | - | - | - | - | - | - | - |
| Czech Republic | 27.145 | 23.634 | 15.857 | 19.991 | 28.236 | 10.652 | 26.934 | 27.131 | 27.831 | 19.541 | 22.737 |
| Estonia | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Hungary | 152.65 | 125.25 | 93.20 | 114.33 | 123.48 | 60.31 | 141.45 | 157.27 | 168.24 | 109.94 | 122.72 |
| Latvia | - | - | - | - | - | - | - | - | - | - | - |
| Lithuania | - | - | - | - | - | - | - | - | - | - | - |
| Malta | - | - | - | - | - | - | - | - | - | - | - |
| Poland | 2.6615 | 2.5632 | 2.2183 | 2.4675 | 3.0131 | 1.3743 | 3.8438 | 2.9763 | 2.6917 | 3.7179 | 2.7115 |
| Slovenia | 152.65 | 152.40 | 138.73 | 210.48 | 163.49 | 91.64 | 169.90 | 205.20 | 142.13 | 165.19 | 154.50 |
| Slovak Republic | 30.650 | 26.956 | 18.031 | 20.322 | 30.908 | 16.202 | 30.210 | 34.986 | 32.567 | 19.182 | 25.966 |
| EU10 | - | - | - | - | - | - | - | - | - | - | - |
| Iceland | 66.711 | 72.177 | 68.342 | 95.728 | 101.283 | 95.950 | 71.613 | 113.929 | 72.336 | 100.212 | 75.800 |
| Norway | 6.4591 | 8.1610 | 7.8911 | 9.3845 | 9.7844 | 7.2085 | 8.7738 | 11.4542 | 7.7797 | 12.6055 | 8.6417 |
| Switzerland | 1.2355 | 2.0979 | 2.0587 | 2.3023 | 2.3072 | 2.6967 | 1.7851 | 2.2269 | 1.9542 | 2.3837 | 2.1443 |
| Turkey | 81405 | 71787 | 53072 | 79732 | 71762 | 51991 | 90774 | 92807 | 86425 | 55965 | 69545 |
| Australia | 1.2779 | 1.4166 | 1.1451 | 1.6613 | 2.0059 | 1.0423 | 1.5462 | 2.0474 | 1.6191 | 1.0935 | 1.32 |
| New Zealand | 1.4549 | 1.5372 | 1.3509 | 1.9514 | 2.1922 | 1.3854 | 2.0498 | 2.3412 | 1.6632 | 1.3317 | 1.51 |
| Japan | 108.78 | 147.40 | 231.35 | 177.87 | 237.61 | 116.49 | 102.53 | 160.30 | 137.04 | 168.04 | 149.93 |
| Korea | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Canada | 1.3635 | 1.3985 | 1.5112 | 1.9356 | 1.3489 | 1.2743 | 1.5238 | 1.2464 | 1.3150 | 1.2248 | 1.3939 |
| Mexico | 7.6009 | 5.8779 | 4.8870 | 3.8821 | 5.8337 | 4.8910 | 5.9478 | 7.6661 | 6.5116 | 4.8969 | 5.8321 |
| United States | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| OECD 30 | - | - | - | - | - | - | - | - | - | - | - |
| Bulgaria | - | - | - | - | - | - | - | - | - | - | - |
| Croatia | - | - | - | - | - | - | - | - | - | - | - |
| Israel | 3.1917 | 3.3960 | 3.7080 | 3.2929 | 4.7883 | 2.9765 | 5.1812 | 4.9493 | 2.5055 | 4.2794 | 3.5106 |
| Macedonia | - | - | - | - | - | - | - | - | - | - | - |
| Romania | - | - | - | - | - | - | - | - | - | - | - |
| Russian Federation | 5.124 | 4.364 | 3.714 | 3.491 | 5.366 | 2.657 | 6.819 | 3.971 | 4.516 | 4.405 | 4.365 |

*Source: Wifo calculations using data for PPPs at the basic heading level from the Eurostat-OECD PPP Programme.*

*Annex table 3d: Purchasing power parities for tradables and exchange rates 1993*

