Privacy Protection: When Does Hiding in Plain Sight Work?

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October 2020

Prince Harry and Meghan Markle: In pursuit of privacy

Prince Harry's lawsuit against tabloids could backfire, commentators claim

Duke of Sussex's legal action against Sun and Daily Mirror over alleged phone hacking takes attack on press up a level

The Guardian, 5 October 2019

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The Sussexes have reportedly collaborated with a book about their split from the royal family. So much for pursuing a new life of privacy

The Guardian, 5 May 2020

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- The realised level of protection is private to the hider.

Results preview

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- When the hider can control the number of seekers, the open access policy with infinite number of seekers is optimal.

Why should we care?

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Other examples

- company hiding financial problems
- central bank hiding the depletion of foreign reserves
- politician hiding her misdeeds

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Policy relevant question

How should a society design its privacy laws?

Is the default protection a complement or substitute to private efforts to protect sensitive information?

Literature

- Privacy as anonymity to avoid price discrimination: Acquisti, Taylor, and Wagman (2016)
- Intrinsic value of privacy: Gradwohl (2018), Dziuda and Gradwohl (2015), Gradwohl and Smorodinsky (2017)
- Reputation concerns: Daughety and Reinganum (2010)
- Law: D. Solove (2007, *San Diego Law Review*) "I've got nothing to hide"
- Strategic experimentation with Poisson bandits: Keller, Rady and Cripps (2005)
- Private learning in experimentation models:
  - Private payoffs but public actions: Rosenberg et al. (2007), Hopenhayn and Squintani (2011), Murto and Valimaki (2011) and Heidhues et al. (2015)
  - Public actions but private information arrival: Das and Klein (2020)
  - Partially observable actions: Guo and Roesler (2018)
  - R&D model with unobservable actions: Akcigit and Liu (2016)

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  - $\theta = 1$: compromising story
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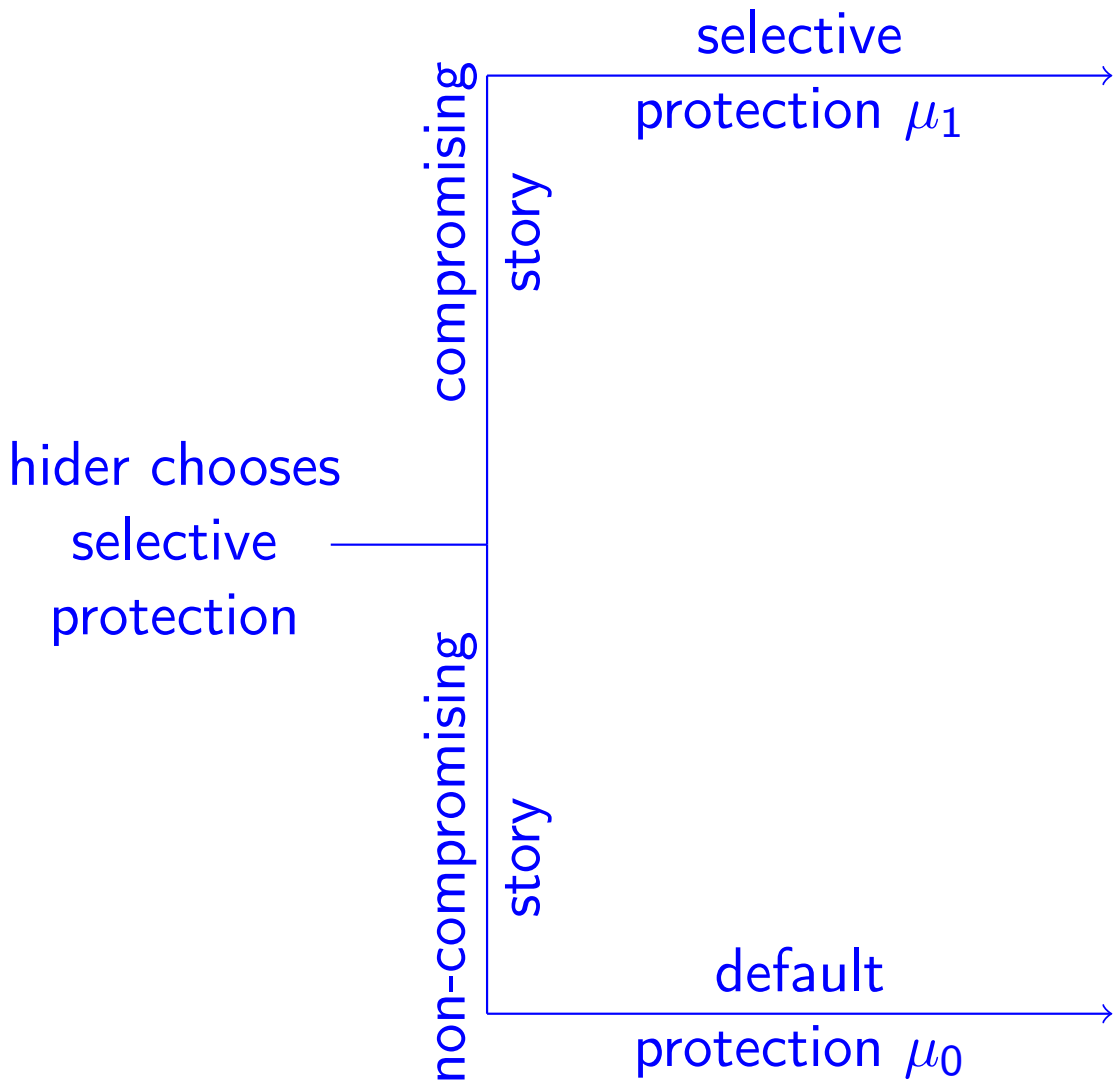
Model

hider chooses
selective
protection

Model


selective
protection μ_1
compromising
story
hider chooses
selective
protection
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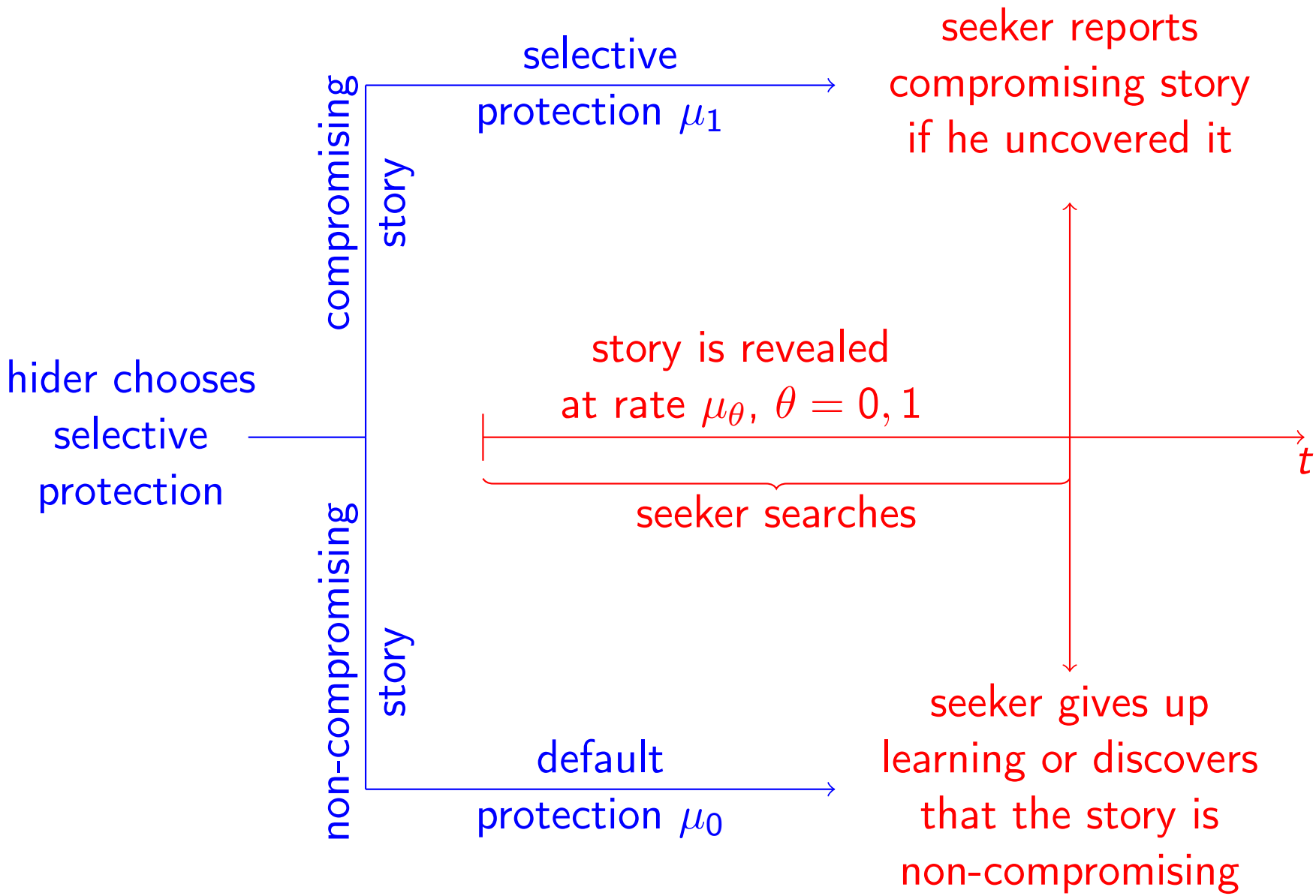
hider chooses
selective
protection
compromising
story
selective
protection μ_1
seeker reports
compromising story
if he uncovered it
story is revealed
at rate μ_θ, $\theta = 0, 1$
t
seeker searches
non-compromising
story
default
protection μ_0
seeker gives up
learning or discovers
that the story is
non-compromising

