Midterm Review

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The Question

- Interim performance reviews are common and consequential.
- But why evaluate midway, when final output is the best evidence of effort?
- **This paper**: interim reviews matter when rewards are bounded.
  - With unbounded pay, no interim review needed:
    a large enough terminal bonus with a high bar $\Rightarrow$ the first-best outcome.
  - Government agencies and non-profits do not pay large cash bonuses.
  - Even in firms, incentives often provided via promotions (e.g., making partner).

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Core Idea

- Without a midterm review, the optimal terminal bonus uses a single threshold:
  1. Pay zero unless performance clears a certain bar.
  2. Make the maximum payment if the bar is achieved.
- Midterm review provides more instruments: early termination and contingent continuation.
- Optimal midterm review is an *incentive ladder* with up to **four** rungs:
  1. Terminate early without payment if performance is *poor*.
  2. Impose a difficult continuation bar if performance is *fair*.
  3. Impose an easy continuation bar if performance is *good*.
  4. Terminate early with maximum payment if performance is *excellent*.

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Related Literature

- **Interim Performance Evaluation**
  - Lizzeri, Meyer, and Persico (2002): Dynamic incentives with interim evaluation.
  - Chen and Chiu (2013), Ely and Szydlowski (2020): History-dependent continuation contracts.
  - Ray (2007), Liu (2026): Sorting and resource allocation at review.

- **Limited Payments and Dynamic Incentives**
  - Jewitt, Kadan, and Swinkels (2008): Moral hazard with bounded payments.
  - Sannikov (2008), Zhu (2013): Dynamic rewards, termination, and relaxation.
  - Ely, Georgiadis, and Rayo (2025): Optimal performance feedback.

- **Timing and Design of Monitoring**
  - Georgiadis and Szentes (2020): Optimal monitoring precision and duration.
  - Varas, Marinovic, and Skrzypacz (2020): Periodic versus random monitoring.
  - Rodivilov (2022), Ball and Knoepfle (2026): Timing of inspections.

Model

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- A principal (**P**) hires an agent (**A**) over $[0, T]$; both risk-neutral, outside options 0.
- **A** exerts effort $e_t \in \{0, 1\}$ at cost $c \in (0, 1)$ per unit time; output evolves as

$$dX_t = e_t\, dt + dB_t, \qquad X_0 = 0,$$

  where B_t is a standard Brownian motion: $B_t \sim N(0, t)$.
- Review at $\tau \in (0, T]$ ($\tau = T$: no review).
  - τ is exogenously given in the presentation.
  - Only X_τ and X_T are observed by anyone, including **A**.
  - **A** chooses effort twice: a_1 on $[0, \tau)$, and a_2 on $[\tau, T]$ after seeing X_τ.

  These assumptions (fixed τ, observability and twice-chosen effort) are relaxed in the extensions.
- **First best**: **A** works throughout ($c < 1$), giving surplus $(1 - c)T$.

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Contract

Payments are bounded below by 0 (**A**'s limited liability) and above by M (**P**'s resources).

Timing: **P** commits at $t = 0$ to:

1. a termination rule $D(X_\tau) \in \{0, 1\}$ $(1$: stop, 0: continue$)$;
2. payments $w_\tau(X_\tau) \in [0, M]$ if stopped, $w_T(X_\tau, X_T) \in [0, M]$ if continued.

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Single-Phase Benchmark

Single Phase: Threshold Contracts

- One phase of length h ($h = T$: no review. $h = T - \tau$: the phase after the review)
  - **A** works ($a = 1$) or shirks ($a = 0$) throughout the phase
  - Output $Y \sim N(ah, h)$ is observed at the end, and **P** pays.

- A **threshold contract** with bar b:

$$w(Y) = \begin{cases} M, & Y \geq b, \\ 0, & Y < b. \end{cases}$$

Lemma 1

*For any contract that induces **A** to work, there exists a threshold contract inducing work at no higher expected cost.*

Intuition: high output is the best evidence of work, so put all the reward there.

