Strategic Decision Making in the 3D Printing Industry

A Robust Decision Making (RDM) analysis

Pedro Nascimento de Lima[1], Maria Isabel Wolf Motta Morandi[1], Daniel Pacheco Lacerda[1]

[1] GMAP Research Group, UNISINOS University, RS, Brazil

November 14, 2018

Introduction

Motivation - DMDU and Business Decisions

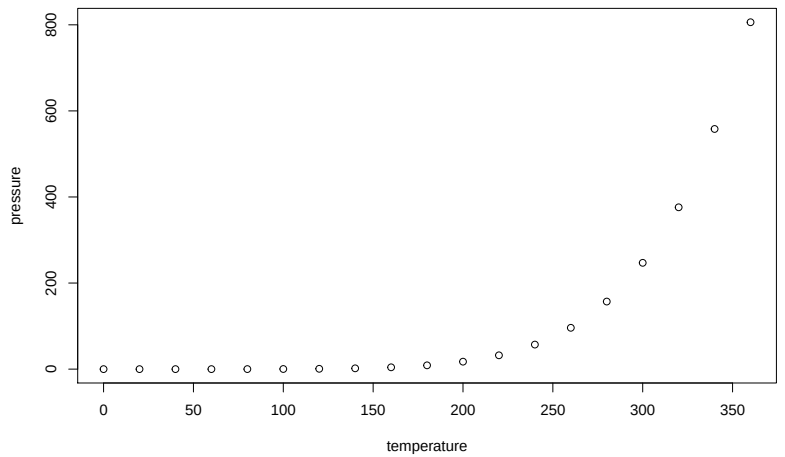
- Decision Makers in Business are faced with uncertainty, but...
- Testing quotation: (Lima 2018, Gong et al. (2017), Wholers (2016))

Key Features of 3D printing

- 3D printing allows us to manufacture parts with unprecedented **complexity**, in **low volume**;
- By doing so, entire manufacturing industries might be disrupted by AM, presenting challenges to . . .

Two Column Layout

- 3D printing allows us to manufacture parts with unprecedented **complexity**, in **low volume**;
- By doing so, entire manufacturing industries might be disrupted by AM, presenting challenges to ...



Why 3D Printing?

3D Printing is an emergint technology, but decision makers face uncertainty.

Positive Evidence: - 3D printing Industry has seen two digits growth consistently in the last few years; - 3D printing is already reshaping supply chains across industries (e.g.: prothesis, aerospace, etc.);

Negative Evidence: - Major players have been observing declining profitability (e.g.: Stratasys, 3D Systems); - Estimates of 3D printing growth diverge;

Shaping events in the 3D Printing Industry

- Patent Dynamics & Patent Expiration (e.g. FDM Patent);
- Fierce Competition;
- After the 3D printing Bubble, major players refocused their operations on industrial-grade printers;

XLRM

Model Boundaries

Outside the Scope of the model

- 3D Printers models disaggregation;
- 3D Printing market disaggregation;
- Mergers and Acquisitions;
- Patent Licensing;
- Disaggregated New Entrants;
- Competition w/ competing Technologies (e.g.: machining);
- 3D printing service industry;
- 3D Printing supplies sales;
- Interactions with non-professional 3D printing Market;

