Corporate Finance Theory

Lecture 12

IPOs versus Acquisitions (1)
Bayar and Chemmanur (2011)

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Intended outcomes for the day:

1. **To intuitively describe** which of the model assumptions in Bayar and Chemmanur (2011) are most important for deriving their main result

2. **To mathematically represent** the entrepreneur's trade-off regarding IPOs versus acquisitions in their framework, and show how it differs from the trade-off faced by the venture capitalist

3. **To analyze** the relevant mixed strategy equilibrium (Proposition 1), and show that determines the equilibrium price, and what determines the equilibrium mixing probability.

Introduction

Young firm, initially run by an entrepreneur with equity financing from a venture capitalist

Needs to raise outside funds, for two reasons

1. Invest in a new project with positive NPV

2. Meet private liquidity needs (partial exit)

To do so, they can choose between:

-**Initial Public Offering (IPO),** listing in stock market
-**Sale to a strategic acquirer**

Theory to address this choice

Main model ingredients

Asymmetric information

- Entrepreneur and venture capitalist have private information on chance of project success
- Strategic acquirer shares this information
- IPO investors do not (leads to signaling)

Synergies

- Strategic acquirer improves chance of project success
- IPO does not

Private benefit of control

- IPO allows entrepreneur to retain control
- Acquisition does not

Ability for owners to deploy ressources within the firm
-> may relate to firm cash flow, like selling assets at advantagenous prices
-> could be non-monetary benefits.

Main model ingredients

Time horizon

- Venture capitalist may have shorter investment horizon
- Higher current liquidity need, less concern for long-term success of firm

Corporate governance

- Venture capitalist may (or may not) have influence on choice of IPO vs acquisition

Preview of results

IPOs and acquisitions, favored by different types of firms

-Strong firms (high quality project) choose IPO

-Weak firms (low quality project) sometimes choose acquisition

Puzzle: IPOs may often be associated with "better" pricing from investors

Then why choose acquisition at all?

Explanation for "IPO valuation premium puzzle"

-Entrepreneurs of weak firms may prefer acquisitions, even though IPO would lead to higher share price

-Conflict with venture capitalist (short term investors) who may instead prefer IPO

The Model

The parameters alpha_E, alpha_V, capture the liquidity need in the model.

They also capture the idea that the entrepreneur and VC (if relevant), may have different time horizons.

All equity firm, initially run by:

- Entrepreneur, with equity δ_E
- Venture Capitalist, with equity δ_V

Both have immediate **liquidity needs**

-Only relevant in case of IPO

-Then must sell fraction α_E, α_V of equity, respectively; $\alpha_E < \alpha_V$

Benefits of control

-Entrepreneur enjoys private benefit B following IPO

-Zero following acquisition

Bargaining power

- Equity is competitively priced (market value) in IPO
- Strategic acquirer has bargaining power, pays fraction ρ of value

The Model

Cash flows: investment costs I, generates

$I + V_S$ if project succeeds
$I + V_F$ if project fails

where $0 < V_F < V_S$

Probability of success

-After acquisition, success with probability p_A
-After IPO, success with probability p_H or p_L, depending on whether firm is strong or weak
-Entrepreneur, Venture Capitalist, Acquirer know whether firm is strong, but IPO investors do not (prior probability θ)
-Assume $p_L < p_H < p_A$: acquisition provides help in product market, in particular for weak firms

Model assumptions

Bayer and Chemmanur derive a mixed-strategy equilibrium where strong firms always choose IPOs and weak firms randomize (sometimes choose IPOs, sometimes acquisitions)

Question: which of the following model assumptions is most important in deriving this equilibrium

most popular

a) The venture capitalist has higher liquidity needs than the entrepreneur: $\alpha_V > \alpha_E$
b) The entrepreneur retains some shares following IPO, $\alpha_E < 1$.
c) The acquirer knows whether a firm is strong or weak: p_H, p_L
d) Private benefit B for entrepreneur following IPO, zero for venture capitalist or acquirer
e) Strong and weak firms perform equally well in the product market following acquisition, p_A

Go to socrative.com, room 897458, vote on the best answer

Net present values - entrepreneur

Acquisition

-Firm NPV: $V_A = p_A V_S + (1 - p_A) V_F$
-Entrepreneur sells all shares δ_E, obtains $\delta_E \ \rho \ \ V_A$
-Parameter $\rho < 1$ represents acquirer bargaining power

