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The intraday directional predictability of large Australian stocks: A cross-quantilogram analysis

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ABSTRACT

This study investigates the directional predictability of overnight periods for intraday returns of large Australian stocks. The intraday reactions to overnight developments are studied using cross-quantilograms, a new, flexible methodology that facilitates detailed insights into the quantile dependence between two time series. The results provide evidence for the existence of intraday reversals after overnight periods that carry very bad news, whereas the picture of the short-term reactions to very positive overnight returns is mixed. The observed rebounds concern extreme quantiles and occur with a short delay during the first part of the trading day. The study also shows that continuation and reversal effects are not mutually exclusive. The economic significance of the identified patterns is illustrated by analysing the performance of a simple contrarian strategy.

1. Introduction

Stock market securities' short-term reactions to large price movements are important to both academia and practitioners, as they concern financial markets' efficiency and securities prices' predictability, which could be exploited to earn abnormal returns. This issue has received considerable attention in literature, but the results are mixed. The current study uses the newly introduced cross-quantilogram of Han et al. (2016), a powerful and flexible approach, to investigate the directional predictability in the Australian equity market. In particular, we study intraday stock performance after overnight returns fall in extreme quantiles.

Reviewing more than sixty papers in the area of financial markets' short-term predictability, conditional on large price changes, Amini et al. (2013) demonstrate that the literature has investigated a wide range of markets, assets, time periods, and sampling frequencies.[1] Extant studies vary in terms of methodology and findings, and an important point is the definition of what makes a large price move large. Most of these studies use a pre-defined absolute number, with the 10% threshold very common (Corrado and Jordan, 1997; Yu and Leistikow, 2011; Larson and Madura, 2003; Choi and Jayaraman, 2009, among others). Fewer studies define a large price move in other terms, including as an asset-pricing model's residual (e.g., Lasfer et al., 2003), the range between the most extreme price observations during a certain period (e.g., Ma et al., 2005), the number of extreme observations on a rolling basis (e.g., Hirschey, 2003), or a move measured in terms of standard deviations (e.g., Zawadowski et al., 2006) that exceeds a certain level. Accordingly, while some studies identify reversals after both large price increases and large price declines (e.g., Fung et al., 2000; Hirschey, 2003), others observe reversals in one case but not both (e.g., Claes et al., 2010; Klössner et al., 2012). In contrast, some contributions document continuations after large price movements (e.g., Koutmos, 1998; Mazouz et al., 2009). In addition, most of the studies look at daily frequencies, while only a few use intraday data (e.g., Wang et al., 2009; Zawadowski et al., 2006; Ammann and Kessler, 2009), although gaining insights into the return predictability at high frequencies is essential for intraday traders.

The present study fills the void identified by Amini et al. (2013) regarding the intraday return dynamics and predictability, investigating in particular the intraday behaviour of ten major Australian stocks after extreme overnight returns.[2] This issue is particularly important for Australia as the Australian Stock Exchange (ASX) operates in a six-hour trading day from 10:00 Australian Eastern Standard Time (AEST) (00:00 GMT) to 16:00 AEST (06:00 GMT). Therefore, trading takes place only during the night in major US and European markets while the ASX is closed when the US and European markets are open (Fig. 1). Information

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[1] Some of the prominent papers in these area are Fung et al. (2000), Fung et al. (2008) and Grant et al. (2005).

[2] Many investors have large holdings of individual stocks (e.g., Campbell et al., 2001), justifying the need for investigating short-term reactions at more than a market index level.

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Fig. 1. Open hours of major exchanges, measured in Greenwich Mean Time (GMT). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

that arrives overnight in Australia may reflect local market news accumulated during non-trading hours and news that originates from other markets.[3] The market efficiency paradigm postulates that the events that occur overnight (during non-trading hours) are typically reflected rapidly in asset prices when the new trading day begins, ideally in the prices at the market opening. However, motivated by existing research on short-term stock price reactions, we investigate whether extreme overnight returns can cause overreactions, resulting in subsequent price adjustments.

The past few years have witnessed vibrant theoretical developments in modelling the multivariate lead-lag cross-correlations beyond the conditional mean (e.g., Davis and Mikosch, 2009; Davis et al., 2012, 2013). The quantilogram of Linton and Whang (2007) was developed to measure and test the directional predictability of a stationary time series at various quantiles. Recently, Han et al. (2016) extended the univariate quantilogram to a multivariate version, the bivariate cross-quantilogram. The cross-quantilogram is an easy-to-interpret method that measures whether a time series can predict another time series in another part of the distribution. Since the method is based on quantile hits it does not require moment conditions. Consistent confidence intervals can be obtained with stationary bootstrapping. Other than Han et al. (2016), who look at the volatility-return relationship and dependence on systematic risks at daily or lower frequencies, the present study is the first to apply the cross-quantilogram to equity markets.[4]