| | Exchange rate per US dollar | All final goods | Food and beverages | Clothing and footwear | Furnishings and household equipment | Health | Transport equipment | Recreation, culture and misc. goods | Machinery and equipment | Travel and trans-portation services | Tradables total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Purchasing power parities | | | | | | | | | |
| Austria | 0.8455 | 1.0334 | 1.0144 | 1.2156 | 1.3348 | 0.5160 | 0.9323 | 1.5228 | 0.9716 | 1.2134 | 1.0588 |
| Belgium | 0.8567 | 0.9974 | 0.9304 | 1.3927 | 1.3800 | 0.4950 | 0.9577 | 1.4280 | 0.8831 | 1.3262 | 1.0271 |
| Finland | 0.9618 | 1.0620 | 1.1213 | 0.8403 | 1.4110 | 0.5483 | 0.7433 | 1.6800 | 1.0775 | 1.2241 | 1.0847 |
| France | 0.8636 | 1.2012 | 1.1015 | 1.7102 | 1.4503 | 0.3931 | 1.0750 | 1.5584 | 1.2648 | 1.5047 | 1.2350 |
| Germany | 0.8455 | 1.1074 | 0.9423 | 1.1121 | 1.3330 | 0.7274 | 1.0559 | 1.4268 | 1.1484 | 1.2858 | 1.1304 |
| Greece | 0.6731 | 0.7344 | 0.7188 | 0.8769 | 0.8260 | 0.1956 | 0.6247 | 1.1132 | 0.6604 | 0.7092 | 0.7234 |
| Ireland | 0.8458 | 0.9123 | 0.7811 | 0.8670 | 1.1518 | 0.5856 | 0.8493 | 1.2368 | 0.9584 | 1.2077 | 0.9441 |
| Italy | 0.8120 | 0.9278 | 0.7901 | 1.3417 | 1.1077 | 0.3818 | 0.8365 | 1.1031 | 0.9432 | 1.1061 | 0.9496 |
| Netherlands | 0.8429 | 0.9831 | 0.9113 | 0.8696 | 1.1547 | 0.6564 | 0.9964 | 1.2614 | 1.0220 | 1.3564 | 1.0206 |
| Portugal | 0.8024 | 0.9168 | 0.7493 | 1.0854 | 0.9112 | 0.3447 | 1.0285 | 1.3412 | 0.9315 | 0.8304 | 0.9012 |
| Spain | 0.7654 | 0.9027 | 0.7855 | 1.0448 | 1.1441 | 0.2879 | 0.9091 | 1.3757 | 0.9250 | 1.0865 | 0.9306 |
| EURO 12 | 0.8386 | 1.0399 | 0.9206 | 1.2381 | 1.2586 | 0.4980 | 0.9996 | 1.3589 | 1.0738 | 1.2290 | 1.0651 |
| Denmark | 6.4847 | 7.2497 | 7.1153 | 8.8626 | 9.9557 | 5.1305 | 7.5577 | 10.9428 | 6.2131 | 12.4969 | 7.6602 |
| Sweden | 7.7895 | 9.1046 | 10.0540 | 7.5582 | 11.6748 | 4.4699 | 8.8841 | 13.1863 | 8.9178 | 10.7822 | 9.3043 |
| United Kingdom | 0.6661 | 0.6855 | 0.5931 | 0.6010 | 0.9716 | 0.4195 | 0.7347 | 0.8775 | 0.6949 | 0.9936 | 0.7213 |
| EU 15 | 0.8386 | 1.0108 | 0.9041 | 1.1775 | 1.2566 | 0.5066 | 0.9920 | 1.3188 | 1.0284 | 1.2362 | 1.0397 |
| Cyprus | - | - | - | - | - | - | - | - | - | - | - |
| Czech Republic | - | - | - | - | - | - | - | - | - | - | - |
| Estonia | - | - | - | - | - | - | - | - | - | - | - |
| Hungary | - | - | - | - | - | - | - | - | - | - | - |
| Latvia | - | - | - | - | - | - | - | - | - | - | - |
| Lithuania | - | - | - | - | - | - | - | - | - | - | - |
| Malta | - | - | - | - | - | - | - | - | - | - | - |
| Poland | - | - | - | - | - | - | - | - | - | - | - |
| Slovenia | - | - | - | - | - | - | - | - | - | - | - |
| Slovak Republic | - | - | - | - | - | - | - | - | - | - | - |
| EU10 | - | - | - | - | - | - | - | - | - | - | - |
| Iceland | 67.600 | 71.164 | 69.645 | 75.474 | 109.599 | 58.063 | 64.082 | 147.624 | 82.634 | 126.787 | 75.835 |
| Norway | 7.0941 | 9.1059 | 7.8477 | 7.8581 | 11.3925 | 4.3475 | 8.9336 | 13.5136 | 10.2105 | 12.0871 | 9.4637 |
| Switzerland | 1.4775 | 2.3999 | 2.3227 | 2.4811 | 2.7242 | 1.6482 | 1.8836 | 3.1591 | 2.3332 | 2.4205 | 2.4123 |
| Turkey | 10985 | 9061 | 6708 | 9430 | 10862 | 3846 | 12133 | 13945 | 10569 | 6018 | 8521 |
| Australia | 1.4706 | 1.3780 | 1.0796 | 1.5899 | 2.3762 | 0.7365 | 1.5000 | 2.1493 | 1.7252 | 1.6630 | 1.44 |
| New Zealand | 1.8505 | 1.5851 | 1.4109 | 1.5929 | 2.4332 | 0.9097 | 1.9362 | 2.4912 | 1.8185 | 1.6867 | 1.61 |
| Japan | 111.19 | 178.37 | 237.08 | 245.80 | 267.91 | 83.00 | 130.22 | 198.22 | 184.73 | 200.03 | 180.30 |
| Korea | - | - | - | - | - | - | - | - | - | - | - |
| Canada | 1.2901 | 1.3646 | 1.3624 | 1.2402 | 1.5024 | 1.3749 | 1.3577 | 1.3451 | 1.3262 | 1.2599 | 1.3658 |
| Mexico | - | - | - | - | - | - | - | - | - | - | - |
| United States | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| OECD 30 | - | - | - | - | - | - | - | - | - | - | - |
| Bulgaria | - | - | - | - | - | - | - | - | - | - | - |
| Croatia | - | - | - | - | - | - | - | - | - | - | - |
| Israel | - | - | - | - | - | - | - | - | - | - | - |
| Macedonia | - | - | - | - | - | - | - | - | - | - | - |
| Romania | - | - | - | - | - | - | - | - | - | - | - |
| Russian Federation | - | - | - | - | - | - | - | - | - | - | - |

*Source: Wifo calculations using data for PPPs at the basic heading level from the Eurostat-OECD PPP Programme.*

