Due Diligence

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Motivation

- **Due diligence is pervasive** in "large" transactions
  - Public M&A
  - Private equity
  - Real estate
  - ...
- Practitioners claim it is crucial...
  - Often it is required by third parties (e.g., financier or board)
- Is it economically important?
- What are the implications of due diligence?

Motivation

"The goal of due diligence in the M&A process is for Buyer to confirm Seller's financials, contracts, customers, and all other pertinent information. In other words, the goal is to make Buyer **comfortable enough** to go through with the deal and close."

"Buyers often have other partners (usually banks or private equity firms) who are providing some of the financing and have stricter requirements than the Buyer does. In other words, Seller may have to overcome both Buyer's demands and Buyer's financial partner's demands."

Snow (2011)

Mergers & Acquisitions (for dummies)

This Paper

What does the right to conduct due diligence imply for transactions?

Due diligence allows the acquirer to **learn** about the asset's value prior to completing the deal

- Transaction may not be executed if due diligence fails

Right to conduct due diligence $\Rightarrow$ acquirer obtains a **real option**

This Paper

A simple **model of due diligence**

- Identical bidders (common value)
- Contract $\equiv$ price
- Acquirer has the right to conduct due diligence
- Symmetric information

Findings

- Seller payoff is non-monotone in the price
- Acquirer makes positive expected profits
- Seller may also benefit from due diligence
- Acquirer is too diligent relative to social optimum

This Paper

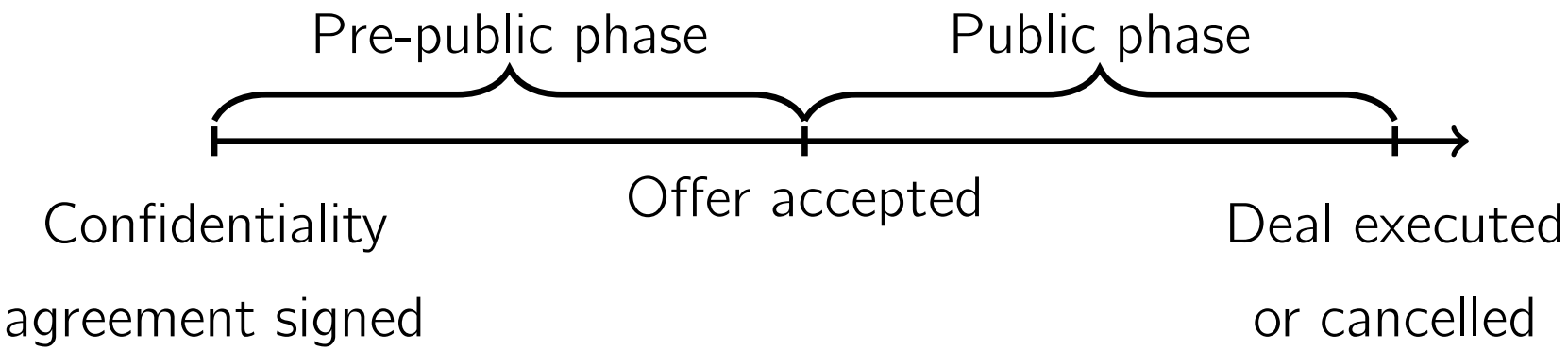
Extensions:

- Enriching the contracting space
- Seller private information
- Dynamic bidding
- Common knowledge of gains from trade
- Costly due diligence
- Endogenous effort

Literature

- **Auctions of Real Options**: Board (2007) and Cong (2018, 2019) $\Rightarrow$ expand the scope + seller private information
- **Auction Mechanism in M&A**: Bulow and Klemperer (1996), Hansen (2001), Ye (2007), Quint and Hendricks (2018), and Gorbenko and Malenko (2018, 2019) $\Rightarrow$ focus on due diligence
- **Learning Before Trading**: Daley and Green (2012, 2019) $\Rightarrow$ acquirer can continue to learn after agreement is reached

Due Diligence In Practice



- **Reasons for public phase**:
  - Information disclosure to competitors (Marquardt and Zur (2015) and Wangerin (2019)). Example: Le Tote vs Urban Outfitters
  - Due diligence is costly, see Lajoux (2010)
- Baseline model studies due diligence during public phase while Daley and Green (2012) looks at the pre-public phase

