

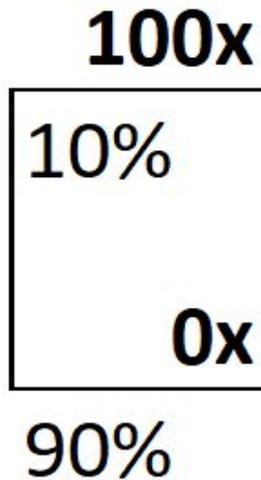
Calculating and Using Probability-Weighted Multiples (PWM)

Presented by Joe Gatto
to Tech Coast Angels
September 19, 2019

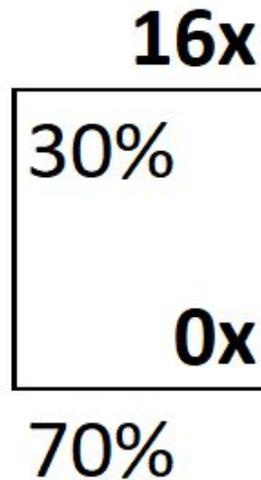
This ppt and spreadsheet are now on Flock:
TCA-SD Education Committee

Which of these deals, would you invest in?

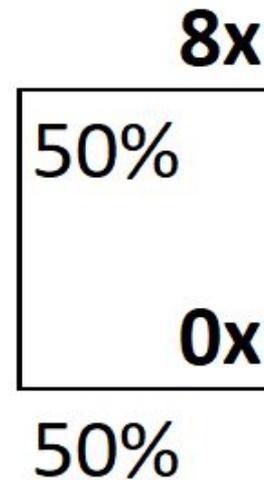
Deal 1



Deal 2



Deal 3



PWM = Probability-Weighted Multiple

| | Deal 1 | Deal 2 | Deal 3 | | | | | | |
|------------|----------------------------------------------------------------------------|---------------|---------------|----------------------------------------------------------------------------|-----|-----------|----------------------------------------------------------------------------|-----|-----------|
| | 100x | 16x | 8x | | | | | | |
| | <table border="1"><tr><td>10%</td></tr><tr><td>0x</td></tr></table> | 10% | 0x | <table border="1"><tr><td>30%</td></tr><tr><td>0x</td></tr></table> | 30% | 0x | <table border="1"><tr><td>50%</td></tr><tr><td>0x</td></tr></table> | 50% | 0x |
| 10% | | | | | | | | | |
| 0x | | | | | | | | | |
| 30% | | | | | | | | | |
| 0x | | | | | | | | | |
| 50% | | | | | | | | | |
| 0x | | | | | | | | | |
| | 90% | 70% | 50% | | | | | | |
| PWM | 10x | 4.8x | 4x | | | | | | |

Which deal represents the “average” TCA deal?

Agenda

- Data from TCA exits
- Calculating Probability-Weighted Multiples (PWM)
 - For Tech
 - For Biotech
- Portfolio-implications of TCA-exit data
- Personal conclusions
- Q&A

TCA's past investments have averaged 4.9x return!

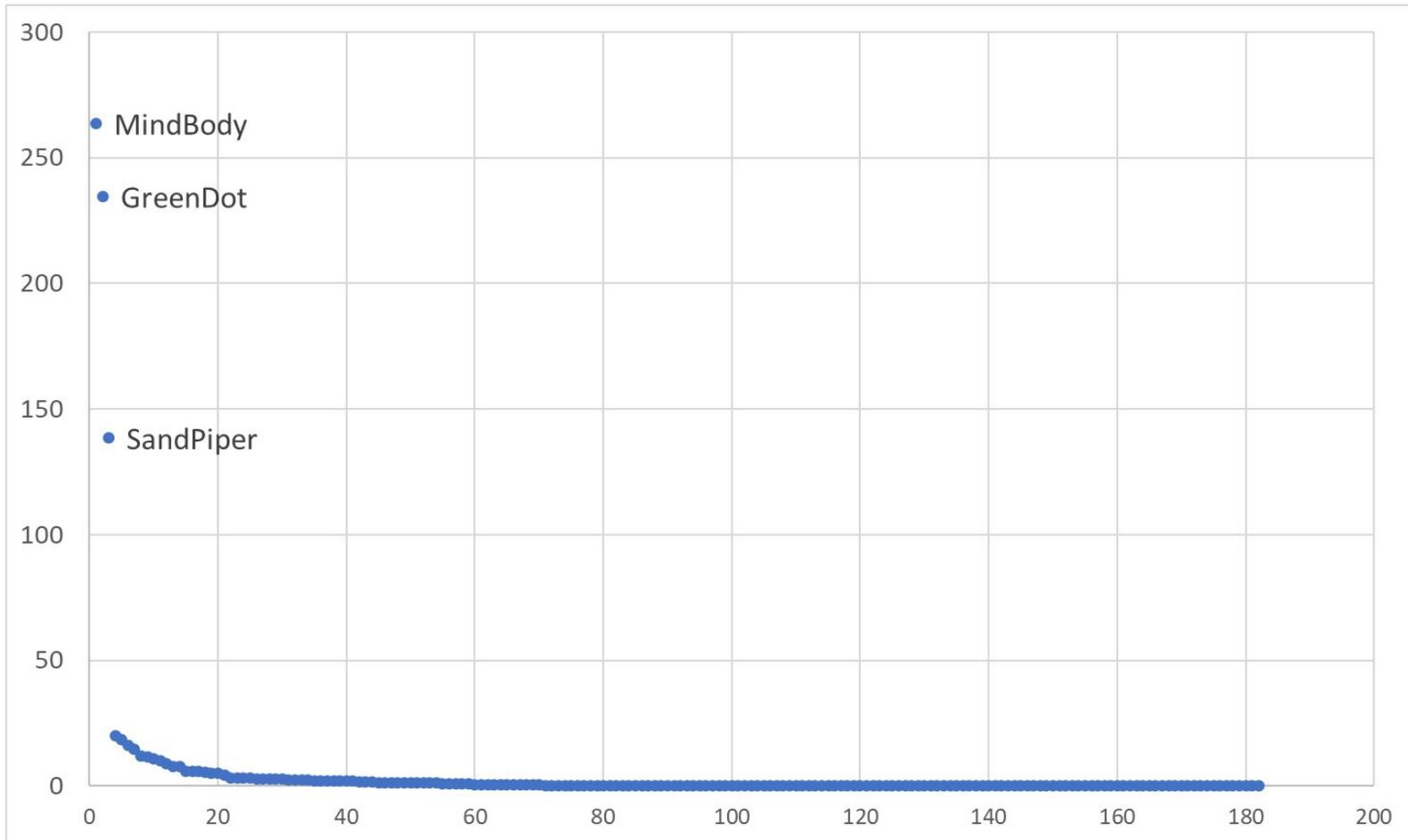
If you had invested \$25k into each of the 182 TCA deals that are shutdown or exited, you would have:

- Invested \$4.6m
- Returned \$22.4m (4.9x)

