

Figure 1a. DM/USD Exchange Rate: June 4, 1973 – Dec 31, 1996

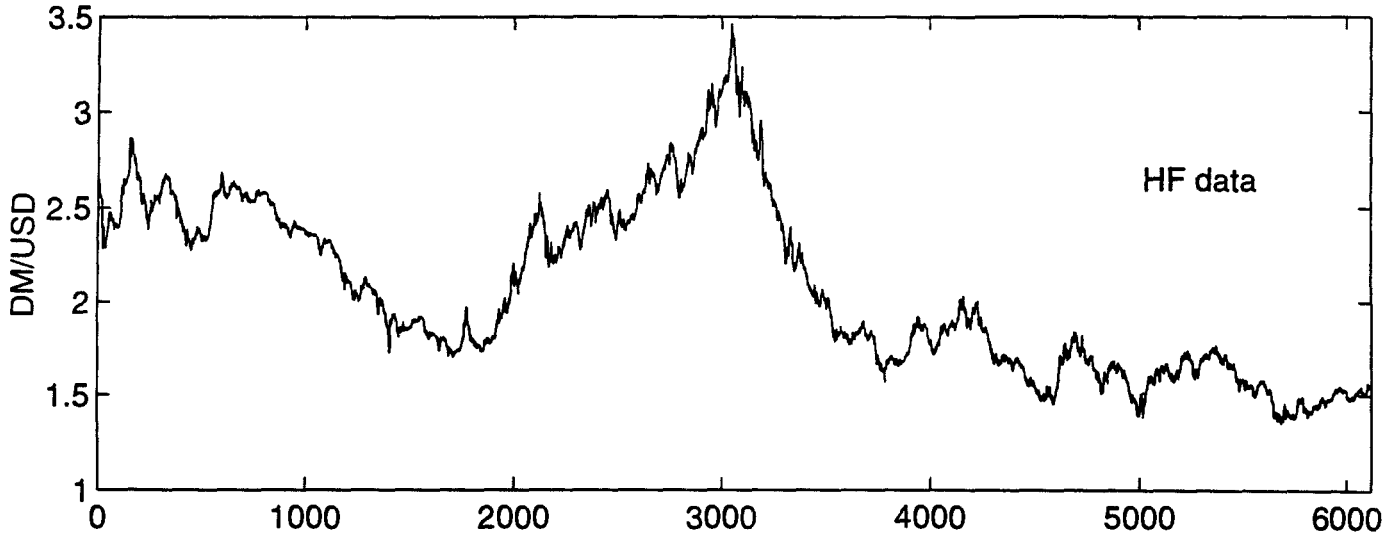


Figure 1b. DM/USD First Differences: June 4, 1973 – Dec 31, 1996

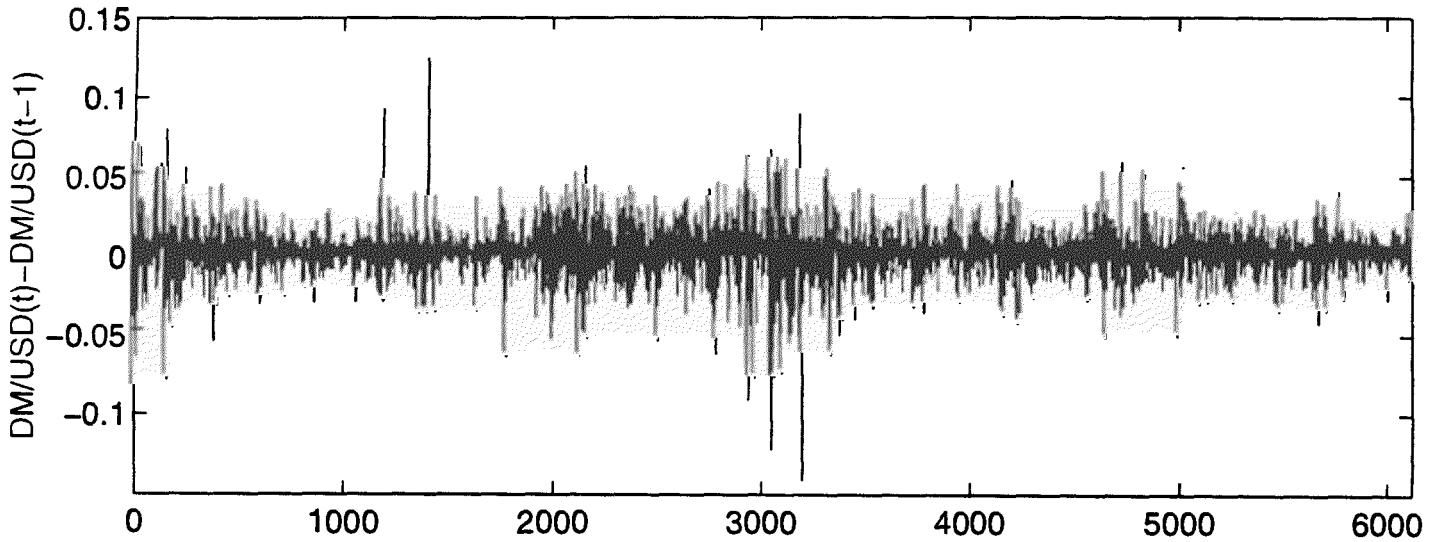


Figure 1c.  $\ln(DM/USD)$  First Differences: June 4, 1973 – Dec 31, 1996

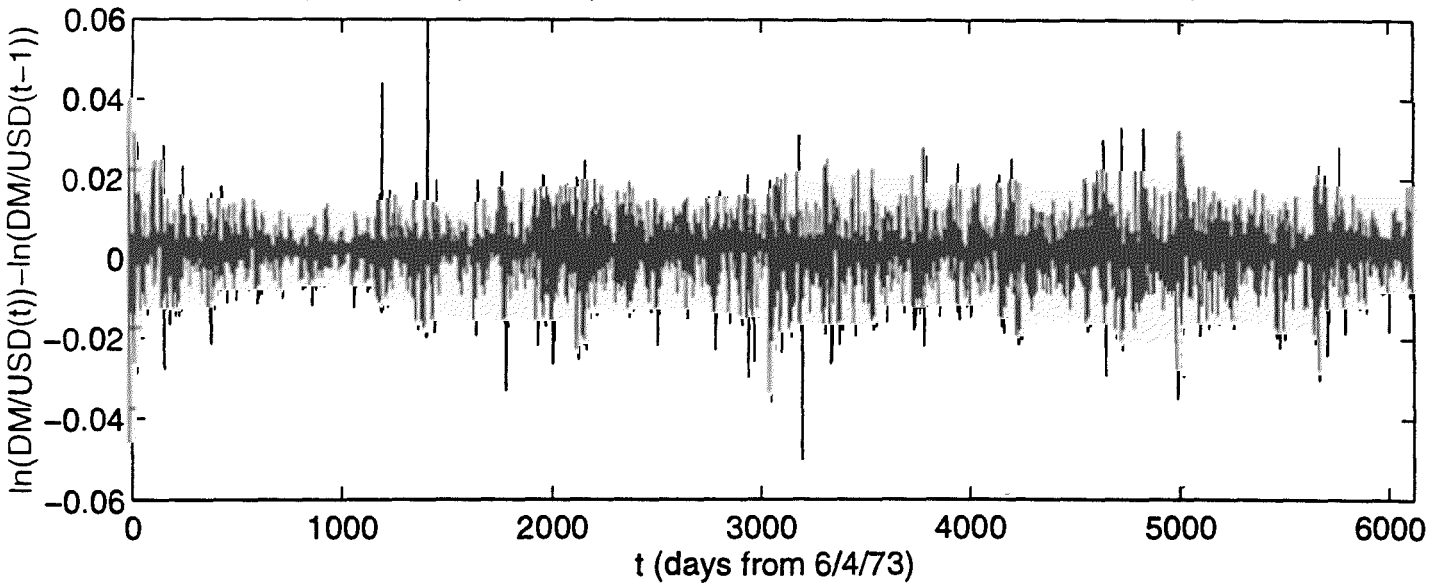


Figure 2. Brownian Motion Scaling,  $q=[1.5-2.5 \text{ by } .25, 3-5 \text{ by } 1]$

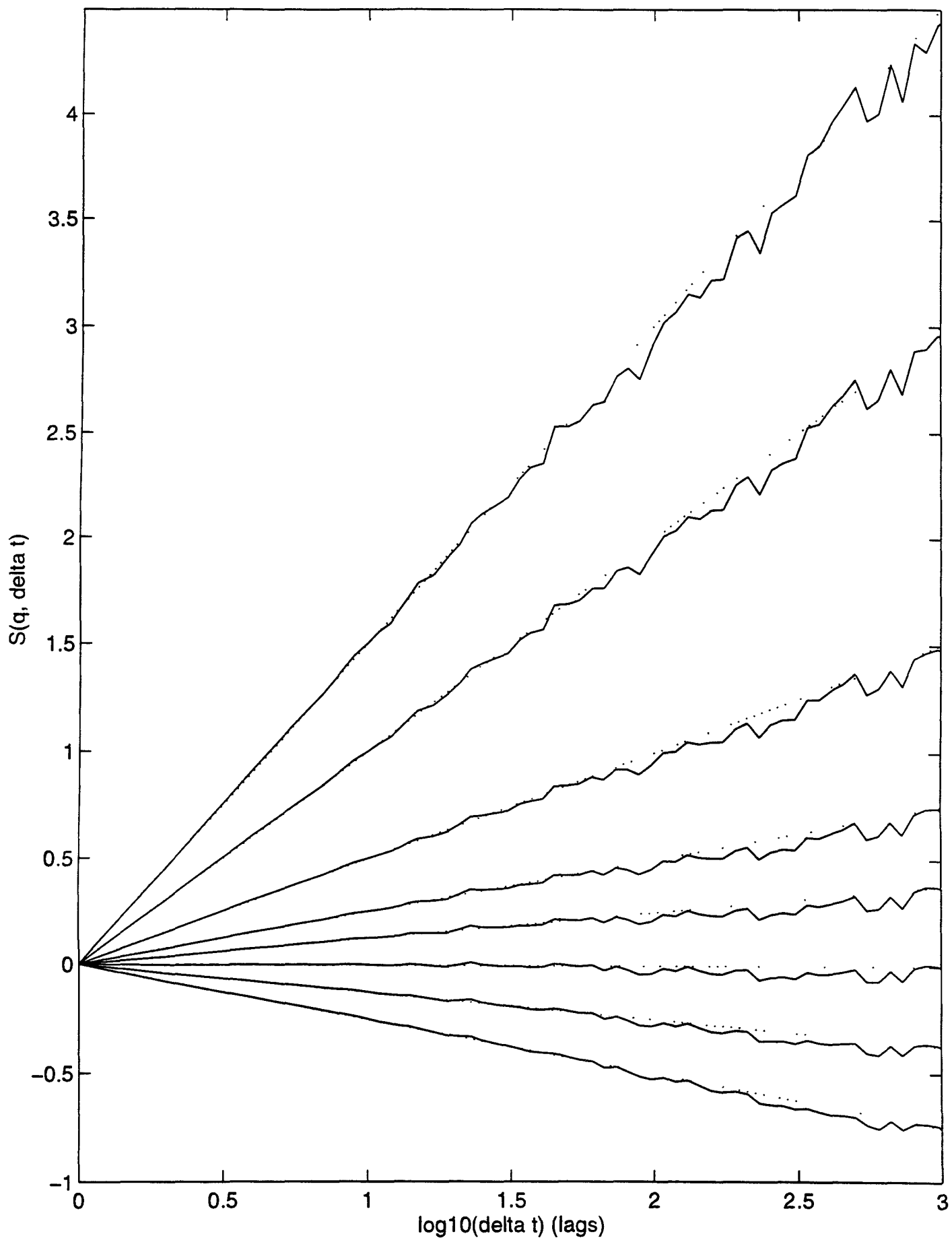


Figure 3. Fractional Gaussian Noise,  $H=.2$  ( $d=-.3$ )

