Economics Bulletin

Volume 29, Issue 3

Do exchange rate bubbles deflate faster than they inflate?

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Abstract

Some theories predict that exchange rate bubbles should deflate faster than they inflate. We find no empirical support for this hypothesis for currencies that floated against the US dollar. The bursting of exchange rate bubbles is not analogous to collapses in the prices of financial assets. Financial asset prices tend to fall faster than they rise, which suggests that the same might be true of relatively risky currencies. We find no evidence that other currencies depreciate faster against the US dollar than they appreciate, even though the US dollar is commonly regarded as a potential safe-haven currency. This is true even of emerging-market currencies.

Citation: Michael Bleaney and Zhiyong Li, (2009) "Do exchange rate bubbles deflate faster than they inflate?", *Economics Bulletin*, Vol. 29 no.3 pp. 1542-1548.
Submitted: May 19 2009. **Published:** July 01, 2009.

1. Introduction

Do exchange rate bubbles deflate faster than they inflate? This is a prediction of the behavioural finance model of De Grauwe and Grimaldi (2006), in which there are two groups of traders – fundamentalists and chartists. Fundamentalists expect the exchange rate to move back towards their estimate of the equilibrium rate, whereas chartists (or technical analysts) are momentum traders who believe that the exchange rate will continue to move in the same direction. The actual movement of the exchange rate is equal to a weighted average of the two groups' expectations plus a stochastic element. The model has various other features, including the fact that the relative weight of the two groups in the market varies according to their recent profitability. In the model, bubbles deflate faster than they inflate because, in the inflation phase, fundamentalists expect the inflation of the bubble to be reversed, and this slows down the movement away from equilibrium, whereas in the deflation phase both sets of traders expect movement towards equilibrium (the chartists because it is an extrapolation of the recent trend) and this speeds up the deflation process.[1]

In this paper we perform an empirical test of the hypothesis that the dollar real (CPI-adjusted) exchange rates of various currencies move away from equilibrium more slowly than they move back towards it.

It is tempting to draw an analogy between exchange rate bubbles and stock market bubbles. In fact De Grauwe and Grimaldi (2006, p. 186) refer explicitly to this analogy when they state that the fact that "bubbles start gradually and build up speed, while crashes occur suddenly" is a "pervasive feature of bubbles in financial markets". In the next section we show that the analogy between stock market crashes and the bursting of exchange rate bubbles is a false one.

2. Stock market bubbles and exchange rate bubbles

In general, stock markets tend to fall more rapidly than they rise (Bekaert and Wu, 2000; French *et al*., 1987; Yuan, 2005). Various explanations of this have been suggested. One is the role of leverage (Christie, 1982). When the price of a firm's stock falls, it becomes more leveraged, and therefore riskier. A given piece of news therefore stimulates larger price movements, increasing price volatility. A second possibility is that the equity risk premium is a function of the predicted volatility of stock prices, and since volatility is strongly positively autocorrelated, an unanticipated volatility shock stimulated by a big piece of news raises anticipated volatility and therefore depresses prices. If the news is negative, the volatility effect enhances the negative impact of the news on prices; if the news is positive, it works against the news effect, so big shocks have a larger price effect if negative than if positive (French *et al*., 1987). Finally, Yuan (2005) presents a model in which some investors have private information, but face borrowing constraints when

[1] An earlier model of a similar type, with similar predictions, is that of Frankel and Froot (1990). See Menkhoff and Taylor (2007) for a recent survey of technical analysis in the foreign exchange market.

asset prices are lower (e.g. because lenders require more collateral or because of fund redemptions). Without borrowing constraints, all the private information is conveyed to uninformed investors through asset prices, but with these constraints uninformed investors do not know whether low prices reflect private information or constraints on the informed investors. Because the constraints tighten as prices fall, prices are more volatile when low.

Do these theories carry over to the foreign exchange market? There seem to be two major differences. One is that all the above explanations refer to the price of a risky asset relative to a safe asset. In the foreign exchange market, however, it is unclear that one currency is intrinsically safer than another. One might perhaps argue that investors are interested in their net wealth measured in their home currency, so that wealthy countries' currencies are intrinsically safer. This argument would suggest that a currency such as the US dollar is a safe haven that should rise faster than it falls, as investors flee riskier currencies. In that case the spectacular crashes should be experienced by risky currencies, and not by the US dollar. Yet De Grauwe and Grimaldi (2006, pp. 2-3) cite the falls in the US dollar in 1985-87 and 2002-04 as their main examples of deflating bubbles.

