Managing unpredictable spare parts demand

Modern solutions beat pure intuition and traditional statistical approach

Introduce speaker: Erik Hoving

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- Likes playing soccer
- Lives in Utrecht
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- Intern at Districon
- Likes playing tennis
- Lives in Vleuten (Utrecht)

Managing unpredictable spare parts demand

4 september 2016

“Hanjin shipping bankruptcy:

'Efficient' just-in-time delivery not so efficient after all”

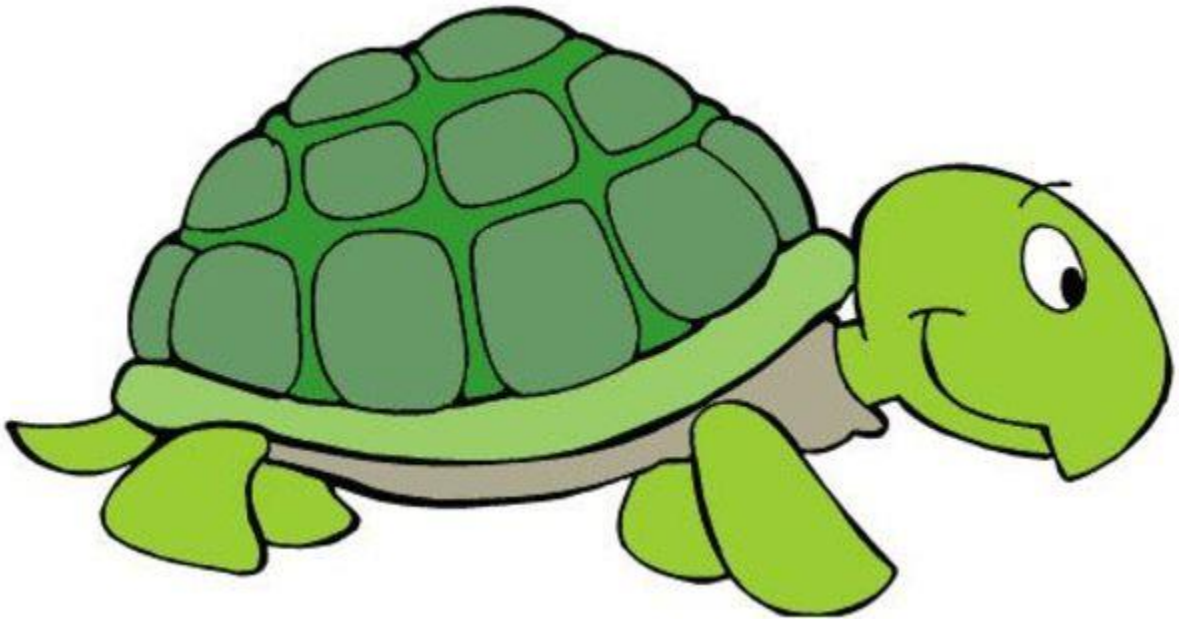
Challenge of unpredictable spare parts demand

Aim: forecast lead time demand

- Slow-moving
- Lumpy

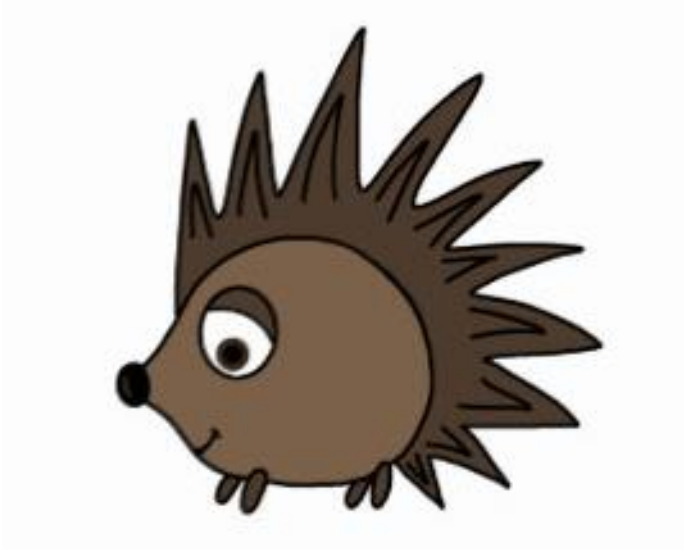
Discussion 1

- What is, in your business, your definition of slow-moving spare parts?

