Limited Ability and Corporate Spin-offs

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Introduction

- Spin-offs among large conglomerates.
  - Horizontal integration brings the benefits.
  - However, large conglomerates recently choose to spin off.
    - ABB/Accelleron
    - Johnson & Johnson
    - 3M
    - General Electric
    - Kellogg
    - ...
- What is a corporate spin-off?
  - The parent company $\rightarrow$ multiple stand-alone, independent entities.
  - New entity, new name.
  - A new top management team for the spinoff.
  - Receive equivalent new shares as in the parent company.

Introduction

- Why does the parent company CHOOSE a spin-off?
  - Empirical findings suggest this as a value-creation activity for shareholders. (Chemmanur, Krishnan, and Nandy 2014)
    - Abnormal returns on average for the parent and the spinoff(s).
    - More frequent takeover activities.
  - Different channels
    - efficiency improvements (P. J. Cusatis, Miles, and Woolridge 1993; P. Cusatis et al. 1994a; Gertner, Powers, and Scharfstein 2002; Ahn and Denis 2004)
    - information asymmetry (Krishnaswami and Subramaniam 1999)
    - productivity improvements (Chemmanur and Yan 2004; P. Cusatis et al. 1994b)
    - regulation (Schipper and Smith 1983)
    - wealth transfer (Maxwell and Rao 2003)

Introduction

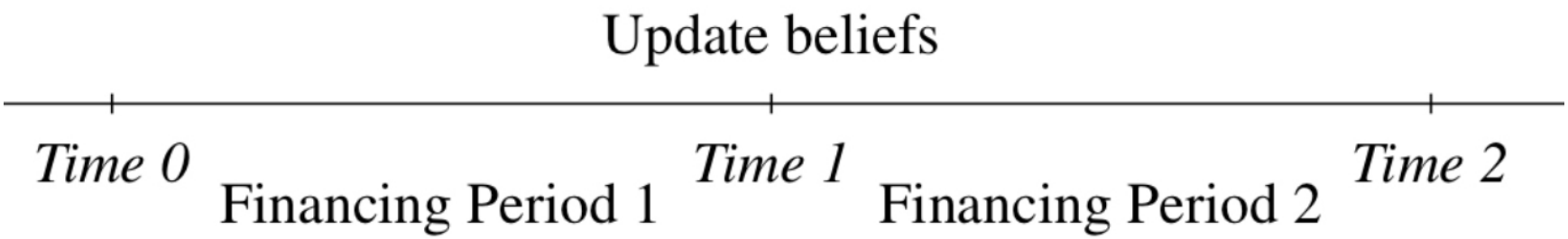
- What is in our paper?
- We propose that the **limited ability** of the entrepreneur induces the corporate spin-off.
  - Limited ability $\rightarrow$ Information asymmetry
    & Entrepreneur $\rightarrow$ Moral hazard
  - What we can explain?
    - Why choose a spin-off?
    - Productivity improvements & Abnormal returns to shareholders
    - Losses of debt holders & The role of entrepreneur

Model: Assumptions

- All agent are risk-neutral
- One entrepreneur and many competitive lenders/investors
  - the entrepreneur (she) endows total asset $2A$
    - is the sole shareholder and the manager
    - has the bargaining power (i.e. proposes the contract).
    - after the spin-off, she will be the sole shareholder in both entities, but only run the parent firm and has the right to choose the new manager.
  - the lender only seeks to break-even.
- Has two independent but identical projects - a and b. All information regarding projects is public.
  - Each project
    - generates a cash flow $r = R$ if successes and $r = 0$ if fails.
    - has a probability of success p_H (p_L) if the entrepreneur exerts effort (shirks). i.e. $E = 1$ ($E = 0$).
    - needs a total investment I with $I > 2A$. i.e. external finance required.
    - $p_H R > I > p_L R$.
- Entrepreneur get private benefits B and $2B$ from shirking on one and two projects.

Model: Setup

- A Two-period, Asymmetric information setting
  - Diversification decision at $t = 0$.
  - Spin-off decision at $t = 1$.
  - Signal X_0 just before $t = 1$. ($X_0 \in \{2R, R, 0\}$)
  - The entrepreneur seeks financing at $t \in \{0, 1\}$ and **projects only operate for one period**.



