

# **A Comparative Analysis of Institutional-Grade Level 2 & Level 3 Market Data Providers for AMER and EMEA Markets**

## **Executive Summary**

This report presents a comprehensive evaluation of market data providers to source the specialized data feeds required to implement the proprietary Chart\_Clarity\_Score and predictive Order\_Imbalance\_Score. The analysis has been revised to prioritize **EODHD** as the primary data source, leveraging the existing "All-In-One" subscription, and to identify supplementary providers only for data categories not covered by EODHD. The evaluation covers the priority markets of the Americas (AMER) and Europe, Middle East, and Africa (EMEA), assessed against four critical criteria: API Quality, Data Granularity, Historical Data Access, and Cost.

A foundational conclusion of this analysis is that the development of a robust Order\_Imbalance\_Score necessitates a data feed with the highest possible granularity—specifically, Level 3, or Market-by-Order (MBO), data. Standard aggregated Level 2 (Market-by-Price, MBP) data is insufficient as it masks the individual order dynamics crucial for predictive modeling of order flow.

Based on a thorough review of EODHD's documented capabilities, it serves as an excellent foundational provider for a wide range of financial data, including real-time prices, deep historical end-of-day and intraday data, and extensive fundamental data across global markets.<sup>1</sup> However, the core requirement for Level 2 (market depth) and Level 3 (full order book) data is not met by the current EODHD API offerings.<sup>3</sup>

Consequently, to fulfill all project requirements, a hybrid strategy is necessary. This approach maximizes the value of the existing EODHD subscription for all applicable data needs while surgically sourcing the essential, high-granularity order book data from specialist providers.

## **Recommendations:**

1. **Primary Provider (Foundational Data): EODHD** should be utilized as the primary data source for all real-time (Level 1), intraday, and end-of-day historical data, as well as for all fundamental, options, and economic data needs across both AMER and EMEA markets. This leverages the existing subscription and EODHD's well-documented Python access.<sup>5</sup>
2. **Supplementary Provider for AMER Markets (Level 2/3 Data): Databento** is the unequivocal top choice for sourcing the required real-time and historical Level 2/3 order book data for AMER markets. It excels across all evaluation criteria, offering true L3/MBO granularity, a high-performance Python API, and a transparent pricing model.<sup>7</sup>
3. **Supplementary Provider for EMEA Markets (Level 2/3 Data): dxFeed** is the recommended provider for Level 2/3 data in the EMEA region. It offers extensive, established L3/MBO coverage across key European exchanges, supported by a mature and performant Python API, striking an optimal balance between coverage and technical quality.<sup>9</sup>

This hybrid strategy—leveraging EODHD as the foundational provider and supplementing with Databento and dxFeed specifically for Level 2/3 data—represents the most effective and cost-efficient path to acquiring the necessary data infrastructure.

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## Part I: The Anatomy of Market Depth Data

A precise understanding of market data granularity is fundamental to selecting a provider that aligns with the sophisticated requirements of quantitative modeling. The terminology—Level 1, Level 2, and Level 3—represents a spectrum of increasing detail, where each successive level unlocks deeper insights into market microstructure. This section defines these levels and analyzes the provider landscape, establishing the technical foundation for the subsequent vendor evaluations.

### 1.1 Beyond the Top of Book: A Spectrum of Granularity and its Impact on Quantitative Models

The data required to power metrics like the `Order_Imbalance_Score` goes far beyond the simple price quotes available to the general public. The efficacy of such a score is directly proportional to the granularity of the underlying data feed.

