Macroeconomic approaches to assessing price competitiveness

Real effective exchange rates are the foremost macroeconomic indicator of a country's price competitiveness. They are particularly well suited to tracking changes in competitiveness. However, in order to assess the competitiveness position, ie the price competitiveness level, they must be referenced to an appropriate benchmark. In practice, various approaches based on different economic considerations are used to calculate such a benchmark.

This article presents some of the approaches commonly used to assess a country's competitiveness position and discusses the extent to which they are suitable as indicators of competitiveness. It focuses on an indicator that is based on the productivity approach. If it is used in conjunction with the deviation of the price competitiveness indicator from its long-run average in order to determine the competitiveness position of the German economy, both indicators currently point to a competitive edge for Germany on the whole. However, this edge is not so large that the German economy's ongoing international competitiveness may be taken for granted without further efforts to maintain its position in what is a rapidly changing global environment.

An assessment of price competitiveness based on the productivity approach can be applied to a large number of countries, including the emerging markets that are currently in an economic catch-up process. By way of example, this article presents the results of a competitiveness assessment of the world's three most important economies outside the euro area – the United States, Japan and China.

Introduction: real effective exchange rates as an indicator of price competitiveness

Real exchange rate and price competitiveness

Real effective exchange rates are the most common proxy used to assess an economy's price competitiveness. The real exchange rate is calculated from the nominal exchange rate and the ratio of the domestic price or cost level to the foreign price or cost level. Thus, a real appreciation can arise either from a nominal appreciation of the domestic currency or when domestic inflationary pressure exceeds that abroad. Both effects make domestic products more expensive in relation to foreign products, thereby causing the international price competitiveness of the domestic economy to deteriorate.

Bilateral and effective real exchange rates

To obtain a representative assessment of an economy's price competitiveness, real effective exchange rates are used rather than bilateral exchange rates, as the former log a country's competitive evolution vis-à-vis a large number of trading partners. The weight assigned to a particular trading partner is usually determined by the intensity of its trade links with the country in question, whereby consideration is also given to trade with third countries (third-market effects).

The evolution of the German economy's price competitiveness

Indicators calculated by the Bundesbank

The Bundesbank calculates a variety of such indicators of price competitiveness, publishing some of them on a regular basis.[1] The calculation method used for this purpose is standardised within the Eurosystem.[2] Various price and cost indices serve as a measure of international inflation differentials, whereby indices that provide comparatively broad coverage of a country's price or cost development appear to be particularly useful.[3]

Development of the overall indicator for Germany

If one considers, for example, the indicator of price competitiveness for the German economy, which is calculated on the basis of the deflators of total sales vis-à-vis 24 trading partners, it is immediately evident that Germany's competitiveness increased significantly between 1995 and 2000 before receding again somewhat in the years that followed.[4] More recently a second, less dynamic improvement in competitiveness took place between mid-2008 and mid-2012. Since then, the indicator has pointed to a moderate deterioration in German competitiveness.

Indicator's low level of volatility vis-à-vis other euro-area states

Some light is shed on the causes of these developments when the group of trading partners is divided into two groups: euro-area member countries and non-euro area trading partners. Since the introduction of the euro in 1999 put an end to nominal exchange rate fluctuations among the trading parties belonging to the euro area, the indicator shows a relatively low level of volatility vis-à-vis those countries over the last one-and-a-half decades. This highlights the fact that the introduction of the euro actually reduced the price risk for German exporters' deliveries to the other euro-area countries.

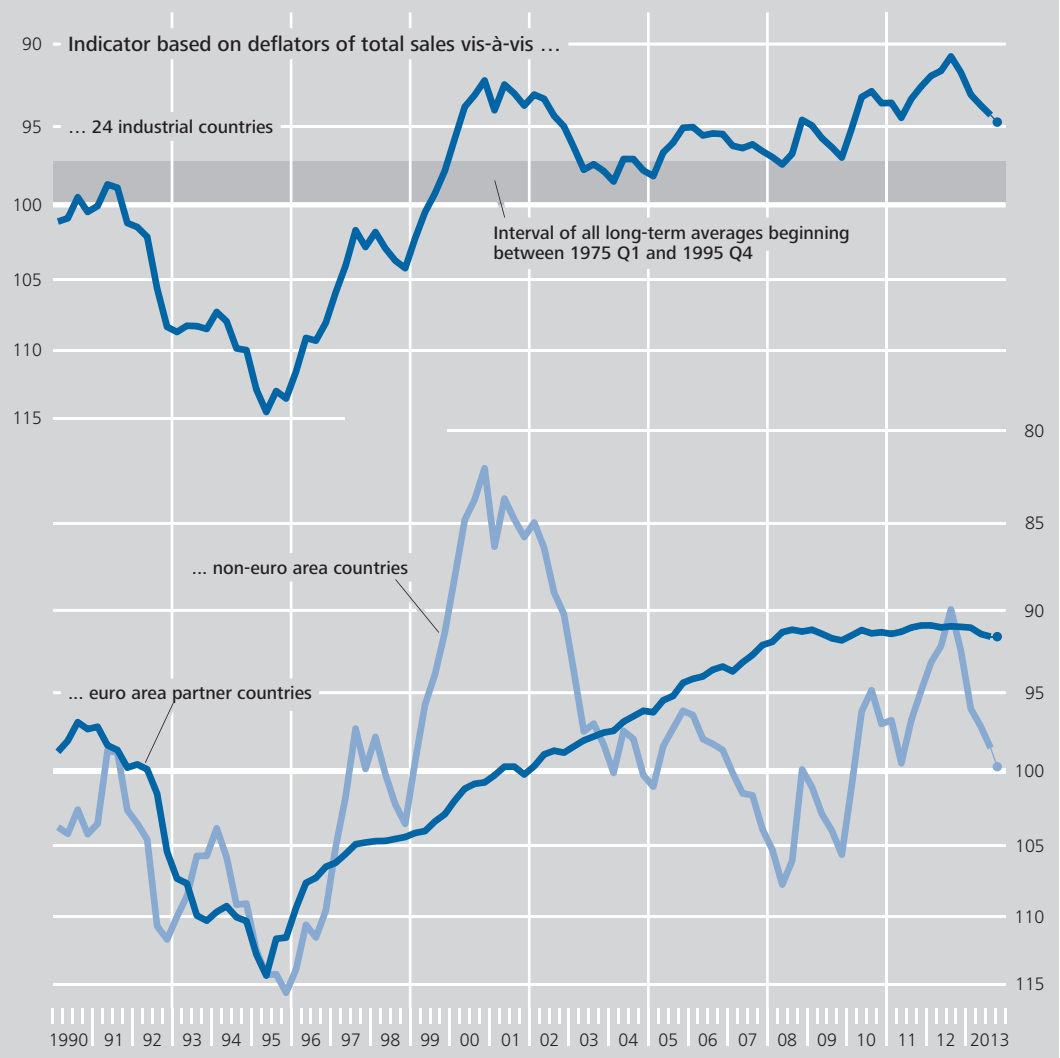
Continuous gains in competitiveness vis-à-vis euro-area trading partners between 1995 and 2008

