

# Preface

This research started in 1998 when Bios Group and Nasdaq entered into a collaboration to explore new ways to better understand Nasdaq's operating world. One set of goals was to explore the effects, including unintended consequences, of the market microstructure, market rules, and changes to them, on the behavior of participants such as market makers and traders in the Nasdaq market, and thereby on the dynamics and behavior of the market as a whole. For reasons that will become clear, the means chosen to pursue these goals was to create agent-based models of the Nasdaq market.

Stock markets in general, and Nasdaq in particular, have undergone a period of rapid change in the past few years, which produced sweeping changes in the market's behavior. The nature and direction of those changes are still far from certain; however, they are certainly dramatic. Therefore, it is of the utmost importance to understand what can happen so that markets and their regulators have sufficient information to prepare for new changes in the future, potentially by making well-informed adjustments to some of their rules and infrastructure.

One of the most important issues in 1998 was the forthcoming decimalization. Decimalization means a change to expressing prices in a decimal system, rather than in dollars and fractions of dollars, and the related questions of what the minimum tick size (or price change) in the markets should be, and what effects a particular minimum tick size might have on the dynamics of the market, and its fairness, volatility, price discovery, etc. Much of the recent history of Nasdaq and NYSE prices were quoted in  $\$1/8$ ths and  $\$1/16$ ths, but in 1998 decimalization was being planned; hence this was a very important issue at the time. The goal of this book is two-

fold: first, to describe our research in investigating this question — how decimalization, and tick size reductions in particular, affect the market’s overall behavior, and the behavior of market’s individual participants; and second, to present a conceptual agent-based market modeling framework and its implementation.

This book will be useful to the people and organizations involved in market research and operations — market modelers, stock brokers, market makers, day traders, etc. It will also be useful to researchers in academia as a welcome departure from more traditional perfectly rational, equilibrium or econometrics based approaches. It will also be useful to policy makers as a presentation of a cohesive conceptual framework and of a test system for evaluating the impacts of various policy and rule changes. And last, but not least, it will be useful to anyone who wants to understand how the observed market dynamics arises from interaction of behaviors of a market’s individual participants and components. However, this is not a cookbook: while we provide a significant amount of detail on how the simulation was constructed and how the results were obtained, it does not provide step by step instructions on how a similar simulation can be created. Additional supplementary materials for this book and for the simulation model described here can be found at [www.agentsim.com](http://www.agentsim.com).

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Since this work was carried out, Bios Group operations have been sold, and both authors have moved on, with Vince setting up a branch of Eurobios in London, UK, and Sasha joining the Los Alamos National Laboratory. Both authors continue to apply the techniques and approaches discussed here to a wide variety of interesting problems, of both a research and practical nature.

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