### **Level 1 (Top-of-Book)**

Level 1 data provides the most basic view of the market: the highest bid price and the lowest ask price, along with the volume available at those prices.<sup>12</sup> This is often referred to as the "inside market" or the National Best Bid and Offer (NBBO). While sufficient for long-term investors or simple execution, it offers no visibility into the supply and demand dynamics beyond the very best price, rendering it entirely inadequate for microstructure analysis.<sup>12</sup>

### **Level 2 (Market-by-Price, MBP)**

Level 2 data, also known as market depth or the order book, expands on Level 1 by displaying the aggregated size of buy and sell orders at multiple price levels beyond the NBBO.<sup>14</sup> It presents a ranked list of bid and ask prices from various market participants, such as market makers and Electronic Communication Networks (ECNs).<sup>14</sup> This provides a visual representation of the supply and demand "walls" for a security, allowing traders to gauge liquidity at different price points.<sup>12</sup>

However, the critical limitation of standard Level 2 data is that it is *aggregated*. At any given price level, it shows a single, consolidated volume figure. It does not reveal whether that volume is composed of one large institutional order or hundreds of small retail orders—a distinction of paramount importance for order flow analysis.<sup>15</sup>

### **Level 3 (Market-by-Order, MBO)**

Level 3 data represents the highest possible granularity. It is the raw, un-aggregated feed of every single event occurring on an exchange's matching engine.<sup>15</sup> An MBO

feed provides the complete lifecycle of each individual order: its initial placement (add), any subsequent changes (modify), its removal (cancel), and its execution (trade).<sup>7</sup> Each event is tied to a unique order ID, allowing for the reconstruction of the entire order book, order by order, at any point in time.<sup>15</sup> This level of detail is what exchange-native data feeds like Nasdaq's TotalView-ITCH provide.<sup>17</sup>

### **The Order\_Imbalance\_Score Mandates Level 3 Data**

The stated goal of creating a predictive Order\_Imbalance\_Score cannot be robustly achieved with standard Level 2 (MBP) data. The predictive power of order flow analysis stems from understanding the intent and behavior behind the orders, which is lost in aggregation.

A true imbalance score must be able to differentiate between market participants and their actions. For example, the placement of a single, large 100,000-share buy order has a vastly different implication for future price movement than the placement of one hundred separate 1,000-share buy orders, even though both scenarios would appear identical on a Level 2 (MBP) display. The former signals potential institutional interest, while the latter may represent fragmented retail activity.

Furthermore, Level 3 data is required to detect sophisticated trading behaviors. It allows for the tracking of order modifications and cancellations, which is essential for identifying patterns like "spoofing," where large orders are placed and then quickly canceled to manipulate market perception.<sup>18</sup> It also provides visibility into the dynamics of "iceberg" or reserve orders, where only a fraction of a large order is displayed on the public book at any given time.<sup>14</sup> Analyzing the replenishment of these reserve orders provides powerful signals about latent supply or demand.

Because Level 2 data aggregates all orders at a price level into a single quantity, it completely obscures these critical microstructure details. Therefore, to build an Order\_Imbalance\_Score with genuine predictive power, access to a Level 3 (MBO) feed is a non-negotiable technical prerequisite. The evaluation of providers must be conducted through this lens, prioritizing those who can deliver this highest level of granularity.

## **1.2 The Provider Ecosystem: Direct Feeds vs. Third-Party Aggregators**

The market for Level 3 data is served by a diverse ecosystem of providers, each with distinct advantages and disadvantages. The choice among them represents a core strategic decision balancing performance, cost, and engineering overhead.

### **Direct Exchange Feeds**

This approach involves connecting directly to the proprietary data feeds of each exchange, such as Nasdaq's TotalView-ITCH or Cboe's PITCH.<sup>17</sup> This method offers the absolute lowest latency and provides the "ground truth" data directly from the source.<sup>20</sup> However, it carries an immense engineering burden. Each exchange uses a different, non-normalized binary protocol, requiring the development and maintenance of a separate, highly specialized feed handler for every venue. The firm must also manage all connectivity, co-location, and complex licensing agreements directly with each exchange, a resource-intensive and costly endeavor.