*Annex table 3e: Purchasing power parities for tradables and exchange rates 1990*

| | Exchange rate per US dollar | All final goods | Food and beverages | Clothing and footwear | Furnishings and household equipment | Health | Transport equipment | Recreation, culture and misc. goods | Machinery and equipment | Travel and trans-portation services | Tradables total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Purchasing power parities | | | | | | | | | |
| Austria | 0.8242 | 1.0480 | 1.0547 | 1.3160 | 1.0680 | 0.6421 | 0.9300 | 1.3843 | 1.0074 | 1.0604 | 1.0497 |
| Belgium | 0.8260 | 1.0638 | 1.0597 | 1.5393 | 1.1550 | 0.5224 | 0.9414 | 1.2712 | 1.0740 | 1.0555 | 1.0607 |
| Finland | 0.6447 | 0.9556 | 1.1108 | 0.9130 | 1.1016 | 0.6069 | 0.6762 | 1.4695 | 0.9274 | 1.2043 | 0.9762 |
| France | 0.8279 | 1.2148 | 1.1311 | 1.9560 | 1.1990 | 0.4629 | 1.0676 | 1.4111 | 1.2886 | 1.0566 | 1.1969 |
| Germany | 0.8240 | 1.1163 | 0.9604 | 1.2363 | 1.0498 | 0.8505 | 1.0027 | 1.2708 | 1.1972 | 1.0661 | 1.1104 |
| Greece | 0.4642 | 0.5400 | 0.5711 | 0.5468 | 0.4445 | 0.1698 | 0.5399 | 0.6915 | 0.5902 | 0.4815 | 0.5340 |
| Ireland | 0.7119 | 0.9098 | 0.8356 | 0.9405 | 0.8309 | 0.6519 | 0.9320 | 1.0893 | 0.9610 | 0.9629 | 0.9146 |
| Italy | 0.6173 | 0.9071 | 0.6833 | 1.3863 | 0.8193 | 0.4399 | 0.7745 | 1.0416 | 0.9799 | 0.9244 | 0.9091 |
| Netherlands | 0.8241 | 0.9112 | 0.9796 | 0.9990 | 0.9141 | 0.7851 | 0.9695 | 0.7854 | 1.0164 | 1.0000 | 0.9162 |
| Portugal | 0.7095 | 0.8148 | 0.6505 | 1.0210 | 0.6634 | 0.2942 | 1.1049 | 0.8309 | 0.8801 | 0.5539 | 0.7733 |
| Spain | 0.6104 | 0.8903 | 0.7824 | 1.0679 | 0.8736 | 0.3314 | 0.9577 | 1.0741 | 0.9778 | 0.8288 | 0.8838 |
| EURO 12 | 0.7713 | 1.0414 | 0.9492 | 1.3747 | 1.0026 | 0.5816 | 0.9574 | 1.1301 | 1.1182 | 0.9977 | 1.0373 |
| Denmark | 6.1705 | 7.9965 | 7.4622 | 11.2998 | 9.3165 | 6.6082 | 8.0759 | 8.7894 | 7.9544 | 10.2501 | 8.1615 |
| Sweden | 5.9190 | 8.2896 | 10.9450 | 7.2434 | 8.5123 | 4.2666 | 7.9199 | 10.7759 | 8.0146 | 9.2944 | 8.3684 |
| United Kingdom | 0.5607 | 0.6701 | 0.5743 | 0.6419 | 0.6617 | 0.4030 | 0.7037 | 0.6983 | 0.7529 | 0.8024 | 0.6844 |
| EU 15 | 0.7713 | 1.0253 | 0.9353 | 1.3216 | 1.0022 | 0.5836 | 0.9605 | 1.1032 | 1.0981 | 1.0209 | 1.0255 |
| Cyprus | - | - | - | - | - | - | - | - | - | - | - |
| Czech Republic | - | - | - | - | - | - | - | - | - | - | - |
| Estonia | - | - | - | - | - | - | - | - | - | - | - |
| Hungary | - | - | - | - | - | - | - | - | - | - | - |
| Latvia | - | - | - | - | - | - | - | - | - | - | - |
| Lithuania | - | - | - | - | - | - | - | - | - | - | - |
| Malta | - | - | - | - | - | - | - | - | - | - | - |
| Poland | - | - | - | - | - | - | - | - | - | - | - |
| Slovenia | - | - | - | - | - | - | - | - | - | - | - |
| Slovak Republic | - | - | - | - | - | - | - | - | - | - | - |
| EU10 | - | - | - | - | - | - | - | - | - | - | - |
| Iceland | 58.280 | 71.244 | 73.416 | 73.482 | 88.486 | 62.340 | 57.041 | 163.402 | 79.067 | 113.118 | 74.648 |
| Norway | 6.2600 | 9.1802 | 9.5638 | 9.1815 | 9.8820 | 4.8452 | 8.4206 | 12.4441 | 9.1880 | 11.0618 | 9.3839 |
| Switzerland | 1.3840 | 2.2389 | 2.5062 | 2.6464 | 2.0753 | 1.8922 | 1.8878 | 2.6071 | 2.1011 | 2.2808 | 2.2439 |
| Turkey | 2613 | 2368 | 1795 | 2458 | 2745 | 894 | 5210 | 3779 | 2131 | 1621 | 2260 |
| Australia | 1.2811 | 1.3367 | 1.1601 | 1.5285 | 1.5907 | 0.9161 | 1.8679 | 2.2154 | 1.4675 | 1.3792 | 1.36 |
| New Zealand | 1.6762 | 1.4714 | 1.3588 | 1.6238 | 2.1316 | 1.1191 | 1.8991 | 2.6132 | 1.7253 | 1.6422 | 1.50 |
| Japan | 144.79 | 163.71 | 247.12 | 207.71 | 192.72 | 98.28 | 128.15 | 154.97 | 162.97 | 209.37 | 166.39 |
| Korea | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Canada | 1.1668 | 1.3446 | 1.3669 | 1.4382 | 1.3689 | 1.2343 | 1.4083 | 1.6328 | 1.2735 | 1.0047 | 1.3101 |
| Mexico | - | - | - | - | - | - | - | - | - | - | - |
| United States | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| OECD 30 | - | - | - | - | - | - | - | - | - | - | - |
| Bulgaria | - | - | - | - | - | - | - | - | - | - | - |
| Croatia | - | - | - | - | - | - | - | - | - | - | - |
| Israel | - | - | - | - | - | - | - | - | - | - | - |
| Macedonia | - | - | - | - | - | - | - | - | - | - | - |
| Romania | - | - | - | - | - | - | - | - | - | - | - |
| Russian Federation | - | - | - | - | - | - | - | - | - | - | - |

