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Trading intensity, volatility, and arbitrage activity

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Abstract

The objective of this paper is to uncover the determinants of trading intensity in futures markets. In particular, the time between adjacent transactions (referred to as *transaction duration*) on the FTSE 100 index futures market is modeled using various augmentations of the basic autoregressive conditional duration (ACD) model introduced by Engle and Russell [Econometrica 66 (1998) 1127]. The definition of transaction duration used in this paper is an important variable as it represents the inverse of instantaneous conditional return volatility. As such, this paper can also be viewed as an investigation into the determinants of (the inverse of) instantaneous conditional return volatility. The estimated parameters from various ACD models form the basis of the hypothesis tests carried out in the paper. As predicted by various market microstructure theories, we find that bid–ask spread and transaction volume have a significant impact upon subsequent trading intensity. However, the major innovation of this paper is the finding that large (small) differences between the market price and the theoretical price of the futures contract (referred to as *pricing error*) lead to high (low) levels of trading intensity in the subsequent period. Moreover, the functional dependence between pricing error and transaction duration appears to be non-linear in nature. Such dependence is implied by the presence of arbitragers facing non-zero transaction costs. Finally, a comparison of the forecasting ability of the various estimated models shows that a threshold ACD model provides the best out-of-sample performance.

JEL classification: C22; C41; G14
Keywords: Futures trading; Autoregressive conditional duration models; Threshold models; Arbitrage

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1. Introduction

Accurate forecasts of the conditional volatility of asset returns is of extreme importance in the areas of risk management and option pricing. In the former, the concept of Value-at-Risk (VaR) has become a widely used method for measuring the market risk of portfolios. It is defined as the tolerable amount of capital that can be lost in the next period for a given predetermined probability. Clearly an accurate forecast of volatility is important here if the solvency of the portfolio owner is to be maintained. Likewise, as the price of an option contract is a function of the volatility of the underlying asset returns, a similar degree of accuracy is required by buyers and sellers of such contracts. Given this importance it is not surprising that a vast literature exists concerning appropriate ways to model conditional volatility.

The conventional approach to modeling conditional volatility is almost always based on the autoregressive conditional heteroscedasticity (ARCH) model introduced by Engle (1982), or one of many generalizations of this model (see Bollerslev (1986) and Nelson (1991), for examples within this vast literature). A common feature of these models is that conditional volatility in the next period is a function of current and previous conditional volatility and/or the square of unexpected returns. In using this form of temporal dependence one necessarily imposes restrictions concerning the sampling frequency of the data. This inevitably leads to ad hoc frequency selection and thus information loss. For example, return volatility measured at hourly intervals could imply zero return volatility even though returns within the interval are highly volatile. At the other extreme, selection of too high a frequency may result in many intervals with no new information and, hence, may induce various forms of heteroscedasticity into the data. To avoid these problems the current paper makes use of various duration models capable of modeling (the inverse of) instantaneous conditional return volatility.

Duration models focus on the times between events and, therefore, do not impose any sampling frequency assumptions. In the current context the event is defined as a *non-zero price impact trade* on the FTSE 100 index futures market with the times between these events being referred to as *transaction duration*. [1] As is shown explicitly in Engle and Russell (1998), there exists an inverse relationship between the conditional expectation of this type of transaction duration and instantaneous conditional return volatility. This follows from basic intuition whereby if transaction duration is expected to be low (high) then it follows that prices are expected to change (in absolute terms) rapidly (slowly). Therefore, by using this particular definition of transaction duration one is able to interpret the models used as models of (the inverse of) instantaneous conditional return volatility.

[1] A non-zero price impact trade is defined as a trade which contains a price that is different from the price observed in the previous trade.