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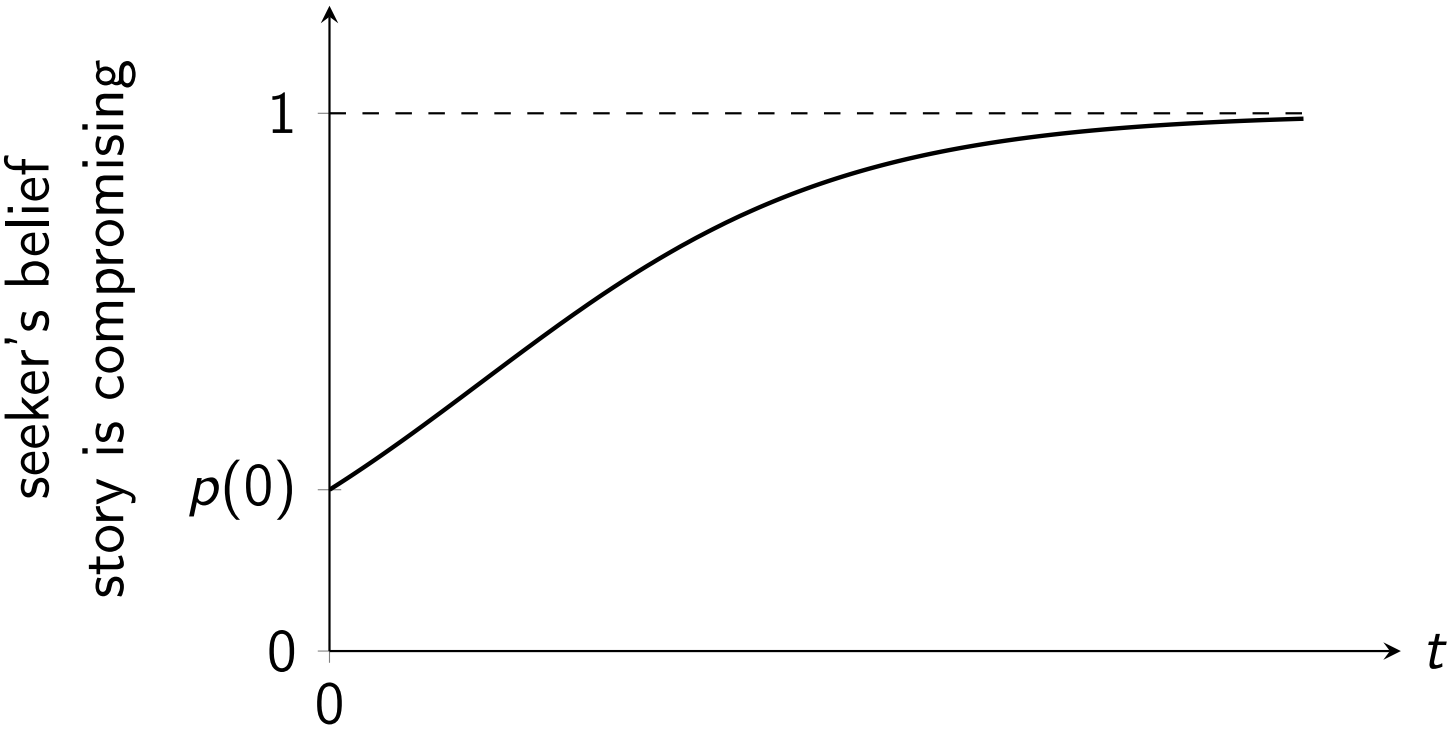
Assumption

The hider can choose any μ_1 such that $\mu_1 \geq c/p$

Results

If $c/p \leq \mu_1 < \mu_0$:



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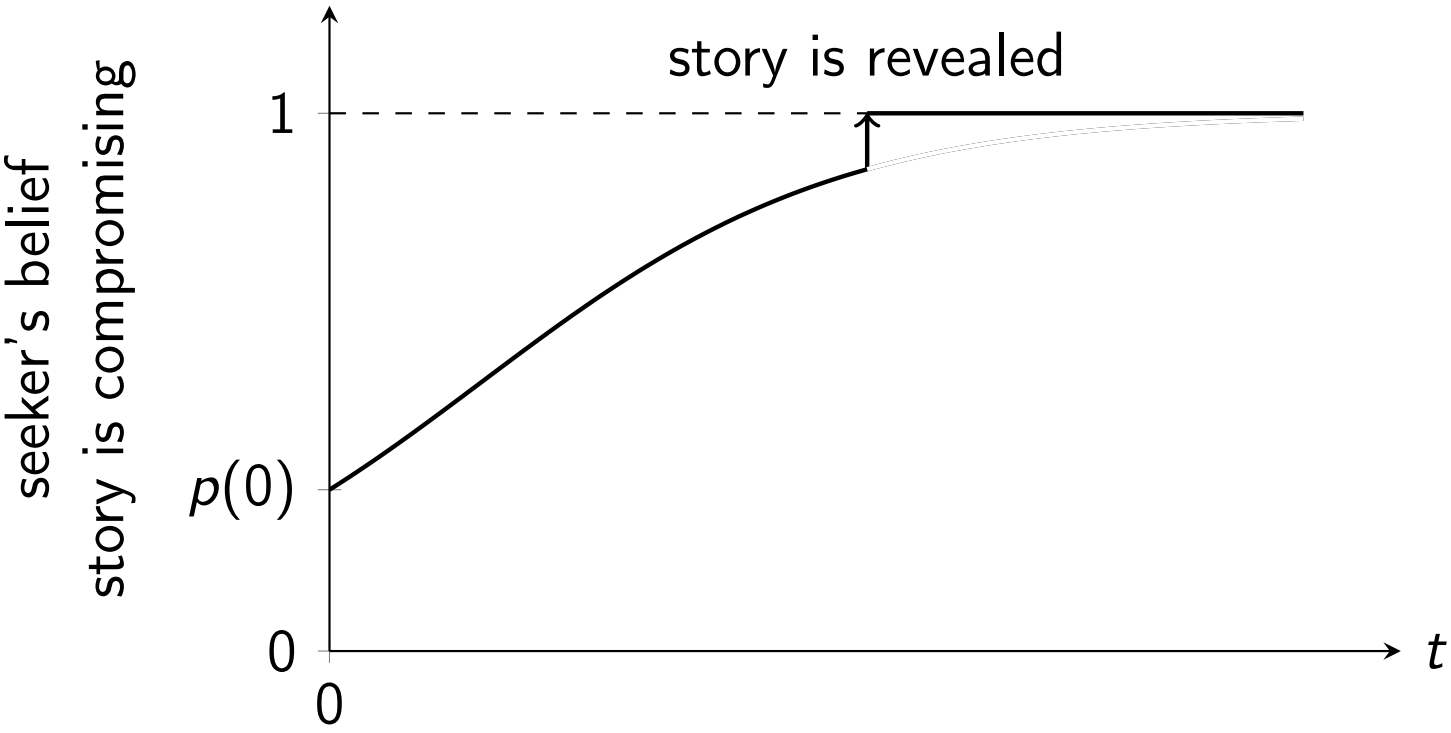