*Source: Wifo calculations using data for PPPs at the basic heading level from the Eurostat-OECD PPP Programme.*

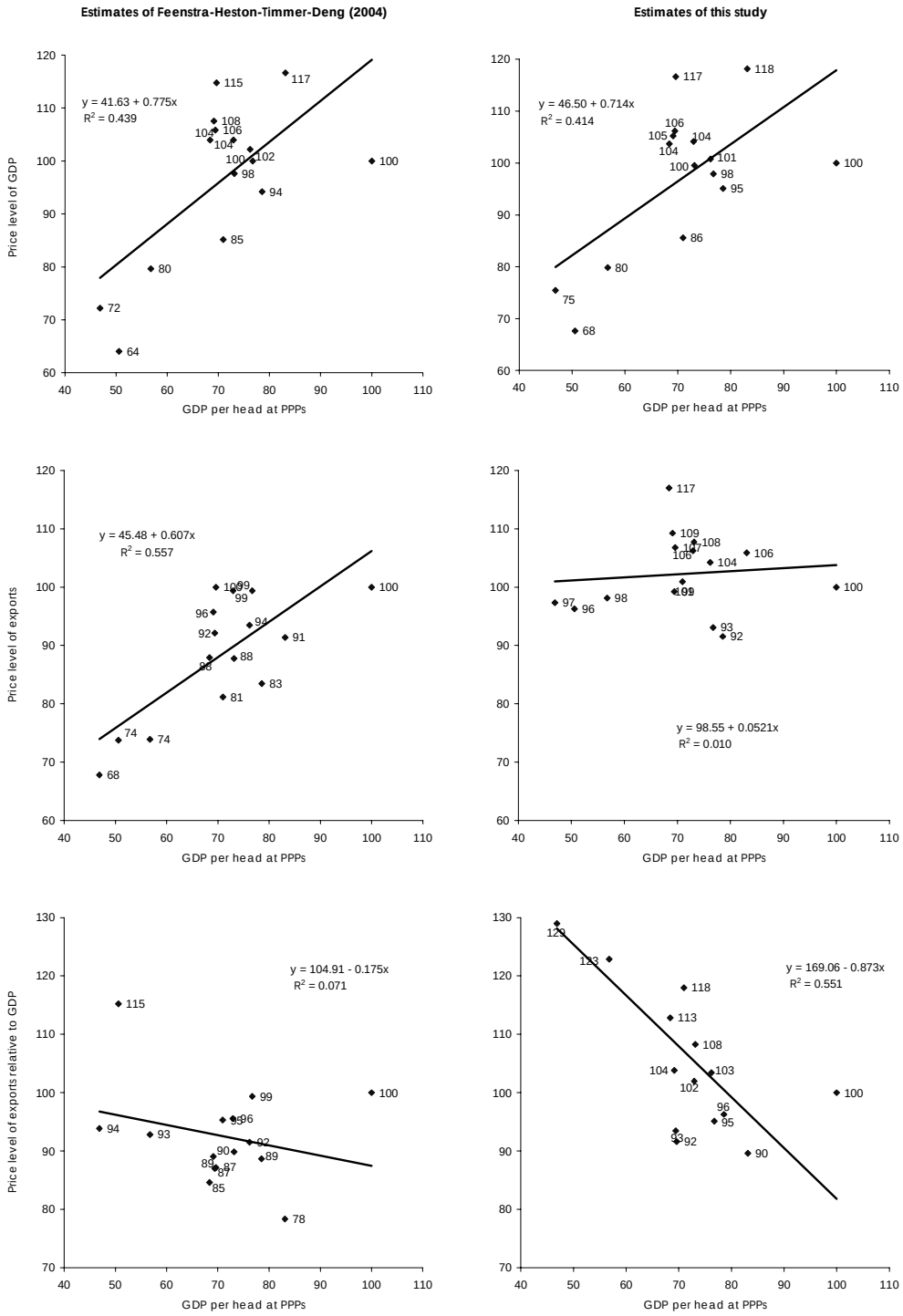
*Annex table 4: Comparison of price levels of GDP and exports for the U.S. and 14 EU countries 1999*
*USA = 100*

