

Detecting trends in the foreign exchange markets

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Abstract

We test for the existence of trends in exchange rate series for 95 currencies against the US Dollar. To that end, we make use of Taylor (1980)'s price trend model that, instead of focusing on the mean reverting behaviour of exchange rates measured over a long horizon, concentrates on the short-term pattern of the price trend. Employing a maximum likelihood method and a genetic algorithm to estimate the model parameters, in 39 of the 95 cases considered we find evidence in favour of the presence of trends, being trends more frequent in intermediate exchange-rate regimes.

JEL classification numbers: C53, F31, G14.

KEY WORDS: Exchange rates, Price trend model, Genetic algorithms.

1. Introduction

In its weak form, the efficient market hypothesis (EMH) establishes that current prices reflect all available public information in the past and investors are only compensated by taking risks. It means that the new information arriving on the market is instantaneously translated to prices and employing any technical trading strategy it is impossible to obtain an abnormal profit above the market. Therefore, for the EMH view the underlying economic fundamental are the best way for making trading decisions.

In contrast, the defenders of technical analysis maintain that prices move following trends. So, when new information arrives at the market it does not immediately translate into prices and a certain amount of time is necessary until the market incorporates the information. This situation will reflect that the market will move through trends which may be used in a profitable way using a technical trading strategy based on the correlations of past returns. Indeed, Taylor and Allen (1992) report that the vast majority of exchange rate participants use chartism on the short-term horizon.

There is a wide empirical evidence of the success of technical trading strategies in exchange-rate markets. Numerous authors support that, even after taking into account interest rate differentials and transaction costs, standard moving average rules yield excess profits for the most US-dollar exchange rates [see Dooley and Shafer (1983), Sweeney (1986), Levich and Thomas (1993), LeBaron (1998), Gencay (1999), Neely et al (1997), Chang and Osler (1999), Dewachter (2001) and Harris and Yilmaz (2009), among others].

The purpose of this paper is to test for trends in exchange-rate markets examining daily data on ninety-five countries from 4 January 1993 to 31 December 2010. In doing so, our study provides interesting information from a wide sample of countries with different exchange-rate regimes, and will complement existing studies on developed markets. Finally, we propose the use of genetic algorithms in the econometric methodology to boost the optimization technique.

The paper is organised as follows. Section 2 presents the econometric methodology, while Section 3 describes the data set and reports the empirical results.

2. Econometric methodology

Taylor (1980)'s trend model for a prices time series P_t is defined as

$$\begin{aligned} x_t &= \log(P_t) - \log(P_{t-1}) = \mu_t + \varepsilon_t, \\ E(\varepsilon_t) &= E(\varepsilon_t \varepsilon_{t+i}) = 0, \quad i \neq 0, \quad \text{cov}(\mu_s, \varepsilon_t) = 0 \quad \forall s, t \end{aligned} \quad (1)$$

where the white noise series ε_t is uncorrelated with the stochastic process μ_t representing the trend in the model and it is interpreted as the response to anticipated changes in the supply and demand of the assets. This μ_t may be positive or negative giving rise to increasing or decreasing price trends. We also define σ^2 as the variance of ε_t , v^2 as the variance of μ_t and $\bar{\mu}$ as the expectation of μ_t .

So, the trend model may be formulated with probability as

$$\mu_t = \begin{cases} \mu_{t-1} & \text{with probability } p \\ \bar{\mu} + \eta_t & \text{with probability } 1-p \end{cases} \quad (2)$$

where η_t is white noise with mean zero and independent of the past trend values μ_s for $s < t$.

In order to find out the number of days that the duration of the trend is expected, a parameter m which is called the mean trend duration is defined as the averages the different durations of possible trends

$$m = \sum_{i=1}^{\infty} i(1-p)p^{i-1} = (1-p)^{-1} \quad (3)$$

Omitting technical details which can be found in Taylor and Kingsman (1978), Taylor (1980) and Taylor (2008), the base of the price trend test is the existence of positive correlations between daily rescaled returns x_t / \hat{a}_t with several lags, where \hat{a}_t represents the estimation of the mean absolute deviation which is considered a proxy of the variance of the returns x_t . On the contrary, in the random walk model, all correlations will be zero for any lag.

