

# Valuation of Private Companies Using Risk, Growth, and Time

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# Agenda:

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- Cui Bono? (who benefits)
- Important characteristics and life stages of companies
- Mechanics of investing
- New and old tools involved in valuation
- EXPLO model – a review
- Input assumptions for each company life stage
- Cash flow distributions for each company life stage
- Valuation results
- Cur hoc Melius? (why is this better)
- Further applications
- Summary

# Cui Bono (who benefits)

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- Private equity managers and deal makers
- Venture capital and investors
- Asset owners that invest directly or co-invest
- Pre-IPO and IPO investors
- Investment bankers
- Public equity managers and investors

# Several stages in company development:

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- Pre-revenue
- Pre-profit
- Growth: Full cash profit reinvestment
- Growth: Extensive investment in growth and innovation
- Mature: Gradual transition to reinvesting to keep company in operational and marketable state

# Important characteristics of company stages:

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- The cross-section of early stages company has a strongly right skewed probability distribution
  - approximately 1 in 10 start-ups reach revenue stage
  - approximately 1 in 3 companies that reach revenue stage eventually break even
  - this creates a special bimodal probability distribution for Investment outcomes - the *Prospector Distribution* - which was discussed in a joint webinar with CAIA in 2018
- The company reaches a mature stage where the reinvestment does not offer growth advantages but is used just to replace the existing production base. These future reinvestments effectively have a NPV of zero, which justifies that the company has effectively a finite life.

# Mechanics of Investing:

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- **Early investors** pay a cash amount based on matching what the model they use says is fair value. When a start-up requires a fixed amount of X dollars, the investment attractiveness is adjusted by the proportion of the company the investor will acquire. If they don't find that match in this start up, the investors would not invest in it. *(bargain on the basis of ownership share)*
- The same is true for **later stage investors** that don't replace existing investors. They put up cash and require a proportion of the enterprise which will issue new shares. Existing investors may accept new bids or not. *(bargain on the basis of ownership share, but also on the basis of share price)*
- **Secondary investors** will take into consideration the changed risk-return profile of the enterprise and will pay to replace an existing investor in the firm according to their own model of fair value. *(bargain on the basis of share price)*

# Valuation Toolset:

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- Expected cash flow forecasting
  - Input vector of profit growth in different stages
  - Input vector of reinvestment of cash profits
- Annual volatility of analogous public equities
  - Forecast by a risk model
- EXPLO valuation model
  - Based on the full cumulative cash flow distribution
  - Incorporates market risk aversion

# A Review of EXPLO Valuation

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- The model is derived from a stochastic model of the logarithm of wealth that incorporates the potential of investor default, investor time horizon, and investor consumption level
- Solves for the price **P** that will satisfy the equation  
 **$P * \text{risk free rate} = \text{Expected Profit}(P) - \text{Loss Aversion} * \text{Expected Loss}(P)$**
- The expected profit and loss are dynamically calculated based on the probability distribution outcomes of the investment (cumulative cash flows) and the price variable P for which the model solves
- Loss aversion can be derived for a single investor from the model
- Loss aversion for the market can also be calibrated to market transactions in the public or private markets
- The model does not impose distributional assumptions of investment outcomes
- It can also be represented as a DCF discount rate model
- It has been demonstrated that EXPLO is much more accurate in reproducing market prices of public equities than mean-variance based models



