

## **The empirical analysis of waiting times with respect to price changes and orders**

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The empirical analysis of the dollar-yen exchange data of Sony bank has been investigated. The Sony bank provides internet-based foreign exchange trading services for the individual clients. The trading rule is not a double auction system. The clients can deal in any time on the web at the Sony bank rate which is linked with the market rate and independent of the clients order. The Sony bank rate for dollar-yen is updated when the market rates change more than 0.1 yen. The transaction costs are normally 0.25 yen per dollar. As of April, 2005, about 370,000 clients join the services. Then we investigate the statistical properties of rate change waiting times and order waiting times in dollar-yen exchange data of Sony bank. First, we show that the price change does not occur randomly and there are more price changes with a short time interval and less price changes with a long time interval. The cumulative distribution function of rate change waiting times is well fitted by a Weibull distribution, which is commonly used to the time to failure. This is consistent with the recent empirical study of high frequency data [Raberto et al. 2002] that the distribution of waiting times between transactions is non-exponential, although the Sony bank rates are less frequent than the market rates. Second, we find that not only price change waiting times but also order waiting times follow a Weibull distribution. The results indicate that individual behavior is related to the past order history, since the order arrival process is not simple poisson process. Finally, it is interesting to note that the estimated shape parameter of the Weibull distribution for price changes and orders are almost the same value.