Monetary and Exchange Rate Stability at the EU Mediterranean Borders

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Abstract

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Stabilizing the exchange rate is a major monetary policy goal in a number of Mediterranean countries. We present a microstructure model of the foreign exchange market based on technical trading that allows us to categorize de facto exchange rate regimes and to derive a market based measure of the credibility of these exchange rate regimes. In our empirical analysis we compare the exchange rate policies of seven non European Mediterranean countries, Algeria, Egypt, Israel, Libya, Morocco, Turkey and Tunisia, with the benchmark of four European non EU countries namely Albania, Bulgaria, Croatia, and Romania. Our results indicate that the fundamental volatility of the market based exchange rates is quite moderate and that markets assign a moderate degree of credibility to the exchange rate management of most of the countries.

JEL-Classification: D84, E42, F31

Keywords: monetary policy; exchange rate policy, credibility; Mediterranean; Eastern Europe; technical trading;
1 Motivation

The ten new member states had just joined the European Union (EU) on May 1st, 2004 as a broad discussion about the future of the EU has restarted among politicians, academics and the public. Quo vadis EU is currently one of the most prominent and important questions discussed. Deepening and/or enlargement? Is there a need to integrate the new members first before beginning to look for new entrants? And is there a need to define the final borders of the EU? Some observers equate the question of the Turkey’s future relation with the EU – membership or privileged partnership – with the matter of the finality of the enlargement process, the final borders of the EU and its future political status.

The Mediterranean countries are particularly affected by this process. As direct neighbors they have close economic and political links with the EU and are thus especially interested in some sort of privileged partnership. As direct EU neighbors they are also potential candidates for future EU membership.¹

Monetary and exchange rate policy is an important field in this process of ever closer integration with the EU. Currently, stabilizing the exchange rate is a major monetary policy goal in a number of Mediterranean countries. By pegging their exchange rate governments typically want to promote trade and/or improve the credibility of their monetary policy. Thus exchange rate management does not only imply the stabilization of the external price of the currency, but is also considered to be a means of stabilizing the internal price level. As the exchange rate is a simple, easily to understand and measurable indicator it is a straightforward way to improve the transparency and accountability of monetary policy by pegging the domestic currency to a stable nominal anchor.

Given a number of financial crisis at the end of the 1990ies, e.g. the 1998 Russian Rubel crisis, the 2001 crisis of the Turkish Lira or the debt crises in Albania 1999, investors as well as long term trade contractors are particularly wary in their assessments of the economic situation and policies of countries like the Mediterranean emerging market countries.² Therefore, markets’ assessments of the monetary policies might serve as a valuable indicator of the region’s (future) economic stability.

We analyze the exchange rate behavior and the credibility of the exchange policy in a microstructure model of the foreign exchange market. This approach is based on market sentiments and has the major advantage that the empirical analysis relies on exchange rate data only. In particular, it does not need any macroeconomic data nor any data on the market micro structure, both potential sources of data problems.³

¹ A comparison of the GDP per capita shows that the Mediterranean countries – with the exception of Israel and Turkey – lie well below 3000USD (current prices). This is comparable to the development status of the ten new EU members ten years before their entry. (data from International Monetary Fund, World Economic Outlook Database, September 2004)

² Despite the fact that the Mediterranean did not experience severe financial crisis after the mid 90’s, (e.g. Tunisia did not suffer from a crisis for at least the last four decades) modern risk management practices imply rising risk coefficients for the entire group of emerging countries.

³ See Keller and Richardson (2003) for the severe problems of obtaining consistent economic data for several CIS countries.
account the macroeconomic environment. The market micro-structure is based on the interplay of fundamental and technical traders. As in De Long, Shleifer, Summers and Waldmann (1990) technical traders react to trend signals and create excess volatility through their actions (see also De Grauwe, Dewachter and Embrechts (1993), Frenkel (1997), and Hung (1997)). Strong signals, e.g. steep or rampant trends, induce technical traders to enter the market thereby increasing the exchange rate volatility. This yields an U shaped relation between the observed exchange rate trend and volatility, i.e., observed exchange rate volatility "smiles".