The second difference is that these explanations do not interpret stock market crashes as a return to equilibrium. Prices are not closer to equilibrium after the crash than before. The first two explanations (leverage and a time-varying equity risk premium) are essentially equilibrium theories – prices are not assumed to deviate from equilibrium at any point. In Yuan's (2005) theory, prices can deviate from the level that would prevail in the absence of borrowing constraints on informed investors, but this tends to happen most when prices are low. Consequently, if the borrowing constraint effect is interpreted as a disequilibrium phenomenon, then a price crash is a movement away from equilibrium rather than towards it.

Thus there are two reasons to reject the analogy between stock market crashes and the bursting of exchange rate bubbles. One is that stock market crashes are not obviously a return to equilibrium; the other is that the bursting of exchange rate bubbles is not necessarily a rush for safer assets, particularly where the exchange rate involved is that of a traditional safe-haven currency such as the US dollar.

3. Empirical specification

In order to test whether exchange rate bubbles deflate faster than they inflate, we test whether the propensity of the real exchange rate to move in the same direction is stronger when it is moving back towards the mean of the series than when it is moving away from it. We also allow for possible reversion of the real exchange rate to an equilibrium that may be subject to a time trend. Thus our estimating equation is:

$$\Delta s_t = \alpha + \beta s_{t-1} + \gamma \Delta s_{t-1} + \delta (s_{t-1} - \bar{s}) \Delta s_{t-1}^2 + \phi t + \varepsilon_t \qquad (1)$$

where s is the logarithm of the real (CPI-adjusted) exchange rate of the US dollar against another currency (an increase representing an appreciation of the US dollar), t is time, ε is a random error and Δ is the first-difference operator. The intuition is that if bubbles deflate faster than they inflate, δ will be negative, because the effective coefficient of Δs_{t-1} is $(\gamma + \delta(s_{t-1} - \bar{s})\Delta s_{t-1})$. The second part of this expression will be positive in the case of a movement towards equilibrium and negative in the case of a movement away from equilibrium, if δ is negative.

We may also test whether the US dollar, as a presumed safe-haven currency, appreciates faster than it depreciates, which is the closest analogy to the observation that stock markets fall faster than they rise. Let z be equal to one if $\Delta s_{t-1} > 0,$ and zero otherwise. Then the equation to be estimated is:

$$\Delta s_t = \alpha + \beta s_{t-1} + \gamma \Delta s_{t-1} + \eta z \Delta s_{t-1} + \phi t + \varepsilon_t \qquad (2)$$

If the US dollar appreciates faster than it depreciates, then η should be positive, since the effective coefficient of Δs_{t-1} is γ when the dollar is depreciating and $\gamma + \eta$ when the dollar is appreciating.

4. Results

Table I shows the results of some empirical tests of equation (1), using end-of-month exchange rates against the US dollar, converted to real rates using consumer price indices. It can be seen that, although δ is negative in four out of six cases, it is never significant at the 5% level, which implies that bubbles do not have any tendency to inflate more slowly (or faster) than they deflate.

Table I. Do bubbles deflate faster than they inflate?

	Canada	UK	Germany	Italy	Japan	Australia	NZ
constant	.00396 (1.42)	-0.0108 (-1.70)	0.0288** (3.15)	-0.114 (-0.98)	0.0768 (1.47)	0.00826 (1.65)	0.0139 (1.70)
s_{t-1}	-0.0196 (-1.77)	-0.0373* (-2.56)	-0.0624* (-3.19)	-0.0147 (-0.95)	-0.0162 (-1.51)	-0.0247 (-1.77)	-0.0212 (-1.77)
Δs_{t-1}	0.0076 (0.13)	0.0823 (1.44)	0.1498* (2.29)	0.0688 (1.00)	0.1051 (1.94)	0.0904 (1.60)	0.0282 (0.49)
$(s_{t-1} - \bar{s})\Delta s_{t-1}^2$	13.12 (0.85)	-1.54 (-0.38)	13.15 (1.59)	-11.59 (-1.87)	-1.43 (-0.32)	-2.21 (-0.41)	-1.15 (-0.66)
t/10000	0.044 (0.40)	-0.035 (-1.79)	-0.213 (-0.56)	-0.416 (-1.18)	0.027 (0.15)	-0.027 (-0.02)	-0.134 (-0.67)
Standard error	0.019	0.031	0.037	0.032	0.33	0.032	0.036
Adjusted R^2	-0.002	0.019	0.046	0.025	0.010	0.010	0.002

Notes. The model estimated is equation (1). Figures in parentheses are *t*-statistics. * (**) denotes significant at the 0.05 (0.01) level. The sample is 1980/01 to 1998/12 for Germany and Italy; 1980/01 to 2008/10 for the other countries. The base currency is the US dollar in each case. A rise in *s* represents a real appreciation of the US dollar.