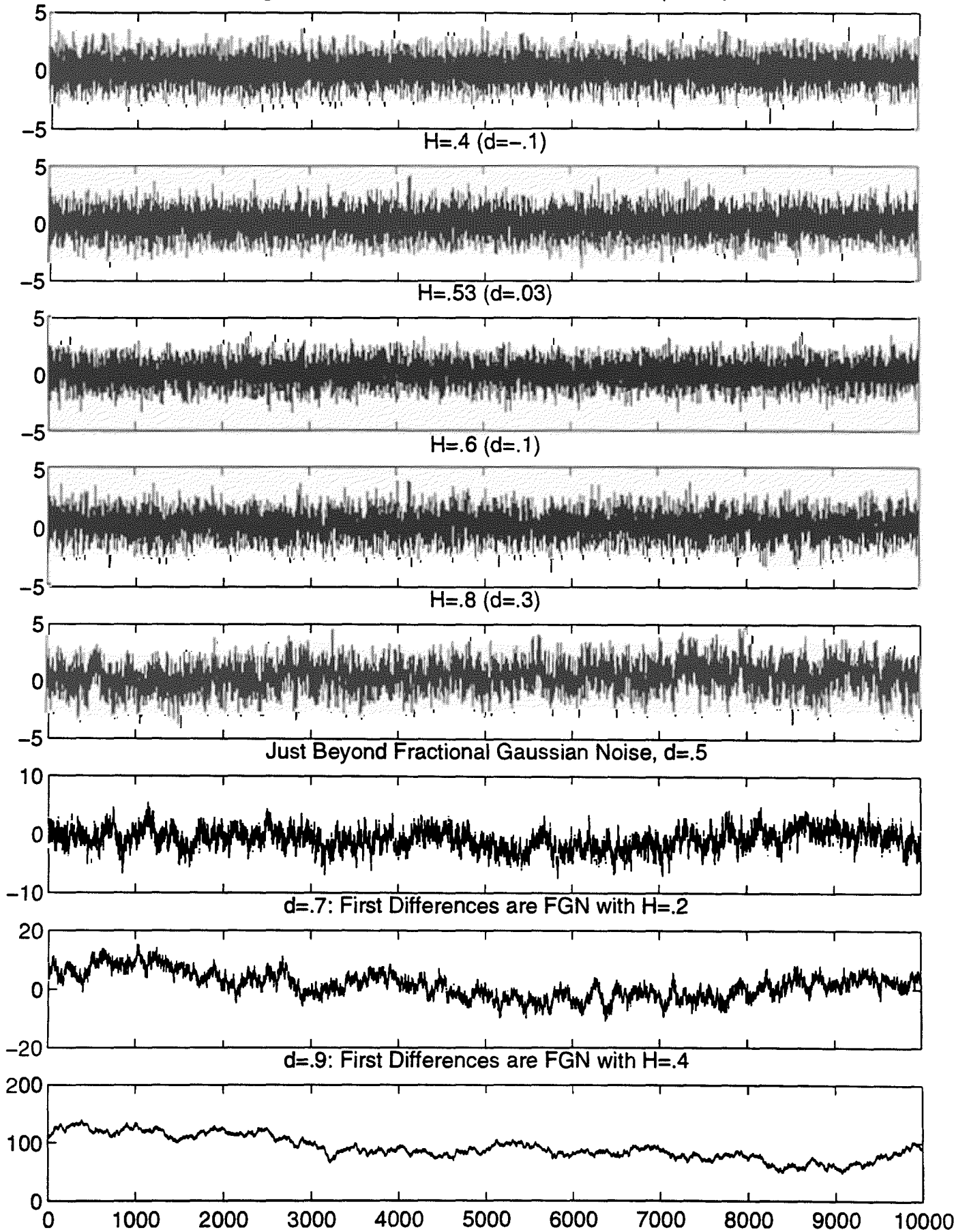


Figure 4. Partition Functions of Fractional Gaussian Noises

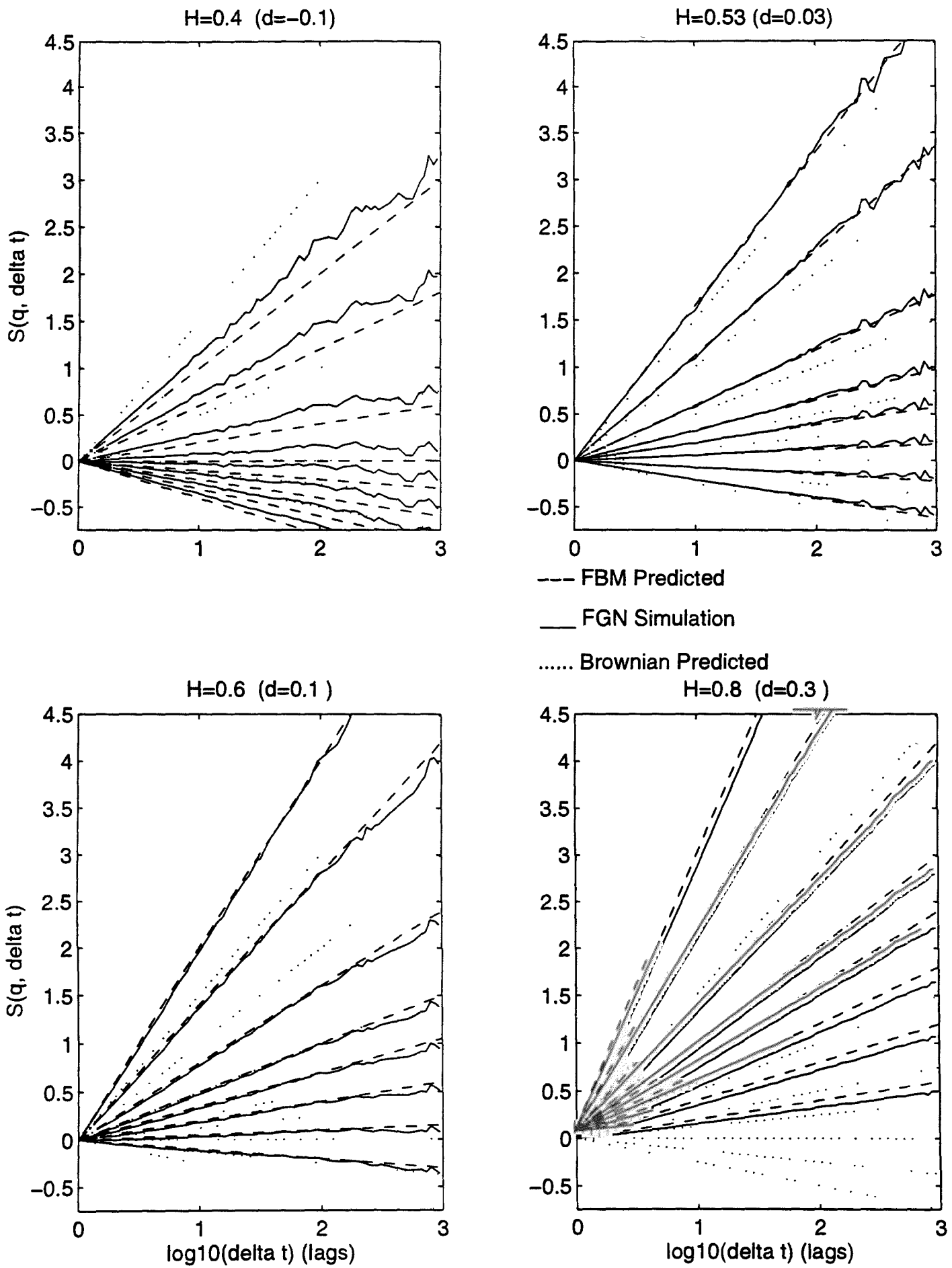


Figure 5a. DM/USD Weekly Seasonality in Quotes/Clock Time

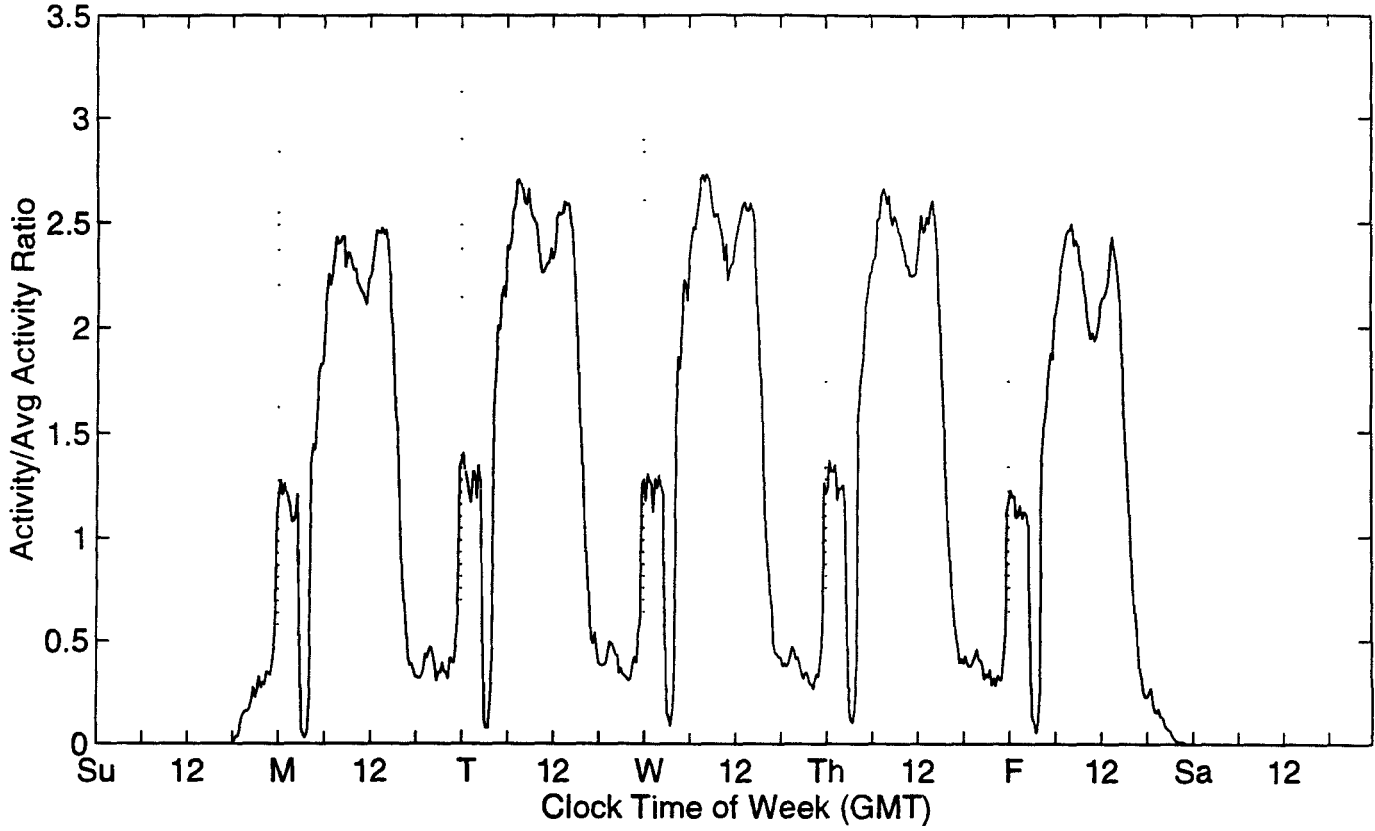


Figure 5b. DM/USD Weekly Seasonality in Absolute Returns

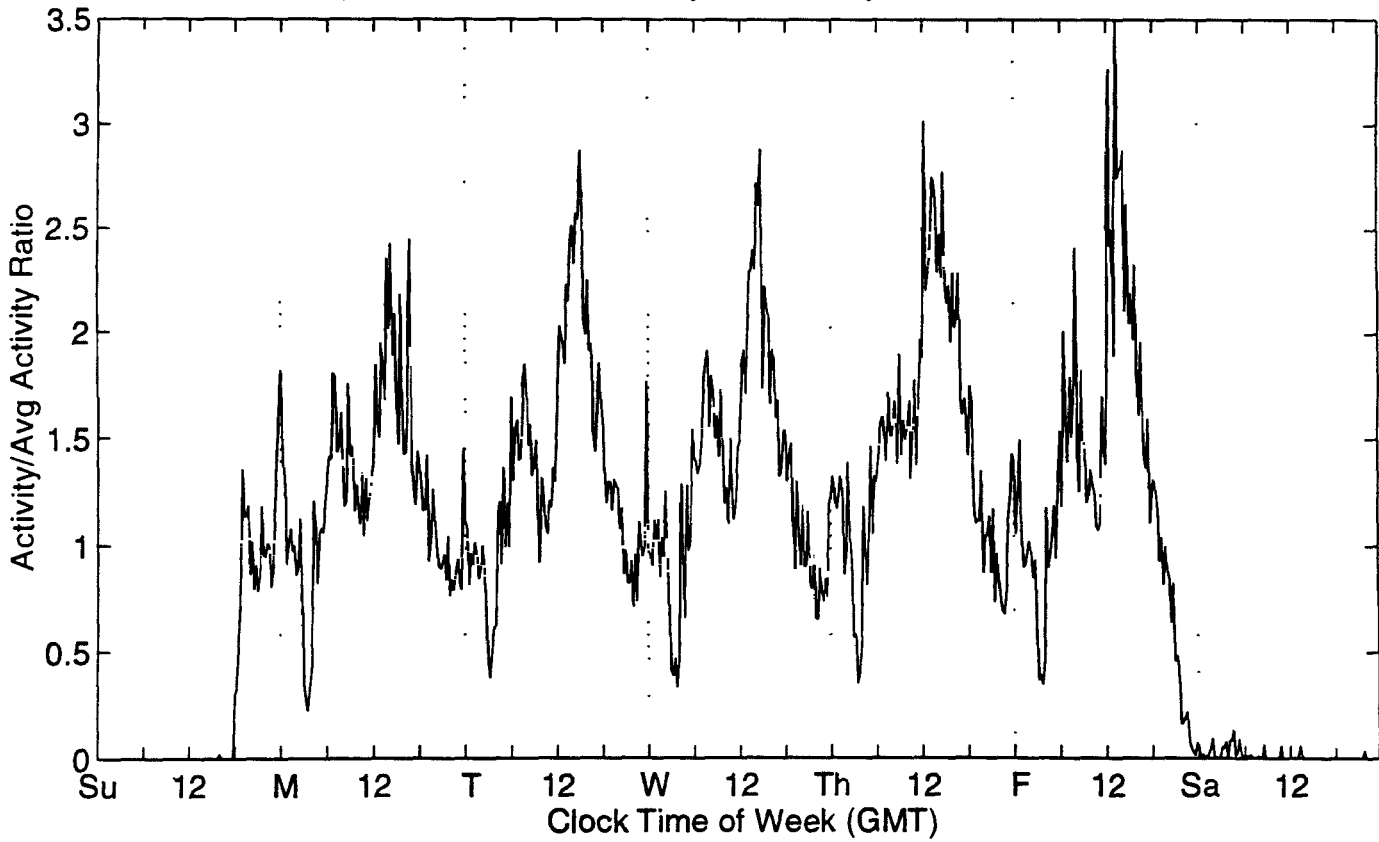


Figure 6. DM/USD Scaling, SEAS2 Prefilter,  $q=[1.75, 1.9, 2, 2.1, 2.25]$

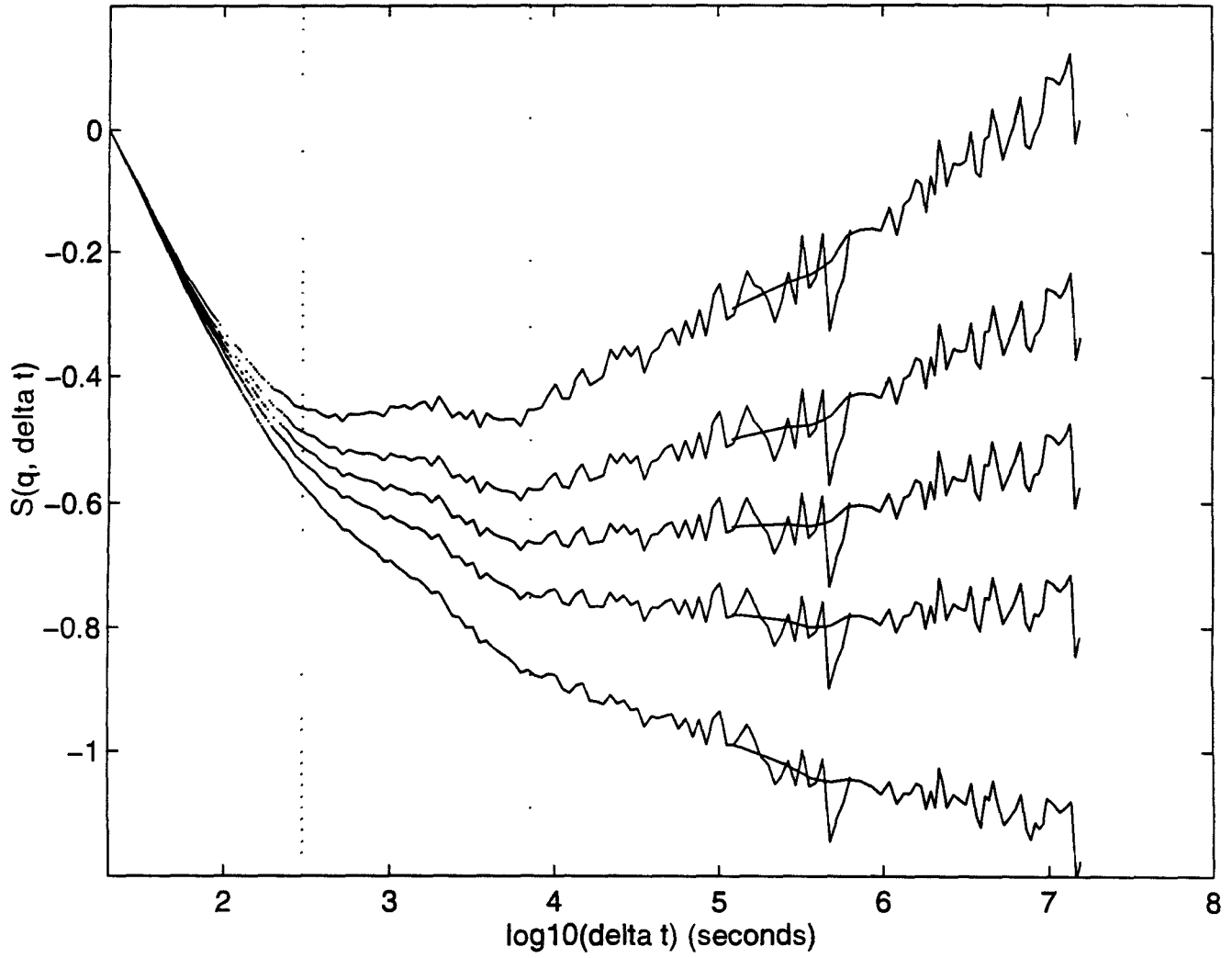


Figure 7. DM/USD Scaling, SEAS2 Prefilter,  $q=[1.5-2.5 \text{ by } .25, 3-5 \text{ by } 1]$

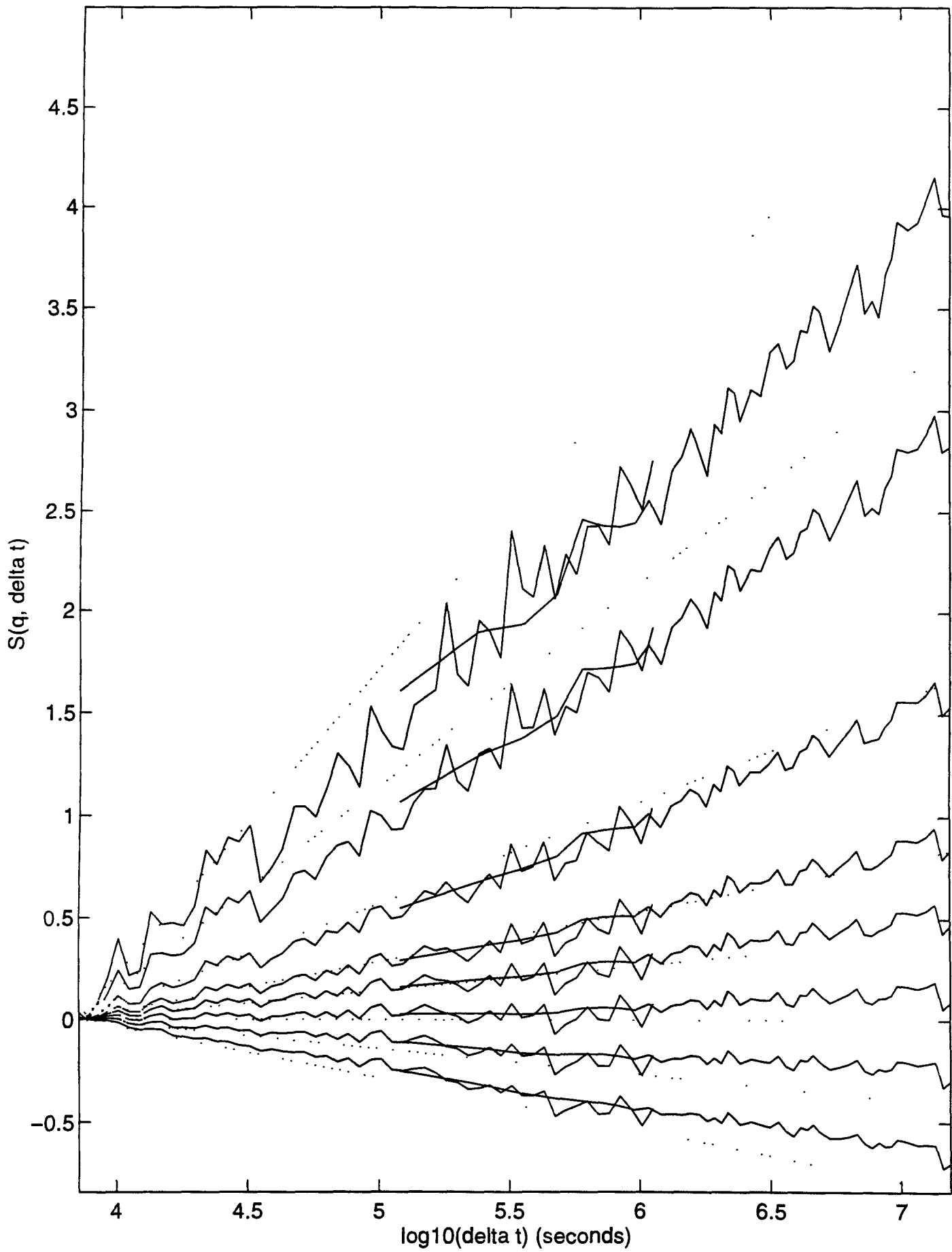


Figure 8. The Multifractal Diagram of a Process

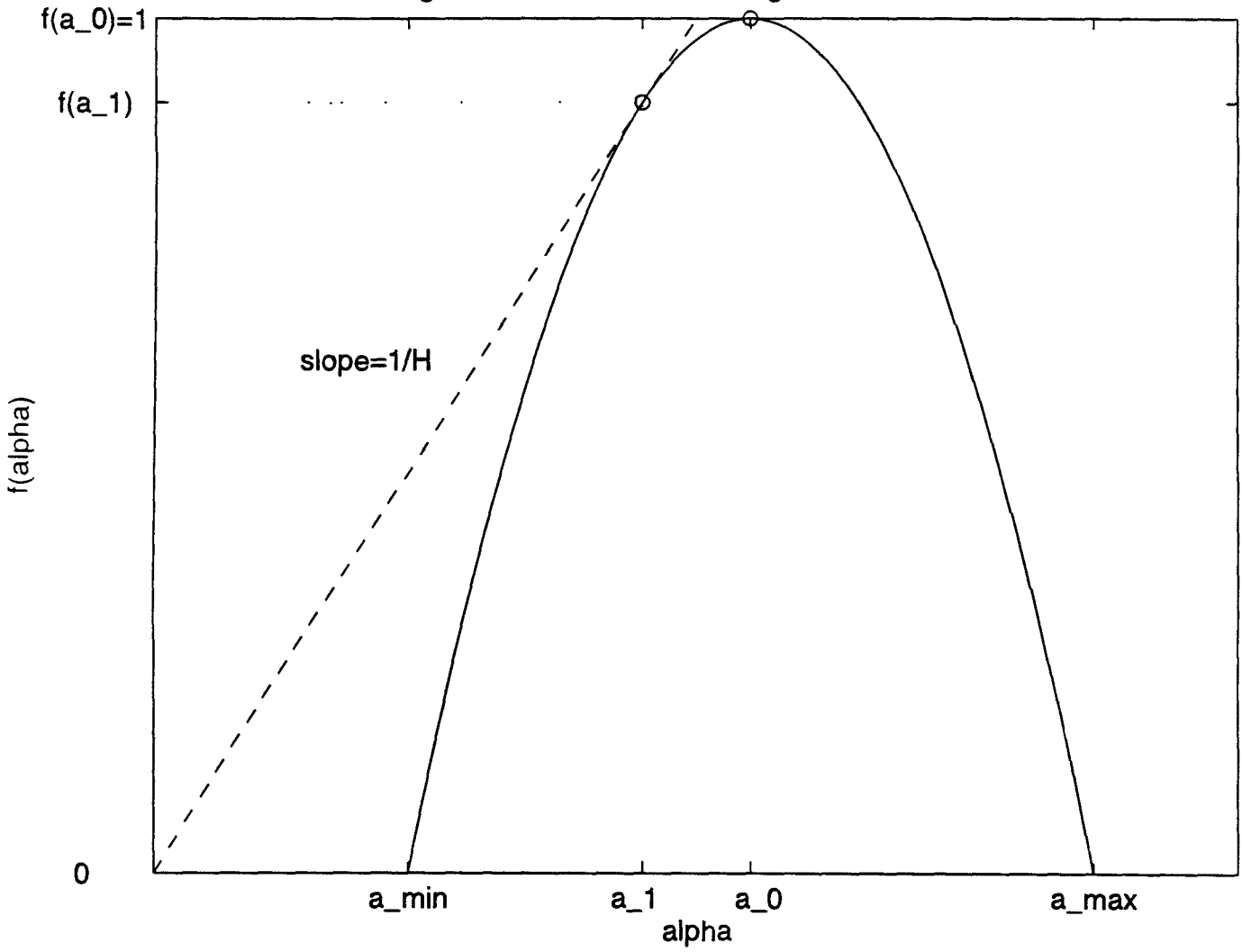
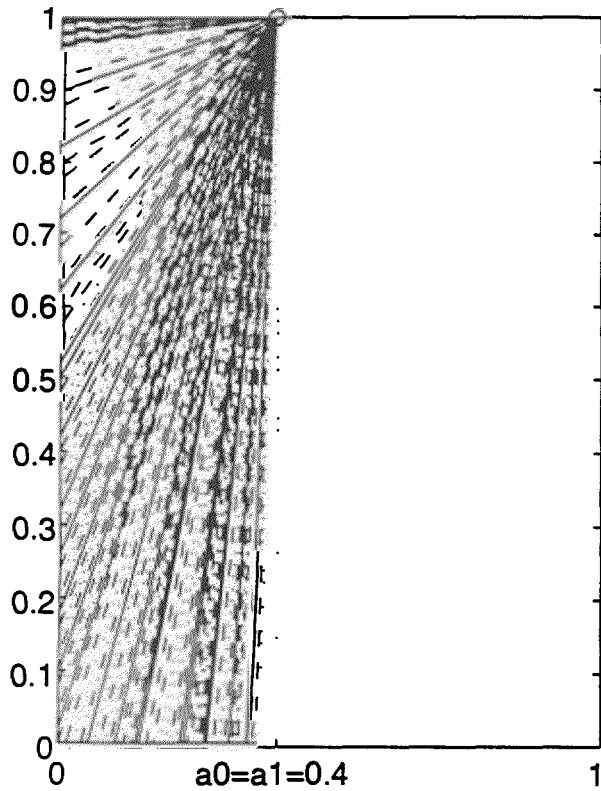