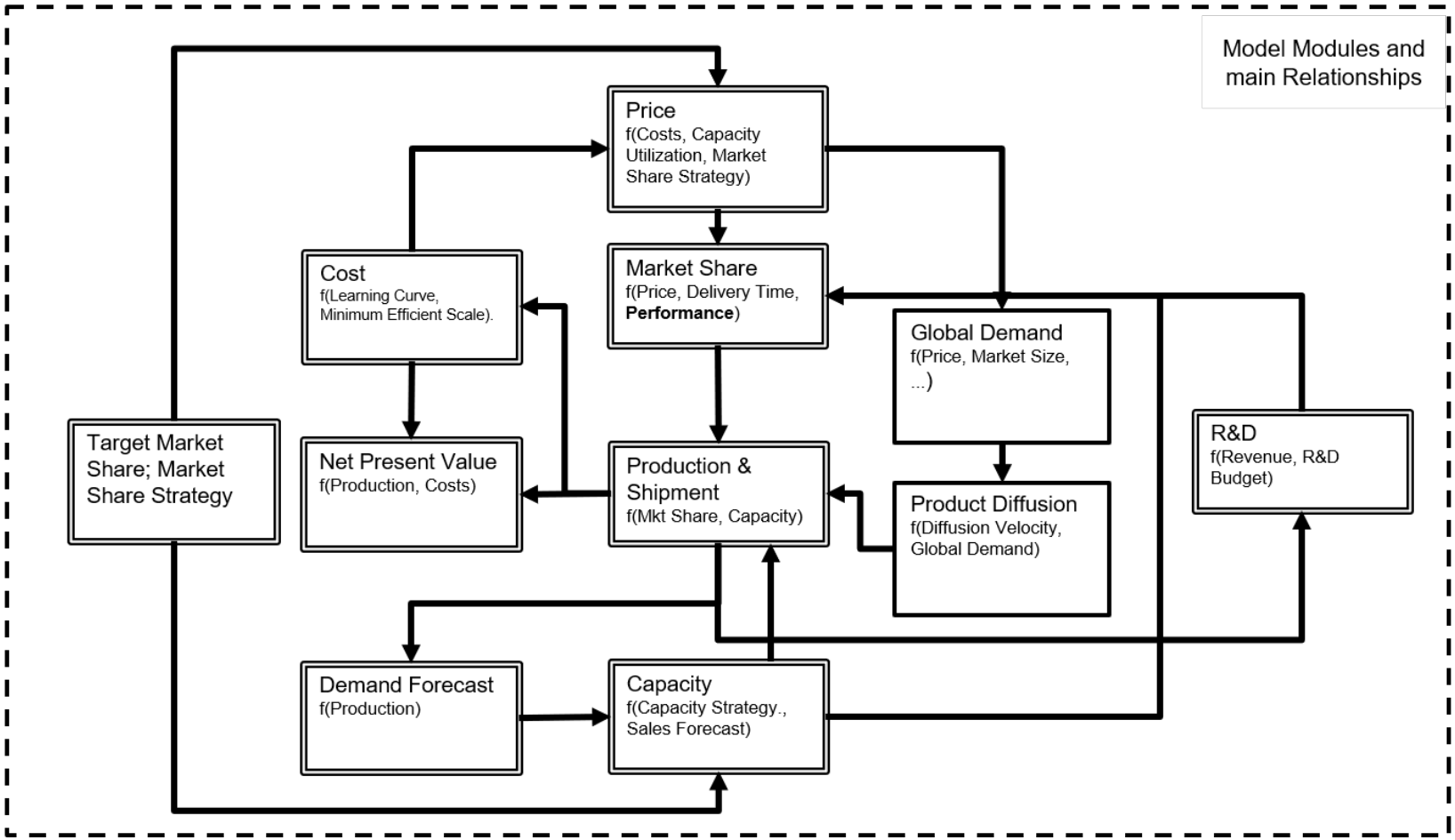


Figure 1: Model Structure & Boundaries

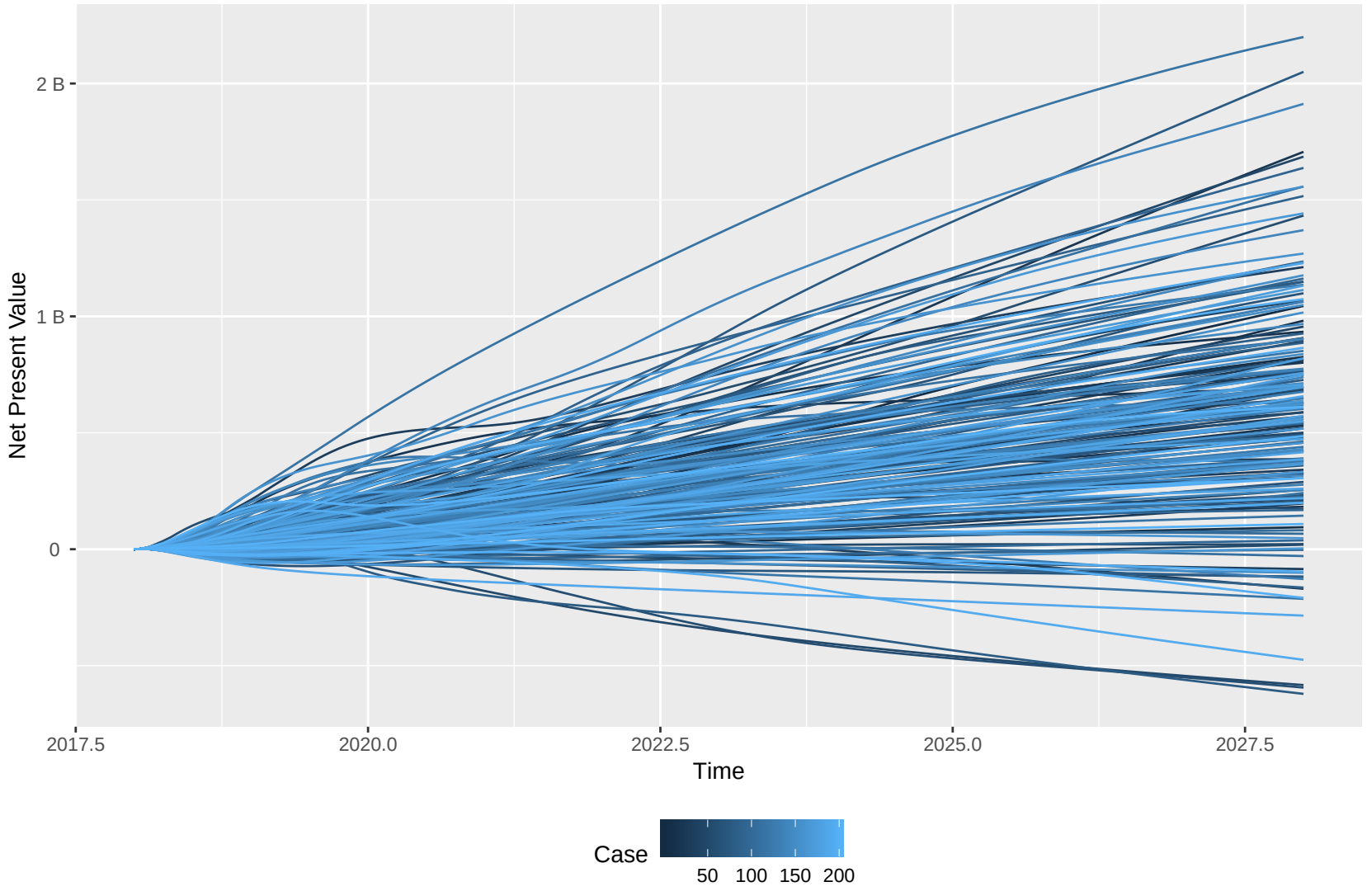
Case Generation

Design of Experiments

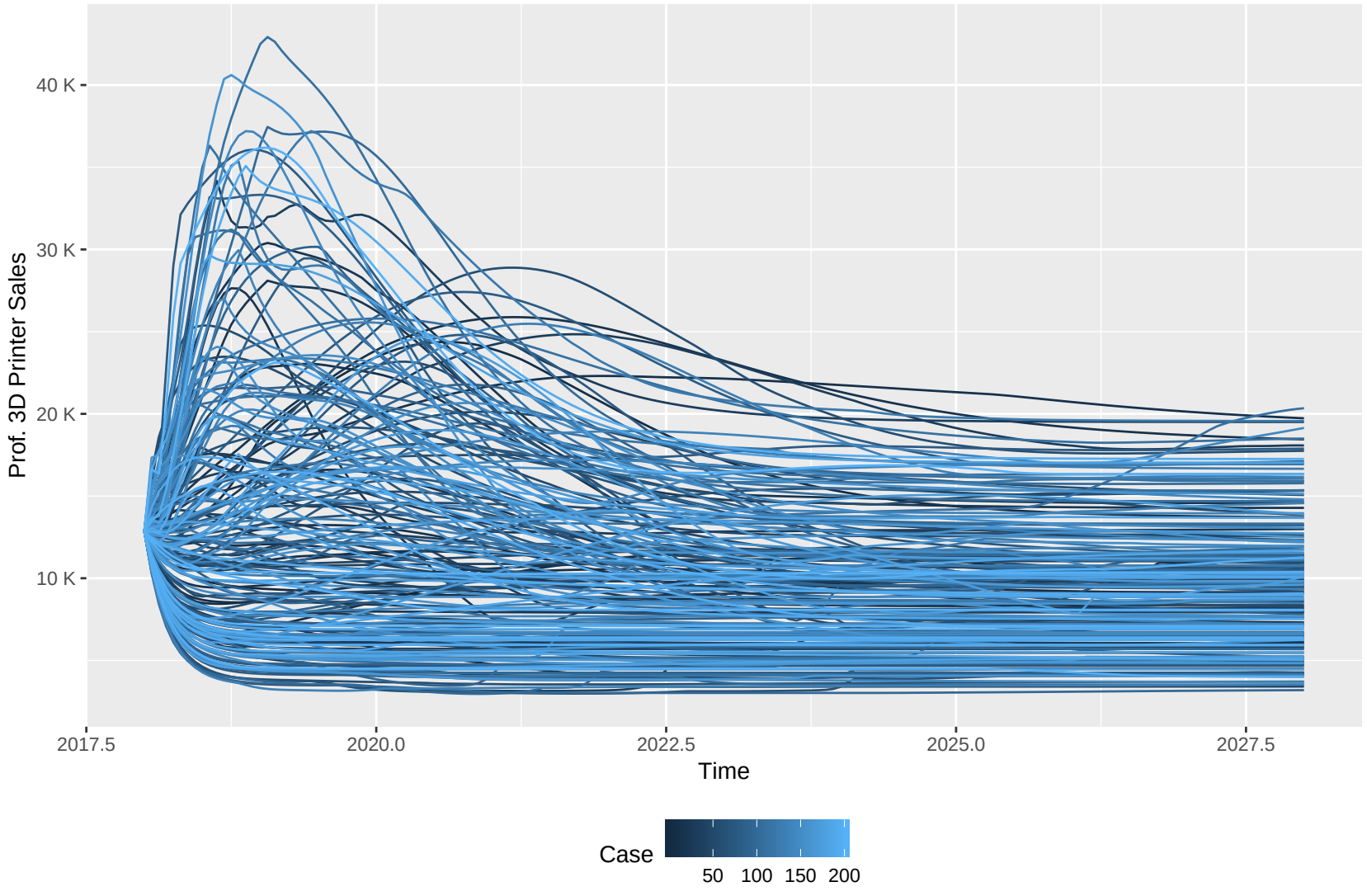
- Full factorial design of these variables, resulting in 54 strategies:

Variable	Meaning	Levels
S_1	Market & Pricing Strategy. Defines wether the player pursue an agressive marketing strategy to gain market share (by cutting prices and accepting excess capacity), or pursue a conservative strategy,	Agressive (1); Conservative (2)
S_1^{max} or S_1^{min}	Desired Market Share. For a Conservative Strategy, the player adopts the S_1^{max}, and	20%; 30%; 40%