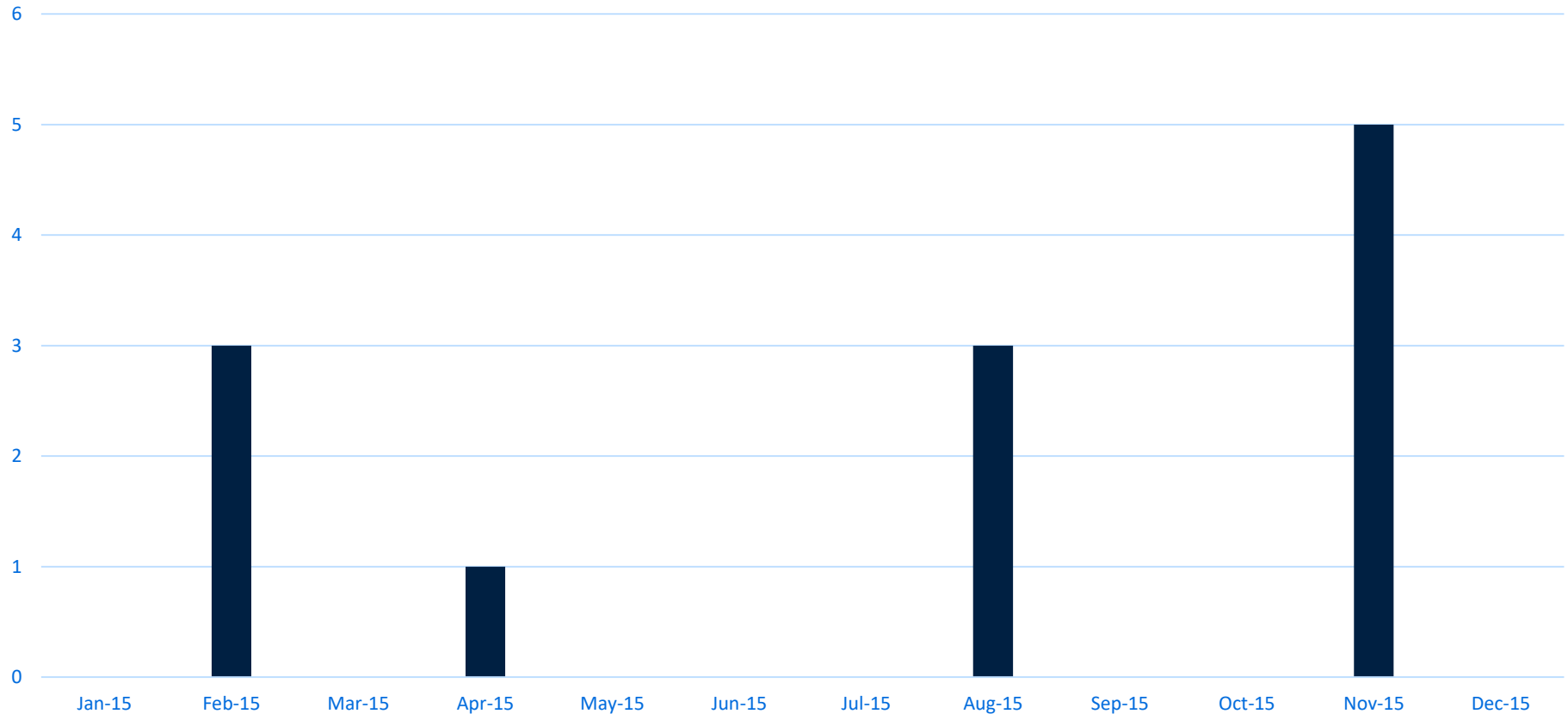


Discussion 2

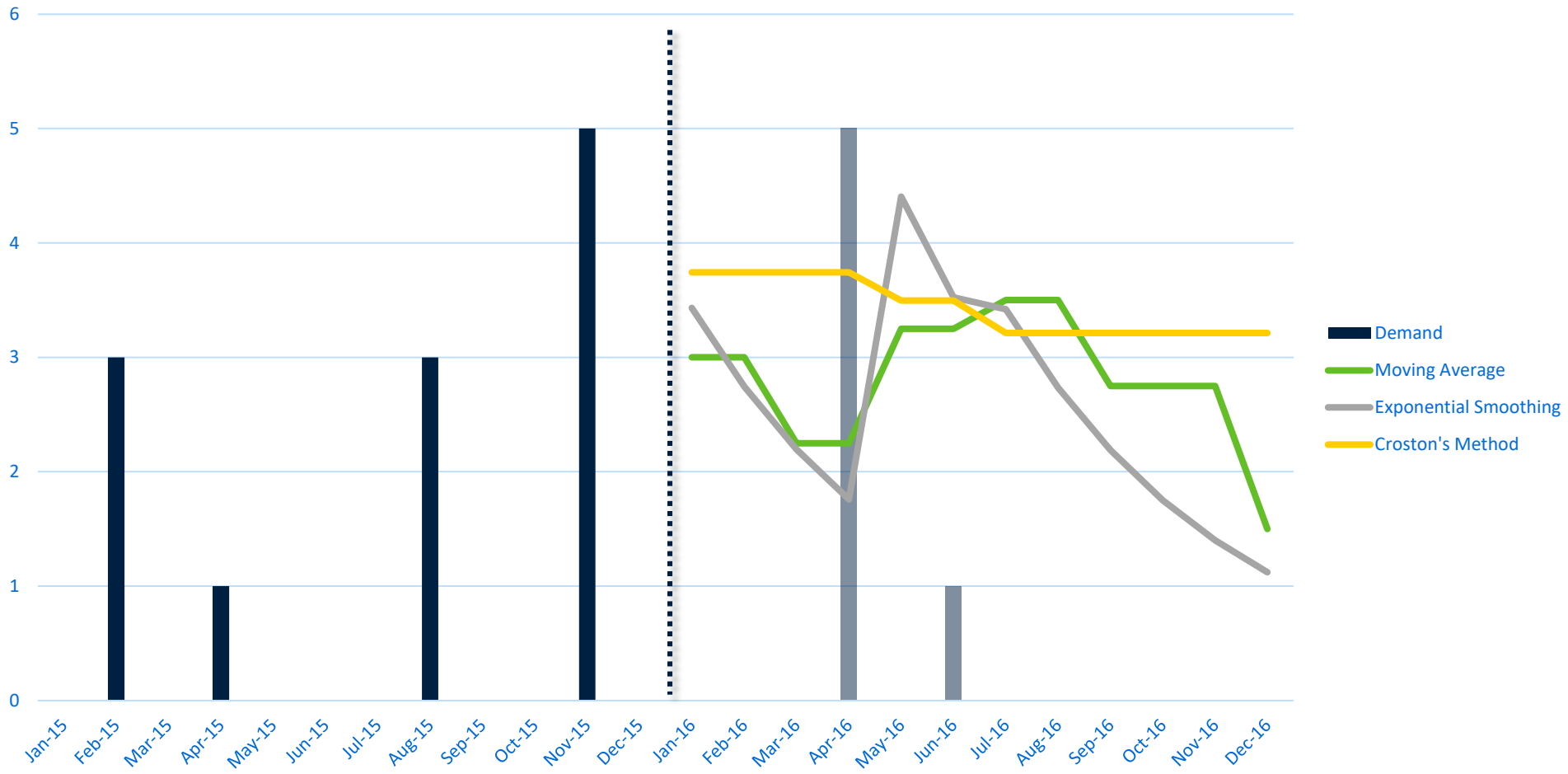
- Why does slow-moving spare parts demand almost always follow a lumpy pattern?



Typical slow-moving spare parts pattern



Traditional Methods



Bootstrapping

Drawing	Observation1	Observation2	Observation3	Sum of observations
1	5	3	3	11
2	0	3	5	8
3	3	0	3	6
4	1	0	0	1
5	0	0	0	0
6	0	0	0	0
7	1	1	0	2
8	0	0	0	0
9	0	0	0	0
10	5	0	0	5
11	0	5	0	5
12	0	0	0	0
13	0	0	3	3
14	0	1	3	4
15	3	1	1	5
16	0	0	3	3
17	0	5	0	5
18	0	0	0	0
19	0	3	0	3
20	0	0	0	0

Marbles

White = 0

Green = 1

Blue = 3

Orange = 5

Data

Period	Demand
Jan	0
Feb	3
Mar	0
Apr	1
May	0
Jun	0
Jul	0
Aug	3
Sep	0
Oct	0
Nov	5
Dec	0