# Cash flow forecasting model inputs:

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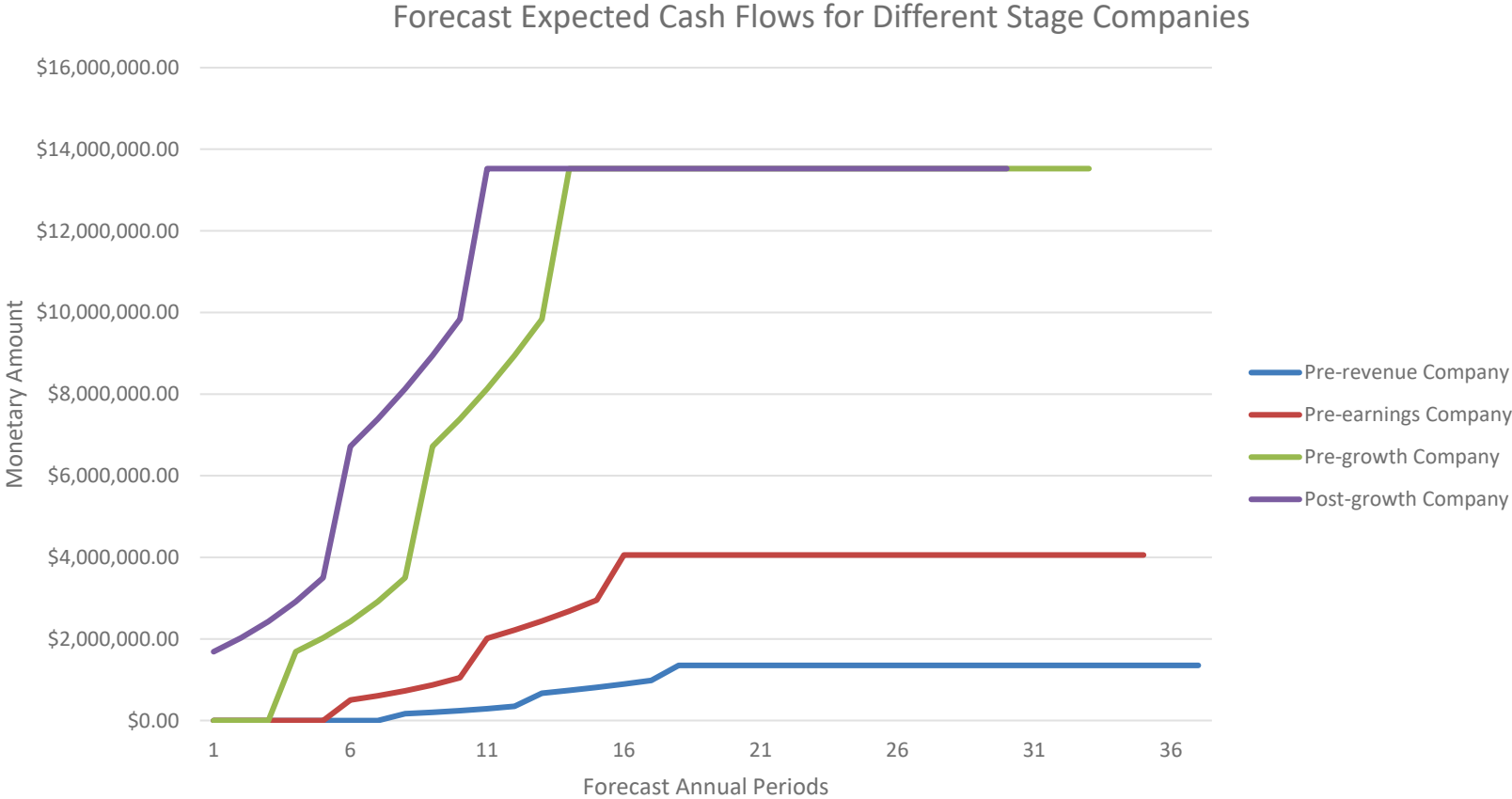
- Baseline annual cash profit of 1 million
- For pre-revenue: build in a period of 2 years of no revenue with zero cash flow distribution to investor
- For pre-earnings: build in a period of 2 years of no earnings with zero cash flow distribution to investor
- Growth stage: build in a period of 3 years of complete reinvestment of profits and therefore zero cash flow distribution to investor
- Post growth stage of non-zero cash flow distributions to investor is 30 years
- Use growth rate of profit of 50% in the first three years of non-zero earnings
- Use growth rate of profit of 20% in the next 5 years
- Use growth rate of profit of 10% in the 5 years after that