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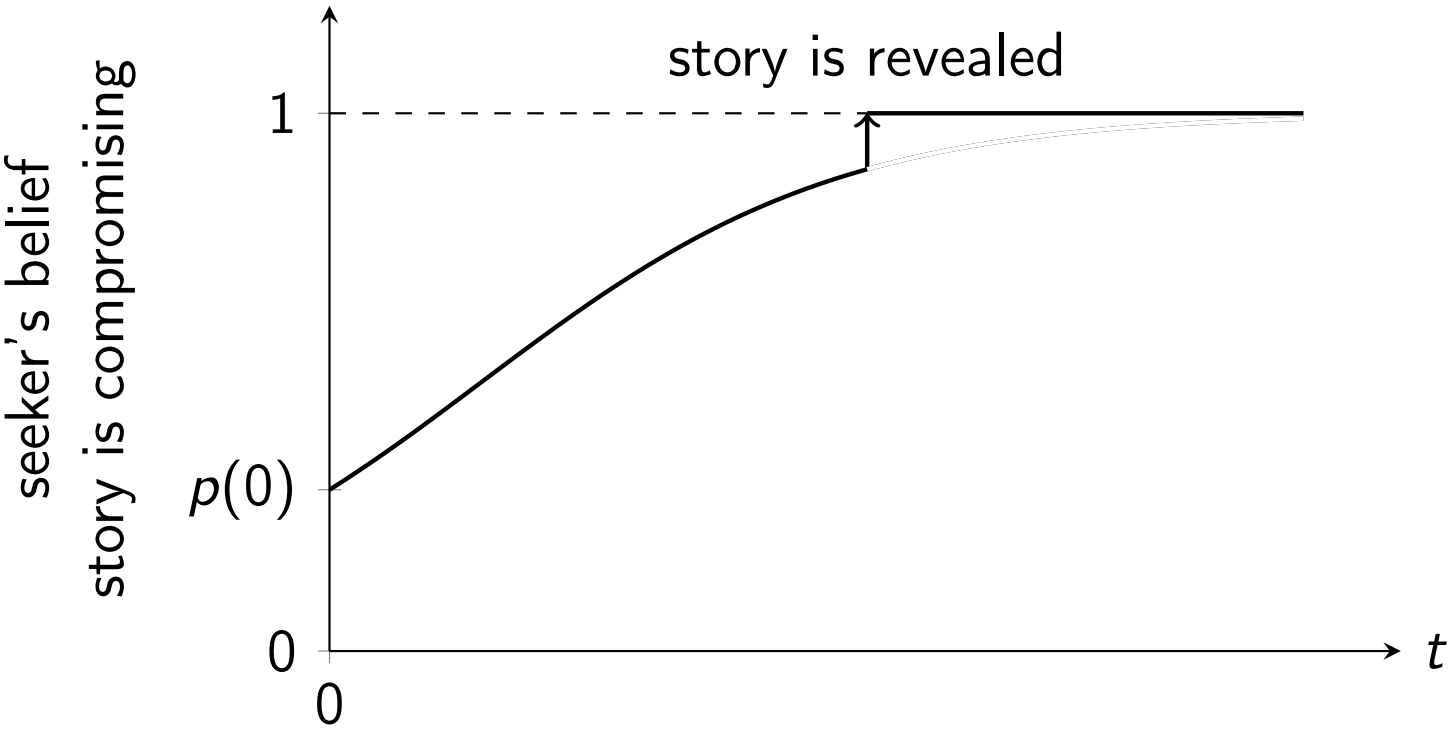
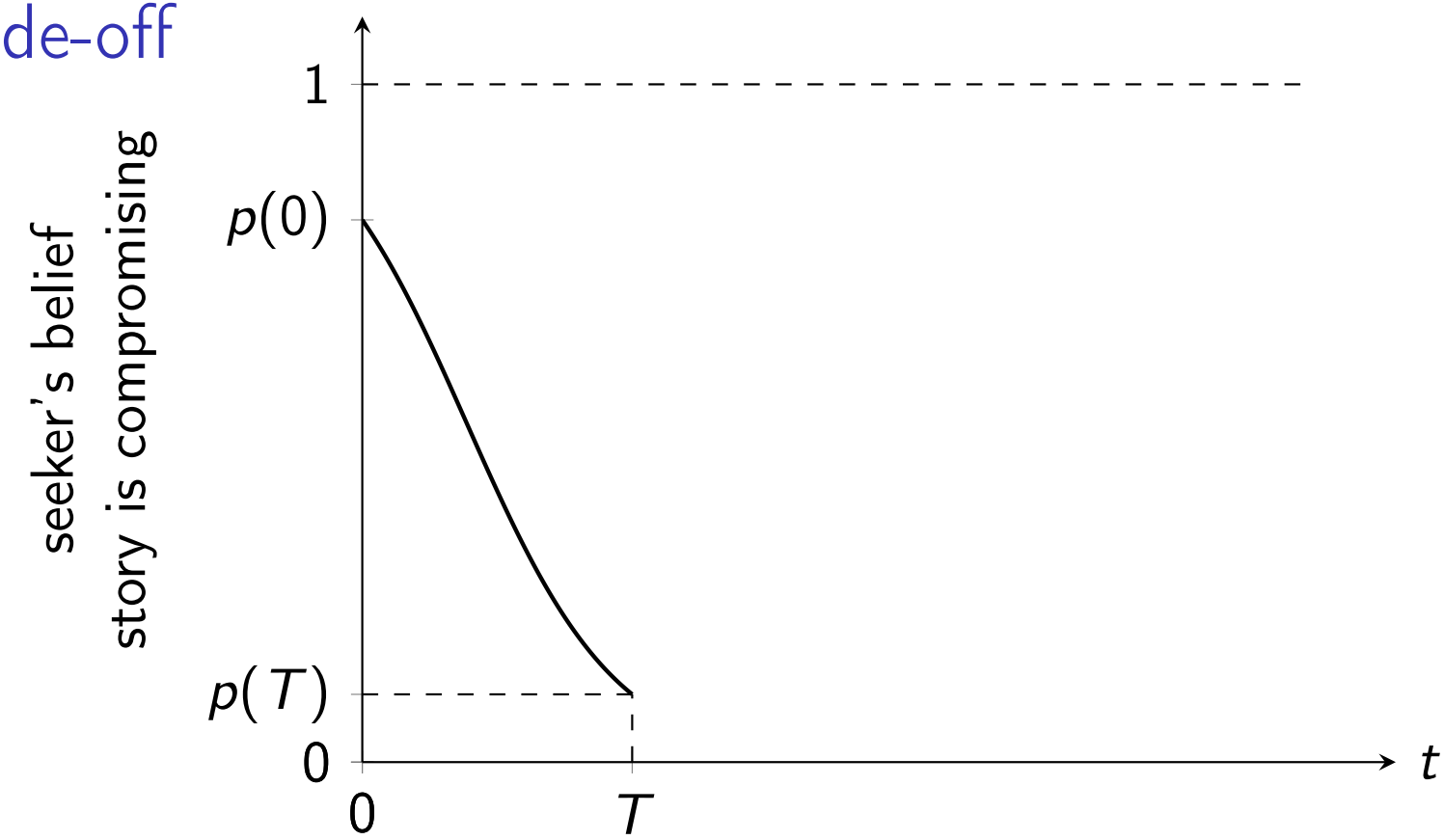


Main result

If $\mu_0 > c/p$ (default protection is weak), then the hider will not choose the strongest feasible selective protection: $\mu_1 \geq \mu_0$ at the optimum.

