Assessing central bank credibility during the ERM crises: Comparing option and spot market-based forecasts[☆]

Markus Haas [a,*], Stefan Mittnik [b], Bruce Mizrach [c]

[a] Institute of Statistics, University of Munich, Germany
[b] University of Munich, Ifo Institute for Economic Research, Center for Financial Studies, Frankfurt
[c] Department of Economics, Rutgers University, USA

Abstract

Financial markets embed expectations of central bank policy into asset prices. This paper compares two approaches that extract a probability density of market beliefs. The first is a simulated moments estimator for option volatilities described in [Mizrach, B., 2002. When Did the Smart Money in Enron Lose Its' Smirk? Rutgers University Working Paper #2002-24]; the second is a new approach developed by [Haas, M., Mittnik, S., Paolella, M.S., 2004a. Mixed normal conditional heteroskedasticity, J. Financial Econ. 2, 211–250] for fat-tailed conditionally heteroskedastic time series. In an application to the 1992–1993 European Exchange Rate Mechanism crises, we find that both the options and the underlying exchange rates provide useful information for policy makers.
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1. Introduction

A basic insight of financial economics is that asset prices should reflect views about the future. For this reason, many economists rely on market prices to make predictions. Even when these views are incorrect, policy makers may want to avoid changes that the market is not expecting.

In recent years, some novel techniques have been introduced to extract market expectations. This paper explores two of them: extracting implied probability densities from option prices and volatility modeling of the underlying. Both methods have the advantage of producing predictive densities rather than just point forecasts. These tools can, in principal, allow central bankers to examine the full range of risks facing their economies.

There are numerous approaches that generalize the Black–Scholes model. Merton (1976) and Bates (1991) allow sudden changes in the level of asset prices. Wiggins (1987), Hull and White (1987), Stein and Stein (1991) and Heston (1993) allow volatility to change over time. A related literature, with papers by Dumas et al. (1998) and Das and Sundaram (1999), has looked at deterministic variations in volatility with the level of the stock price or with time.

To extract market expectations of the exchange rate, we utilize a method first used in Mizrach (2002) that looks directly at the probability distribution. We parameterize the exchange rate process as a mixture of log normals, as in Ritchey (1990) and Melick and Thomas (1997), and fit the model to options prices. In an application to the Enron bankruptcy, Mizrach found that investors were far too optimistic about Enron until days before the stock's collapse.

Our second approach tries to extract information directly from the underlying currencies. We utilize a general mixture of two normal densities to extract information from the spot foreign exchange market. In this model, both the mixing weights as well as the parameters of the component densities, i.e., component means and variances, are time-varying and may depend on past exchange rates as well as further explanatory variables, such as interest rates. The dynamic mixture model we specify is a combination of the logistic autoregressive mixture with exogenous variables, or LMARX, model investigated in Wong and Li (2001) and the mixed normal GARCH process recently proposed by Haas et al. (2004a). The predictive densities generated from the resulting LMARX–GARCH model exhibit an enormous flexibility, and they may be multimodal, for example, in times where a realignment becomes more probable.

In this paper, we utilize the two approaches to explore market sentiment prior to the exchange rate crises of September 1992 and July–August 1993. In the first episode, the British Pound (BP) and Italian Lira withdrew from the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS). The Pound had traded in a narrow range against the German Deutsche Mark (DM) for almost two years and the Lira for more than five. The crisis threw the entire plan for European economic and financial integration into turmoil. The French Franc (FF) remained in the mechanism, but speculative pressures against it remained strong. In the second crisis we examine, the Franc, in August 1993, had to abandon its very close link with the DM (the "Franc fort") and widen it's fluctuation band.

Campa and Chang (1996) have looked at ERM credibility using arbitrage bounds on option prices. They find that option prices reflected the declining credibility of the Lira and Pound in 1992 and the Franc in 1993. Malz (1996) finds an increasing risk of BP devaluation starting in late August 1992. Christoffersen and Mazzotta (2004) find useful predictive information in 10 European countries' over-the-counter currency options.

We first examine the options markets' implied probability of depreciation in the FF and BP prior to the ERM crises. The model estimates reveal that the market anticipated both events. The devaluation risk with the Franc rises significantly 11 days in advance of the crisis. With the Pound,