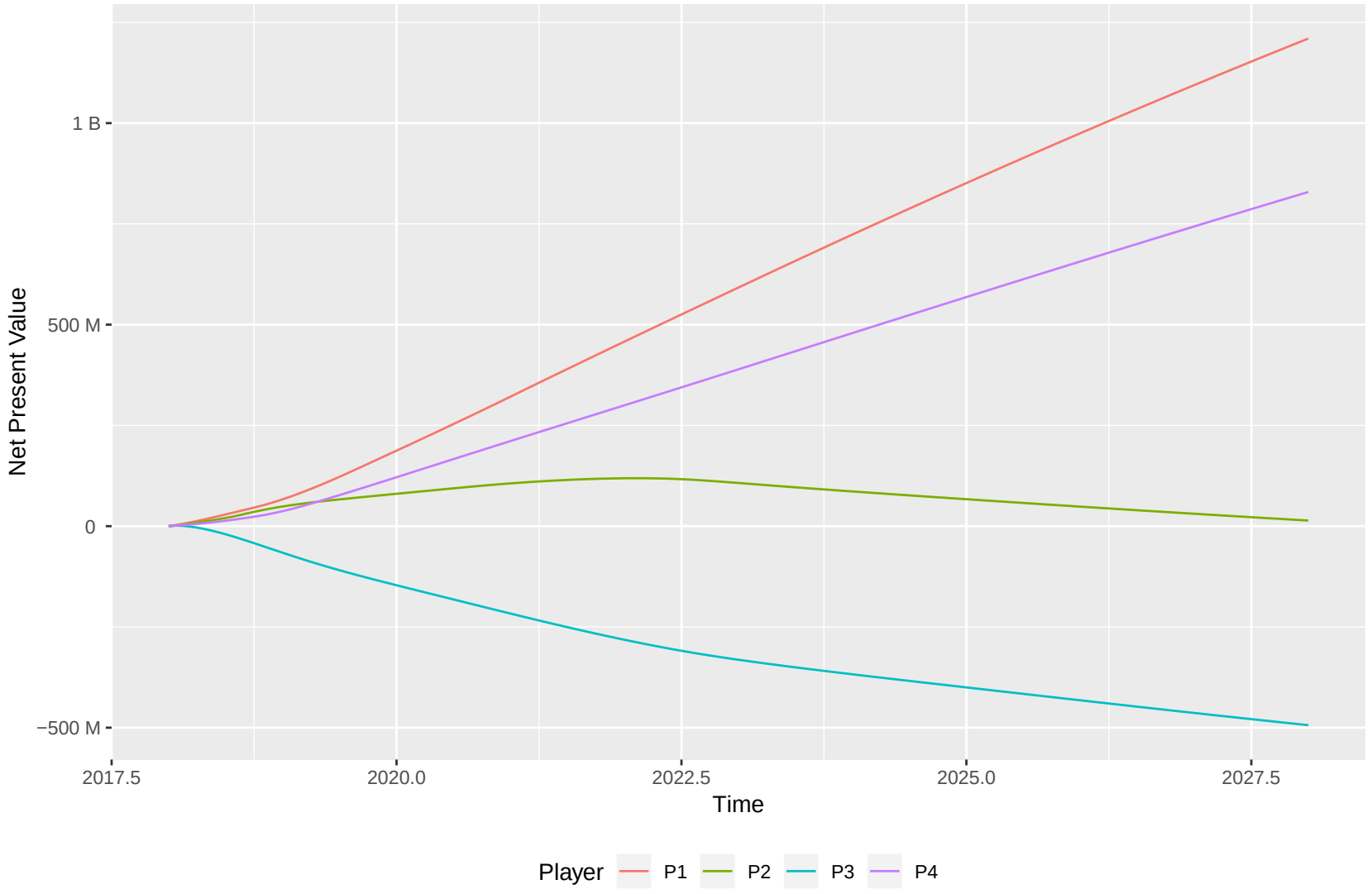
Candidate Strategy NPV across scenarios



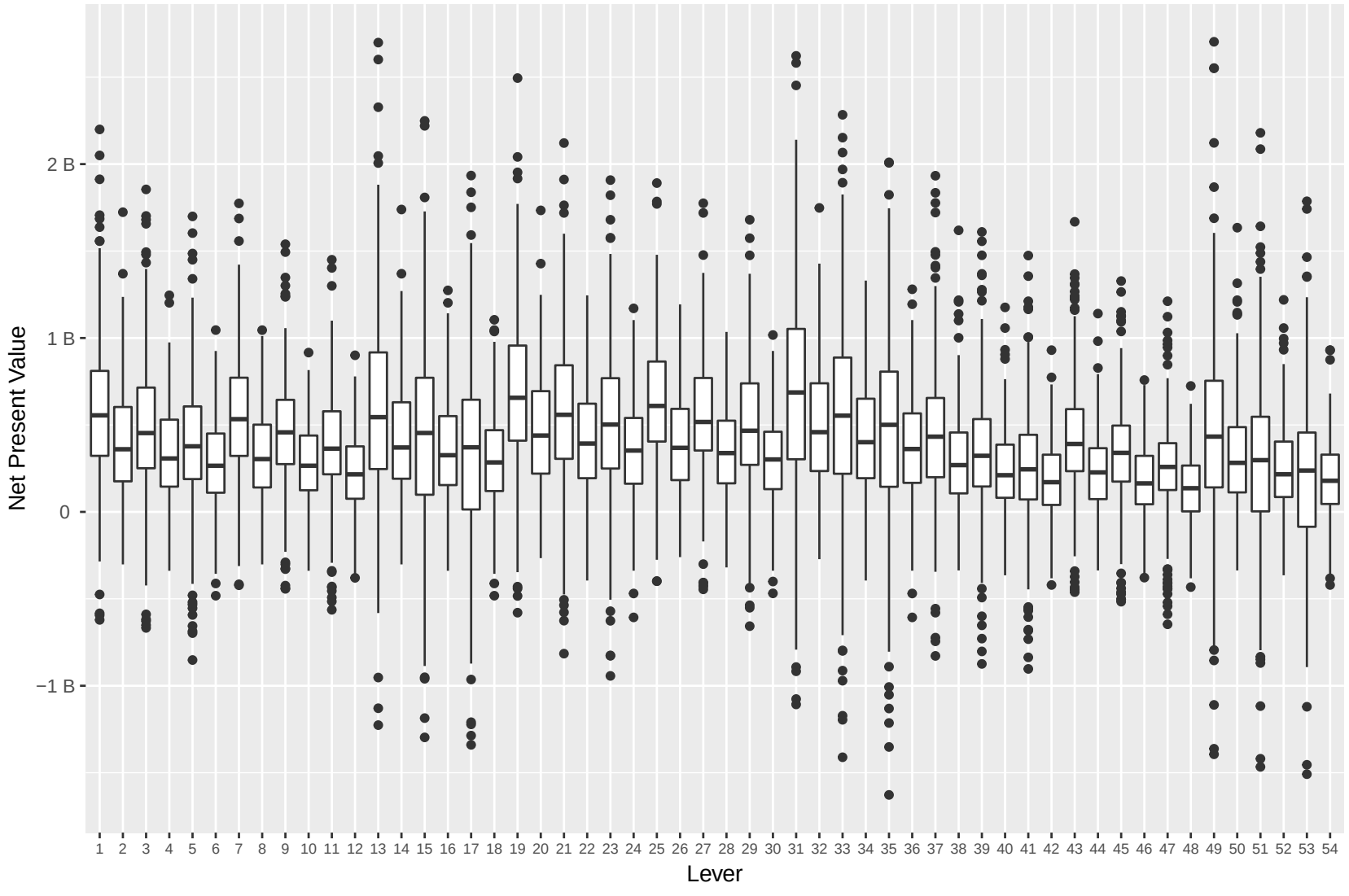