### **Institutional Aggregators**

Large, established vendors like LSEG (Refinitiv) and ACTIV Financial solve the integration problem by consolidating and normalizing data from hundreds of global exchanges into a single, unified feed.<sup>21</sup> They offer comprehensive, global coverage and robust, battle-tested infrastructure, making them a traditional choice for large financial institutions.<sup>23</sup> The trade-off is typically high cost, opaque enterprise-level pricing, contractual inflexibility, and, in some cases, reliance on legacy API technologies that may not be optimized for modern development workflows.<sup>24</sup>

### **Modern API-First Aggregators**

A newer category of provider, including firms like EODHD, Databento, and dxFeed, has

emerged to address the shortcomings of the traditional models. These vendors are built with a developer-first ethos, focusing on providing high-quality, normalized data through modern, high-performance APIs (e.g., WebSocket, REST) and user-friendly client libraries, particularly for Python.<sup>7</sup> Their key differentiators are ease of integration and transparent, often usage-based, pricing models that significantly lower the barrier to entry for accessing institutional-grade data.<sup>26</sup>

For a quantitative team whose core competency is model development rather than large-scale infrastructure engineering, the modern API-first aggregators present the most compelling value proposition. They abstract away the immense complexity of direct exchange connectivity while offering a more flexible and cost-effective solution than the traditional institutional aggregators.

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## Part II: In-Depth Provider Analysis

This section provides a detailed, evidence-based evaluation of market data providers, beginning with the preferred provider, EODHD, and then exploring supplementary options for data not available through the existing subscription.

### 2.1 EODHD (Primary Provider for Foundational Data)

EODHD is a comprehensive financial data provider offering a wide array of data types through a flexible and developer-friendly platform.<sup>1</sup> Given the existing "All-In-One" subscription, it is the logical and most cost-effective starting point for sourcing the majority of the data required for this project.

- **API Quality:** EODHD provides robust API access designed for developers. Data can be accessed via a **REST API** for historical and fundamental data queries, and a **WebSocket API** for real-time data streaming.<sup>4</sup> The platform officially supports a **Python library (eodhd)** which simplifies data access, authentication, and formatting.<sup>5</sup> An unofficial but comprehensive Python SDK is also available, providing another well-documented option for integration.<sup>4</sup> The APIs deliver data in standard JSON and CSV formats, making it easy to integrate with common data analysis libraries like Pandas.<sup>28</sup>

- **Data Granularity:** EODHD's data granularity is well-suited for many quantitative applications, but it does not extend to Level 2 or Level 3 order book data.
  - **Real-Time Data:** The WebSocket API provides real-time data for the US market, Forex, and cryptocurrencies with a delay of less than 50ms. For US stocks, this includes pre-market and post-market hours (4 am to 8 pm EST).<sup>4</sup> This data is equivalent to **Level 1 (Top-of-Book)**, providing real-time trades and quotes.
  - **Historical Intraday Data:** The Intraday Historical Data API provides tick-level data with 1-minute intervals for US markets (NYSE, NASDAQ) dating back to 2004. For other global exchanges, 5-minute and 1-hour intervals are available from October 2020.<sup>4</sup>
  - **Historical End-of-Day Data:** The End-of-Day Historical API provides daily, weekly, or monthly OHLCV data, with history for some US stocks extending back to 1972.<sup>28</sup>
  - **Level 2/3 Data Gap:** A thorough review of EODHD's API documentation and product offerings confirms that **Level 2 (market depth) and Level 3 (full order book) data are not currently available** through their platform.<sup>3</sup> This is a critical gap for the Order\_Imbalance\_Score which requires full order book visibility.
- **Historical Data Access:** This is a core strength of EODHD. The "All-In-One" package provides access to over 30 years of historical data for many instruments.<sup>1</sup> This deep historical data is accessible programmatically via the REST API and the Python library, making it ideal for backtesting models that rely on EOD or intraday (1-minute bar) data.<sup>4</sup>
- **Cost:** The project already has access to the "All-In-One Package," which covers all data types discussed above.<sup>1</sup> This makes EODHD the most cost-effective solution for all data it is capable of providing.
- **AMER/EMEA Coverage:** EODHD offers extensive global coverage, sourcing data from over 70 exchanges.<sup>30</sup> For the priority regions:
  - **AMER:** US data is sourced from the Nasdaq Cloud API, covering NYSE, NASDAQ, and OTCM markets.<sup>31</sup>
  - **EMEA:** European data is sourced from Cboe Europe Equities, which covers a broad range of Western and Eastern European markets.<sup>31</sup> A list of specific European exchanges includes XETRA, Berlin, Dusseldorf, and others.<sup>32</sup>

In summary, EODHD is the ideal primary provider for this project. It fulfills the requirements for a high-quality Python API, deep historical data access, and broad AMER/EMEA coverage for Level 1, intraday, and end-of-day data. However, to implement the Order\_Imbalance\_Score, it is essential to supplement EODHD with a

provider that specializes in Level 2 and Level 3 order book data.