The correlations of daily rescaled returns are defined as $\rho_i = cor(x_t / \hat{a}_t, x_{t+i} / \hat{a}_{t+i})$. Taylor shows that model (1) with μ_t variable as in (2) provides the following correlation expression for rescaled returns

$$\rho_i = \frac{p^i v^2}{v^2 + \sigma^2} = Ap^i, \quad (4)$$

where $A = v^2 / (v^2 + \sigma^2)$.

So Taylor (1980) formulates a hypothesis test where the null corresponds to the random walk:

$$H_0 : \rho_i = 0, \text{ for each } i > 0 \quad (5)$$

meanwhile the alternative hypothesis to the random walk model is:

$$H_1 : \rho_i = Ap^i, \text{ for some } A \geq 0, 0 \leq p \leq 1, \text{ for each } i > 0 \quad (6)$$

The parameter A is a measure of information that is not instantaneously reflected in the market prices, meanwhile p measures the speed at which the information is reflected in them. If A or p were very close to zero, the information would be used perfectly by the market. But when the trend is accepted, A has a small value, around 3%, and p is close to 1. It means that the market has a slow interpretation of the relevant information that arrives.

In order to reject the presence of trends in the financial series Taylor (1980) proposes a statistic U^* based on the likelihood ratio, using the sample autocorrelations r_t of rescaled returns x_t / \hat{a}_t

$$U^* = \frac{\sum_{i=2}^{30} 0.92^i r_i}{\sum_{i=2}^{30} (0.92^{2i} n^{-1})^{\frac{1}{2}}} = 0.4649 \sqrt{n} \sum_{i=2}^{30} 0.92^i r_i \quad (7)$$

If H_0 is accepted, the statistic U^* has $N(0,1)$ asymptotic distribution.

Once the trends are detected by the U^* statistic, the trend parameters A , p and m are going to be estimated in all series. Due to the complexity of the log likelihood function, in order to estimate the parameters, a genetic algorithm is employed [see Dorsey and Mayer (1995) for the use of genetic algorithms for optimizing complex likelihood functions in econometrics].

3. Data and empirical results

In this paper the study of the existence of trends is carried out using daily data of nominal exchange rates against the US dollar for 95 countries from 4 January 1993 to 31 December 2010¹ taking from Reuters' EcoWin Pro.

We divide each series into two parts: a training period and a prediction period. The training period is the first part of the time series and, inside it, the parameters A , p and q are estimated. These parameters will be employed for trading in the predicting period which is the second part of the series. The training period used to test for random walk hypothesis against trend ranks from the beginning of the series recorded by [EcoWin Pro](#) until 31-12-2007. The prediction period ranks from 01-01-2007 until 31-

¹ This period differs between series depending on data availability.

12-2010. For the series where the trend is accepted the characteristic parameters of the trend model are estimated. Finally, in the series where the mean trend duration is longer than two days, predictions are carried out in the prediction period.

Given that the countries in our sample present different exchange rate regimes that could affect the existence of trends, we have use the “natural fine classification” of Reinhart and Rogoff (2004), updated until December 2010 by Ilzetzki, Reinhart and Rogoff (2011), to distinguish between a wide range of *de facto* regimes:

1. No separate legal tender
2. Pre announced peg or currency board arrangement
3. Pre announced horizontal band that is narrower than or equal to +/-2%
4. De facto peg
5. Pre announced crawling peg
6. Pre announced crawling band that is narrower than or equal to +/-2%
7. De facto crawling peg
8. De facto crawling band that is narrower than or equal to +/-2%
9. Pre announced crawling band that is wider than or equal to +/-2%
10. De facto crawling band that is narrower than or equal to +/-5%
11. Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)
12. Managed floating
13. Freely floating
14. Freely falling
15. Dual market in which parallel market data is missing.

Given that there are changes in the exchange rate regime in the 95 currencies examined in this paper, Table 1 provides an overview of the evolution of the statistical U^* within each regime for each currency. This table reports for each individual currency and exchange rate regime, if at any time within that combination the statistic U^* accepts the trend or not. To that end, we use the following codes:

0: the currency is not under a given exchange-rate regime

-1: the currency is under a given exchange-rate regime, but there is not evidence of the presence of a trend

+1: the currency is under a given exchange-rate regime and there is evidence of the presence of a trend at some point.