| | GDP | | Exports | | Exports relative to GDP | |
|---|---|---|---|---|---|---|
| | Feenstra-Heston-Timmer-Deng [1]) | Eurostat/ OECD | Feenstra-Heston-Timmer-Deng [1]) | Estimates of this study [2]) | Feenstra-Heston-Timmer-Deng [1]) | Estimates of this study [2]) |
| Austria | 102.2 | 100.8 | 93.5 | 104.2 | 91.5 | 103.4 |
| Belgium | 97.6 | 99.5 | 87.7 | 107.7 | 89.9 | 108.2 |
| Denmark | 116.6 | 118.2 | 91.4 | 105.9 | 78.3 | 89.6 |
| Finland | 105.8 | 106.2 | 92.1 | 99.2 | 87.0 | 93.5 |
| France | 104.0 | 103.7 | 87.9 | 117.0 | 84.6 | 112.8 |
| Germany | 104.0 | 104.2 | 99.4 | 106.3 | 95.6 | 102.0 |
| Greece | 72.2 | 75.5 | 67.8 | 97.3 | 93.9 | 129.0 |
| Ireland | 100.0 | 97.9 | 99.4 | 93.1 | 99.4 | 95.1 |
| Italy | 85.2 | 85.6 | 81.2 | 100.9 | 95.3 | 118.0 |
| Netherlands | 94.2 | 95.1 | 83.5 | 91.5 | 88.6 | 96.3 |
| Portugal | 64.0 | 67.6 | 73.7 | 96.3 | 115.2 | 142.3 |
| Spain | 79.6 | 79.8 | 73.9 | 98.1 | 92.8 | 122.9 |
| Sweden | 114.7 | 116.6 | 100.0 | 106.8 | 87.2 | 91.6 |
| United Kingdom | 107.5 | 105.2 | 95.7 | 109.3 | 89.0 | 103.8 |
| USA | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

*[1]) Expenditure price level. - [2]) Based on PPP for exports of final goods.*

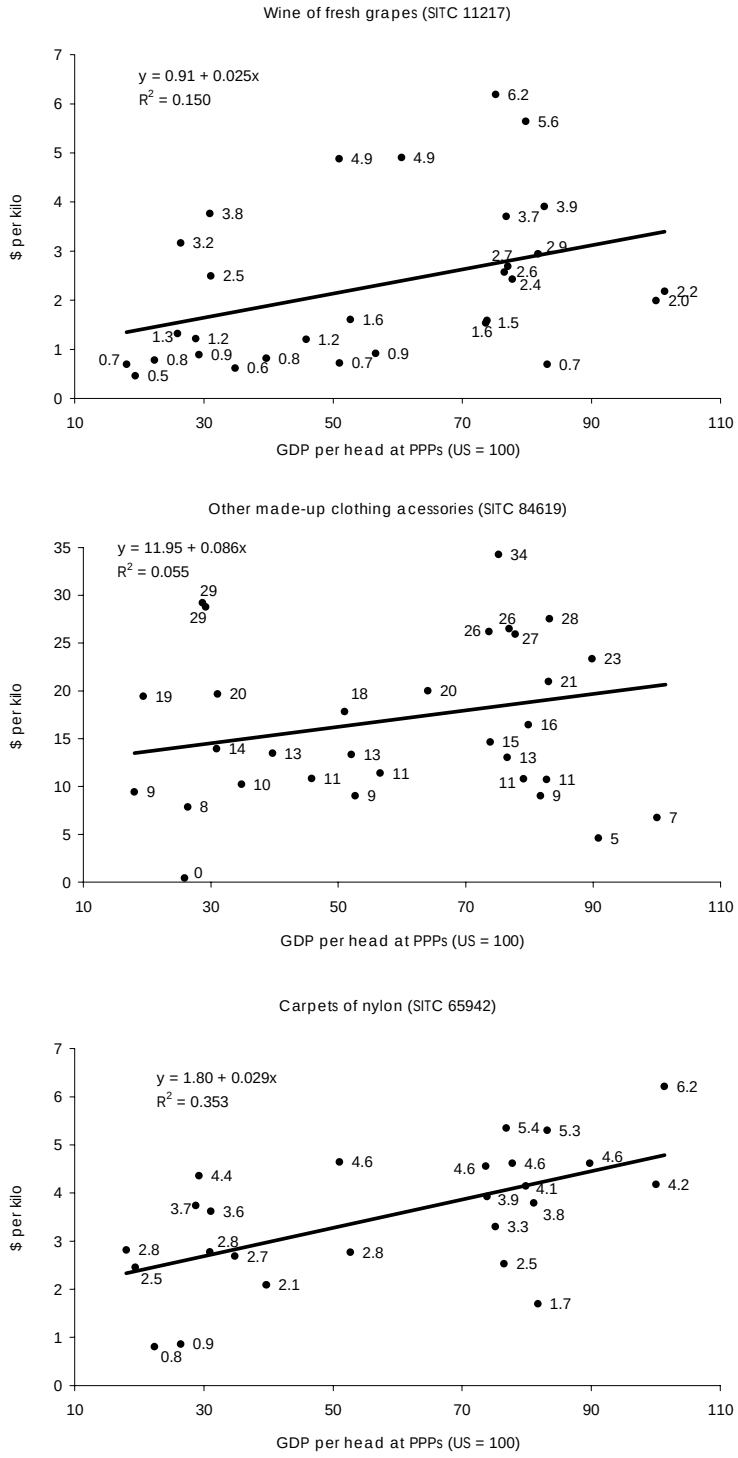
*Source: Feenstra-Heston-Timmer-Deng (2004), Eurostat, OECD, WIFO calculations.*

*Annex figure 1: Price level and GDP per head in the U.S. and 14 EU countries 1999*
*USA = 100*