Model

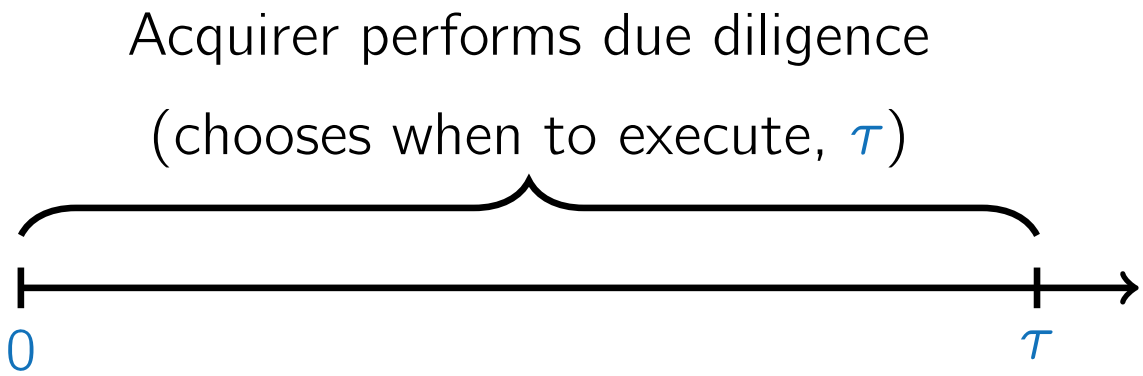
- A single seller owns a durable asset
- A set of identical bidders
- Asset type is $\theta \in \{L, H\}$
  - θ is unknown
  - Players have common prior that $q_0 = \mathbb{P}_0(\theta = H)$
  - Sellers value is k, independent of θ
  - Bidders value is V_θ, where $0 = V_L < k < V_H$
- All players are risk neutral and discount at rate r

Model: Timing

- Bidders simultaneously make bids to the seller
- If the seller accepts a bid
  - The acquirer (=winning bidder) has the **right to conduct due diligence**, and
  - decide when (if ever) to complete the deal at bid price
- While conducting due diligence, the acquirer uncovers information via a Brownian diffusion process

$$dX_t = \mathbb{I}_{\{\theta=h\}} dt + \frac{1}{\phi} dB_t$$

Model: Timing



Bidder's make offers and seller selects winner

Acquirer receives $V_\theta - P$ and seller receives $P - k$

Model: Beliefs

- The acquirers belief about θ is **updated during due diligence**
- Using Bayes rule, the belief at time t is

$$q_t = \mathbb{P}(\theta | \{X_s, 0 \leq s \leq t\}) = \frac{q_0 f_t^H(X_t)}{q_0 f_t^H(X_t) + (1 - q_0) f_t^L(X_t)}$$

where f_t^θ is pdf of $X_t|\theta$, which is $\mathcal{N}\left(\mathbb{I}_{\{\theta=H\}} t, \frac{1}{\phi^2} t\right)$

Equilibrium: Due Diligence

- Suppose the winning offer is P
- Then the acquirer's due diligence problem is

$$F_B(q|P) = \sup_{\tau} \mathbb{E}_q[e^{-r\tau}(V_\theta - P)]$$

Lemma (Acquirer-Optimal Execution)

Given any price $P \in (0, V_H)$, the acquirer completes the deals as soon as beliefs q_t exceed $b(P)$ while it delays completion when beliefs are below this threshold.