[Table 1, here]

For example, for the Australian Dollar we observe that it was never under regime 1 (no separate legal tender); it was under regime 2 (pre announced peg or currency board arrangement) in some subperiods, but we could not accept the presence of a trend; and it was under regime 8 (*de facto* crawling band that is narrower than or equal to $\pm 2\%$) in some subperiods and we find evidence of a trend.

As can be seen, we find evidence of the presence of a trend in the exchange rate in 93 cases. As one could have expected, these episodes are more frequent the more flexible the exchange-rate is. In addition, we find that the existence of a trend is generally accepted most frequently for currencies of developed countries and less frequently for currencies of developing countries. A reason for this finding could be that

the latter have more efficient markets or because the former are more likely to have less flexible exchange-rate regimes.

Additionally, we repeated the study using all the available data, therefore ending in 31 December 2010. The results for this experiment are presented in Table 2. As it can be observed, several countries that did not accept the trend with data until December 2007 for their last known exchange rate regime, do accept the trend if we extend the sample until 31 December 2010. It is interesting to note that among these countries we find the Euro area and the United Kingdom.

[Table 2, here]

Table 3 reports the results of the U^* test as well as other important parameters in the trend model as it is the probability p of maintaining the trend, the parameter A of the correlation function in (7) and the mean trend duration obtained for the last known regime for each currency. As mentioned, all parameters were obtained by maximum likelihood employing a GA in the optimization process.

[Table 3, here]

As a general comment, it is possible to observe in Table 3 that the series where the statistic U^* accepts the trend predominate values of A which are lower than the values corresponding to the series where U^* accepts the null of random walk. The parameter p is usually higher than 0.5 in the series where the trend is accepted, which means that the new information needs more than one day to be incorporated into the

prices. Note that for the series where the trend is not accepted we have not estimated the parameters A , p , q and m , so we have filled with zeros the corresponding columns.

With respect to U^* statistic, the results shown in Table 3 point out the following conclusions:

- In 56 out of a total of 95 exchange rates cases, the U^* statistic accepts the null hypothesis of random walk ($U^* < 1.65$, in a one-tail $N(0,1)$ test with 5% of confidence)
- Trends are detected in 39 out of 95 exchange rates ($U^* > 1.65$), being trends more frequent in intermediate exchange-rate regimes.
- The mean trend duration is always higher than one day ($m > 1$) when a trend is detected.

5. Concluding remarks

This paper has provided evidence on the presence of trends in foreign exchange markets in 39 of the 95 cases considered, being trends more frequent in intermediate exchange-rate regimes.

Facts found here might have both some practical meaning for investors and some theoretical insights for academic scholars interested in the behavior of exchange-rate markets.

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Table 1: Summary of the evidence on the presence of exchange-rate trends using the U* statistic (sample until 31 December 2007)