*Notes: GDP per head at PPPs is taken from Eurostat-OECD (2004) for both estimates.*
*Source: Feenstra-Heston-Timmer-Deng (2004), Eurostat, OECD, WIFO calculations.*

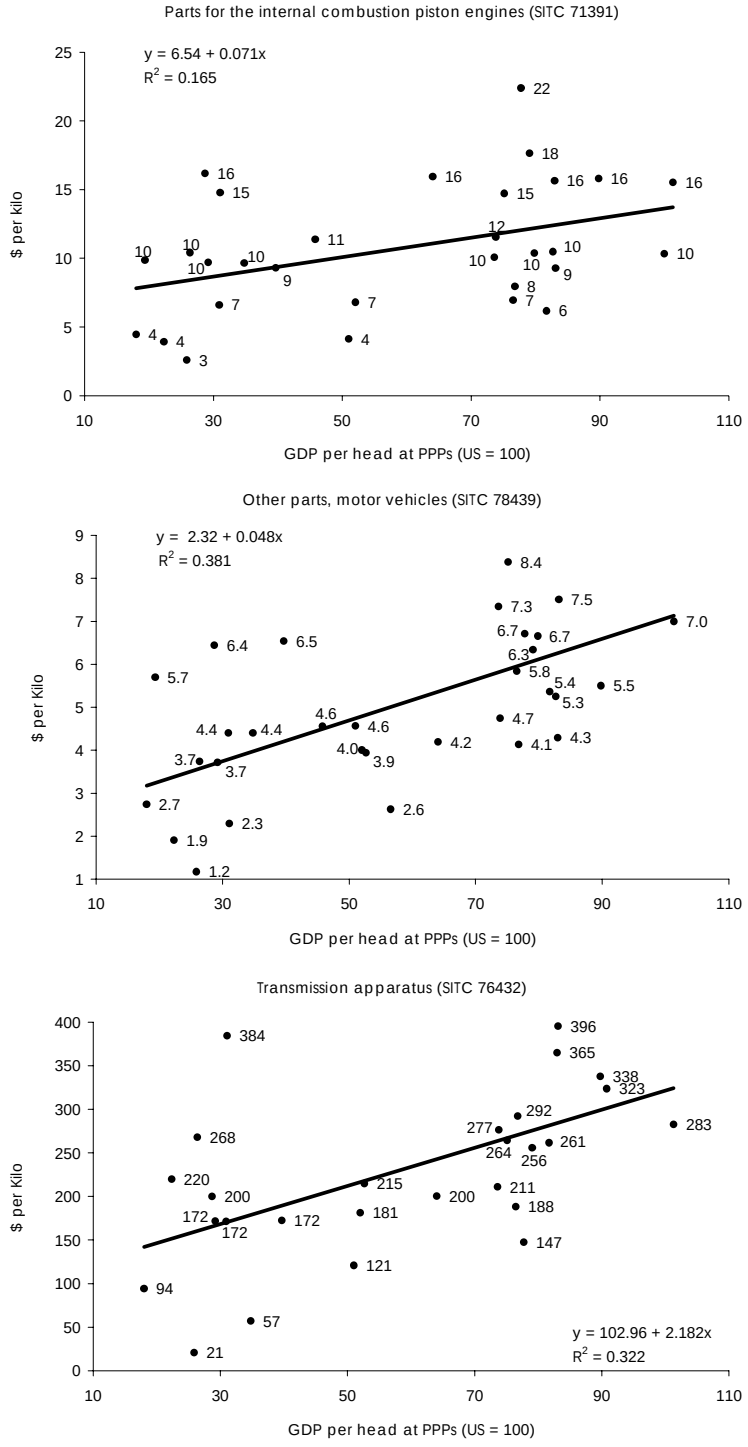
*Annex figure 2: Export unit value and GDP per head 2002*




*Notes: This figure shows the wide dispersion of unit export unit values across countries. In most cases unit values tend to be the higher the more advanced an economy is (as measured by real GDP per head). The numbers refer to unit values (y-axis).*

*Source: Wifo database using UN-COMTRADE.*

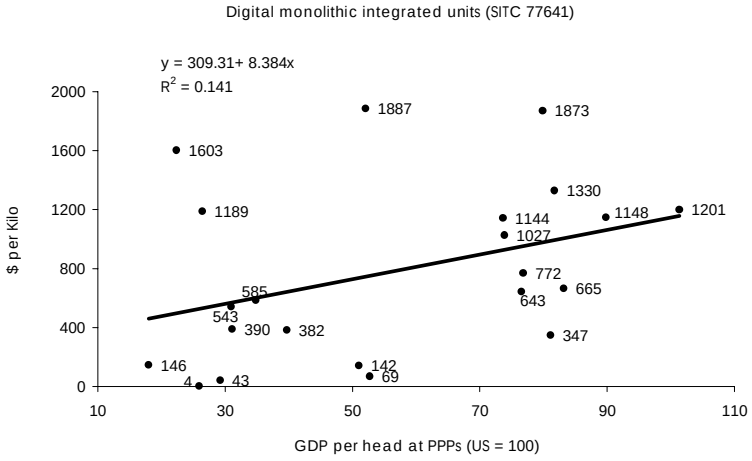
*Annex figure 2 (continued): Export unit value and GDP per head 2002*