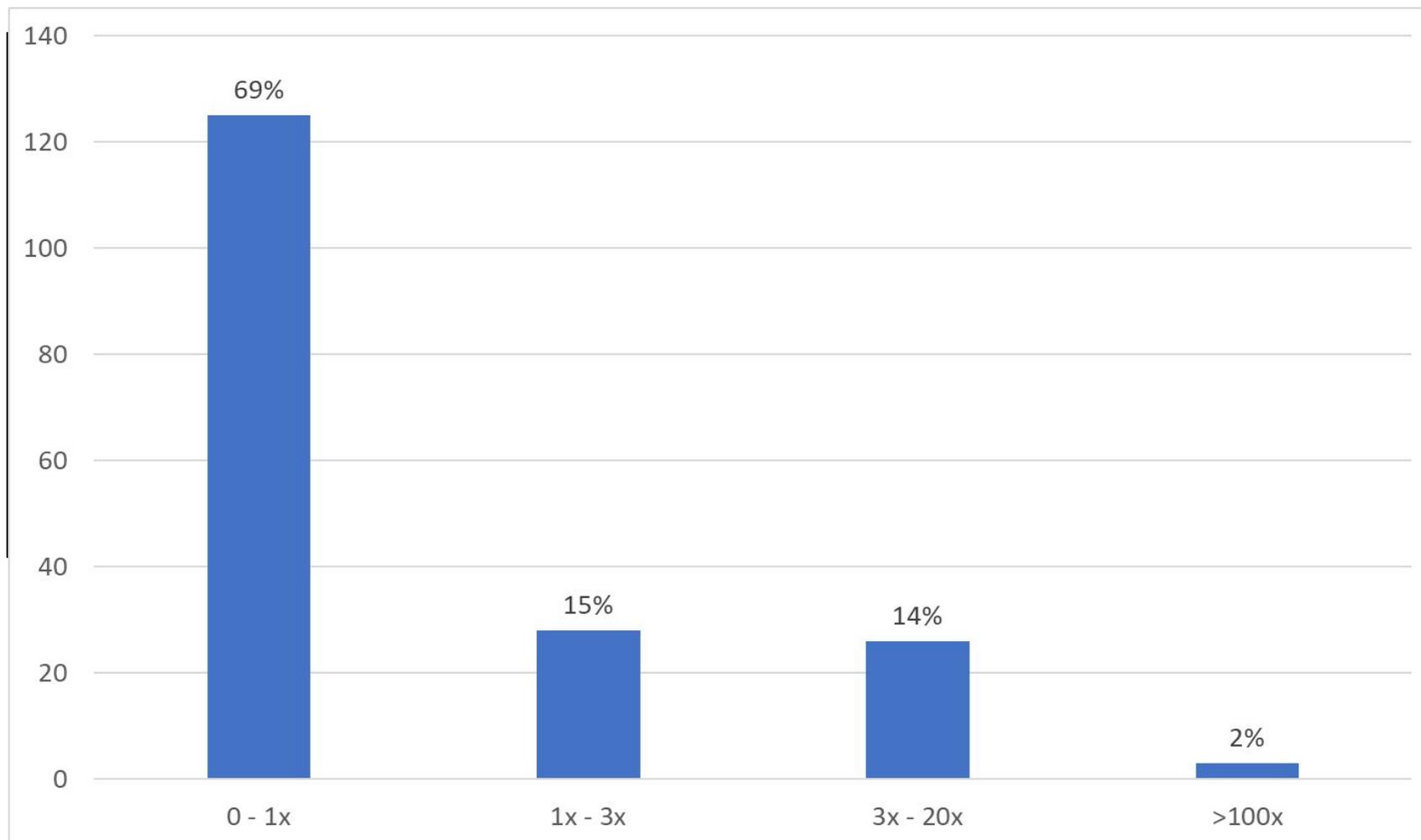
If you had sold MindBody and GreenDot at their IPOs, your return would have only \$14.4m (3.2x)

Source: *TCA Portfolio Analysis*, July 2019, John Harbison

However, returns were driven by 3 home runs.
If you missed those 3, your return was only 1.4x.
1.6% of deals produced 71% of returns



125 of 182 deals (69%) lost money. 3 (1.6%) > 100x.



Analysis of angel-investment opportunities should:

Be grounded in the reality of past-deal statistics

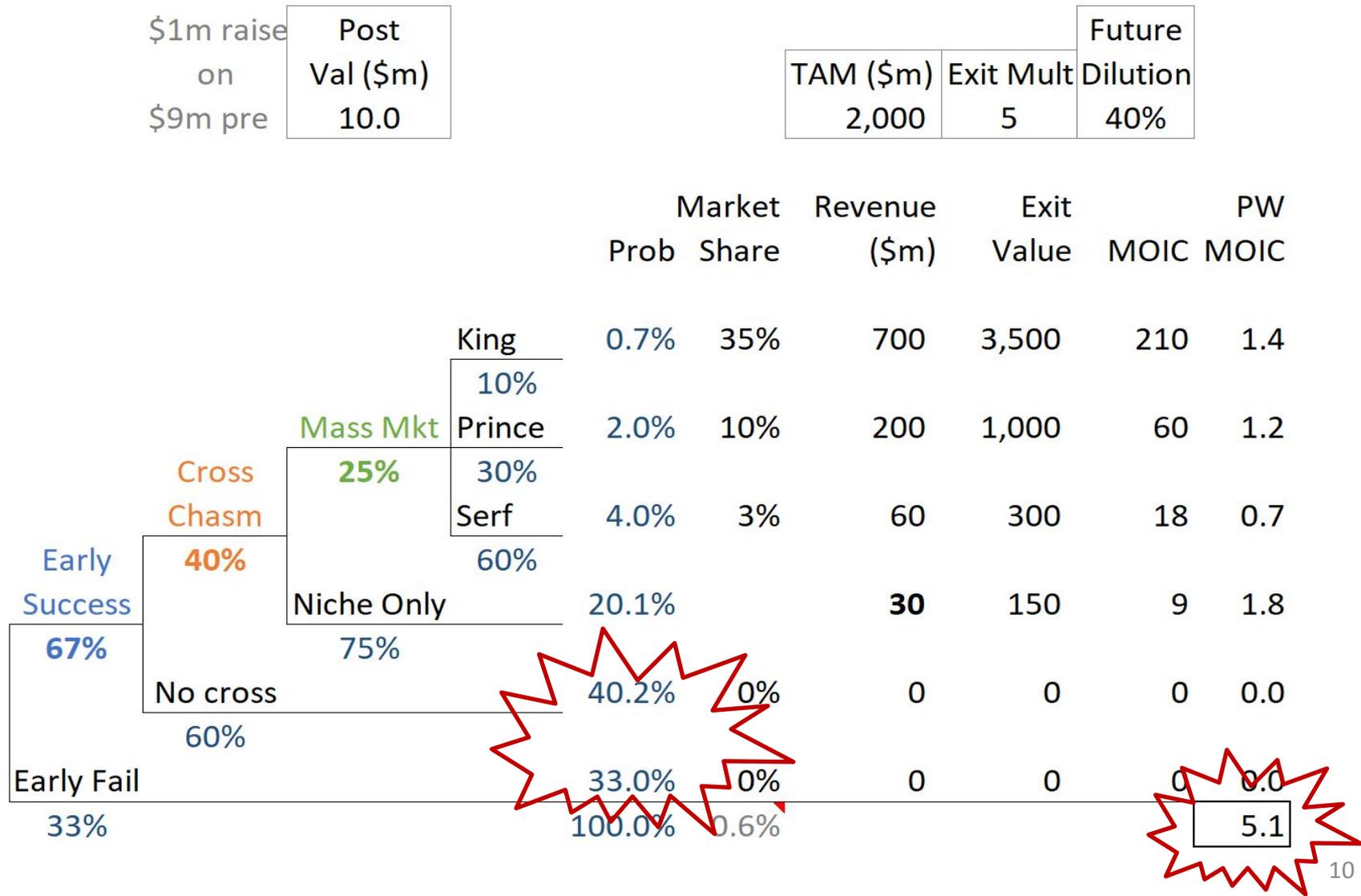
- “This deal is like the other 182”
- 69% chance of losing money

and

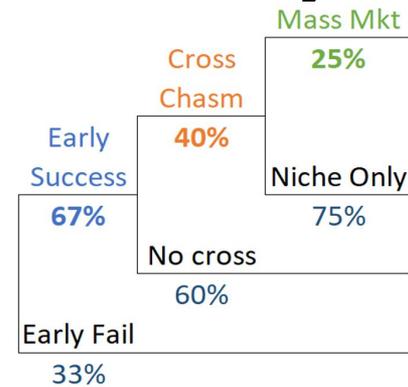
Allow you to have deal-specific judgments

- “This deal is different”
- Total Addressable Market size (TAM)
- Demonstrated product-market fit
- Deal price
- Future dilution needed
- Management’s ability to scale
- IP/Competition

This baseline tree comports with past stats:
 About 70% chance of loss. “Expected” 5.1x return.



