Kiel Policy Brief

International Comparison of Stock Market Valuation – Evidence from a New Index

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No. 61 | May 2013

Institut für Weltwirtschaft Kiel
Kiel Institute for the World Economy
ISSN 2195–7525

International Comparison of Stock Market Valuation – Evidence from a New Index[1]

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This Kiel Policy Brief demonstrates the calculation of a new stock market index informing about the price competitiveness of a country's assets vis-à-vis its foreign competitors. In line with the portfolio balance approach we empirically identify net foreign holdings of a country's assets as the long-run driver of the index dynamics. Both, the index and its fundamental value are discussed for a number of important economies shading new light on the relative assessment of financial assets on international capital markets.

JEL: F31, G15, E58
Keywords: Real Effective Exchange Rate, Capital Flows, Financial Markets.

[1] This article represents the authors' personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank, the University of Kiel or the Kiel Institute for the World Economy.

1. Introduction

Since the dramatic fall of stock indices in the aftermath of the Lehman default the most important markets had recovered quickly and substantially. For instance, the German DAX as well as the Dow Jones Index roughly doubled in the time between early 2009 and early 2013, while the Nikkei's increased at a slightly lower pace. Of course, most stock market participants are convinced that expansionary monetary policy of the FED, the ECB, and the Bank of Japan largely account for this regained strength in valuation, also because competing asset classes such as government bonds exhibit historically low returns (*Frankfurter Allgemeine Zeitung*, March, 6th, 2013). Against the backdrop of these unconventional monetary policy measures it has been argued that stock markets already follow a new bubble path (*Frankfurter Allgemeine Zeitung*, February, 3rd, 2013). Besides concerns about the level of global stock valuations international investors also face the problem of optimally weighting different stock markets in their portfolios. To this end it is important to assess the *relative* performance of a country's stocks vis-á-vis its foreign competitors. For example, an investor would be reluctant to increase the portfolio weight of a given market if its stocks are currently believed to be overvalued relative to an average of all other stock markets, whereby the relative valuation may be driven by both relative stock price changes and exchange rate changes.

In Gelman, Jochem and Reitz (2013) we propose the construction of a real effective financial exchange rate (REFER) as a useful measure of relative price competitiveness of a country's assets vis-á-vis its foreign competitors. The REFER conceptually refers to the traditional real effective exchange rates, but is deflated by relative stock price indices instead of goods prices. In line with the portfolio balance approach we empirically identify net foreign holdings of a country's assets as the long-run driver of the REFER. Consequently, deviations of the index from its equilibrium value may be identified as temporary misalignments. This Kiel Policy Brief demonstrates the calculation of the fundamental value of the REFER for a number of important economies and compares it with the actual REFER shading new light on the relative assessment of financial assets on international capital markets. Resulting from a differing risk assessment concerning the economic outlook, US and German stocks currently seem to be relatively expensive, while Italian, Japanese, and, to a lesser extent, French equities come at a discount.

2. Model and Data

The theoretical model underlying the cointegration relationship between a country's REFER and NFH is a modified version of the standard portfolio balance approach put forward in the seminal work of Branson (1983) and Branson and Henderson (1985). We start with the definition of nominal wealth (W_t^j) of the country *i* representative investor in terms of the domestic currency (equation 1) and an equilibrium condition that respects the budget constraints of all market participants (equation 2):

$$W_t^i = \sum_{j=1}^{N} \frac{P_{j,t} \cdot F_{j,t}^i}{S_{ij,t}}, j = 1, .., i, .., N \quad (1)$$

$$P_{i,t} \cdot F_i = \sum_{j=1}^{N} P_{i,t} \cdot F_{i,t}^j, j = 1, .., i, .., N \quad (2)$$

where $P_{i,t}$ and $P_{j,t}$ are the domestic currency price of the domestic asset and the foreign currency prices of the *N-1* foreign assets, respectively. The exchange rate $S_{ij,t}$ is defined as the price of the domestic currency in units of the foreign currency and $S_{ii,t} \equiv 1$. The stock of country *i*'s assets F_i is held by *N* investors and prices are set to ensure equation (2).