Currency/Regime	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Euro (from 1999)	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0
Algeria Dinar	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0
Angola Adjusted Kwanza	0	0	0	1	0	0	0	0	0	0	0	0	-1	-1	0
Argentina Peso	0	-1	0	0	0	0	0	-1	0	0	0	0	0	-1	-1
Australian Dollar	0	-1	0	0	0	0	0	1	0	0	0	-1	-1	0	0
Bangladesh Taka	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0
Barbados Dollar	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Belize Dollar	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Buthan Ngultrum	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivia Boliviano	0	0	0	0	0	0	-1	-1	0	-1	0	-1	0	-1	0
Brazil Real	0	-1	0	0	0	-1	0	0	0	-1	0	1	0	-1	0
Brunei Darussaleem Ringgit	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Burundi Franc	0	0	0	0	0	0	0	1	0	-1	0	0	0	-1	0
Cambodia Riel	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0
Canada Dollar	0	0	0	0	0	0	0	1	0	-1	0	0	0	0	0
Cape Verde Escudo	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0
Chile Peso	0	-1	0	0	-1	0	0	0	1	1	0	1	0	1	0
China Yuan Renminbi	0	0	0	-1	0	0	0	-1	0	0	0	-1	0	0	0
Colombia Peso	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0
Congo Democratic Republic Franc	0	0	0	0	0	0	0	0	0	-1	0	-1	-1	-1	0
Costa Rica Colon	0	-1	0	0	0	0	1	1	0	-1	0	-1	0	-1	0
Dominican Republic Peso	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0
Ecuador Sucre (until 2001)	0	-1	0	0	0	0	0	-1	0	-1	0	-1	0	1	-1
Egypt Pound	0	0	0	-1	0	0	0	0	0	-1	0	0	0	0	0
El Salvador Colon	-1	0	0	-1	0	0	0	-1	0	0	0	-1	0	0	0
Equatorial Guinea Ekwwele	0	-1	0	0	0	0	0	-1	0	0	0	0	0	0	0
Ethiopia Birr	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0
Fiji Dollar (USD per FD)	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
Gambia Dalasi	0	1	0	0	0	0	0	1	0	0	0	0	-1	-1	-1
Ghana New Cedi	0	-1	0	0	0	0	0	1	0	0	0	-1	-1	-1	0
Guinea Franc	0	-1	0	0	0	0	-1	1	0	-1	0	-1	0	-1	1
Guinea-Bissau Escudo/Peso (until 1997)	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	-1
Guyana Dollar	0	0	0	0	0	0	-1	0	0	0	0	0	0	-1	0
Haiti Gourde	0	-1	0	0	0	0	0	-1	0	-1	0	1	-1	1	0
Honduras Lempira	0	-1	0	0	0	0	-1	0	0	-1	0	0	0	-1	0
Hong Kong Dollar	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
India Rupee	0	-1	0	-1	0	0	1	1	0	0	0	-1	0	0	0
Indonesia Rupiah	0	0	0	0	0	0	1	0	0	-1	0	1	0	1	0
Israel New Sequel	0	0	0	0	0	-1	0	1	-1	1	0	-1	0	-1	0
Jamaica Dollar	0	-1	0	-1	0	0	1	-1	0	-1	0	0	0	-1	0
Japan Yen	0	-1	0	0	0	0	0	1	0	0	0	-1	1	0	0
Jordan Dinar	0	-1	0	-1	0	0	-1	0	0	-1	0	0	0	-1	0
Kazakhstan Tenge	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0

Notes: a. Codes: 0: the currency is not under a given exchange-rate regime
-1: the currency is under a given exchange-rate regime, but there is not evidence of the presence of a trend
+1: the currency is under a given exchange-rate regime and there is evidence of the presence of a trend at some point.
b. See text for the classification of *de facto* exchange-rate regimes.

Table 1 (continued)

