

Supplemental Materials for





**Algorithmic Trading and Market Quality: International Evidence**

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## Notes on co-location events in our sample

Country	Earliest co-location date	Source	Notes
Australia	200811	2008 Annual Report	In April 2008 ASX implemented a capacity upgrade to its equities trading platform to stay ahead of the anticipated trade execution growth curve. A further, more substantial capacity upgrade to the equities platform is scheduled for the second half of FY09. This project will also deliver additional trade matching functionality, to follow on from the introduction (in November 2008) of a co-location hosting initiative aimed at further reducing order execution latency to accommodate high frequency trading activity. Migration to the next generation of ASX's futures platform is currently at a planning and specification stage, with a view to implementation in FY10. In the meantime,
Belgium	200804	Info-Flash Euronext Cash Market	<p><b>9 April 2008</b></p> <p><b>PROJECT: Co-location service</b></p> <p><b>Co-location service now available for Euronext Cash Markets</b></p> <p>NYSE Euronext is pleased to announce the introduction of a co-location service for its European cash markets.</p>
Brazil	200906	Financial Industry Network Thinking	Direct market access via co-location ended the month of June 2009 with 287 trades and 2,920 contracts traded in two days of trading in the BM&F segment. This access service was implemented by BM&FBOVESPA on June 15 and trading began on June 29. Direct connection via co-location allows clients to place their own computer equipment inside the BM&FBOVESPA data processing center.
Canada	200811	2008 Annual Report	<p>In market data, we continued to make strides in our on-going effort to deliver low-latency, marketplace neutral solutions for market participants. We launched the Consolidated Data Feed of pre and post-trade data for equity marketplaces in Canada, reducing the costs of building multiple feed formats for vendors and clients, and helping our trading customers meet best execution and trade-through obligations. The second phase of the Consolidated Data Feed, the Canadian Best Bid and Offer real-time data feed, was launched in November 2008.</p> <p>In order to deliver the ultra-low latency required by our algorithmic and high velocity traders, we began to offer clients the opportunity to locate their trading applications in the same physical data centre as the TSX Quantum equity trading engine and the TSX market data content provider. In November, we announced that following the completion of the integration of Montreal Exchange and TSX data centres, co-location services will be expanded to</p>
Denmark	200806	Financial Times	<p>Rush to co-location proves every microsecond counts</p> <p>Jeremy Grant JUNE 25 2008</p> <p>This week, Nasdaq OMX will become the latest exchange in Europe to offer "co-location" – that is, allowing traders to physically locate the computer servers in exchange data centres, right next to – or metres from – the exchange's matching engine itself.</p>
Finland	200806	Financial Times	<p>Rush to co-location proves every microsecond counts</p> <p>Jeremy Grant JUNE 25 2008</p> <p>This week, Nasdaq OMX will become the latest exchange in Europe to offer "co-location" – that is, allowing traders to physically locate the computer servers in exchange data centres, right next to – or metres from – the exchange's matching engine itself.</p>

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Germany	2006	Financial Times	<p>Rush to co-location proves every microsecond counts</p> <p>Jeremy Grant JUNE 25 2008</p> <p>Deutsche Börse has offered the service since mid-2006 for both its Xetra cash equities and Eurex derivatives customers and has more than 70 users.</p>
India	201011	Business Standard	<p><b>BSE's co-location facility begins to get brokers</b></p> <p>Mehul Shah / Mumbai January 20, 2011, 0:23 IST</p> <p>The co-location facility at the Bombay Stock Exchange (BSE) has started attracting brokers in the past three weeks due to active marketing by Asia's oldest stock exchange and its partners. The facility went live on November 15.</p>
India	200908	Business Standard	<p>High-frequency trading through co-location is catching on in India. BSE's rival, National Stock Exchange (NSE), was the first to offer this facility in India in August 2009.</p>
Italy	200909	Borsa Italiana	<p>Exchange Hosting, which was formally launched in September 2009, provides high frequency algorithmic trading firms with microsecond access to any of the London Stock Exchange Group's markets, allowing firms to physically locate their servers as close as possible to the Exchange's matching engines.</p>
Japan	200811	Osaka Securities Exchange	<p>OSE rolled out the co-location service in November 2008. This service enables latency sensitive participants to conduct trades without a time lag by installing their servers next to the OSE matching engine. The service has been very well received by foreign securities firms and investors because, with some of their mostly algorithmic trading strategies, time to market is the paramount factor for the success of their trading. To them, every nano second counts. OSE is very proud of the fact that it rolled out all OSE co-location racks within a very short period of time. In a way, this clearly indicated that OSE is a thriving and competitive exchange.</p>