Trade-off



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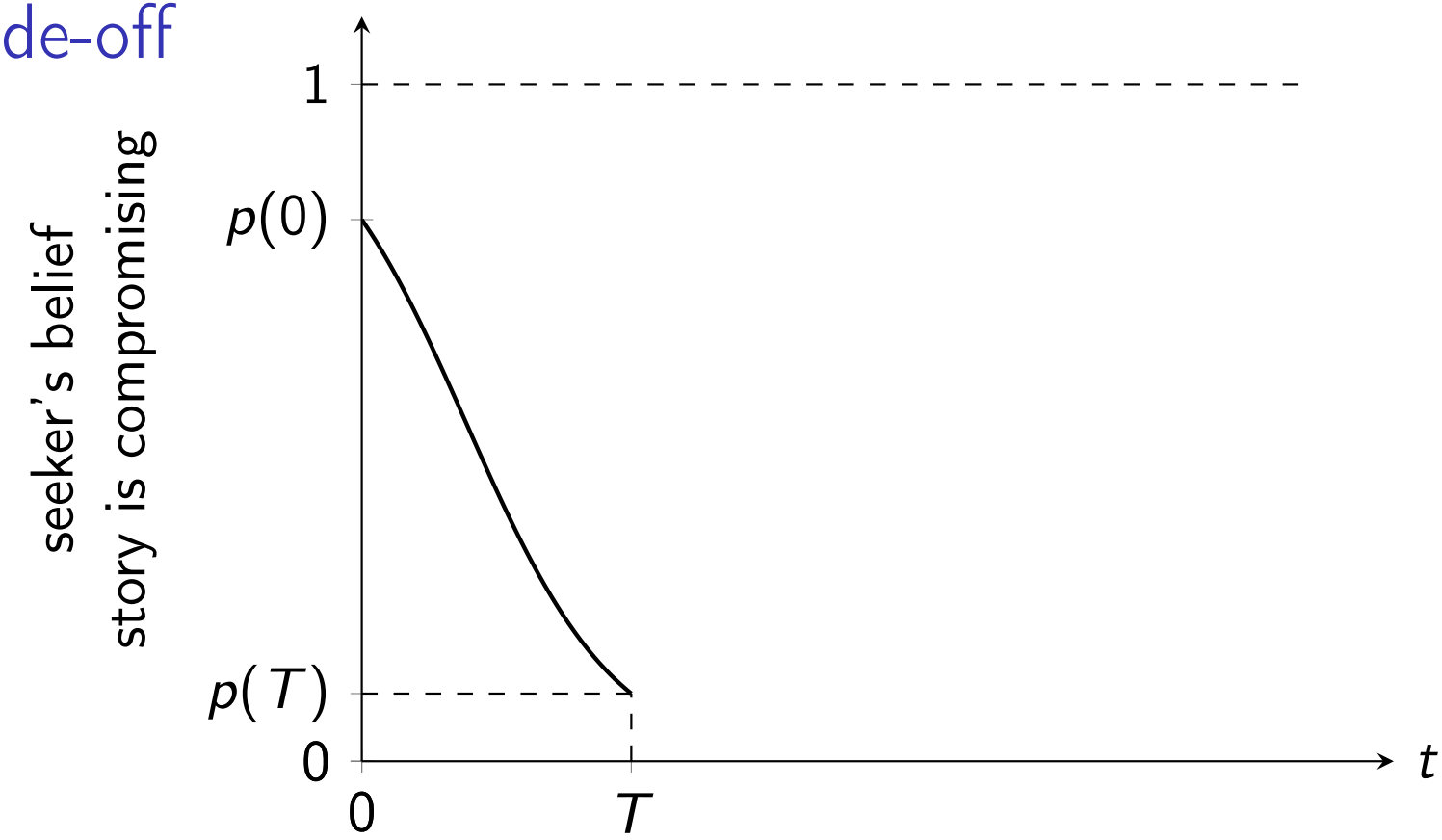
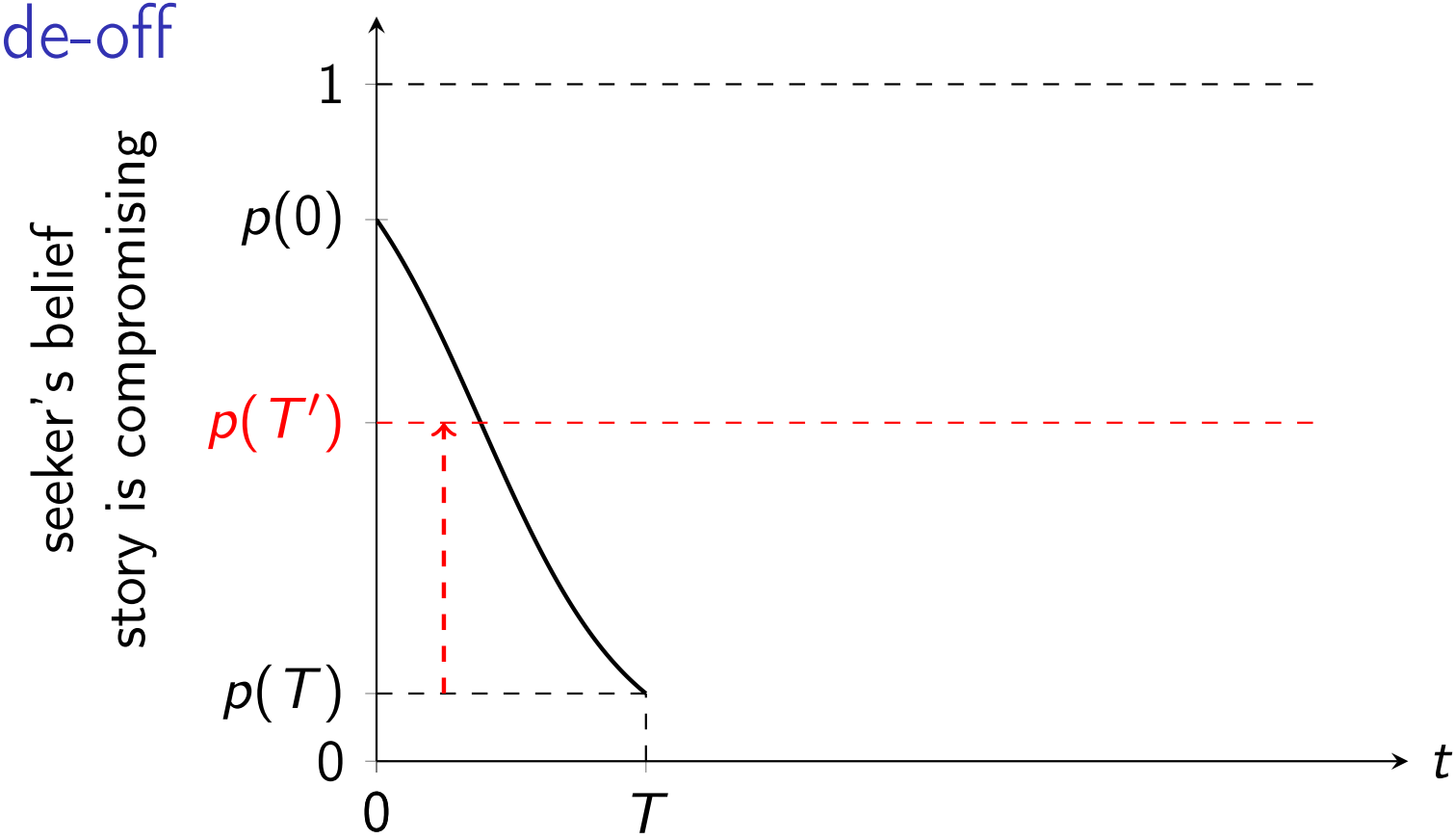

1
$p(0)$
$p(T)$
0
0
T
t
seeker's belief
story is compromising


Pr(save reputation)
selective protection

Trade-off


1
$p(0)$
$p(T')$
$p(T)$
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Pr(save reputation)
cost effect (+)
selective protection