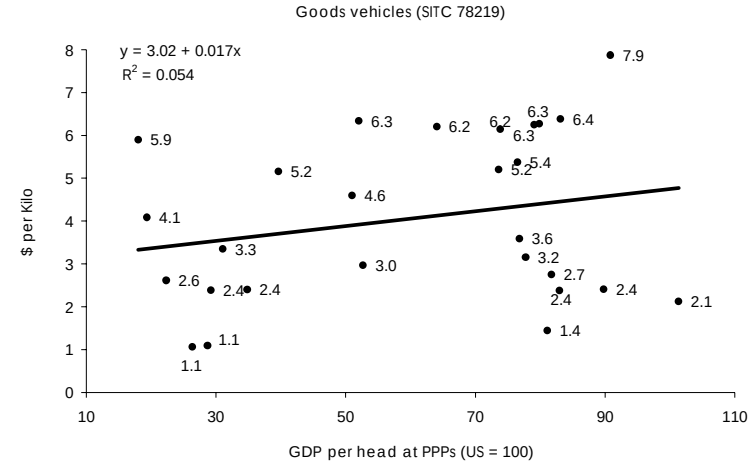


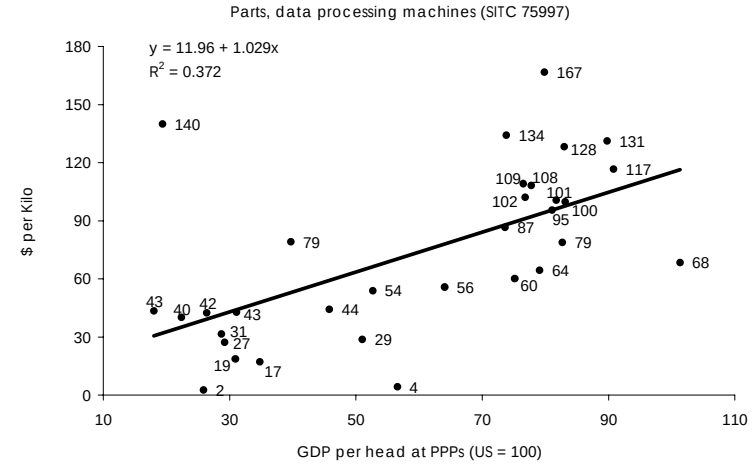

*Notes: This figure shows the wide dispersion of export unit values across countries. In most cases unit values tend to be the higher the more advanced an economy is (as measured by real GDP per head). The numbers refer to unit values (y-axis).*