Table II. Does the US dollar appreciate faster than it depreciates?

	Canada	UK	Germany	Italy	Japan	Australia	NZ
constant	.00495 (1.83)	-0.0121 (-1.93)	0.0232** (2.64)	0.218* (2.05)	0.0859 (1.84)	0.00897 (1.84)	0.0152 (1.89)
s_{t-1}	-0.0163 (-1.77)	-0.0393* (-2.92)	-0.469 (-2.76)	-0.0285 (-2.03)	-0.0180 (-1.90)	-0.0270 (-2.23)	-0.0192 (-1.65)
Δs_{t-1}	0.233* (2.00)	0.0752 (0.75)	0.1885 (1.34)	0.1432 (1.09)	0.1252 (1.34)	0.1144 (1.02)	0.1617 (1.62)
Δs_{t-1} (if > 0)	-0.4284* (-2.24)	0.0262 (0.16)	-0.0655 (-0.32)	-0.0745 (-0.36)	-0.0464 (-0.26)	-0.538 (-0.32)	-0.2549 (-1.67)
t/10000	0.103 (0.92)	-0.340 (-1.73)	-0.191 (-0.50)	-0.435 (-1.22)	0.023 (0.12)	-0.039 (-0.22)	-0.086 (-0.43)
Standard error	0.019	0.031	0.037	0.032	0.033	0.032	0.036
Adj. R^2	0.010	0.019	0.036	0.010	0.010	0.009	0.008

Notes. The model estimated is equation (2). Otherwise see notes to Table I

Table II shows a test of the safe-haven hypothesis for the same currencies. Since a rise in *s* represents an appreciation of the US dollar, the safe-haven hypothesis predicts that η should be positive. In fact it turns out to be negative in five cases out of six.

It may be that the safe-haven hypothesis does not apply to these currencies because they are not risky enough. In Table III we apply the hypothesis to the currencies of some middle-income countries which were classified as independently floating for all or nearly all of the period concerned (Brazil, Chile, Colombia, Korea, Mexico, South Africa), but even in these cases there is no evidence of a safe-haven effect.

Table III. Testing the safe-haven effect for middle-income countries

	Brazil 99/04-09/02	Chile 99/10-09/02	Colombia 99/10-09/02	Korea 00/10-09/02	Mexico 95/04-09/02	S. Africa 97/04-09/01
constant	.0534* (2.08)	0.4076* (2.18)	0.0496* (2.16)	-0.0164 (-0.04)	0.0773 (1.19)	0.0856 (1.88)
s_{t-1}	-0.0617 (-2.26)	-0.0623 (-02.15)	-0.0635 (-2.16)	-0.0003 (0.00)	-0.0357 (-1.34)	-0.0426 (-1.75)
Δs_{t-1}	-0.264 (-1.37)	0.313 (1.50)	0.086 (0.41)	-0.368 (-1.91)	0.015 (0.09)	0.135 (0.75)
Δs_{t-1} (if > 0)	0.412 (1.45)	-0.198 (-0.64)	0.227 (0.73)	0.599 (1.61)	0.118 (0.50)	-0.116 (-0.42)
t/10000	-3.64 (-1.94)	-1.61 (-1.39)	-2.73 (-1.85)	1.88 (0.77)	0.456 (0.75)	0.020 (0.02)
Standard error	0.053	0.032	0.034	0.033	0. 029	0.048
Adj. R^2	0.018	0.041	0.050	0.054	0.042	0.0300

Notes. The model estimated is equation (2). Figures in parentheses are *t*-statistics. * (**) denotes significant at the 0.05 (0.01) level. The sample is determined by the period over which each currency was independently floating according to the IMF classification. The base currency is the US dollar in each case. A rise in *s* represents a real appreciation of the US dollar.

5. Conclusions

Some theories suggest that exchange rate bubbles inflate faster than they deflate. In this paper we have tested this hypothesis using data on real bilateral rates against the US dollar for six OECD countries. The results do not support the hypothesis.

In other financial markets the prices of risky assets are observed to fall faster than they rise. In the context of the foreign exchange market, this would suggest that safe-haven currencies should appreciate faster than they depreciate, since they represent the relatively safe side of the currency transaction. Safe-haven currencies are likely to be those where most investors are based and in which they measure their net wealth, such as the US dollar. We find that, in contradiction of this hypothesis, against other OECD currencies the US dollar tends to appreciate *more slowly* than it depreciates, although the difference is not generally statistically significant. Amonst the currencies of middle-income countries which float, there is no systematic tendency for depreciation against the US dollar to be more rapid than appreciation.

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