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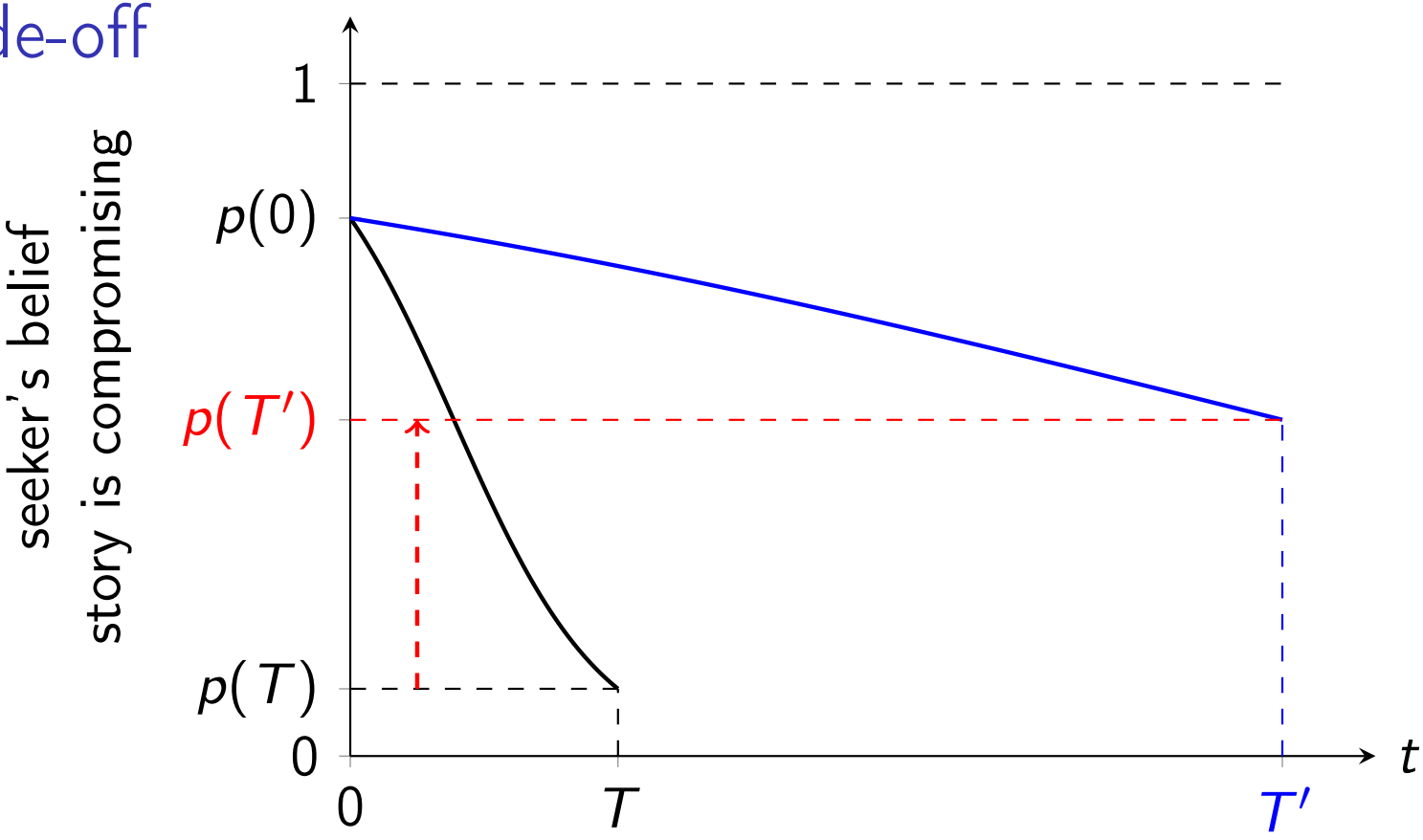
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$p(T)$
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T
T'
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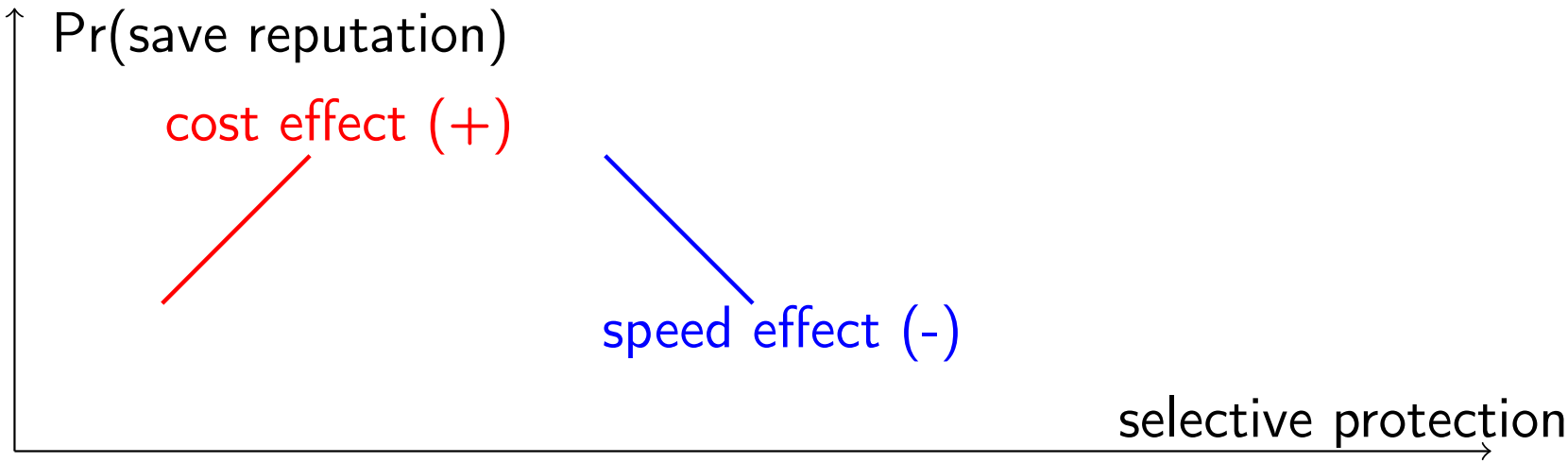
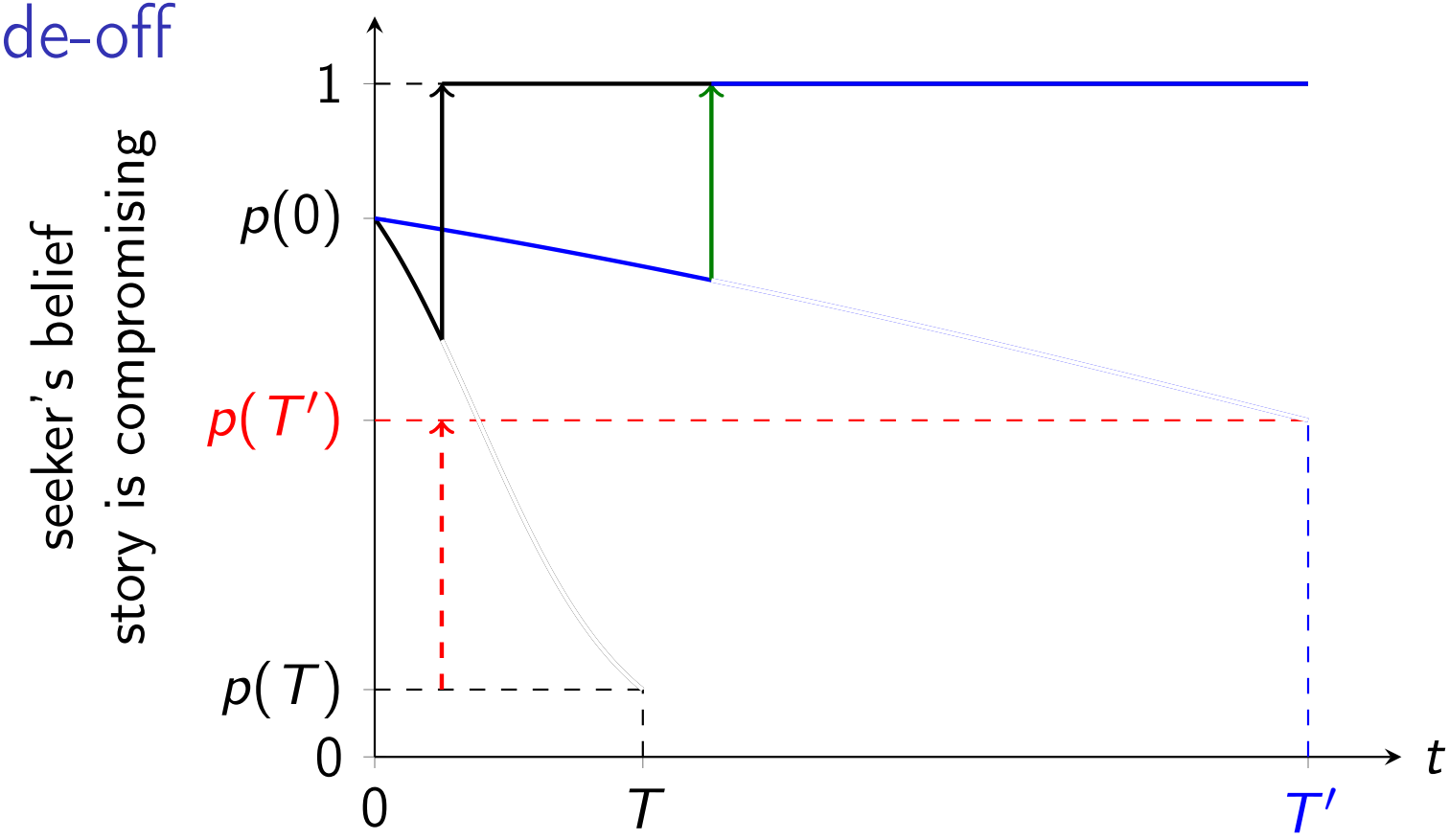

Pr(save reputation)
cost effect (+)
speed effect (-)
selective protection

Trade-off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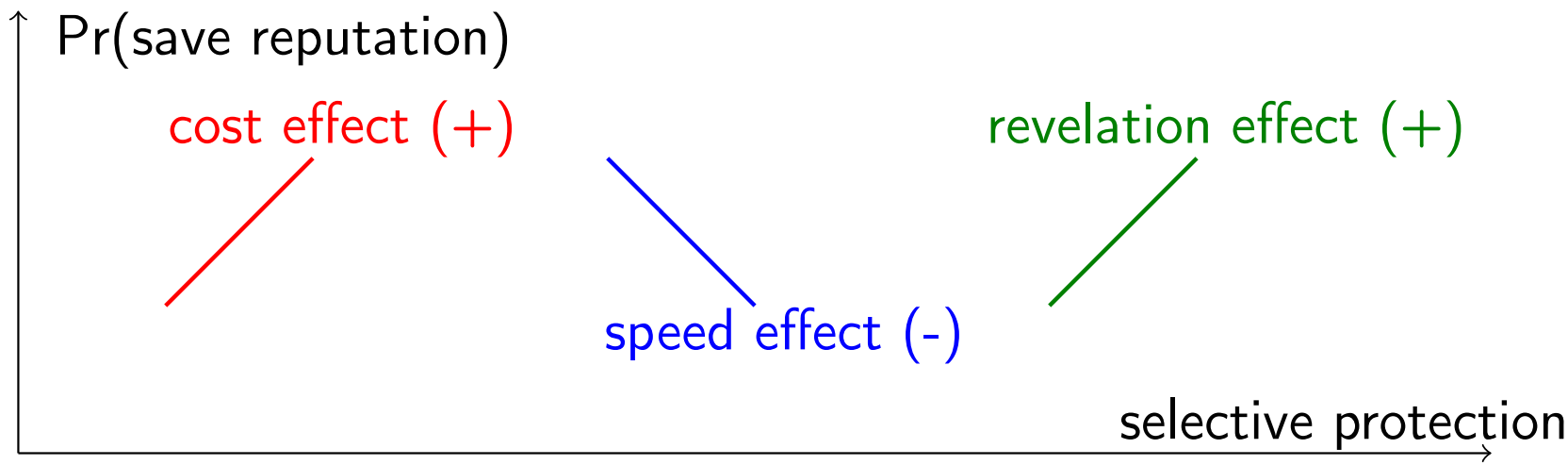
Pr(save reputation)
cost effect (+)
revelation effect (+)
speed effect (-)
selective protection