Nevertheless, this indicator shows that German competitiveness in relation to the other euro-area countries improved continuously between 1995 and 2008. At least in the period 1999 to 2008, this resulted exclusively from the fact

1 See Deutsche Bundesbank, Monthly Report, Statistical Section, Table XII/13, and Deutsche Bundesbank, Exchange rate statistics, Table III.
2 The calculation method is described in detail in M Schmitz, M de Clercq, M Fidora, B Lauro and C Pinheiro, 2012, Revisiting the effective exchange rates of the euro, ECB Occasional Paper No 134. Recent adjustments to the method can be found in Deutsche Bundesbank, Adjustments in the calculation of effective exchange rates and indicators of price competitiveness in August 2013, Monthly Report, August 2013, pp 50-52.
3 See Deutsche Bundesbank, The indicator quality of different definitions of the real external value of the Deutsche Mark, Monthly Report, November 1998, pp 39-52.
4 It should be noted in this context that the scale is usually inverted in graphical representations of such indicators. Thus, a rising curve denotes a fall in values and so describes an increase in price competitiveness.

Price competitiveness of the German economy

Average since 1975 = 100, quarterly, log scale[1]



1 Inverted scale: a rising curve (fall in values) denotes an increase in competitiveness. • = as at 17 October 2013, estimated.
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that inflation in Germany was consistently lower than the weighted average for Germany's euro-area trading partners. While the trading partners' annual losses in competitiveness were small, they increased cumulatively because they persisted for over a decade following the euro's introduction. This development played a crucial role in the dislocations that arose during the financial and sovereign debt crisis in Europe. Since 2008, the indicator has shown only minor changes in Germany's competitiveness position in relation to the other euro-area states. Above all, this is a reflection of a recession-induced weakening of inflationary pressures in some euro-area countries.

Nominal exchange rate movements and Germany's price competitiveness

The indicator that measures Germany's price competitiveness vis-à-vis non-euro-area trading partners is determined largely by nominal exchange rate movements, which makes it considerably more volatile than the indicator described above. Like the overall indicator, it was strongly influenced by the marked improvement in German competitiveness between 1995 and 2000. Germany's relatively low inflation played a part in this improvement in the case of non-euro-area trading partners, too. The key factor, however, was the nominal depreciation of the D-Mark against the currencies outside the euro area during the last years of the D-Mark and that of the euro in the first two

years of monetary union. This was instrumental in facilitating the considerable improvement of the overall indicator of price competitiveness between 1995 and 2000 by up to 19½%. Conversely, the equally sharp nominal appreciation of the euro between 2000 and 2008 was barely reflected in the overall indicator because Germany's competitiveness vis-à-vis the other euro-area countries continued to improve during that time. And, finally, the subindicator likewise suggests that Germany's gains in competitiveness between 2008 and 2012, when the tensions caused by the financial crisis reached their peak, as well as the subsequent competitive losses were largely driven by corresponding developments in the euro's nominal exchange rate.

Assessing the competitiveness position on the basis of long-run averages

Benchmark needed to interpret the indicator level

The rate of change of the described indicators can be simply interpreted as an improvement or deterioration in price competitiveness. By contrast, this initially tells nothing about the level of such an indicator. This is mainly because price or cost indices are normally used to calculate an indicator level, and these are related to a particular base year. Yet even if this were not the case, the indicator value would still have to be measured against a standard or benchmark signifying an appropriate level of price competitiveness before the indicator level could be interpreted.

The long-run average as a benchmark

One possible benchmark for indicators of price competitiveness which, like the one described above for Germany, are based on price or cost indices is their long-run average. Such a benchmark is derived using the relative purchasing power parity theory,[5] according to which any international inflation differentials are offset in the long term by nominal exchange rate movements as a result of arbitrage transactions.[6] Thus, the norm ultimately is that, according to the theory, the relative price of a domestic basket of goods is constant in relation to that of a foreign basket of goods in the long term when calculated in a uniform currency. If the current relative price (the indicator value) is markedly below this benchmark because, for example, the domestic inflation rate is comparatively low, the competitiveness position is considered to be favourable.