Input

First value positive? FALSE

Output

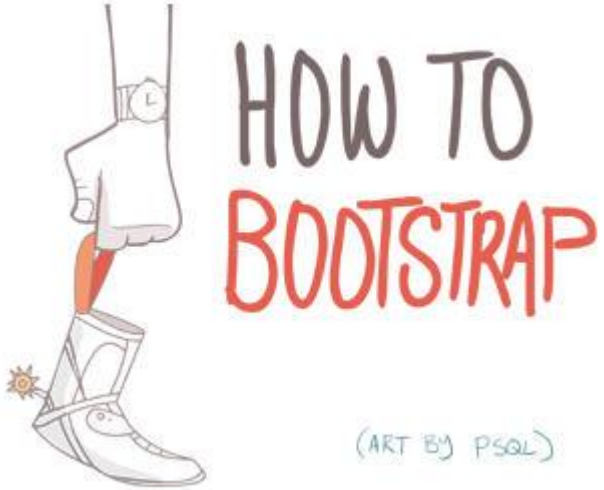
Bootstrap Average **2.956**

Draw

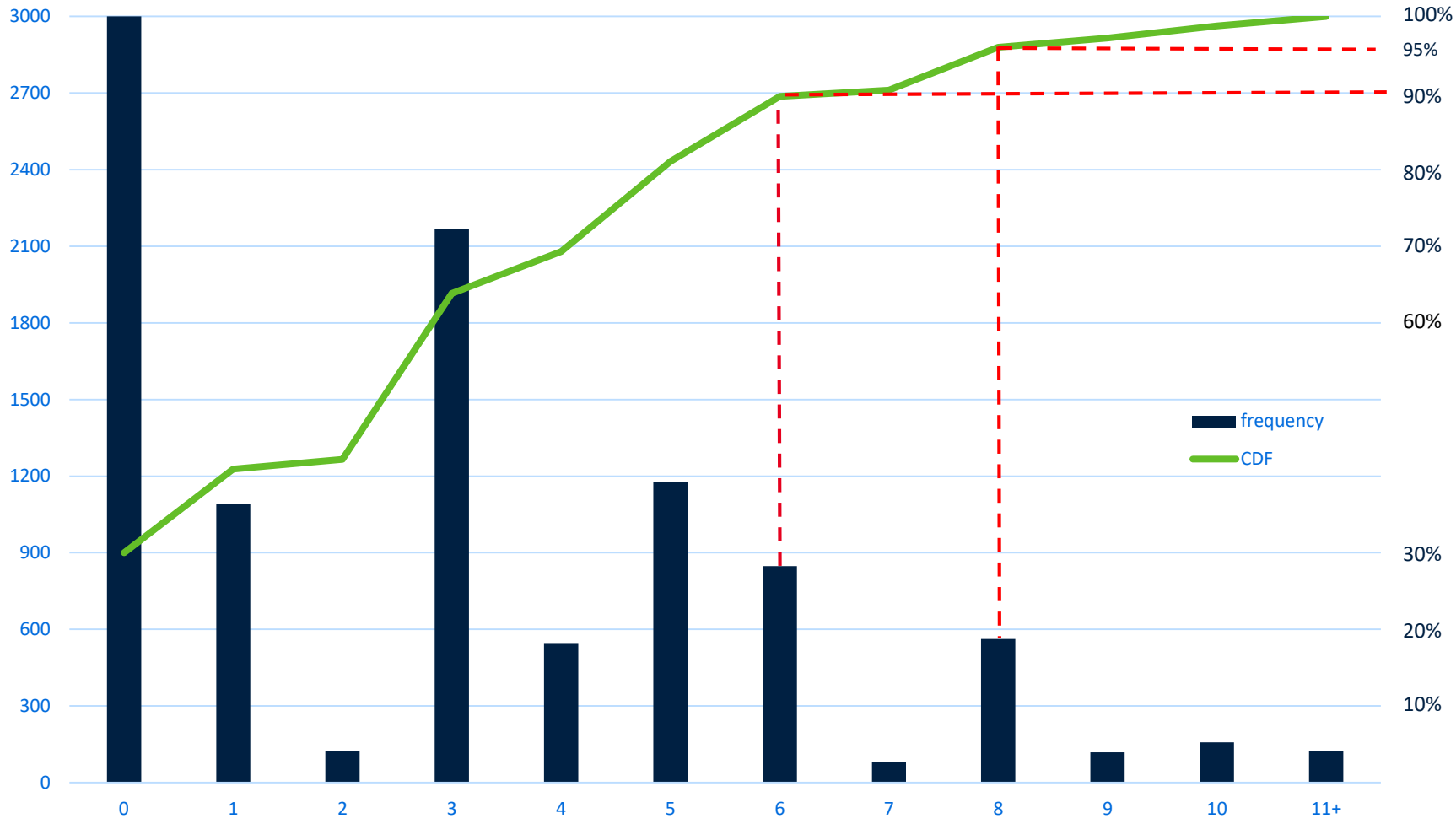
Clear

Why bootstrapping?

