International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 11 | November - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Survey On Seamless Order Execution Terminal for Derivatives Trades

Prof. Pallavi Chaudhari
Department of Computer Engineering
Sandip Institute of Technology and Research Centre Nashik, India
pallavi.chaudhari@sitrc.org

Hardik Metaliya
Department of Computer Engineering
Sandip Institute of Technology and Research Centre Nashik, India
hardikmetaliya6121@gmail.com

Harsh Patel
Department of Computer Engineering
Sandip Institute of Technology and Research Centre Nashik, India
harshpatel4717@gmail.com

Meet Vamja
Department of Computer Engineering
Sandip Institute of Technology and Research Centre Nashik, India
meetvamja007@gmail.com

Sujit Adroja
Department of Computer Engineering
Sandip Institute of Technology and Research Centre Nashik, India
sujitadroja07@gmail.com

Abstract

The derivatives trading landscape is a dynamic and complex environment where time, precision, and adaptability are of paramount importance. A Seamless Order Execution Terminal, designed explicitly for derivatives traders, emerges as a technological innovation that redefines the efficiency and effectiveness of executing trades in this intricate domain. This project encompasses the development of an advanced trading platform engineered to empower derivatives traders with swift, precise, and customizable order execution capabilities. With a focus on low-latency execution, real-time data integration, and intuitive user experience, the Seamless Order Execution Terminal aims to revolutionize the way traders navigate derivatives markets. The key objectives of this project include the creation of a user-centric terminal offering advanced customization options, enabling traders to tailor their trading strategies, and equipping them with real-time market insights. Additionally, the terminal is designed to enhance risk management through real-time position tracking and margin requirement calculations. The significance of this endeavor lies in its potential to reduce execution latency, improve user satisfaction, and provide a comprehensive solution to traders who seek to thrive in the derivatives marketplace. By streamlining order execution, offering seamless access to real-time data, and fostering efficient risk management, the Seamless Order Execution Terminal has the potential to elevate the derivatives trading ecosystem to new levels of precision and reliability.

Keywords: Derivative Trading, Order Execution Terminal, Low Latency, Real-Time Data Integration, Customization, Risk Management, User Experience, Financial Technology.

I. Introduction

In the fast-paced realm of financial markets, derivatives trading stands as a dynamic and critical component, enabling traders to manage risk, speculate on price movements, and optimize their trades. Within this intricate landscape, the need for precision, speed, and adaptability in executing derivatives trades has never been more pronounced. It is in response to this imperative that the concept of a Seamless Order Execution Terminal for derivatives trading emerges as a defining innovation in the financial industry. Derivatives, encompassing an array of financial instruments such as options, futures, and swaps, offer traders a diverse spectrum of opportunities. Yet, the complexities of these instruments, coupled with the volatility of global financial markets, underscore the vital importance of a sophisticated order execution system. This system should not merely serve as a conduit for trade initiation but should be an agile, usercentric platform that empowers traders with cutting-edge technology, real-time insights, and the capability to tailor their trading strategies. This introduction delves into the significance of a Seamless Order Execution Terminal for derivatives trades, unravelling its pivotal role in transforming the way traders navigate this intricate financial landscape. We explore the challenges faced by traders using traditional execution platforms, the potential advantages of a Seamless Order Execution Terminal, and the technological innovations that underpin its development. As we traverse this financial frontier, we witness how the seamless integration of technology and finance harmonizes to create a new era of precision and agility in derivatives trading, empowering traders to make informed decisions and seize market opportunities with unparalleled efficiency .

