

What's in a price?

We take for granted that the price ticking up and down in our stock portfolio is an empirical truth about the value of our investments. The reality is that what we're usually seeing is an approximation built from recent trading activity on a subset of the market. Each exchange packages up their trade data in various ways for this purpose, and licenses it through platforms like ours to be integrated into applications. Costs and policies differ between exchanges and packages, and as you'd expect, tradeoffs are usually made between cost and accuracy.

By far the most common feedback we hear from our startup customers is that the barrier to entry for market data is too high. Exchange approvals, exchange fees, manual user reporting, and audit exposure are not the things you want to be thinking about as you're launching your breakthrough application.

We've created some out-of-the-box products that ease this pain by compiling sources of trade data that have favorable policies, such as non-fee-liable exchanges or fifteen-minute delayed consolidated data. These products work great for development or even for some live applications that aren't sensitive to intraday movements. Still, the few non-fee-liable exchanges have a small share of the market, which means the last trade for thinly traded securities can drift noticeably from the current best bid or offer, and fifteen-minute delayed data can lag the market significantly in periods of volatility. Hence, a true entry-level product for market data display remained elusive.

With this in mind, we set out to create a product that was accurate enough for display – even for thinly traded securities, but without the up-front barriers that come with proprietary exchange data. We created an algorithm based on mathematical modeling of market-moving factors, plugged in an expansive array of real-time inputs, and then tested its accuracy using years of historical tick data. The result is a formative new data point that uses our proprietary algorithm to generate an accurate Fair Market Value of a tradable security.

How does FMV stack up?

We compared the accuracy of Fair Market Value to the last trade of some of the leading products on the market to determine how accurate they were.

Accuracy Statistics for Ticker AMD

Average Daily Volume 80m

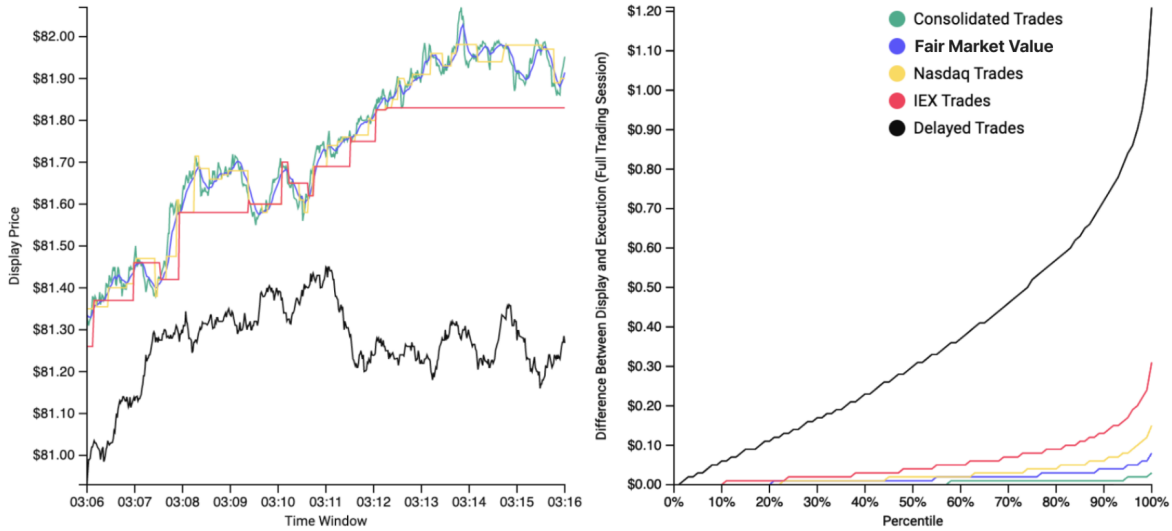


Figure 1: (Left) FMV compared to competing products for ticker AMD. (Right) Percentile curve of price error against trading price, measured from each trade in the day

	Median error	90th percentile error	99th percentile error
Delayed Consolidated Trades ¹	29 cents	72 cents	108 cents
IEX Last Trade	4.0 cents	13 cents	28 cents
Nasdaq Last Sale	1.5 cents	6.5 cents	14 cents
FMV	1.3 cents	3.8 cents	7.5 cents
Consolidated Trades	0.5 cents	1.0 cents	2.3 cents

Figure 2: Percentile error compared against trading price for AMD, measured from each trade in the day.
¹15-minute delayed data.

Figures 1 and 2 show that real-time consolidated trade data is the most accurate, followed closely by FMV, then Nasdaq Last Sale, IEX Last Trade, and Delayed Consolidated Trades. Notably, Nasdaq, IEX, and Delayed have varying degrees of staleness, as shown in Figure 1: the last trade prices on IEX or Nasdaq have many stretches of time where they stay constant, corresponding to periods of time where no trades occurred on those exchanges. In such

instances, we see that the Fair Market Values and Consolidated Trades continue to move despite IEX and Nasdaq remaining still.