Hypothetical Stopping Problem

- Define $P_0(q) = b^{-1}(q)$ as the highest price such that the acquirer is willing to forego due diligence and execute immediately

- Also define the hypothetical optimal stopping problem:

$$\sup_{\tau} \mathbb{E}_q \left[e^{-r\tau} (P_0(q_\tau) - k) \right]. \qquad \text{(SP-hypothetical)}$$

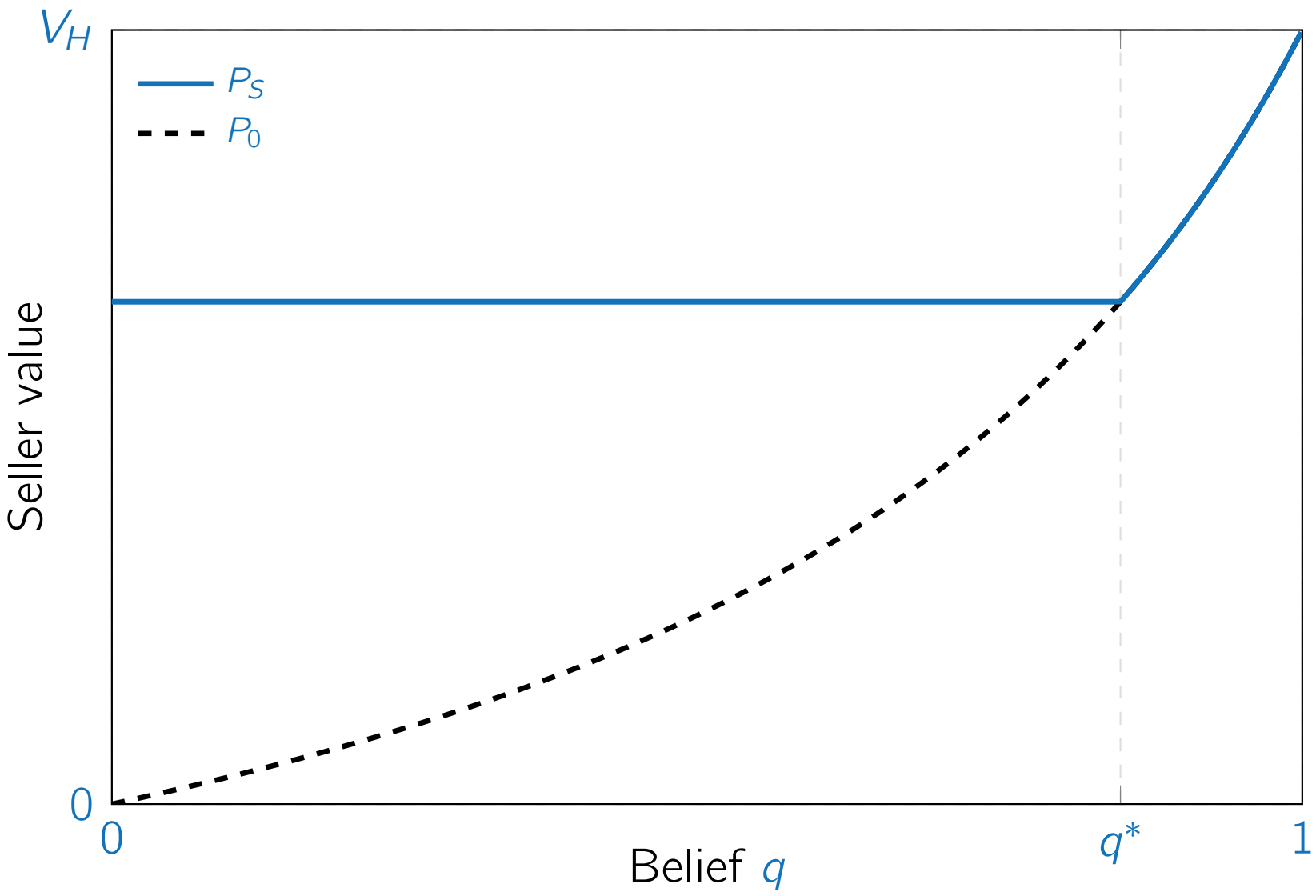
- We know for (SP-hypothetical) that stopping is optimal for beliefs above some q^* and assume delay is optimal below q^*

Equilibrium: Seller's Preferences

- What is the **seller's preferred price**?
- Seller's expected discounted payoff is

$$\begin{aligned} F_S(q|P) &= \mathbb{E}_q\left[e^{-r\tau^*(P)}(P-k)\right] \\ &= \mathbb{E}_q\left[e^{-r\tau^*(P)}\right](P-k) \end{aligned}$$

- A higher price leads to:
  - Higher payoff conditional on completion 🙂
  - Longer expected due diligence and less likely to complete 🙁
- The seller does not necessarily prefer a higher price


V_H
P_S
P_0
Seller value
0
0
q^*
1
Belief q

Equilibrium

Proposition

There exists a unique equilibrium. In it,

- *The winning offer is the seller-optimal price,* $P_S(q_0)$.
- *In the due-diligence subgame, the acquirer plays according to* $\tau^*(P)$.
- *There is a period of due diligence if and only if* $q_0 < b(P^*)$.