Currency/Regime	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Kenya Shilling	0	-1	0	0	0	0	0	1	0	0	0	-1	0	-1	0
South Korea Won	0	-1	0	0	0	-1	1	0	0	1	0	1	0	-1	0
Kuwait Dinar	0	-1	0	-1	0	0	-1	0	0	0	0	0	0	0	0
Kyrgyzstan Som	0	0	0	0	0	0	0	1	0	0	0	0	0	-1	0
Lebanon Pound	0	-1	0	0	0	0	-1	1	0	1	0	0	0	1	0
Leshoto Loti	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Madagascar Ariary	0	1	0	0	0	0	0	-1	0	0	0	1	0	-1	-1
Malawi Kwacha	0	1	0	0	0	0	-1	0	0	0	0	1	-1	-1	0
Malaysia Ringgit	0	1	0	0	0	0	0	1	0	0	0	0	-1	0	0
Maldives Islands Rufiyaa (until 1984)	0	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0
Mauritania Ougiyaa	0	1	0	-1	0	0	-1	1	0	-1	0	0	0	0	0
Mauritius Rupee	0	0	0	0	0	0	0	1	0	-1	0	0	0	0	-1
Mexico New Peso	0	-1	0	-1	-1	0	-1	0	-1	0	0	-1	0	1	0
Moldova Leu	0	0	0	-1	0	0	0	1	0	0	0	0	0	1	-1
Mongolia Tugrik	0	0	0	-1	0	0	0	-1	0	0	0	0	-1	-1	0
Morocco Dirham	0	0	0	0	0	0	-1	-1	0	0	0	0	0	0	0
Mozambique New Metical	0	0	0	-1	0	0	0	-1	0	0	0	0	0	0	0
Myanmar (Burma) Kyat	0	-1	0	0	0	0	0	0	0	1	-1	-1	0	1	-1
Namibia Dollar	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Nepal Rupee	0	-1	0	0	0	0	0	-1	0	-1	0	0	0	0	0
New Zealand Dollar	0	-1	0	0	0	0	0	1	0	0	0	1	0	0	0
Nicaragua Cordoba Oro	0	-1	-1	0	0	0	-1	-1	0	0	0	0	-1	-1	0
Nigeria Naira	0	-1	0	0	0	0	0	0	0	0	0	1	-1	-1	0
Pakistan Rupee	0	-1	0	0	0	0	-1	-1	0	0	0	0	0	0	-1
Papua New Guinea Kina	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Paraguay Guarani	0	0	0	0	0	0	1	-1	0	1	0	-1	0	-1	0
Peru New Sol	0	0	0	0	0	0	0	1	0	0	0	0	0	-1	-1
Philippines Peso	0	0	0	-1	0	0	-1	1	0	-1	0	-1	0	-1	0
Qatar Ryal	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Sao Tome and Principe Dobra	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
Saudi Arabia Rial	0	-1	0	1	0	0	0	0	0	0	0	0	0	0	0
Seychelles Rupee	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Sierra Leone Leone	0	0	0	-1	0	0	0	0	0	0	0	0	-1	0	0
Singapore Dollar	0	-1	0	0	0	0	0	0	0	0	1	0	0	0	0
South Africa Rand	0	-1	0	0	0	0	0	0	0	0	0	1	1	0	1
Sri Lanka Rupee	0	-1	0	0	0	-1	1	-1	-1	1	0	-1	0	0	0
Sudan Pound	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0
Suriname Dollar	0	-1	0	0	0	0	0	-1	0	-1	0	-1	0	-1	0
Swaziland Lilangeni	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0
Syria Pound	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	0	0
Tajikistan Somoni	0	-1	0	0	0	0	1	0	0	0	0	0	0	-1	0
Tanzania Shilling	0	-1	0	-1	0	0	0	1	0	-1	0	-1	0	1	0
Thailand Baht	0	-1	0	1	0	0	0	0	0	0	1	-1	0	-1	0
Tonga Pa'anga	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0
Trinidad and Tobago Dollar	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0
Tunisia Dinar	0	-1	0	0	0	0	0	1	0	0	0	0	0	0	0
United Arab Emirates Dirham	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
British Pound	0	1	-1	0	0	0	0	0	0	-1	1	0	0	0	0
Uruguay Peso	0	0	0	0	-1	-1	0	1	0	0	0	1	0	-1	0
Venezuela Bolivar Fuerte	0	-1	0	0	0	1	0	0	0	0	0	1	0	-1	-1
Viet Nam Dong	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Zambia Kwacha	0	-1	0	0	0	0	0	0	0	0	0	-1	-1	1	0

Notes: a. Codes: 0: the currency is not under a given exchange-rate regime
-1: the currency is under a given exchange-rate regime, but there is not evidence of the presence of a trend
+1: the currency is under a given exchange-rate regime and there is evidence of the presence of a trend at some point.
b. See text for the classification of *de facto* exchange-rate regimes.

Table 2: Summary of the evidence on the presence of exchange-rate trends using the U* statistic (sample until 31 December 2010)

Currencies	last regime	data until 12/31/2007	data until 09/27/2008
Euro (from 1999)	14	-1	1
Algeria Dinar	8	-1	-1
Angola Adjusted Kwanza	4	1	1
Argentina Peso	8	-1	1
Australian Dollar	13	1	1
Bangladesh Taka	7	-1	-1
Barbados Dollar	2	-1	-1
Belize Dollar	2	-1	-1
Buthan Ngultrum	2	1	1
Bolivia Boliviano	7	-1	-1
Brazil Real	12	1	1
Brunei Darussaleem Ringgit	8	1	1
Burundi Franc	8	1	1
Cambodia Riel	7	-1	-1
Canada Dollar	10	-1	-1
Cape Verde Escudo	7	-1	-1
Chile Peso	10	1	1
China Yuan Renmimbi	4	-1	-1
Colombia Peso	10	1	1
Congo Democratic Republic Franc	13	-1	-1
Costa Rica Colon	7	1	1
Dominican Republic Peso	12	-1	-1
Ecuador Sucre (until 2001)	14	1	1
Egypt Pound	4	-1	-1
El Salvador Colon	1	-1	-1
Equatorial Guinea Ekwale	2	-1	-1
Ethiopia Birr	7	-1	-1
Fiji Dollar	10	-1	-1
Gambia Dalasi	8	1	1
Ghana New Cedi	8	1	-1
Guinea Franc	10	-1	-1
Guinea-Bissau Escudo/Peso (until 1997)	15	-1	-1
Guyana Dollar	7	-1	-1
Haiti Gourde	12	1	1
Honduras Lempira	7	-1	-1
Hong Kong Dollar	2	1	1
India Rupee	8	1	1
Indonesia Rupiah	12	1	1
Israel New Sequel	10	1	1
Jamaica Dollar	7	1	-1
Japan Yen	13	1	1
Jordan Dinar	4	-1	-1
Kazakhstan Tenge	8	1	1
Kenya Shilling	8	1	1