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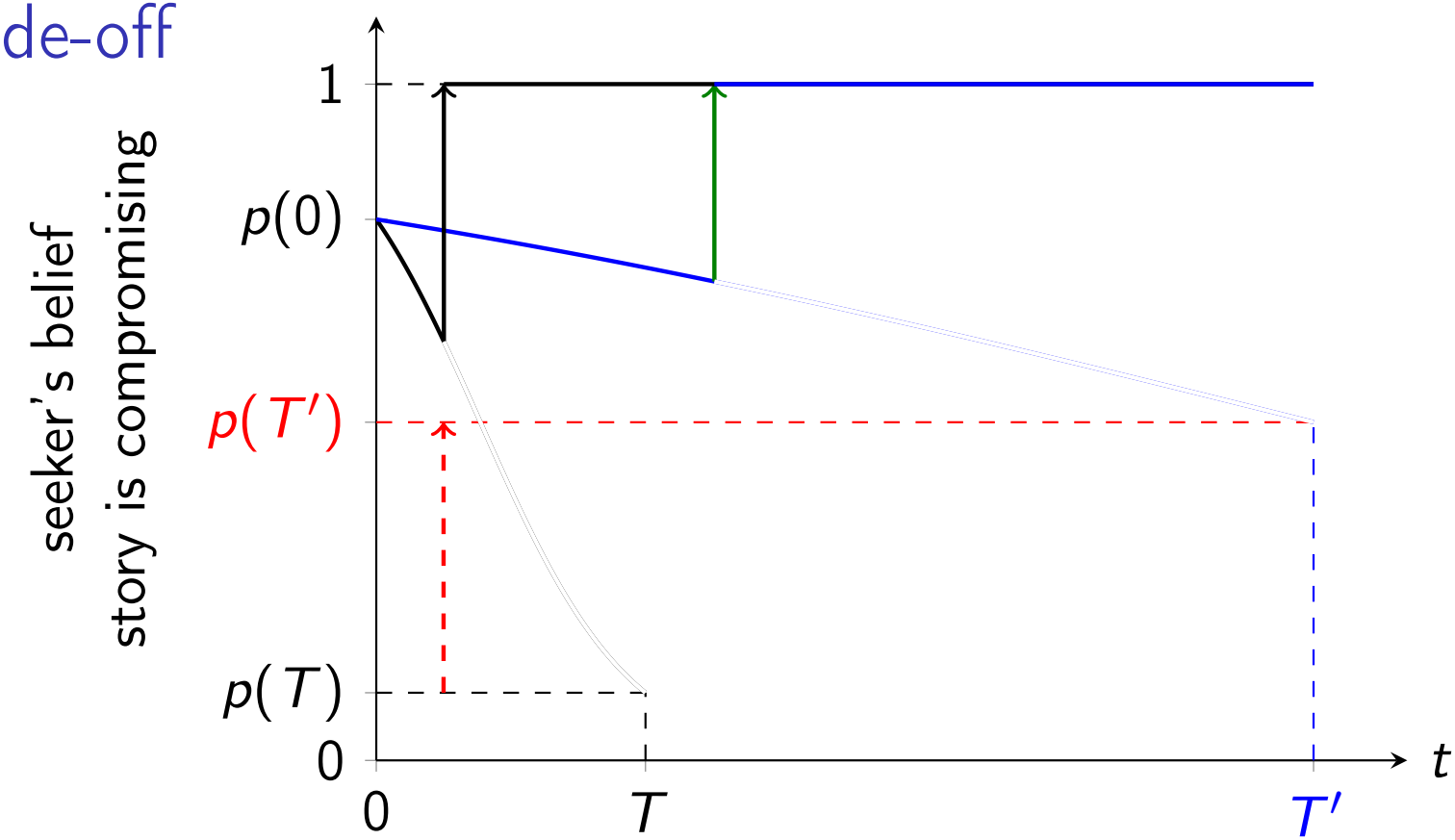
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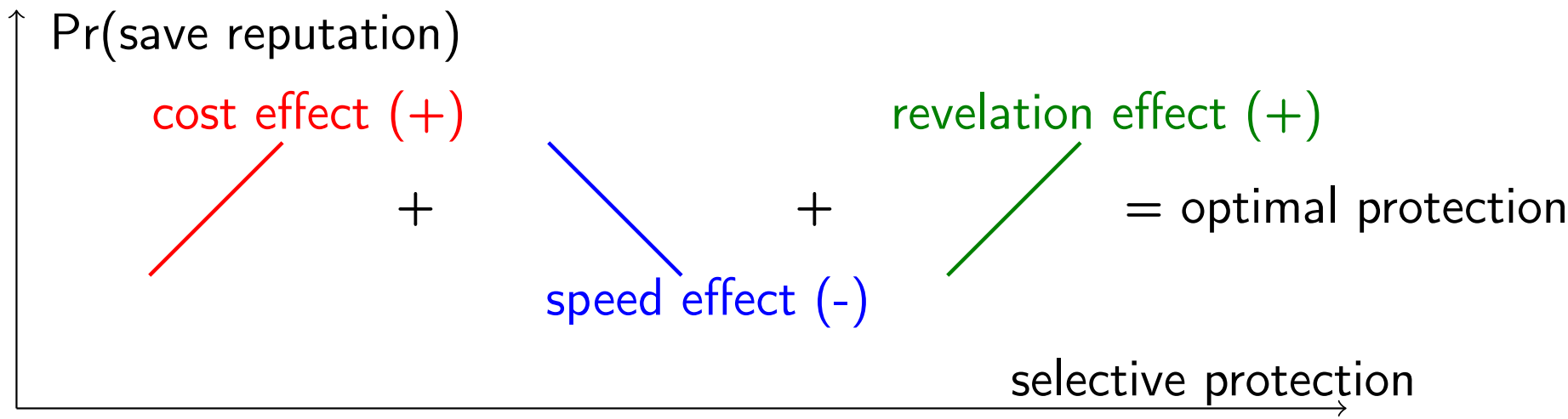
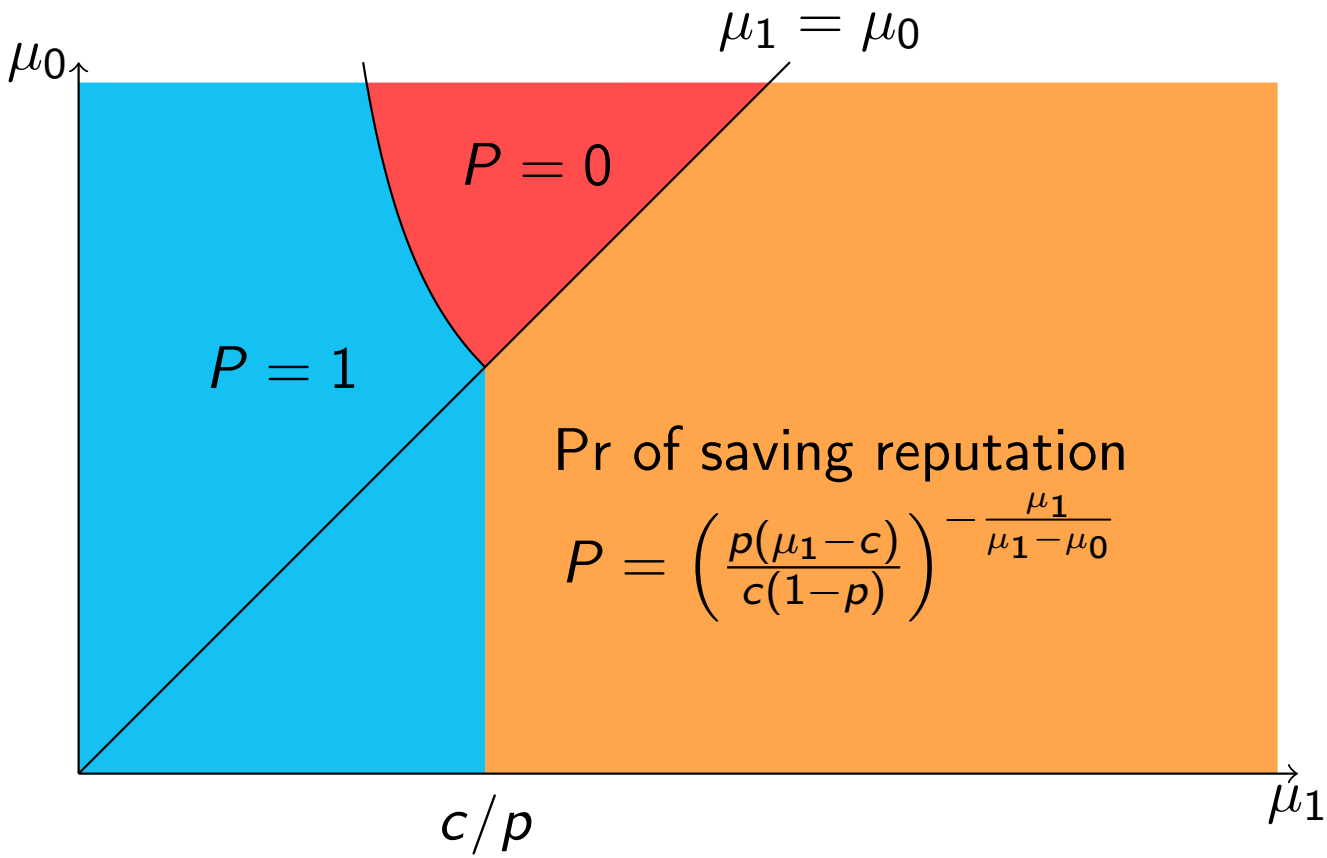

