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Intra-day periodicity, temporal aggregation and time-to-maturity in FTSE-100 index futures volatility

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Abstra

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contracts are also considered, but are statistically rejected for both forms of periodicity-adjusted data.

Notes

[1] For reviews, see Bollerslev et al. (1992), Bera and Higgins (1993), and Bollerslev et. al. (1994).

[2] See, for example, Guillaume et al. (1995), Müller et al. (1996), Dacorogna et al. (1997) and Andersen and Bollerslev (1997a).

[3] See, for example, Wood et al. (1985), Harris (1986), McInish and Wood (1988) for evidence of a ‘U’-shape pattern in the intra-day volatility of stock returns traded on the NYSE, Jain and Joh (1988) for the S&P 500 index, and Eckman (1992) for S&P 500 index futures.

[4] Andersen and Bollerslev (1997a), for example, found that such adjustment leads to improved GARCH model performance in their analysis of deutschmark–dollar exchange rate and S&P 500 stock index futures returns, but still note some discrepancy between estimate [illegible] regation. Also see [illegible]

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[7] This da [illegible] r 1991 sample [illegible] 93 sample analysed by Abhyankar et al. (1999).

[8] Since multiple futures contract maturities are traded at any given time, some criterion must be set in order to obtain a continuous price series. The point at which the price data taken switches from one contract to another is frequently termed the rollover date. In the data analysed here, contract price splicing is conducted on the day prior to expiry, resulting in 14 rollover dates due to the quarterly expiry cycle of FTSE-100 futures in March, June, September and December. This is a standard method of constructing an continuous price series from high frequency futures data (Becker et al. 1995), and given that the contracts examined are heavily traded, such a sampling procedure should induce no systematic bias.

[9] Eighteen days were discovered to have been lost from the data-tape. These days were: 2 March 1992; 21 May 1992; 31 July 1992; 29 and 30 September 1992; 7 October 1992; 5–8, 23, 26 July 1993; and 7–10, 13, and 14 December 1993.

[10] An alternative approach employed in the literature is to take price data on the nearest maturity (front month) contract until the day that traded volume in that contract is exceeded by traded volume in the second nearest contract (e.g. Abhyankar et al., 1995). This procedure ensures that price data for the most liquid contract is always used. Inspection of traded volume for FTSE-100 futures contracts reveals that volume rollover was indeed on the day immediately prior to expiry in all but one case, and on the expiry date itself in the remaining case. The standard splicing criterion
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[13] Among alternative approaches, Baillie and Bollerslev (1991) suggested introducing a simple dummy variable for each intra-day interval, while Müller et al. (1990), Dacorogna et al. (1993) and Guillaume et al. (1995) suggested using time scale transformations, based on polynomial approximations to activity in distinct geographical regions over the twenty-four hour trading cycle. The former approach has the disadvantage of requiring a large number of additional parameters to be estimated at the higher intra-day frequencies. The innovative latter approach, while appealing in the context of the foreign exchange market, has little direct bearing in the context analysed here, and our attention therefore focuses on the more general adjustment procedures described in the text.

[14] The restriction $\rho<1$ is also required for stability and covariance stationarity of the error process, and as a necessary condition for the existence of a finite unconditional variance. As shown by Nelson (1990), the integrated-GARCH arising under $\rho = 1$ (Engle and Bollerslev, 1986) nevertheless remains strictly stationary and ergodic.

[15] In the terminology of Drost and Nijman, financial returns are modelled as ‘flow’ variables, such that $r_t = \Delta x_t$, where x_t, the (logarithmic) security price, is a ‘stock’ variable.

[16] While the first-order GARCH model is a widely preferred specification for the modelling of return volatility dynamics, and that specification corresponds to the class
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not only upon the parameters of the high frequency model, but also on the high frequency kurtosis. The implied low frequency kurtosis level is given by:

while the relationship between the kurtosis of the rescaled innovations and is given by:

For further details, see Drost and Nijman, (1993), p. 920, Table 1and Equations 13–18 in particular.

[18] Among the various possible explanations for this paradoxical result, it has been suggested that intra-day volatility may be reflect the aggregation of numerous volatility components, each of which is endowed with a particular dependence structure due to the arrival of heterogeneous information flows (Andersen and Bollerslev, 1997b). If the decay of the short-run component(s) dominates over inter-day frequencies, and the long-run volatility component(s) dominate over inter-day and lower frequencies, the aggregation of such component processes will give rise to the near-integrated dependencies commonly found in the inter-day volatilities of many asset prices. For further discussion of this and related approaches, see Andersen and Bollerslev (1997b) and Müller et al. (1997).