Germany's price competitiveness currently better than long-run average

To enable observers to directly gauge the price competitiveness level, too, the indicators are often benchmarked in graphical representations to the long-run average, which is given an indicator value of 100. Using this measure Germany's price competitiveness currently appears more favourable than the long-run average. In fact, the benchmark was beaten in 1999, when the euro was introduced, and has been outperformed ever since then.

Choice of time period for calculating benchmark has little impact

The choice of the time period over which the long-run average is calculated has little bearing on the fact that Germany's competitiveness position may currently be considered favourable. For instance, if this period is shortened from over 38 years (calculating from the beginning of 1975) to just under 18 years (calculating from the end of 1995),[7] the benchmark varies by less than 3% at most, which does not impair the quality of the assessment of the current indicator value.

When the group of trading partners is again divided into countries within and outside the euro area, Germany's competitiveness position at present turns out to be particularly favour-

5 See Deutsche Bundesbank, Purchasing power parity theory as a concept for evaluating price competitiveness, Monthly Report, June 2004, pp 29-42.
6 In Germany's case, the euro's introduction abolished the nominal exchange rate for inflation differentials vis-à-vis the euro-area countries through which adjustments could have been made. The theory can nevertheless be applied in this case, too, if, instead, relative prices assume any necessary adjustment burdens. Although a corresponding tendency may indeed be expected if the market mechanisms are functioning properly, the adjustment process is then often rather sluggish.
7 However, it is important that the observation period chosen for such calculations is not too short; otherwise, the benchmark would not be representative and the calculated average could no longer be described as "long-run".

German competitiveness position vis-à-vis euro-area countries particularly strong at present

able vis-à-vis the rest of the euro area. This implies that we cannot infer from Germany's strong competitiveness position that price competitiveness for the euro area as a whole is strong.

Long-run average as a benchmark is readily understandable, easy to calculate and offers plausible results, …

Benchmarking to the long-run average to assess the current competitiveness position has proved its worth in a number of ways. For instance, it can be quickly and simply calculated, and is readily understandable. Moreover, it has in the past produced quite robustly plausible results. Yet critics point to at least two disadvantages of the method, particularly when the competitiveness position of other countries, too, is to be assessed.

… but price competitiveness of all countries is equally good in the long run, …

First, as an average over time the indicator is, by definition, equivalent to the benchmark for each country on the basis of long-run averages. This is in keeping with the notion that imbalances do not persist in the long term. Yet in the case at hand, this equivalence also implies that the price competitiveness of all countries would have to be interpreted as being equally good on average over time. However, there is some disagreement as to whether this is true.

… and the method cannot be applied to all countries

Second, this method can only be applied to a relatively small group of countries that are comparatively homogeneous in economic terms. Particularly for countries that are in an economic catching-up process, this method is unsuitable as a basis for calculating an appropriate benchmark. This is because, if long-run averages were used as a benchmark, the competitiveness position of such countries would be severely underestimated at the current end, as is shown in the next section.

Possible alternative approaches to calculating a benchmark

Different approaches to calculating a benchmark

In addition to the classical concept of the purchasing power parity theory described above, there are a number of other approaches to calculating benchmarks for real effective exchange rates which are more or less theoretically well founded. In the following section, some of the most common concepts are introduced that are also mostly used by international institutions. Given the wide range of approaches that exist – some of them competing, others complementary – only a selection can be presented here.[8] The productivity approach, the Behavioral Equilibrium Exchange Rate (BEER) approach and two of the approaches used by the International Monetary Fund (IMF) as part of its External Balance Assessment (EBA) methodology are outlined below.[9]

Direct regression-based benchmarks and benchmarks derived from the current account

The different concepts can be assigned to two general categories. On the one hand, there are those that model the real effective exchange rate directly on the basis of one or more determinants to calculate a benchmark; these include the productivity approach, the BEER approach and, closely related to it, the Real Exchange Rate Panel Regression approach that the IMF uses for its EBA. On the other hand, there are those that derive an adjustment need for the real exchange rate from deviations in the current account balance from a benchmark that may be either calculated in a number of different ways or posited. These include all the concepts that are built on the Fundamental Equilibrium Exchange Rate (FEER) model.

As mentioned above, the purchasing power parity theory is suitable for calculating a benchmark only for a homogeneous group of countries. Otherwise, the results can prove misleading. Whereas the purchasing power parity theory assumes a constant benchmark for the real

8 Comprehensive overviews are provided by, for example, R MacDonald, Concepts to calculate equilibrium exchange rates: an overview, Deutsche Bundesbank Discussion Paper No 3/2000, R Driver and P Westaway, 2004, Concepts of equilibrium exchange rates, Bank of England Working Paper No 248, and M Bussière, M Ca'Zorzi, A Chudík and A Dieppe, 2010, Methodological advances in the assessment of equilibrium exchange rates, ECB Working Paper No 1151.

9 A methodological overview of the approaches used by the IMF is provided in its June 2013 report "External balance assessment methodology: technical background".