Success stages are roughly based on Geoffrey Moore's *Crossing the Chasm*



- **Early Success**

- Reach ~ \$200k (non-trial, non-pilot) annual revenue
- Default probability 67%; however, set to 100% if already reached

- **Cross Chasm**

- Reach ~ \$20m ARR
- Default probability 40% (given Early Success)
 - Gently increase for rock star, full team; high ARR; high growth

- **Mass Market**

- Reach ~ \$100m ARR
- Default probability 25% (given Crossed Chasm). Rarely adjust.

Mass-Market Share Approach

10 major competitors (83% share) + niche players (17%)

- Equally likely that AwesomeCo becomes one of the 10 majors
- 1 King (35% share) (1/10 or 10% probability)
- 3 Princes (10% share each, 30% total) (3/10, or 30% probability)
- 6 Serfs (3% share each, 18% total) (6/10, or 60% probability)

| | Market Share | Revenue (\$m) |
|-------------------|--------------|---------------|
| King | 35% | 700 |
| Prince | 10% | 200 |
| Serf | 3% | 60 |
| Mass Mkt | 25% | |
| Niche Only | 75% | 30 |

Market share approach can be tailored to market

- Some markets are more or less consolidated >>

| | Consolidated | Typical | Fragmented |
|----------------------|--------------|---------|------------|
| # MM Competitors | 5 | 10 | 20 |
| # King | 1 | 1 | 2 |
| % Share per King | 50% | 35% | 15% |
| Tot Share of Kings | 50% | 35% | 30% |
| # Princes | 1 | 3 | 6 |
| % Share per Prince | 20% | 10% | 4% |
| Tot Share of Princes | 20% | 30% | 24% |
| # Serfs | 3 | 6 | 12 |
| % Share per Serf | 7% | 3% | 2% |
| Tot Share of Serfs | 21% | 18% | 24% |
| Share MM Players | 91% | 83% | 78% |
| Share Niche Players | 9% | 17% | 22% |
| Tot Share (MM+Niche) | 100% | 100% | 100% |

- AwesomeCo's chances (given MM success) >>

| | | | |
|---------------|------|------|------|
| King Chance | 20% | 10% | 10% |
| Prince Chance | 20% | 30% | 30% |
| Serf Chance | 60% | 60% | 60% |
| | 100% | 100% | 100% |

TAM: focus on Sweet Spot market

- SS might include ex-US, often not
- SS might include follow-on products, usually not
- MUST align with your Market Share numbers
 - If they become King, could they really get 35% of *this* TAM
- Use TAM 5 – 7 years from now (if growth is believable)

- Mechanodontics: 10m cases/yr * \$1,500/case = \$15b
- Habitu8: 125m corporate desktops * \$24/yr = \$3b

Case Study: Habitu8

- \$800k ARR for product 1. LOIs for product 2.
- CEO co-founded co that IPO'd for \$900m. Eng+Sales

| | | | | |
|--------------------------------|-------------------|-----------|-----------|--------------------|
| \$.75m raise on \$6m pre | Post Val (\$m) | TAM (\$m) | Exit Mult | Future Dilution |
| | 6.75 | 3,000 | 5 | 45% |

Valuation Tree for Habitu8

| | Prob | Market Share | Revenue (\$m) | Exit Value | MOIC | PW MOIC |
|--------------|---------------|--------------|---------------|------------|------|-------------|
| King | 1.1% | 35% | 1,050 | 5,250 | 428 | 4.5 |
| Prince | 3.2% | 10% | 300 | 1,500 | 122 | 3.9 |
| Serf | 6.4% | 3% | 90 | 450 | 37 | 2.3 |
| Niche Only | 31.9% | | 30 | 150 | 12 | 3.9 |
| No cross | 42.5% | 0% | 0 | 0 | 0 | 0.0 |
| Early Fail | 15.0% | 0% | 0 | 0 | 0 | 0.0 |
| Total | 100.0% | 0.9% | | | | 14.7 |

The valuation tree branches from left to right:

- Early Success (85%)** vs **Early Fail (15%)**
- From **Early Success (85%)**:
 - Cross Chasm (50%)**
 - Mass Mkt (25%)**
 - King (10%)
 - Prince (30%)
 - Serf (60%)
 - Niche Only (75%)**
 - No cross (50%)**

Case study: Mechanodontics (now Brius)

| Post | | | | TAM (\$m) | Exit Mult | Future Dilution | | |
|-------------|----------|------------|--------|-----------|-----------|-----------------|---------------|------|
| \$11.5m | | | | 15,000 | 5 | 75% | | |
| | | | | | | | Prob | PW |
| | | | | | | | Share | MOIC |
| | | | | | | | Revenue (\$m) | MOIC |
| | | | | | | | Exit Value | MOIC |
| | | King | 0.5% | 20% | 3,000 | 15,000 | 326 | 1.8 |
| | | 5% | | | | | | |
| | Mass Mkt | Prince | 3.3% | 10% | 1,500 | 7,500 | 163 | 5.3 |
| | 33% | 30% | | | | | | |
| Cross Chasm | | Serf | 7.1% | 3% | 450 | 2,250 | 49 | 3.5 |
| | | 65% | | | | | | |
| | | Niche Only | 22.1% | 0.2% | 30 | 150 | 3 | 0.7 |
| | | 67% | | | | | | |
| | No cross | | 67.0% | 0% | 0 | 0 | 0 | 0.0 |
| | 67% | | 100.0% | | | | | 11.3 |

Case Study for ??? (real company pitched TCA)

- TAM: 600k shops * \$2k/yr = \$1.2b
- Had \$600k ARR from 1000 shops. Team of 16 FTEs.
- Had reached CF breakeven. Wanted \$ to speed growth.