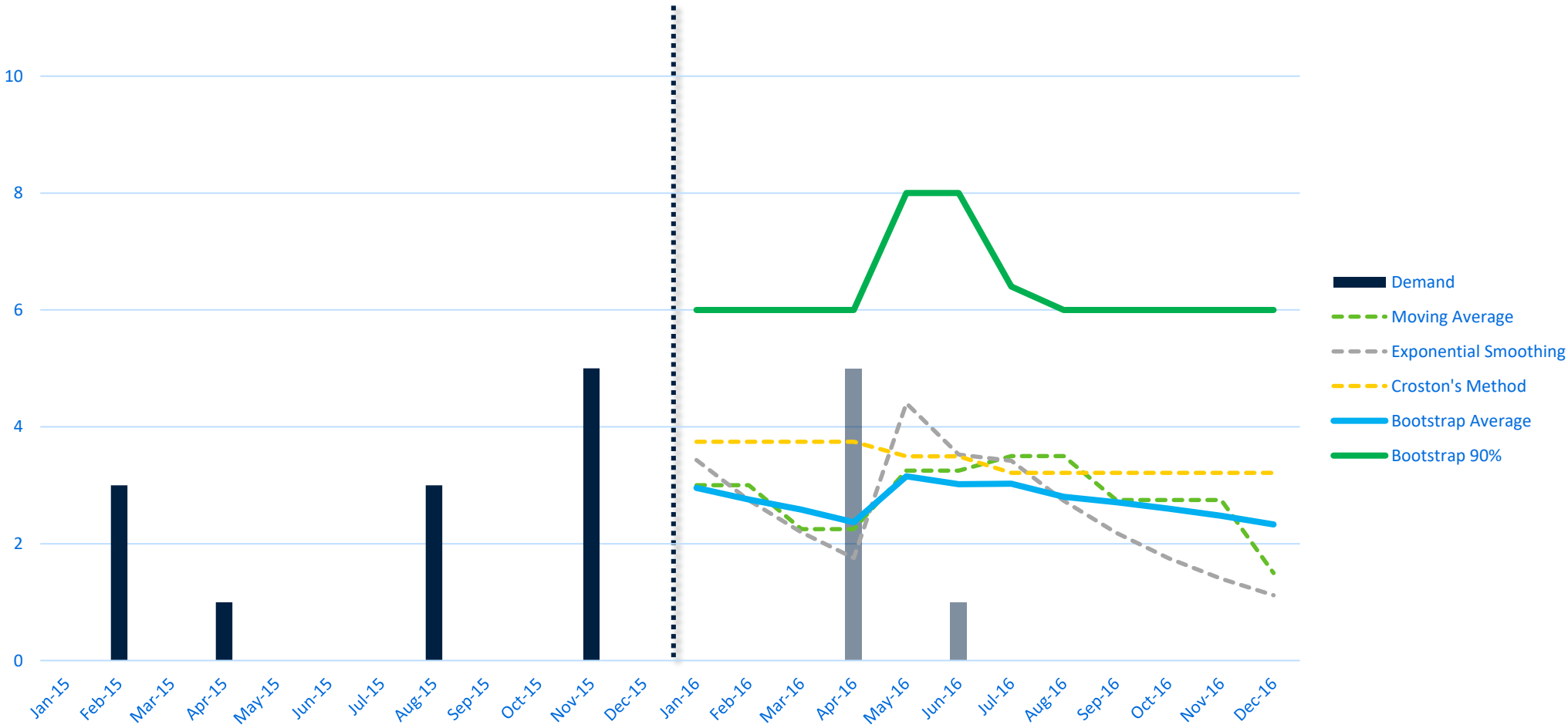
- Distribution-free
- Utilizes limited data efficiently
- Extendable
- Forecasts entire distribution



Scenarios


3000
2700
2400
2100
1800
1500
1200
900
600
300
0
100%
95%
90%
80%
70%
60%
30%
20%
10%
frequency
CDF
0
1
2
3
4
5
6
7
8
9
10
11+

Bootstrapping



Improvement

- Use all information available: order is triggered by positive demand

First value positive

Drawing	Observation1	Observation2	Observation3	Sum of observations
1	5	3	3	11
2	3	3	0	6
3	3	0	0	3
4	1	5	0	6
5	3	0	0	3
6	1	1	0	2
7	1	0	0	1
8	5	0	0	5
9	5	0	0	5
10	5	0	0	5
11	3	0	1	4
12	3	3	1	7
13	1	0	0	1
14	3	0	5	8
15	3	0	0	3
16	3	0	0	3
17	3	3	0	6
18	1	0	1	2
19	1	0	0	1
20	1	3	3	7