Monetary policy influences the volatility of the exchange rate via two channels, fundamental exchange rate volatility and credibility. In the case of a managed exchange rate the conditional volatility of the exchange rate is low due to either currency market interventions and/or an exchange rate orientated interest rate policy. In contrast, exchange rate volatility is high in the case of a floating rate regime. If the exchange rate management is credible, excess volatility is low as technical traders will react more reluctantly to trend signals, since they expect trend breaking interventions. Obviously excess volatility is high, if the credibility of the exchange rate regime is low. Technical traders react actively to trend signals, since they do not anticipate trend breaking interventions. Based on the size and shape of the resulting volatility smile we categorize the de facto exchange rate regimes and derive a market based measure of the credibility of these regimes.

Combining these results we can identify four sectors corresponding to four types of exchange rate regimes in the fundamental volatility - excess volatility plane:

1. credibly managed exchange rate regimes with low base and low excess volatility,
2. non-credibly managed exchange rate regimes with low base and high excess volatility,
3. floats of large currencies with high base and low excess volatility,
4. floats of small currencies with high base and high excess volatility.

Tight pegs with virtually no exchange rate volatility and currency crises with extremely high volatility are the border cases.

In our empirical analysis we compare the exchange rate policies of seven non European Mediterranean countries, namely Algeria, Egypt, Israel, Morocco, Turkey, and Tunisia, with the benchmark of four European non EU countries namely Albania, Bulgaria, Croatia, and Romania. In doing so we focus on the - the official exchange rate regime, - the de facto exchange rate behavior, and - the markets’ assessments of the exchange rate policies, i.e. the credibility of the central banks’ announcements and actions.

We empirically determine the de facto exchange rate regimes of these countries and test their credibility as assessed by the market participants. In contrast to von Hagen and Zhou (2002), Levy-Yeyati and Sturzenegger (2004), or Reinhard and Rogoff (2004) our classification scheme explicitly differentiates between exchange rate regimes with high and low credibility.
Concerning the choice of the nominal anchor, the growing importance of the trade with the Euro area and the political history of this region have made the Euro (EUR) the natural choice for most of the countries in the sample. The second natural anchor is the US Dollar (USD) because of its central role as an international currency and in the case of Israel because of close political ties.

In a first step we analyze the measured exchange rate trend and volatility relation with kernel regressions. Our empirical results confirm the model prediction of an U shaped relation between observed exchange rate trend and volatility. Using a parametric regression we then analyze the evolution of monetary policies and their credibility throughout the sample period.

We find that there are two groups of exchange rate regimes in the sample. Markets assign a relatively high degree of credibility to the exchange rate management in Albania, Bulgaria, Morocco, and Tunisia. The paths to credibility, however, were quite different.

The exchange rate management of Algeria, Croatia, Egypt, Israel and Romania is assigned less credibility. Egypt and Israel appear credible during calm periods but show low credibility during crises. However, fundamental and excess volatility of the exchange rates remain far lower than the values from a floating regime like Turkey.

Turkey finally has undergone a regime shift after the crises in 2001 to a floating exchange rate. Markets seem not to expect any exchange rate management.

2 Exchange rate volatility and nominal anchor

When deciding on its exchange rate policy a government has to determine two key features:
- the degree of exchange rate stabilization,
- the nominal anchor, i.e. the exchange rate which is to be stabilized.

In the case of the Mediterranean countries there have been strong incentives for exchange rate stabilization as these countries are on the edge of developing into open economies which in most cases do not have a long history of macroeconomic stability. There are two natural choices for the nominal anchor, the USD and the EUR. The USD plays a central role as an international reserve currency. The Euro is attractive because of the growing importance of the trade with the Euro area and the political history of this region. Last but not least there is a considerable inflow of foreign capital from the Euro zone into the region.