Payoff: $(\delta_E \ \rho \ )[p_A V_S + (1 - p_A) V_F]$

IPO

-Let γ denote shares of new outside investors
-Shares sold at price P, market value (competitive price)
-An amount I = P γ required to finance investment
-Price satisfies: $P = I + p_{IPO} V_S + (1 - p_{IPO}) V_F$

Payoff: $\delta_E (1 - \gamma) [\alpha_E P + (1 - \alpha_E)(I + V_q)] + B$

where $V_q = p_q V_S + (1 - p_q) V_F$ with Entrepreneur's known $p_q \in \{p_L, p_H\}$

Model assumptions (one more time)

Bayer and Chemmanur derive a mixed-strategy equilibrium where strong firms always choose IPOs and weak firms randomize (sometimes choose IPOs, sometimes acquisitions)

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Discussion

Bayer and Chemmanur derive a mixed-strategy equilibrium where strong firms always choose IPOs and weak firms randomize (sometimes choose IPOs, sometimes acquisitions)

Strong firms must have a strict incentive to choose IPOs, weak firms must be indifferent

-> the incentive to choose IPOs over acquisition should be increasing in firm strength

-> Equation shows IPO payoff is lower for weak firms ($p_L < p_H$), but only if $\alpha_E < 1$; entrepreneur must retain some shares (answer b best)

-> Also important that strong firms do not significantly outperform weak firms in product market following acquisition (relates to answer e)

Net present values – venture capitalist

Acquisition (essentially same as for entrepreneur)

-Firm NPV: $V_A = p_A V_s + (1 - p_A) V_F$
-Venture capitalist sells share δ_V, obtains $\delta_V \ \rho \ \ V_A$
-Parameter $\rho < 1$ represents acquirer bargaining power

$$(\delta_V \ \rho \ )[p_A V_s + (1 - p_A) V_F]$$

IPO (two differences: high liquidity needs, no control benefits)

-Let γ denote shares of new outside investors
-Shares sold at price P, market value (competitive price)
-An amount I = P γ required to finance investment
-Price satisfies: $P = I + p_{IPO} V_s + (1 - p_{IPO}) V_F$

$$\left[\delta_V (1 - \gamma)\left(\alpha_V P^V_{\text{IPO}} + (1 - \alpha_V)(I + V_q)\right)\right]$$

smaller long-term stake in the firm than the entrepreneur

where $V_q = p_q V_S + (1 - p_q) V_F$ with known $p_q \in \{p_L, p_H\}$

Equilibrium: entrepreneur-controlled firm

Equilibrium strategies:

-strong firm chooses IPO with probability 1

-weak firm chooses IPO with probability β

-overall proportion of strong firms in the population is θ

investor beliefs (prior).

Question: show that when investors observe an IPO, they believe that the probability the firm is strong is given by

$$\Pr(q = H \mid a = 1) = \frac{\theta}{(1-\theta)\beta_E + \theta},$$

Explain the intuition why this probability is always between θ and 1, and why it is decreasing in β.

Don't worry about the notation

LHS → investor beliefs, given IPO.

RHS: β_E is what I call β, weak firm strategy.

Discussion

Question: show that when investors observe an IPO, they believe that the probability the firm is strong is given by

$$\Pr(q = H \mid a = 1) = \frac{\theta}{(1-\theta)\beta_E + \theta},$$

$= P(H, IPO) / P(IPO).$

Bayes' rule:

Pr(H| IPO) = Pr(IPO|H) Pr(H)/Prob(IPO)

= Pr(IPO|H) Pr(H)/ [Pr(IPO|H)Pr(H) + Pr(IPO|L)Pr(L)]

= 1 * θ / [1 * θ + β * (1 – θ)]

Larger than θ : IPO sends positive signal about firm strength

Decreasing in β : signal strength depends on likelihood that weak firms also choose IPO

Equilibrium: entrepreneur-controlled firm

Find an equilibrium where the strong firm chooses IPO, and the weak firm randomizes, choosing IPO with probability $\beta \in (0,1)$

Following the logic from previous slides, we can assume parameter values such that the strong firm indeed finds IPO optimal. Concentrate on "making" the weak firm indifferent.