# Cash flow forecasting inputs (cont'd):

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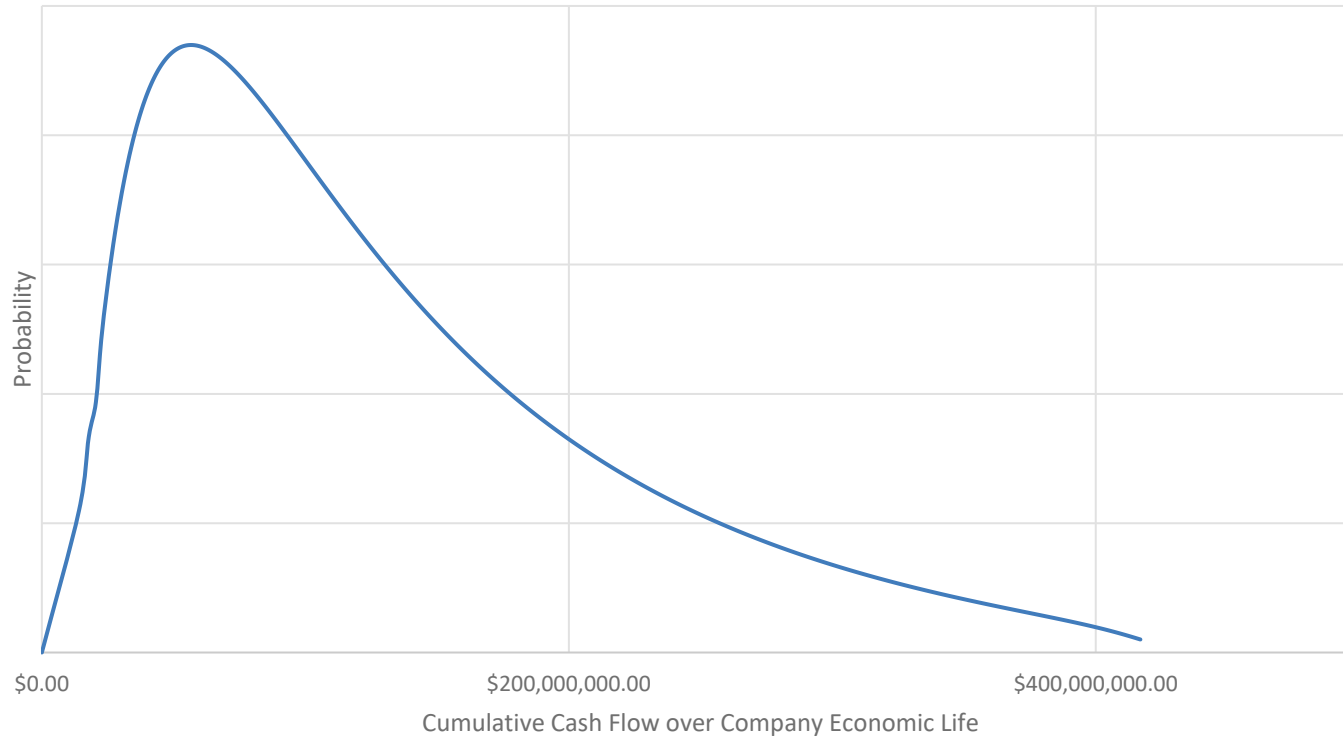
- Assume zero percent distribution of profit in the first period of earnings (i.e. for 3 years)
- Assume 50% distributions of profit in the next five years of earning
- Assume 80% distributions of profit in the next five years of earnings
- Assume 100 percent distribution of profit in final period
- Assume 1 in 10 companies reach revenue
- Assume 1 in 3 companies that turn to revenue turn to profit

# Expected Cash Flows



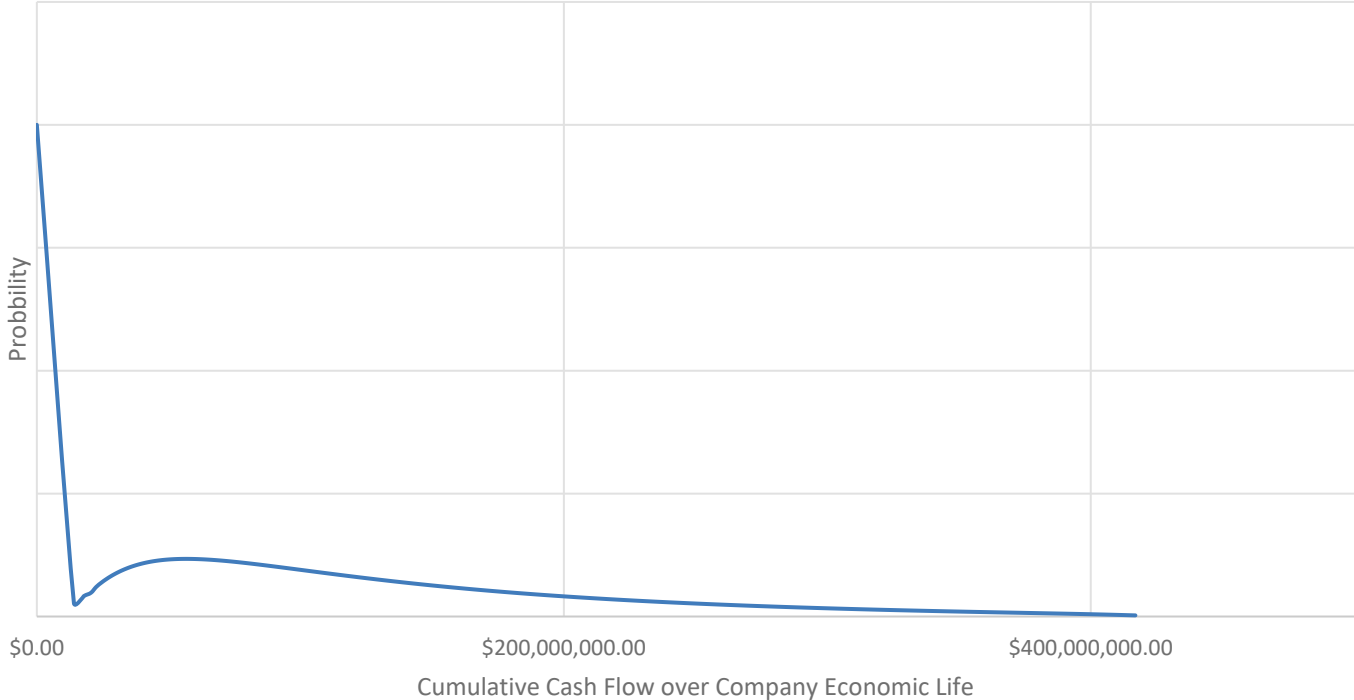
# Pre-Revenue Firm Cumulative CF if no Ruin

