Excess Volatility of British Pound: Jumps or Regime Switches?

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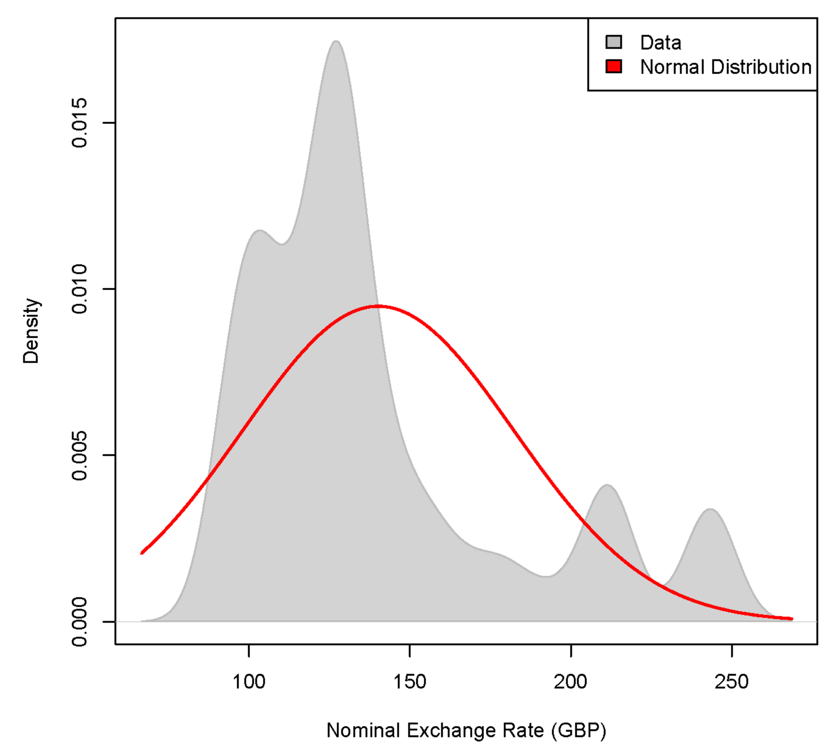
Introduction

- Explaining the excess volatility of the nominal exchange rate has been a challenge in international finance.
- This paper uses the continuous-time model with the jump-diffusion process and the regime-switching feature to decompose the driving force of the excess volatility of the nominal exchange rate.
- This study can shed light on the unknown structure of the excess volatility of the nominal exchange rate.



Variance	Skewness	Kurtosis
1770.49	1.21	3.44

Table 1. Summary Statistics.

Method

Model: $dX_t = \kappa(Z_t)\left[\theta(Z_t) - X_t\right]dt + \sigma(Z_t)\,dL_t$

- L_t: a Lévy process which follows a normal inverse Gaussian (NIG) distribution.
- $(Z_t)_{t\in[0,T]}$: a continuous time Markov chain with transition probability Π^Z_{ij}.
- $f_{NIG}(x;\alpha,\beta,\delta,\mu) = e^{\delta\gamma+\beta(x-\mu)}\frac{\alpha\delta K_1(\alpha\sqrt{\delta^2+(x-\mu)^2})}{\pi\sqrt{\delta^2+(x-\mu)^2}}$: the density function of the NIG distribution.

Two-step estimation:

- Step 1: estimate the regime-switching Gaussian model.
- Step 2: fit the NIG distribution to each regime separately.

Model comparison:

- Regime-switching Gaussian model: $dX_t = \kappa(Z_t)\left[\theta(Z_t) - X_t\right]dt + \sigma(Z_t)\,dW_t$
- Gaussian model: $dX_t = \kappa(\theta - X_t)dt + \sigma dW_t$