Formally, the exchange rate policy implies choosing the feedback parameters $\alpha$ and $\lambda$ from $(0, 1)$

$$m = \frac{1 - \lambda}{\lambda} \left[ (1 - \alpha) (e_{\text{euro}} - e_{\text{euro}}) + \alpha (e_{\text{dollar}} - e_{\text{dollar}}) \right]$$

$e$ denotes the exchange rate, and $m$ is a policy instrument, e.g. money supply or an interest rate. The feedback parameter $\lambda$ describes to what degree a central bank stabilizes its exchange rate, while parameter $\alpha$ determines the relative weight of the Deutschmark/Euro and the US Dollar as nominal anchors. $\bar{e}$ denotes the respective exchange rate target. Low values of $\lambda$ imply a strong reaction of the central bank to exchange rate movements, i.e. a fixed exchange rate regime. $\alpha = 0$ indicates a Euro peg and $\alpha = 1$ a Dollar peg. (see table 1).
Reinhard and Rogoff (2004) extensively list the de facto exchange rate regimes of a very broad sample of countries which includes the region analyzed here. We rely on their analysis for the determination of the reference currency for the exchange rates used in our empirical analysis. We use USD rates for countries with the USD as external anchor and Euro rates for countries with the Euro as external anchor in the de facto exchange rate regime according to the Reinhard and Rogoff (2004) classification. Table 1 gives the latest classification of the de facto exchange rate regime of Reinhard and Rogoff (2004) and the respective external anchor currency.

Table 1 about here

3 Market assessments of the exchange rate regime

3.1 The basic model

Markets’ assessments of the underlying exchange rate and monetary policy crucially affect the viability and the economic consequences of an exchange rate regime. The second generation currency crises models for example show how self-fulfilling expectations of market participants can trigger currency crises (see e.g. Obstfeld (1994) and Jeanne (2000)). Adoptions of the Barro-Gordon (e.g. Melitz (1988), Andersen (1994) or Bensaid and Jeanne (2000)) model to exchange rate regimes analyze the role of credibility for the effects of monetary policy. If decisions on exchange rate policy are discretionary rather than rule based, low credibility and self-fulfilling expectations lead to a suboptimal policy output. Such a rule should be an explicitly stated and verifiable policy including the choice of the nominal anchor and target exchange rate.

We base our empirical analysis of exchange rate behavior and the role of market sentiments on a micro-structure model of the foreign exchange market which also takes into account the macroeconomic environment. In particular we are interested in the role of technical trading in currency markets. The impact of technical trading on asset volatility has been analyzed by Bertola and Caballero (1992) for exchange rates and has been generalized for other assets by Balduzzi, Foresi and Hait (1997). Our model generalizes the approach of Jeanne and Rose (2002) by introducing technical trading and non i.i.d. macroeconomic variables.

The macroeconomic aspects of the model are captured by a conventional two country monetary model of the exchange rate. In money market equilibrium, money supply \( m_t \) equals the interest elastic money demand in both countries. The exchange rate is given by

\[
e_t = m_t - m_t^* + \alpha (i_t - i_t^*) + q_t, \tag{1}
\]

where \( p \) denotes the price level, \( i \) the interest rate, and \( q \) the real exchange rate. Foreign is a large country that remains in the long run equilibrium, i.e. foreign macroeconomic variables are normalized to

\[
m_t^* = p_t^* = i_t^* = 0, \tag{2}
\]
so that the exchange rate equation (1) simplifies to

\[ e_t = m_t + \alpha t + q_t. \]  

(3)

The microeconomic aspects of the model build on an overlapping generations model with risk averse heterogeneous traders. The foreign country is large relative to the home country so that the market processes are driven by the foreign traders’ investment decisions. The foreign traders face a portfolio optimization problem between a safe asset in their domestic country and an asset in the small home country which has a risky return due to the unknown exchange rate change. Adjustments of the interest rate clear the market.

The optimal wealth allocation depends on the expected excess return of domestic bonds relative to foreign bonds, so that the investments depend on the expected exchange rate, the interest differential, and the risk of such investments. We extend the theoretical approach of Jeanne and Rose (2002) along two lines. First, we introduce an explicit monetary and exchange rate policy by the central bank. Secondly, we specify technical trading as a source of noise in exchange markets.

Technical traders react to trend signals and create excess volatility through their actions. Strong signals, e.g. steep or rampant trends, induce technical traders to enter the market thereby increasing the exchange rate volatility. This yields a smile of the observed exchange rate volatility. Volatility increases if trends are strong and declines if trends fade, i.e. volatility smiles if plotted against the trend.