Company Pre-Revenue Cumulative Cash Flow



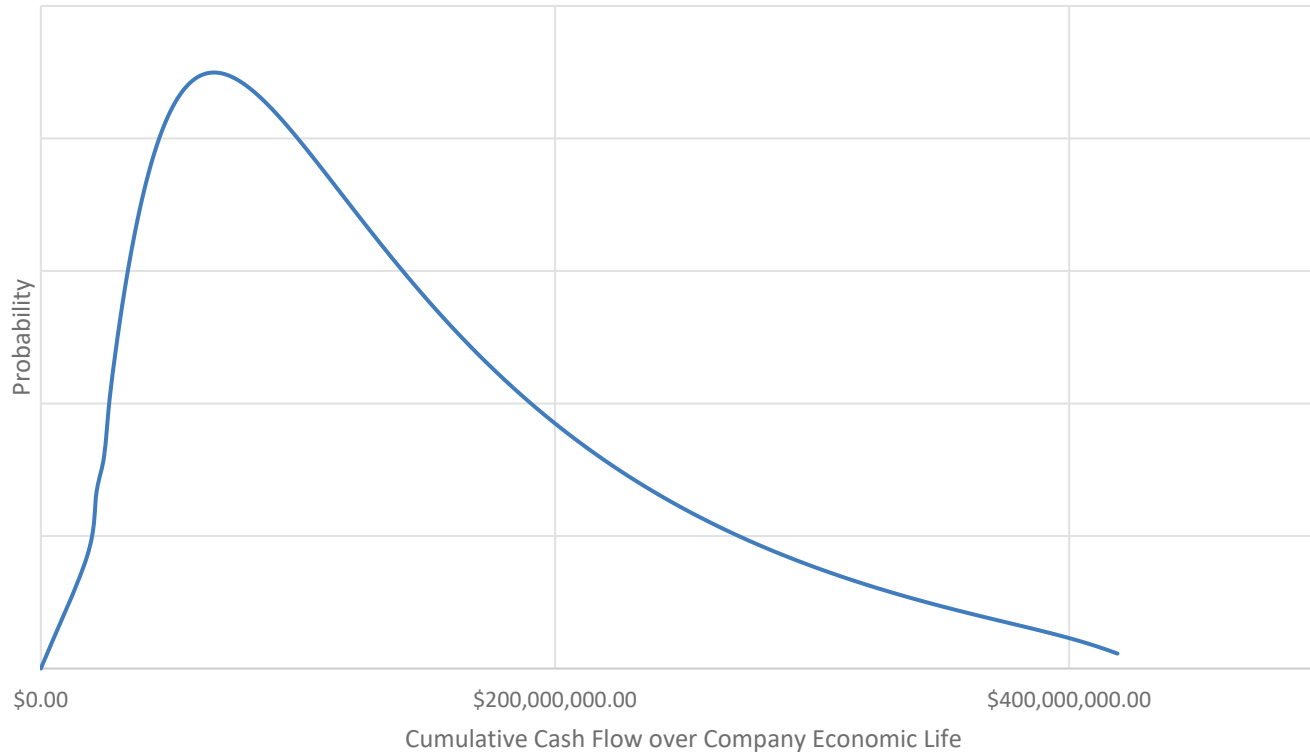
# Pre-Revenue Firm CCF with Potential of Ruin