Productivity approach takes account of productivity growth differences between countries in calculating the benchmark

exchange rate, the productivity approach – which ultimately has its origins in the work of Harrod, Balassa and Samuelson – takes account of the fact that the productivity of the countries observed can develop asymmetrically during a catching-up process, thus affecting the benchmark.[10] This theory is based on the notion that international price differentials in the non-tradable sector – which often includes services such as the frequently cited visit to the hairdresser's – are negligible with regard to competitiveness. The model asserts that if an emerging economy's productivity in the tradable goods sector rises – assuming free labour mobility between the sectors and tradable goods prices that are determined by the global market – the wage level will rise not only in the tradable sector of the country in question but also in the non-tradable sector as well. Given a broad-based price index, the price increase thus induced in the non-tradable sector is reflected in a higher general price level, and therefore also in real currency appreciation which, however, is attributable exclusively to the growth in productivity in the tradable goods sector. If the cause of the productivity rise were disregarded, real appreciation would appear as a deterioration in the competitiveness of the emerging economy in question. As a result, it would currently be considered less competitive than it actually is.

BEER approach can better explain exchange rate movements ex post, …

The BEER approach is largely empirical and is loosely based on the theory of uncovered interest rate parity. The real effective exchange rate is understood to be the sum of two components: a short-term component made up of the interest rate spread and a risk premium, and a long-term component that is dependent on other determinants. The relative change in the domestic economy's productivity compared with that of its trading partners, the net external asset position and relative government expenditure are frequently used as long-term determinants. Yet this does not exhaust the list of potential determinants. Different studies select different explanatory variables. This is problematical in that the benchmark calculated on the basis of this approach largely depends on the choice of the determinants that are included in the estimation – often on an *ad hoc* basis and without theoretical foundation. While this approach can better explain real effective exchange rate movements *ex post* than can the purchasing power parity theory (and the constant benchmark for the real exchange rate derived from it) or the productivity approach, its theoretical foundation is flawed given the discretionary choice of the determinants, which casts doubt on whether the approach can really serve as a basis for a benchmark for the real effective exchange rate.

… but is not fully suited to calculating a benchmark.

IMF's regression-based approach

In addition to two rather normative approaches, the IMF also uses, for the EBA, an approach very similar to the BEER concept (Real Exchange Rate Panel Regression), which involves regressing, in a panel estimation, real effective exchange rates on a large number of determinants. Based on these estimations, benchmarks are then calculated for the real effective exchange rates of the countries included in the estimation according to the country-specific determinants.[11]

Benchmarks based on the current account balance …

Besides the above regression-based approach, which derives the benchmark for the real effective exchange rate directly from an estimation with that variable as a dependent variable, the IMF deploys two other, indirect approaches. These are used to calculate the adjustment requirement for the real effective exchange rate

10 See R F Harrod, 1933, International Economics, Cambridge University Press, London; B Balassa, 1964, The purchasing power parity doctrine: a reappraisal, Journal of Political Economy 72, pp 584-596; and P A Samuelson, 1964, Theoretical notes on trade problems, Review of Economics and Statistics 46, pp 145-154. It is conceivable that other determinants besides relative productivity growth affect the benchmark (see the BEER approach, which is described in the following section). The results presented later in this article demonstrate, however, that no additional variables are necessary to calculate a theoretically and econometrically substantiated benchmark.

11 Since country-specific constants (fixed country effects) are included in the estimation, this approach implies for each individual country a real effective exchange rate which as an average is equivalent to the benchmark, ie international price competitiveness which as an average is to be considered neutral.

from the deviation of the actual current account balance from a benchmark value that can be determined in a number of different ways. The observed real effective exchange rate together with the calculated adjustment requirement can thus also be used to calculate a benchmark for its level. Both approaches follow in the tradition of Williamson's FEER approach (1983, 1994).[12] Unlike the approaches described above, they rather have a normative character.

… are fraught with a particularly high degree of model uncertainty.

Under the IMF's Current Account Panel Regression approach, the current account balances are first regressed in a panel estimation on various determinants which, with very few exceptions, correspond to those in the Real Exchange Rate Panel Regression approach. In this case, traditional determinants are used (including the economy's expected growth rate or demographic factors), along with financial market variables such as reserve currency status or measures of global risk aversion and, finally, a number of policy-driven factors such as the fiscal policy stance. Generally speaking, the explanatory power of these regressions is not particularly high, however, and varies depending on the model specification. This partly reflects the high degree of model uncertainty. The IMF uses the results of its current account regression to carry out a more detailed normative analysis. To this end, the values of those variables that are at least partly subject to political influence are calibrated to desired target values. In a second step, the deviation of the thus calculated current account norm from the actual current account balance is measured. In order to determine the real effective exchange rate adjustment necessary for the current account to match its calculated norm, the elasticities between exports and imports, on the one hand, and the real effective exchange rate, on the other, are estimated. Although the approach has a better theoretical foundation on the whole than, say, the BEER approach, its suitability for determining a benchmark for the real effective exchange rate is open to question given its high model uncertainty with regard both to the current account regression and to calculating the trade elasticities.[13]

Assessing Germany's competitiveness position using indicators based on the productivity approach

Better to include more than one approach in assessing the competitiveness position

The multiplicity of the above theoretical and econometric approaches to calculating a benchmark for an appropriate level of price competitiveness already shows that such an assessment entails a degree of uncertainty that generally exceeds the statistically derived error probability for a given approach. For this reason, it makes sense to base an assessment of a country's competitiveness position on more than one of those approaches wherever possible.