3.2 Technical trading: trends and volatility

A central feature of our model is the technical traders’ assessment of the excess return

\[ \rho_{t+1} = i_t - i^*_t + e_t - e_{t+1} \]  

(4)

of a foreign investment. Traders in the foreign exchange market face a portfolio allocation problem. They have to optimize the portfolio weights of the foreign asset position under uncertainty about the excess return of that asset. Based on public and individual information each trader chooses his optimal action, i.e. whether to enter the foreign exchange market at some cost and to determine the optimal size of the foreign position. The interest rates adjusts to ensure money market equilibrium.\(^4\)

Heterogeneity in the foreign exchange market is represented by two types of traders: fundamentalists and technical traders. In contrast to the fundamentalists, technical traders extract information \( f_t \) about the excess return from observed exchange rate trends. The instantaneous update of a fundamental evaluation is rather costly compared to updating a technical analysis. Thus, chartists use technical analysis to process the new information at time \( t \).\(^5\)

\[ \mathbb{E}_t^{\text{fund}}(\rho_{t+1}) = \mathbb{E}_t(\rho_{t+1}) \]  

(5)

\[ \mathbb{E}_t^{\text{chartist}}(\rho_{t+1}) = \mathbb{E}_{t-1}(\rho_{t+1}) + (1 - \mu) f_t + \nu_t. \]  

(6)

\(^4\) For a detailed analysis see Bauer and Herz (2005b).

\(^5\) See De Grauwe and Grimaldi (2002).
The technical traders’ expectation of the excess return consists of the lagged expectation of the excess return $\rho_{t+1}$ which includes the interest differential between foreign and home $i_t - i^*_t$, the trend expectation $(1 - \mu) f_t$, and noise $\nu_t$. The term $(1 - \mu)$ depicts the credibility of monetary policy as seen by the technical traders. If the monetary policy is credible, i.e. $\mu \approx 1$, the impact of trends on technical traders is negligible. The central bank is expected to break exchange rate trends. Only very large trends, $| (1 - \mu) f_t | \gg 0$, can significantly influence the traders’ decisions. If credibility is low, i.e. $\mu \approx 0$, even relatively small trends are expected to continue and to yield excess returns.

The model solution for the conditional volatility $v_e$ of the exchange rate is characterized by

$$2a g - \ln(1 + c) = \frac{\left( \frac{a B}{N_i} v_e + (1 - \mu)f \right)^2}{(1 + c)v_e \left( 1 + \frac{1 + \beta}{\beta \sqrt{c}} \sqrt{1 - \frac{v_{fund}}{v_e}} \right)^2}$$

(7)

for $v_e \in (v_{e,\min}, v_{e,\max})$. The equilibrium curve is also influenced by the fundamental variance $v_{fund}$, the number of fundamentalists $N_i$, the size of the noise $c$, the interest semi-elasticity of money demand $\beta$, the market size $\bar{B}$, the market entry costs $g$, and the risk aversion of the traders $a$.

The stylized volatility smile in figure 2 shows the equilibrium solution. The smile is characterized by two levels of volatility. The low volatility equilibrium represents the fundamental or base volatility of the exchange rate. It is located around the center where trends are small. No chartists are in the market and excess volatility is zero. This volatility is caused by macroeconomic variables. In contrast, the high volatility equilibrium occurs at large trends when all technical traders are active. The difference in volatility between these two levels is the maximum excess volatility induced by technical trading. Since technical traders are most active when large trends occur the maximum level of volatility is reached at large trends.

This brings us to the question, in which way technical traders extract trend information from the data. Models of technical traders often use weighted averages of past returns $r_t$ (e.g. De Grauwe and Grimaldi (2002))

$$f_t = \sum_{i=1}^{n} w_i r_{t-i}.$$  

(8)

Positive weights $w$ correspond to trend followers, negative weights to adverse trading strategies. Exponential trends are given by $w_i = w^i$, $0 < w < 1$. We use a simple moving average trend rule with $w_i = \frac{1}{n}$ and a window size of $n = 5$ trading days.

Implied volatility smiles are well known from empirical analysis of derivatives using various versions of the Black-Scholes pricing formula. Some explanations link these volatility smiles to technical trading due to portfolio insurance and hedging (e.g. Frey and Stremme (1997) and Sircar and Papanicolaou (1998)). Note that the smile of the implied volatility in this literature differs from the smile

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6 A full derivation of the equilibrium equation is left to the appendix available from the authors.
of the measured volatility discussed in this paper. The implied volatility is the solution of the pricing formula of a derivative, where the derivation depends on certain assumptions on the underlying process of asset returns and market structure. In contrast, the measured volatility in our model is the empirical volatility of the asset itself.