- Two types of entrepreneur: Good: $\bar{E} = 2$ & Bad: $\bar{E} = 1$
- Investors has a prior regrading the type of entrepreneur

$$\mathbb{P}(\bar{E}) = \begin{cases} q & \text{, if } \bar{E} = 2 \\ 1 - q & \text{, if } \bar{E} = 1, \end{cases} \quad \text{and Type} = \mathbf{1}_{q \geq \bar{q}} \in \{0, 1\}$$

Analysis: Period 1

Optimal contract for a Bad entrepreneur identified as a Good type[1]:
$\Omega = \{2R, R, 0\}$

$$\max_{R_b(r)} \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=1) + B \quad \text{s.t.}$$

$$(\text{PC}) \quad \sum_{r\in\Omega}(r - R_b(r))\mathbf{P}(r|E=2) \geq 2(I-A)$$

$$(\text{IC}_1) \quad \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=2) \geq \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=1) + B$$

$$(\text{IC}_2) \quad \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=2) \geq \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=0) + 2B$$

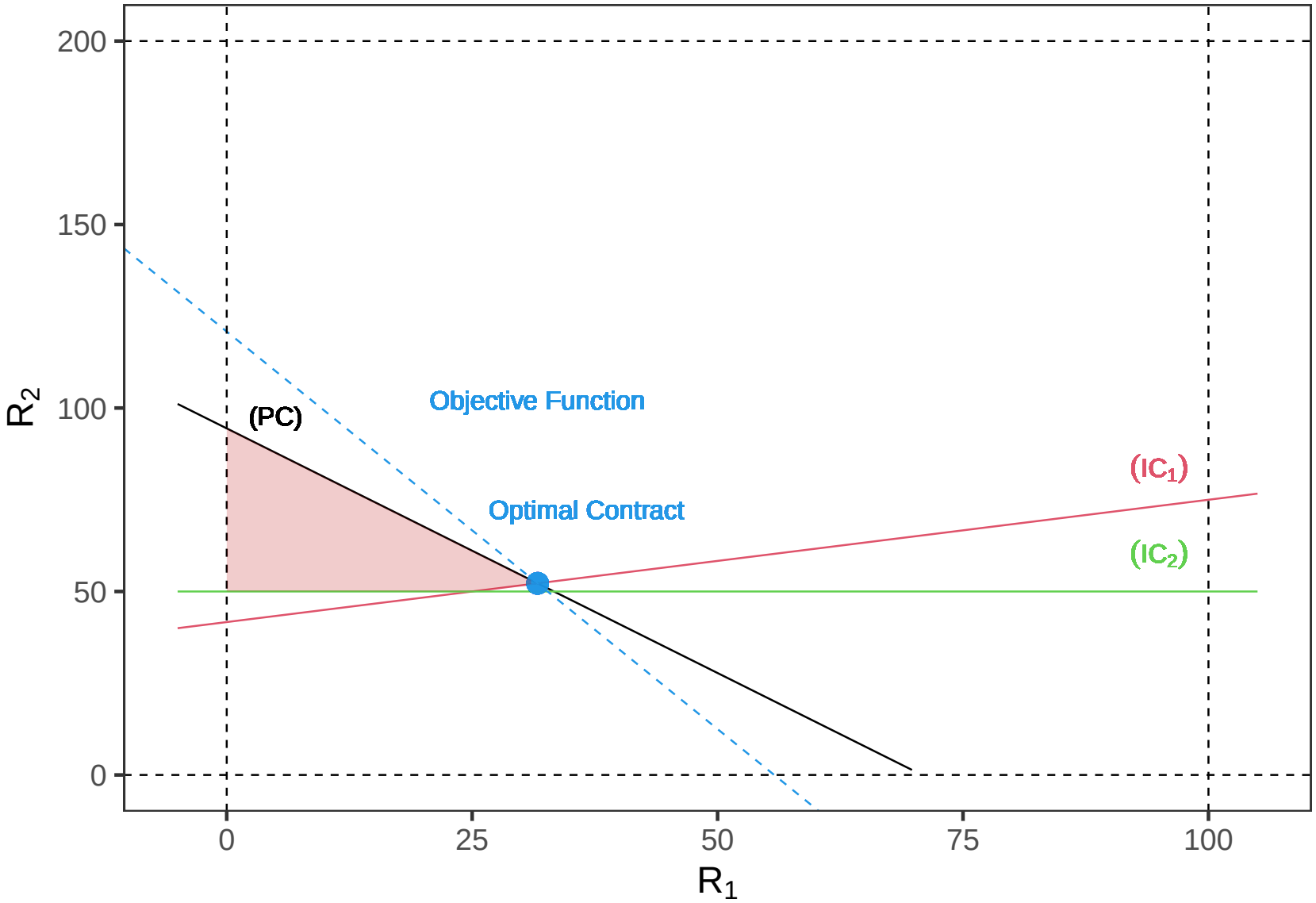
[1] See Appendix: Optimization in Period 1 for the optimal contract.

