CBB Book Review No. BR/25/3

Data Science for Economics and Finance: Methodologies and Applications

Edited by Sergio Consoli et al.

Book Review Contributed by Tré Hollingsworth

May 13, 2025

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Edited by Sergio Consoli, Diego Reforgiato Recupero and Michaela Saisana.

Publisher: Springer Cham (2021)

ISBN Hardcover: 978-3-030-66890-7
ISBN Softcover: 978-3-030-66893-8
ISBN eBook: 978-3-030-66891-4

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A Review of Data Science for Economics and Finance: Methodologies and Applications

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"The "polycrisis" is paralyzing only for those who are attached to the old order of mechanistic and colonial thinking. For those who are not, it offers a "polytunity" to usher in new paradigms that invert the way we think about the development process, the sources of solutions, and the role of the state" (Ang 2024).

With all modern economies being susceptible to a variety of economic shocks, concurrent and converging crises continue to challenge the global community (World Bank 2024). However, as a small island developing state, Barbados faces substantial and compounding vulnerabilities that disproportionately subject it to the vagaries of polycrises (UNDP 2024). Burdened with a small fiscal space and declining but persistently high levels of debt, the tourism- and import-dependent island is forced to pursue economic growth and development while navigating climate risks, supply-chain disruptions, and mounting geopolitical tensions and international polarisation.

Across the globe, the growing regularity with which economic shocks occur increases the difficulty of building economic forecasts and nowcasts that are highly accurate in the medium- to long-term. This complicates the ability of policymakers, economists and finance professionals to make data-driven decisions in their respective spheres, placing the resilience of our economies at significant risk. In the era of FinTech and Big Data, however, there are new opportunities to leverage data science techniques and the exponentially increasing quantities of data to better identify financial and economic relationships, improve model-building and facilitate more accurate, real-time forecasts.

Following the publication of the corresponding healthcare text, *Data Science for Economics and Finance: Methodologies and Applications* sheds much necessary light on the potential of expanding data science applications in the underexplored fields of business, economics and finance. Principally written for data scientists, analytics professionals, policymakers and academics interested in data science technologies, it generally uses comprehensible language to convey ideas that are likely best understood by those with some experience in financial and economic research. Notwithstanding, more now than ever before, its contents are of tremendous value to stakeholders at every level of the relevant decision-making processes.

Throughout its fourteen chapters, the book employs theoretical models, case studies and empirical data to explore the utility of data science in our modern context. In Chapter 1, the authors provide a general introduction to the use of the multidisciplinary field for economic and financial modelling, highlighting some of the main challenges associated with its applications. Due to the interrelated nature of data science, there is clear repetition in the topical coverage across the chapters that follow. Nonetheless, the remainder of the text is still effectively organised into thematic subsections.

Chapters 2 to 4 scrutinise the use of machine learning (ML) models through the lens of their "black box" categorisation which impacts the usefulness of the tools beyond their predictive capacity. Chapters 5 and 6 explore applications of algorithmic classification methods to the areas of credit scoring and market analysis. The use of alternative data in macroeconomic monitoring is the principal focus of Chapters 7 and 8 with the subsequent five chapters homing in on the analysis of textual data. To conclude, Chapter 14 applies network analysis to develop a model of global firm ownership.

Currently, we find ourselves in what is called the Big Data era—characterised by expansive volumes and varieties of high-veracity and high-velocity data. It follows then that, due to their ability to handle Big Data in both its structured and unstructured forms, applications of data science technologies are said to be gaining popularity across a range of domains.

As such, the computing capacities of the systems we use in data generation, processing and sharing are of concern in the implementation of these new technologies. Still, the authors impress on practitioners that to maximise their analytical power, great attention must be paid to ensuring that data is properly aggregated, stored and protected while also maintaining its quality, accessibility and utility. In the realm of open data, the World Wide Web Consortium has also established guidelines to ensure that such data is findable, accessible, interoperable and reusable.

Heavily influenced by the EU's General Data Protection Regulation, Barbados' Data Protection Act came into force in 2021 and is regarded as one of the most robust in the region (Morgan 2021). Despite this, perceptions of ensuing malpractice and the apparent proliferation of breaches related to sensitive personal data have led to continued consternation among the island's populace (Blunt 2024). The country would therefore benefit from appropriately balancing its goal of bolstering institutional data and cybersecurity safeguards while also improving the open data frameworks that will undergird the strength of its analytical capacity.

By foregoing the parametric assumptions of traditional economic and financial models, data science tools like ML algorithms are able to uncover complex, nonlinear relationships that may not otherwise be immediately evident. In turn, this drives their often-superior predictive power, causing the tools to be increasingly considered for application in economics and finance.