### 3.3 Monetary policy: fundamental and excess volatility

In our context, monetary policy influences the volatility of the exchange rate via two channels, fundamental exchange rate volatility and credibility. In the case of a managed exchange rate the conditional volatility of the exchange rate is low, while it is high in the case of a floating exchange rate. If monetary policy is focused on stabilizing the exchange rate, its goal is to reduce the expected difference between the exchange rate and the target rate $\pi_t$.

$$m_t = -\mu_{NB} \mathbb{E}_{t-1} (\epsilon_t - \bar{m}_t) + \varepsilon_t.$$ (9)

Within this exchange rate policy the central bank reduces the fundamental or base volatility of the exchange rate, which is created by various macroeconomic variables. Monetary policy can also reduce the excess volatility. If the exchange rate management is credible ($\mu \approx 1$), excess volatility is reduced to a large degree, since technical traders have no incentive to enter the market. If the exchange rate is floating ($\mu_{NB} = 0$), the assumption of a trend breaking exchange rate policy would be unreasonable. Thus free floating exchange rates have ceteris paribus not only higher fundamental volatility, but also higher excess volatility.

The amount of excess volatility depends on the activity of the technical traders and thus on the relative weight of fundamentalists and chartists in the market as well as the size of the noise. If there are only few technical traders, the maximum excess volatility created by their activity is lower than in a market with a high share of technical traders. We assume that small currency markets like the Euro-Romanian Leu market are more likely to be influenced by technical trading than foreign exchange markets for the three major currencies US Dollar, Euro and Japanese Yen. Transactions between the large currencies are to a higher degree portfolio based or pure vehicle transactions for the exchange of less liquid currencies. Furthermore, the number of traders and trades in large market is much higher than in small markets. Thus the individual weight of each trader is higher in small markets and information is more clumpy. The structure of private information in large foreign exchange markets should be closer to white noise than in small currencies markets.

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7 The target value $\bar{m}$ may be varying over time e.g. in the case of a crawling peg.
8 The macroeconomic framework with interest parity and money demand equation yields a simple equation for the equilibrium exchange rate

$$\epsilon_t = m_t + \alpha (i_t - i_t^*) + q_t.$$ To stabilize the expected deviation of the exchange rate from a target the money supply is adjusted according to (9). In order to prevent circular calculation the expected deviation is calculated without the money supply itself.

9 De Grauwe and Decupere (1992) find only very weak evidence for psychological barriers in Dollar/Yen and Dollar/Deutschmark exchange rates.
Figure 3 plots the equilibrium volatility for various exchange rate regimes: the volatility smiles. Size and location of the smiles vary with the market structure and the exchange rate regime. The model can be solved for the conditional volatility of the exchange rate without specifying the type of trend used by the chartists. Figure 3 displays the impact of the type of the monetary regime and the credibility on the volatility smile derived in the theoretical model in equation (7).

Each of the smiles in figure 3 can be characterized by its fundamental and excess volatility. Monetary policy can influence both base and excess volatility. The base volatility depends directly on the behavior of macroeconomic variables like money. By managing the exchange rate the central bank (partially) offsets the fluctuations of fundamental variables and thus lowers the base volatility. The influence of the monetary policy on the excess volatility depends on its credibility. The chartists’ activity and in turn the level of excess volatility is reduced only if the policy is credible, i.e. if the chartists believe in trend breaking interventions by the central bank.

Summarizing, we can combine our results to identify four sectors in the fundamental volatility-excess volatility plane:

1. credibly managed exchange rate regimes with low base and low excess volatility,
2. non-credibly managed exchange rate regimes with low base and high excess volatility,
3. floats of large currencies with high base and low excess volatility,
4. floats of small currencies with high base and high excess volatility.

Tight pegs with virtually no exchange rate volatility and currency crises with extremely high volatility are the border cases.