Analysis: Optimal Contract in Period 1

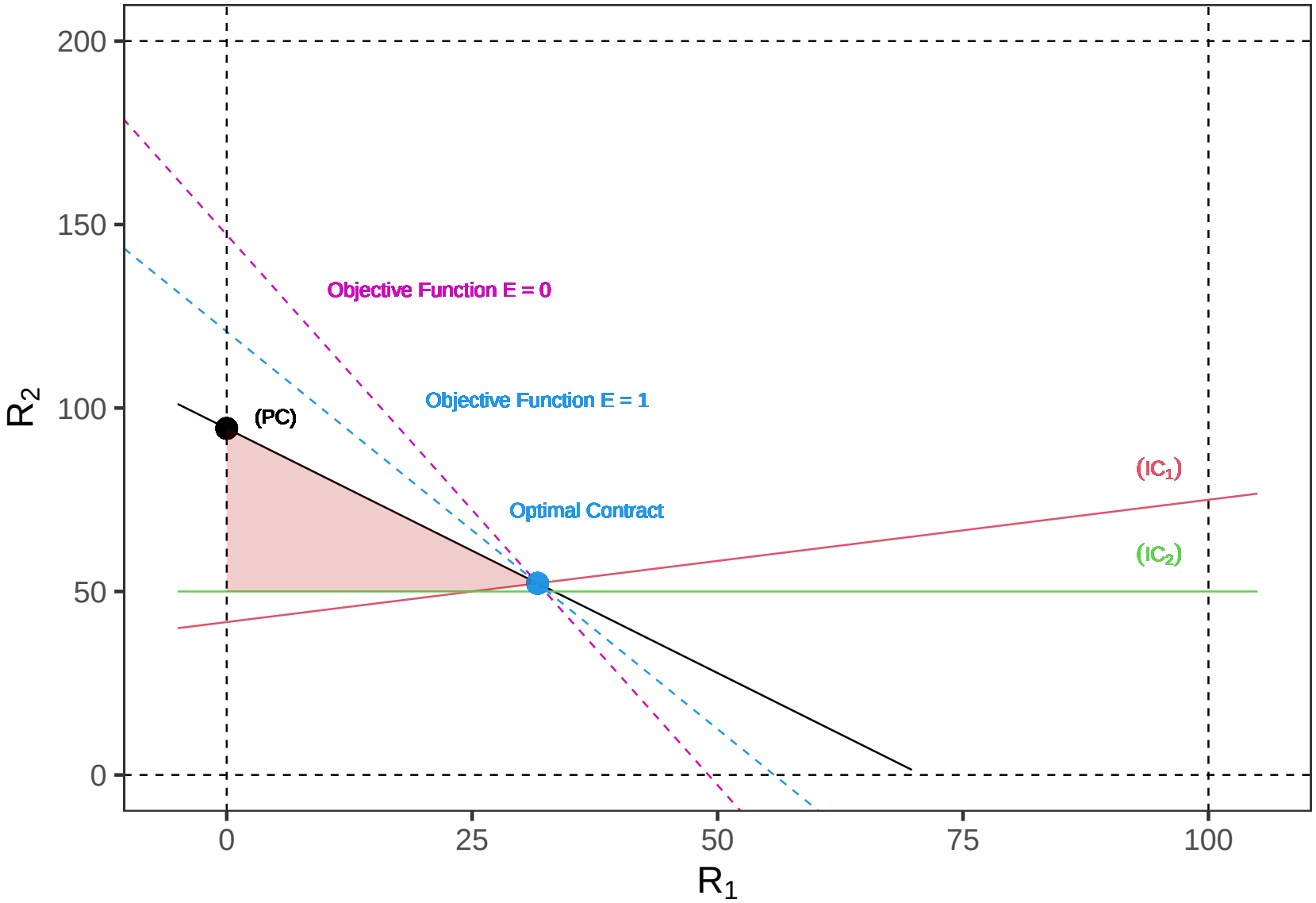
The list of parameters values:

- $p_H = 0.6$: conditional prob of success under efforts
- $p_L = 0.4$: conditional prob of success under shirking
- $R = 100$: project's cash flow under success
- $B = 5$: private benefits under shirking on each project
- $I = 50$: total investment required for each project
- $A = 7$: assets contributed by the entrepreneur in each project (*This value is different from that in the previous document.*)