Japan	200905	Tokyo Stock Exchange (TSE) News	<p><b>TSE News</b></p> <p><b>TSE Customer Connectivity Services: Provision of "TSE Proximity Service" at Access Point and Expansion of "TSE Co-Location Service" at the Primary Site</b></p> <hr/> <p style="text-align: right;">Update : Jun. 22, 2010 [Tokyo Stock Exchange, Inc.]</p> <p>Tokyo, June 22, 2010 - Tokyo Stock Exchange, Inc. (TSE), which has been providing TSE Co-Location Service (TSE Co-Lo) at its Primary Site since May 2009, announced today that it plans to provide a new proximity service ("TSE Proximity Service" or "TSE Prox") at the arrownet Access Point in Ikebukuro in order to meet the increasingly diverse needs of users.</p>
Netherlands	200804	Info-Flash Euronext Cash Market	<p><b>9 April 2008</b></p> <p><b>PROJECT: Co-location service</b></p> <p><b>Co-location service now available for Euronext Cash Markets</b></p> <p>NYSE Euronext is pleased to announce the introduction of a co-location service for its European cash markets.</p>
Portugal	200804	Info-Flash Euronext Cash Market	<p><b>9 April 2008</b></p> <p><b>PROJECT: Co-location service</b></p> <p><b>Co-location service now available for Euronext Cash Markets</b></p> <p>NYSE Euronext is pleased to announce the introduction of a co-location service for its European cash markets.</p>
Singapore	201104	The Trade	<p>Regionally, exchanges have been in a race to upgrade their trading infrastructure in an attempt to grow their volumes and tackle competition from alternative trading venues. In April, the Singapore Exchange launched a new data centre and co-location facility as part of its S\$250 million Reach project, including the world's fastest trading platform, that is scheduled for launch this month.</p>
Sweden	200806	Financial Times	<p><b>Rush to co-location proves every microsecond counts</b></p> <p>Jeremy Grant JUNE 25 2008</p> <p>This week, Nasdaq OMX will become the latest exchange in Europe to offer "co-location" – that is, allowing traders to physically locate the computer servers in exchange data centres, right next to – or metres from – the exchange's matching engine itself.</p>
Switzerland	200806	Colt, provider of co-location service	<p><b>SWX Swiss Exchange teams with Colt on proximity service</b></p> <p>23 June 2008</p> <p style="text-align: center;">  0  0  0  </p> <p>Source: Colt</p> <p>Colt, a leading European provider of business communications, today announced that SWX Swiss Exchange and the company will provide 'Proximity Services' to members of SWX Swiss Exchange and its London-based recognised investment exchange SWX Europe.</p>

Taiwan	2010Q4	Asia ETrading	<p><b><u>Taiwan Stock Exchange to Launch Co-location Services</u></b></p> <p>The Taiwan Stock Exchange ("TWSE") has proposed a "Data Centre Rental and Co-location Service" to better meet the needs of offshore and domestic trading firms, further develop its capital market and strengthen its services to investors.</p> <p>The service gives broker-dealers the opportunity to rent and install their servers in the Exchange's data centre, allowing them to improve the efficiency of their trading network and reduce the repair and operating costs of maintaining their own data centres. The service will also serve additional functions, such as providing more back-up options for broker-dealers.</p> <p>The proposal has received regulatory approval and TWSE is preparing for the new rental service of its data centre. Arrangements are expected to be completed by September 2010, with the co-location service to be launched in the fourth quarter.</p>
UK	200809	Wall street tech	<p><b>London Stock Exchange Offers Collocation</b></p> <p>By Penny Crosman (mailto:pcrosman@cmp.com) September 02, 2008</p> <p>URL: (<a href="http://wallstreetandtech.com/data-latency/london-stock-exchange-offers-collocation/210201765">http://wallstreetandtech.com/data-latency/london-stock-exchange-offers-collocation/210201765</a>)</p> <p>The London Stock Exchange has latched onto the collocation/proximity hosting trend, allowing its algorithmic trading firm customers to physically locate their servers within the exchange's own data center, thereby giving them fast access to the exchange's TradElect and Infolect trading and information systems.</p>
USA	200504	Wall street tech	<p><b>Data Latency Playing An Ever Increasing Role In Effective Trading</b></p> <p>By Richard Martin, InformationWeek (mailto:) May 25, 2007</p> <p>About 100 firms now collocate their servers with Nasdaq's, says Brian Hyndman, Nasdaq's SVP of transaction services, at a going rate of about \$3,500 per rack per month. Nasdaq has seen 25 percent annual increases in collocation the past two years, according to Hyndman.</p>
USA	200701	NYSE	<p><b>2007 NYSE Group Acquires TransactTools</b></p> <p>January</p> <p>The acquisition of TransactTools messaging solutions, coupled with its recently completed acquisition of the Securities Industry Automation Corporation (SIAC), gives NYSE Group a world-class platform for delivering technology and services to customers for accessing liquidity and managing transactions across markets and geographies.</p>