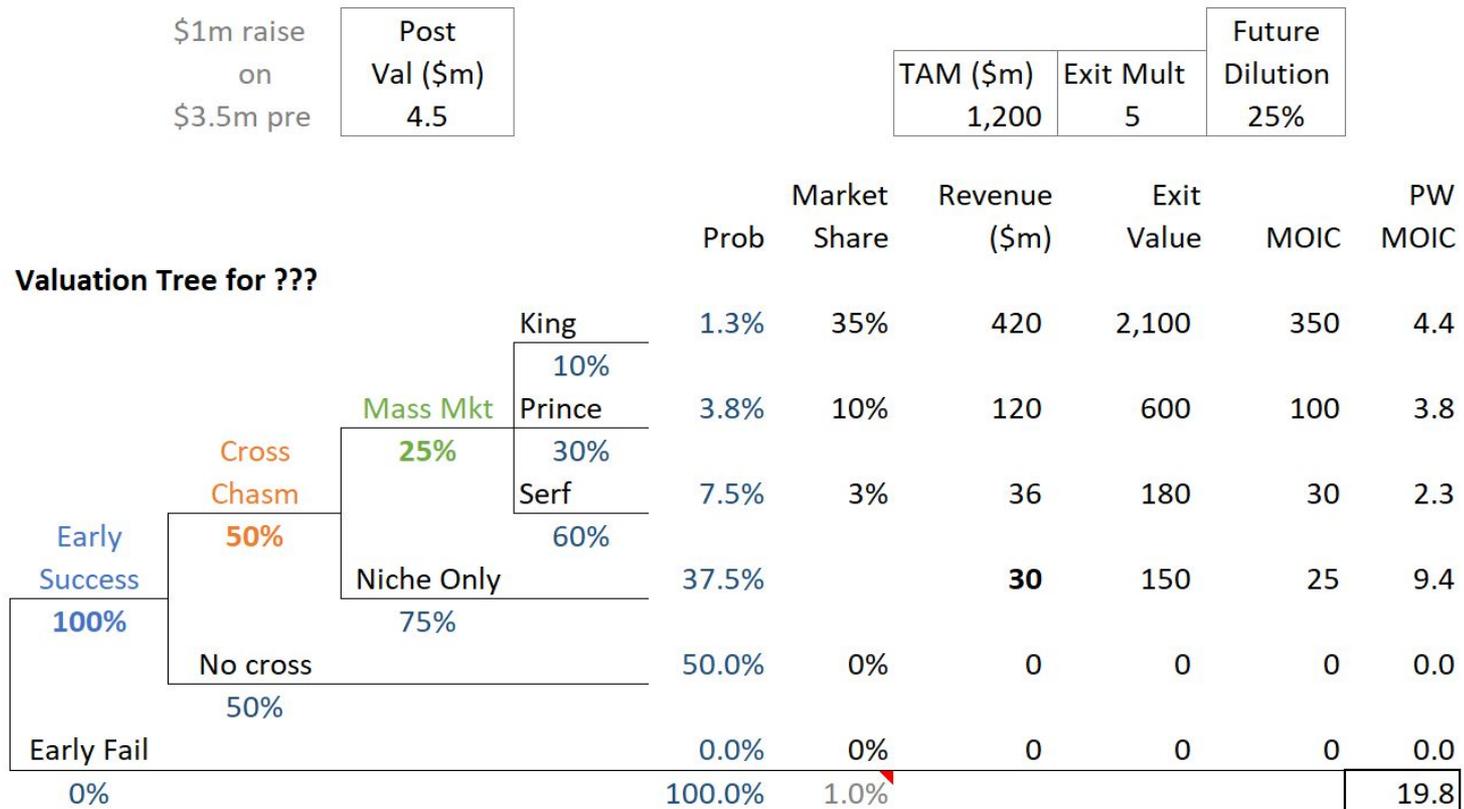
| | | | | |
|--------------------------------|--------------------------|--------------------|----------------|---------------------------|
| \$1m raise on \$3.5m pre | Post Val (\$m) 4.5 | TAM (\$m) 1,200 | Exit Mult 5 | Future Dilution 25% |
|--------------------------------|--------------------------|--------------------|----------------|---------------------------|

Valuation Tree for ???

| | Prob | Market Share | Revenue (\$m) | Exit Value | MOIC | PW MOIC |
|----------------------|-------------|--------------|---------------|------------|------|-------------|
| King | 1.3% | 35% | 420 | 2,100 | 350 | 4.4 |
| 10% | | | | | | |
| Prince | 3.8% | 10% | 120 | 600 | 100 | 3.8 |
| 30% | | | | | | |
| Serf | 7.5% | 3% | 36 | 180 | 30 | 2.3 |
| 60% | | | | | | |
| Niche Only | 37.5% | | 30 | 150 | 25 | 9.4 |
| 75% | | | | | | |
| No cross | 50.0% | 0% | 0 | 0 | 0 | 0.0 |
| 50% | | | | | | |
| Early Fail | 0.0% | 0% | 0 | 0 | 0 | 0.0 |
| 0% | | | | | | |
| Early Success | 100% | | | | | |
| | 100.0% | 1.0% | | | | 19.8 |

MindBody was TCA's most profitable deal: 264x

- TAM: 600k shops * \$2k/yr = \$1.2b
- Had \$600k ARR from 1000 shops. Team of 16 FTEs.
- Had reached CF breakeven. Wanted \$ to speed growth.



This core idea (start by understanding base rates, then adjust) can be applied to **biotech** as well.

- “POA”, or Probability of Approval, is the Probability of success from phase 1 through to approval
- POAs range by therapeutic area
 - Overall: 10 – 15%
 - 4% for cancer

I decomposed overall POA of 12% into chances for “Safe”, “Effective”, and “Execute”

- **Safe**: is the toxicity level acceptable for approval?
- **Effective**: will it work well enough to be approved?
- **Execute**: raise enough funding, execute trials well?
- Lack of efficacy is more common failure than toxicity
- This tree is for IND-approved therapy about to start ph1
 - For a *pre*-IND therapy, add a branch at left for chance of IND



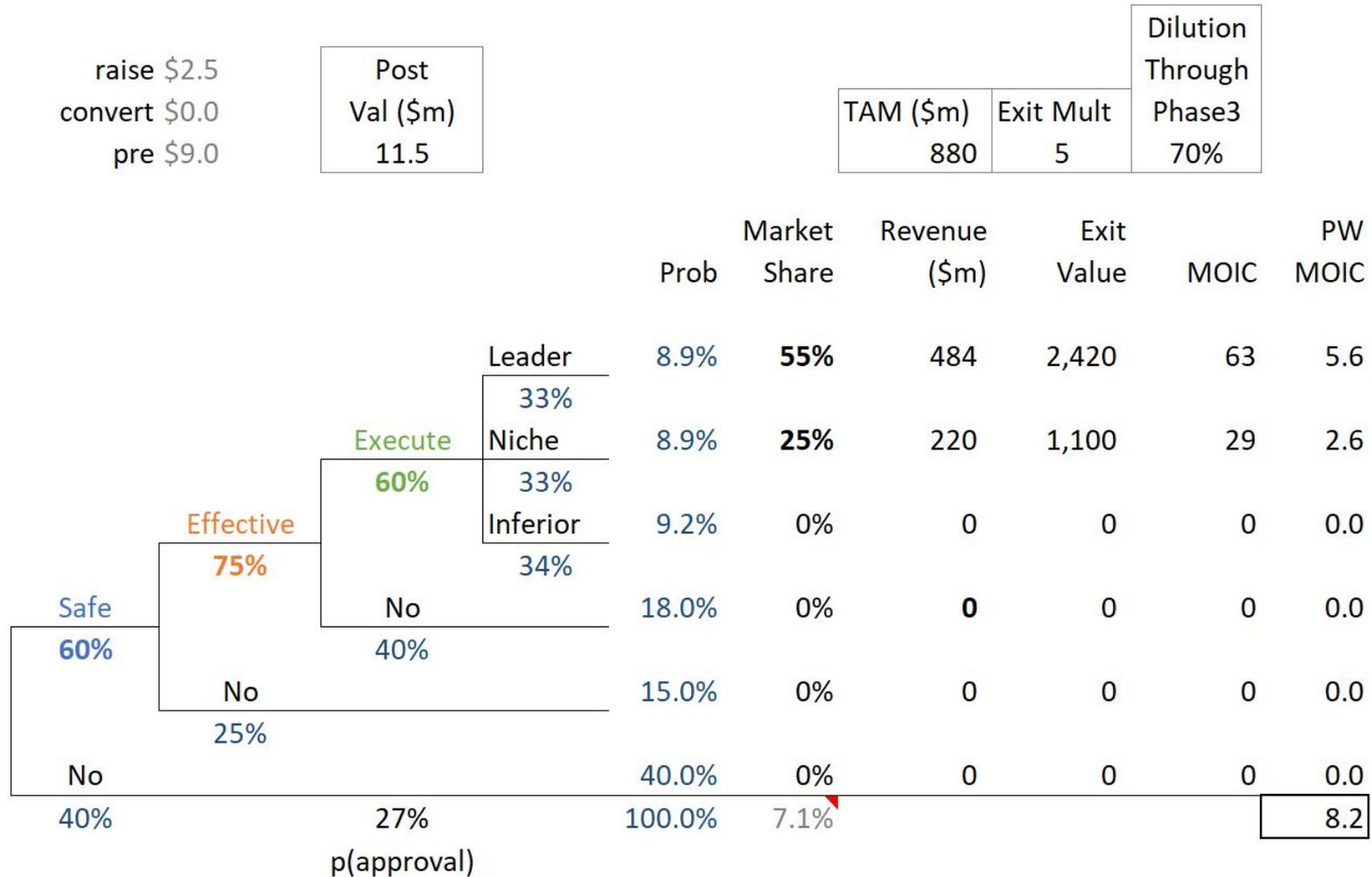
I relied on these sources for success/failure rates:

- “Clinical development success rates for investigational drugs” Hay, et al., *Nature Biotechnology* Jan 2014
- “Failure of Investigational Drugs in Late-Stage Clinical Development and Publication of Trial Results” Hwang et al, *JAMA Internal Medicine*, Oct 2016
- *Clinical Development Success Rates 2006-2015* Thomas (BiomedTracker), et al.
- Estimation of clinical trial success rates and related parameters” Wong et al., *Biostatistics* (2019)

Biotech case study—A real company I analyzed

- **Efficacy:** demonstrations of efficacy (directly in pigs and indirectly in humans) was very compelling. Theory and MOA seemed very solid. I **increased** $p(\text{Effective})$ from base rate of 25% to **75%** (**probably *too much***)
- **Safety:** shown safe in pigs, but no long-term tests. Naturally occurring in humans, but some possibility of immunogenicity due to donor sourcing. I **used default** $p(\text{Safety})$ of **60%**
- **Execution:** the more I communicated with CEO, the less confident I became. I dug deep into market size and surmised that they were off by 10x for this orphan indication. I **dropped** $p(\text{Execute})$ from base rate of 80% to **60%**

The PWM calculated to 8.2. Even that felt high.
I passed.



Avoid “garbage in garbage out”

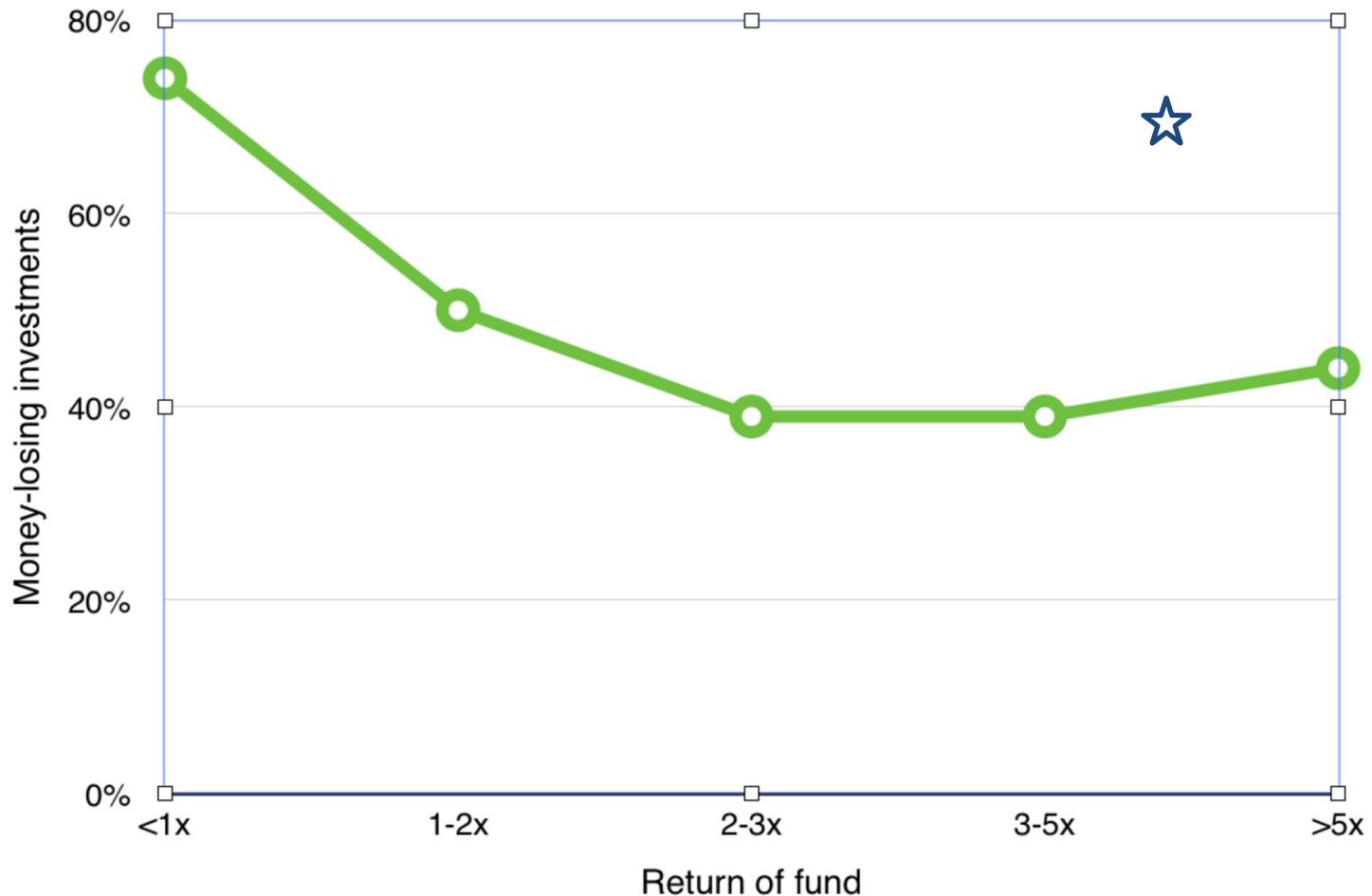
Avoid “undue optimism”. Undue optimism is...

- Expecting your personal-success probability to be inappropriately higher than what the statistics would warrant
- Like giving *this* coin a 75% chance of heads because you really did due diligence on this coin and you have a really good feeling about the team that handed you this coin
- Like giving *this* coin a 75% chance of heads because it would be really great for the world if this coin turned out heads

Many angel studies point to 25% - 30% IRR; however, 50% - 70% of deals lose money