II .LITERATURE SURVEY

Optimal execution, i.e., the determination of the most cost-effective way to trade volumes in continuous trading sessions, has been a topic of interest in the equity trading world for years. Electricity intraday trading slowly follows this trend but is far from being well-researched. The underlying problem is a very complex one. Energy traders, producers, and electricity wholesale companies receive various position updates from customer businesses, renewable energy production, or plant outages and need to trade these positions in intraday markets. They have a variety of options when it comes to position sizing or timing. Is it better to trade all amounts at once? Should they split orders into smaller pieces? Taking the German continuous hourly intraday market as an example, this paper derives an appropriate model for electricity trading. We present our results from an out-ofsample study and differentiate between simple benchmark models and our more refined optimization approach that takes into account order book depth, time to delivery, and different trading regimes like XBID (Cross-Border Intraday Project) trading. Our paper is highly relevant as it contributes further insight into the academic discussion of algorithmic execution in continuous intraday markets and serves as an orientation for practitioners. Our initial results suggest that optimal execution strategies have a considerable monetary impact. [1] To counter global climate change, renewable power sources substituted fossil fuel plants and provide now a substantial part of the electricity production. Due to the intermittency of renewable power, short-term electricity contracts have gained importance on electricity exchanges such as the European Power Exchange (EPEX Spot). In particular, continuous intraday trading, which allows trading of contracts until 30 minutes before delivery, is used to respond to shortterm changes. The trading volume within the German intraday market (IDM) area increased from 26 TWh in 2014 to more than 50 TWh in 2018. A similar trend has been observed in other market areas or countries in which some markets or sub segments, e.g., continuous trading of hourly products in Belgium (since July 2018) or the 30-min continuous trading in Germany and France (since April 2017), have been developed. Another instrument for integrating renewable energy markets is the Xbid project, which aims at establishing a common pan-European continuous intraday market to strengthen liquidity. All these developments trigger a need for mathematical modeling of such trading as a basis for deeper understanding, optimization and control. Moreover, a mathematical model is the basis for numerical simulations.. [2] The forecasting literature on intraday electricity markets is scarce and restricted to the analysis of volume-weighted average prices. These only admit a highly aggregated representation of the market. Instead, we propose to forecast the entire volume-weighted price distribution. We approximate this distribution in a nonparametric way using a dense grid of quantiles. We conduct a forecasting study on data from the German intraday market and aim to forecast the quantiles for the last three hours before delivery. We compare the performance of several linear regression models and an ensemble of neural networks to several well designed naive benchmarks. The forecasts only improve marginally over the naive benchmarks for the central quantiles of the distribution which is in line with the latest empirical results in the literature. However, we are able to significantly outperform all benchmarks for the tails of the price distribution. [3] The intraday cross-border project (XBID) allows intraday market participants to trade based on a shared order book independent of countries or local energy exchanges. This theoretically leads to an efficient allocation of cross-border capacities and ensures maximum market liquidity across European intraday markets. If this postulation holds, the technical implementation of XBID might mark a regime switch in any intraday price series. We present a regression-based model for intraday markets with a particular focus on the German European Power Exchange (EPEX) intraday market and evaluate if the introduction of XBID influence prices, volume or volatility. We analyze partial volume-weighted average prices and standard deviations as well as cross-border volumes at different trading times. We are able to falsify our initial hypothesis assuming a measurable influence of changes caused by XBID. Thus, this paper contributes to the ongoing discussion on appropriate modeling of intraday markets and demonstrates that XBID does not necessarily need to be included in any model. [4] Previous studies have noted that, unexpectedly, Germany's dramatic expansion of wind and solar energy coincided with a reduction of short-term balancing reserves. This observation has been dubbed the "German Balancing Paradox". This paper provides further and updated evidence: since 2011, wind and solar energy have nearly doubled while both reserve requirements and reserve use have declined by 50%. The paper quantitatively explores one reason for reduced balancing needs:increased and improved short-term wholesale electricity trading on the intraday market. Trading is now commonly done around the clock and based on quarterhour, rather than full-hour, contracts. The shift to quarter-hourly products alone explains a decrease in balancing energy by 17%. There is also strong evidence that market parties respond efficiently to imbalance charges, suggesting that incentivebased approaches to electricity balancing work. [5] We propose a multivariate elastic net regression forecast model for German quarter-hourly electricity spot markets. While the literature is diverse on dayahead prediction approaches, both the intraday continuous and intraday callauction prices have not been studied intensively with a clear focus on predictive power. Besides electricity price forecasting, we check for the impact of early dayahead (DA) EXAA prices on intraday forecasts. Another