After rearranging and calculation of a geometric average we arrive at the relationship between a country's real effective financial exchange rate and net foreign holdings relative to the market capitalisation of the respective countries:[2]

$$\prod_{j=1}^{N} \left(\frac{P_{j,t} \cdot S_{ij,t}}{P_{j,t}} \right)^{\theta_j^i} = \prod_{j=1}^{N} \left(\frac{\omega_{i,t}^j W_t^j S_{ji,t} / F_{i,t}^j}{\omega_{j,t}^i W_t^i / F_{j,t}^i} \right)^{\theta_j^i}, \ \forall j \neq i \quad (3)$$

where the θs are constant weights derived from the cross-country holdings of investors *i* and *j* in a base period.

The empirical investigation is based on a panel of 15 countries, which represent the most important international lenders and borrowers of equity securities as reported in the IMF CPIS data set of 2004.[3] The same dataset is used to calculate a country's REFER as a geometric average of bilateral real financial exchange rates. MSCI stock market indices are used to obtain the relevant deflators. The estimates refer to yearly data covering the period from 1993 to 2011.

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[2] For a detailed discussion of the theoretical model and the derivation of (3) see Gelman et al. (2013).

[3] Australia, Brazil, Canada, Germany, Spain, France, Hong Kong, Italy, Japan, Korea, Mexico, Portugal, Singapore, United Kingdom, and United States. China and Luxemburg are excluded, because of a lack of national data in the CPIS.

Data on foreign holdings of equity securities are provided by the IMF CPIS data set and Kubelec/Sa (2012), while market capitalisation is obtained from the World Bank Database. Bilateral exchange rates were obtained from the Deutsche Bundesbank's database.

3. Estimation results

To analyze the long-term relationship between real financial exchange rates and net foreign holdings, we perform standard panel cointegration analyses. As a starting point, panel unit root (Augmented Dickey Fuller) tests are applied to the levels of REFER and NFH, respectively. The PP Fisher $\chi 2$ test statistics of 20.19 and 38.69 do not reject the null hypothesis of non-stationarity at conventional levels.4 When looking at logs, test statistics of 37.16 and 27.94 do not reject the unit root behavior of both variables, either. Having established that both the variables were I(1) in logs and levels, we move on testing for cointegration. As suggested by Pedroni (2004) and Kao (1999) OLS regressions are estimated and stationarity of the resulting residuals are tested using the Engle Granger framework.[5] The associated panel ADF-statistics allowing for individual AR coefficients are significant at the five percent level rejecting the null hypothesis of no cointegration.

The subsequent Error Correction Models are based on the long-run relationship (standard errors in brackets):

$$REFER_{i,t} = \underset{(9.144)^{***}}{85.31} + \underset{(5.418)^{***}}{24.74} \cdot NFH_{i,t} + u_{i,t}. \quad (4)$$

The coefficients in equation (4) are derived from a Dynamic OLS (DOLS) estimation where the exchange rate is regressed on a constant, net foreign holdings, the current and lagged change of net foreign holdings, the lead change of net foreign holdings, and two AR terms. The computed variance-covariance matrices are robust against cross-section correlation and heteroskedasticity using panel corrected standard errors (PCSE). The resulting errors $u_{i,t}$ are used to analyse the error correction properties of the model along the following two equations:

[4] See Fisher (1932) and Maddala and Wu (1999). The number of lags is automatically determined using the Schwarz info criterion. Furthermore, we allow for fixed effects in the individual cross sections.

[5] See Pedroni (2004) as well as Kao (1999).

$$\Delta REFER_{i,t} = \beta_{10} + \beta_{11} \cdot u_{i,t-1} + \beta_{12} \cdot \Delta REFER_{i,t-1} + \beta_{13} \cdot \Delta NFH_{i,t-1} + \varepsilon_{1i,t}. \quad (5)$$

and

$$\Delta NFH_{i,t} = \beta_{20} + \beta_{21} \cdot u_{i,t-1} + \beta_{22} \cdot \Delta REFER_{i,t-1} + \beta_{23} \cdot \Delta NFH_{i,t-1} + \varepsilon_{2i,t}. \quad (6)$$

The estimation results represented in Table 1 are based on fixed effects OLS regressions. Again, PCSE are used to allow for cross-section correlation and heteroskedasticity. Table 1 shows the parameter estimates of the model with the REFER and NFH variables.