## 2.2 Sourcing Essential Level 2/3 Data

Because EODHD does not provide the required market depth data, it is necessary to evaluate specialist providers to fill this specific, critical gap.

### 2.2.1 Databento (For AMER Markets)

Databento is a modern market data platform that has rapidly gained a strong reputation within the quantitative community for its high-performance data, developer-centric API, and disruptive pricing model.<sup>33</sup>

- **API Quality:** Databento provides official, high-performance, and well-documented client libraries for **Python, C++, and Rust**.<sup>16</sup> A core design principle is the unified API for both real-time streaming and historical data replay, allowing the same code to be used for backtesting and live trading.<sup>17</sup>
- **Data Granularity:** Databento explicitly provides **Market-by-Order (MBO)** data, which they classify as Level 3, or "full order book".<sup>7</sup> Their data is captured directly from exchange co-location facilities and provided with nanosecond-resolution hardware timestamps, ensuring the highest possible data fidelity.<sup>17</sup> This offering perfectly aligns with the project's most stringent granularity requirement.
- **Historical Data Access:** Historical data is a core product, seamlessly integrated and accessible via the same API used for live data. Subscription plans provide access to deep historical archives.<sup>8</sup>
- **Cost:** Databento employs a transparent and highly competitive pricing model, offering both pay-as-you-go and flat-rate monthly subscriptions.<sup>8</sup> New users are offered \$125 in free credits to facilitate initial testing.<sup>26</sup>

### 2.2.2 dxFeed (For EMEA Markets)

dxFeed is a well-established global market data provider with a reputation for



delivering high-quality, low-latency data feeds.<sup>34</sup>

- **API Quality:** dxFeed provides a comprehensive suite of APIs, including an official **Python API** built as a wrapper around their core C API for performance.<sup>10</sup> The API is well-documented with resources on PyPI and a dedicated ReadTheDocs site.<sup>36</sup>
- **Data Granularity:** dxFeed meets the project's granularity requirements. The company is an authorized distributor of **Nasdaq TotalView**, which provides the full, un-aggregated order book, and their product documentation explicitly lists "Full Order Depth" as an available data type.<sup>9</sup>
- **Historical Data Access:** The company offers deep historical data archives via its "Data Lake" platform, with some datasets extending back to 1998, available at tick-level resolution.<sup>9</sup>
- **AMER/EMEA Coverage:** This is a significant strength for dxFeed. In addition to all major US exchanges, they provide direct feeds for key European venues, including **Cboe Europe, Eurex, and Euronext**, making them a very strong candidate for fulfilling the EMEA data requirement.<sup>39</sup>

### 2.2.3 Algoseek (For Deep Historical Backtesting)

Algoseek is a highly specialized data vendor with a singular focus: providing institutional-grade, "as-is" historical intraday data for the US markets, tailored specifically for quantitative research and backtesting.<sup>41</sup>

- **API Quality:** Algoseek provides data access via a REST API for programmatic queries, as well as bulk delivery methods like AWS S3 and FTP.<sup>44</sup> It is not a real-time streaming provider.
- **Data Granularity:** Algoseek provides **Full Depth / Multiple Depth** order book data, which is their equivalent of L2/L3.<sup>44</sup> Their unique value is that the data is "as-is," meaning it is raw and unfiltered, preserving all market artifacts. This is critically important for realistic backtesting of microstructure-sensitive models.<sup>45</sup>
- **Historical Data Access:** This is the entirety of Algoseek's business. They offer comprehensive, survivorship-bias-free historical datasets for US equities, options, and futures.<sup>45</sup>

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## Part III: Comparative Synthesis and Strategic Recommendations

This final section synthesizes the analysis into a direct comparison and culminates in a set of actionable strategic recommendations, placing EODHD at the center of the data procurement strategy.