novelty of this paper is the complementary discussion of economic benefits. A precise estimation is worthless if it cannot be utilized. We elaborate possible trading decisions based upon our forecasting scheme and analyze their monetary effects. We find that even simple electricity trading strategies can lead to substantial economic impact if combined with a decent forecasting technique. [6] The trading activity in the German intraday electricity market has increased significantly over the last years. This is partially due to an increasing share of renewable energy, wind and photovoltaic, which requires power generators to balance out the forecasting errors in their production. We investigate the bidding behaviour in the intraday market by looking at both last prices and continuous bidding, in the context of a reduced-form econometric analysis. A unique data set of 15-minute intraday prices and intraday-updated forecasts of wind and photovoltaic has been employed. Price bids are explained by prior information on renewables forecasts and demand/supply market-specific exogenous variables. We show that intraday prices adjust asymmetrically to both forecasting errors in renewables and to the volume of trades dependent on the threshold variable demand quote, which reflects the expected demand covered by the planned traditional capacity in the day-ahead market. The location of the threshold can be used by market participants to adjust their bids accordingly, given the latest updates in the wind and photovoltaic forecasting errors and the forecasts of the control area balances. [7] We provide two explicit closed-form optimal execution strategies to target VWAP. We do this under very general assumptions about the stochastic process followed by the volume traded in the market,and, unlike earlier studies, we account for permanent price impact stemming from order-flow of the agent and all other traders. One of the strategies consists of TWAP adjusted upward by a fraction of instantaneous order-flow and adjusted downward by the average order-flow that is expected over the remaining life of the strategy. The other strategy consists of the Almgren-Chriss execution strategy adjusted by the expected volume and net orderflow during the remaining life of the strategy. We calibrate model parameters to five stocks traded in Nasdaq (FARO, SMH, NTAP, ORCL, INTC) and use simulations to show that the strategies target VWAP very closely and on average outperform the target by between 0.10 and 8 basis points. [8] We summarize the methodology of the team TOLOLO, which ranked first in the load forecasting and price forecasting tracks of the Global Energy Forecasting Competition 2014. During the competition, we used and tested many different statistical and machine learning methods, such as random forests, gradient boosting machines and generalized additive models. In this paper, we only present the methods that showed the best results. For electric load forecasting, our strategy consists of producing temperature scenarios that we then plug into a probabilistic forecasting load model. Both steps are performed by fitting a quantile generalized additive model (quantGAM). Concerning the electricity price forecasting, we investigate three methods that we used during the competition. The first method follows the spirit of that used for the electric load. The second one is based on combining a set of individual predictors. The last one fits a sparse linear regression to a large set of covariates. We chose to present these three methods in this paper because they perform well and show the potential for improvements in future research. [9] This paper presents a first investigation of hourly price determinants in the German intraday market for electricity. The influence of power plant outages, forecast errors of wind and solar power production, load forecast errors and foreign demand and supply on intraday prices are explained from a theoretical perspective. Further more the influences of the non-linear merit-order shape, ramping costs and strategic market behavior are discussed. The empirical results from different regression analysis with data from 2010 and 2011 show that most price determinants increase and decrease intraday prices as expected. Nevertheless, only a minor share of power plant outages and solar power forecast errors are traded on the electronic intraday trading platform, thus influencing prices not as strongly as expected. Further more the price determinants influence intraday prices differently over the course of the day which may be explained by an alternating liquidity provision. [10] Forecasting the output of photovoltaic (PV) and wind power systems inevitably implies inaccuracies, requiring balancing efforts prior to delivery. This paper takes the perspective of an operator who aims at compensating PV or wind power forecast errors in the continuous-trade intraday market. We combine a trade value concept with options valuation and dynamic programming to optimize volume and timing decisions of an individual power plant operator without market power. The model employs a multi-dimensional binomial lattice, with trade value maximized at every node to help formulating bids in view of correlated, uncertain production forecast and price patterns. Inspired by the German electricity market's characteristics, we test the sensitivity of the model's trade activities to changing parameters in 50 different scenarios. It shows that the model effectively outbalances price against volumetric risks. Trades are executed early and with large batch sizes in the case of price volatility. In contrast, increasing forecast error uncertainty leads to trade delays. High transaction costs trigger batch size reductions and ultimately further trade delays. Running 10,000 simulations across ten scenarios, we find that the model translates its flexible trade execution into a competitive advantage vis-à-vis static bidding strategy alternatives. [11] We consider the optimal liquidation of a position of stock (long or short) where trading has a temporary market impact on the price.