Table 1:
Estimation results of the error correction models

Dependent Variable	$\Delta REFER_t$	ΔNFH_t
Constant	–0.783 (1.682)	0.010 (0.070)
Error Correction	–0.221*** (0.054)	0.003 (0.002)
$\Delta REFER_{t-1}$	0.379*** (0.105)	0.002 (0.006)
ΔNFH_{t-1}	1.592 (1.720)	–0.389* (0.205)
R^2-adj	0.36	0.12

According to Table 1 both variables provide significant error correction. In case of a positive deviation from the long-run equilibrium implying that the current REFER is higher than its equilibrium value a depreciation of the real effective financial exchange rate proportional to the current error can be expected to restore equilibrium. The adjustment is further enhanced by the autocorrelation of $\Delta REFER_t$. When looking at the error correction equation of net foreign holdings, however, we do not find a significant reaction of NFH to a given deviation from the long-run equilibrium.

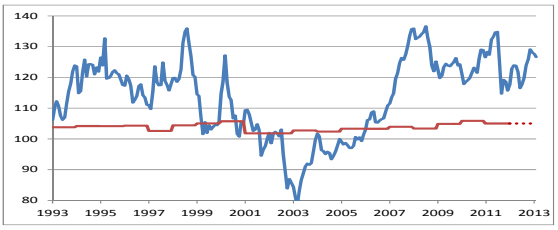
4. Actual and Fundamental REFER

In this section we present actual and fundamental values of the REFER for individual countries, where fundamental values are derived from the estimated cointegration relationship.

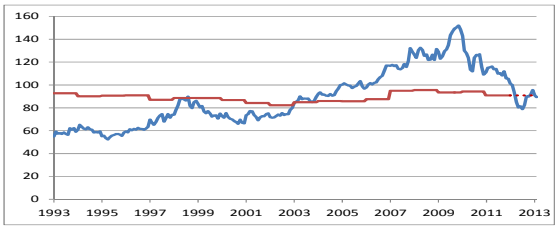
Graph 1:
Actual and Fundamental REFER of Individual Countries, *Data from January 1993 to March 2013*

EMU Countries

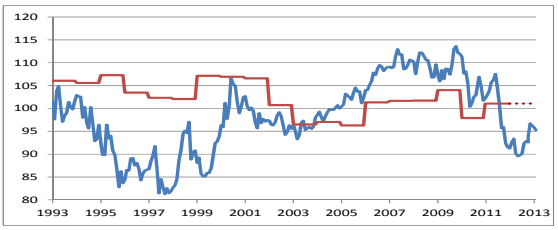
Germany



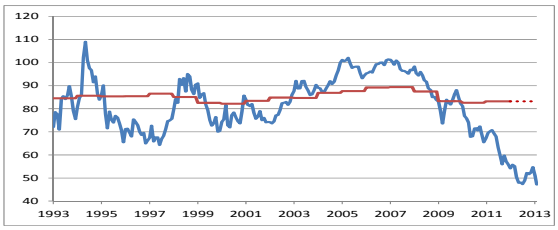
Spain



France

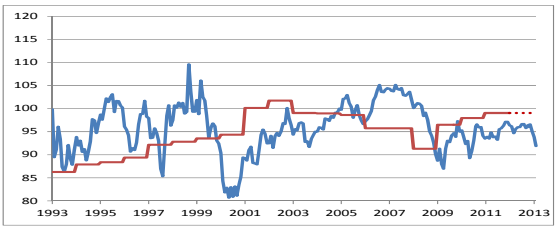


Italy

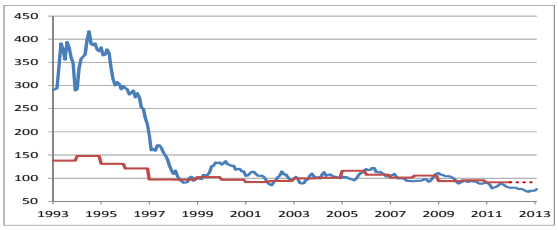


Non-EMU Countries

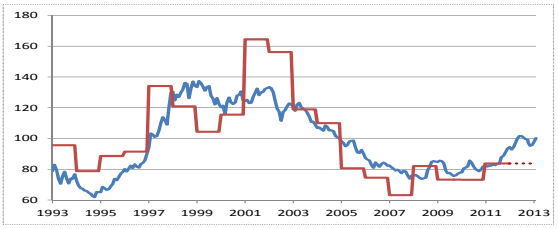
United Kingdom



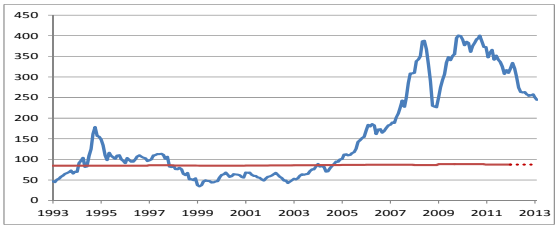
Japan



United States



Brazil



Notes: The blue lines represent the real effective financial exchange rate of the respective country, while the red lines represent their fundamental values based on net foreign equity holdings. Data for net foreign equity holdings are available until 2011. The graphs assume an unchanged fundamental value after 2011 (dotted line)