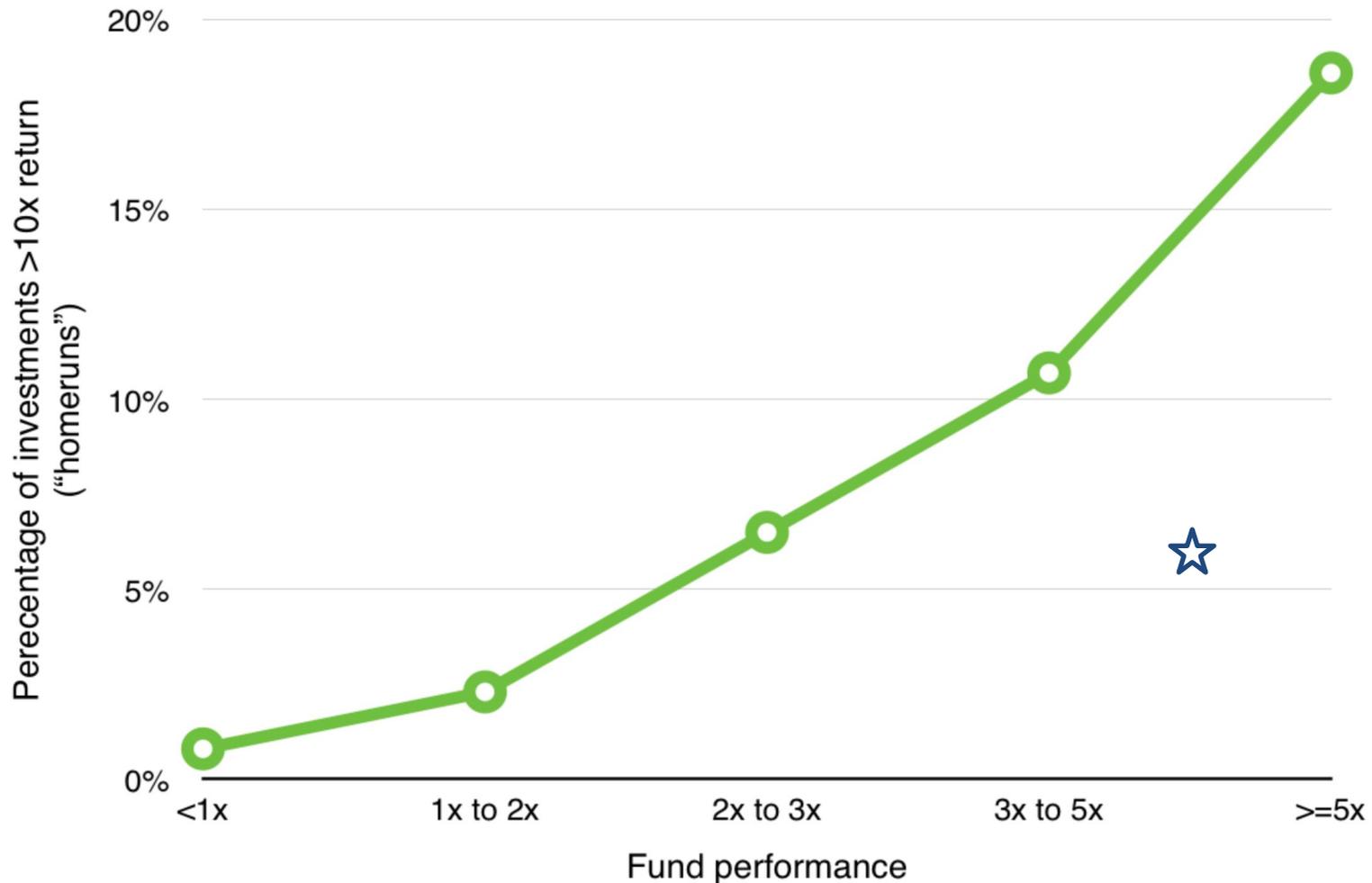
- Harbison (2019) 182 TCA deals
 - 69% lost money, 4.9x, 1.6% of deals provided 71% of returns
- Villalobos & Payne (2007) 117 “TCA” deals
 - 68% lost money, 5x overall return
- Wiltbank and Boeker (2007) 3,097 angel investments
 - 52% lost money, 7% of deals returned greater than 10x, 30% IRR

TCA ☆ had a %-strikeouts in line with the worst VC funds, but overall return of best funds

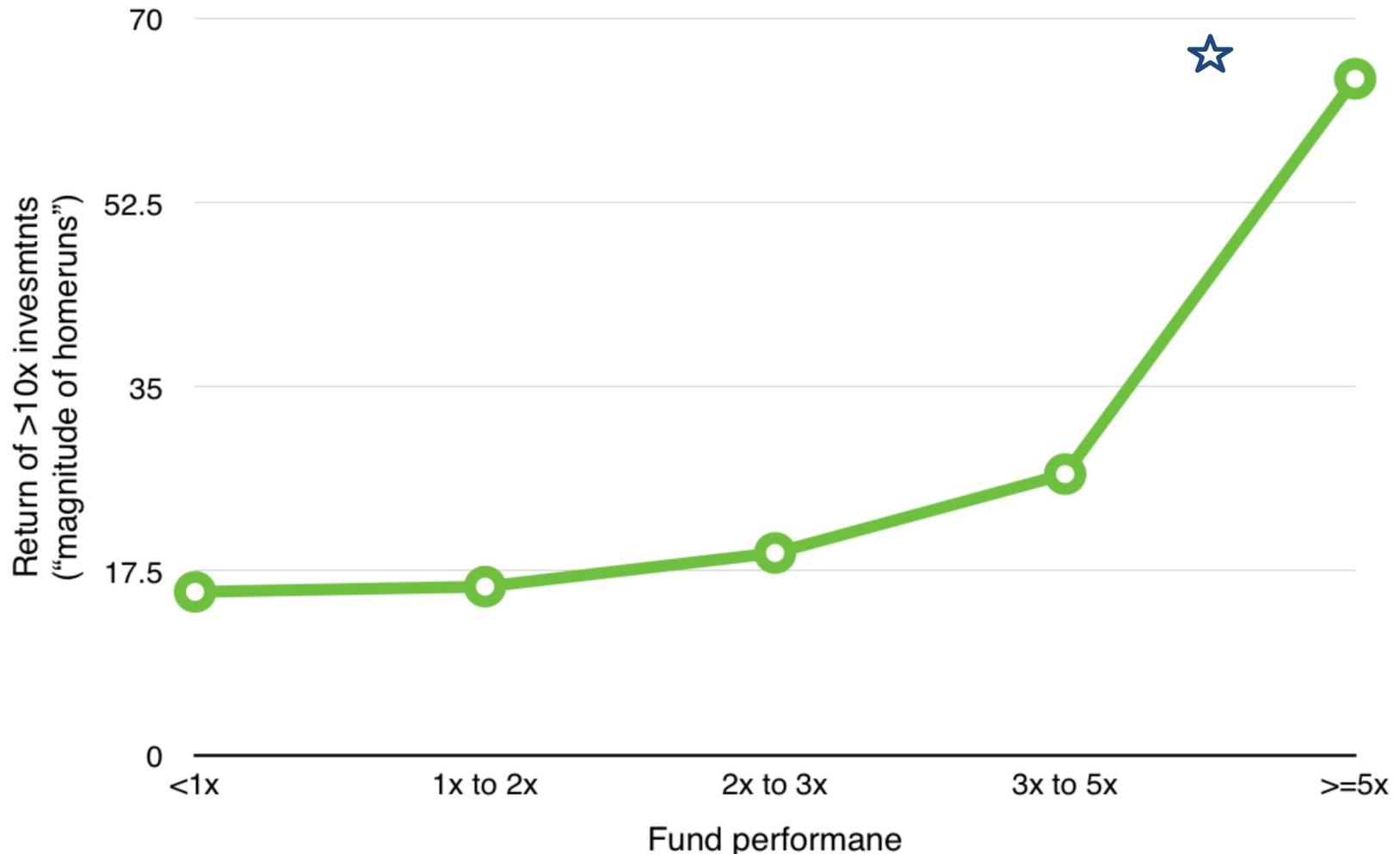


Successful funds have more “home run” investments (defined as investments that return >10x)