4 Empirical characteristics of the exchange rates

The theoretical model yields two main implications: (1) observed volatility smiles and (2) the size as well as the location of the smile, i.e. the base and the excess volatility, characterize the type of exchange rate policy and its credibility. In this empirical section we analyze the behavior of exchange rates pertaining to the model’s implications. After discussing descriptive statistics of the exchange rates we analyze the smile of the measured volatility over the entire sample period. Afterwards we look into the development of the exchange rate regimes and their credibility over time.

Our data cover daily Euro and US Dollar exchange rates of seven Mediterranean countries, Algeria, Egypt, Israel, Libya, Morocco, Turkey and Tunisia, with the benchmark of four European non
EU countries namely Albania, Bulgaria, Croatia, and Romania. The data are from 23/10/1995 to 05/10/2004.10

Looking at the Euro and US Dollar exchange rates and their logarithmic returns

Figure 5 about here

Figure 6 about here

a number of characteristics are evident. Firstly, nearly all of the countries devaluated their exchange rates over the sample period. Some of the countries, Albania, and Libya show periods of absolutely fixed rates. Egypt pegged its Pound to the dollar and readjusted the conversion rate periodically. Israel devalues continuously against the USD with two outbursts in 1998 and 2002. Morocco kept a moving band around the EUR/FFR which became smoother during the last years. Algeria and Tunisia kept their EUR exchange rates within relatively tight bands until 2002 and devalued rather rapidly thereafter.

The Albanian Lek significantly revalued after capital controls were relaxed in 1997. Bulgaria installed a currency board system in 1997 and fixed the exchange rate of the Lev (BGN) at a level which is equivalent to about 1.95 Euro. The Romanian central bank has maintained a policy of constant Leu (ROL) devaluation against the Euro of approximately 30% per annum for the last 5 years. Finally the Turkish Lira (TRL) has obviously undergone a regime shift after the 2001 crisis from low to high volatility, i.e. from a managed to a floating regime. Croatia maintains a wide band around the EUR. However, the short horizon volatility significantly increased in the last 3 years.

4.1 Volatility smiles

Figure 7 shows kernel regressions of the volatility smile for all USD and Euro exchange rates over the entire sample period.11 The figures reveal the volatility smile for all non-strictly pegged currencies. Each of the exchange rates can be classified according to the equilibrium patterns shown in figure 3.

Figure 7 about here

Euro and US Dollar exchange rates are characterized by a pronounced U shape in the analysis of the entire sample period. The typical characteristics of the exchange rate management are clearly visible. Evidently the float of the Turkish Lira and the credible peg of Bulgaria are most easily to identify in figures 7 and 8.

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10 The data on the Tunisian Dinar starts in August 1996.
11 The model implies that technical traders react to the occurrence and strength of trends. Thus volatility increases after the appearance of trends. Plots therefore show the measured trend of period \( t \) and conditional volatility of period \( t + 1 \). This separation of the windows from which trend and volatility are estimated also ensures that typical time series processes like random walk, GARCH or FIGARCH processes do not show the smile. See Bauer and Herz (2004) for details.
12 The data on the Bulgarian Lev starts at 1998 to concentrate on the actual regime.
The crisis situation in Turkey and the float thereafter account for the high excess volatility and large trends. This currency is by far the most volatile regime which includes crisis situations and floating periods. The high base and excess volatility as well as the size of the occurring trends demonstrate that the actual exchange rate regime of Turkey is a free float and subject to high degree of technical trading, i.e. market participants do not expect any sort of exchange rate management. Note that the rectangle in figure 7 marks the plotting area of figures 8 and 9, i.e. these figures are zoomed out of figure 7 to make the individual differences of the exchange rates more visible.

The tight exchange rate management of the Bulgarian national bank is responsible for the smaller short term trends and reduced exchange rate volatility. The Bulgarian Lev shows nearly no trend nor conditional volatility vis-à-vis the Euro.

Between these two extremes a continuum of regimes can be identified. We present two classifications of these regimes. One group consists of credibly managed regimes (see figure 8). The other consists of not credibly managed regimes (see figure 8). In both groups the EUR/USD rate is added as a benchmark.

In figure 8 all regimes show only small trends and relatively low conditional volatility. Trend and volatility are smallest for the Bulgarian Lev, representing the credible peg. The values are a bit larger for Albania, Morocco, and Tunisia. The latter shows higher conditional volatility if trends become larger, which might indicate credibility problems. However, the EUR/USD as the reference dominates the estimates of trends and volatility in this group.