With regard to the German stock market, the actual REFER has significantly increased after the burst of the dot-com bubble surpassing the NFA-driven equilibrium value in 2006 and ending some 30% above this level in 2008. The resulting gap has fluctuated on the strong side since then indicating relatively high prices of German equities compared to international capital markets. Since net foreign holdings of German equities did not change substantially, most of the difference between the actual and fundamental REFER is unrelated to portfolio rebalancing and—from the underlying model's perspective—perceived to be temporary. We interpret this deviation as a markup consisting of the cumulative expected current and future negative risk premia (or safe haven return component) of German stocks.

Due to investors' risk reconsiderations surrounding the economic outlook, Spanish, Italian and—to a less extent—French equity securities significantly corrected preceding upward trends. In case of Italy, the substantial difference between the actual and fundamental REFER suggests either a short period of high risk premia or a long adjustment process with smaller premia. The Spanish and French REFERs, in contrast, are still in line with the predicted values derived from net foreign holdings and regained some strength in the very recent past.

The deviations of the actual REFER from fitted values also shed light on stock markets outside EMU. In case of the US market, the fundamental value shows substantial fluctuations indicating time-varying shares of US stocks in international portfolios. In the early 2000s the US market faced a strong excess demand from foreign investors relative to its market capitalization, which most observers attributed to the new economy hype. The related upward movement of the fundamental value was completely reversed a few years later, when the so-called dot-com bubble burst. The actual REFER, however, does not fully mirror these capital flows. It seems that stock market re-valuations (measured in a given currency) remained quite balanced across the US and its competitor markets. More recently, safe haven considerations have led to somewhat higher US stock prices than the fundamental value would suggest.

When looking at the Japanese market the REFER clearly reflects the strong adjustments in the aftermath of the real estate and stock price bubble. The largest decline of Japanese stock price valuation relative to its international competitors took place in 1996/1997 when Japanese authorities started their deflation policy. Until recently, the Japanese REFER has been more or less in line with its fundamental value before it started to lose ground again in 2011. Similarly, UK stocks generally exhibit minor deviation from the fundamental value. While experiencing moderately higher prices in 2006 and 2007 UK shares came under pressure thereafter relative to their foreign competitors. Another dip can be observed at the start of the European Monetary Union. In general, the fundamental value evolves quite smoothly reflecting the fact that UK shares are a stable component in international portfolios.

Among industrialized economies, the international financial crisis had remarkably little impact on *relative* valuation of international stocks markets giving rise to its classification as a symmetric global shock. This is somewhat different in the case of emerging market economies.

Investigating the development of the Brazilian REFER reveals a strong relative appreciation of stock prices due to a heightened risk appetite of international investors in the period between 2003 and 2008. The strong price fluctuations are clearly a result of a relatively small size of the Brazilian stock market compared to globally available funds, which also forced the domestic authorities to engage in capital market policy measures. In the aftermath of the Lehman default when international investors cut their exposures the Brazilian stock market experienced a substantial decline. The subsequent recovery was of temporary nature only, also reflecting investors' changing willingness to engage in risky positions.

5. Conclusion

We propose a new index of real effective exchange rates based on asset price deflators. While the standard assumption of traditional real effective exchange rates based on consumer price indices was that trade flows dominate the cross boarder international activities in the long run, capital flows now superseded trade flows by far. Given that the suggested index can be viewed as the price competitiveness of a country's assets a significant relationship with capital flows, an otherwise hard to explain macroeconomic variable, might be expected. The empirical results are encouraging in the sense that we find a country's net foreign holdings to be cointegrated with its real effective financial exchange rate and deviations are sensibly interpreted.

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Imprint

Publisher: Kiel Institute for the World Economy
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Value Added Tax Identification Number: DE 251899169

Authorised Representative: Prof. Dennis Snower, Ph.D. (President)

Responsible Supervisory Authority: Schleswig-Holstein Ministry for Education and Science

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