Advantages of an assessment based on the productivity approach

Against this background, the result obtained using long-run averages will now be compared with an assessment based on the productivity approach, which is particularly well suited to assessing a country's competitiveness position for several reasons. First, it is based on a theoretical model, which means it can provide a robust foundation for a norm. Moreover, it can be calculated for a wide range of economies including (former) emerging and transition countries. The advantage with regard to the latter is that those countries' share of trade with Germany and of global gross value added has grown markedly in recent years. And finally, this approach permits an up-to-date calculation of benchmarks that are consistent across all the countries observed.

12 See J Williamson, 1983, The exchange rate system, Policy Analyses in International Economics No 5, Institute of International Economics, Washington, DC; and J Williamson, 1994, Estimates of FEERs, in J Williamson (ed), Estimating equilibrium exchange rates, Institute of International Economics, Washington, DC.

13 The third approach used by the IMF is open to similar criticism. While the External Sustainability Approach is not vulnerable to uncertainty in estimating the current account regression, the optimal level of external debt is set in a discretionary manner, which means that this approach, too, is less suitable as a norm on which to base the real effective exchange rate.

Key elements of the calculation method are, first, an econometric estimation of …

The productivity approach-based method of calculating benchmarks is somewhat more complex than merely forming long-run averages, however. The real exchange rate used first has to be adjusted for productivity effects. An econometric estimation calculates how strongly a country's relative productivity affects its real exchange rate.

… the extent to which a country's relative productivity level determines its relative price level, …

When applying the productivity approach to calculate the benchmark it should be noted, moreover, that the theory gives rise to a relationship in levels. The higher a country's productivity level in relation to its trading partners, the higher its relative price level can be without its price competitiveness being impaired as a result. However, conventional real exchange rates which, as described earlier, are calculated using price or cost indices, provide no information on price level differences between countries. For this reason, purchasing power parities are drawn on as an alternative data source for the purposes of this study. These indicate, for a given country and year, how many units of local currency it takes to buy a broad basket of goods that costs a fixed US dollar amount in the USA. The basket includes a large number of goods and services (around 3,000 consumer goods alone), the prices of which are collected by the national statistical offices using a consistent methodology.[14] The relationship between a purchasing power parity and the corresponding actual nominal bilateral exchange rate between the two countries gives the relative price level – a real exchange rate in (relative) levels. This, in turn, is matched with a relative productivity level calculated from internationally comparable productivity data. Labour productivity per hour is the preferred productivity measure.[15]

… second, the calculation of an effective benchmark …

Thus, the estimation provides information as to what relative price level can be expected given a specific relative productivity level. As explained above, both the price level and the productivity level are defined bilaterally in relation to a specific base country. However, bilateral ratios provide little information about a country's overall competitiveness. For this reason, the estimation is followed by the calculation of an effective benchmark by relating the two variables to the respective country's trading partners (see the box on pages 39 to 41 for details on calculating the effective benchmark). The partner countries' weighting rises in proportion to the intensity of their trading links with the country in question. Finally, in a third step the calculated deviation from the benchmark is extrapolated to the current end using data on productivity growth, inflation and nominal exchange rate changes.

… and third, the forecast of an up-to-date indicator value

Indicator based on productivity approach suggests German competitiveness position is currently fairly good, …

The resulting benchmark indicates the relative price level of the country in question, which is explained by its relative productivity level when the weighted average of its trading partners is chosen as a yardstick. If the actual relative price level is lower than the average, the indicator shows a favourable competitiveness position for the country in question. Applying the above calculation method to the German economy shows that Germany's price level, adjusted for productivity differences, was lower of late than the weighted average for its trading partners. This indicator therefore confirms the finding already made using long-run averages, ie that Germany's competitiveness position can be considered relatively favourable at present. The indicator value, which is the difference vis-à-vis other countries in the relative price level adjusted for differences in productivity, may be due to the fact, for example, that wage growth in relation to productivity growth was greater in other countries than in Germany.

… yet the competitive edge calculated for Germany is small

In qualitative terms, the competitive edge calculated for Germany vis-à-vis its trading partners is quite small, however. The calculated indicator value underlines the fact that a given competitiveness position at a particular point in

14 See Eurostat and OECD, 2012, Eurostat-OECD methodological manual on purchasing power parities, Luxembourg. The calculated purchasing power parities are provided by, for instance, the IMF in its World Economic Outlook Database.
15 The data source in this case is the Conference Board Total Economy Database.

On estimating a benchmark for the real effective exchange rate based on the productivity approach

This box describes the procedure used to determine the benchmark for the real effective exchange rate based on the productivity approach. It outlines the econometric model, the panel composition, the estimation method and the estimation results. The text closes by discussing how to determine a multilateral benchmark on this basis.

To calculate the influence of relative productivity on the real exchange rate (ie the relative price level), the econometric model

$$q_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it}$$

is estimated using a panel regression where the variable q_{it} denotes the log relative price level of the respective country i compared with the otherwise unconsidered but in principle arbitrarily selected base country Columbia at point in time t, x_{it} is the correspondingly normalised log relative productivity level and α_i stands for the country-specific constants.[1]

The panel encompasses up to 57 countries, depending on the individual model specification. It therefore mirrors the group of countries referenced by the ECB and the Bundesbank when they calculate real effective exchange rates for a broad group of countries.[2] The data series needed to calculate the relative price level are obtained from the World Economic Outlook (WEO) database compiled by the International Monetary Fund (IMF), while the productivity data are taken from the Conference Board's Total Economy Database. The relative price levels are in each case calculated by dividing an implicit purchasing power parity exchange rate available in the WEO database by the matching nominal bilateral exchange rate. Two measures are used to gauge the productivity level; first, labour productivity per hour and second, labour productivity per employee. The first of these measures is generally preferable as it is very unlikely to be affected by differences between countries in the average number of working hours per week which is influenced, for instance, by the percentage of part-time employees. These data are, however, only available for 46 of the 57 countries under observation, meaning that it is always necessary to use the second measure of productivity when making an estimate for the remaining 11 countries. For the majority of countries, data for the period 1980 to 2011 are included in the analysis, but for a few countries only data from 1995 onward is used.[3] This causes the panel to be unbalanced.