Model Analysis: Acquirer Extract Rents

$P_S(q) < \mathbb{E}_q[V_\theta] \Rightarrow$ due diligence allows **acquirer to extract rents**.

Model Analysis: Social Optimal Outcome

Social optimal acquisition time solves

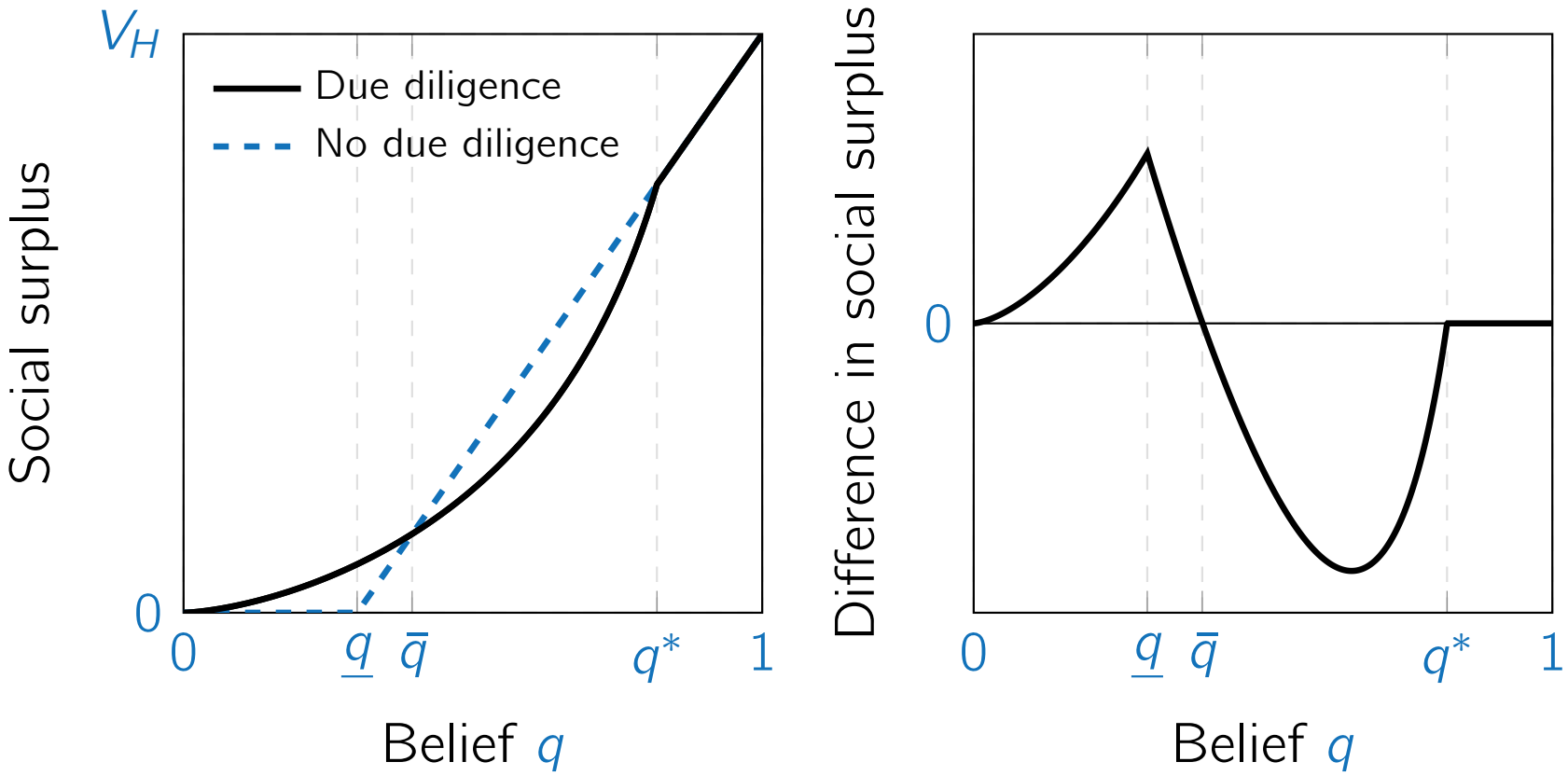
$$\sup_{\tau} \mathbb{E}_q \left[e^{-r\tau} (V_\theta - k) \right]$$