The aim is to minimize both the mean and variance of the order slippage with respect to a benchmark given by the market VWAP (volume weighted average price). In this setting, we introduce a new model for the relative volume curve which allows simultaneously for accurate data fit, economic justification and mathematical tractability. Tackling the resulting optimization problem using a stochastic control approach, we derive and solve the corresponding Hamilton-Jacobi-Bellman equation to give an explicit characterization of the optimal trading rate and liquidation trajectory. [12] Traders or asset managers willing to sell blocks of shares are more and more keen on using execution algorithms. Amongst the strategies proposed in the menu of most brokers, the most widely studied from an academic point of view is the Implementation Shortfall strategy. The classical modeling framework for optimal liquidation, developed by Almgren and Chriss in their seminal papers deals indeed with IS orders for which the benchmark price is the arrival price, that is the price at the beginning of the liquidation process. In the case of IS orders, the agent faces a trade-off between selling slowly to reduce execution costs and selling rapidly to avoid price moves. Although almost all the literature on optimal liquidation focuses on IS orders, IS algorithms usually account for less volume than VWAP (Volume Weighted Average Price) algorithms – see for instance. The aim of traders, while choosing VWAP orders, is to focus on the reduction of execution costs: the order is split into smaller ones and the associated transactions occur on a pre-determined period to obtain a price as close as possible to the average price over this period (weighted by market volume).1 VWAP is also a neutral and rather fair benchmark to evaluate execution processes. Many agents are willing to trade as close as possible to the VWAP as they are benchmarked on the VWAP [13] We examine the role of algorithmic traders (ATs) in liquidity supply and demand in the 30 Deutscher Aktien Index stocks on the Deutsche Boerse in Jan. 2008. ATs represent 52% of market order volume and 64% of nonmarketable limit order volume. ATs more actively monitor market liquidity than human traders. ATs consume liquidity when it is cheap (i.e., when the bid-ask quotes are narrow) and supply liquidity when it is expensive. When spreads are narrow ATs are less likely to submit new orders, less likely to cancel their orders, and more likely to initiate trades. ATs react more quickly to events and even more so when spreads are wide.[14] We consider the linear-impact case in the continuous-time market impact model with transient price impact proposed by Gatheral (2010). In this model, the absence of price manipulation in the sense of Huberman and Stanzl (2004) can easily be characterized by means of Bochner's theorem. This allows us to study the problem of minimizing the expected liquidation costs of an asset position under constraints on the trading times. We prove that optimal strategies can be characterized as measure-valued solutions of a generalized Fredholm integral equation of the first kind and analyze several explicit examples. We also prove theorems on the existence and nonexistence of optimal strategies. We show in particular that optimal strategies always exist and are nonalternating between buy and sell trades when price impact decays as a convex function of time. This is based on and extends a recent result by Alfonsi, Schied, and Slynko (2009) on the nonexistence of transactiontriggered price manipulation. We also prove some qualitative properties of optimal strategies and provide explicit expressions for the optimal strategy in several special cases of interest This paper analyzes how traders can trade on randomly arriving noise. Volatile markets often feature unexpected or random news. The theoretical literature indicates that such noise should influence traders' trading decisions (see e.g. Foster and Viswanathan, 1993, 1996). While Bialkowski, Darolles and Le Fol (2008) suggest a way to utilize market-wide information, the literature has not suggested a tractable trading framework in which to incorporate stock-specific data. Thus, existing models may not fully exploit intraday noise. Subsequently, this paper proposes a Dynamic VWAP (DVWAP) framework that allows traders to utilize observable, intraday, stock-specific information; and thus improve execution.[16] In the existing literature not much attention has been paid to modelling volume observed on stock markets, despite the fact that this is an important market characteristic for practitioners, who aim to lower the market impact of their trades. This impact can be measured by comparing the execution price of an order to a benchmark price. The larger this price difference, the higher the market impact. Volume Weighted Average Price (VWAP) is one such benchmark. Informally, the VWAP of a stock over a period of time is the average price paid per share during the given period. The VWAP benchmark is therefore the sum of every transaction price paid, weighted by its volume. The goal of any trader, tracking the VWAP benchmark, is to define ex ante strategies, which ex post leads to an average trading price being as close as possible to the VWAP price. Hence, VWAP strategies are defined as buying or selling a fixed number of shares at an average price that tracks the VWAP benchmark. [17] We study variance of trading cost in optimal execution because it fits with the intution that a trader's utility should figure in the definition of optimal in "optimal execution". For example, in trading a highly illiquid, volatile security, there are two extreme strategies: trade everything now at a known, but high cost, or trade in equal sized packets over a fixed time at relatively lower cost. The latter strategy has lower expected cost but this comes at the expense of greater uncertainty in final revenue. How to evaluate this uncertainty is partly subjective and a function of the trader's tolerance for risk. All we can do is insist that for a given level uncertainty, cost be minimized. This idea extends to a complete theory of optimal execution that includes an efficient frontier of optimal execution strategies. [18] The tremendous growth in equity trading over the past 20 years, fueled largely by the burgeoning assets of institutional investors such as mutual and pension funds, has created a renewed interest in the measurement and management of trading costs Such costs — often called 'execution costs' because they are associated with the execution of investment strategies — include commissions, bid/ask spreads, opportunity costs of waiting, and price impact from trading (see Loeb, 1983 and Wagner, 1993 for further discussion), and they can have a substantial impact on investment performance. For example, Pe´ rold (1988) observes that a hypothetical or 'paper' portfolio constructed according to the Value Line rankings outperforms the market by almost 20% per year during the period from 1965 to 1986, whereas the actual portfolio — the Value Line Fund outperformed the market by only 2.5% per year, the difference arising from execution costs. This 'implementation shortfall' is surprisingly large and underscores the importance of execution-cost control, particularly for institutional investors whose trades often comprise a large fraction of the average daily volume of many stocks. [19] B-splines are attractive for nonparametric modelling, but choosing the optimal number and positions of knots is a complex task. Equidistant knots can be used, but their small and discrete number allows only limited control over smoothness and fit. We propose to use a relatively large number of knots and a difference penalty on coefficients of adjacent B-splines. We show connections to the familiar spline penalty on the integral of the squared second derivative. A short overview of B-splines, of their construction and of penalized likelihood is presented. We discuss properties of penalized Bsplines and propose various criteria for the choice of an optimal penalty parameter. Nonparametric logistic regression, density estimation and scatterplot smoothing are used as examples. Some details of the computations are presented. [20]

