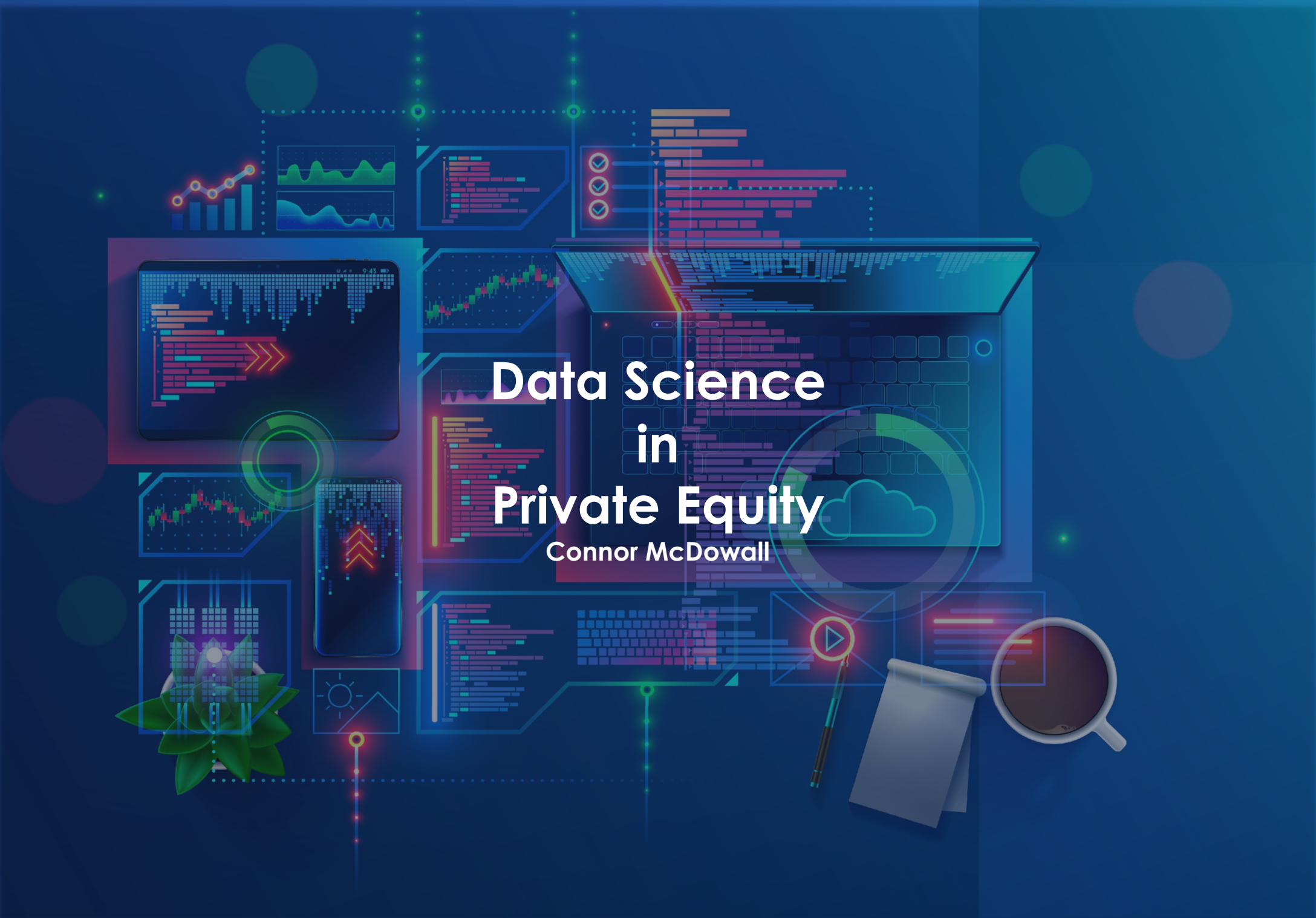
Data Science
in
Private Equity
Connor McDowall

# Introduction

Private Equity (PE) is an alternative asset class Limited Partners (LP) choose to allocate capital to General Partner (GP) for investments in privately-held assets.