TCA had 11/182 or 6% home runs (>10x) ☆



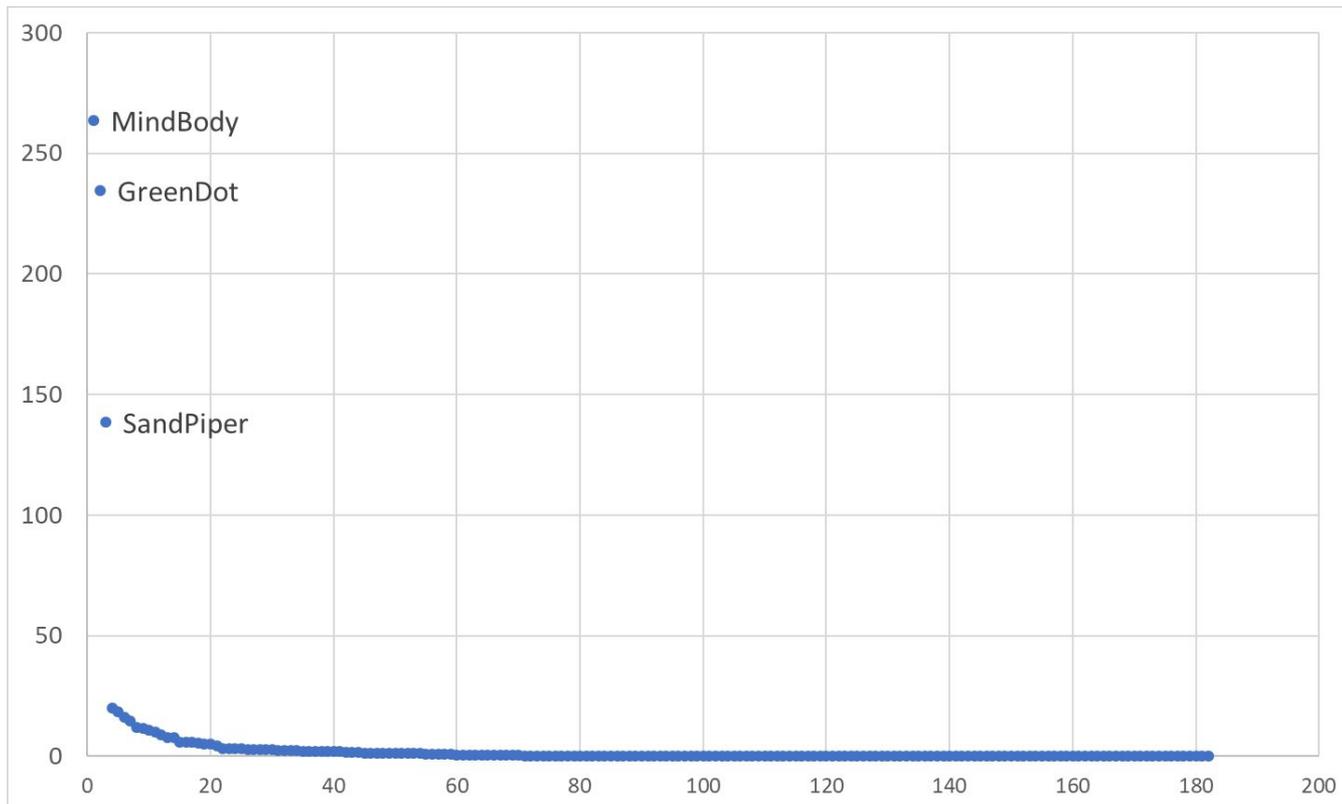
Great funds have home runs of greater magnitude.
TCA's average homerun was 68x



Portfolio Construction Implications

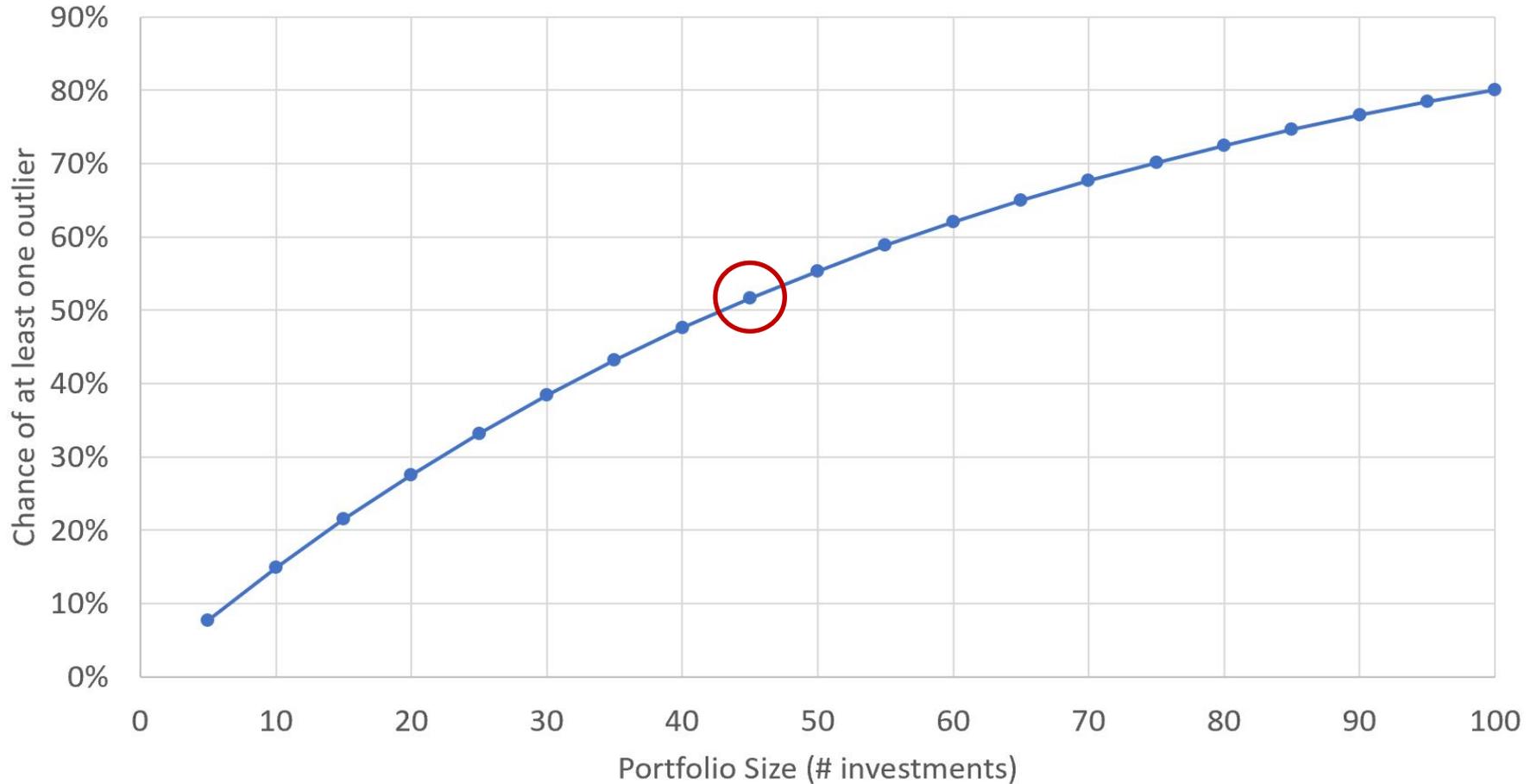
If 1.6% of TCA deals are outliers, and yield 71% of returns, it is critical to have at least one outlier in your portfolio.

How many deals did it take to get $> 50\%$ chance of outlier?