### 3.1 Provider Evaluation Matrix

Provider	Primary Use Case	AMER Coverage	EMEA Coverage	Max Granularity	Python API Quality	Historical Data	Suitability (AMER)	Suitability (EMEA)
<b>EODHD</b>	Foundational Data	Excellent (Nasdaq) <sup>31</sup>	Excellent (Cboe) <sup>31</sup>	L1 / Intraday <sup>3</sup>	Very Good <sup>5</sup>	Excellent (30+ yrs) <sup>1</sup>	<b>Excellent (L1/Intraday)</b>	<b>Excellent (L1/Intraday)</b>
<b>Databento</b>	AMER L2/3 Data	Excellent	Good (ICE, Eurex) <sup>46</sup>	<b>L3/MB O</b> <sup>7</sup>	Excellent <sup>17</sup>	Excellent <sup>8</sup>	<b>Excellent (L2/3)</b>	Good (L2/3)
<b>dxFeed</b>	EMEA L2/3 Data	Excellent	Excellent <sup>40</sup>	<b>L3/MB O</b> <sup>9</sup>	Very Good <sup>11</sup>	Very Good <sup>9</sup>	Very Good (L2/3)	<b>Excellent (L2/3)</b>
<b>Algoseek</b>	Historical Backtesting	Excellent (US Only)	None	<b>L3/MB O ("As-is")</b> <sup>44</sup>	N/A (REST for historical)	Best-in-Class (US)	N/A (Real-Time)	N/A

### 3.2 Strategic Recommendations for Implementation

The analysis strongly indicates that while EODHD is a powerful and cost-effective

primary data source, it cannot fulfill the project's core requirement for Level 2/3 order book data. Therefore, a hybrid strategy is the only viable path forward.

## **Optimal Provider Strategy**

- **Primary (All Foundational Data): EODHD**  
Utilize the existing "All-In-One" EODHD subscription for all foundational data needs. This includes real-time Level 1 data (via WebSockets), deep historical end-of-day and 1-minute intraday data (via REST API), and all required fundamental and economic data across both AMER and EMEA. The official eodhd Python library should be used for integration.<sup>5</sup>
- **Supplementary (AMER Level 2/3 Data): Databento**  
To acquire the mission-critical Level 2/3 order book data for AMER markets, a separate subscription with Databento is recommended. Its superior Python API, true MBO granularity, and unified architecture for live and historical data will significantly accelerate the development and validation cycle of the `Order_Imbalance_Score`.<sup>17</sup>
- **Supplementary (EMEA Level 2/3 Data): dxFeed**  
For the EMEA markets, dxFeed is the strongest candidate to provide the necessary Level 2/3 data. They possess a broad and mature list of direct exchange connections across Europe and can deliver the required L3/MBO data through their performant Python API.<sup>11</sup>
- **Optional (Deep Historical Backtesting): Algoseek**  
To ensure the utmost robustness of the backtesting process for US markets, consider procuring deep historical "as-is" data from Algoseek. This raw data preserves market artifacts that are critical for validating microstructure-sensitive models and provides the highest confidence that a model's performance will translate from research to production.<sup>45</sup>

## **3.3 Actionable Roadmap for Procurement and Integration**

The following phased approach is recommended to validate these findings and proceed with implementation.

