

Transaction Cost Analysis

Understanding Trade Execution Impact

Transaction Cost Analysis (TCA) lets investment managers determine the effectiveness of their portfolio transactions. By providing greater transparency into investment strategies and trading performance, TCA helps investment managers lower their trading costs. The Charles River Investment Management Solution (CR IMS) provides TCA seamlessly integrated with order, execution and portfolio management capabilities. Charles River's TCA scales with your analytics needs, from pre-trade to post-trade capabilities. Pre-trade TCA is included as standard functionality in Charles River IMS.

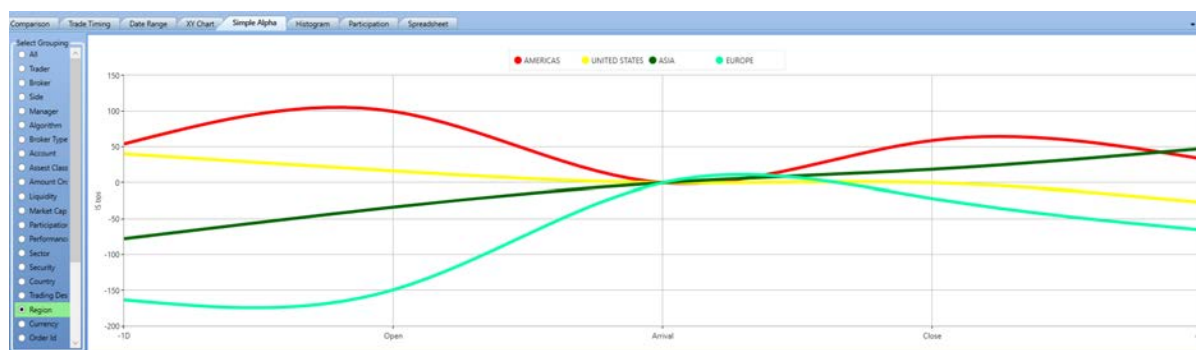
Real-Time Decision Support

Charles River's integrated TCA capability produces immediately actionable intelligence, accessible directly from the blotter. Extensive reporting and visualization options provide portfolio managers and traders with highly individualized feedback, helping them improve performance and reduce slippage. For example, Charles River TCA provides insight into questions such as:

- Which algorithm is working for me?
- What's my optimal execution rate?
- Should I use crossing networks for my orders?
- Do my orders differ by time of day, order size, sector, PM?

Key Benefits

- Evaluate trading costs and trends on one platform
- Measure the performance of portfolio managers, traders & brokers
- Make more informed trading decisions
- Helps improve quality of trade execution
- Can reduce execution costs and slippage
- Seeks to maximize alpha



Generate performance profiles in Charles River TCA to understand factors impacting trade costs.

Advanced Capabilities

- Pre- and post-trade analytics application
- Multi-agent perspective on order life-cycle
- Best-in-class customized reporting
- Optimize trading strategies to fit PM and trader profiles
- Align behavioral profiles with implementation strategies
- Covering: Global Equity Markets, US/Canada inter-listed, EU composite
- Supports entire order life-cycle
- Real-time implementation shortfall
- Real-time unrealized gain/loss (UGL)
- %ADV and liquidity indicators
- UI-based research tool

Portfolio Manager Window

Portfolio manager initiates the investment action and estimates impact

Trader Window

Trader executes the order with best broker and strategy

Firm

Firm evaluates overall trading performance by looking at individual performance

Improved Execution & Increased Alpha

Charles River's TCA helps portfolio managers, traders and buy-side firms understand trade execution impact throughout the trade lifecycle.