The GPs invest the capital for a period depending on the mandate. Funds range from Venture Capital, Growth Equity to Leveraged Buyout. Funds traditionally adopt a 2/20 fee structure. 2% for assets under management and 20% on all returns generated in the funds.

Data science combines the scientific method, math and statistics, specialized programming, advanced analytics, AI, and even storytelling to uncover and explain the business insights buried in data (IBM, 2021).

The number of data science applications are increasing in most industries but there is slow uptake in private equity. This creates opportunity.

# Supporting Literature

**Preceding Literature emphases returns and value creation from private equity**

- The presence of cyclicity in PE returns that differs according to fund type and is consistent with the conjecture that capital market segmentation contributes to private equity returns (Cavagnaro et al, 2019)

- Institutional investors returns are not from chance alone, but skill leads to outperformance when selecting private equity investors (Ang et al, 2018)

- Adaptation of stochastic discount factor valuation methods for venture capital performance evaluation, generalizing the Popular Market Equivalent (PME) method to reflect risk-free rates and public returns, finds abnormal performance (Korteweg & Nagel, 2016)

- Evidence of differences of skill and exit styles among venture partners investing at the same VC firm at the same time, estimating human capital is two to five times more important than a VC firm's organizational capital in explaining performance (Ewens & Rhodes-Kropf, 2015)

# Supporting Literature

**Preceding Literature emphases returns and value creation from private equity**

- Classification of risks and post-investment actions inform agency and hold-up problems are important to contract design and monitoring (Kaplan & Stromberg, 2005)

- Analysis of firm and VC characteristics, in combination with value increasing investments post-IPO for both VC's and underlying companies, is an efficient solution to information problems (Iliev & Lowry, 2020)

- Harris et al (2014) found buyout performance consistently exceeds the public markets (S&P 500) by 3% annually, calculated using the Burgiss data set. Performance in Cambridge Associates and Preqin datasets is qualitatively consistent with Burgiss, but is lower in Venture Economics.

- The main determinant of leverage in buyouts is variation in economy-wide credit conditions. Higher deal leverage is associated with higher transaction prices and lower buyout fund returns. This suggests that acquirers overpay when access to credit is easier (Axelson et al, 2013)

# Supporting Literature

**Preceding Literature emphases returns and value creation from private equity**

- Investments in innovation, measured by patenting activity, informs one form of long-run activity. Based on 472 LBO transactions, There is no evidence that LBOs sacrifice long-term investments (Lerner et al, 2011)

- Phalippou (2020) finds evidence private equity performance does not exceed public market once carry and other factors.

# Hypothesis Development

**Precedent literature informs several key insights:**

1) Fund type and capital market segmentation create variability in portfolio construction and subsequent performance. Multiple examples with interactions must be considered
2) Skill plays an important factor in investing mandates from an institutional perspective. Analytical tools may inform mandates and investing perspectives.
3) Human capital can lead to variability in investing performance, both under and over performance depending on the individual
4) Prior research uses four separate datasets with provide the perspective of the fund:
   - Burgiss & Preqin – Private Capital Fund Performance
   - Cambridge Associates & Venture Economics – TBC
5) Current credit environment indicates funds overpay for investments, leading to unprofitable investments
6) Diverging views exist between private and public market performance

Subsequently, there is an opportunity to consider new analytics methodologies to improve due diligence and generate returns.