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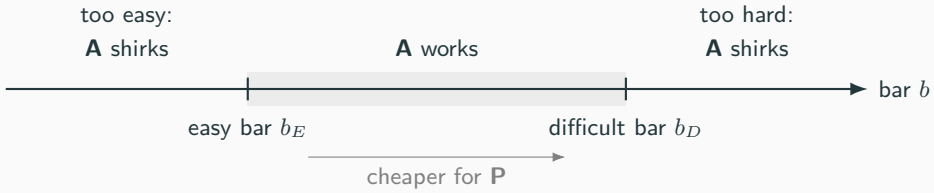
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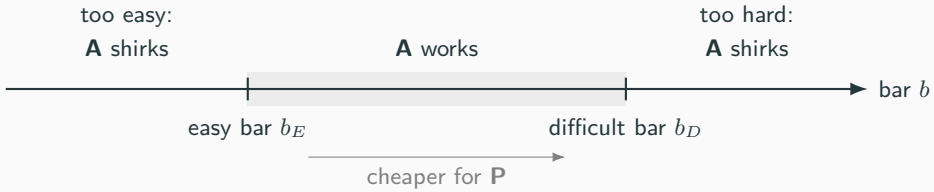
Single Phase: Where to Set the Bar?



b_E and b_D depend on the payment bound M and the phase length h

- **Too easy:** **A** likely clears the bar even when he shirks $\Rightarrow$ **A** shirks.
- **Too hard:** **A** rarely clears it even when he works $\Rightarrow$ **A** shirks.
- **In between:** working raises the odds of winning M enough to cover the effort cost.
- **The difficult bar b_D is optimal for P**:
  among all bars inducing work, the hardest pays out least often $\Rightarrow$ cheapest for **P**.

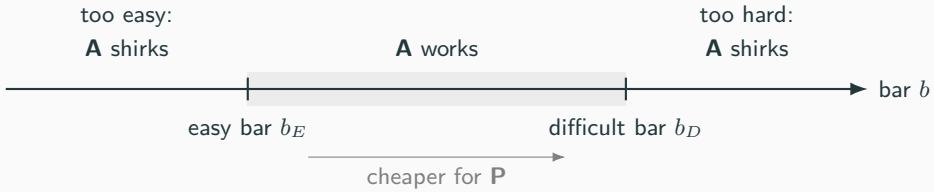
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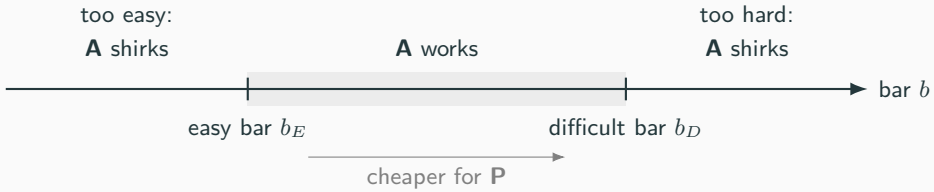
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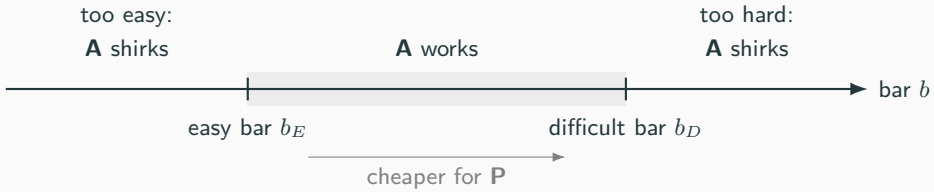
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Single Phase: Two Uses

No review (phase length $h = T$)

- **P** uses the difficult bar b_D
- **A** keeps a positive rent: he may clear b_D even if he shirks
- $M \to \infty$: $b_D \to \infty$ & rent $\to 0$, **P** gets first best

$\Rightarrow$ review can matter only if M is *not too large*

After a review (phase length $h = T - \tau$)

- r_D: **A**'s rent under the difficult bar b_D.
- r_E: **A**'s rent under the easy bar b_E.
- Rents that still induce work: $r \in [r_D, r_E]$
- Mixing the two bars fills the interval

$\Rightarrow$ continuation rents are **P**'s tool to reward pre-review work

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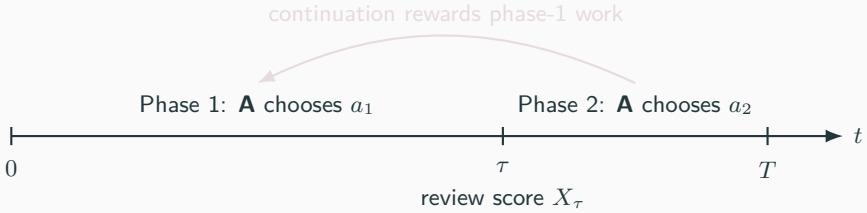
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Optimal Contract with Review