Proposition (Social Optimum)

The socially optimal execution threshold is $b(k)$, which is strictly less than $b(P^*)$.

Therefore, in equilibrium, the acquirer conducts **"too much" due diligence** *(and the probability of deal failure is too high) relative to the social optimum.*

Model Analysis: Optimality Due Diligence



Due diligence can both **benefit or harm social efficiency** (and the seller)

Optimal Mechanism

$C \equiv (U, P)$, where $U \geq 0$ is an upfront unconditional transfer and P is the price paid contingent on execution

Optimal mechanism:

- $P = k \Rightarrow$ efficient execution $\Rightarrow$ maximize social surplus
- $U = F_B(q|k) \Rightarrow$ seller extracts all surplus

Asymmetric Information

- As we show now, **seller private information** hinders the implementability of the socially efficient outcome
- Seller knows the asset's type $\theta \in \{L, H\}$ but bidders do not
- Seller's reservation value depends on the asset's type k_θ with $V_H > k_H > k_L > V_L = 0$
- Seller posts a contract $C = (U, P)$ and bidders update their beliefs and decide whether (or not) to accept

Asymmetric Information: Constrained Efficiency

- (Social optimal) **constrained efficient** execution time solves

$$\sup_{\tau} \mathbb{E}_q \left[e^{-r\tau} (V_\theta - k_\theta) \right]$$

- Setting the price at $P_{SP} < k_H$ achieves this outcome
- For this price, the high-type seller prefers the deal not to be executed (conditional on having this offer accepted)
- If q becomes small $\Rightarrow F_H(q_0|P_{SP}) + F_B(q_0|P_{SP}) < 0 \Rightarrow$ high type rejects constrained efficient outcome
- What is a "reasonable" equilibrium?

Asymmetric Information: Equilibrium

- Can a **separating** Perfect Bayesian Equilibrium (PBE) exist? And what does it look like?
- Separating PBE $\Rightarrow$ direct or no execution since type is revealed
- Separating PBE $\Rightarrow$ low type payoff is zero
- High type payoff must be zero
- The transaction is never executed in a separating PBE