- Notes:** a. Codes: 0: the currency is not under a given exchange-rate regime
-1: the currency is under a given exchange-rate regime, but there is not evidence of the presence of a trend
+1: the currency is under a given exchange-rate regime and there is evidence of the presence of a trend at some point.
- b. See text for the classification of de facto exchange-rate regimes.

Table 2 (continued)

Currencies	last regime	data until 12/31/2007	data until 09/27/2008
South Korea Won	12	1	1
Kuwait Dinar	4	-1	1
Kyrgyzstan Som	8	1	1
Lebanon Pound	2	-1	-1
Leshoto Loti	2	1	1
Madagascar Ariary	12	1	1
Malawi Kwacha	7	-1	-1
Malaysia Ringgit	8	1	1
Maldives Islands Rufiyaa (until 1984)	4	-1	-1
Mauritania Ougiyaa	7	-1	-1
Mauritus Rupee	8	1	1
Mexico New Peso	12	-1	-1
Moldova Leu	8	1	1
Mongolia Tugrik	4	-1	1
Morocco Dirham	7	-1	1
Mozambique New Metical	8	-1	-1
Mianmar (Burma) Kyat	15	-1	-1
Namibia Dollar	2	-1	-1
Nepal Rupee	8	-1	1
New Zealand Dollar	12	1	1
Nicaragua Cordoba Oro	7	-1	-1
Nigeria Naira	12	1	1
Pakistan Rupee	7	-1	-1
Papua New Guinea Kina	7	1	1
Paraguay Guarani	10	1	1
Peru New Sol	8	1	1
Philippines Peso	8	1	1
Qatar Ryal	2	-1	-1
Sao Tome and Principe Dobra	10	-1	-1
Saudi Arabia Rial	4	1	1
Seychelles Rupee	8	1	1
Sierra Leone Leone	4	-1	-1
Singapore Dollar	11	1	1
South Africa Rand	13	1	1
Sri Lanka Rupee	7	1	1
Sudan Pound	7	-1	-1
Suriname Dollar	2	-1	-1
Swaziland Lilangeni	2	-1	-1
Syria Pound	10	-1	-1
Tajikistan Somoni	7	1	1
Tanzania Shilling	10	-1	-1
Thailand Baht	11	1	1
Tonga Pa'anga	8	-1	-1
Trinidad and Tobago Dollar	7	-1	-1
Tunisia Dinar	8	1	1
United Arab Emirates Dirham	2	-1	-1
British Pound	11	-1	1
Uruguay Peso	8	1	1
Venezuela Bolivar Fuerte	15	-1	-1
Viet Nam Dong	7	1	1
Zambia Kwacha	13	-1	-1

Notes: a. Codes: 0: the currency is not under a given exchange-rate regime
-1: the currency is under a given exchange-rate regime, but there is not evidence of the presence of a trend
+1: the currency is under a given exchange-rate regime and there is evidence of the presence of a trend at some point.
b. See text for the classification of de facto exchange-rate regimes.