*Source: Wifo database using UN-COMTRADE.*

*Annex figure 2 (continued): Export unit value and GDP per head 2002*



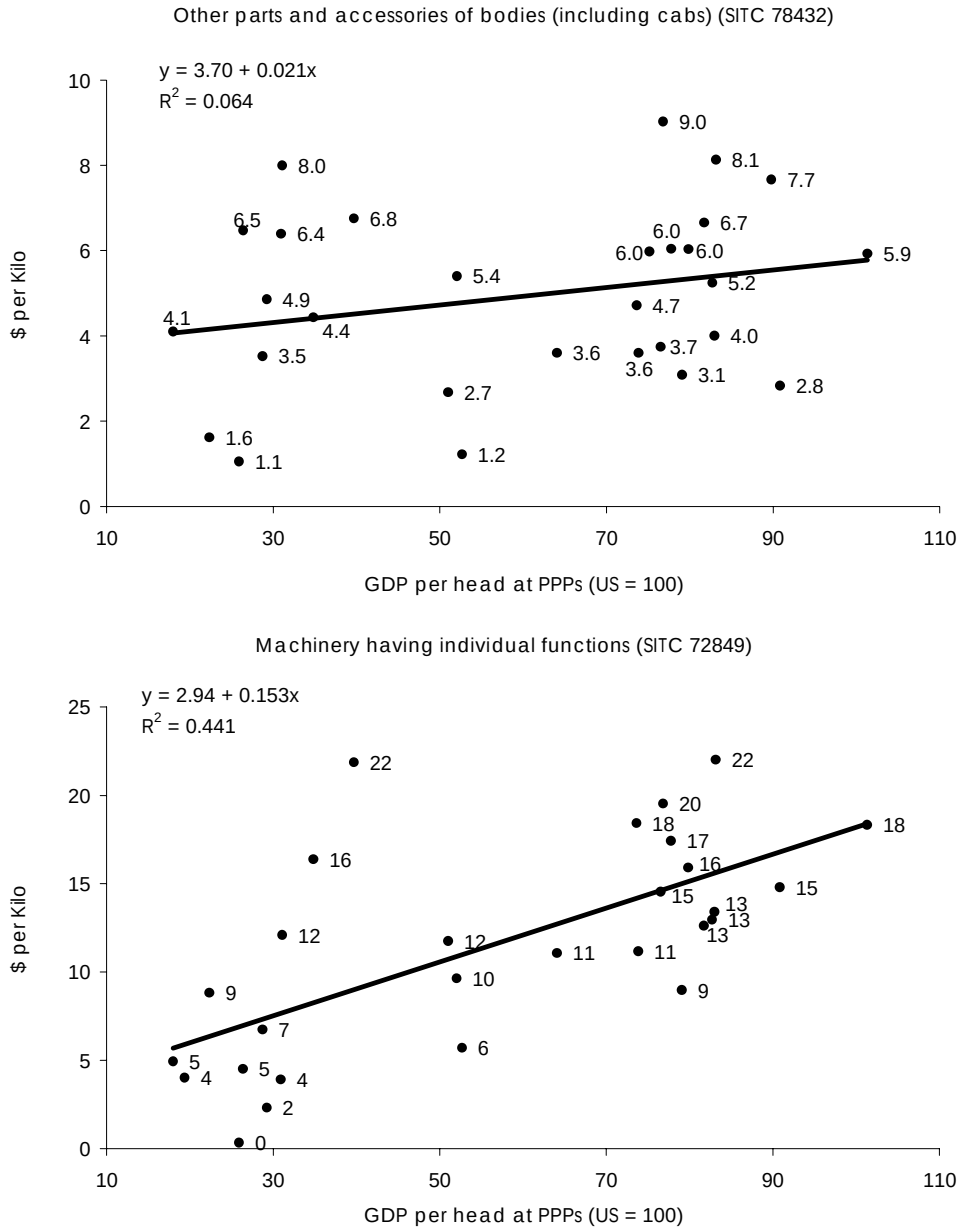




*Notes: This figure shows the wide dispersion of export unit values across countries. In most cases unit values tend to be the higher the more advanced an economy is (as measured by real GDP per head). The numbers refer to unit values (y-axis).*

*Source: Wifo database using UN-COMTRADE.*

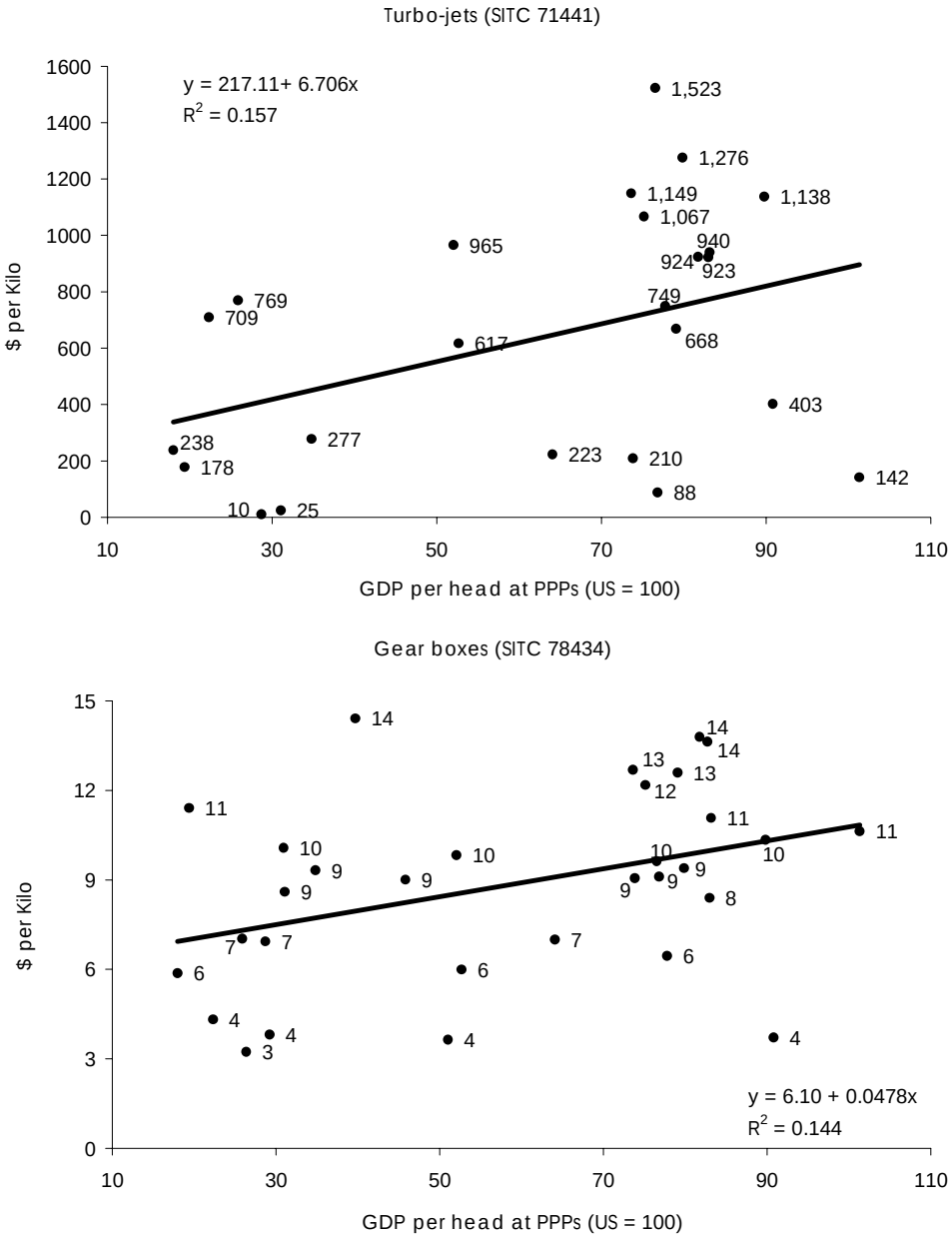
*Annex figure 2 (continued): Export unit value and GDP per head 2002*




*Notes: This figure shows the wide dispersion of export unit values across countries. In most cases unit values tend to be the higher the more advanced an economy is (as measured by real GDP per head). The numbers refer to unit values (y-axis).*

*Source: Wifo database using UN-COMTRADE.*

*Annex figure 2 (continued): Export unit value and GDP per head 2002*




*Notes: This figure shows the wide dispersion of export unit values across countries. In most cases unit values tend to be the higher the more advanced an economy is (as measured by real GDP per head). The numbers refer to unit values (y-axis).*

*Source: Wifo database using UN-COMTRADE.*

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