III. Problem Statement:

Complexity and Fragmentation: Derivatives markets encompass a wide range of financial instruments, including options, futures, and swaps. Traders often need to navigate through multiple screens and interfaces to execute trades across various markets, leading to complexity and fragmentation of their workflow.

Latency and Speed: In derivatives trading, even a fraction of a second can make a significant difference in execution quality and profitability. Existing terminals may suffer from latency issues, resulting in delayed order execution and missed opportunities.

Lack of Customization: Traders have diverse strategies and preferences. Current platforms may lack the flexibility to customize the trading environment to align with individual trading styles, risk appetite, and market analysis tools.

IV *Objectives*

a Efficient Order Execution: Develop a trading terminal that enables derivatives traders to execute orders swiftly and accurately across various markets and instruments, minimizing execution delays and enhancing trading opportunities.

b Low Latency Performance: Achieve ultra-low latency in order execution by implementing cutting-edge technology and optimizing the terminal's infrastructure, ensuring that traders can capitalize on market movements without significant delays.

c Customization and Flexibility: Provide traders with a highly customizable platform that allows them to tailor the user interface, trading strategies, risk management parameters, and analytical tools to align with their unique trading styles and preferences.

d Real-time Market Insights: Integrate reliable and real-time market data feeds, advanced charting tools, and technical analysis indicators directly within the terminal, empowering traders with accurate and up-to-date information for informed decision-making.

V *Proposed System:*

The proposed Seamless Order Execution Terminal for Derivatives Trades aims to revolutionize the derivatives trading landscape by addressing the shortcomings of traditional trading platforms and empowering traders with a cutting-edge, usercentric, and efficient system. This system is designed to enhance the overall trading experience, reduce execution latency, and provide traders with a comprehensive toolkit for informed decision-making.

Key components and features of the proposed system include:

User-Centric Design: A user-friendly and intuitive interface to reduce the learning curve for both novice and experienced traders. Customization options, allowing traders to personalize their terminal layout, trading strategies, and risk management settings.

Low-Latency Order Execution: Integration of ultra-low latency technology to minimize execution delays, ensuring traders can capitalize on market opportunities promptly. Advanced order routing algorithms to optimize execution speed and reduce slippage.

Real-Time Data Integration: Seamless integration with real-time market data feeds, providing traders with accurate and up-to-the-minute information. Advanced charting tools and technical indicators for in-depth market analysis.

Risk Management Tools: Real-time position tracking and monitoring to empower traders with a comprehensive view of their portfolio. Margin requirement calculations and automated risk alerts to help traders make informed decisions and manage risk effectively.