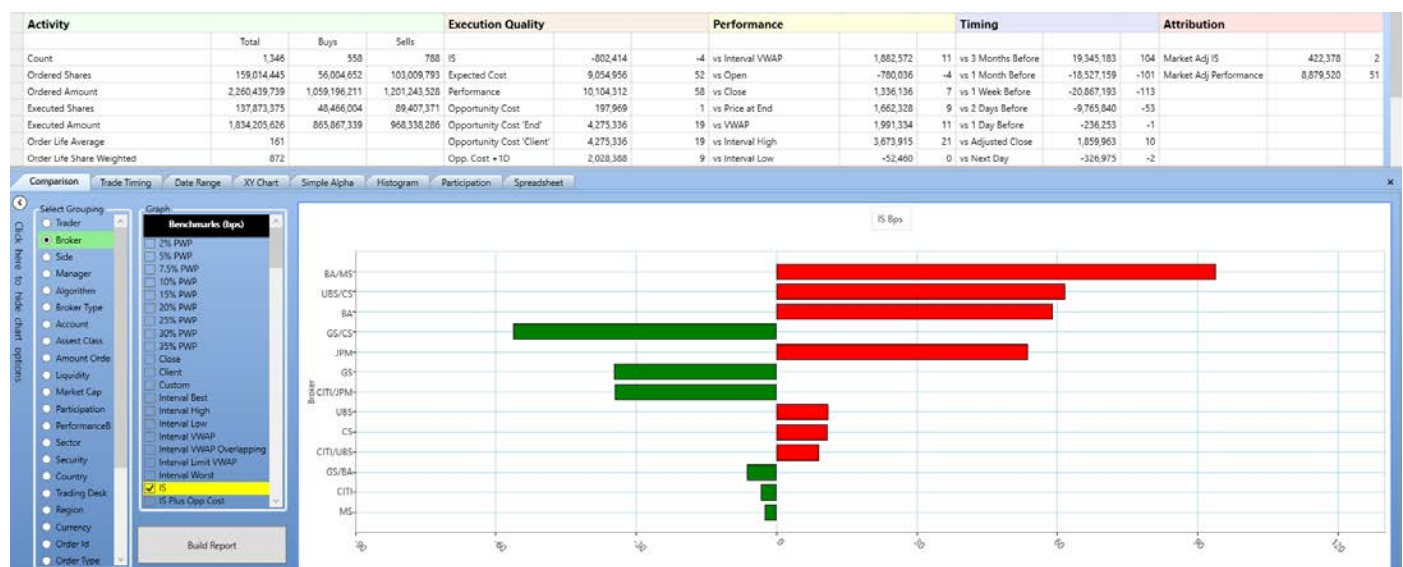
Pre-Trade TCA

Pre-Trade TCA provides portfolio managers with estimates of trade costs and market impact based on extensive historical trade information for a particular name. It evaluates all relevant trade execution strategies and recommends the strategy that is most consistent with a manager's risk preferences.

Current User's Active Equity Orders (197)												
Status	Side	Name	Tgt Qty	Tgt Amt	Trd Curr	Total Cost	Total Cost (bps)	Spread Cost (bps)	Price Impact Cost (bps)	Standard Deviation	Trader	Mgr
Work	Buy	GOOG	110,000	65,919,700	US	204,094.23	30.961	2.325	28.636	64.822	TJ	TMDEV
Work	Buy	BBD/B	4,017,613	16,391,861	US	176,899.11	107.919	20.391	87.527	161.324	TJ	TMDEV
Work	Buy	CASY	86,996	4,890,915	US	38,768.62	79.267	10.045	69.222	58.755	TMDEV	TMDEV
Work	Buy	EBAY	370,383	8,781,781	US	36,875.69	41.991	1.684	40.307	41.423	TMDEV	TMDEV
Work	Buy	APA	88,470	7,316,469	US	16,891.68	23.087	1.691	21.396	107.496	TMDEV	TMDEV
Work	Buy	RY CN	100,000	5,350,000	US	4,251.96	7.948	0.692	7.255	47.838	TMDEV	TMDEV
Open	Buy	ADSK	80,500	3,151,575	US	3,721.85	11.809	0.920	10.889	86.772	TJ	TMDEV
Open	Buy	AAPL	100,000	10,819,000	US	2,431.09	2.247	0.500	1.747	35.023	TMDEV	TMDEV
Work	Sell	AAPL	83,960	8,785,566	US	1,881.85	2.142	0.504	1.638	34.737	TMDEV	TMDEV

Post-Trade TCA

Post-Trade TCA helps firms and portfolio managers profile and analyze trader performance across numerous metrics. Users can assess trade execution quality by comparing actual executed prices to user-selected benchmark prices. A full suite of benchmarks are provided, including volume-weighted average price, opportunity cost, performance, open/close/previous close price. Custom benchmarks are also supported.





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ABOUT CHARLES RIVER

Investment firms, asset owners, wealth managers, hedge funds and insurers in more than 30 countries rely on Charles River's front and middle office investment management platform to manage more than US\$30 Trillion in assets. Together with State Street's middle and back office capabilities, Charles River's software technology forms the foundation of State Street AlphaSM. The Charles River Investment Management Solution (Charles River IMS) is designed to automate and simplify the institutional investment process across asset classes, from portfolio management and risk analytics through trading and post-trade settlement, with integrated compliance and managed data throughout. Charles River's growing partner ecosystem enables clients to seamlessly access external data and analytics, applications and liquidity venues that support the unique demands of their product and asset class mix. Headquartered in Burlington, Massachusetts, we serve clients globally with more than 975 employees in 11 regional offices. (Statistics as of October 2019)

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