Global Demand across scenarios



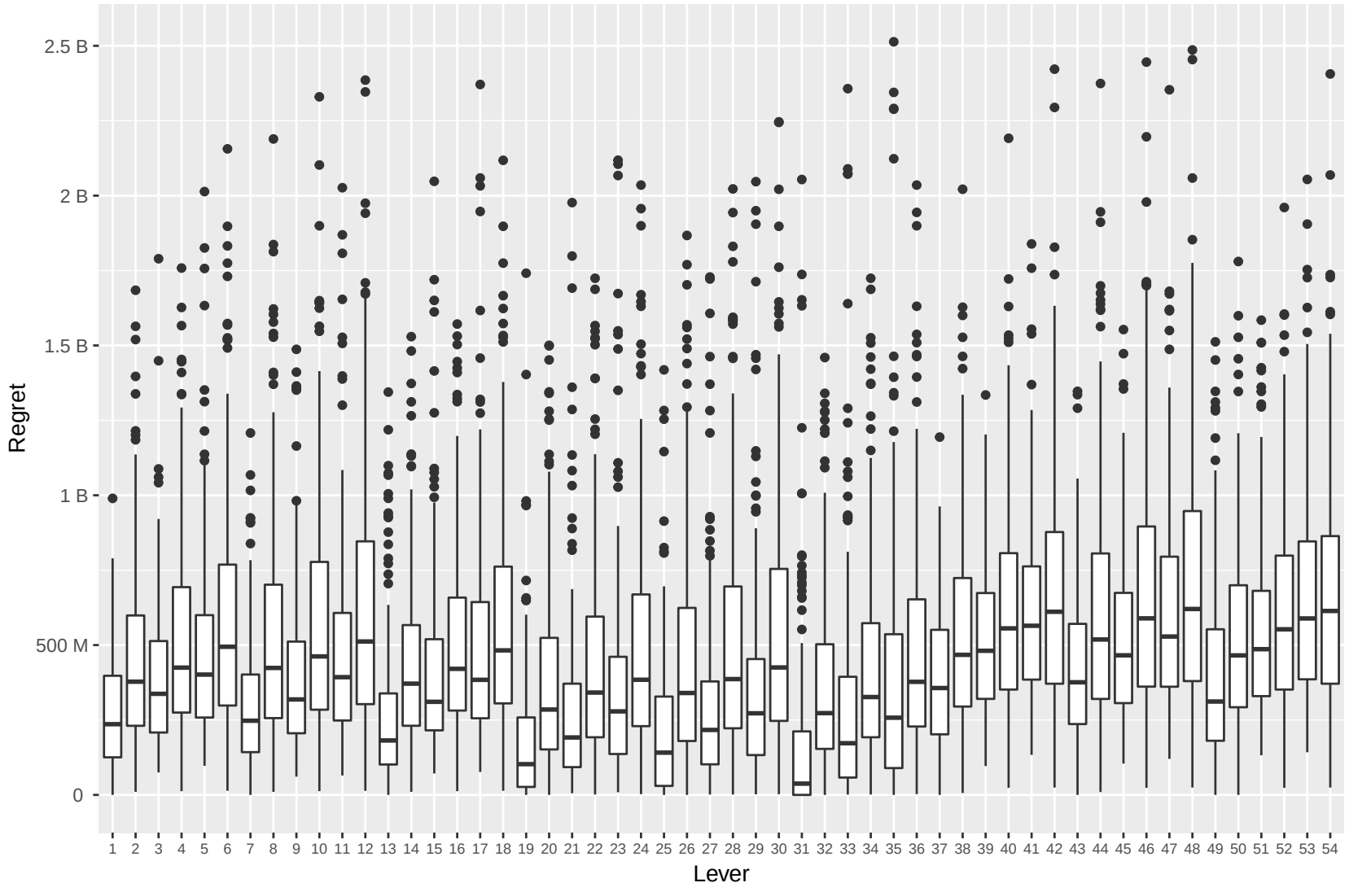
4 Players Net Present Value in a given scenario



Net Present Value across strategies and Scenarios



Regret across strategies and Scenarios



Ranking Strategies by Regret

Scenario Discovery

Conclusions