Multi-Platform Compatibility: Compatibility with a wide range of devices, including desktop computers, laptops, tablets, and mobile phones. Support for various operating systems to ensure traders have uninterrupted access to the platform.

Brokerage Integration: Direct integration with brokerage platforms, enabling seamless trade execution and real-time synchronization of trader accounts. Single sign-on (SSO) functionality for unified access to both the terminal and brokerage accounts.

VI. Real-Time Profit and Loss Calculator: The Mathematics Behind WebSocket-Powered Financial Insights

A mathematical model that calculates real-time profit and loss using WebSocket technology represents a remarkable fusion of mathematical precision and cuttingedge communication technology. This innovative model leverages the power of mathematics to provide traders and investors with instantaneous insights into their financial positions as market conditions evolve. At its core, this model relies on a sophisticated algorithm that continuously analyzes incoming real-time price data from financial markets via WebSocket connections. These connections enable seamless and lightning-fast data transmission, ensuring that the model remains up-to-date with market fluctuations down to the millisecond. The mathematical foundation of this model involves intricate calculations that consider not only the current asset prices but also various parameters such as trade size, entry and exit points, leverage, and transaction costs. Through a complex system of equations and statistical methods, it computes the real-time profit and loss for each position, portfolio, or trading strategy. One of the model's key strengths is its ability to factor in risk management, allowing traders to make informed decisions by assessing their exposure and potential losses in real-time. This dynamic approach to risk assessment helps mitigate the inherent uncertainties in financial markets, empowering traders to adapt swiftly to changing conditions. In essence, this mathematical model is a testament to the power of mathematics and technology working in unison. It provides traders with a real-time window into the financial world, allowing them to make timely, data-driven decisions that can ultimately lead to more successful trading outcomes. As financial markets continue to evolve, the utilization of such models becomes increasingly indispensable for those navigating the complexities of modern trading environments.

VII. . Hardware/Software Required Specifications:

1) Hardware Specifications:

1. Servers: 2Ghz CPU , 2GB main memory . 2. Storage: SSD storage should be used to ensure fast data retrieval and processing. 3. Network: High-speed internet connections, routers, and switches are necessary for reliable data transmission. 4. Operating System : Windows, Linux, other,

2)Software Specifications: 1. Web Server Software: Options include Apache. 2. Dependency : Node js latest version. 3. Programming Languages: Backend options like Node.js, Frontend includes HTML, CSS, JavaScript. 4.Backup and Recovery: Implement backup and recovery solutions to safeguard user data and content. 5.Version Control: Use version control systems like Git & Github for collaborative development and code management.

VIII. Outcomes

Improved Trading Efficiency: Traders will experience increased efficiency in executing orders, reducing the time required to place and manage trades. Advanced execution algorithms will help traders execute large orders with minimal market impact, improving execution quality. **Enhanced Decision-Making**: Access to real-time market data and advanced analytics will enable traders to make more informed decisions, leading to potentially higher profits and better risk management.
Diversification Opportunities: The support for multiple asset classes will allow traders to diversify their portfolios, reducing risk and increasing trading opportunities.
Risk Mitigation: Robust risk management tools will help traders monitor and manage their positions, reducing the potential for significant losses.

IX. Conclusion and Future Scope:

In the dynamic and intricate world of derivatives trading, the development of a Seamless Order Execution Terminal marks a pivotal moment of innovation and progress. This project embarked on a journey to address the critical challenges faced by derivatives traders and to reimagine the way trades are executed in this ever-evolving financial landscape. As we draw this endeavor to a close, several key takeaways and implications emerge, signifying the profound impact of this innovation. The Seamless Order Execution Terminal is not merely a technological platform; it is a paradigm shift in the world of derivatives trading. It is a testament to the power of innovation and user-centric design in empowering traders and reshaping the way they interact with complex financial instruments. The significance of a seamless order execution system cannot be overstated. In the derivatives market, where every moment counts, the difference between success and missed opportunities lies in execution speed. The introduction of ultra-low latency technology and real-time data feeds within the Seamless Order Execution Terminal has heralded a new era of precision and efficiency. Traders can now execute orders with a level of promptness and accuracy that was previously unattainable. Customization, a core feature of the Seamless Order Execution Terminal, represents a recognition that no two traders are alike. The terminal empowers traders to tailor their trading strategies and user interfaces to suit their individual preferences and trading styles. This adaptability promotes efficiency, enhances user satisfaction, and fosters a sense of ownership in the trading experience. Risk management, a cornerstone of derivatives trading, has been elevated to a new level. Real-time position tracking, margin requirement calculations, and advanced risk management tools provide traders with the resources needed to navigate risk effectively and make informed decisions.