Parameter β is of key importance when adjusting the relative price level to take account of the impact of the relative productivity level. This parameter can be interpreted as elasticity because the dependent and the explanatory variables are both log variables. In the estimation, parameter β is assumed to be homogenous, in other words it is assumed to be the same for all countries included in the panel.

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1 Columbia and Peru are the only countries not included among the observed group of countries for which the preferred productivity data are available across the entire period of observation. As Peru experienced hyperinflation during the 1980s, Columbia is chosen as the base country.

2 See M Schmitz, M de Clercq, M Fidora, B Lauro and C Pinheiro (2012), Revisiting the effective exchange rates of the euro, ECB Occasional Paper No 134.

3 Data for the period prior to these years are either unavailable or are excluded from the analysis owing to the distorting effect that such data are, theoretically, expected to have when estimating the coefficients. Such anticipated distortion results from the lack of a functioning price mechanism due either to hyperinflation or centrally planned economies.

Prior to computing the above model, a preparatory analysis is made which affects the choice of estimation method. As a first step, a suitable panel unit root test is used to establish whether the variables are stationary or non-stationary.[4] It is not possible to reject the null hypothesis of non-stationarity for either variable. The fact that it is necessary to assume non-stationarity on the part of the log relative price level suggests that this group of countries and this estimation period require at least one additional variable to determine a benchmark that can substantiate a norm and be interpreted in a meaningful manner. As the log relative productivity level is also non-stationary, it qualifies as an acceptable long-run determinant, not just in theoretical terms but also from a statistical perspective.

In order to avoid a spurious regression between non-stationary variables, panel cointegration tests are conducted as a second step of the analysis. If a cointegrating relation is detected between the variables, no spurious regression exists. Use is made of a family of panel cointegration tests based on an error-correction model developed by Joakim Westerlund (2007).[5] These tests all rest on the notion of the need for a significant adjustment towards long-run equilibrium if a long-run relationship between the variables exists. Unlike many other approaches, the tests *inter alia* take into account dependencies between the different countries (ie cross-sectional dependence), as does the panel unit root test used above. Such dependencies are to be expected, not least because of the common base country. The test results point to the existence of a long-run relationship between the relative price level and the relative productivity level.

In a third step, the above model is estimated using a simple panel fixed effects regression,[6] according to which the long-run elasticity of the relative price level vis-à-vis the relative productivity level is gauged at 0.35 if the latter is approximated in terms of labour productivity per employee, and at 0.47 if this is instead done based on labour productivity per hour. To test the robustness of the results, the estimation is alternatively conducted using the pooled OLS estimator along with the panel DOLS estimator developed by Mark and Sul (2003),[7] in which case the point estimates diverge only slightly from the previous results. The table on page 41 provides an overview of the various estimated long-run elasticities, depending on the choice of estimator and the variables used to approximate the relative productivity level.

As all the variables contained in the estimation were placed in relation to the base country, thus rendering them bilaterally normalised, they have to be placed in a multilateral context if a meaningful benchmark is to be determined. To this end, the weighted average of the partner countries is subtracted from the log relative price level of country i

$$\tilde{q}_{it} = q_{it} - \sum w_{ij}\, q_{jt}\ ,$$

whereby $w_{ii} = 0$ and $\Sigma w_{ij} = 1$. If the multilateral normalised relative productivity level $\tilde{x}_{it}$ is defined along the same lines, the

4 Use was made of the cross-sectionally augmented IPS test in M H Pesaran (2007), A simple panel unit root test in the presence of cross-section dependence, Journal of Applied Econometrics No 22, pp 341-361.
5 See J Westerlund (2007), Testing for error correction in panel data, Oxford Bulletin of Economics and Statistics 69, pp 709-748, in addition to D Persyn and J Westerlund (2008), Error-correction-based cointegration tests for panel data, Stata Journal, Vol 8, issue 2, pp 232-241.
6 This is possible because the least square estimator is super consistent where a cointegrating relation exists.
7 For details of this approach, see N C Mark and D Sul (2003), Cointegration vector estimation by panel DOLS and long-run money demand, Oxford Bulletin of Economics and Statistics 65, pp 655-680.

multilateral benchmark $\tilde{q}_{it}^{*}$ for the relative price level can be computed as

$$\tilde{q}_{it}^{*} = \hat{\beta}\tilde{x}_{it}$$

using the estimated slope coefficient $\hat{\beta}$. The (log) deviation from the benchmark $\tilde{d}_{it}$ is then conveyed as

$$\tilde{d}_{it} = \tilde{q}_{it} - \tilde{q}_{it}^{*}.$$

If $\tilde{d}_{it}$ is positive, the actual price level in country i relative to the price levels in its partner countries exceeds the benchmark value that would have been expected given its relative productivity level. This would put the country in an unfavourable competitive position.