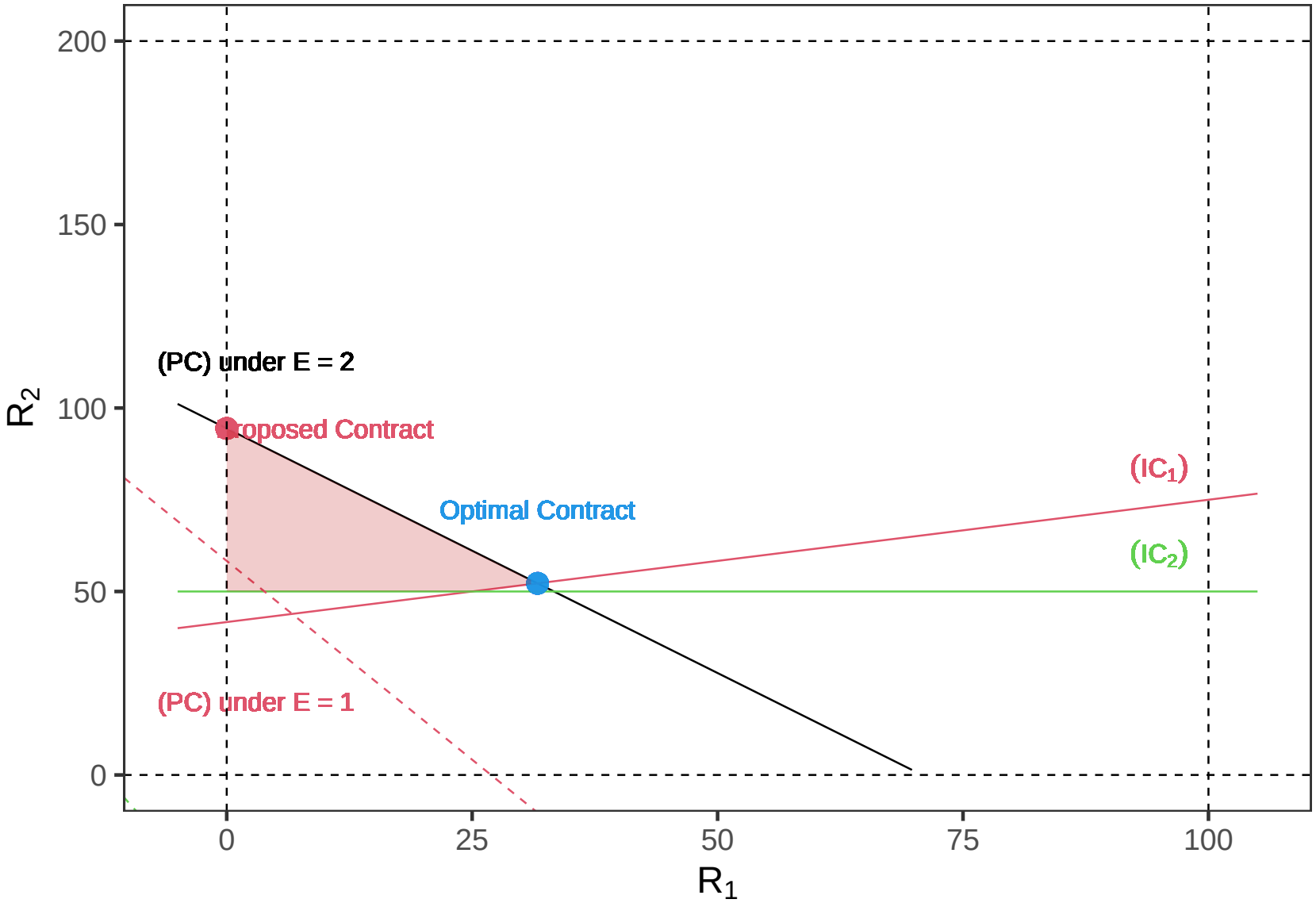
Constraints in Period 1



Optimal Contract for a Bad Entrepreneur



True PC Constraint



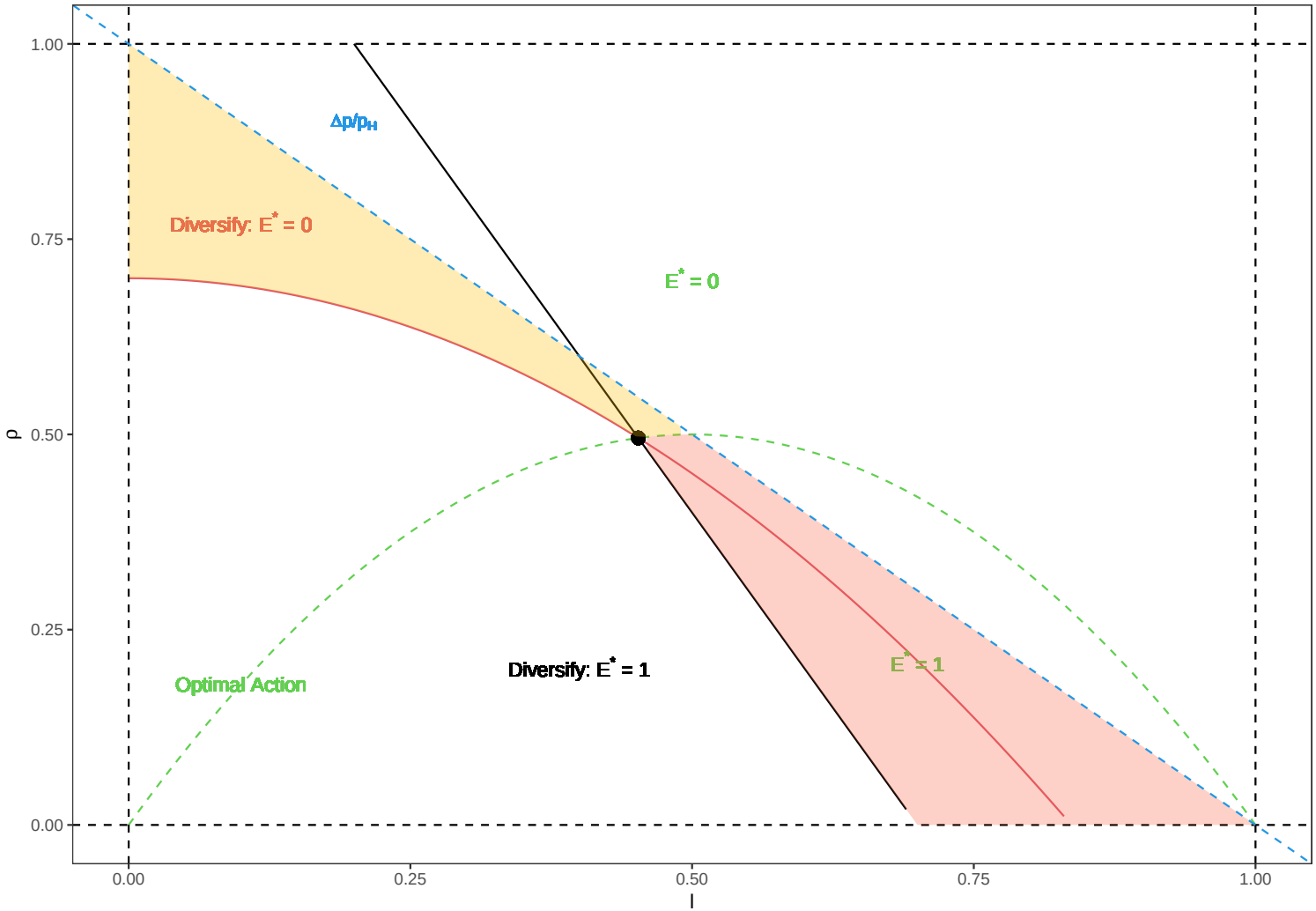
Analysis: Optimal Contract in Period 1

- Two questions emerge:
  - Necessary condition(s) for the entrepreneur choosing to diversify at $t = 0$.
  - Entrepreneur's optimal action after the diversification.
- The proposed contract by the Bad type is the same as that by the Good type
  - $R_b = \{R_2, 0, 0\}$
- Characteristic of the project: $\{I, \rho, k\}$
  - likelihood ratio: $I = \frac{p_L}{p_H} \in [0, 1]$
  - relative private benefits: $\rho = \frac{B}{p_H R - (I - A)} \in (0, \frac{\Delta p}{p_H}]$
  - $k = \frac{A}{2[p_H R - (I - A)]} \in (0, \frac{1}{2})$

$$\begin{cases} \frac{p_L}{p_H} \geq -\frac{B-A}{2[p_H R-(I-A)]} + \frac{1}{2} \\ \frac{p_L^2}{p_H^2} \geq -\frac{2B-A}{2[p_H R-(I-A)]} + \frac{1}{2} \\ \frac{p_L}{p_H} - \frac{p_L^2}{p_H^2} \geq \frac{B}{2[p_H R-(I-A)]} \end{cases} \Longrightarrow \begin{cases} I \geq -\frac{1}{2}\rho + k + \frac{1}{2} \\ I^2 \geq -\rho + k + \frac{1}{2} \\ I - I^2 \geq \frac{1}{2}\rho \end{cases}$$