Company Pre-Revenue Cumulative Cash Flow



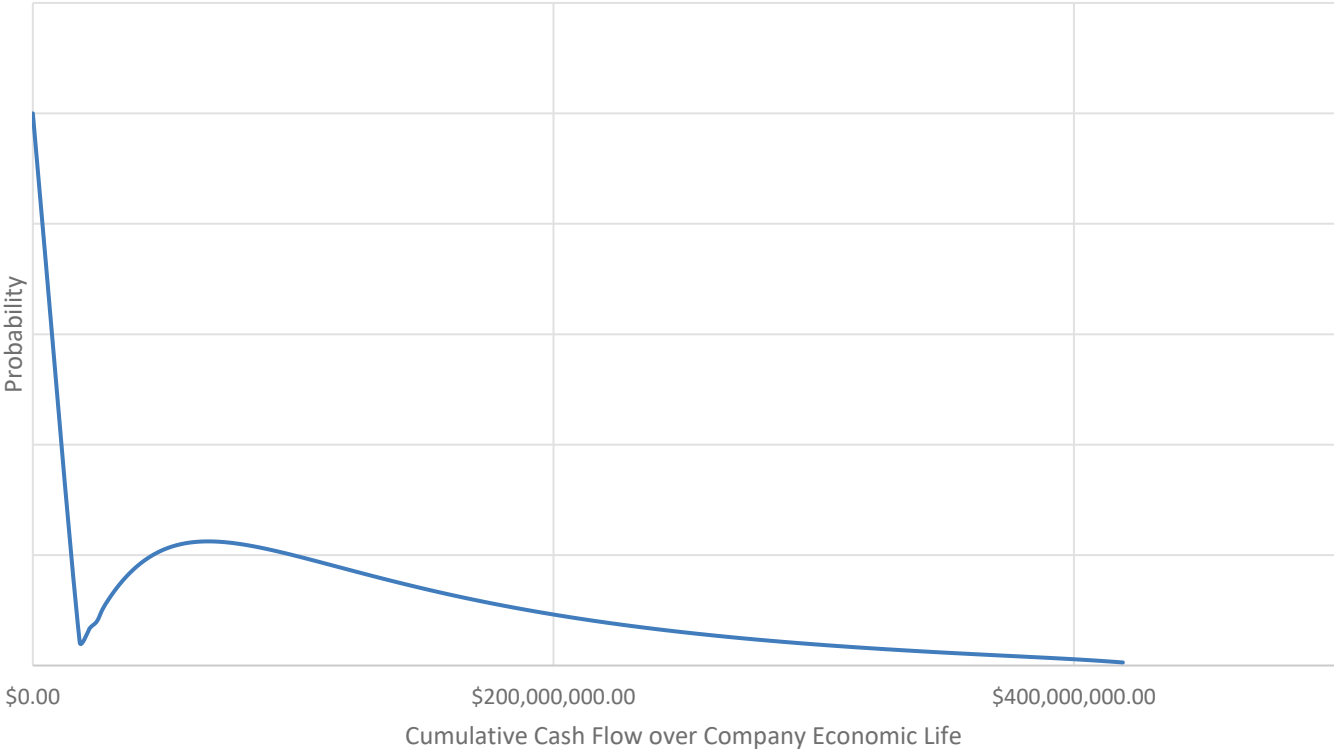
# Pre-Earnings Firm Cumulative CF if no Ruin