Estimated long-run elasticities

Specification	Panel OLS (FE)	Pooled OLS	Pooled DOLS	Panel DOLS (FE)	Panel DOLS (FE+TD)
(1)	0.35**	0.40***	0.43***	0.35***	0.43***
(2)	0.47**	0.54***	0.51***	0.46***	0.52***

Note: Specification (1) is based on labour productivity per employee, while specification (2) uses labour productivity per hour. In the case of the pooled OLS and the panel OLS estimation results, the marginal significance levels are based on standard errors in accordance with J C Driscoll and A C Kraay (1998), Consistent covariance matrix estimation with spatially dependent panel data, The Review of Economics and Statistics 80, pp 549-560. FE and TD denote the inclusion of fixed country and time effects. ***, **, * represent significance levels of 1%, 5% and 10%, respectively.

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time may not persist and that maintaining it requires ongoing efforts both to foster technological progress, product and process innovations so as to boost productivity and to keep wage and price developments in line with it. This is the only way that an open economy such as Germany can safeguard its market position in a dynamic global economic environment and offer attractive employment opportunities.

The price competitiveness of other economies

As mentioned above, one of the advantages of the productivity approach-based indicator of price competitiveness is that it can be calculated for a large number of countries; moreover, it can be interpreted in economic terms. To illustrate this, results for the USA, Japan and China – the three largest economies outside the euro area – are presented below.

Favourable competitiveness position for the USA

The indicator shows the United States to be in an exceptionally favourable competitiveness position. Whereas the price level in the USA is only marginally above the weighted average for its trading partners, US productivity exceeds that of its trading partners considerably. This positive assessment applies both to the current situation and to the year 2007, when the financial and economic crisis started.[16] As the USA is one of the established advanced economies, an alternative indication can be provided for the USA in comparison with the long-run average. This indicator likewise points to a competitive advantage.

This finding may initially come as a surprise given that the USA has posted a trade deficit

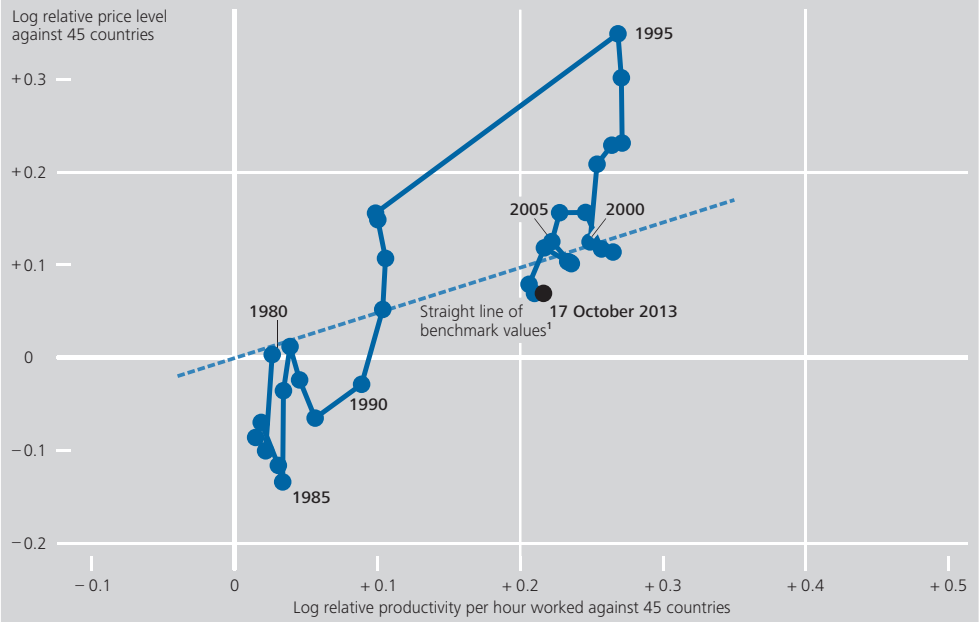
16 Looking further back in time, however, there were also periods in which US competitiveness was low according to this indicator. This is especially true of the mid-1980s, before the G5 group of countries agreed under the Plaza Accord in September 1985 to take internationally coordinated economic and monetary policy measures aimed at weakening the US dollar.

Development of the indicator of Germany's price competitiveness based on the productivity approach – a graphical representation

A graphical representation of the indicator based on the productivity approach facilitates the interpretation of the results. Combinations of Germany's relative price level and relative productivity are shown for different points in time. The variables are logarithmised and shown in relation to the weighted average of the trading partners, with the result that Germany's price and productivity level corresponds to the average in the partner countries at the origin of the coordinate system. By contrast, positive values imply a price or productivity level that exceeds the respective average of the trading partners. At the origin, where the German price and productivity level matches that of the other countries, the indicator shows a neutral price competitiveness for Germany. The same applies to all the dots on the dashed straight line from the origin with a positive slope, which indicates the price increase that would be justified for any given productivity growth according to the estimation. Dots above the straight line indicate a price level that is too high to be justified by productivity, and therefore point to an unfavourable competitive position.

However, the estimated current value for Germany lies below the straight line. Therefore, although the price level for Germany is above its trading partners' weighted average, relative productivity is so high in Germany that the indicator nevertheless points

Indicator of the German economy's price competitiveness based on the productivity approach



1 For information on how to calculate the benchmark values, see the comments on pp 39-41. The straight line is based on the fixed effects least squares estimation using log relative labour productivity per hour worked. Values below this line indicate a favourable competitive position.

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to a favourable competitive position. The calculated competitive advantage is relatively small, however.