Table 3: Taylor's statistics and trend parameters

Currencies	Last regime	Initial date	Final date	U*	A	p	m
Euro	14	11062007	12312007	-0.3778	0	0	0
Algeria Dinar	8	11062007	12312007	-0.5152	0	0	0
Angola Adjusted Kwanza	4	7202005	12312007	1.6615	0.1216	0.7072	3
Argentina Peso	8	11062007	12312007	-1.1554	0	0	0
Australian Dollar	13	11062007	12312007	-0.2062	0	0	0
Bangladesh Taka	7	11062007	12312007	-0.4555	0	0	0
Barbados Dollar	2	11062007	12312007	0.0000	0	0	0
Belize Dollar	2	11062007	12312007	0.0000	0	0	0
Buthan Ngultrum	2	8112004	12312007	2.2324914	0.02638808	0.95237738	20.9984245
Bolivia Boliviano	7	11062007	12312007	0.0000	0	0	0
Brazil Real	12	10011999	12312007	2.1350	0.0134	0.9858	70
Brunei Darussalam Ringgit	8	2011990	12312007	4.3782	0.0134	0.9911	113
Burundi Franc	8	3242006	12312007	2.568965893	0.0560163	0.90872455	10.9558484
Cambodia Riel	7	11062007	12312007	0.2519	0	0	0
Canada Dollar	10	11062007	12312007	-0.7328	0	0	0
Cape Verde Escudo	7	11062007	12312007	-0.5032	0	0	0
Chile Peso	10	2012002	12312007	2.9770	0.0489	0.8809	8
China Yuan Renminbi	4	11062007	12312007	-0.3220	0	0	0
Colombia Peso	10	1021985	12312007	23.6481	0.0607	0.9979	465
Congo Democratic Republic Franc	13	10292007	12312007	0.0611	0	0	0
Costa Rica Colon	7	2012002	12312007	2.0314	0.0138	0.9980	512
Dominican Republic Peso	12	11062007	12312007	0.0391	0	0	0
Ecuador Sucre	14	9102001	11022001	0.0000	0	0	0
Egypt Pound	4	11222007	12312007	-0.5040	0	0	0
El Salvador Colon	1	11062007	12312007	0.0000	0	0	0
Equatorial Guinea Ekwale	2	9171986	11111986	-0.6719	0	0	0
Ethiopia Birr	7	11062007	12312007	0.0000	0	0	0
Fiji Dollar (USD per FD)	10	11062007	12312007	-0.5813	0	0	0
Gambia Dalasi	8	5112007	12312007	1.6774	0.0464	0.9389	16
Ghana New Cedi	8	6042007	12312007	4.170444834	0.10777243	0.95284192	21.2052717
Guinea Franc	10	11062007	12312007	0.0588	0	0	0
Guinea-Bissau Escudo/Peso	15	11062007	12312007	0.0000	0	0	0
Guyana Dollar	7	11062007	12312007	0.3133	0	0	0
Haiti Gourde	12	4052007	12312007	1.705477566	0.04337436	0.94006856	16.6857328
Honduras Lempira	7	11062007	12312007	-0.0925	0	0	0
Hong Kong Dollar	2	4162007	12312007	1.7206	0.0721	0.8715	8
India Rupee	8	2012005	12312007	2.470463417	0.02465232	0.95318002	21.3584013
Indonesia Rupiah	12	5031999	12312007	3.3993	0.0527	0.8815	8
Israel New Sequel	10	3011991	12312007	3.4449	0.0223	0.9198	12
Jamaica Dollar	7	6142007	12312007	1.7064	0.2987	0.6303	3
Japan Yen	13	1031978	12312007	5.0840	0.0221	0.9373	16
Jordan Dinar	4	11062007	12312007	-0.6463	0	0	0
Kazakhstan Tenge	8	8012005	12312007	3.6718	0.0663	0.9390	16
Kenya Shilling	8	2011996	12312007	3.9789	0.1732	0.5176	2

Notes:

- All calculations were carried out from the beginning of the series until 27 September 2008
- The parameters A and p [$m=1/(1-p)$] were obtained through maximizing the logarithm of likelihood function by a genetic algorithm.
- In blue, the U^* statistic rejects the null in favour of trend at the 5% confidence level.
- See text for the classification of *de facto* exchange-rate regimes.