Marbles

White = 0

Green = 1

Blue = 3

Orange = 5

Data

Period	Demand
Jan	0
Feb	3
Mar	0
Apr	1
May	0
Jun	0
Jul	0
Aug	3
Sep	0
Oct	0
Nov	5
Dec	0

Input

First value positive? TRUE

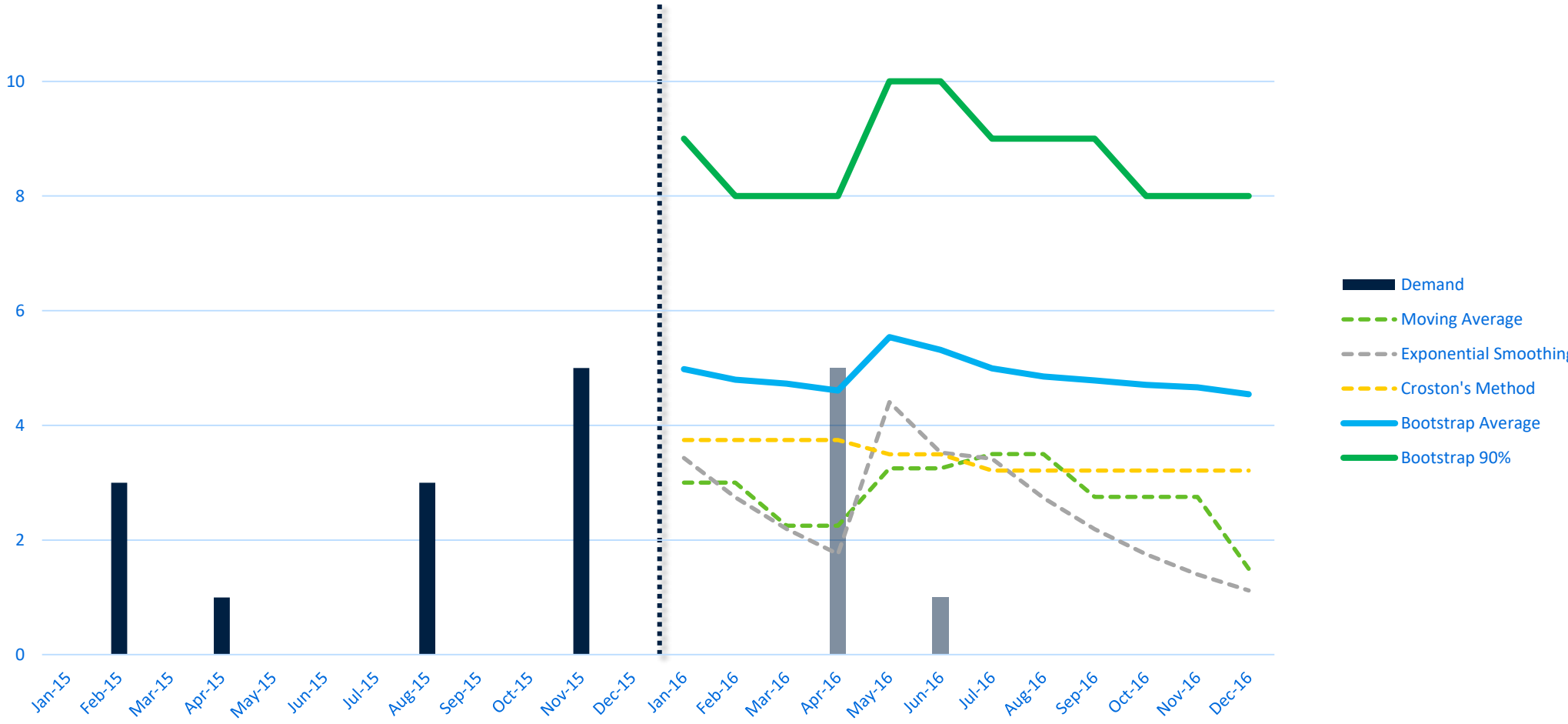
Output

Bootstrap Average **4.983**

Draw

Clear

Impact


10
8
6
4
2
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Demand
Moving Average
Exponential Smoothing
Croston's Method
Bootstrap Average
Bootstrap 90%

Discussion 3

- Do you prefer intuition above statistics?