The dots that are connected with a line in the chart show the development of the indicator for Germany over time and represent indicator values for successive years. The indicator shows a rather favourable price competitiveness for Germany for the 1980s, and in particular for 1985, which was the year in which the US dollar recorded an historical high against the D-Mark. However, in the first half of the 1990s, the relative price level increased quite sharply in Germany without this being accompanied by corresponding gains in productivity. This development is – despite the knock-on effects of German reunification – attributable only to a relatively small extent to inflation differentials with other countries. Instead, the key reason was the nominal exchange rate development of the D-Mark. During that period, the then European Monetary System entered a severe crisis, in the course of which the currencies of several partner countries significantly depreciated against the D-Mark.

For 1995, the chart suggests a marked year-on-year increase in both relative productivity and the relative price level in Germany. However, this development is due, in part, to a structural break. The group of partner countries included was extended in 1995 by a large number of – above all central and east European – economies, which were undergoing a transition process at the time. This expansion had the effect of considerably lowering the German trading partners' average productivity level as well as their average price level. Germany's relative price and productivity level therefore increased at that point. The transition countries could not be regarded as partner countries prior to this expansion. In some cases, there was a lack of adequate data, but above all the market mechanisms that would have allowed for a price adjustment in line with the theory were not in place in the centrally planned economies. In the 1990s, it was not only market mechanisms that became increasingly important in these countries in the course of the transition process; there was also a disproportionate growth in Germany's trade links with them. With regard to the indicator's representativeness, this meant that these economies could no longer be disregarded. Due to the changeover, the in reality slightly more steady integration of economic structures is concentrated in one year for the statistics.

The fact that the indicator value for 1995 shows a particularly unfavourable competitive position for Germany is nevertheless well in line with conventional indicators of price competitiveness, for example. In its 1995-96 Annual Report, the German Council of Economic Experts also established a real appreciation, which could "not be explained by looking at the fundamental macroeconomic data".[1] It was not until the nominal effective appreciation of the D-Mark came to an end in the second half of the 1990s that – coupled with ongoing below-average inflationary pressures – the indicator came closer to its benchmark value again. Since then, changes to the indicator have been comparatively small, not least owing to Germany becoming a member of European monetary union.

1 German Council of Economic Experts, 1995-96 Annual Report (Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung, Im Standortwettbewerb, Jahresgutachten 1995/96), pp 131 and 133 (only available in German).

Price competitiveness of selected countries

Deviation from benchmark in %[1]

1 Inverted scale: an upward column (negative value) indicates a favourable competitiveness position. **2** Indicator unsuitable for China.

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US trade balance and competitiveness

for many years. However, it has to be borne in mind that the trade balance is determined not only by an economy's international competitiveness but by other determinants as well. Particular importance is usually attached to aggregate demand in the countries in question. In fact, the combination of persistently strong price competitiveness and continued trade deficits in the USA could indicate that the cause of the latter lies less in the US dollar exchange rate and more in the fact that the US saving ratio has been rather low for a long time, which tends to encourage a high level of imports.

Indicators of Japan's price competitiveness …

In contrast to Germany and the USA, the productivity approach-based indicator for Japan suggests an unfavourable competitiveness position both in the recent past and when the crisis began in 2007. It should, moreover, be noted that the marked depreciation of the yen observed for around a year now has already led to a substantial improvement in the international competitiveness of the Japanese economy; in other words, the indicator previously pointed to even more serious competitive disadvantages for Japan.

… paint a mixed picture

However, if an indicator that is calculated on the basis of the long-run average is applied instead, the assessment of Japan's competitiveness position changes perceptibly and currently indicates a relatively favourable competitiveness position for Japan. The reason for this apparent discrepancy between the two indicators is that, with the concept of long-run averages, the main focus is on the time dimension. By historical standards, Japanese competitiveness is currently high according to both indicators. Despite this progress, the current indicator based on the productivity approach calculates a weak Japanese competitiveness position because the price level there continues nevertheless to exceed the average level for its trading partners. By contrast, the productivity level – seen from a macroeconomic perspective – is below the corresponding average. The fact that the price level in Japan has exceeded that of its trading partners for quite some time now without producing a sufficient, offsetting real depreciation could indicate that this situation was caused by structural factors such as high market access barriers.

China's competitiveness deteriorating

China is one of those economies that have been undergoing an economic catching-up process for years. For this reason, it would not be appropriate to assess the country's competitiveness position using long-run averages. Instead, it makes sense to use a productivity-based indicator, which currently diagnoses an unfavourable competitiveness position for China. Moreover, the indicator points to a pro-

gressive deterioration in competitiveness over the last few years. This development is attributable not only to a gradual nominal effective appreciation of the renminbi, but above all to China's high inflation compared with that of its trading partners. Although China has recorded continuous relative productivity gains, they have not been sufficient to offset the above effects on price competitiveness.

Summary

Alternative indicators of price competitiveness …

In many cases, real effective exchange rates are good indicators of changes in price competitiveness. However, in order to shed light on a country's level of competitiveness, the indicator has to reference a suitable benchmark. Various approaches to calculating the benchmark are possible. For this reason alone, caution is called for when interpreting the results.

… all point to minor competitive advantages for Germany

Different indicators arrive at a uniform assessment for Germany. Thus the competitiveness position of the German economy is currently somewhat more favourable than the long-run average. An alternative, productivity approach-based indicator likewise points to small competitive advantages for Germany at present. However, these are not so great that Germany can afford to relax its efforts to boost innovation and raise productivity as well as to pursue a wage and price policy geared to those desiderata and the opportunities they create.