Analysis: Optimal Contract in Period 1

Takeaway: $E^* = 1$ is more likely and



Investors' Belief Update

investors' belief at the beginning of period 1 is

$$\mathbb{P}(T) = \begin{cases} q & \text{, if } T = G \\ 1 - q & \text{, if } T = B, \end{cases}$$

where $q \geq \bar{q}$ and $\bar{q}$ is a threshold. This threshold $\bar{q}$ is a scaler predetermined by investors and if investors' subjective probability of the entrepreneur being a Good type is below $\bar{q}$, they will identify the entrepreneur as a Bad type.

$$\mathbb{P}(X_0|T = G) = \begin{cases} p_H^2 & \text{, if } X_0 = 2R \\ 2p_H(1 - pH) & \text{, if } X_0 = R \\ (1 - p_H)^2 & \text{, if } X_0 = 0. \end{cases}$$

Investors' Belief Update (cts.)

Therefore, investors can use the Bayes rule to update their beliefs towards the type of the entrepreneur at the beginning of the period 2, before deciding whether to continue to finance the company. And we have

$$\mathbb{P}(T = G|X_0) = \frac{\mathbb{P}(X_0|T = G)q}{\mathbb{P}(X_0|T = G)q + \mathbb{P}(X_0|T = B)(1-q)}.$$