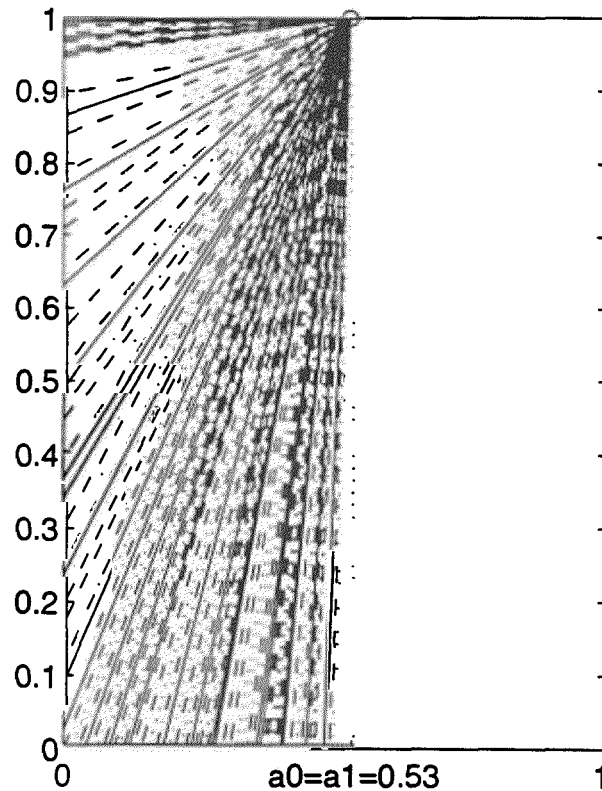


Figure 9. Single-Valued Multifractal Spectrum of FBMs

FBM,  $H=0.4$

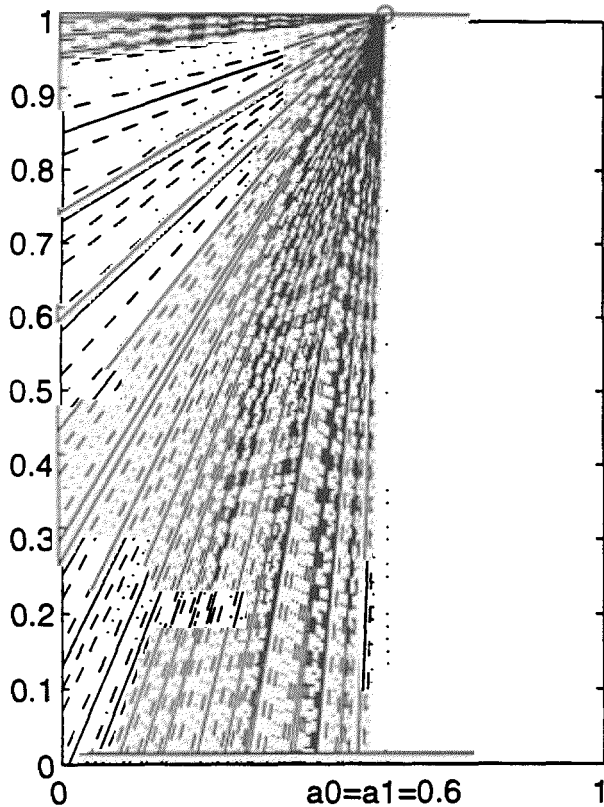


FBM,  $H=0.53$



Note: Only left side of spectrum shown

FBM,  $H=0.6$



FBM,  $H=0.8$

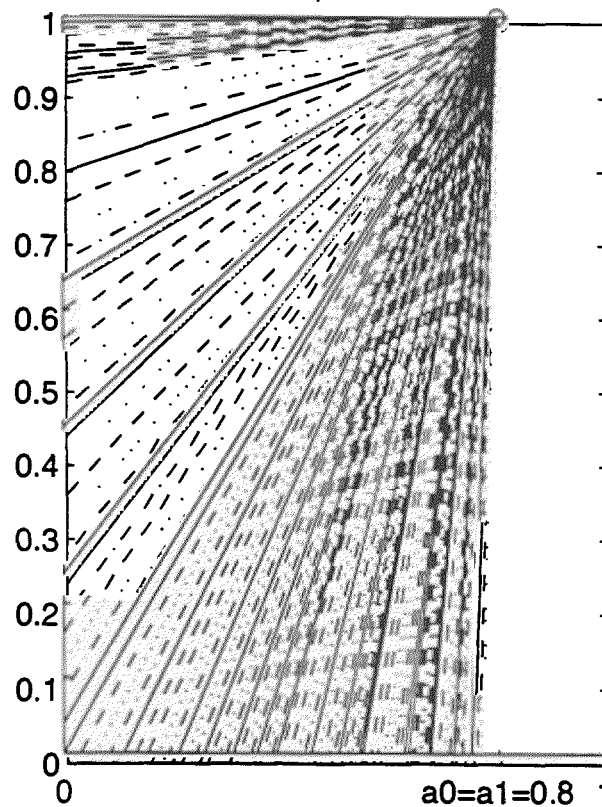


Figure 10a. DM/USD Scaling Function

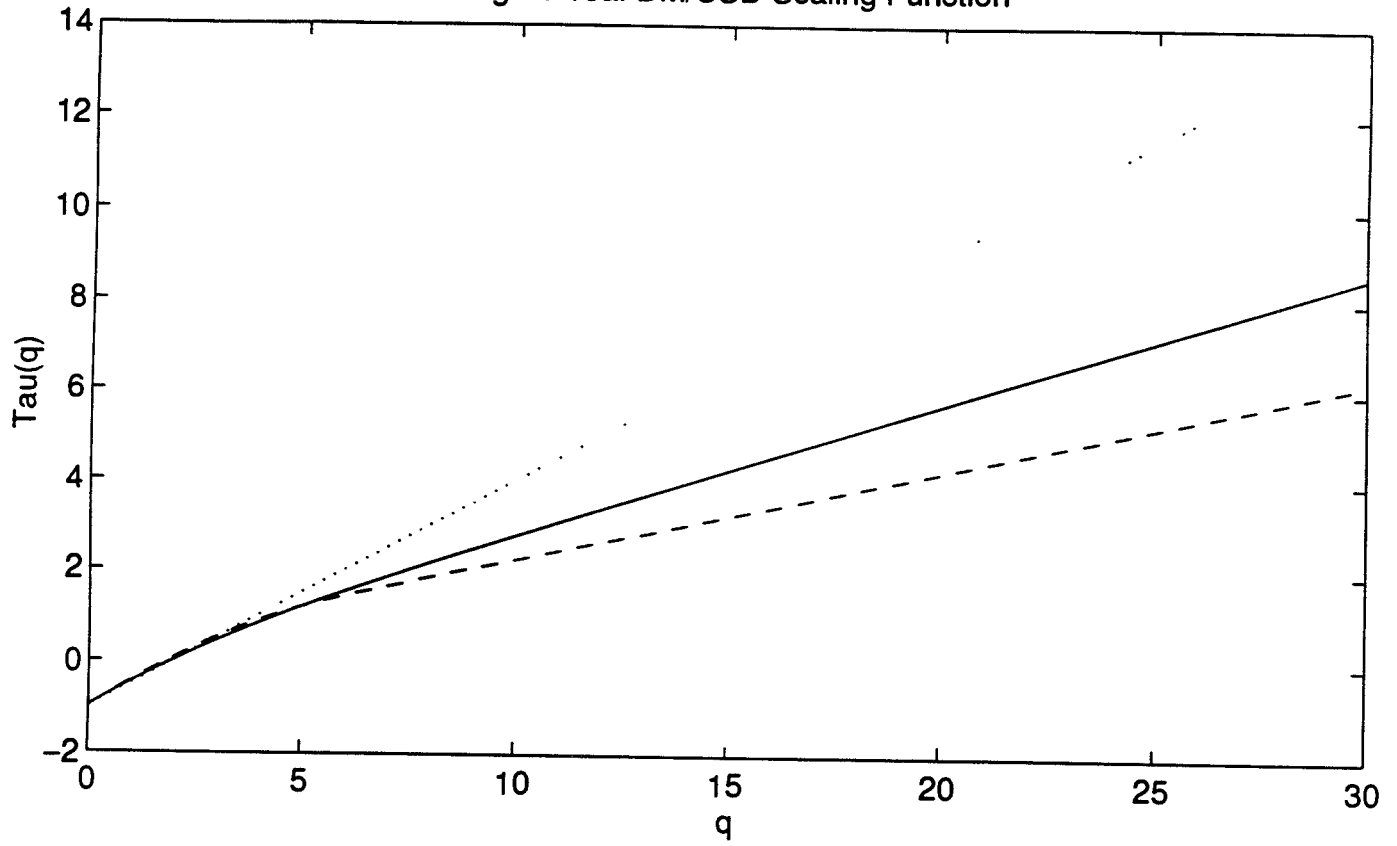


Figure 10b. DM/USD Scaling Function, Low Moments

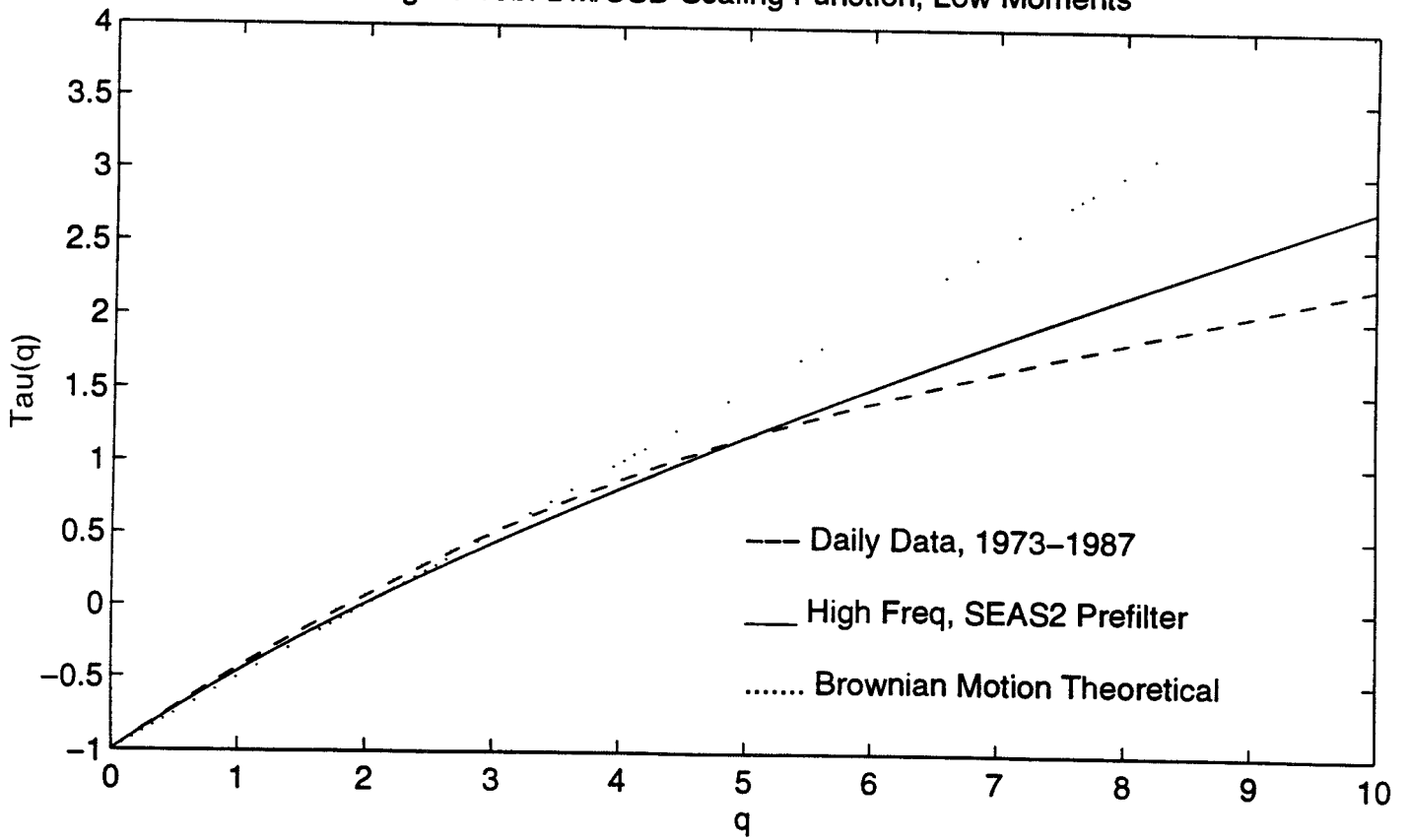


Figure 11. DM/USD Multifractal Spectrum of High Frequency Data, SEAS2 Prefilter

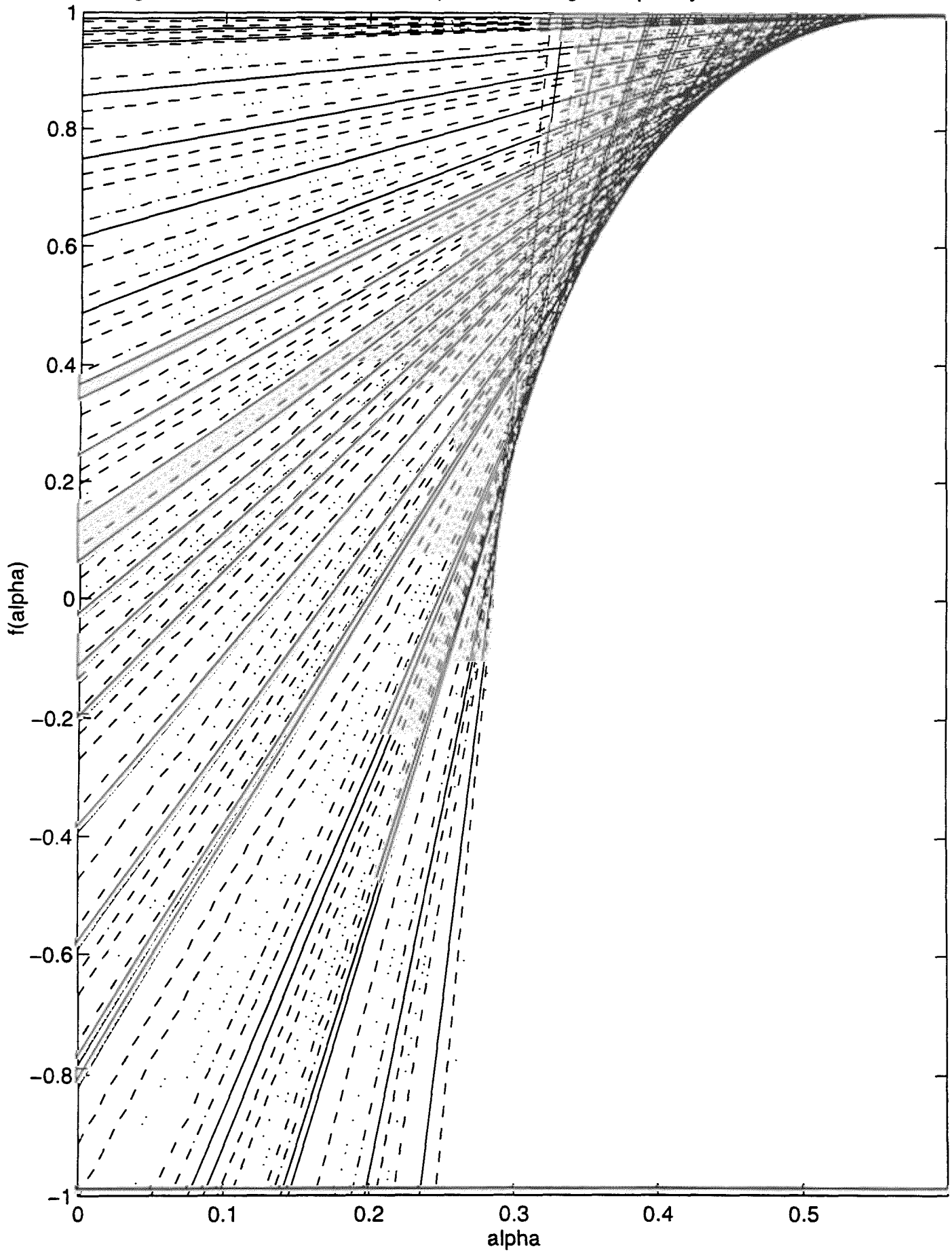


Figure 12. DM/USD Multifractal Spectrum of Daily Data

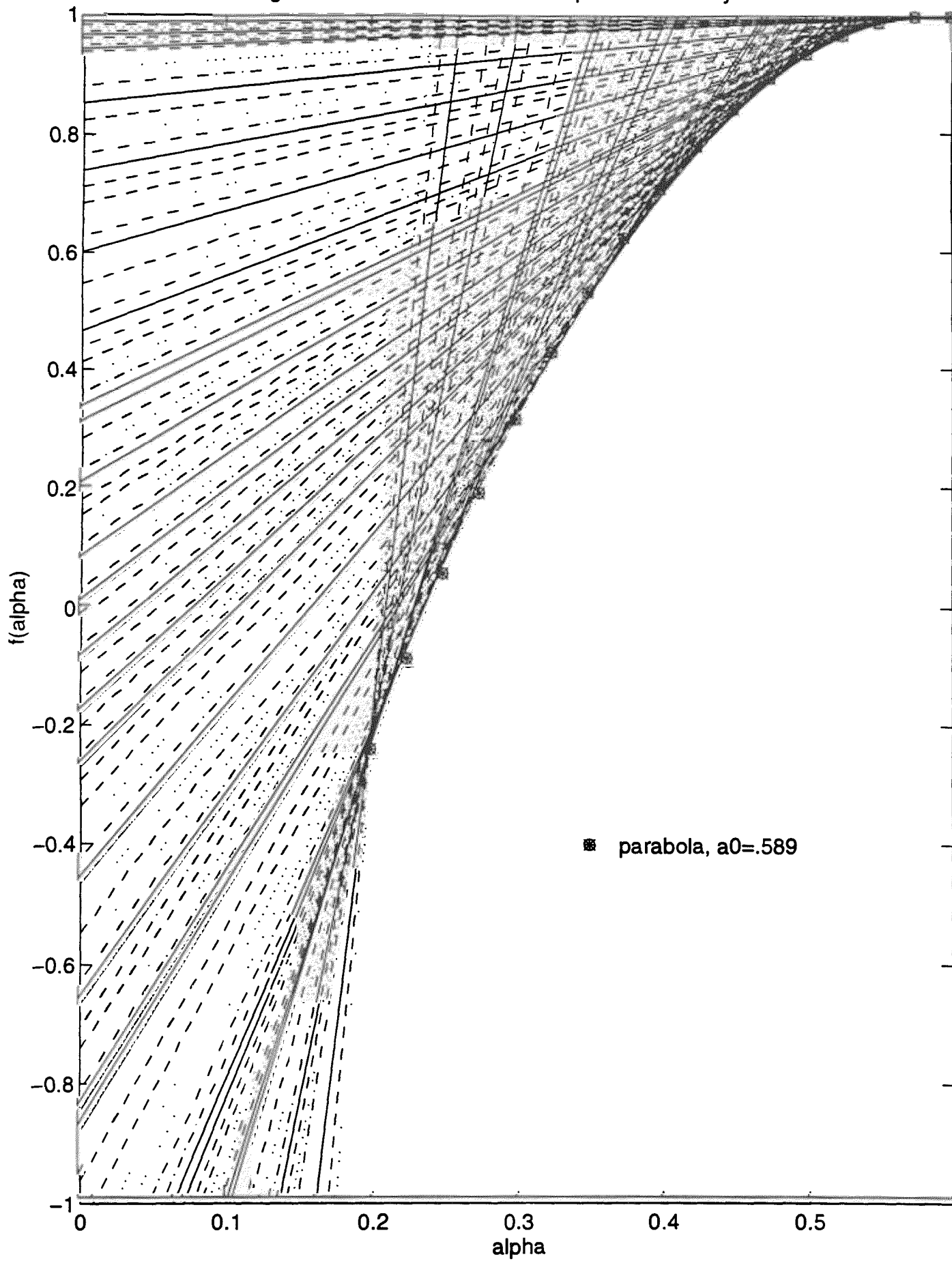
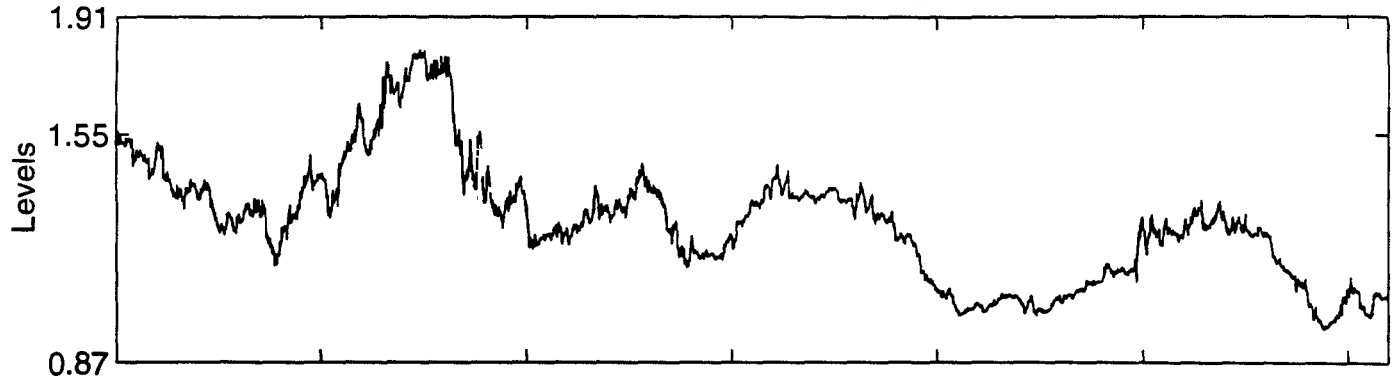
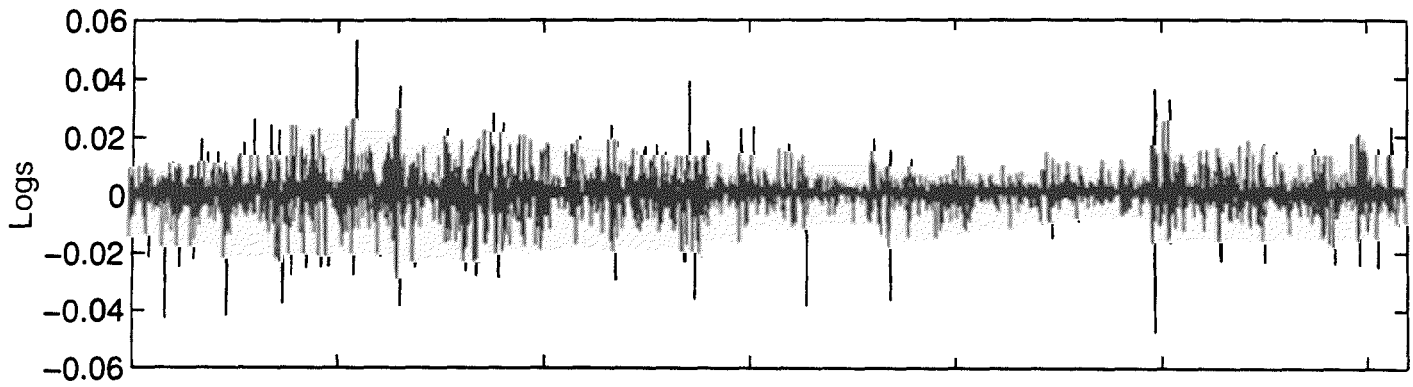


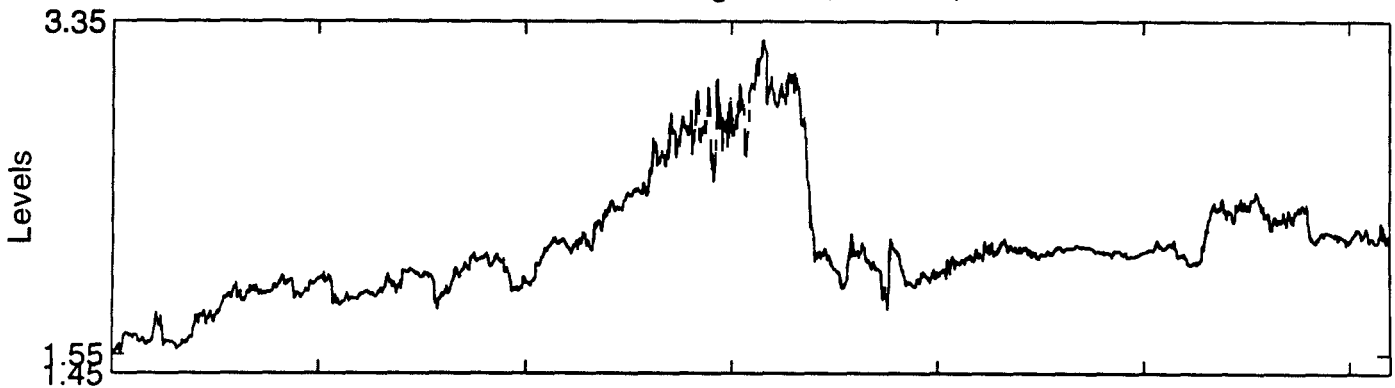
Figure 13a. Selected MMAR Simulations, Limit Lognormal,  $n=6200$ ,  $H=1/1.88$



Increments



Simulation 2, Limit Lognormal,  $n=6200$ ,  $H=1/1.88$



Increments

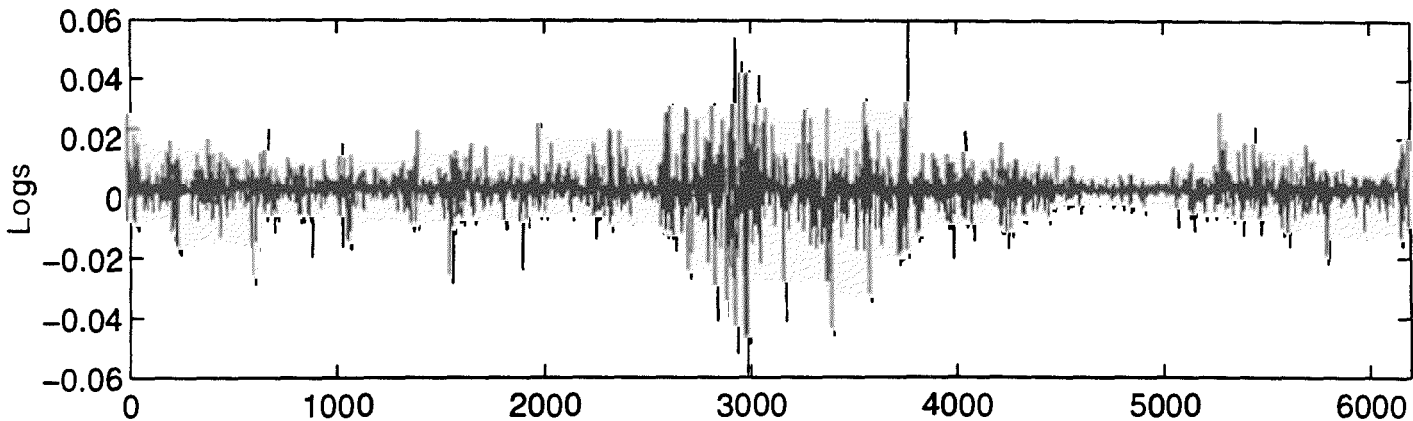
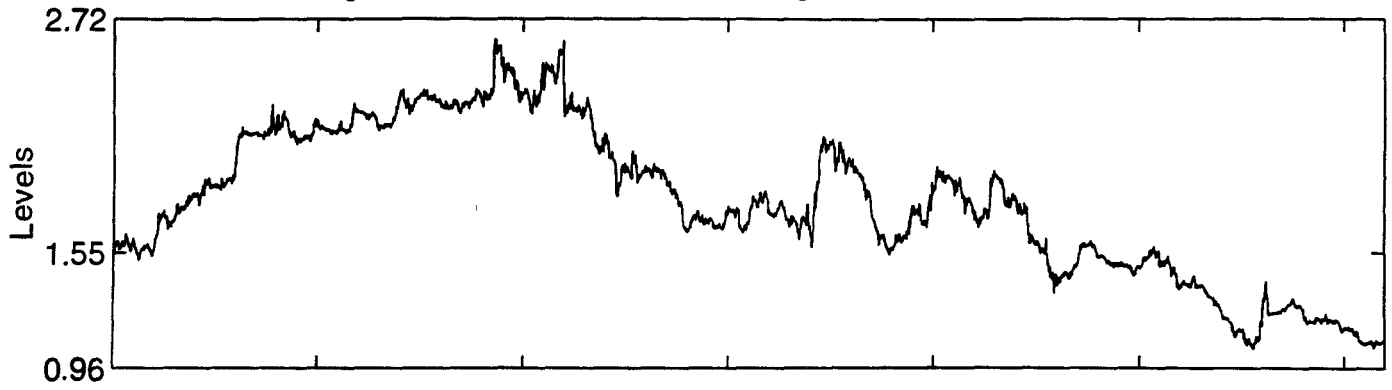
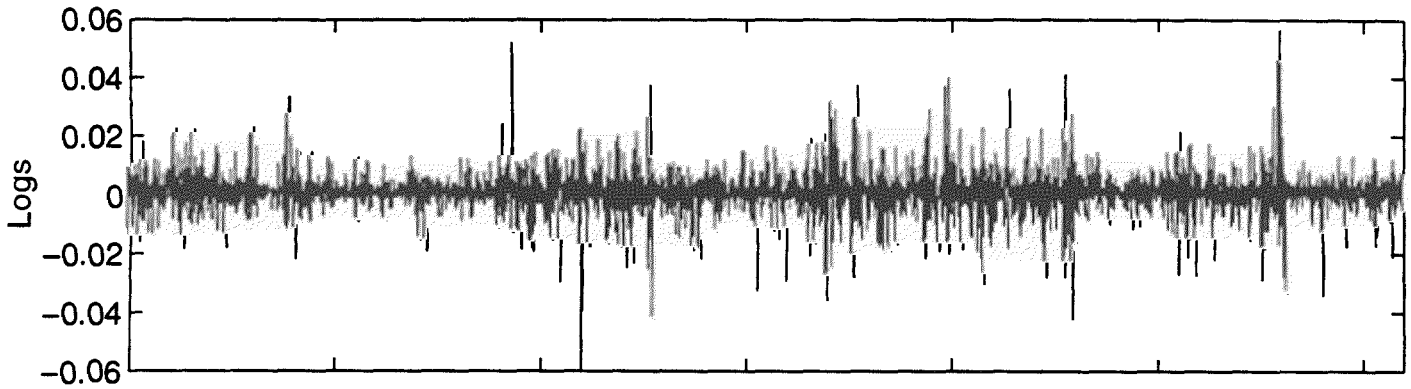


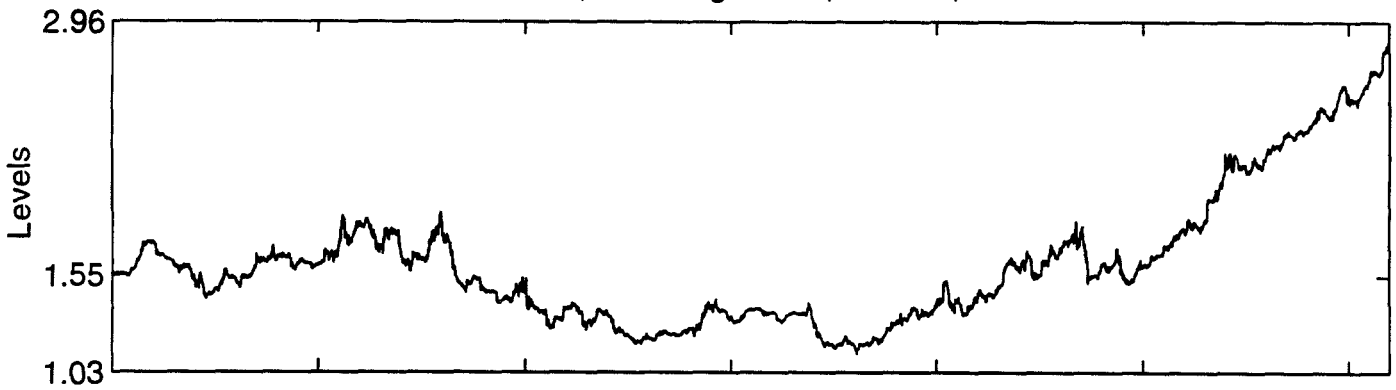
Figure 13b. Simulation 3, Limit Lognormal,  $n=6200$ ,  $H=1/1.88$



Increments



Simulation 4, Limit Lognormal,  $n=6200$ ,  $H=1/1.88$



Increments

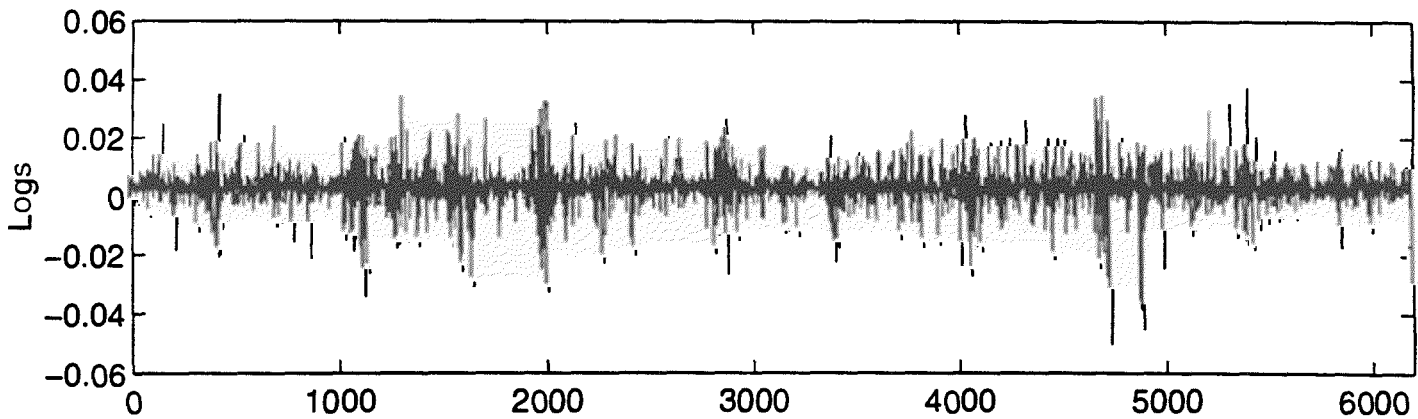
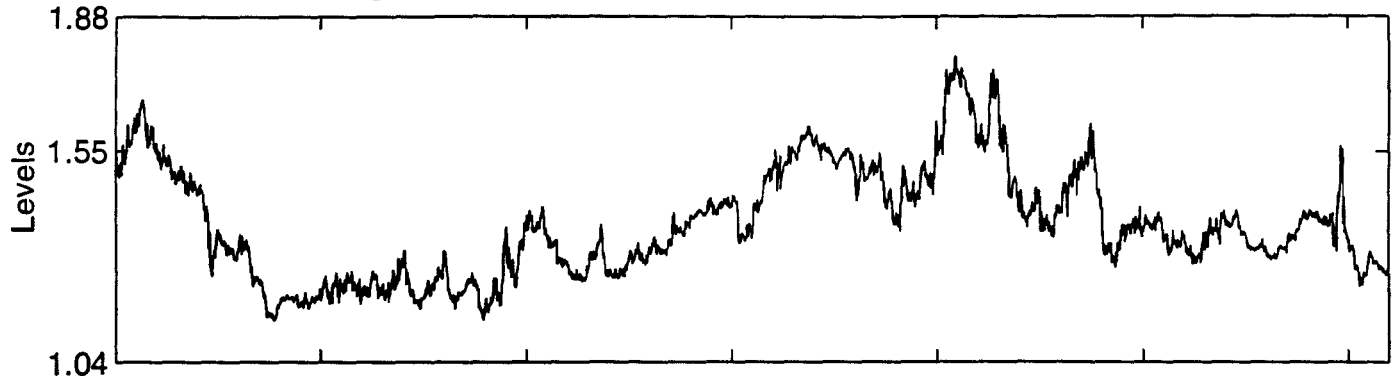
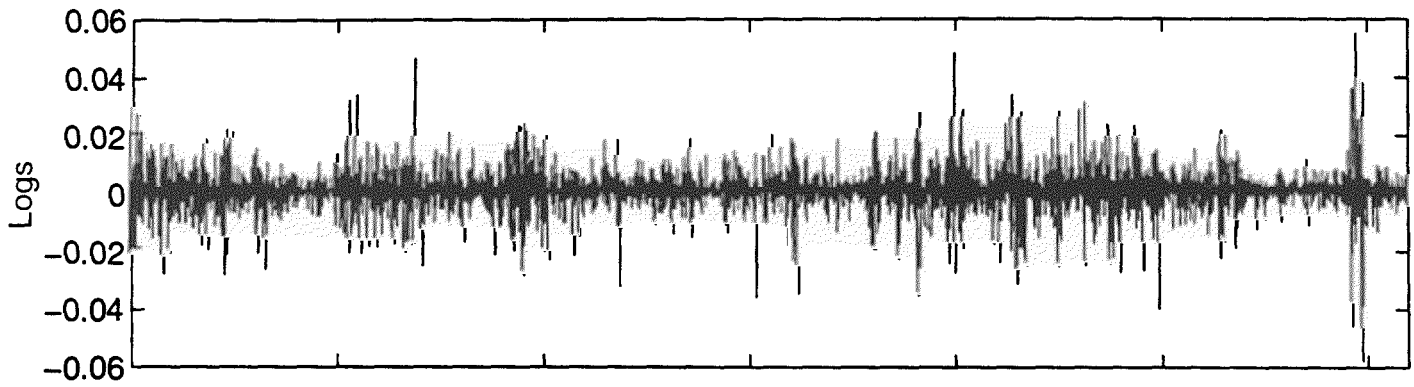


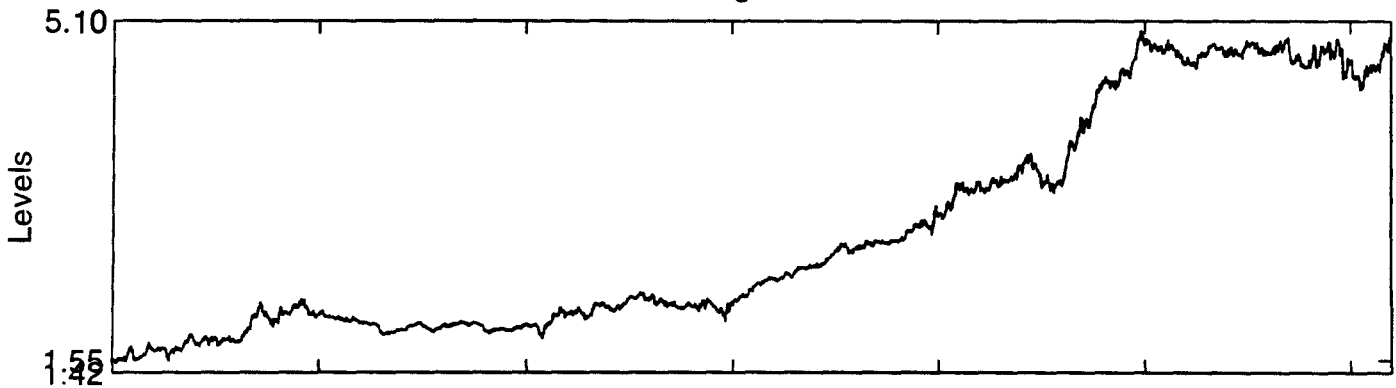
Figure 13c. Simulation 5, Limit Lognormal,  $n=6200$ ,  $H=1/2$