Pr(save reputation)
cost effect (+)
+
speed effect (-)
+
revelation effect (+)
= optimal protection
selective protection

Optimal Protection

Theorem



Optimal Protection

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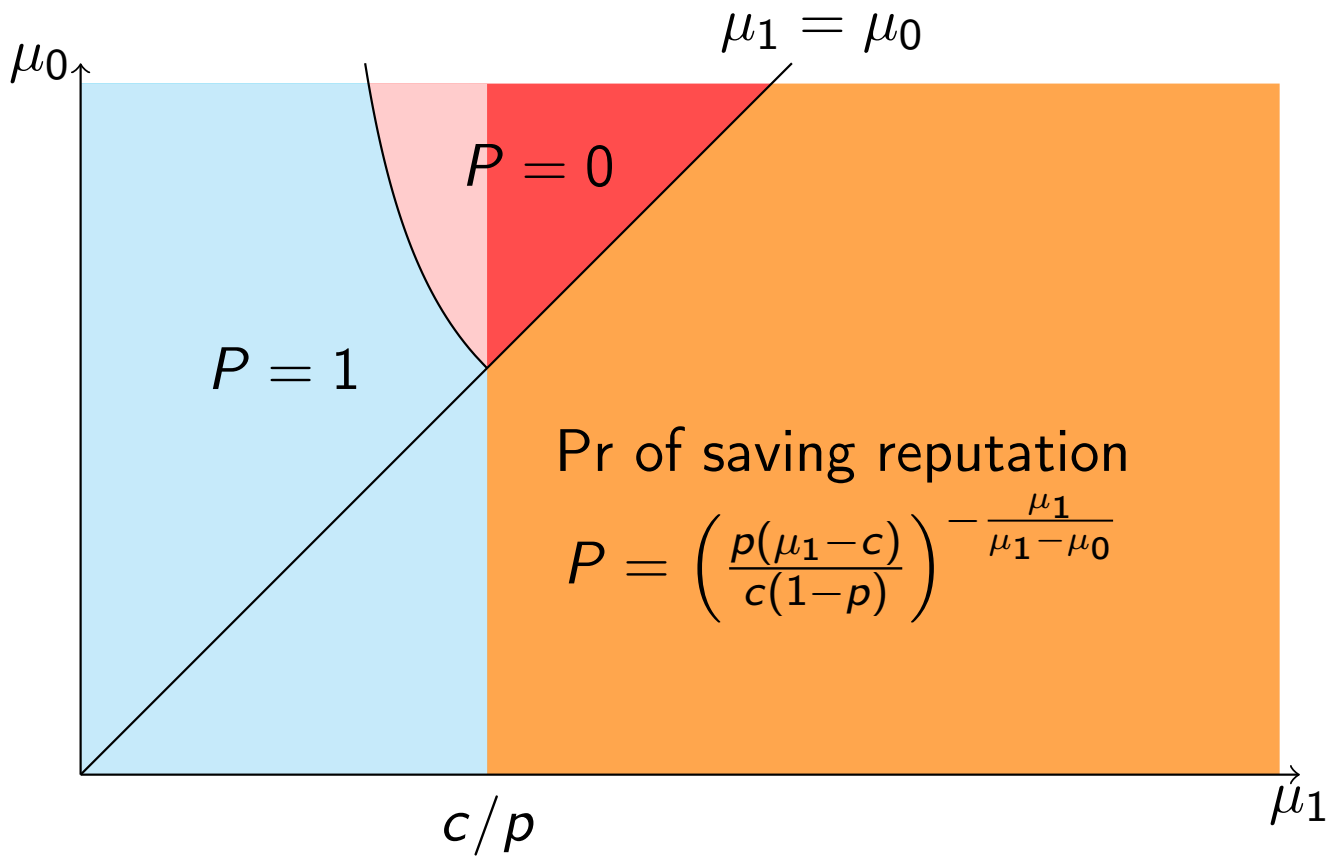

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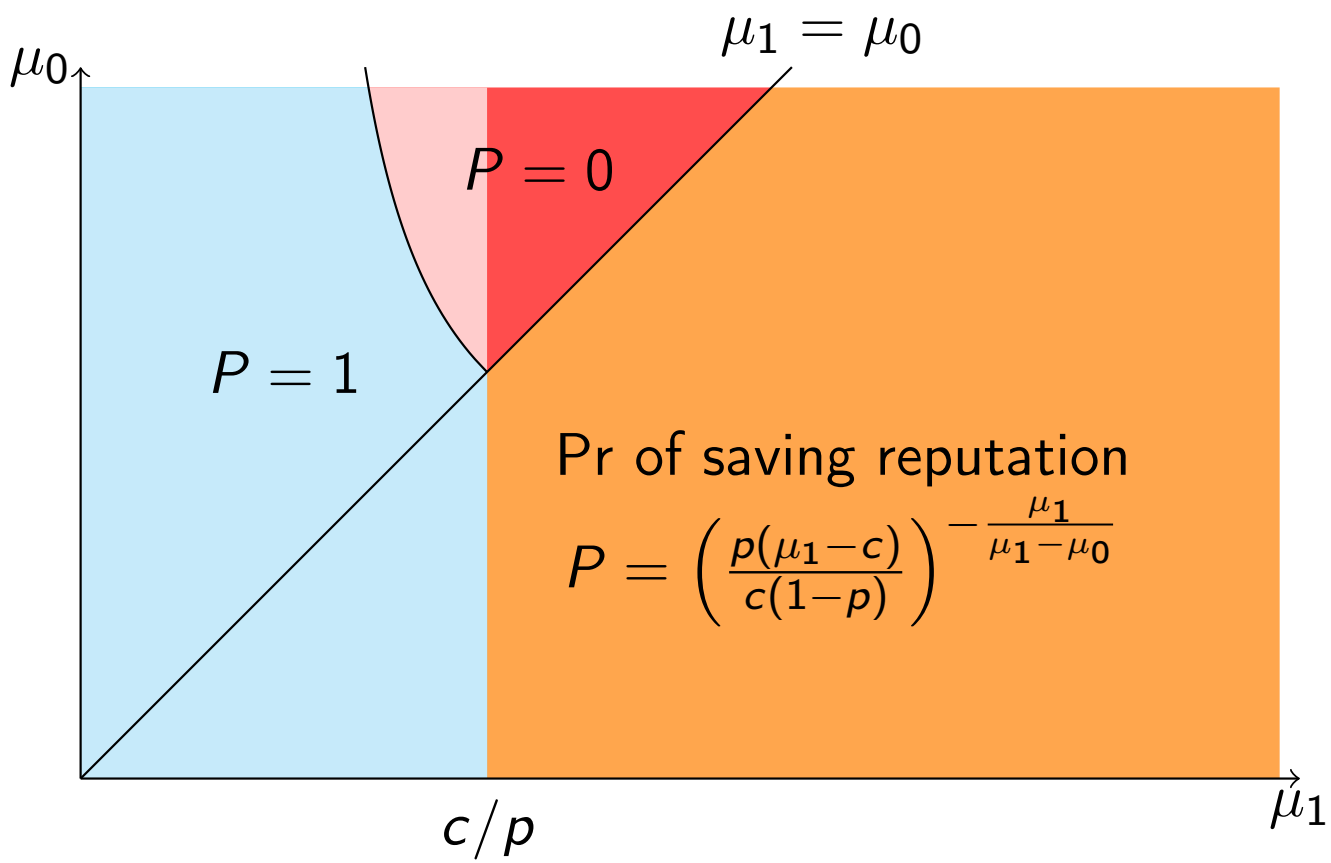
Under assumption $\mu_1 \geq c/p$, the optimal selective protection is characterized by μ_1^*, which is a function of μ_0, c, and p.