Our study is related to Berkman et al. (2012). However, while these authors focus on positive overnight returns, we study the whole empirical return distribution. Moreover, Berkman et al. (2012) show that intraday reversals following positive overnight returns are more pronounced for stocks which are difficult to value and costly to arbitrage. In contrast, we rule out these effects by focusing on the most liquid shares in the Australian market. Our methodology is particularly suitable for investigating the dependence of intraday returns on the immediately preceding overnight development and providing detailed insights into the quantile dependence of stock returns. More specifically, it is possible simultaneously to uncover continuation and rebound effects, which cannot be done with commonly used methodologies in this area of research. By relating the magnitude of overnight returns to their own empirical distribution, the more or less arbitrary nature of defining "large" returns boils down to the choice of historical quantiles. Bertram (2004) studies the time-series properties of a large stock sample of the Australian market with intraday data and advocates treating the stock price as two separate processes: an intraday process and an overnight process. In a study on volatility modelling, Andersen et al. (2011) decompose the total daily return variability into the continuous sample path variance, the variation arising from discontinuous jumps that occur during the trading day, as well as the overnight return variance based on the notion for a very different price dynamics exhibited by overnight and intraday returns. These results provide an imperative for treating overnight and intraday returns as two individual time series. Thus, the current study aligns also with the strand of recent literature seeking to exploit the informational content inherent in time series other than the own intraday return history (e.g., Narayan et al., 2015; Narayan and Sharma, 2016; Phan et al., 2016, among others). For example, Narayan et al. (2015) show that order imbalances can be utilized to predict intraday Chinese stock returns. Narayan and Sharma (2016) investigate the potential of S & P500 futures returns to predict Chinese spot market returns. Phan et al. (2016) show that trading activity indicators such as bid-ask spreads and trading volume information can be employed to improve the performance of price volatility forecasts.

Based on intraday data from January 2010 to March 2016, we observe negative and significant cross-quantilograms for extreme quantiles to find that, after a non-trading period with very low returns, the likelihood of having a large positive intraday return increases. After particularly bad overnight developments, the intraday stock prices tend to rebound and exhibit values that are often assigned to the opposite extreme of the intraday return distribution; on the contrary, intraday price behaviour after nights of very positive return developments measured in terms of quantile dependence does not suggest consistent reversal effects. Extending the intraday horizon up to open-close (daily) returns shows that rebounds emerge at the beginning of the trading day, and their overall impact tends to fade during the next few hours. In addition, the cross-quantilograms show that continuation and reversal effects are not mutually exclusive, which is a cue to the varying results documented in the literature. Finally, based on a simple contrarian rule motivated by the documented cross-quantilogram results, we investigate the economic significance of the identified intraday reversals, taking bid-ask spreads into account.

The structure of the paper is as follows. Section 2 introduces the cross-quantilogram, followed by Section 3, which describes the data. Section 4 presents and discusses the findings, and Section 5 concludes.

2. The cross-quantilogram

This section describes the chosen approach for empirical analysis. We follow closely the notation of Han et al. (2016) and Jiang et al. (in press). Different than a quantile regression which allows considering quantiles of the dependent variable only, the methodology used in this study is constructed to reveal cross-quantile predictability of two time series.[5]

Define $\{x_{i,t}, t \in \mathbb{Z}\}$, $i = 1, 2$ as two strictly stationary time series. In the context of this paper, $x_{1,t}$ and $x_{2,t}$ are the overnight stock returns and the consecutive intraday returns, respectively.[6] Let $F_i(\cdot)$ and $f_i(\cdot)$ be the distribution function and the density function of the series $x_{i,t}$. The

[3] Around 25% of the ASX 200 index volatility and up to half of individual Australian stocks' volatility emerges overnight (Todorova and Soucek, 2014). In comparison, only around 20% of the US stock market volatility emerges during inactive market periods (Hansen and Lunde, 2005). Bertram (2004), Heaton et al. (2011) and Moshirian et al. (2012) further confirm the relevance of overnight periods to the Australian stock market.

[4] So far, the cross-quantilogram has been used only to study cross-market dependencies for agricultural futures (Jiang et al., in press) and the directional predictability from stock market sector indices to the gold market (Baumöhl and Lyócsa, in press).

[5] To check whether the application of a cross-quantilogram methodology is justified, quantile regressions with intraday and the immediately preceding overnight returns as dependent and independent variables, respectively, were conducted for various intraday periods. In the majority of the cases, the quantile regression coefficient estimates for the impact of the overnight returns are not statistically significant. Since the cross-quantilograms allow to explicitly select the quantiles of both series under consideration, while the quantile regression approach allows looking at individual quantiles of the dependent variable only, the cross-quantilogram approach is likely to detect directional predictability in a more precise manner. Quantile regression results are available upon request.

[6] Without exception, all overnight and intraday return series considered are stationary. Table 1 presents the corresponding test statistics of the unit root tests conducted for the overnight returns. Those for the intraday returns are not reported to save space but are available upon request.