Company Pre-Earning Cumulative Cash Flow



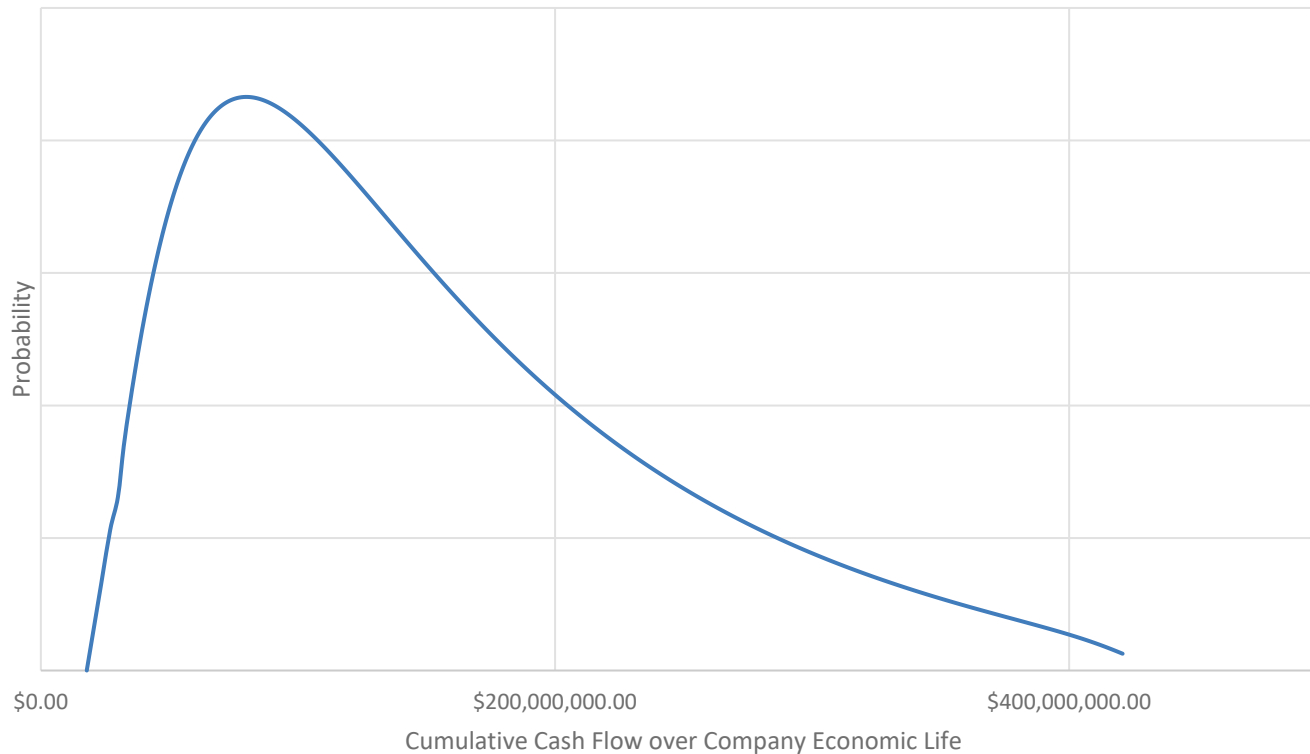
# Pre-Earnings Firm CCF with Potential of Ruin