In figure 9 all regimes show relatively large trends and relatively high conditional volatility. The EUR/USD as the reference lies well below the estimates of trend and volatility in this group. These values, however, remain lower than the estimates for Turkey. The estimates of Algeria, Croatia, Egypt, Israel and Romania show significant trends and conditional volatility. Each of these exchange rates shows a very pronounced U shape. Volatility is higher than in the first group indicating less effective exchange rate management. Israel shows low volatility at the base, which indicates a credible management. However, for rising trends conditional volatility rises steeply, i.e. in potential crisis situations credibility deteriorates quickly.

Bauer and Herz (2004) show that the U shape of the conditional volatility is also evident in OECD exchange rates and is not replicated by simple benchmark models like a random walk. They further show that even sophisticated heteroskedastic time series models, namely GARCH\((p, q)\) or FIGARCH\((1, d, 1)\), do not show an U shaped dependency between trend and volatility as is characteristic for the data.\(^{13}\)

\(^{13}\) Bauer and Herz (2005b) investigate the impact of a credible explicit monetary policy within the microstructure exchange rate model and generate a classification for exchange rates due to their de facto behavior. In contrast to other popular de
The model predicts and the empirical estimates from figure 7 suggest that the volatility of an exchange rate is related to its trend. The actual trend is indeed a very important predictor for the conditional volatility of the exchange rate and influences the volatility process significantly. Bauer and Herz (2005b) and Bauer and Herz (2005a) show that the explanatory power of FIGARCH models for exchange rate time series can be significantly improved by adding a trend component to the variance equation. FIGARCH models are typically used to explain complex patterns like volatility clusters and the long memory property in the volatility structure of empirical time series, that cannot be reproduced by simpler models. Due to structural breaks in the time series of our sample the validity of such a testing procedure on the entire sample period might be questionable. Thus we leave the results of the estimations as an illustration in table 2 in the appendix.

4.2 Exchange rate regimes and credibility

In a next step we want to gain better insight in the nature of the exchange rate regimes and their credibility. Using an OLS-regression we fit the even fourth order polynomial

\[ v_{t+1} = \gamma_0 + \gamma_2 f_t^2 + \gamma_4 f_t^4 \]  

(10)

to the trend-volatility estimates and extract the estimates of fundamental and excess volatility as proposed in figure 2.

The visualization of the regression results in the following figures allows a more direct interpretation than the kernel regressions illustrated in figure 7. The fundamental and the excess volatility are estimated from each volatility smile and each country estimate is displayed in the fundamental/excess volatility plane. To analyze the development of the regimes and their credibility we carry out these estimations for each year separately. As shown above fundamental and excess volatility can be interpreted as measures for the type and the credibility of an exchange rate regime.

Figure 10 visualizes the fundamental and the excess volatility of the three mostly credibly managed non European exchange rates, namely the Moroccan Dirham, the Israeli New Shekel and Tunisian Dinar on a yearly basis. The graphs on the right show the estimates for the entire sample period on an individual scale which covers all estimates of the respective country. The graphs on the left show the same estimates on a scale which is identical for all 12 countries in the entire sample. The left columns in figures 10 to 13 allow to compare the different countries whereas each row allows the analysis of a single country over whole sample period. The respective graphs for the EUR/USD rate are shown in figure 13 and may serve as benchmarks.

facto classification schemes like Levy-Yeyati and Sturzenegger (2003), Reinhard and Rogoff (2004) or Reinhard and Calvo (2002) this algorithm does not rely on additional macroeconomic data like reserves, which are typically available only on a monthly base. Instead the classification is based only on the exchange rate itself which is available on a daily and even intraday base i.e. the exchange rate’s behavior that reflects the market’s assessment of the underlying exchange rate regime.
The excess volatility is a measure of the credibility of the monetary policy. During a crisis both fundamental and excess volatility increase as the credibility of the monetary policy decreases. The subsample in figure 10 shows very low fundamental volatility on x-axes. The excess volatility is very moderate for most of the sample period, i.e. these exchange rates are credibly managed. The Moroccan Dirham remains very stable and credible throughout the sample period. Only during 2001 it encounters a very small increase in fundamental and excess volatility. The exchange rate management of the Israeli New Shekel and the Tunisian Dinar remains credible most of the time. Both show low fundamental volatility, but the credibility problems of the Shekel in 1998 and of the Dinar 2001 and 2002 are clearly recognizable.