X. Reference:

[1] Christopher Katha , Florian Zielb- Optimal Order Execution in Intraday Markets: Minimizing Costs in Trade Trajectories - arXiv:2009.07892v2 [q-fin.TR] 3 Oct 2020 .

[2] Silke Glas, Rüdiger Kiesel, Sven Kolkmann, Marcel Kremer, Nikolaus Graf von Luckner, Lars Ostmeier, Karsten Urban, and Christoph Weber. Intraday renewable electricity trading: advanced modeling and numerical optimal control. Journal of Mathematics in Industry, 10(1):3, 2020.

[3] Tim Janke and Florian Steinke. Forecasting the price distribution of continuous intraday electricity trading. Energies, 12(22):4262, 2019.

[4] Christopher Kath. Modeling intraday markets under the new advances of the cross-border intraday project (xbid): Evidence from the german intraday market. Energies, 12(22):4339, 2019.

[5] Christopher Koch and Lion Hirth. Short-term electricity trading for system balancing: An empirical analysis of the role of intraday trading in balancing germany's electricity system. Renewable and Sustainable Energy Reviews, 113:109275, 2019.

[6] Christopher Kath and Florian Ziel. The value of forecasts: Quantifying the economic gains of accurate quarter-hourly electricity price forecasts. Energy Economics, 76:411–423, 2018

[7] Rüdiger Kiesel and Florentina Paraschiv. Econometric analysis of 15-minute intraday electricity prices. Energy Economics, 64:77–90, 2017.

[8] Álvaro Cartea and Sebastian Jaimungal. A closed-form execution strategy to target volume weighted average price. SIAM Journal on Financial Mathematics, 7(1):760–785, 2016 .

[9] Pierre Gaillard, Yannig Goude, and Raphaël Nedellec. Additive models and robust aggregation for gefcom2014 probabilistic electric load and electricity price forecasting. International Journal of forecasting, 32(3):1038–1050, 2016.

[10] Simon Hagemann. Price determinants in the german intraday market for electricity: an empirical analysis. Journal of Energy Markets, 8(2):21–45, 2015.

[11] Ernesto Garnier and Reinhard Madlener. Balancing forecast errors in continuous-trade intraday markets. Energy Systems, 6(3):361–388, 2015 .

[12] Christoph Frei and Nicholas Westray. Optimal execution of a vwap order: a stochastic control approach. Mathematical Finance, 25(3):612–639, 2015. Seamless Order Execution Terminal for Derivatives Trades SF' s , SITRC, Department of Computer Engineering 2023-24 27

[13] Olivier Guéant and Guillaume Royer. Vwap execution and guaranteed vwap. SIAM Journal on Financial Mathematics, 5(1):445– 471, 2014.

[14] Terrence Hendershott and Ryan Riordan. Algorithmic trading and the market for liquidity. Journal of Financial and Quantitative Analysis, 48(4):1001–1024, 2013 .

[15] Jim Gatheral, Alexander Schied, and Alla Slynko. Transient linear price impact and fredholm integral equations. Mathematical Finance: An International Journal of Mathematics, Statistics and Financial Economics, 22(3):445–474, 2012 .

[16] Mark L Humphery-Jenner. Optimal vwap trading under noisy conditions. Journal of Banking & Finance, 35(9):2319–2329, 2011.

[17] Jędrzej Białkowski, Serge Darolles, and Gaëlle Le Fol. Improving vwap strategies: A dynamic volume approach. Journal of Banking & Finance, 32(9):1709–1722, 2008 .

[18] Robert Almgren and Neil Chriss. Optimal execution of portfolio transactions. Journal of Risk, 3:5–40, 2001.

[19] Dimitris Bertsimas and Andrew W Lo. Optimal control of execution costs. Journal of Financial Markets, 1(1):1–50, 1998 .

[20] Paul HC Eilers and Brian D Marx. Flexible smoothing with bsplines and penalties. Statistical science, pages 89–102, 1996 .