- **Phase 1: Validation (1-2 Weeks)**

- Confirm with EODHD support that Level 2/3 order book data is not available, validating the findings of this report.
  - Initiate proof-of-concept (PoC) trials with the supplementary vendors.
  - Sign up for a Databento account and utilize the \$125 in free credits to download sample L3/MBO historical data and test the live streaming API for a select group of US symbols.<sup>26</sup>
  - Contact the sales teams at dxFeed and Algoseek to request trial access and sample historical MBO datasets for both a US and a European equity.
  - **Phase 2: Technical Due Diligence (2-4 Weeks)**
    - Assign a quantitative developer to build prototype data ingestion clients using the Python APIs from Databento and dxFeed to evaluate API ergonomics, performance, and data consistency.
    - Concurrently, use the sample historical MBO data from Algoseek, Databento, and dxFeed to begin building the initial version of the Order\_Imbalance\_Score backtesting pipeline.
    - Engage vendors with a formal Request for Information (RFI) to confirm coverage and obtain detailed, all-in cost estimates for the specific non-display use case.
  - **Phase 3: Procurement & Integration (4-8 Weeks)**
    - Based on the performance during the PoC, the RFI responses, and the final cost analysis, execute contracts with the selected supplementary providers (Databento and dxFeed).
    - Begin the full-scale integration of all three APIs (EODHD, Databento, dxFeed) into the firm's production research and live trading environments.
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## Appendix

### A.1 Detailed API Information

- **EODHD API:**
  - **Access:** REST API for historical/fundamental data; WebSocket API for real-time data.<sup>4</sup>
  - **Python Library:** Official eodhd library available via pip (python3 -m pip install

eodhd -U).<sup>5</sup> Unofficial SDK also available on GitHub.<sup>4</sup>

- **Example (Python - EOD):**  
`client.get_eod_historical_stock_market_data(symbol='MCD.US', period='d', from_='2017-01-05', to='2017-02-10').`<sup>4</sup>
- **Example (Python - Real-Time):**  
`requests.get(f"https://eodhd.com/api/real-time/{ticker}", params={"api_token": api_token, "fmt": "json"}).`<sup>29</sup>
- **Databento API:**
  - **Access:** Unified API for both real-time (TCP/WebSocket) and historical (HTTP) data.<sup>17</sup>
  - **Python Library:** Official databento library available via pip.
  - **Example (Python - Historical MBO):** `data = client.timeseries.get_range(dataset='XNAS.ITCH', schema='mbo', start='2023-01-01T14:30', end='2023-01-01T14:31', symbols='AAPL')`
- **dxFeed API:**
  - **Access:** Multiple APIs including Java, C/C#, Python, FIX, and REST.<sup>10</sup>
  - **Python Library:** Official dxfeed library available on PyPI, built on the C-API for performance.<sup>36</sup>
  - **Example (Python - Subscription):** `trade_sub = endpoint.create_subscription('Trade').add_symbols().`<sup>47</sup>

## A.2 Glossary of Key Market Data Terminology

- **As-is Data:** Raw market data provided exactly as it was received from the exchange, including any errors, out-of-sequence packets, or other artifacts. Considered the highest fidelity data for realistic backtesting.<sup>45</sup>
- **ITCH / PITCH:** Proprietary binary protocols used by Nasdaq (ITCH) and Cboe (PITCH) to disseminate their full order book data feeds.<sup>17</sup>
- **Level 1 (L1):** Market data showing only the best (highest) bid and best (lowest) ask price for a security. Also known as Top-of-Book or NBBO.<sup>12</sup>
- **Level 2 (L2):** Market data showing aggregated order volume at multiple price levels beyond the best bid and ask. Also known as Market-by-Price (MBP) or Depth of Market (DOM).<sup>14</sup>
- **Level 3 (L3):** The most granular form of market data, showing every individual order and its full lifecycle (add, modify, cancel, execute). Also known as Market-by-Order (MBO).<sup>15</sup>
- **Market-by-Order (MBO):** A data schema that provides an event-based stream

of every individual order, allowing for the full reconstruction of the order book. Equivalent to Level 3.<sup>7</sup>

- **Market-by-Price (MBP):** A data schema that provides an aggregated view of the order book, showing the total volume at each price level. Equivalent to Level 2.<sup>7</sup>
- **National Best Bid and Offer (NBBO):** The highest bid price and lowest ask price for a security available across all US exchanges, as consolidated by the Securities Information Processors (SIPs).<sup>14</sup>
- **Non-Display Use:** The use of market data in applications that do not directly display the data to a human user, such as for algorithmic trading or automated calculations. Typically carries a different and often higher license fee than display use.<sup>48</sup>

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