Increments



Simulation 6, Limit Lognormal,  $n=6200$ ,  $H=1/2$



Increments

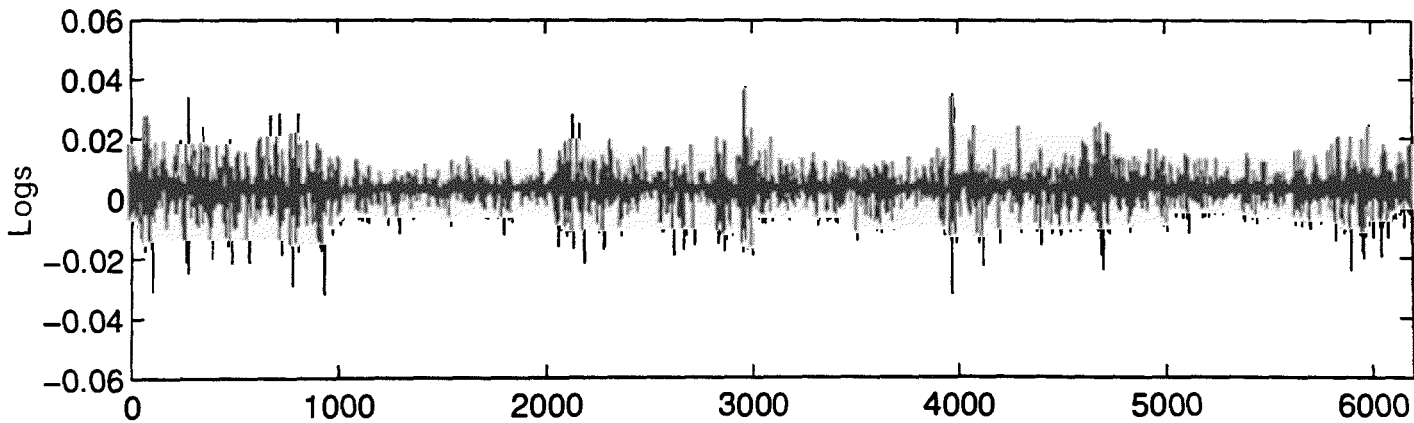
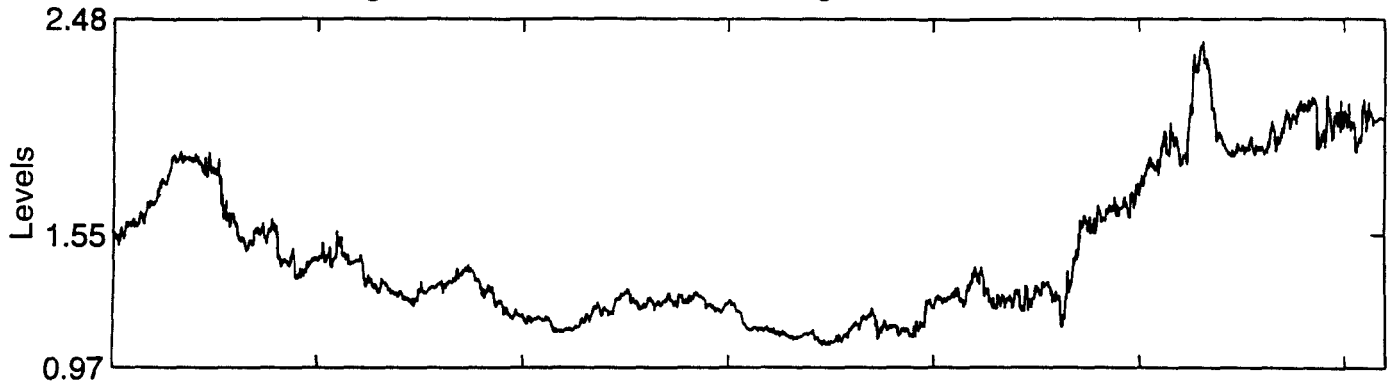
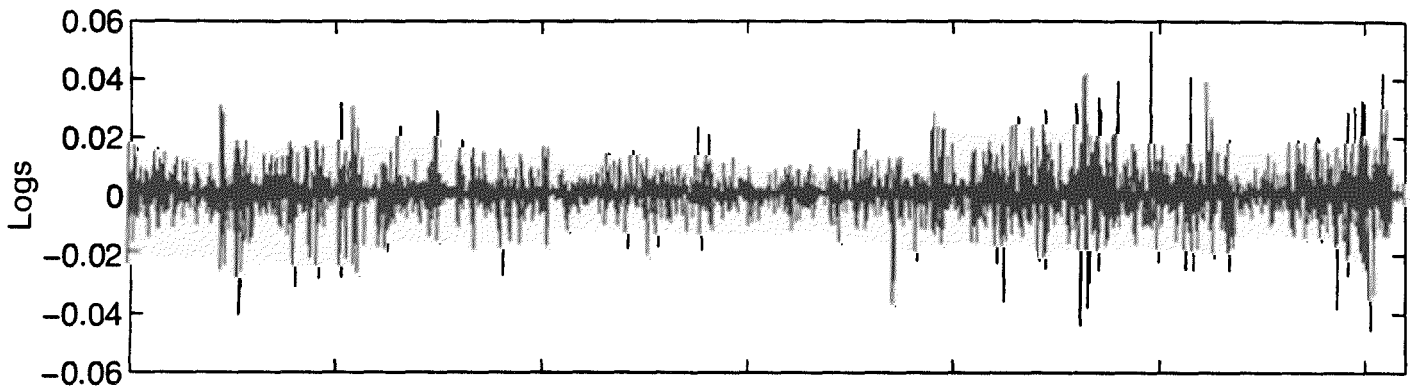


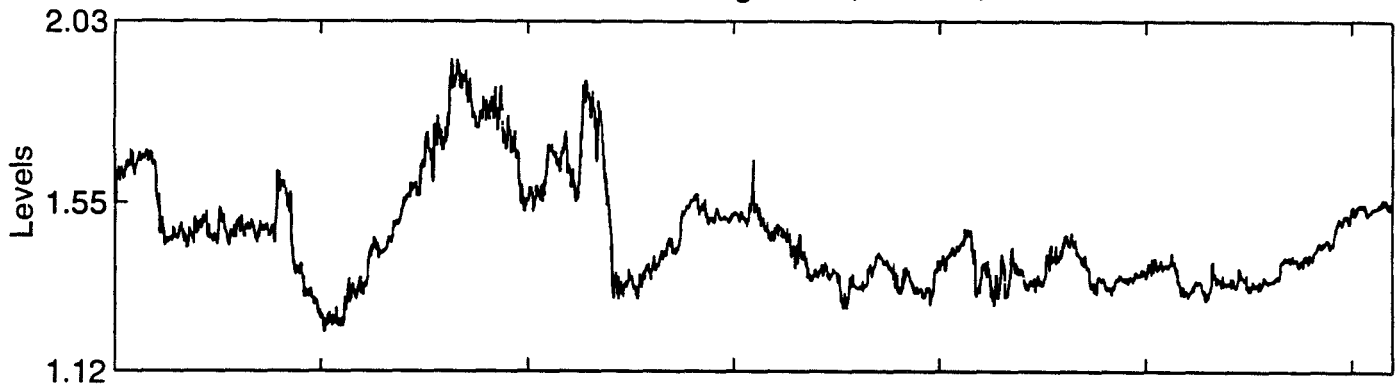
Figure 13d. Simulation 7, Limit Lognormal,  $n=6200$ ,  $H=1/2$



Increments



Simulation 8, Limit Lognormal,  $n=6200$ ,  $H=1/2$



Increments

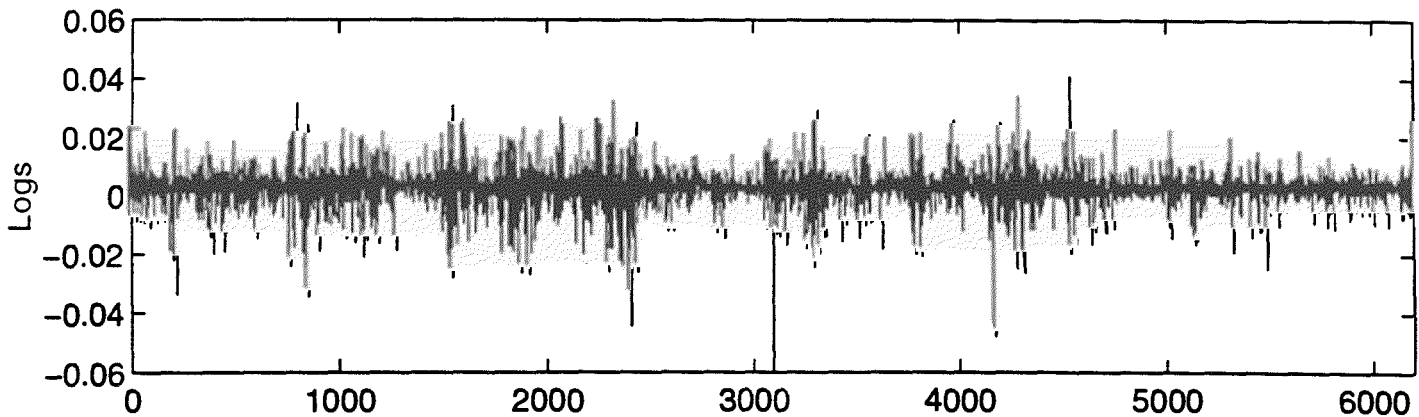
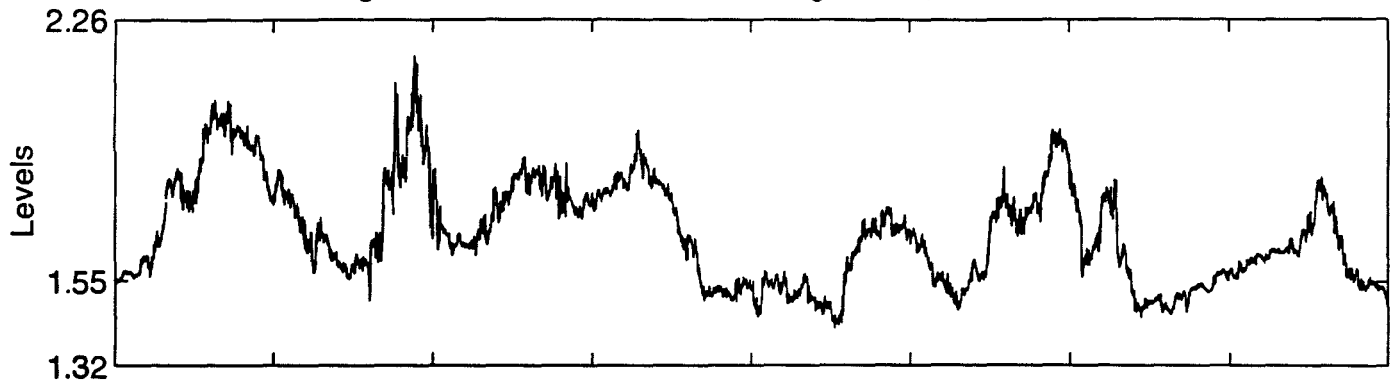
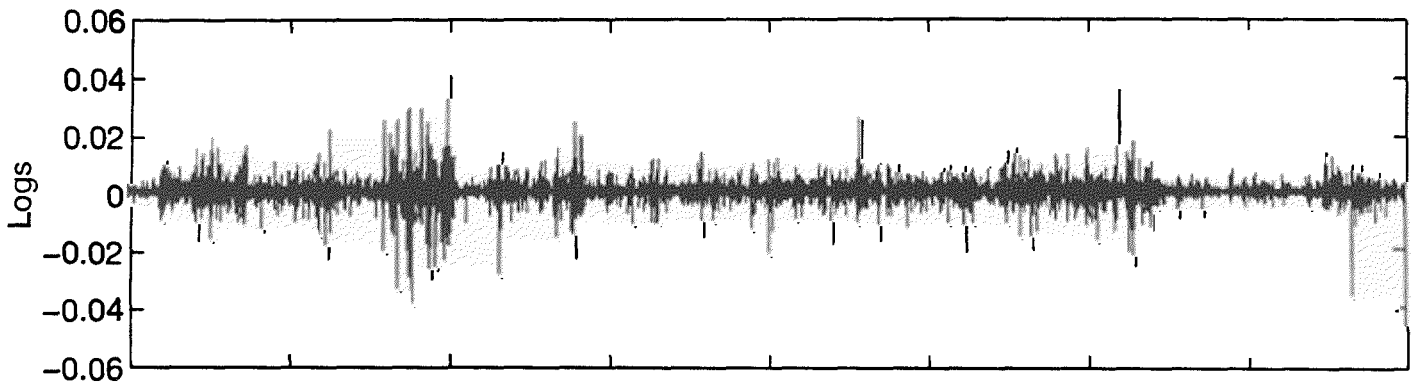




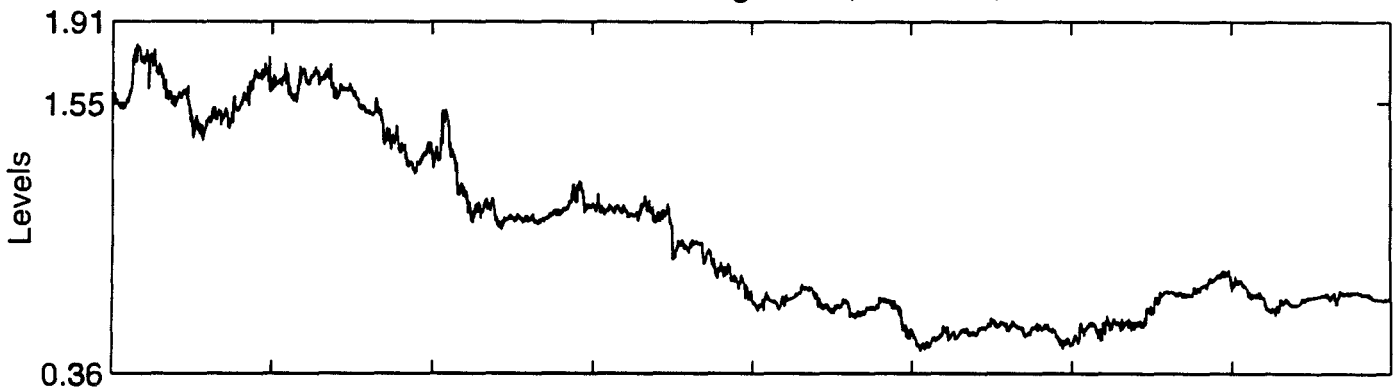
Figure 13e. Simulation 9, Limit Lognormal,  $n=40000$ ,  $H=1/2$



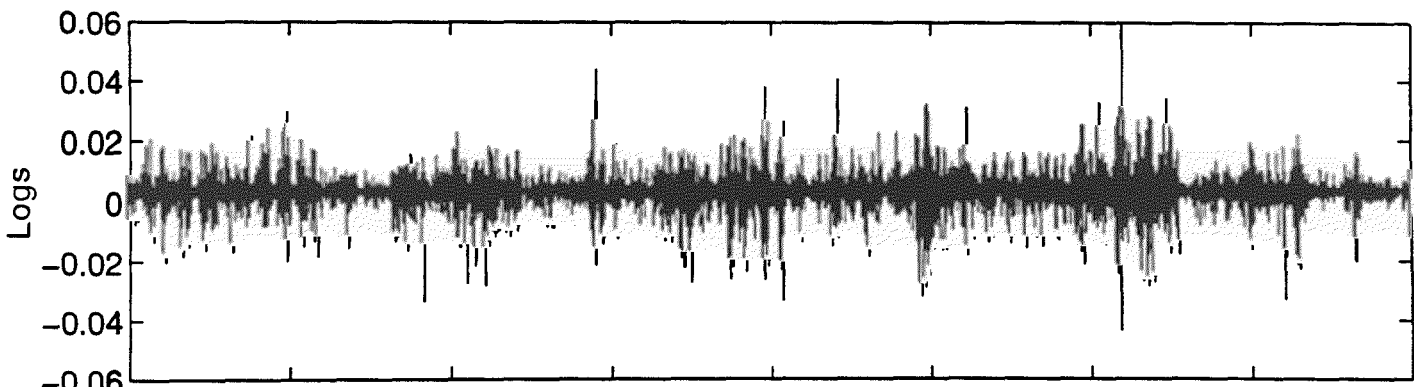
Increments



Simulation 10, Limit Lognormal,  $n=40000$ ,  $H=1/2$

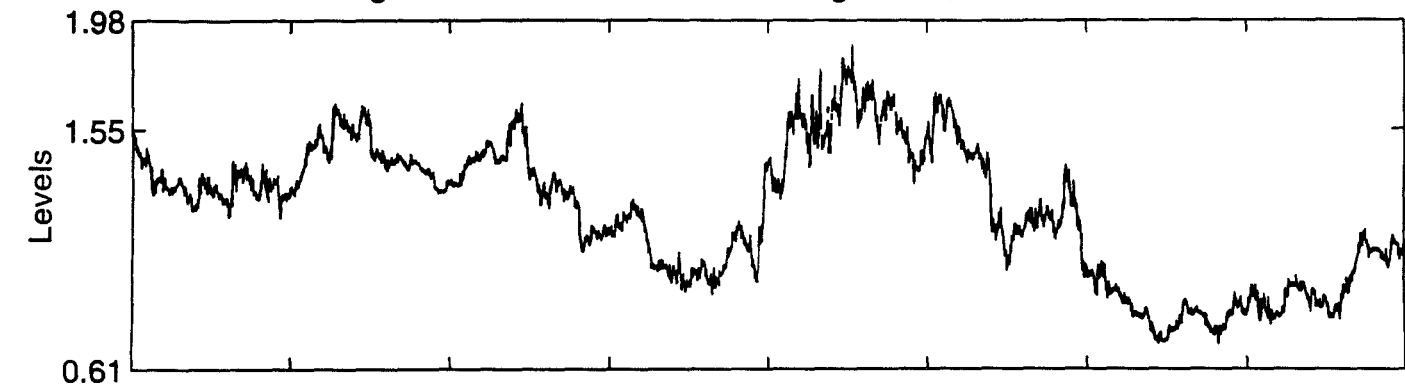


Increments

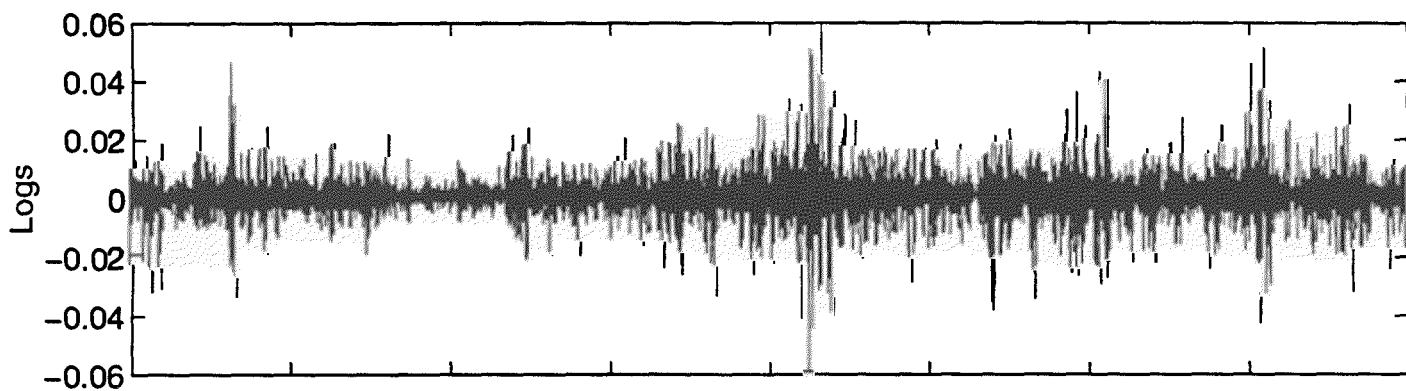


$\times 10^4$

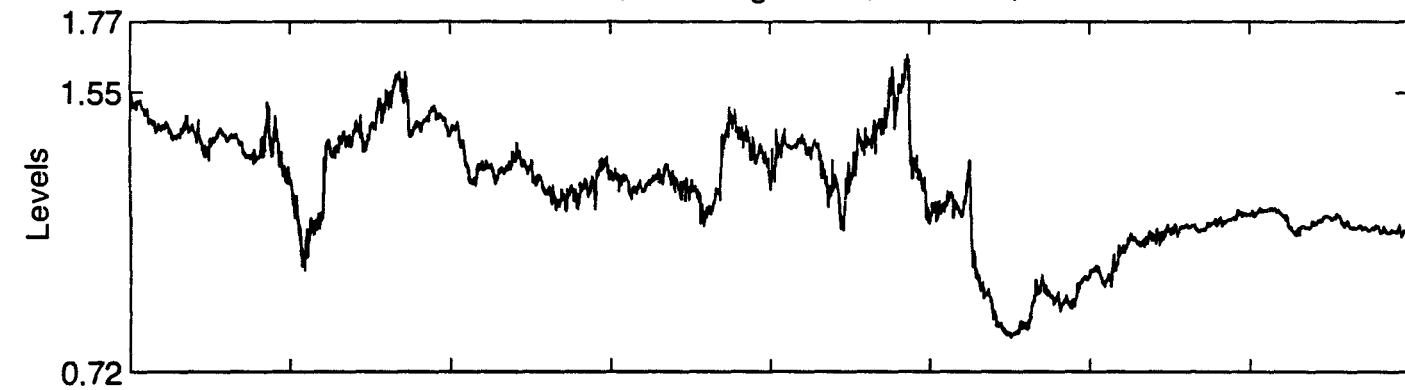
Figure 13f. Simulation 11, Limit Lognormal,  $n=40000$ ,  $H=1/2$



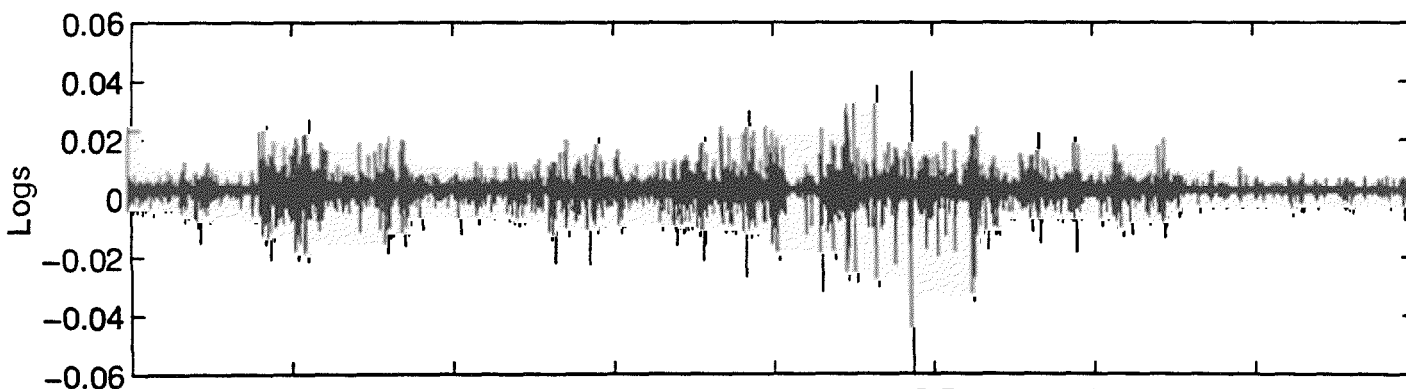
Increments



Simulation 12, Limit Lognormal,  $n=40000$ ,  $H=1/2$

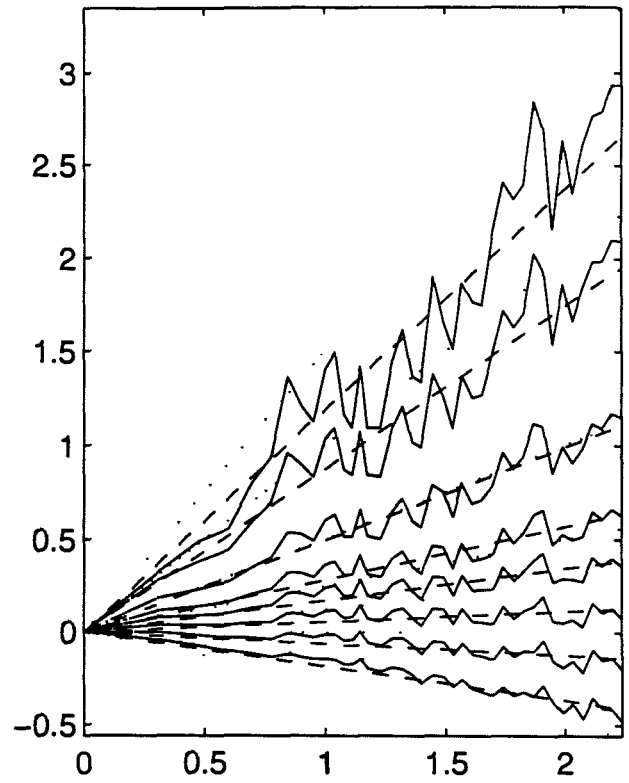
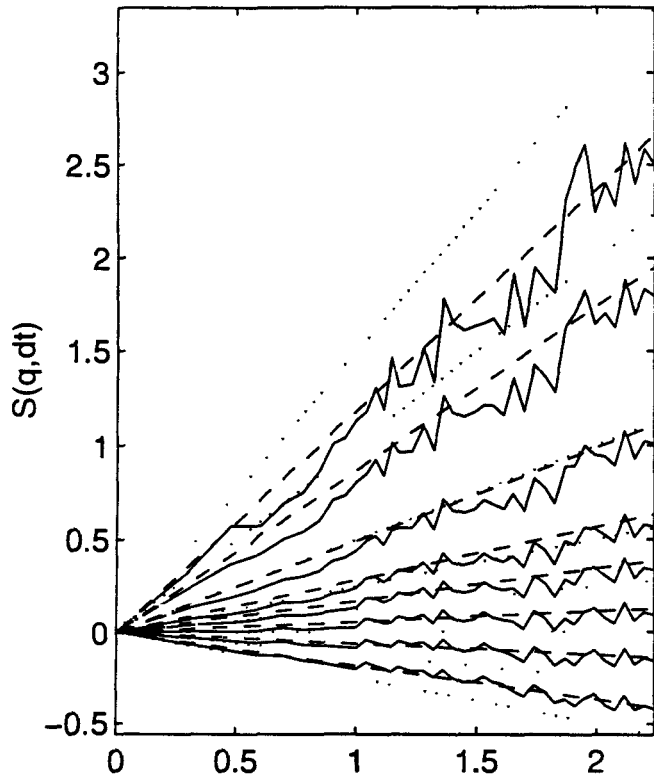