Acquisition: payoff given by

$$(\delta_E \ \rho\ )[p_A V_S + (1-p_A)V_F]$$

IPO: payoff from substituting $\gamma = I/P$ into

$$\delta_E (1-\gamma)\left[\alpha_E P + (1-\alpha_E)(I+V_q)\right] + B$$

where $V_q = V_L = [p_L V_S + (1-p_L)V_F]$ for the weak firm

Equate the two payoffs (quadratic in P). **Pins down the equilibrium price, P*!**

Equilibrium: entrepreneur-controlled firm

In IPO, equity priced at

$$P = I + Pr(H|IPO)\left[p_H V_S + (1-p_H)V_F\right] + (1 - Pr(H|IPO))\left[p_L V_S + (1-p_L)V_F\right]$$

Previous slide pinned down the equilibrium price, P*, which leaves weak firms indifferent.

Hence, in equilibrium, the above expression must satisfy P=P*

The right-hand-side of this expression is monotonic in β.

Hence, if a value $0 < \beta < 1$ exists such that P = P*, then this value is unique.

Pins down probability β* that a weak firm chooses IPO

Equilibrium: entrepreneur-controlled firm

In IPO, equity priced at

$$P = I + Pr(H|IPO)\Big[p_H V_S + (1-p_H)V_F\Big] + (1 - Pr(H|IPO))\Big[p_L V_S + (1-p_L)V_F\Big]$$

Stated earlier that the above expression is monotonic in β.

Question: show mathematically whether this expression is increasing or decreasing in β. What is the intuition for this result?

a) Increasing in β

b) Decreasing in β

Go to socrative.com, room 897458, and vote

No need to vote.
Think about how a change in β affects (which parts of) the expression for P at the top of the slide.

Equilibrium: entrepreneur-controlled firm

In IPO, equity priced at

$$P = I + Pr(H|IPO)\Big[p_H V_S + (1-p_H)V_F\Big] + (1 - Pr(H|IPO))\Big[p_L V_S + (1-p_L)V_F\Big]$$

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Equilibrium: entrepreneur-controlled firm

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$$P = I + Pr(H|IPO)\left[p_H V_S + (1-p_H)V_F\right] + (1 - Pr(H|IPO))\left[p_L V_S + (1-p_L)V_F\right]$$

Pr(H|IPO) is decreasing in β:

$$\Pr(q = H \mid a = 1) = \frac{\theta}{(1-\theta)\beta_E + \theta},$$

Combine with $p_H > p_L$ and $V_S > V_F$ gives the result:

market price of equity is decreasing in β

Intuition: the higher the (expected) value of β, the higher the probability that a firm choosing IPO is weak, and therefore less valuable

Graphical analysis (if time permits)

We can represent the preceeding steps graphically.

Same formal steps as before, depicted in slightly different way

Let vertical axis denote price P

Let horizontal axis depict mixing probability β

Determine the equilibrium mixing probability.

Intended outcomes revisited

1. To intuitively describe which of the model assumptions in Bayar and Chemmanur (2011) are most important for deriving their main result

Weak firm must have a lower payoff than strong firm from choosing IPO. Important assumption: the entrepreneur does not sell all equity in IPO

2. To mathematically represent the entrepreneur's trade-off regarding IPOs versus acquisitions in their framework, and show how it differs from the trade-off faced by the venture capitalist

Importance of investor beliefs, liquidity needs, benefits of control, acquirer bargaining power, help in product market (synergies). Venture capitalist has higher liquidity needs and no benefit of control

3. To analyze the relevant mixed strategy equilibrium (Proposition 1), and show that determines the equilibrium price, and what determines the equilibrium mixing probability.

Required equilibrium price in IPO determined by indifference condition of weak firm. Equilibrium mixing probability ensures that investors are willing to pay exactly this price

For next time

1. Read the rest of Bayar and Chemmanur (2011), concentrating on understanding the comparative statics (Propositions 2 and 3)

2. Recall that the equilibrium price and mixing probabilities are pinned down by two equalities, from slides 17 and 18. Think about how to represent both equations in a graph, as alluded to on slide 22. Looking at this graph, where can we find the equilibrium values of p and β?

3. Reflect on how the ideas from Bayar and Chemmanur relate to the Pecking order theory, in particular that firms tend to avoid issuing equity because of information asymmetries.