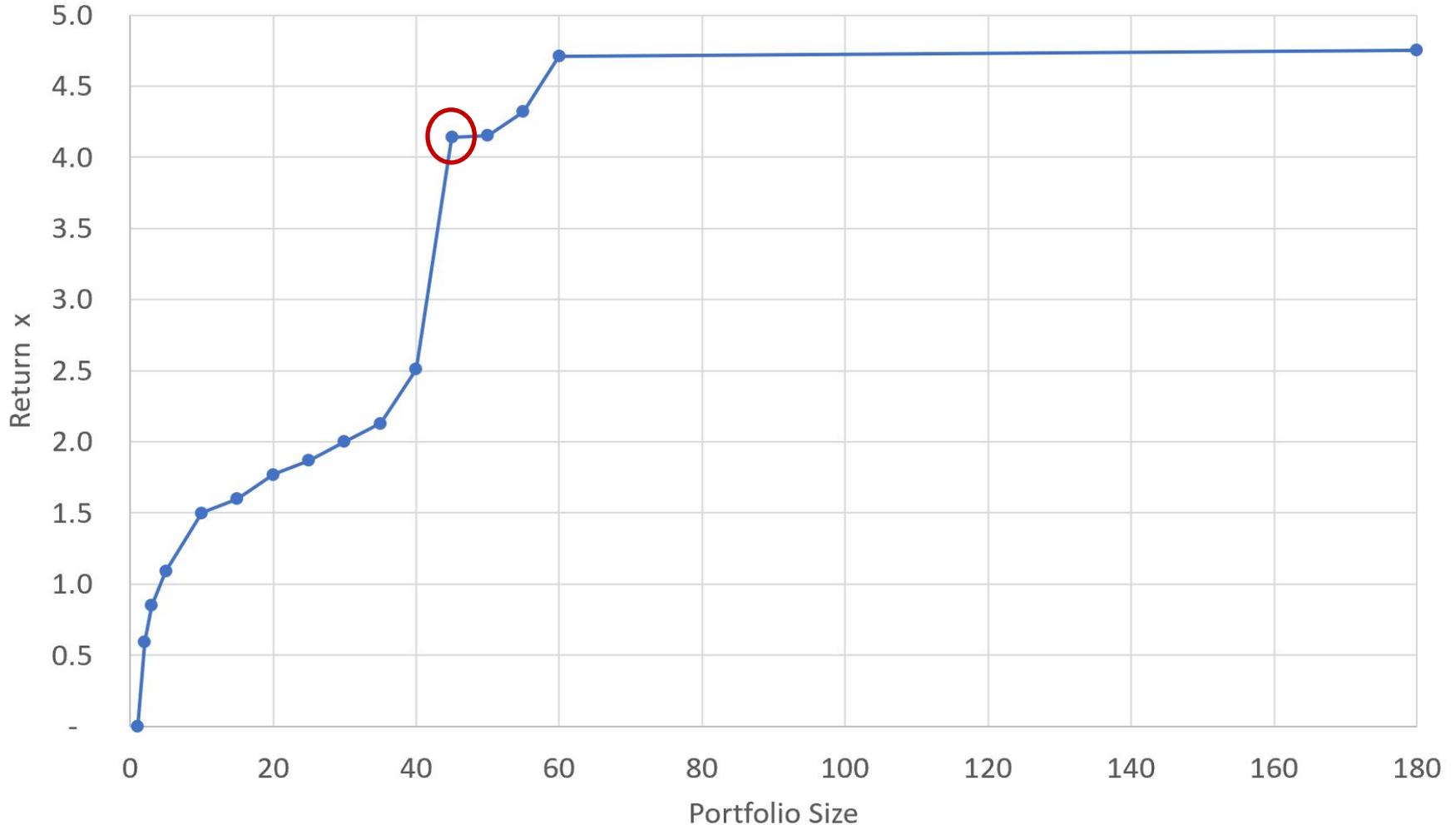
It took 45 investments to get 50% chance of outlier

Assuming 1.6% of deals are outliers (>100x)



You would have needed a portfolio of 45 deals to achieve a 50-50 chance of 4x portfolio return

MEDIAN of 10,000 portfolios constructed randomly from TCA's 182 exited deals



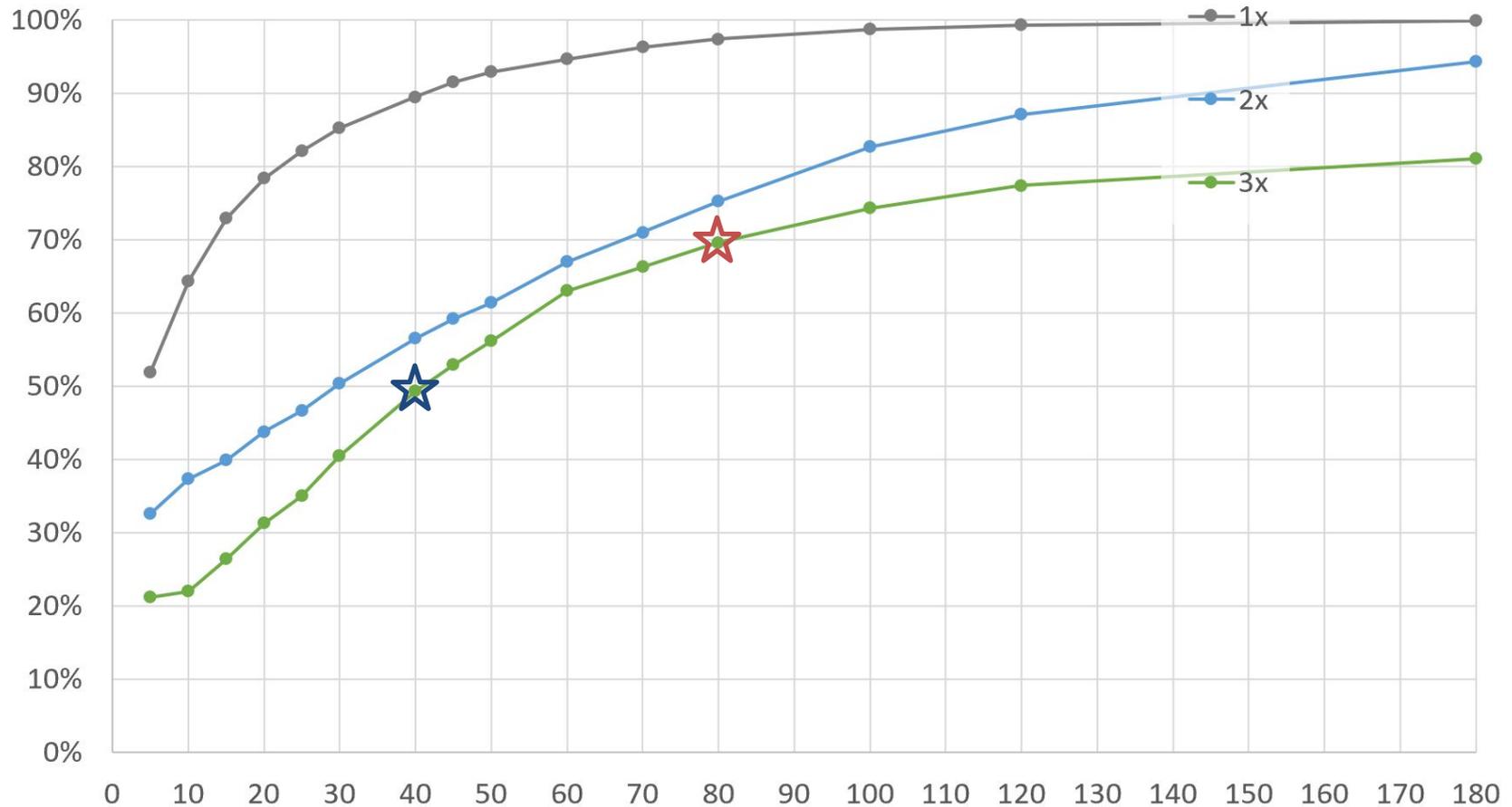
40 deals gave you 50% chance of 3x



80 deals gave you 70% chance of 3x



Chance of getting multiple (or better) by portfolio size



Personal conclusions I plan to employ:

- Be realistic and explicit about chance of failure
- Build a tree and calculate PWM for each deal
- Only invest when PWM is a believable 10x or better
- Continue to grow my portfolio to 50 deals or more
- To do that, I need to stretch my capital
 - Reduce my typical check size to \$25k
 - Generally avoid follow-ons

Questions?

Joe Gatto

joe@joegatto.com

in/joegatto1

Acknowledgments and thanks! to :

- John Harbison, TCA, data on 182 TCA outcomes
- Clint Korver, Ulu Ventures, *Crossing the Chasm* tree approach