Accuracy Statistics for Ticker QQQ

Average Daily Volume 60m

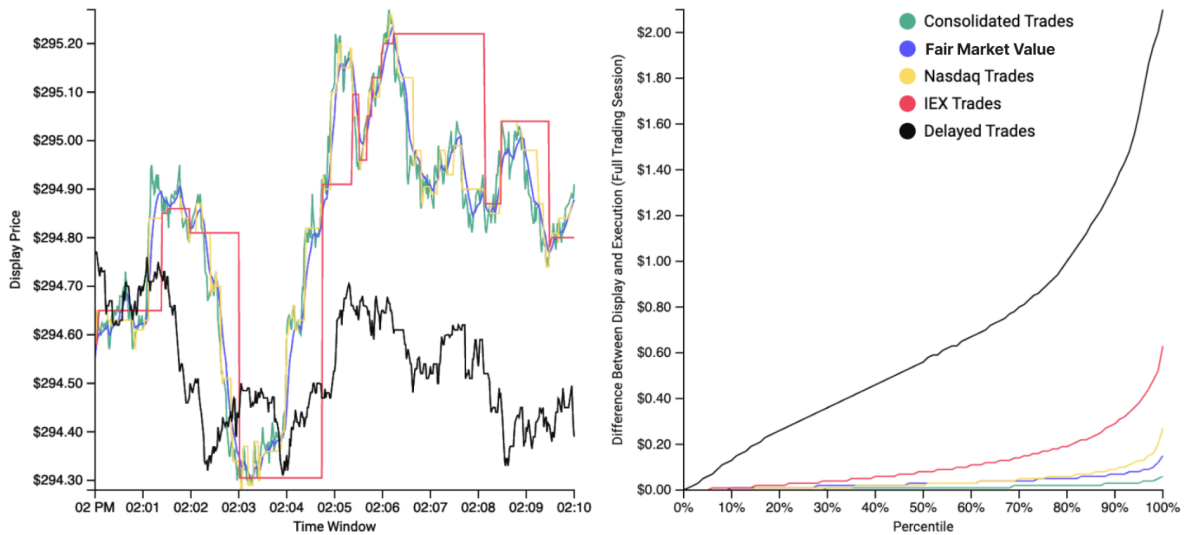


Figure 3: (Left) FMV compared to competing products for ticker QQQ. (Right) Percentile curve of price error against trading price, measured from each trade in the day

Accuracy Statistics for Ticker VXX

Average Daily Volume 5m

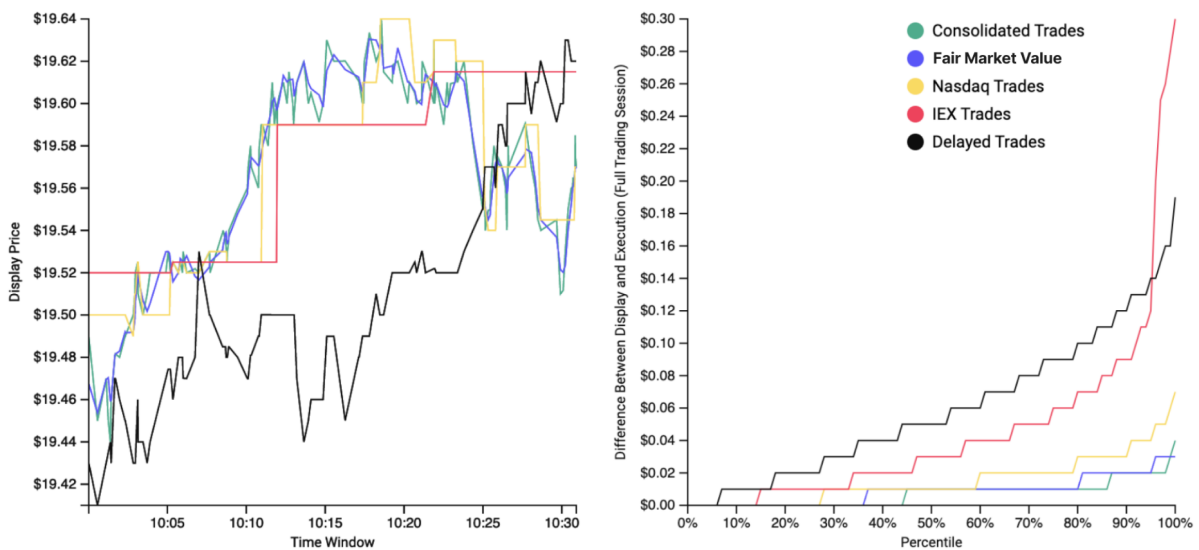


Figure 4: (Left) FMV compared to competing products for ticker VXX. (Right) Percentile curve of price error against trading price, measured from each trade in the day

Figures 3 and 4 show that the comparative accuracy of the analyzed products remains relatively stable for tickers with varying average volumes. FMV provides an accurate representation of value, even on thinly traded stocks, compared to other products we tested.

Our Methodology

To determine the accuracy of Fair Market Value, we used our historical data to analyze millions of historical trades to determine the last trade price that would have been displayed using the given exchange product, then we compared that to the price at which the trade actually executed.

A more technical explanation of our methodology is as follows:

Given a historical trading day, select a trade in the day, T , and look at the previous trade's price T' . Then take the current fair market value L . The percentile chart shows the distribution of $|T - T'|$ (current trade price vs. previous trade price) and $|T - L|$ (current trade price vs. most recent fair market value). Thus, we are measuring the performance of the previous trade price and the fair market value as predictors of the next trade price.

The data shows a clear pattern: our Fair Market Value is a more accurate predictor of the next trade price than any other products we tested, short of the consolidated last trade.