Increments



$\times 10^4$

Figure 14. Selected (4 of 20) Simulated MMAR Partition Functions,  $n=6200$



--- Limit Lognormal Predicted,  $H=.53$

— Limit Lognormal Simulation

..... Brownian Predicted

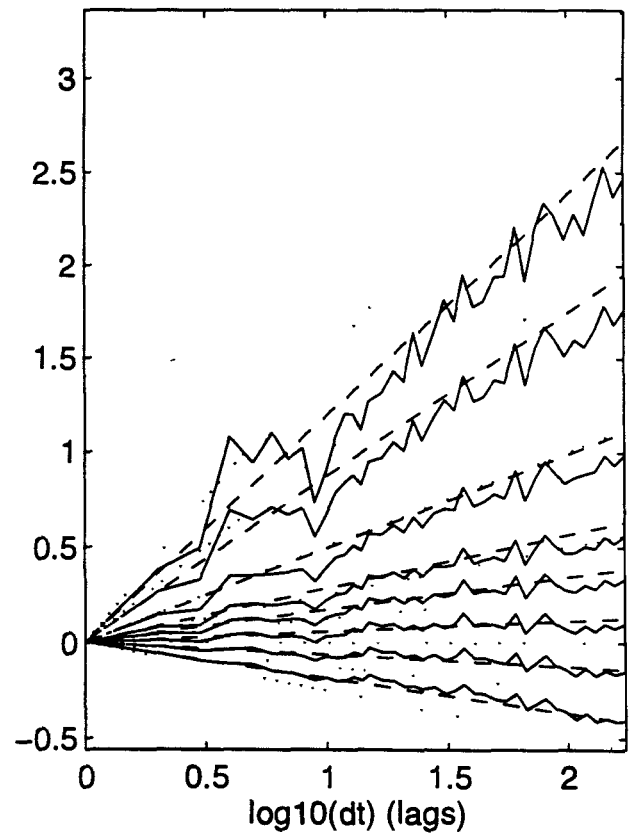
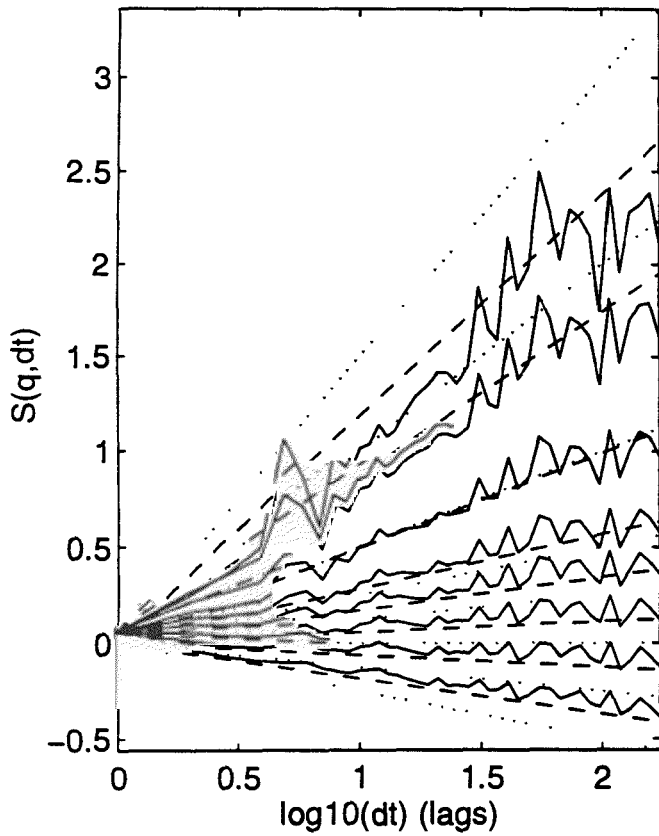


Figure 15a. Simulated MMAR Partition Functions,  $n=10^5$ , High Moments

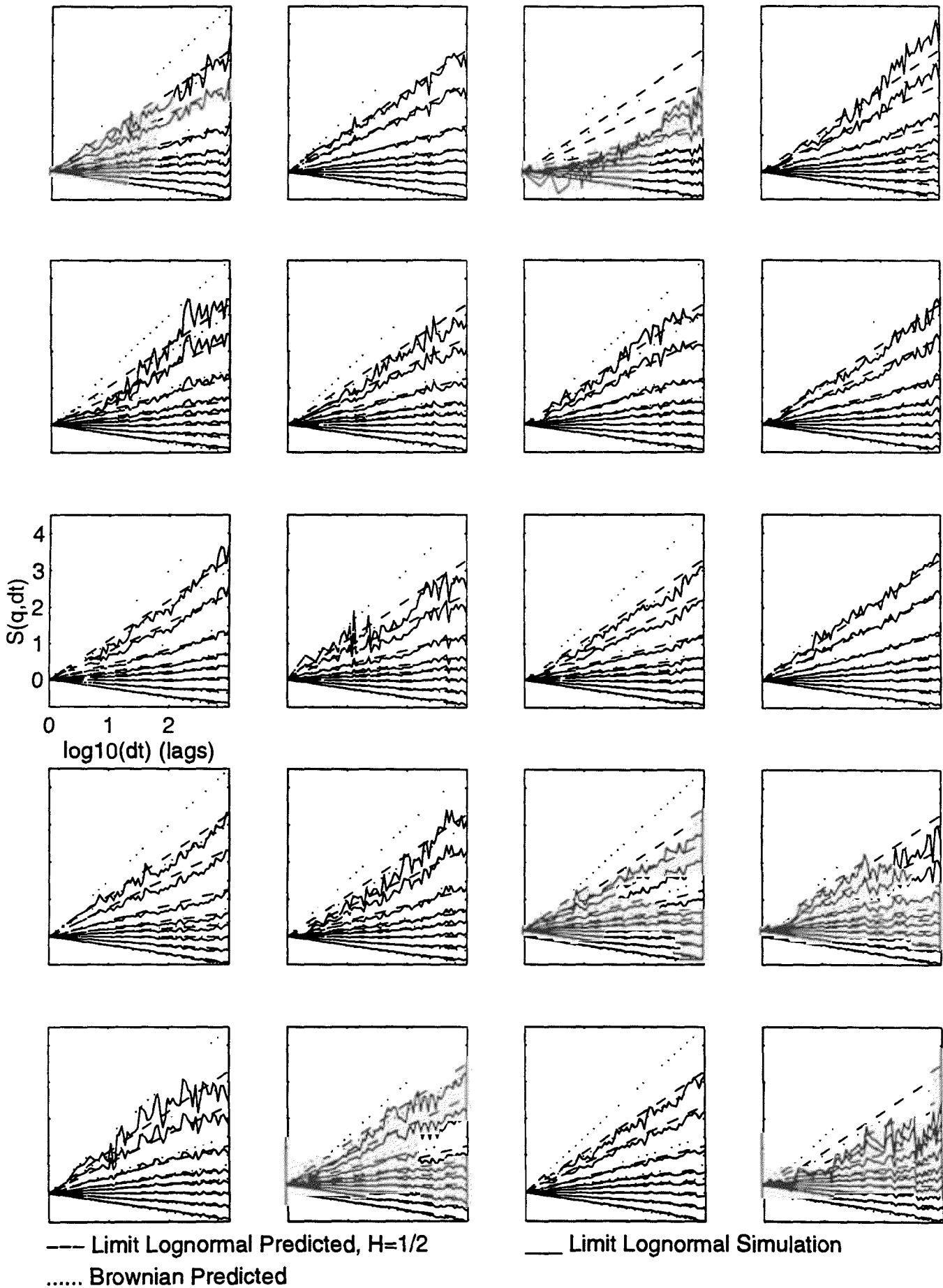


Figure 15b. Simulated MMAR Partition Functions,  $n=10^5$ , Low Moments

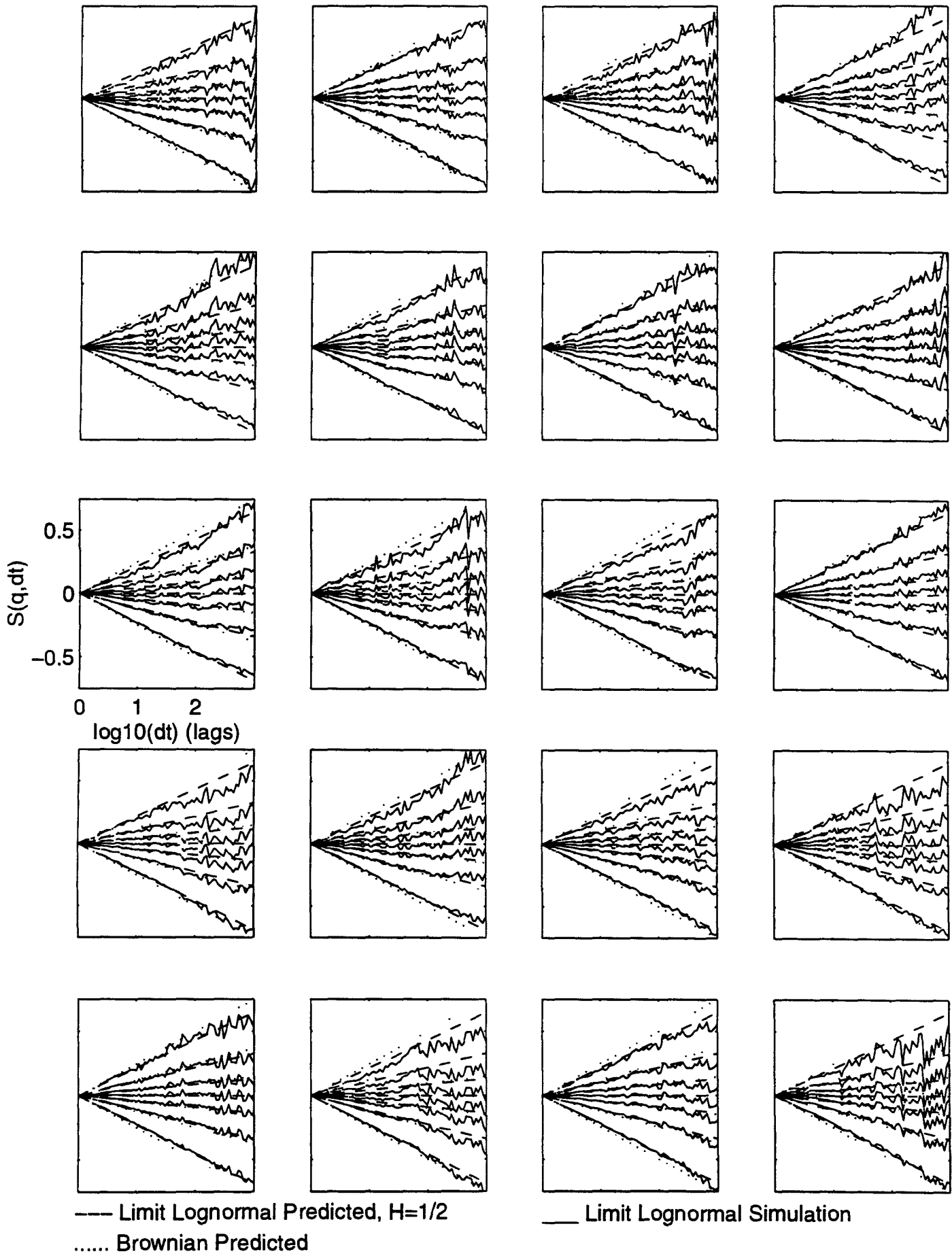


Figure 16. Twenty Simulated Multifractal Spectra,  $n=10^5$

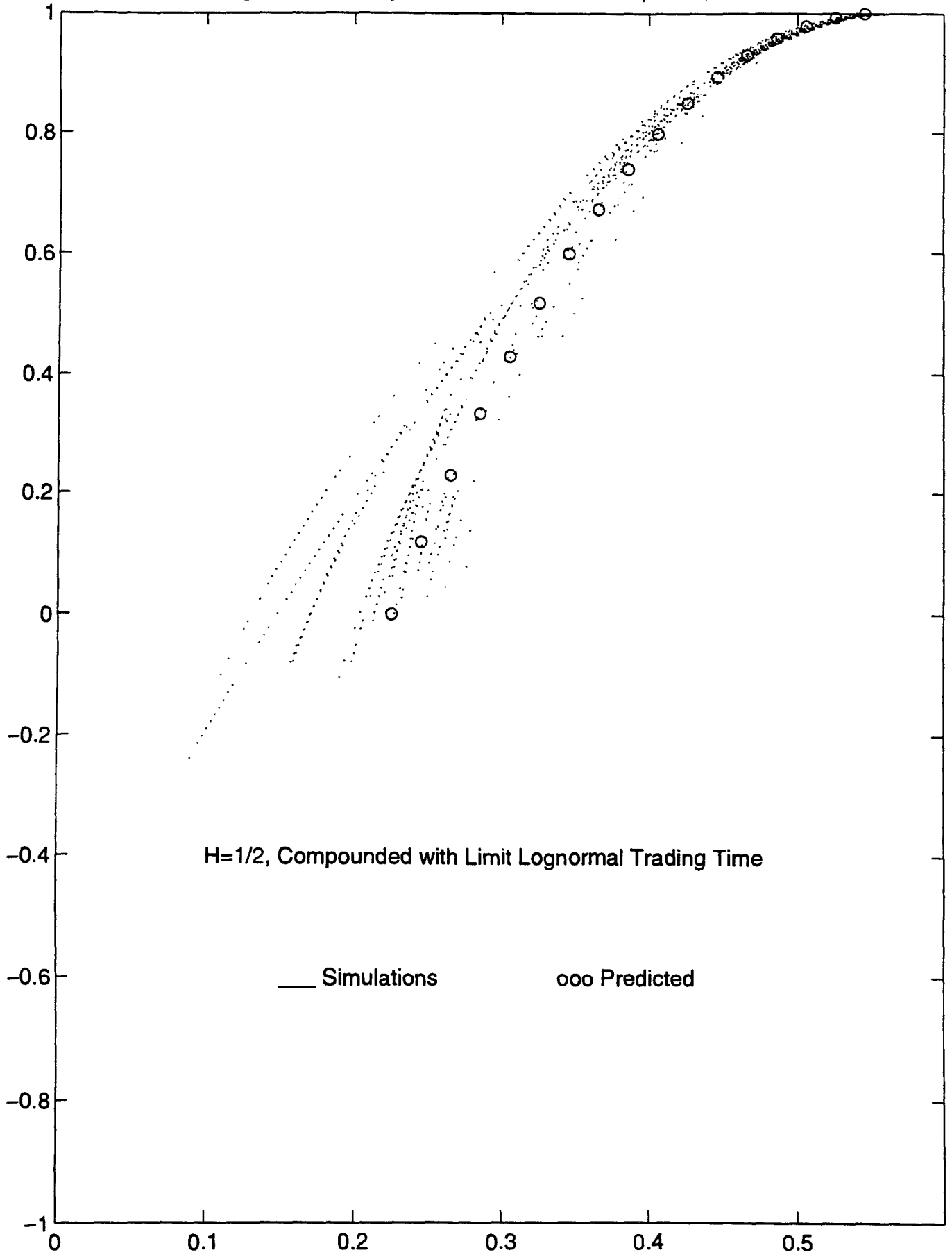


Figure 17. Simulated GARCH(1,1) Increments,  $n=40000$

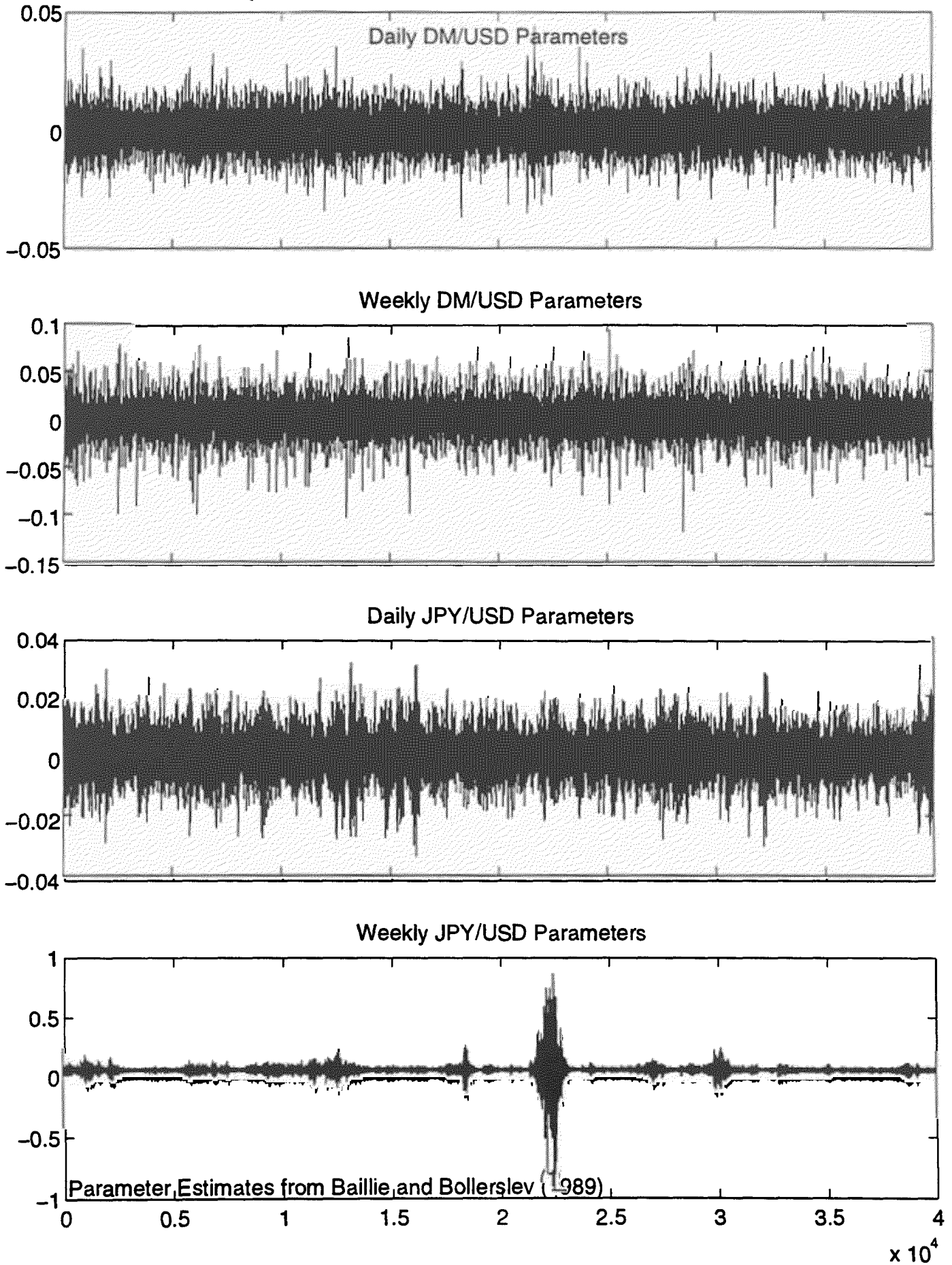


Figure 18. Simulated GARCH(1,1) Partition Functions

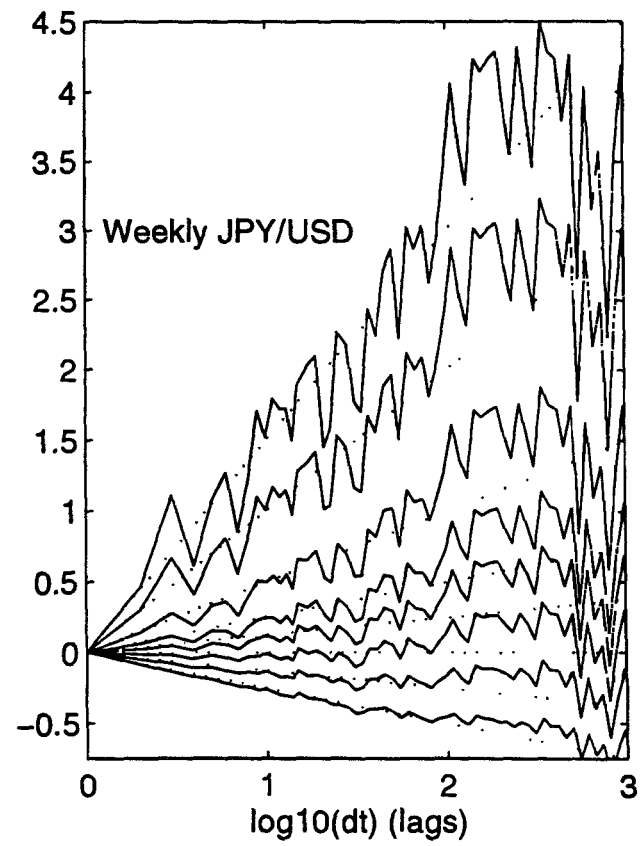
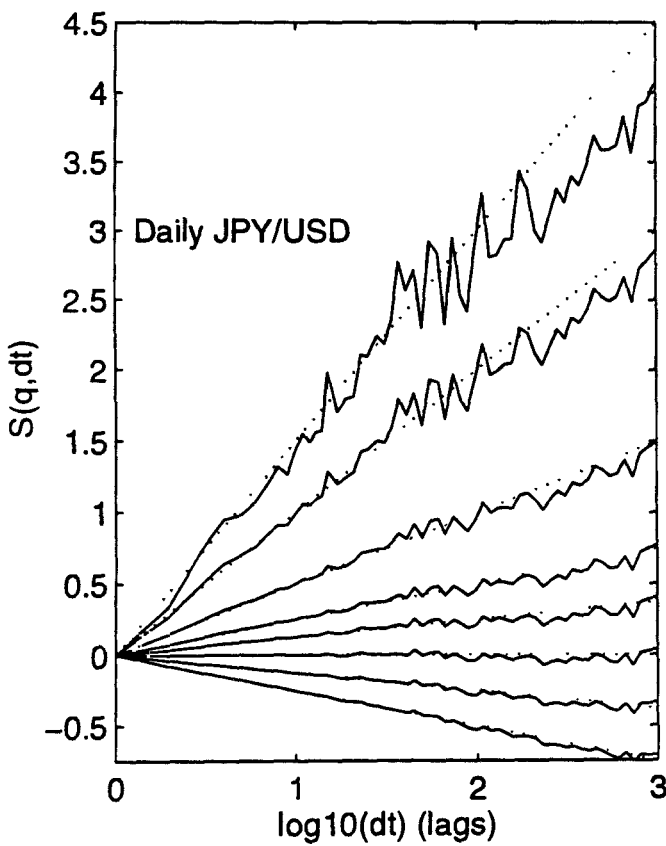
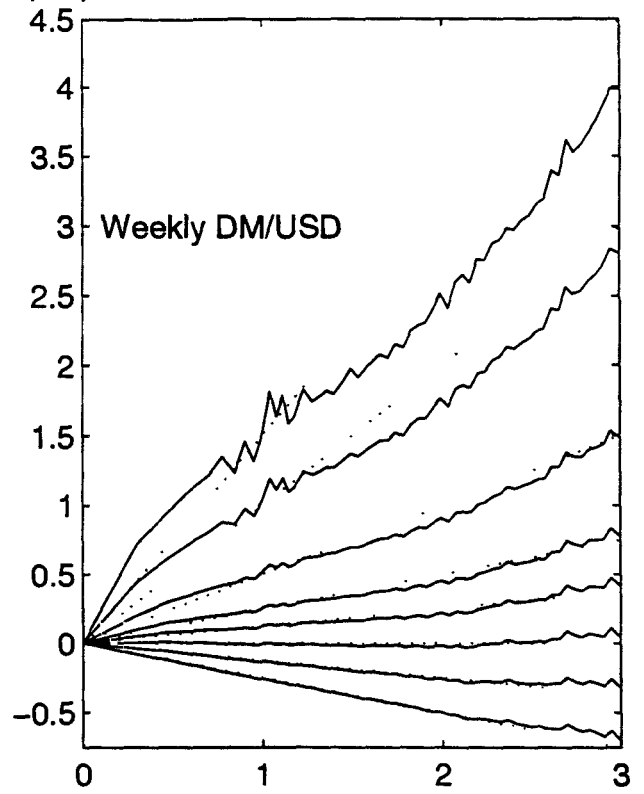
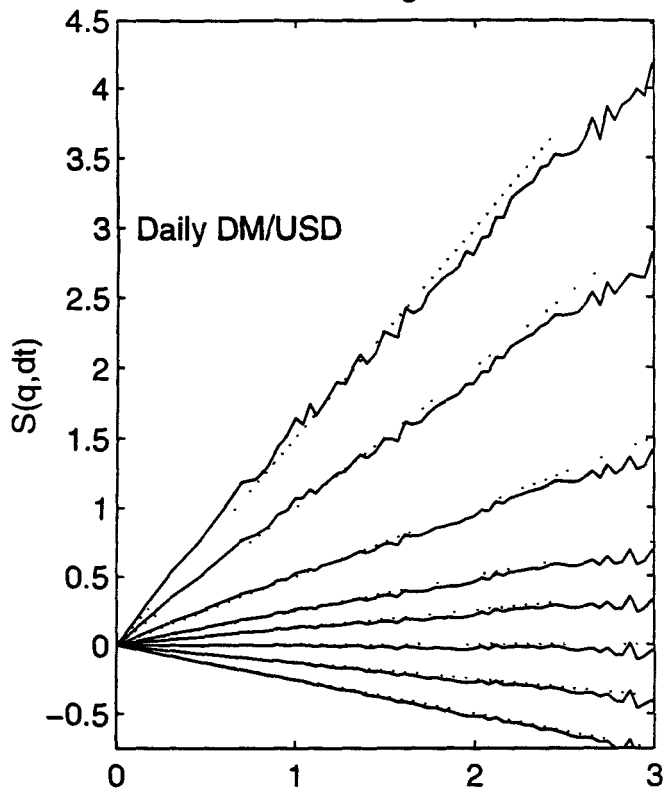
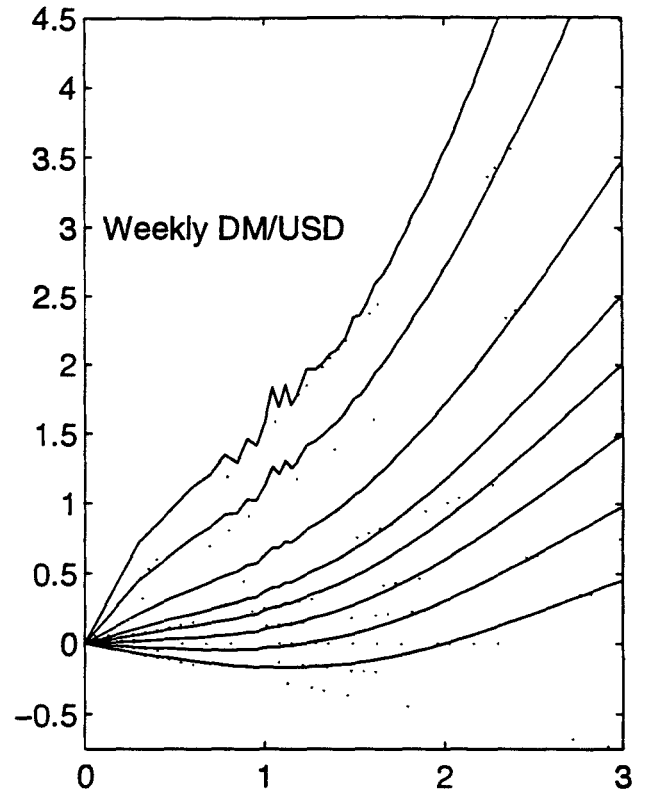
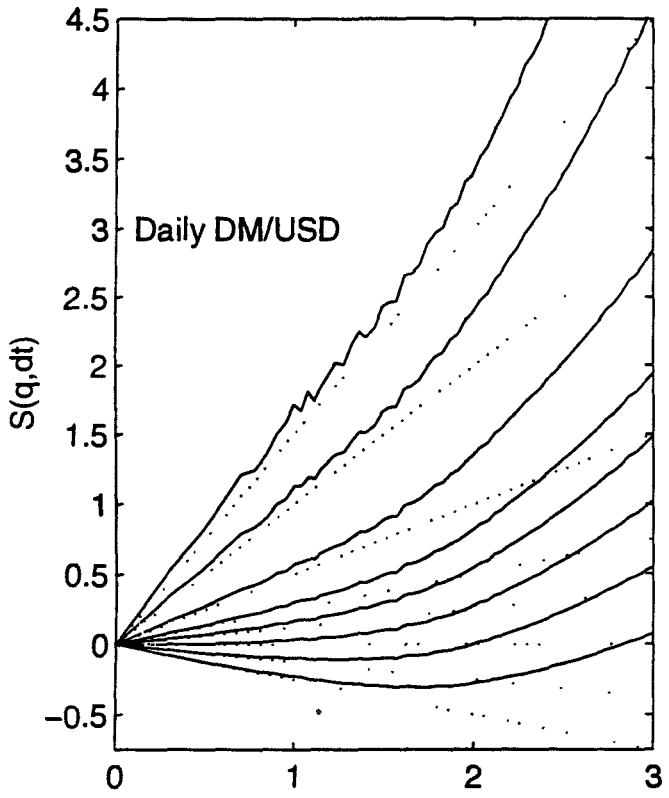