There is very little prior research on the use of data science in private markets

# Case Studies: BCG, Blackstone & NZ Super Fund

**Several case studies inform the intersection of data science and private equity:**

BCG published analysis on creating value in Private Equity with Advanced Data and Analytics, providing three key examples:

1) Geo-analytics
   - Identified profitable locations for vending machines
2) Predictive Maintenance
   - Prioritization in repairing machines with a higher risk of failing
3) Workforce Optimisation
   - Match skillsets of technicians with customer requirements

Blackstone employ data scientists to inform both portfolio operations and investment practices. A unique asset is the data of portfolio companies may create value for the owner.

The former comments on BCG and Blackstone are operational applications. They frame potential applications for phenomena outlined in the literature

From an investing perspective, NZ Super Fund are exploring data science applications in equities selection methods to compare against traditionally processes.

# Data: PitchBook Introduction

**PitchBook may be a better alternative to the other data sources:**

- PitchBook is financial data and software company who provide thousands of professional's comprehensive data on private and public market information
- Comprehensive data on Companies, Investors, Deals, M&A, LPs, Funds, Financials, Advisors, Professionals, Debt & Lenders
- In particular:
  - Companies of various designations (Publically traded, Pre-IPO, PE-backed, Startups/Stealth)
  - Deal information (Bankruptcies, IPOs, PIPEs, LBO, VC Investments)
  - Financial information (calculation transparency, balance sheets, cash flow statements, income statements, consensus information, deal multiples, financial ratios, fundamentals)
- Time-series and cross-sectional data is available
- Data accessible through API and Excel
- Widely adopted/used in industry (New Zealand Trade & Enterprise)
- The product has high levels of granularity for data science applications

# Data: PitchBook Data

**The PitchBook database continues to grow (figures as at 03/06/2021):**

**Deals**

- 1,540,549 deals with 45+ deals types
- Evaluate deal histories
- Get key information and deal multiples
- Access pre- and post-money valuations
- Explore series terms and stock information

**Companies**

- 3,096,933 (private)
- 58,362 (public)
- Get key information
- Explore financing history
- Evaluate financials and filings
- View executives and board members
- Follow non-financial metrics

**Financials**

- See financials and estimates summary
- Analyze key metrics
- Explore balance sheets, income statements, cash flows, ratios & multiples

# Methodology: Data Science Process

**Most data science projects follow the same process:**

1) Get the "Big picture" (what problem are you trying to solve –and why?)
   - Analysed Prior Literature and Case Studies
2) Data (what data do you have – and what data should you get?)
   - Pitchbook: Venture Capital, Private Equity, M&A Database
     - Download Company and Deal-related information
3) Look at the data (understand the structure, relationships, missing data)
4) Prepare the data (cleaned up, in table form)
   - Data divided into three sets:
     1. Training set (gradient descent/stochastic gradient descent optimisation)
     2. Validation set (fine-tune hyperparameters, regularisation (over/underfit))
     3. Testing
5) Select a model and train it (but which model? No free lunch)
   - Implementation of two supervised learning methods:
     - Artificial Neural Net (ANN)
     - Ensemble of Naïve Bayes Classifiers (Random Forest)
6) Fine-tune the model (hyper-parameters, performance)
7) Present the solution (to whoever paid for it)
8) Put solution into production

# Implementation, Contributions & Applications

**The subsequent technologies inform research implementation:**

1. Python - Numpy, Pandas, Scikit-Learn, TensorFlow, Module
2. Anaconda
3. macOS Mojave (OS)
4. MacBook Pro (13inch, 2019; 1.4 GHz Intel Core i5; 8 GB 2133 MHz LPDDR3)
5. Microsoft Visual Studio Code (IDE)
6. Git/GitHub (Version Control)
7. IBM Academic Initiative (If needed)
8. AWS (If needed)

**There are two major contributions in this research proposal:**

1. Assess the feasibility of PitchBook as a suitable database for future work/analysis in private market-related
2. Show data science can inform due diligence, portfolio operations and/or investing in private equity (Development of accurate models)

There are a couple applications:

1. Industry Adoption
2. Incorporation into Ansarada

# Questions

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