However, this is not without a major caveat as many data science models continue to be deemed "black boxes". That is to say that, by principally focusing on maximising predictive performance, these models often fail to retain the level of transparency and interpretability required to support decisions made by policymakers and other relevant professionals. As a result, the authors stress that to make data science more impactful, these stakeholders must work to find solutions that are better able to balance prediction power, scalability and interpretability.

To address this, the authors compare the performances of various conventional, algorithmic and ensemble models across a number of use cases. They argue that these evaluation exercises

are imperative as the applicability of the models relies heavily on the financial and economic context under consideration. In their assessments of the various case studies, the importance of reserving human experts in the engineering, testing and deployment of data science technologies is also underscored. The book cautions that their domain knowledge better positions these individuals to choose the best algorithms, select the most relevant predictors, make more accurate forecasts and issue more insightful interpretations of the results.

The authors' use of ML models to predict risk and unemployment in addition to firm success and competitiveness are of great relevance to the Barbadian landscape. Within the island's formal business sector, micro, small and medium-sized enterprises (MSMEs) account for 96.3 percent of the operating firms (IADB 2020). While simultaneously responsible for approximately 60.7 percent of the country's employment, these businesses are overwhelmingly classified as high risk when assessed for traditional loan financing. This restricts their access to critical capital required for growth and places additional strain on the already limited resources provided through Government-funded business development programmes (SBA 2023). Although ML technologies demonstrate the potential for more efficient resource allocation, efforts must be made to ensure that they can also be used to justify the actions of the public and private sector officials ultimately accountable for these decisions.

After exploring the varied ML applications, the book acknowledges that the transformative capabilities of data science are also constrained if model inputs are only received periodically as is customary with traditionally sourced data. Once accuracy can be assured, the authors endorse the incorporation of alternative sources that produce various types of granular, high-frequency data. By narrowing information gaps in a timely manner, this data can complement the existing statistical systems to allow for more efficient, real-time macroeconomic and financial monitoring.

Owing to its heavy reliance on the import of goods and the export of tourism services, Barbados' growth and development is highly sensitive to global economic and climatic conditions. As a result, alternative data like that which the authors source from Google Trends and the automatic identification system (AIS) may prove salient to the country. Used respectively to develop proxies for tourism and external commodity trade, the replication of similar indices could aid in enhancing Barbados' forecasting and nowcasting power, thus boosting its responsiveness and resilience.

Unstructured text from newspapers, social media posts and other textual formats is another example of alternative data examined by the authors. Through applications of text mining techniques and natural language processing (NLP)[2] models, they explore the use of textual data to build network maps, perform topic modelling and conduct various sentiment analyses.

As discussed in the book, network maps can be employed to depict relationships between any selection of financial institutions, businesses or other economic agents within Barbados. In spite

[2] NLP is a subfield of artificial intelligence. It utilises machine learning to enable computers to comprehend and communicate with human language.

of this, given the country's innumerable interactions with external entities, the more difficult development of a global network map may be of greater relevance. This would enable more thorough investigation into Barbados' overall exposure to risk as well as the sectors in which it is concentrated. In doing so, regulators will be better equipped to not only exercise their powers but to also rationalise the need for potentially restrictive mandates.

Topic modelling and sentiment analysis, on the other hand, show mixed potential for application in the Barbadian context. As the country's official language, newspapers and other formal information sources are mainly written in standard English. Conversely, the creole language, Bajan dialect, is recognised as the island's vernacular and is therefore expected to predominate text found on social media and other unofficial communication channels. Due to its lack of standardisation, the development of a comprehensive vernacular lexicon on which the two approaches would be based may prove to be a complex and laborious undertaking. This, therefore, may limit the scope of their applications to textual data derived from non-official sources. As a result, the depth of possible analysis may also be restricted.

Be that as it may, it is important to note that normalising the use of alternative data has implications for the information monopoly held by public institutions. Particularly, when done in concert with opening access to data, it further calls into question the framing of official reports as incontrovertible versions of the truth.

Leaders are therefore left with a choice. They can view the potential for additional scrutiny and competing financial and macroeconomic assessments as a threat to their legitimacy and relevance or as an opportunity for the substantiation and improvement of institutional practices. Whichever perspective is taken will ultimately impact their ability to holistically transform and modernise their operations. By extension, their decisions on the adoption of broader data science technologies and open data principles will also affect the responsiveness and resilience of their countries in the face of prevailing global financial and economic crises.

Data Science for Economics and Finance: Methodologies and Applications primarily draws on expertise from Europe and the United States of America which is reflected in its almost exclusive study of these territories. Recognising that other jurisdictions are in less-advanced stages of developing their digital and data science capabilities, this book can help to inspire their progress and serve as a solid basis for further research in which their economies take precedence.

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