Figure 18b. Simulated GARCH(1,1) Partition Functions, With Trends



— GARCH (1,1) Sim  
..... Brownian Predicted

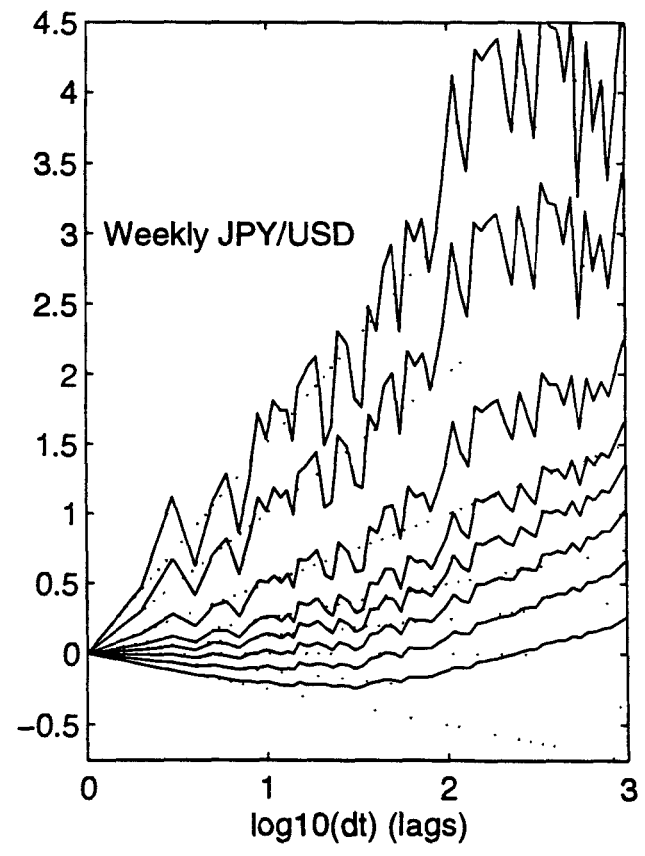
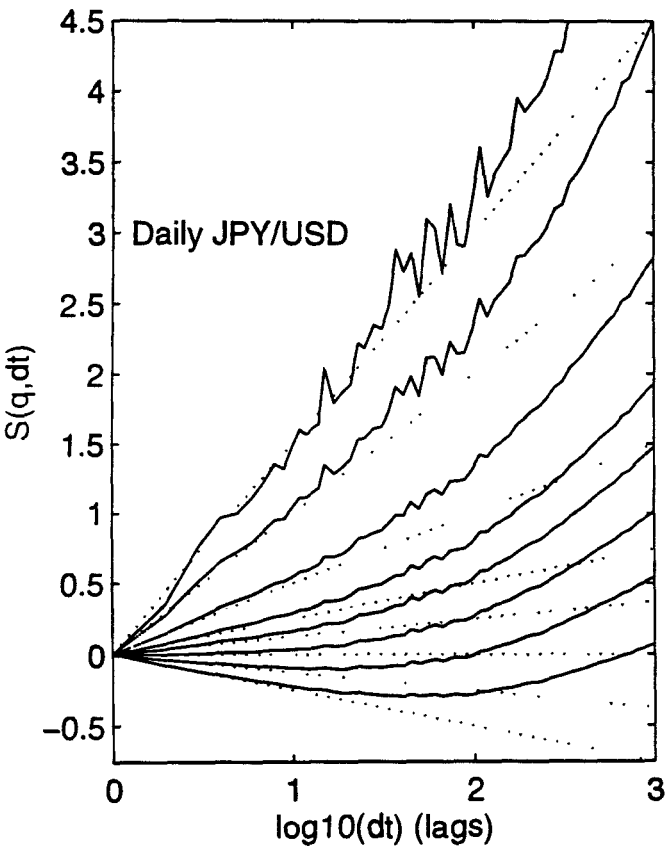
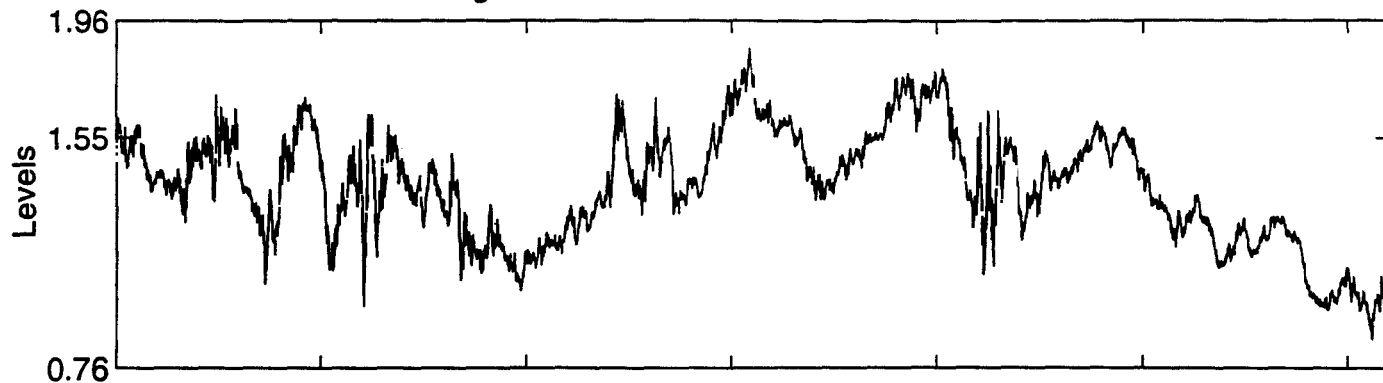
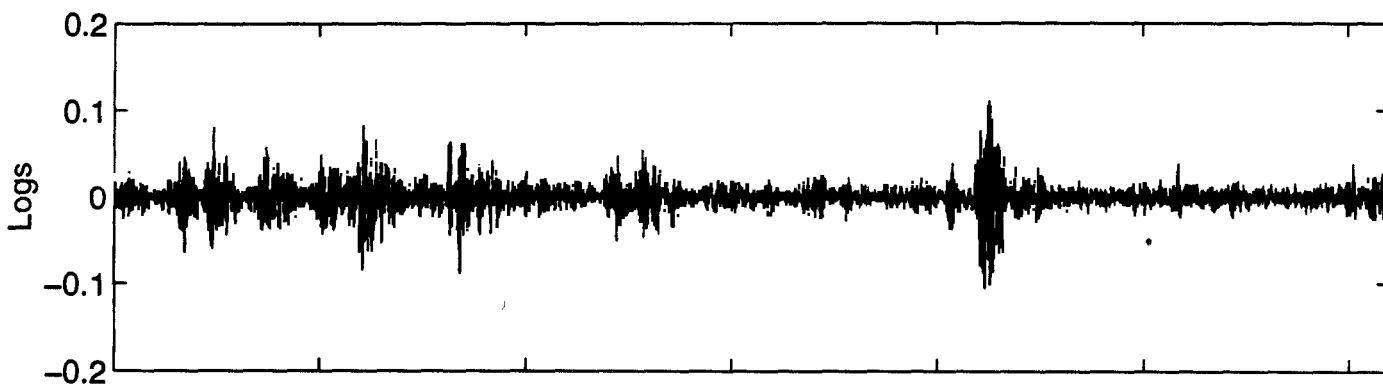


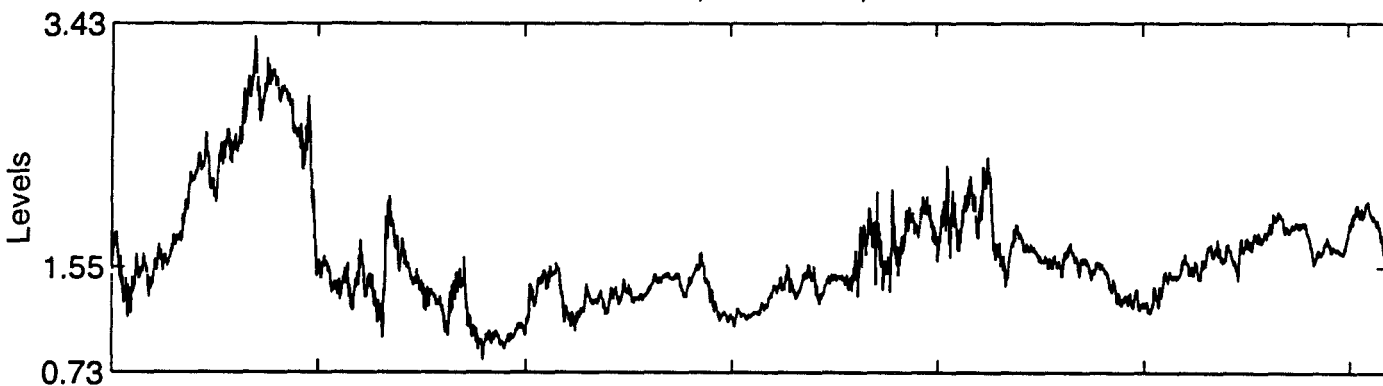
Figure 19a. FIGARCH Simulations, n=6200



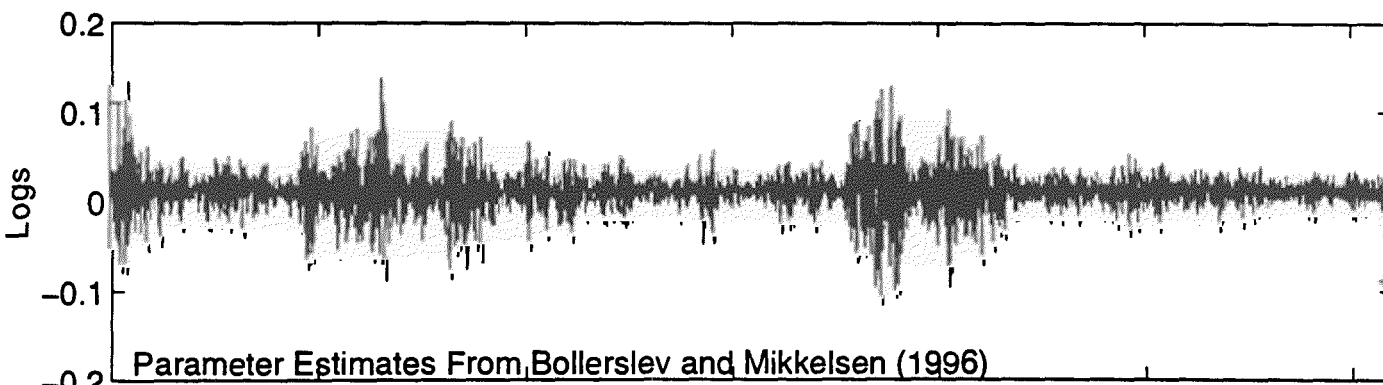
Increments



Simulation 2, FIGARCH, n=6200



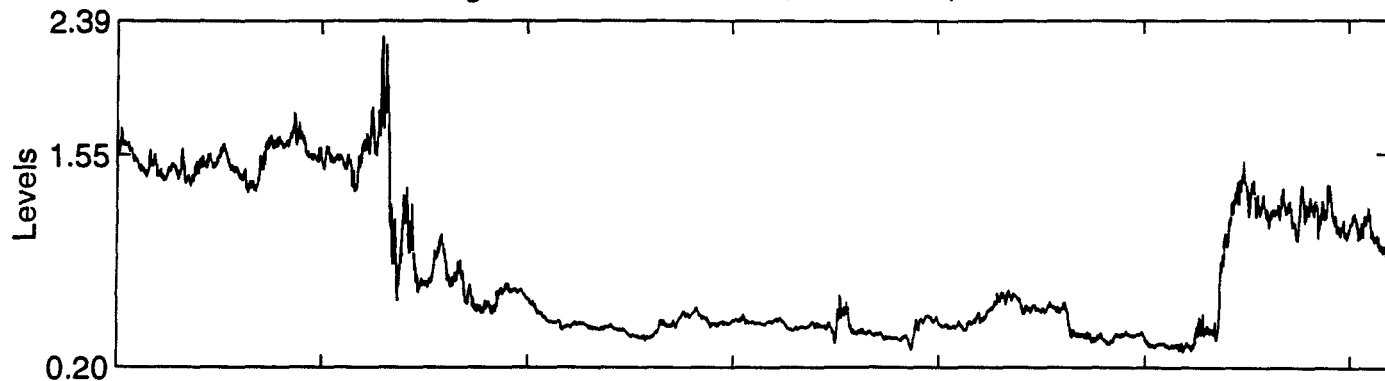
Increments



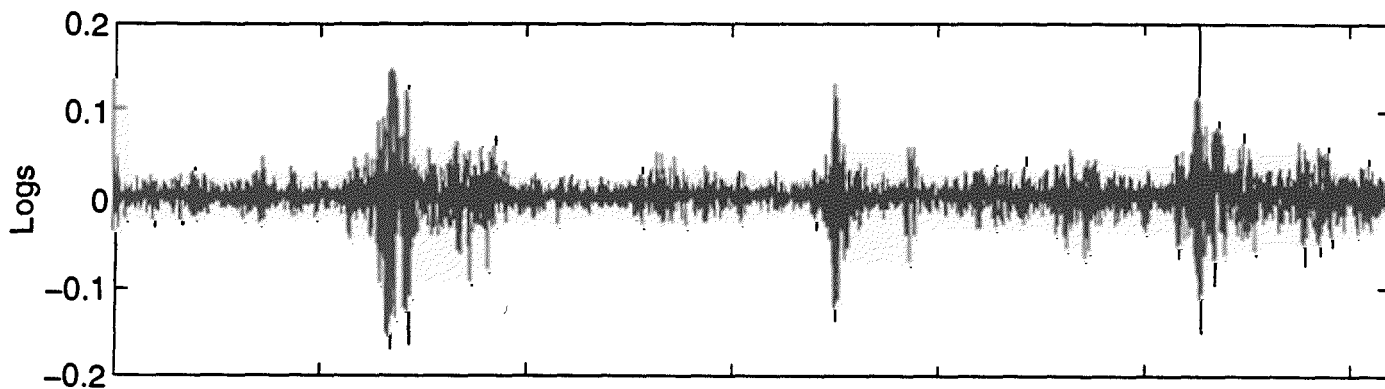
Parameter Estimates From Bollerslev and Mikkelsen (1996)

0 1000 2000 3000 4000 5000 6000

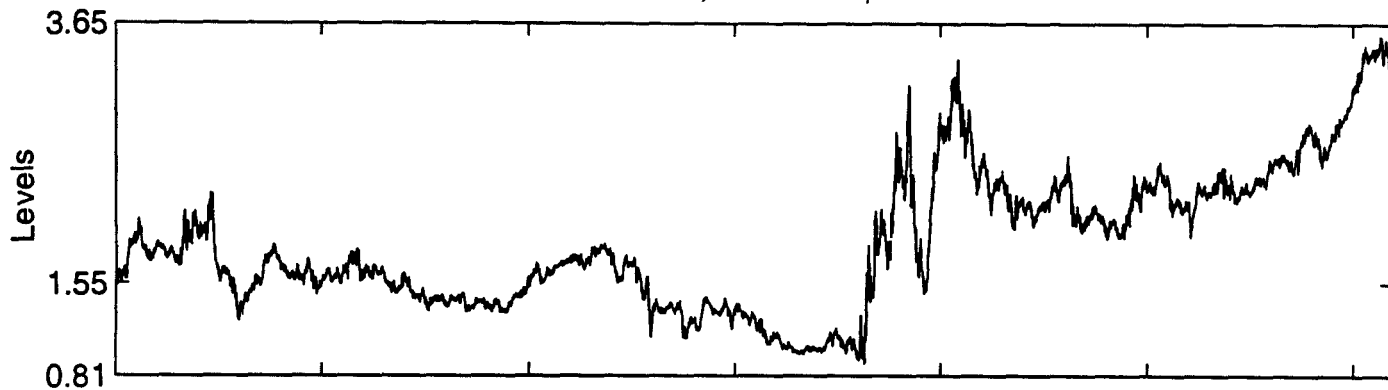
Figure 19b. Simulation 3, FIGARCH,  $n=6200$



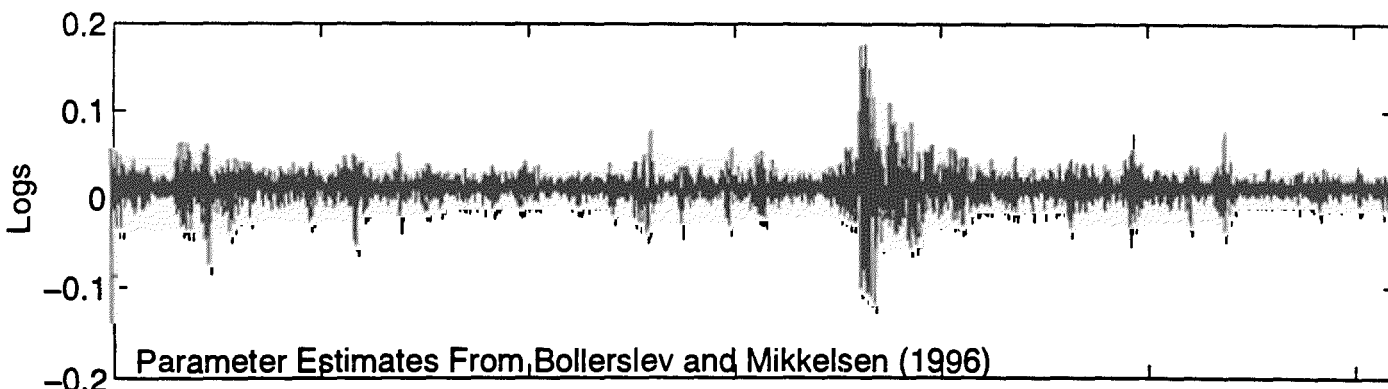
Increments



Simulation 4, FIGARCH,  $n=6200$



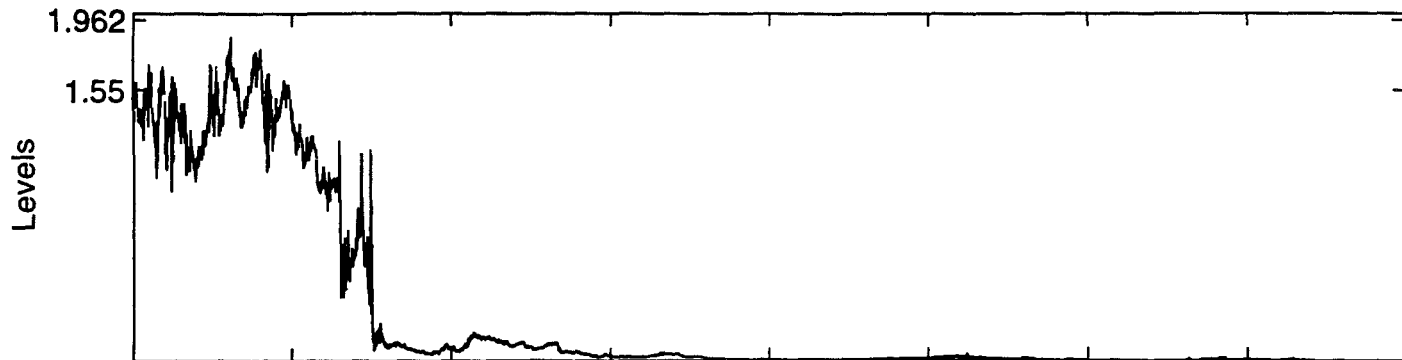
Increments



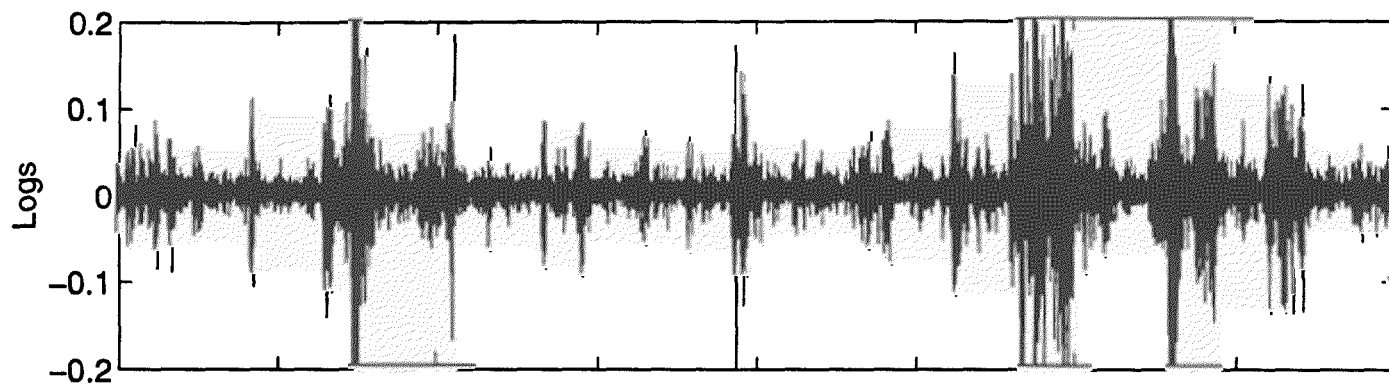
Parameter Estimates From Bollerslev and Mikkelsen (1996)

0 1000 2000 3000 4000 5000 6000

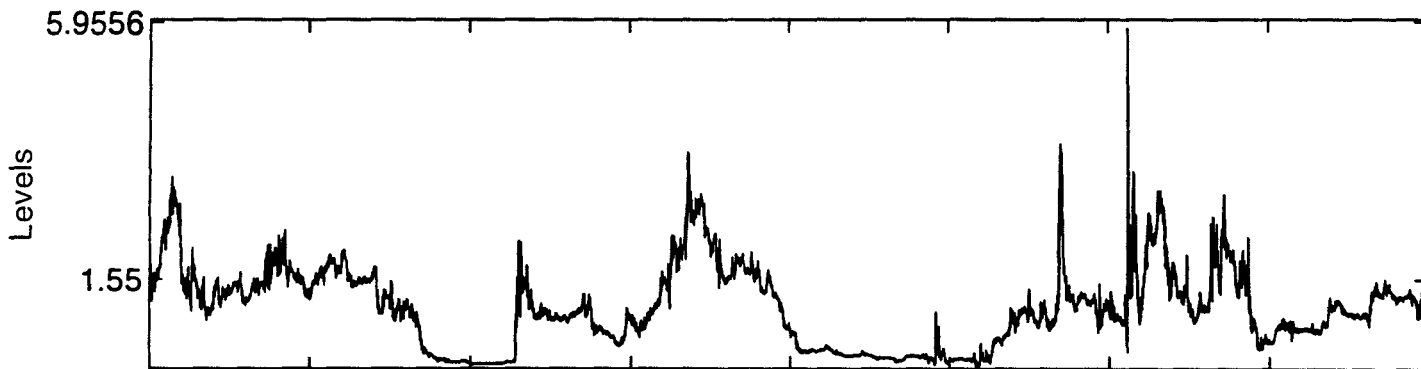
Figure 19c. FIGARCH Simulations, n=40000