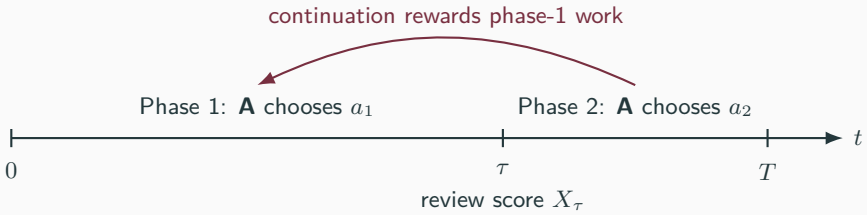
With Review: Two Linked Problems



- **Post-review:** a single phase of length $h = T - \tau$
- **Pre-review:** **A** must also be motivated to work before τ
- The continuation can depend on the review score X_τ

$\Rightarrow$ the post-review contract is a tool for pre-review incentives

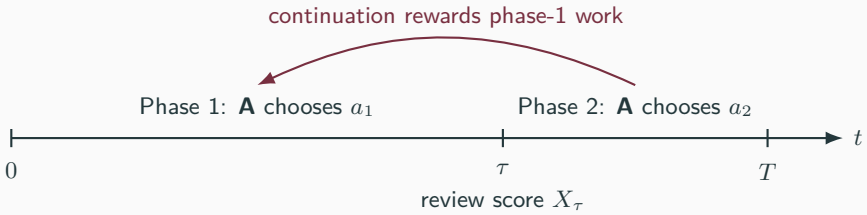
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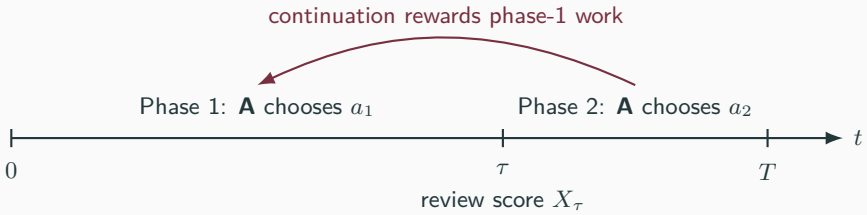
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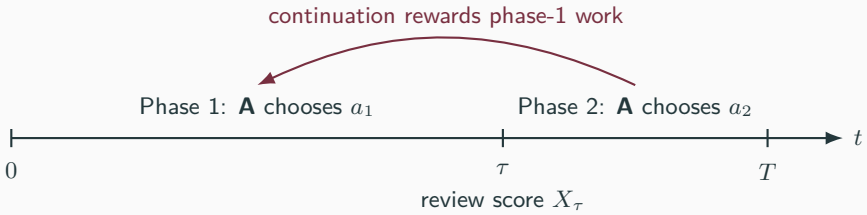
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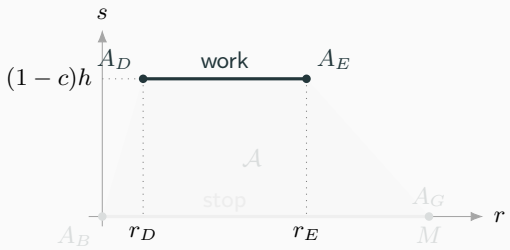
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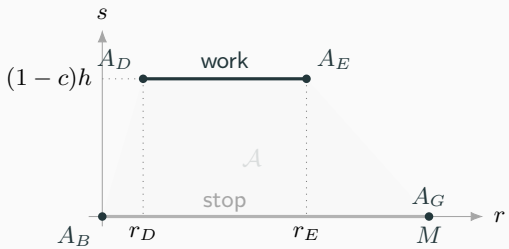
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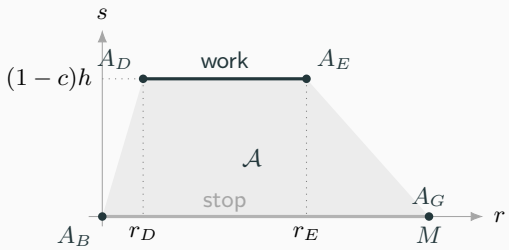
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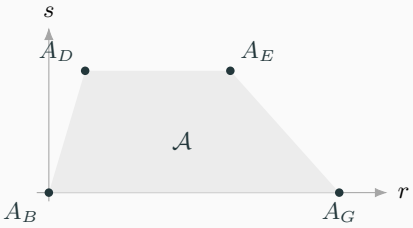
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Solving the LP: Only Corners Matter

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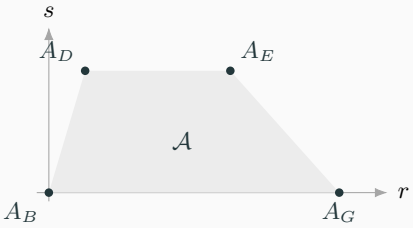