Figure 12 visualizes the fundamental and the excess volatility of those non European exchange rates in the sample which were the not credibly or not at all managed, namely the Algerian Dinar, the Egyptian Pound, and the Turkish Lira. Algeria had maintained some exchange rate stability and credibility until 1999 and experienced an increase in fundamental volatility in 2000. The 2001 crisis disrupted the exchange rate policy and led to a uncontrolled devaluation. Stabilization efforts took hold in 2002. However, neither fundamental volatility nor credibility reached the previous levels. Egypt pegs its Pound rather unsuccessfully to the USD. Until 1999 the Peg was tight and credible. But beginning with the year 2000 a series of realignments increased fundamental volatility and finally led to a loss of credibility in 2004. The Turkish crises of 2001 marks a profound shift in the exchange rate regime. The previous credibly managed Lira began to float with high fundamental and excess volatility, i.e. low credibility.

Figure 11 displays the managed exchange rates of Albania, Bulgaria, and Romania. Except for the crisis in 1997 the management of the Albanian Lek is clearly credible with low excess volatility. Also the fundamental volatility seems to be declining. The Bulgarian Lev with its currency board system is assigned a very high level of short term stability and credibility. The crawling peg of the Romanian Leu remains quite stable and credible after the 1999 disturbances.

Figure 13 shows the graphs for the EUR/USD and the Croatian Kuna. The EUR/USD serves as a benchmark. The Kuna passed through a period of high short term volatility in 2001 and 2002. While it has regained considerable credibility in 2003 and 2004, the fundamental volatility has not fully returned to its previous level.
5 Summary

We find that in the case of the non EU Mediterranean countries – with the exception of Turkey – the markets assess the exchange rate management as relatively credible. Within this sample two groups of exchange rate regimes can be distinguished.

The first group consists of the credibly managed exchange rate regimes. Morocco, Israel and Tunisia belong to this group as well as Albania, Bulgaria, and Romania. The paths to gain this credibility, however, were quite different. While Morocco retained a credible exchange rate management throughout the sample period, the Israeli credibility was diminished in 1998 and the Tunisian in 2001 and 2002. The peg at the Bulgarian currency board is highly stable and credible. The crawling band of the Romanian Leu is relatively credible after the 1997 and 1999 crisis. The exchange rate regime of Albania is assigned high credibility, too, while fundamental volatility has been decreasing during the last years.

Algerian Dinar, the Egyptian Pound, the Turkish Lira and the Croatian Kuna form the second group. These exchange rate regimes are either not managed – Turkey – or not efficiently managed. Markets assess low credibility to the management of the Kuna since 2001. Although some of the credibility has been regained, the fundamental volatility remains high. Egypt pegs its pound to the USD, but had to realign the conversion rate frequently since 2000. These realignments increased both fundamental and excess volatility and diminish the credibility of the management. Algeria still recovers from the crisis in 2001 and has not jet reached its previous level of stability and credibility.

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References


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<th>Country</th>
<th>Last de facto exchange rate regime</th>
<th>since</th>
<th>reference currency</th>
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<td>1998</td>
<td>USD</td>
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<td>de facto crawling band</td>
<td>1995</td>
<td>EUR/FFR</td>
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<td>peg (currency board)</td>
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<td>1994</td>
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<td>Egypt, Arab Rep.</td>
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<td>USD</td>
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<td>1991</td>
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<td>dual market</td>
<td>1999</td>
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<td>moving band</td>
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<td>EUR</td>
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<td>freely falling/freely floating</td>
<td>2001</td>
<td>EUR</td>
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<td>Tunisia</td>
<td>de facto crawling band</td>
<td>1974</td>
<td>EUR/FFR</td>
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Table 1: Classification of de facto exchange rate regimes and reference currencies according to Reinhard and Rogoff (2004)

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<tr>
<th>Country</th>
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Table 2: Estimation of trend coefficients in the volatility process of figarch(1,1) models
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