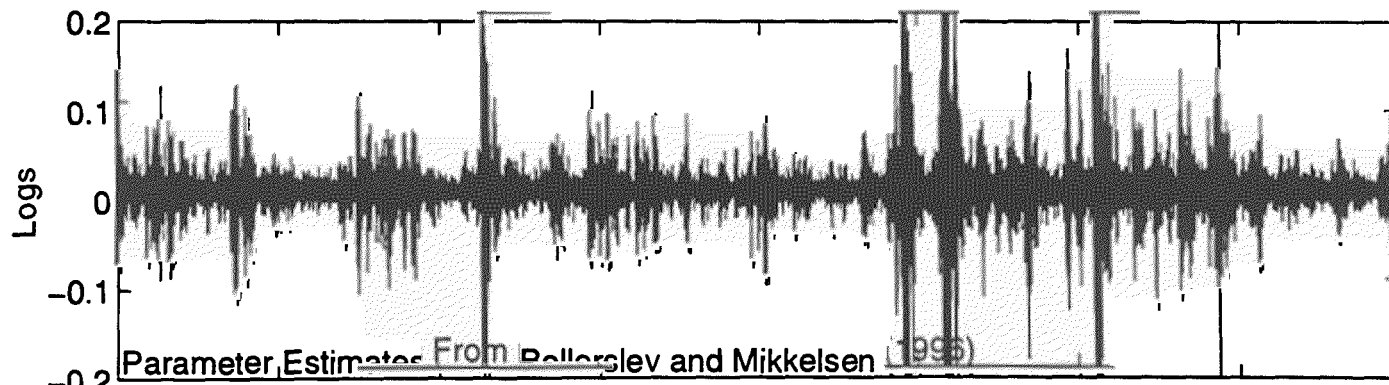
Increments



Simulation 6, FIGARCH, n=40000



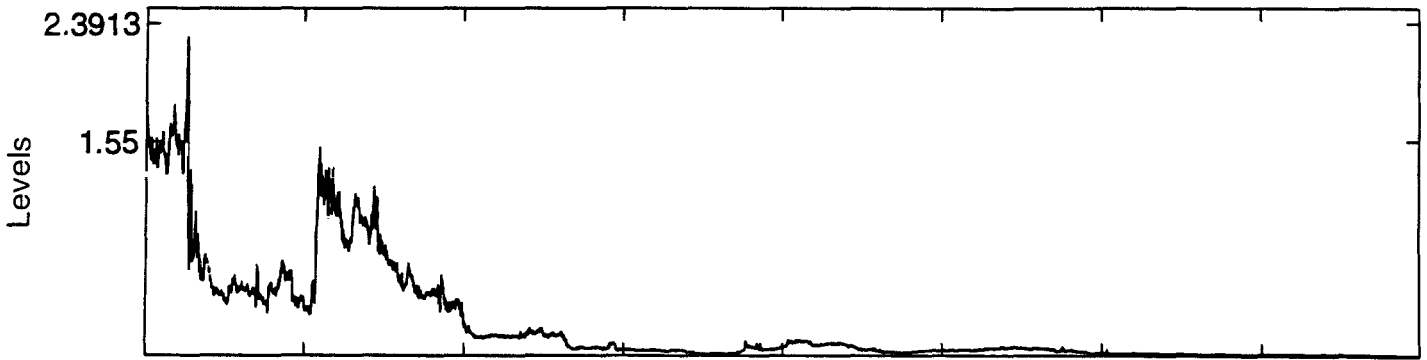
Increments



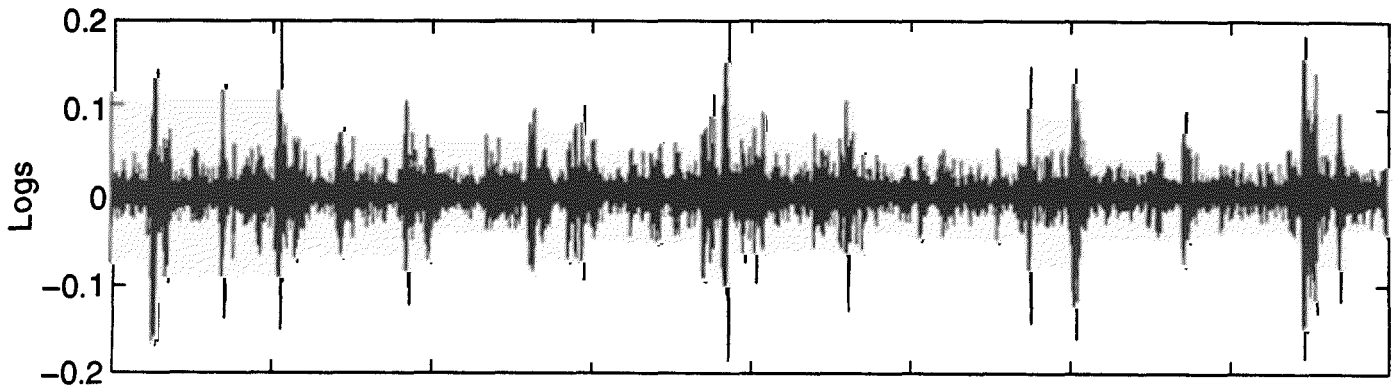
Parameter Estimates From Bollerslev and Mikkelsen (1996)

x 10<sup>4</sup>

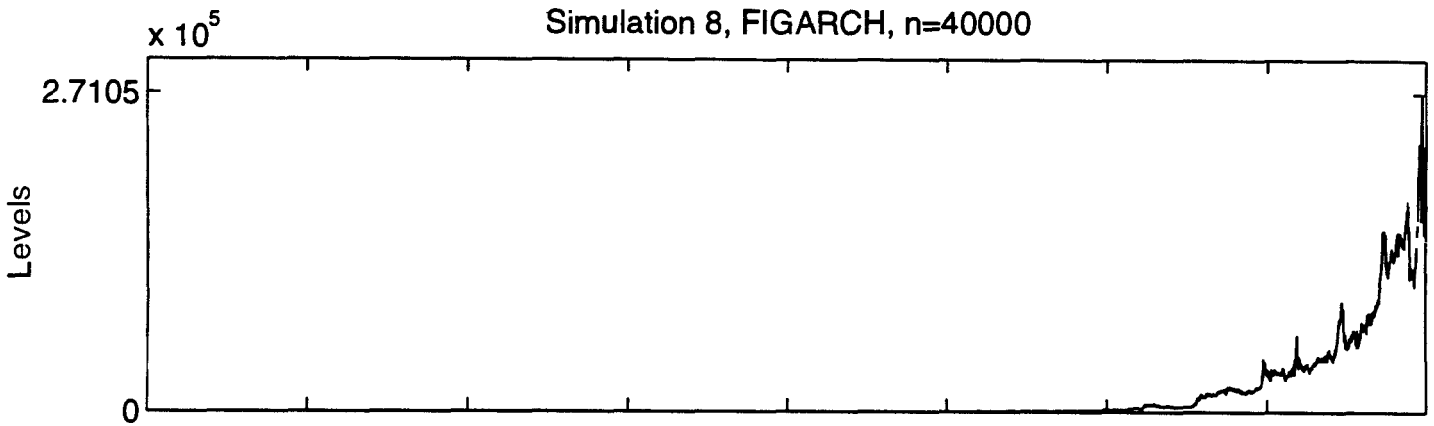
Figure 19d. Simulation 7, FIGARCH,  $n=40000$



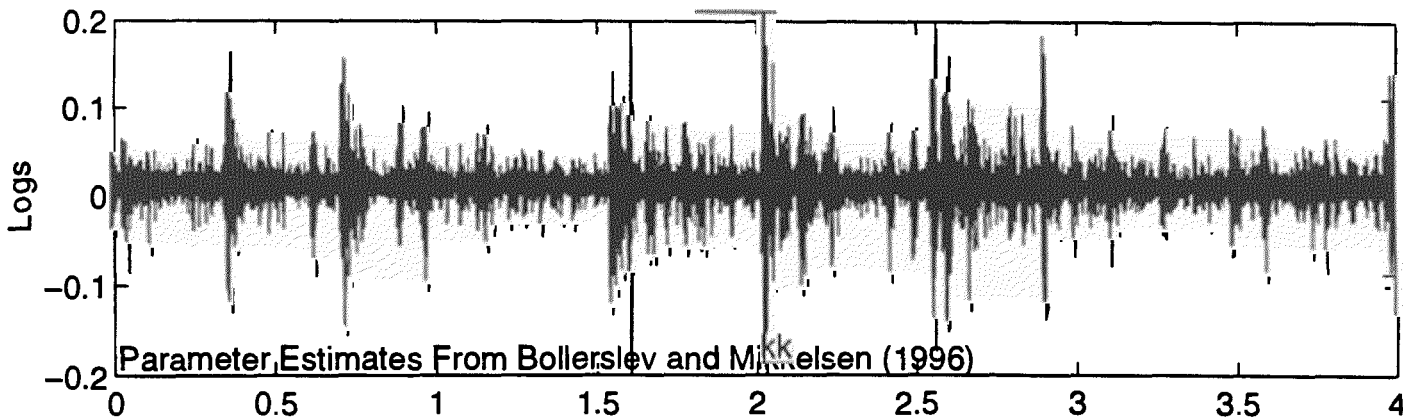
Increments



Simulation 8, FIGARCH,  $n=40000$



Increments



Parameter Estimates From Bollerslev and Mikkelsen (1996)

$\times 10^4$

Figure 20a. Simulated FIGARCH Partition Functions,  $n=10^5$ , High Moments

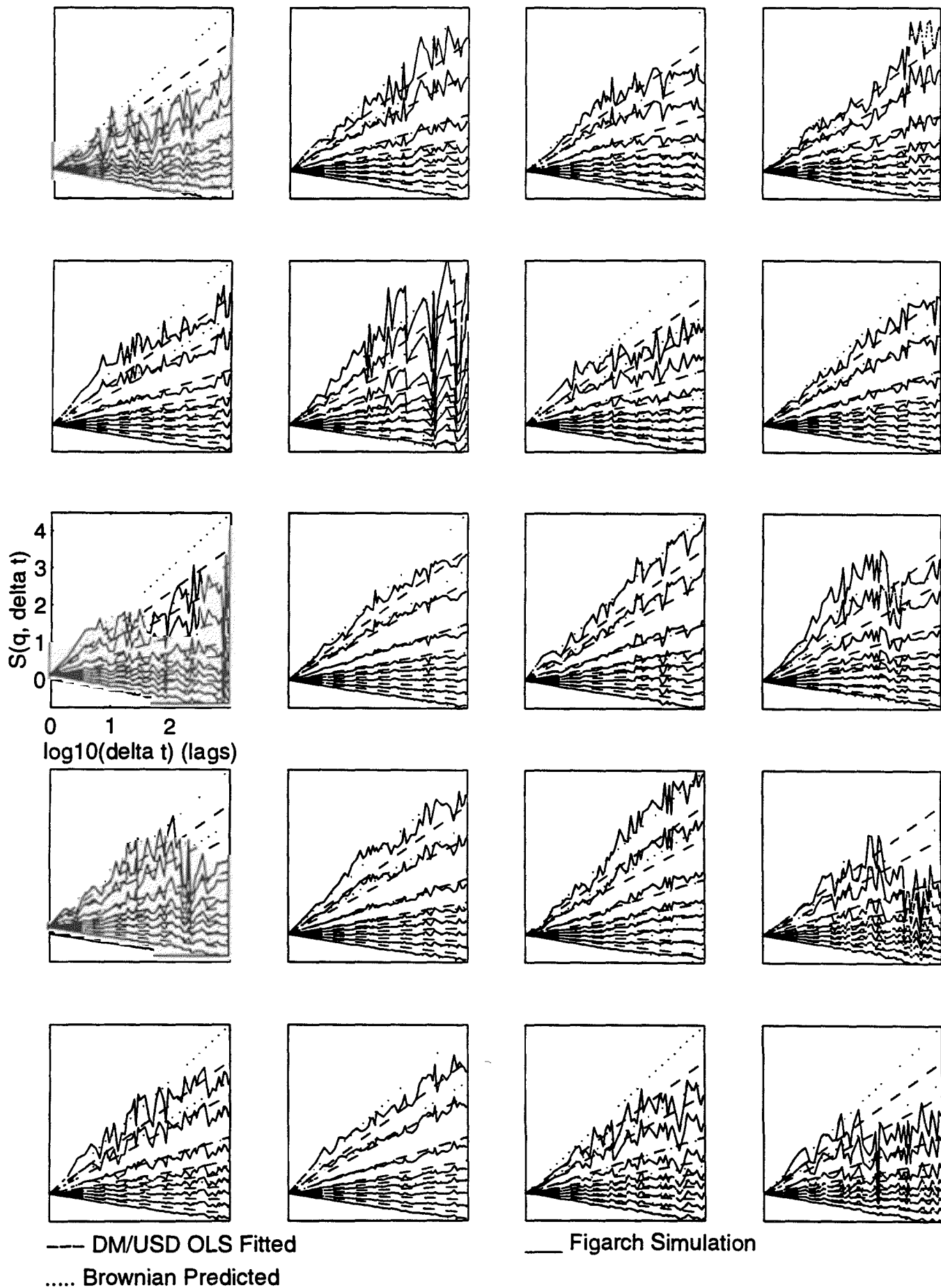
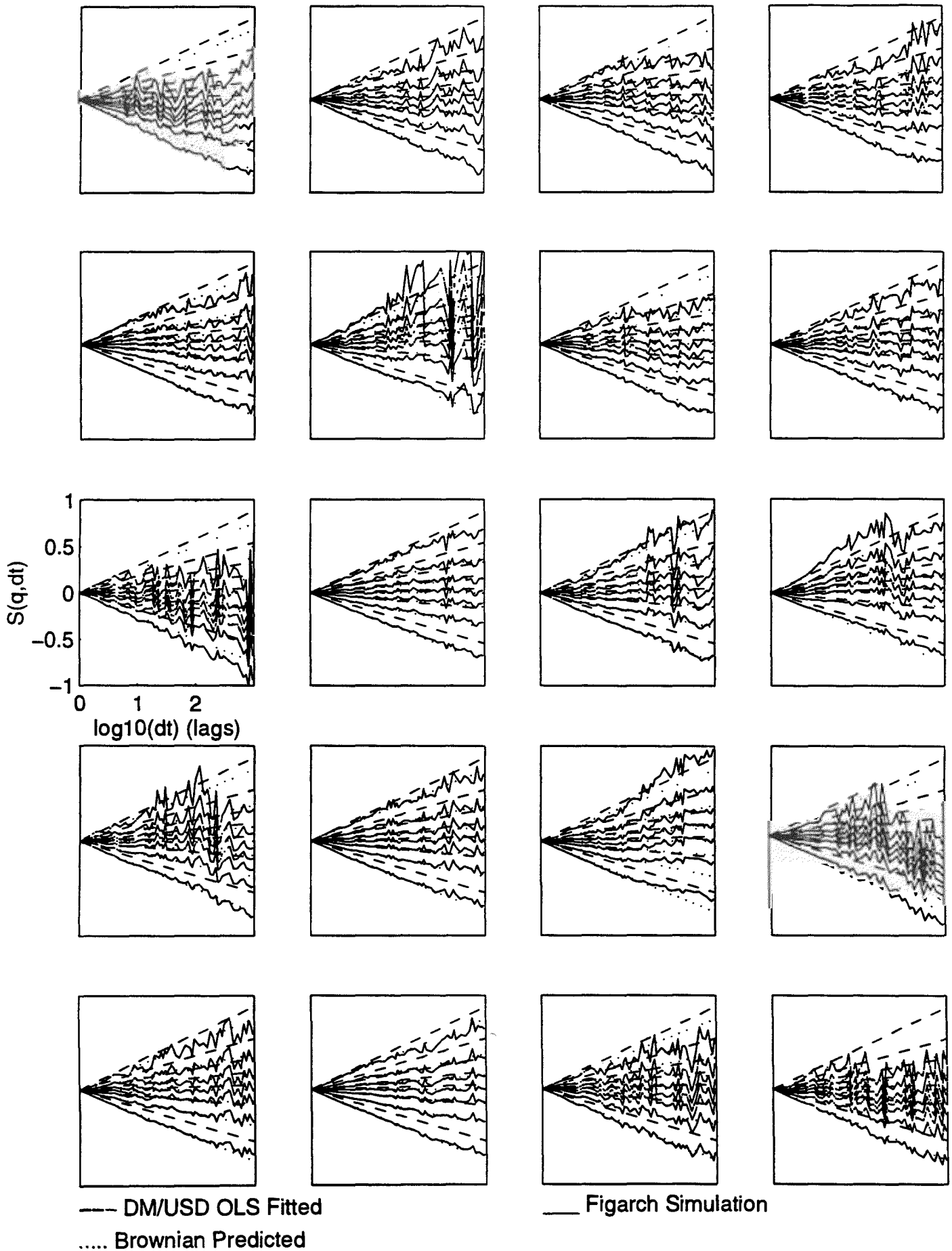


Figure 20b. Simulated FIGARCH Partition Functions,  $n=10^5$ , Low Moments



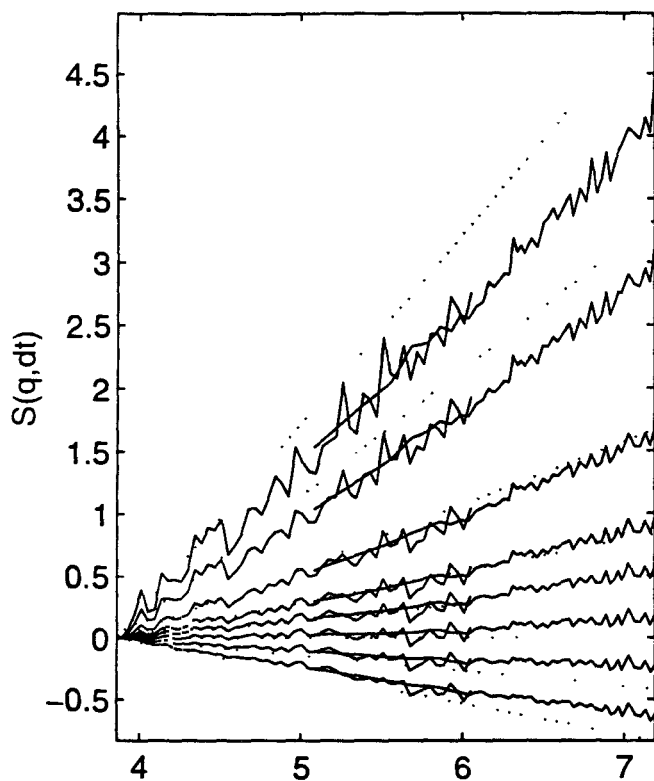
--- DM/USD OLS Fitted

..... Brownian Predicted

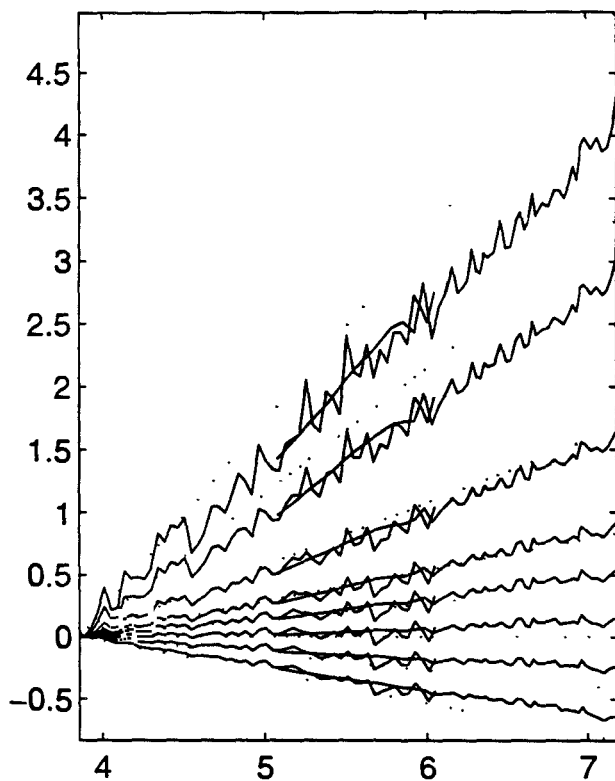
— Figarch Simulation

Figure 21. Robustness of DM/USD Scaling to Change in Daily Data

FED1 Daily Data, Full Sample

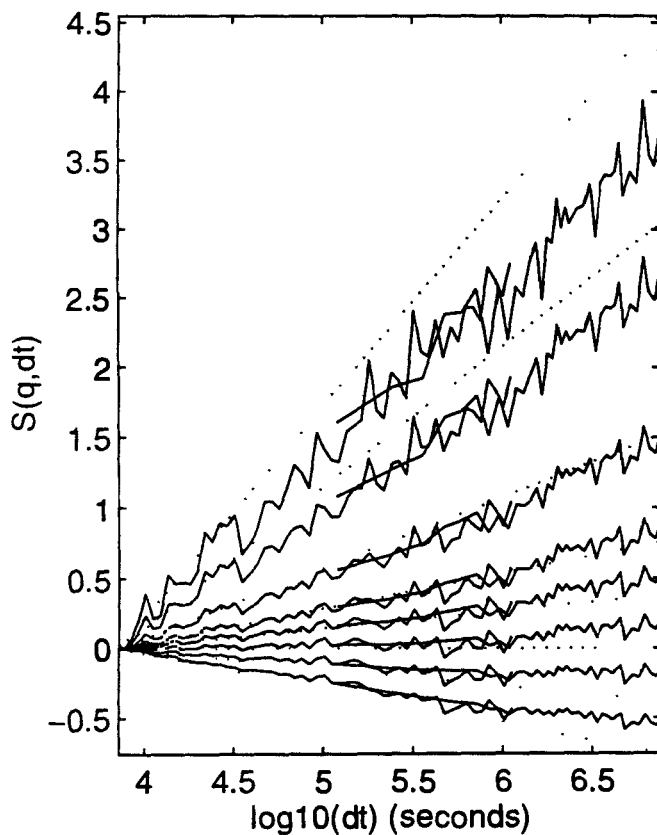


FED2 Daily Data, Full Sample



\*All Plots Use SEAS2 for HF Data

FED1 Daily Data, 1973-1985



FED1 Daily Data, 1985-1997

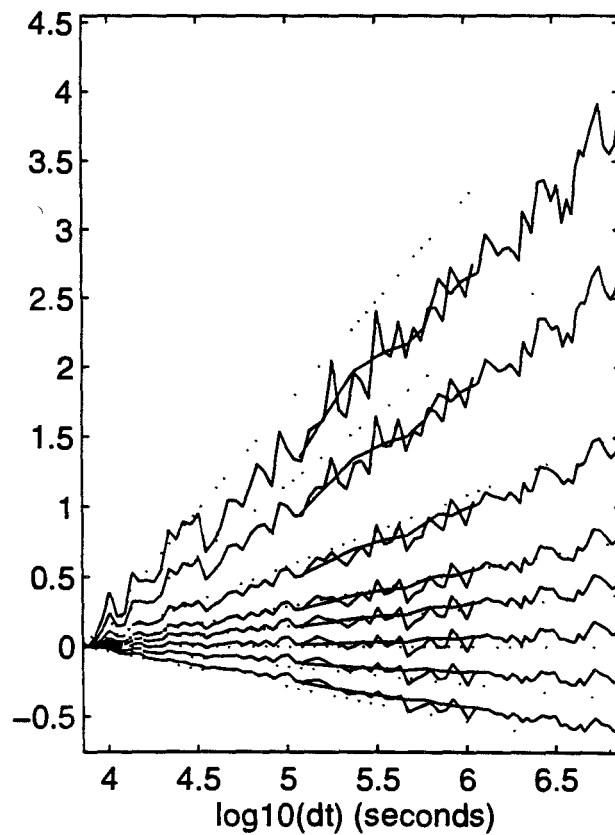
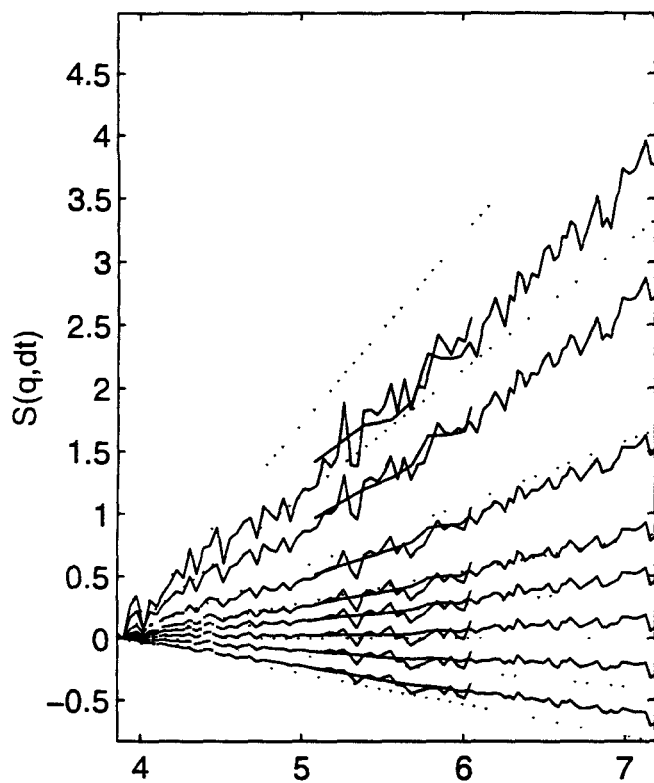