Company Pre-Earnings Cumulative Cash Flow



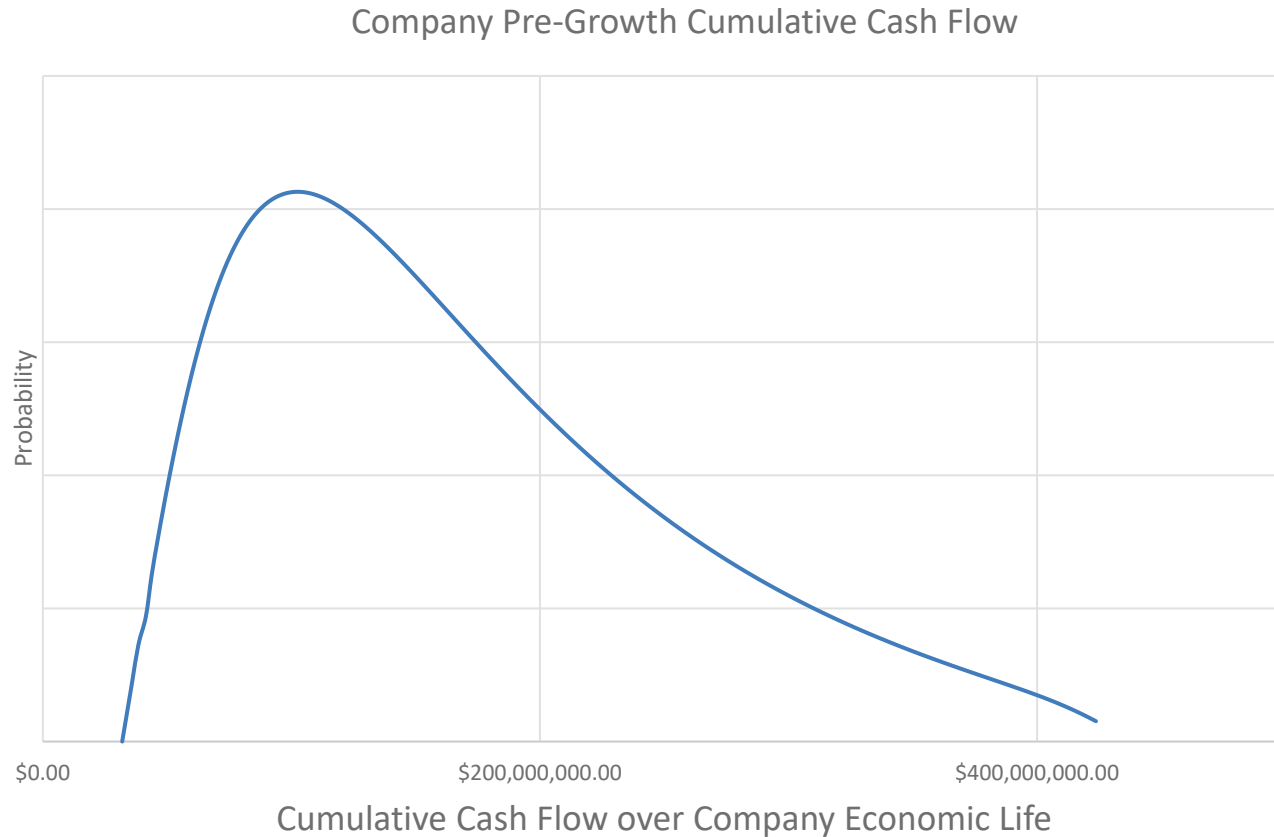
# Pre-Growth Firm Cumulative Cash Flows

Company Pre-Growth Cumulative Cash Flow





# Post-Growth Firm Cumulative Cash Flows



# Valuation Results:

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- Fair Values are:
  - Pre-revenue: **\$3,859,890**
  - Pre-earnings: **\$5,783,160**
  - Pre-growth: **\$117,134,000**
  - Post-growth: **\$136,904,000**
  
- Earnings Multiples are:
  - Pre-revenue: **0.29**
  - Pre-earnings: **0.43**
  - Pre-growth: **8.66**
  - Post-growth: **10.12**

# Valuation Results (cont'd):

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Some notable observations:

- Big impact of non-survival probability
- The impact of positive skew of early-stage company outcome prospects: the relatively smaller difference between the value of pre-revenue and pre-earnings vs. the big difference between one-in-ten and one-in-three odds of survival for each kind respectively
- Note that for early-stage companies Earnings Multiple is a very small number, which is one of the reasons it is often not a topic of conversation

# Cur hoc Melius? (why is this better)

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- Accounts for the multi-period nature of investment risk
- Deals with highly non-normal distributions
- Provides an extremely robust simulation of investment outcomes -  $10^{50}$  cashflow paths
- Provides distinct treatment of different stage companies and provides intuitive results
- The differentiation between pre-growth and post-growth - the uncertainty represented in the zero cash flow growth period gap penalizes company value. Try and CAPM that!

# Further Applications - Indexing

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**Question:** Do you think that indices of different stage company returns derived using the toolset described herein for different industries and geographies will be a useful addition to the Northfield offering of private asset services?

- a) Yes, because it will provide an independent and objective mark-to-market view of an obscure market that is otherwise undermined by subjectivity
- b) Yes, because it will be one of a few indices that shed light on early stage and pre-IPO investments
- c) No, because it will be model-based
- d) No, because its application in practice will be unclear

# Cui Bono Redux

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- Private equity managers and deal makers
- Venture capital and investors
- Asset owners that invest directly or co-invest
- Pre-IPO and IPO investors
- Investment bankers
- Public equity managers and investors

# Summary:

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- An application that fills a critical void in the investment practice - objective valuations of early stage and pre-IPO companies which are responsive to changing market conditions in real time
- Provides significant estimation advantages over existing valuation models
- An integrated framework for analysis of all stage companies that uses both fundamental inputs and advanced quantitative methods and technology
- Provide benefits to the full spectrum of market players

# Questions, Comments, Feedback

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