Table 3 (continued)

Currencies	Last regime	Initial date	Final date	U*	A	p	m
South Korea Won	12	8031998	12312007	2.7173	0.0353	0.8536	7
Kuwait Dinar	4	11222007	12312007	-0.6618	0	0	0
Kyrgyzstan Som	8	8072007	12312007	2.5968	0.0736	0.9713	35
Lebanon Pound	2	11062007	12312007	0.0205	0	0	0
Leshoto Loti	2	5082000	12312007	1.7028	0.0106	0.9883	85
Madagascar Ariary	12	2021999	12312007	2.0820	0.0080	0.9738	38
Malawi Kwacha	7	11062007	12312007	-0.2968	0	0	0
Malaysia Ringgit	8	11062007	12312007	-1.0430	0	0	0
Maldives Islands Rufiyaa	4	11062007	12312007	-0.6685	0	0	0
Mauritania Ougiyaa	7	11062007	12312007	-0.2448	0	0	0
Mauritus Rupee	8	4082002	12312007	3.2323	0.0090	0.9966	290
Mexico New Peso	12	11062007	12312007	-0.1758	0	0	0
Moldova Leu	8	4032000	12312007	13.4773	0.1224	0.9445	18
Mongolia Tugrik	4	11062007	12312007	-0.1417	0	0	0
Morocco Dirham	7	11062007	12312007	-0.4420	0	0	0
Mozambique New Metical	8	11022007	12312007	-0.5163	0	0	0
Myanmar (Burma) Kyat	15	11062007	12312007	0.0000	0	0	0
Namibia Dollar	2	11062007	12312007	-1.1625	0	0	0
Nepal Rupee	8	11062007	12312007	-0.2180	0	0	0
New Zealand Dollar	12	3221994	12312007	1.6545	0.0122	0.9821	56
Nicaragua Cordoba Oro	7	11062007	12312007	0.0430	0	0	0
Nigeria Naira	12	10031996	12312007	1.7528	0.0003	0.9980	494
Pakistan Rupee	7	11062007	12312007	0.1947	0	0	0
Papua New Guinea Kina	7	2011990	12312007	1.8081	0.0070	0.9735	38
Paraguay Guarani	10	4142005	12312007	1.6760	0.1127	0.7389	4
Peru New Sol	8	12011993	12312007	3.9348	0.0160	0.9936	156
Philippines Peso	8	1032000	12312007	3.6923	0.0172	0.9933	150
Qatar Ryal	2	11222007	12312007	-0.7693	0	0	0
Sao Tome and Principe Dobra	10	11062007	12312007	-0.3100	0	0	0
Saudi Arabia Rial	4	11171980	12312007	2.0420	0.0069	0.9887	89
Seychelles Rupee	8	12222006	12312007	1.6681	0.0664	0.8413	6
Sierra Leone Leone	4	11062007	12312007	-0.6095	0	0	0
Singapore Dollar	11	9171973	12312007	1.7808	0.0008	0.9860	71
South Africa Rand	13	4031995	12312007	2.3190	0.6210	0.1273	0
Sri Lanka Rupee	7	6012001	12312007	2.9840	0.9999	0.1601	0
Sudan Pound	7	11022007	12312007	-0.7243	0	0	0
Suriname Dollar	2	10292007	12312007	0.0000	0	0	0
Swaziland Lilangeni	2	11062007	12312007	-1.1661	0	0	0
Syria Pound	10	11062007	12312007	0.0000	0	0	0
Tajikistan Somoni	7	1272005	12312007	3.9395	0.0390	0.9531	21
Tanzania Shilling	10	11062007	12312007	0.0326	0	0	0
Thailand Baht	11	11011999	12312007	4.0850	0.0238	0.9653	29
Tonga Pa'anga	8	11062007	12312007	-1.2339	0	0	0
Trinidad and Tobago Dollar	7	11062007	12312007	-0.3101	0	0	0
Tunisia Dinar	8	3311977	12312007	2.4425	0.0027	0.9197	12
United Arab Emirates Dirham	2	10292007	12312007	0.3601	0	0	0
British Pound	11	11062007	12312007	-0.6628	0	0	0
Uruguay Peso	8	9252006	12312007	1.8378	0.1185	0.7975	5
Venezuela Bolivar Fuerte	15	10292007	12312007	0.0000	0	0	0
Viet Nam Dong	7	2012002	12312007	2.6170	0.0078	0.9904	105
Zambia Kwacha	13	11062007	12312007	-0.7285	0	0	0

Notes:

- The training period used in the calculations spans from that indicated in the column "initial date" to that in the "final date". The prediction period spans from the day after that indicated in the column "final date" to 27 September 2008
- The parameters A and p [$m=1/(1-p)$] were obtained through maximizing the logarithm of likelihood function by a genetic algorithm.
- In blue, the U^* statistic rejects the null in favour of trend at the 5% confidence level.
- See text for the classification of *de facto* exchange-rate regimes.