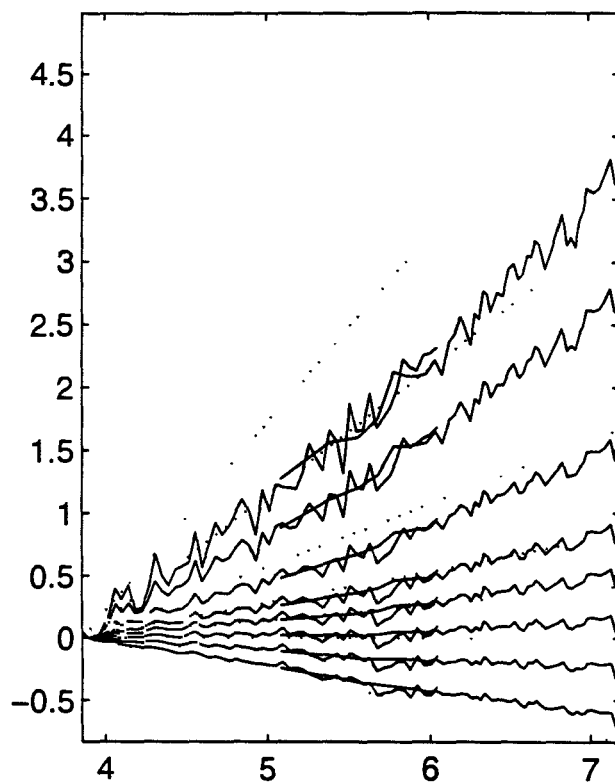


Figure 22. Robustness of DM/USD Scaling to Change in Seasonal Filter

SEAS0

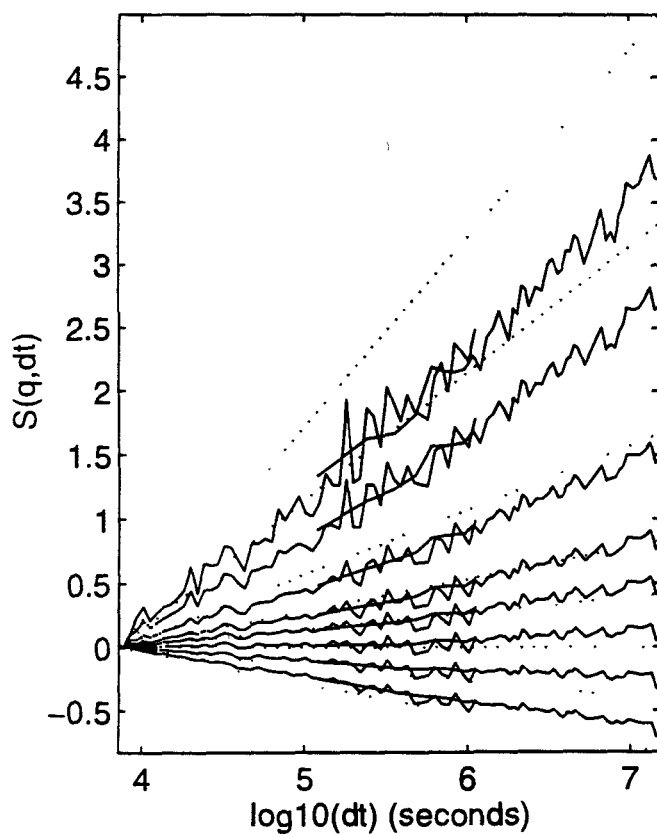


SEAS1



\*All Plots Use Olsen Daily Data

SEAS3



SEAS4

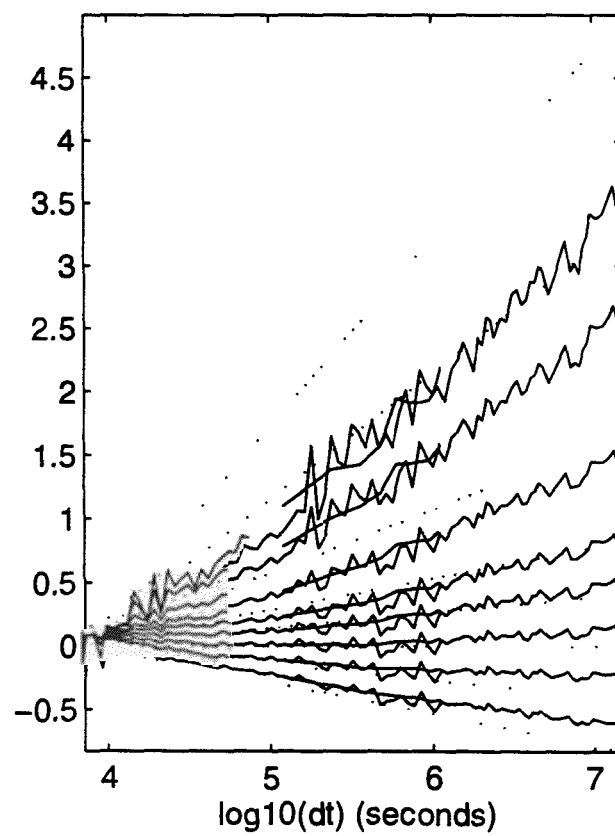


Figure 23. Robustness of Estimated DM/USD Multifractal Spectra

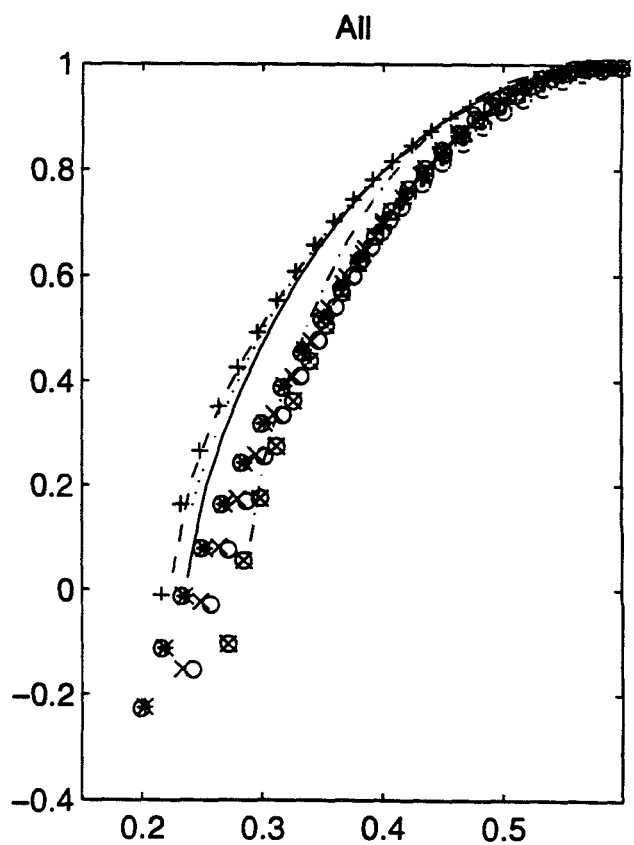
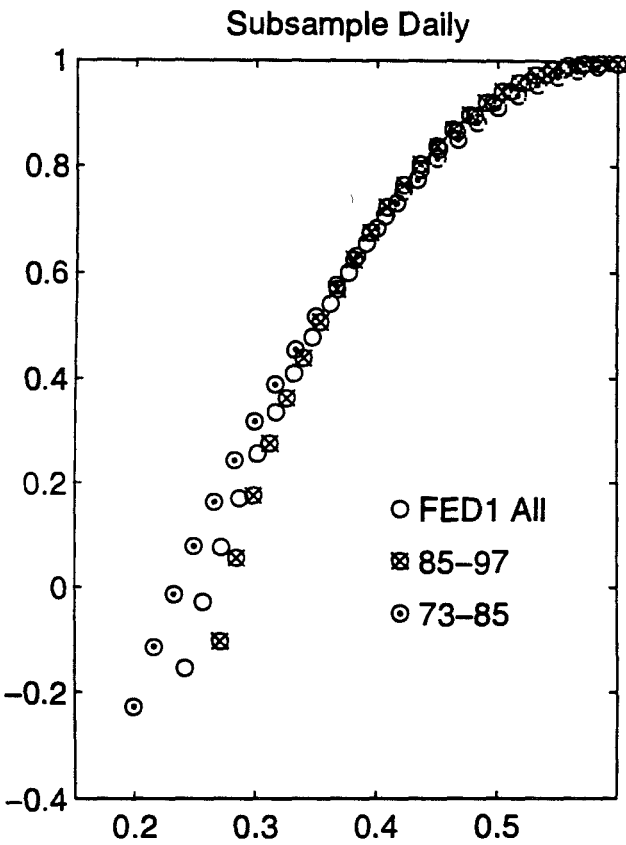
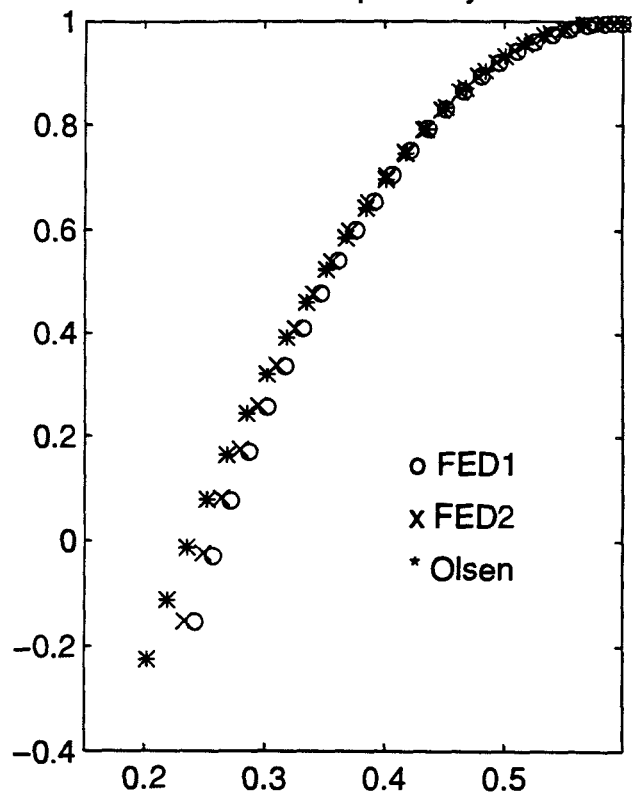
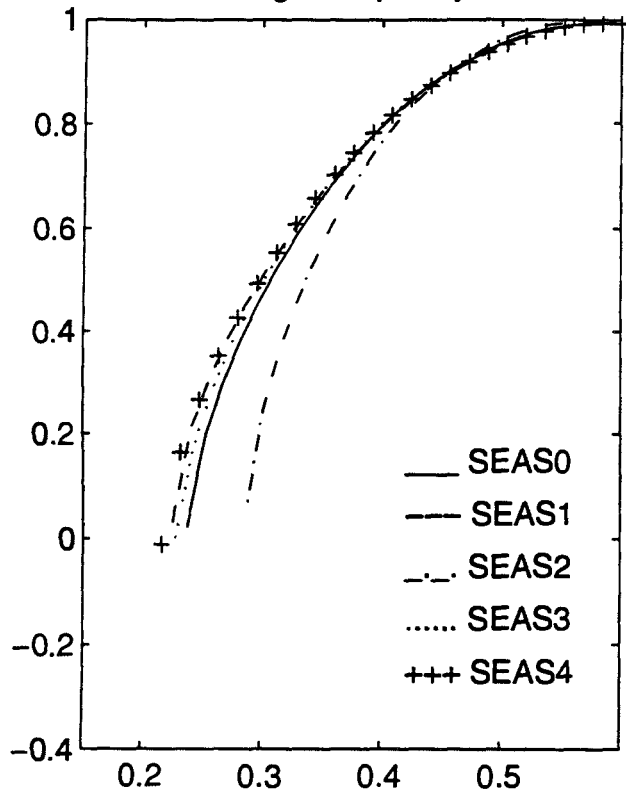
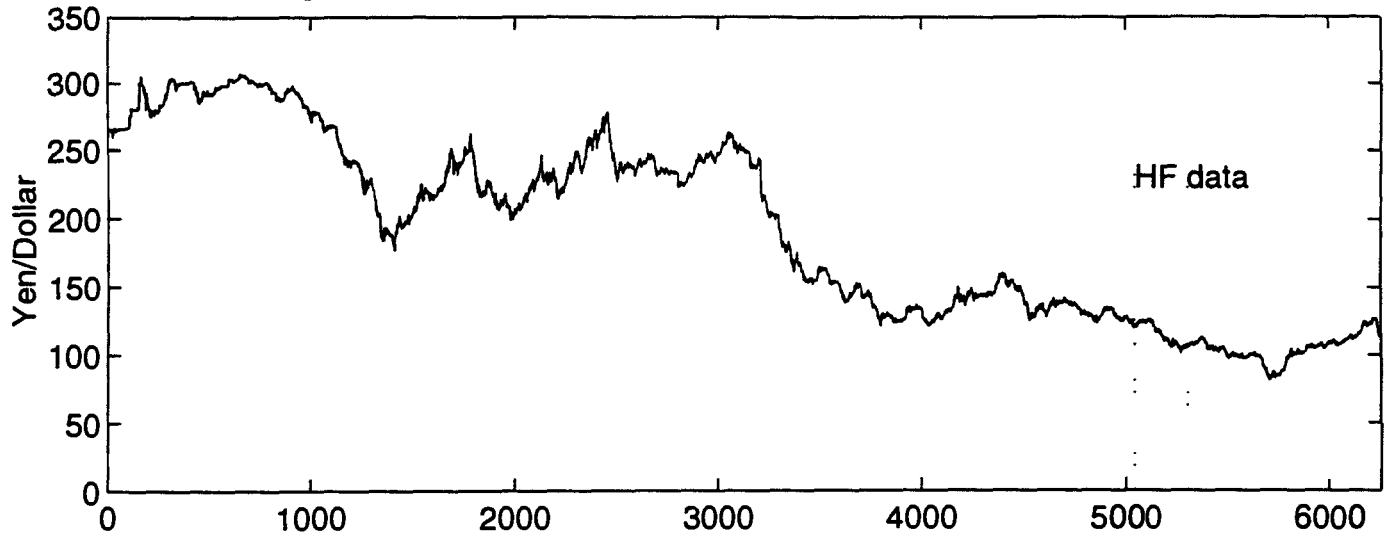
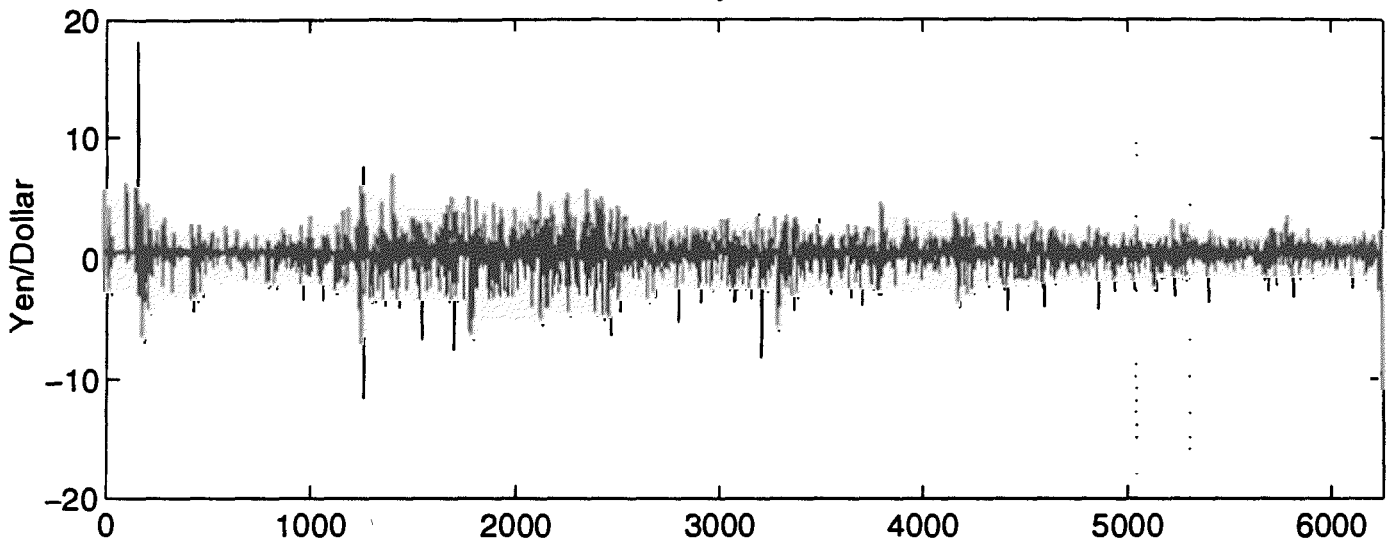


Figure 24. JPY/USD Exchange Rate: June 4, 1974 – June 3, 1997



JPY/USD Daily First Differences



$\ln(\text{JPY/USD})$  Daily First Differences

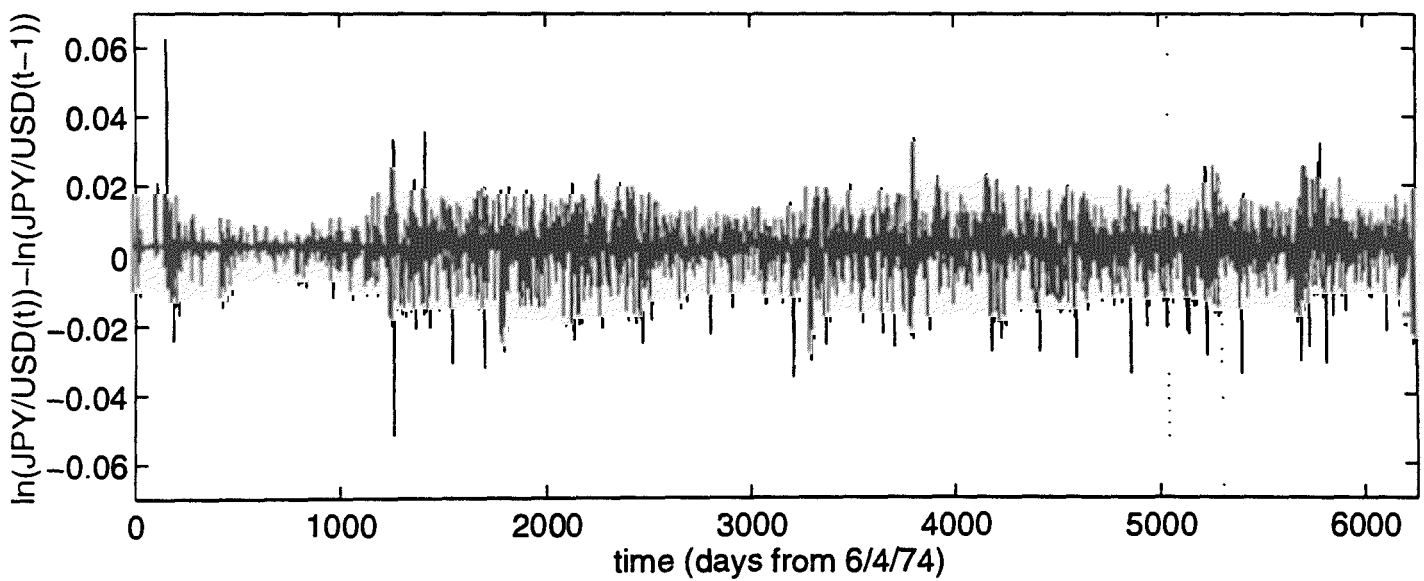


Figure 25a. JPY/USD Weekly Seasonality in Quotes/Clock Time

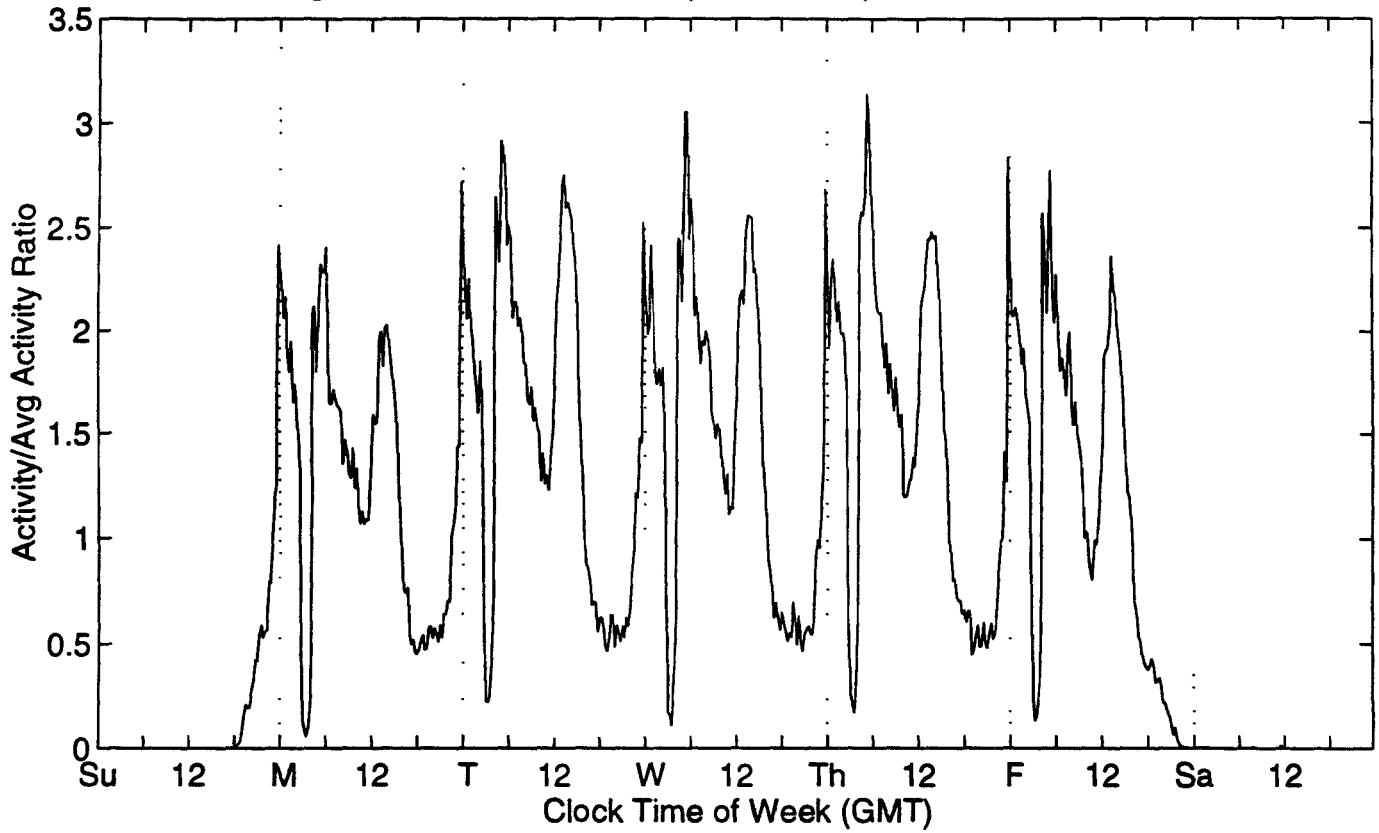


Figure 25b. JPY/USD Weekly Seasonality in Absolute Returns

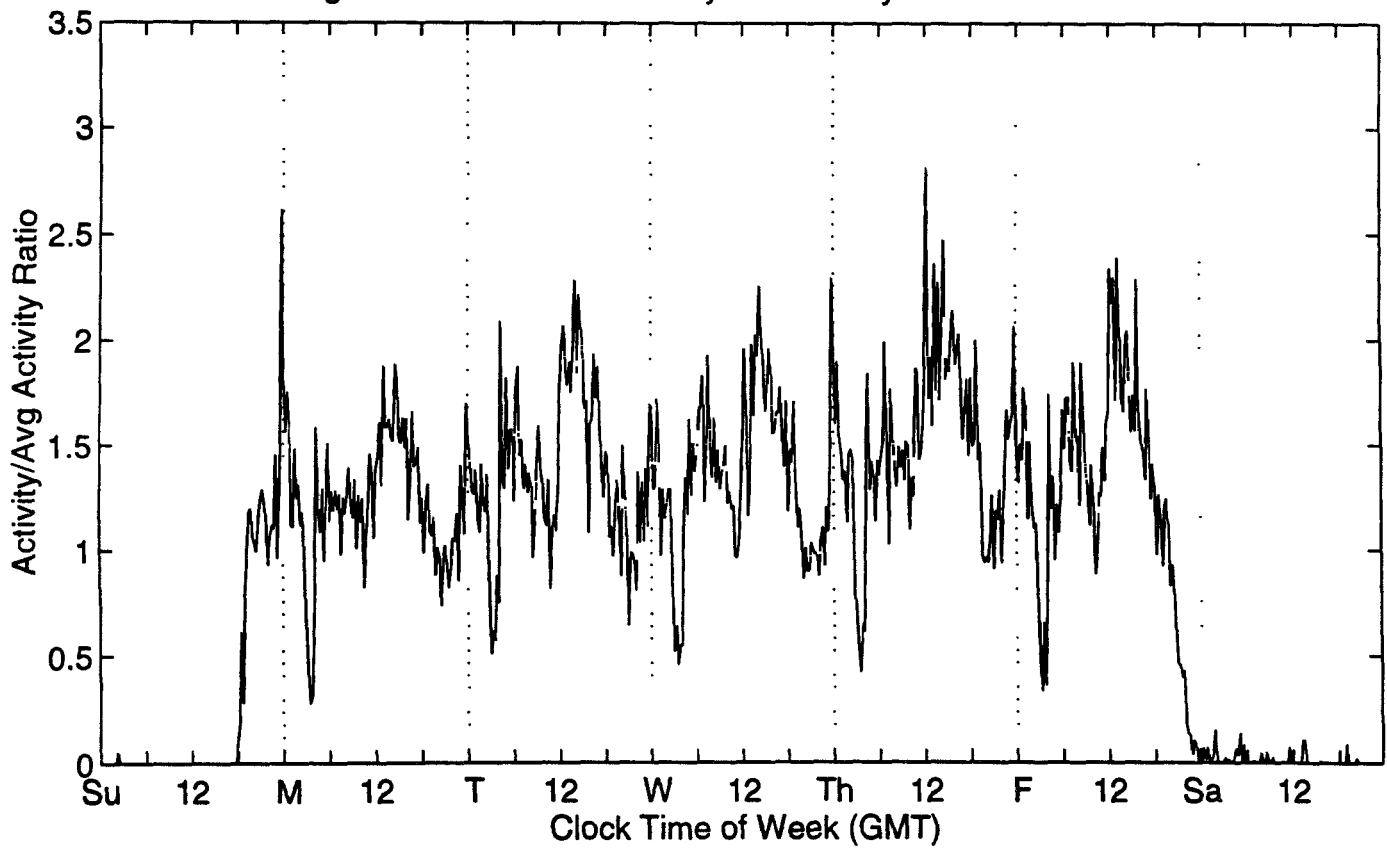


Figure 26. JPY/USD Partition Function, SEAS2