Model Estimation

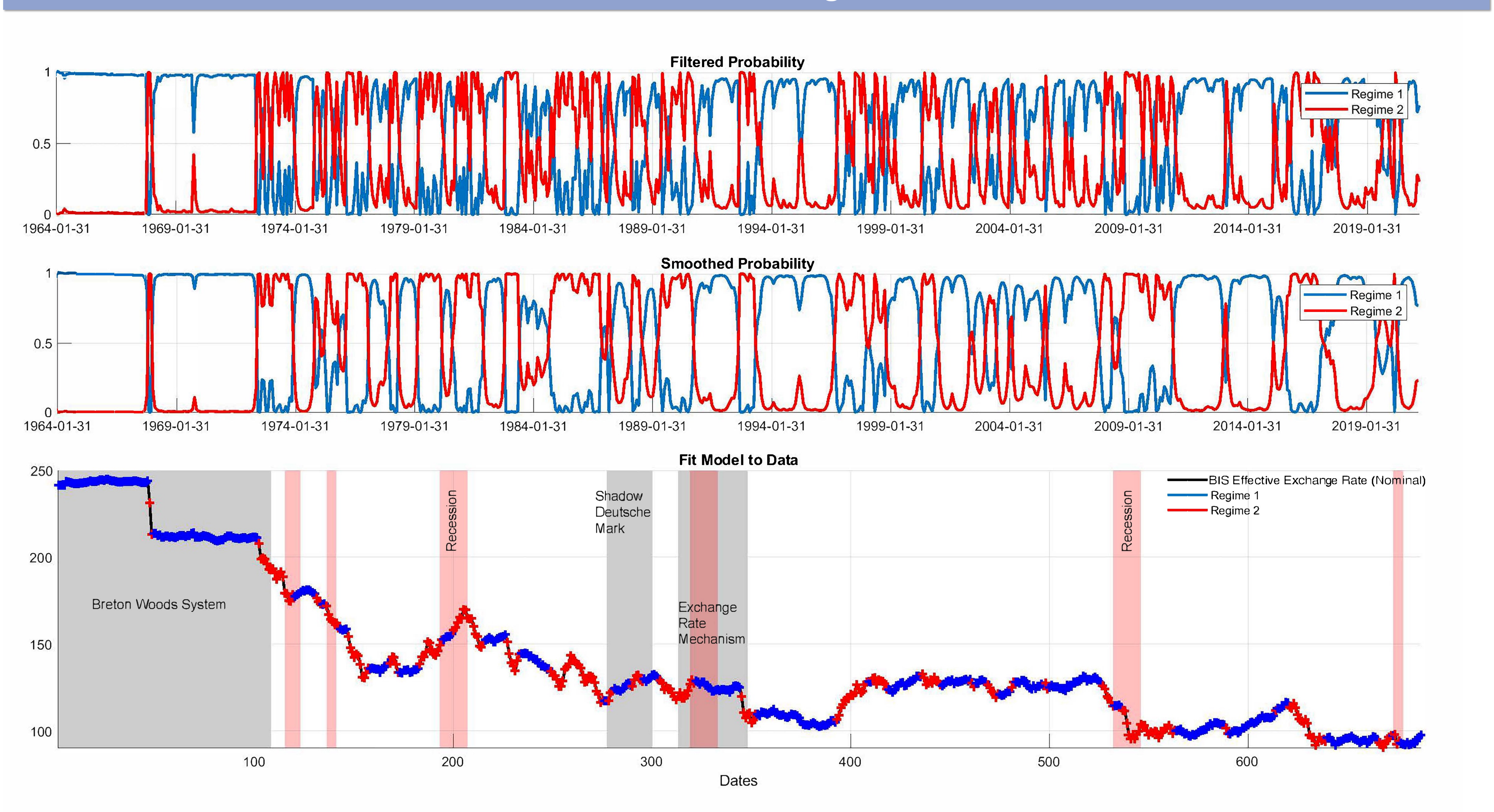
- α_i : the tail heaviness and the intensity of jumps in state i. Smaller α_i reflects higher intensity of jumps.
- σ_i : the volatility in state i.
- Π^Z_{ii} : the probability of staying in the same regime i.

Diffusion Process	κ_i	θ_i	σ_i	Π^Z_{ii}
Regime 1	0.001109	230.486546	**0.901875**	**0.91848**
Regime 2	0.032429	110.618922	8.704419	0.87552
NIG Distribution	α_i	β_i	δ_i	μ_i
Regime 1	**0.536864**	-0.371010	0.180108	0.172204
Regime 2	2.371331	-0.250890	1.021525	0.108689

Table 2. Estimated Parameters.

- Regime 1 has smaller volatility and is more persistent. However, it faces larger extreme variations when unpredictable jump events happen.
- Switching between regimes adds further change of the volatilities and the jumps.

Model Fitting



Contact

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Conclusion

- Jumps and regime switches play different roles in the exchange rate volatility.
- Understanding the dynamics opens future research to analyze the endogenous and the exogenous factors in the economic system that generate the excess volatility of the nominal exchange rate.