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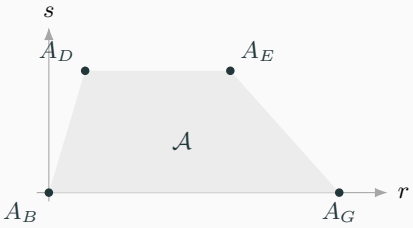


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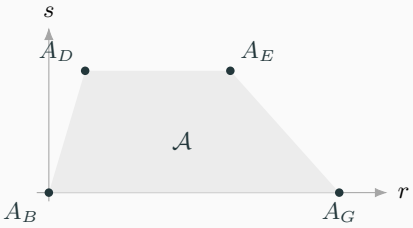


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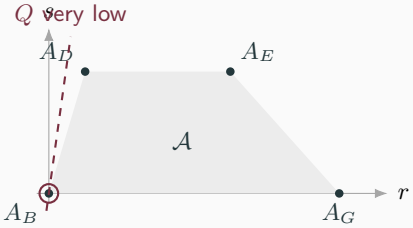


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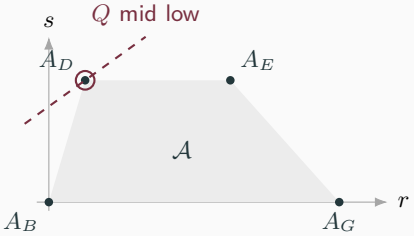


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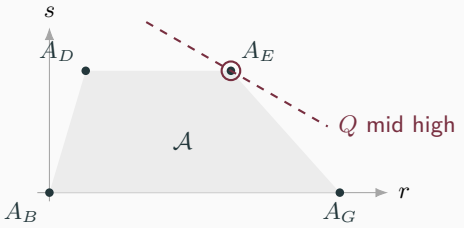


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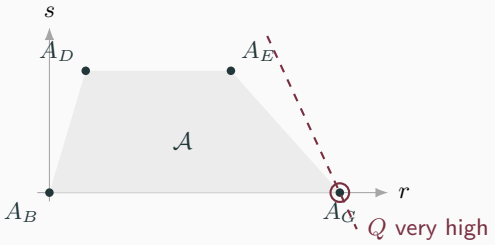


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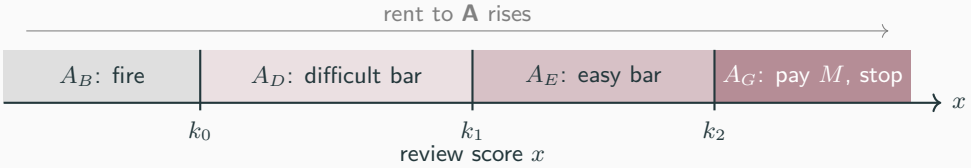
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The Optimal Contract: An Incentive Ladder

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Fix $\tau \in (0, T)$. An optimal contract cuts the review score at $k_0 \leq k_1 \leq k_2 \leq \infty$ and assigns A_B, A_D, A_E, A_G in that order.

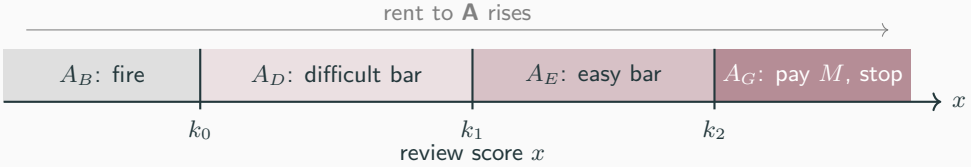


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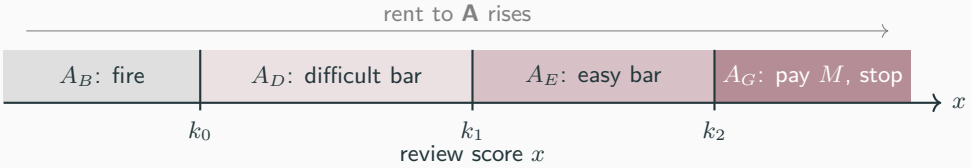


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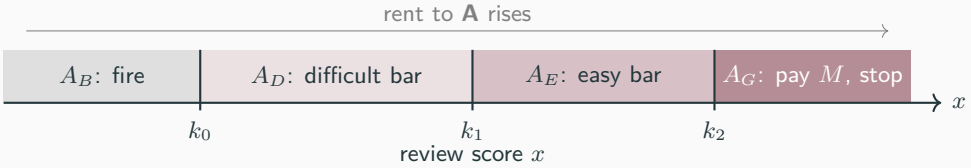


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