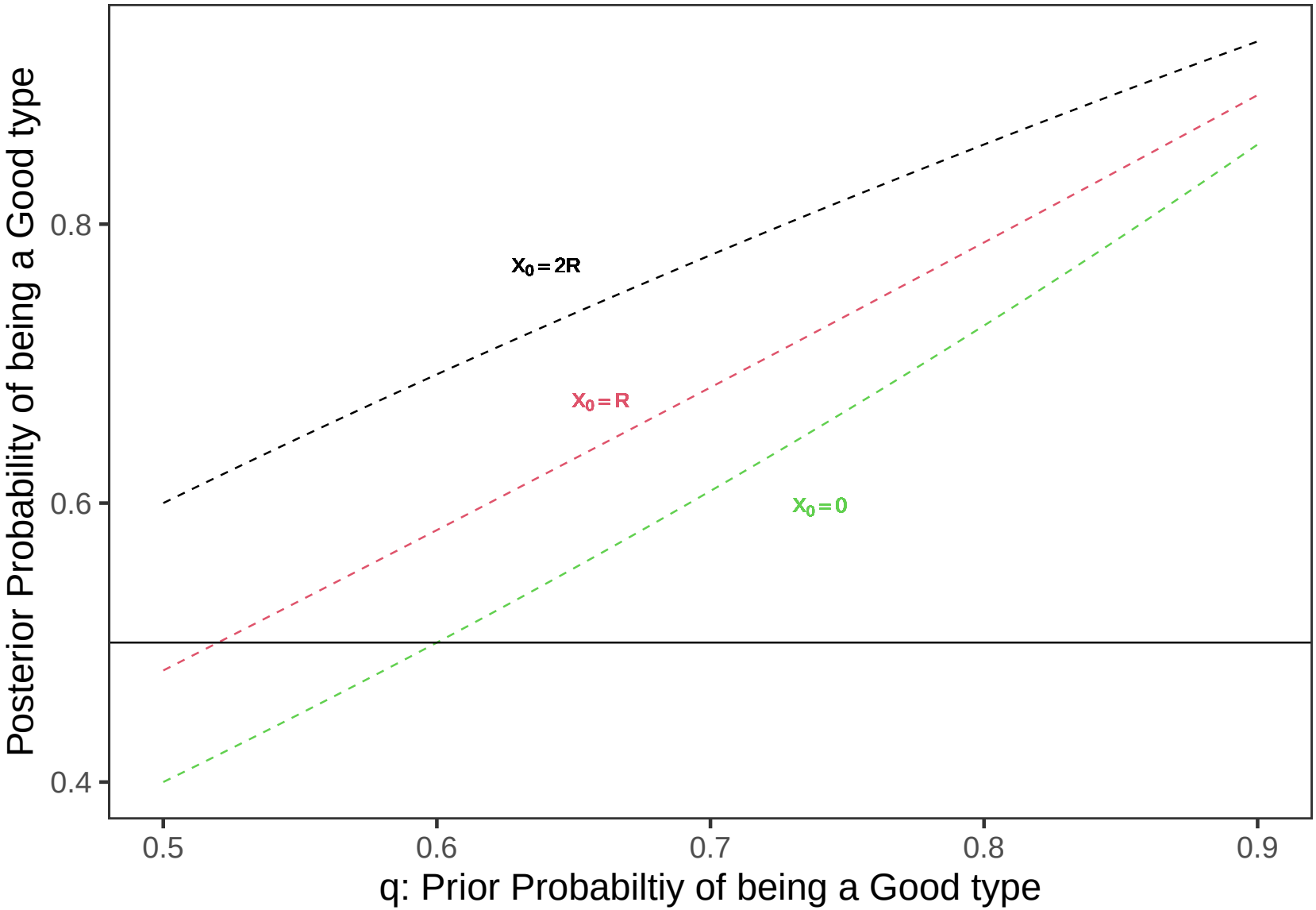
Specifically, we have

$$\mathbb{P}(T = G|X_0 = 2R) = \frac{1}{1 + \frac{p_L}{p_H}\frac{1-q}{q}} > \frac{1}{2},$$

$$\mathbb{P}(T = G|X_0 = R) = \frac{1}{1 + \frac{p_H(1-p_L)+(1-p_H)p_L}{2p_H(1-p_H)}\frac{1-q}{q}},$$

$$\mathbb{P}(T = G|X_0 = 0) = \frac{1}{1 + \frac{1-p_L}{1-p_H}\frac{1-q}{q}} > \frac{1}{2}.$$

Investors' Belief Update (cts.)



Optimal Contract in Period 2

Rewrite the optimization problem in the case that investors know the entrepreneur is a Bad type.

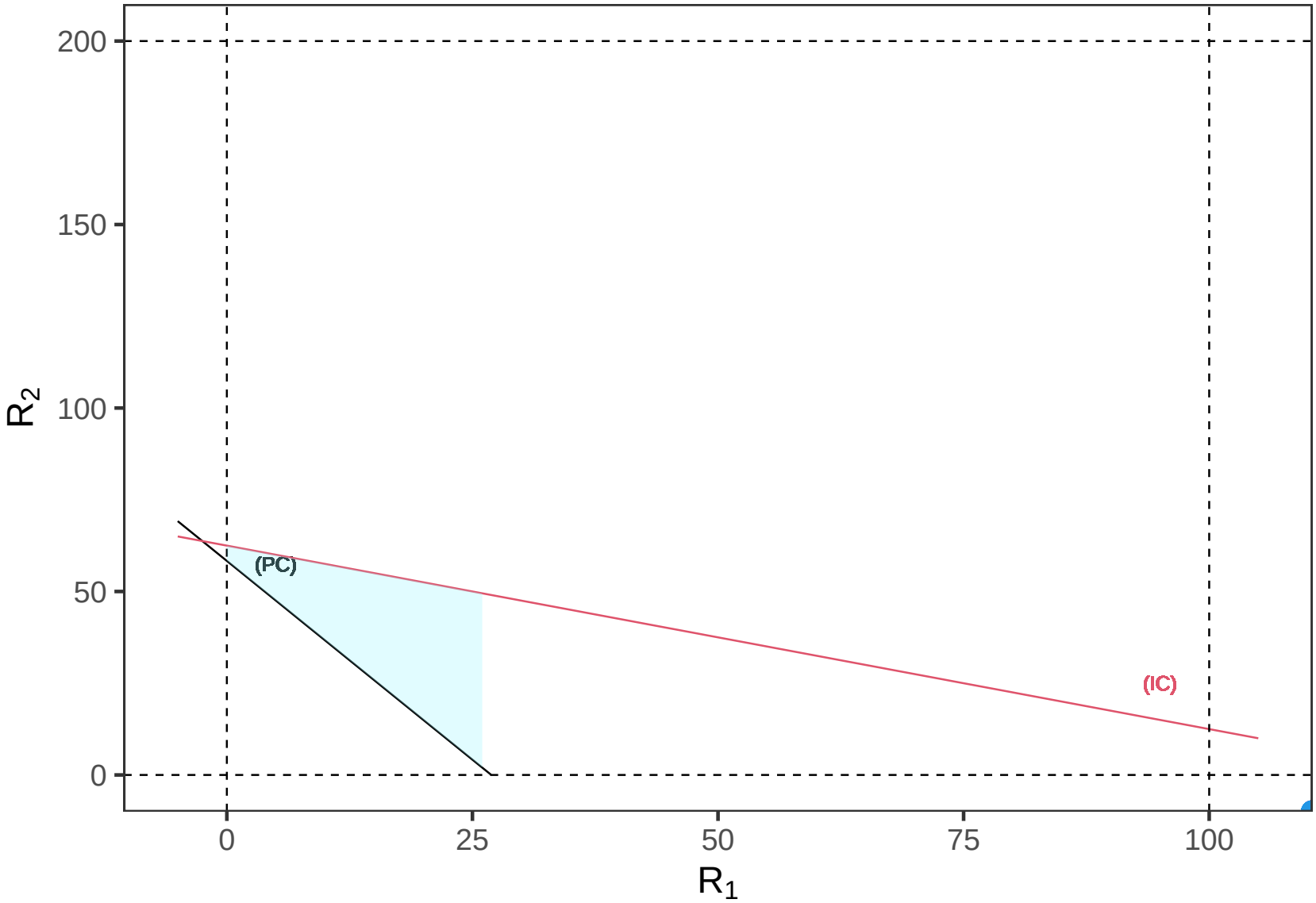
$$\max_{R_b(r)} \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=1) + B \quad \text{s.t.}$$