Asymmetric Information: Equilibrium

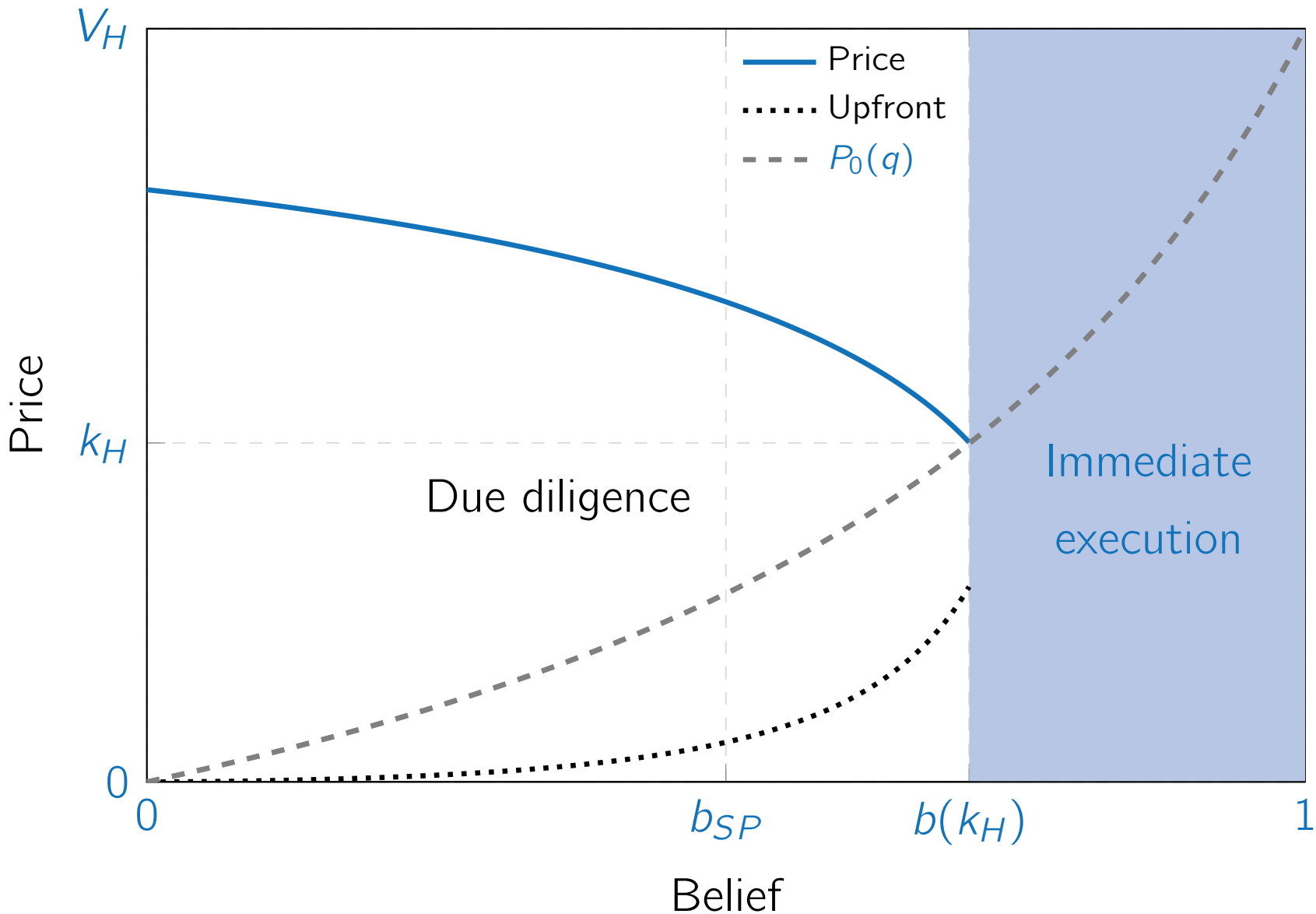
A natural candidate is the **high type optimal** (HTO) equilibrium.

Proposition

A nontrivial PBE ($\mathbb{P}(\textit{deal execution}) > 0$) *is a high type optimal (HTO) equilibrium if and only if it satisfies both divinity and the undefeated criterion (Mailath et al., 1993)*

Any HTO involves full pooling on a single contract.

Asymmetric Information: HTO Equilibrium



Asymmetric Information: HTO Equilibrium

- $P_H^*(q) > P_{SP} \Rightarrow$ acquirer "too diligent" which leads to socially inefficient delay
- Contract $C_H^* = (P_H^*, U_H^*)$ cannot achieve constrained efficient outcome
- Rent extraction from low type less important as beliefs go up $\Rightarrow$ price decreasing and upfront increasing in beliefs

Extensions

- When X is contractible $\Rightarrow$ can approximate first-best (Mirleesian non-existence)
- Dynamic bidding $\Rightarrow$ option to conduct more due diligence is crucial assumption
- Common knowledge of gains from trade $\Rightarrow$ seller might prefer due diligence even though it's socially inefficient $\Rightarrow$ dynamic bidding is preferred
- Costly due diligence $\Rightarrow$ acquirer drops out too early
- Endogenous due diligence effort $\Rightarrow$ more effort closer to completion

Conclusions

We investigate a simple model of **due diligence**:

- Due diligence allows acquirer to extract rents
- Sellers do not always prefer a higher price
- Acquirer is too diligent relative to first best
- Acquirer gains from due diligence, but sellers can too