$$\text{(PC)} \quad \sum_{r\in\Omega}(r - R_b(r))\mathbf{P}(r|E=1) \geq 2(I-A)$$

$$\text{(IC)} \quad \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=1) + B \geq \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=0) + 2B$$

$$\Rightarrow \sum_{r\in\Omega} R_b(r)\Big(\mathbf{P}(r|E=1) - \mathbf{P}(r|E=0)\Big) \geq B$$

Constraints in Period 2



Corporate Spin-off or Not?

- Assume no exogenous cost & Two scenarios at $t = 1$ after the entrepreneur being correctly identified as a Bad type.
- Case 1: facing financial constraints after being identified as a Bad type
  - manager's characteristic θ^*

$$\theta^* = \arg\max_{\theta} f(\theta), \text{ where } f(\theta) = p'_H R - (I - A) - p'_H \frac{B'}{\Delta p'}$$

$$\text{and } \Delta p' = p'_H - p'_L,$$

  and project b's expected payoff towards the entrepreneur is $f(\theta^*)$.
  - If both entities after the spin-off receives financing, the total payoff is $p_H R - (I - A) + f(\theta^*)$.
  - Choose a spin-off if $p_H R - (I - A) + f(\theta^*) \geq p_H R - I + 2A$. Otherwise, a divestment.

Corporate Spin-off or Not?

- Case 2: not financially constrained after being identified as a Bad type
  - $p_H R - I + 2A \leq p_H p_L R_2 + B = 2p_L R + B - 2(I - A) <$ $(p_H + p_L)R + B - 2(I - A)$. & Divestment is always suboptimal.
  - Choose a spin-off if $(p'_H - p_L)R - p'_H \frac{B'}{\Delta p'} - B \geq 0$.
  - Whether such manager is available? private benefits $\leftrightarrow$ agency rent
  - Link to the takeover activities.

Conclusion and Extensions

- Limited ability
- Extensions
  - Long term debts
  - Institutional detail regarding restructuring

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Appendix: Optimization in Period 1

From Analysis: Period 1, we can write out the Lagrangian as

$$\mathcal{L} = \sum_{r\in\Omega} R_b(r)\mathbf{P}(r|E=1) + B + \lambda_{PC}\Big\{\sum_{r\in\Omega}(r - R_b(r))\mathbf{P}(r|E=2) - 2(I-A)\Big\}$$

$$+\lambda_{IC1}\Big\{\sum_{r\in\Omega} R_b(r)\big[\mathbf{P}(r|E=2) - \mathbf{P}(r|E=1)\big] - B\Big\}$$

$$+\lambda_{IC2}\Big\{\sum_{r\in\Omega} R_b(r)\big[\mathbf{P}(r|E=2) - \mathbf{P}(r|E=0)\big] - 2B\Big\}$$

FOC:

$$\frac{\partial\mathcal{L}}{\partial R_b(r)} = \mathbf{P}(r|E=1) - \lambda_{PC}\{\mathbf{P}(r|E=2)\} + \lambda_{IC1}\{\mathbf{P}(r|E=2) - \mathbf{P}(r|E=1)\}$$

$$+\lambda_{IC2}\{\mathbf{P}(r|E=2) - \mathbf{P}(r|E=0)\} = 0, \quad \forall r \in \{2R, R, 0\}$$