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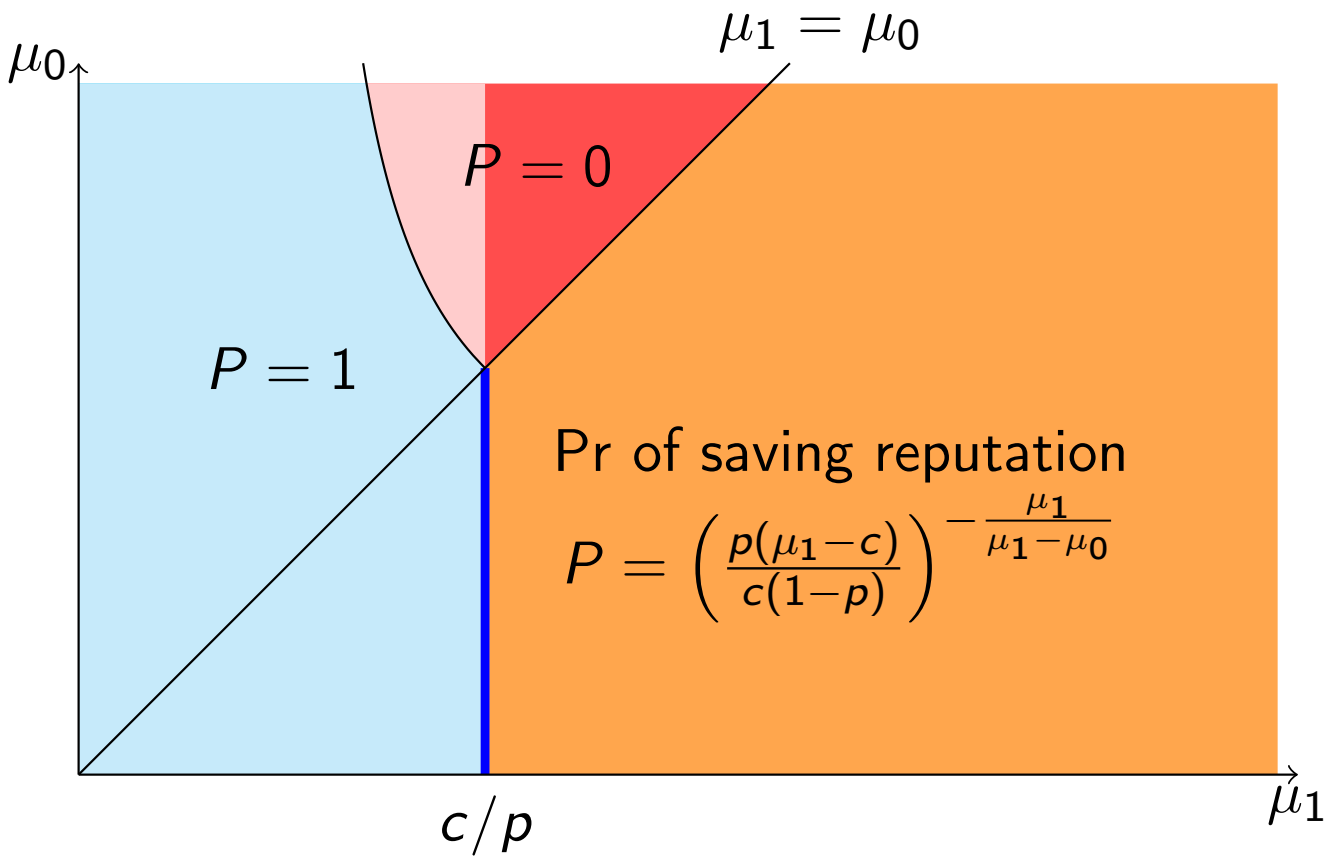
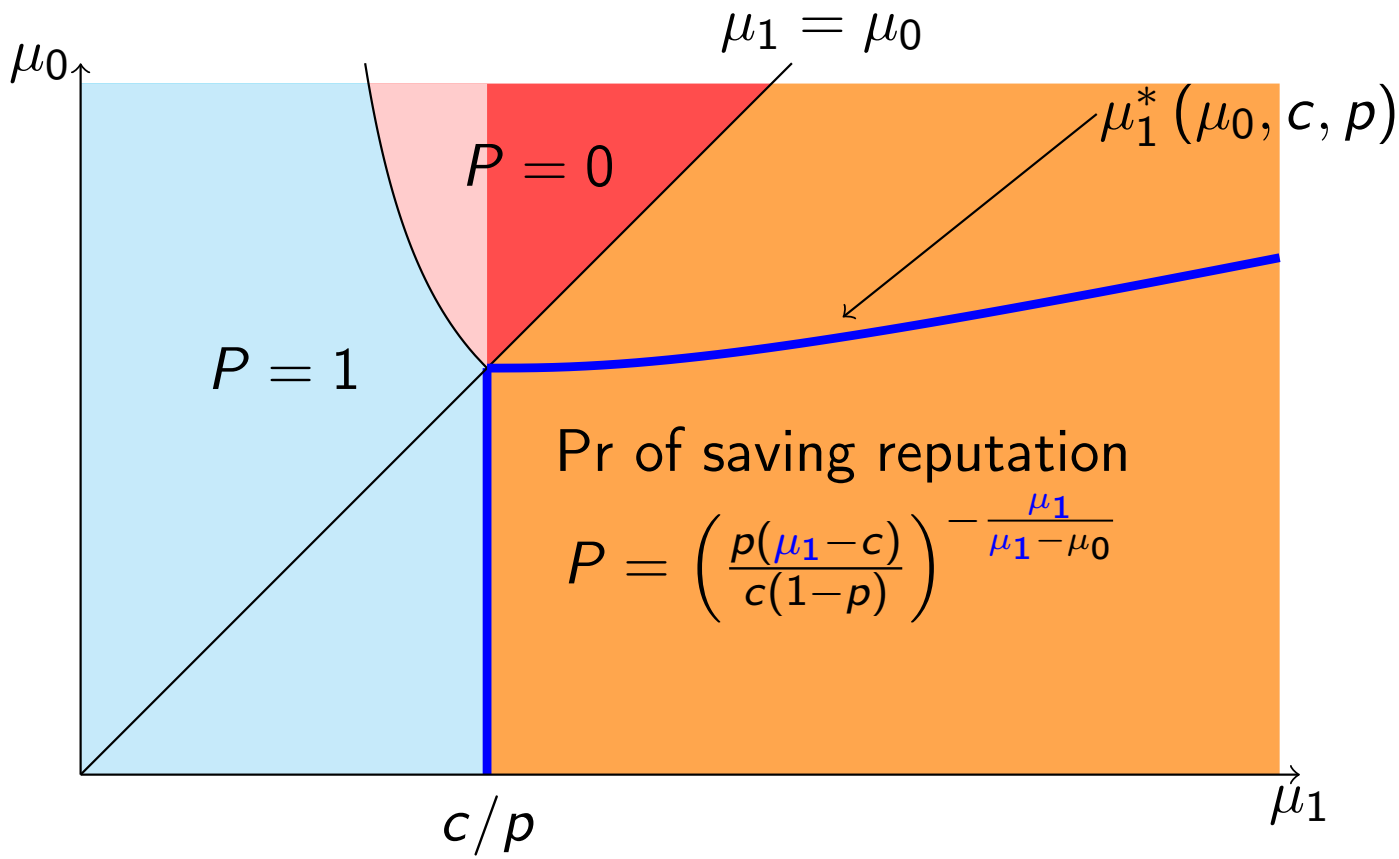


Optimal Protection

Theorem

If $\mu_0 \leq c/p$, then $\mu_1^*(\mu_0, c, p) = c/p$. If $\mu_0 > c/p$, then $\mu_1^*(\mu_0, c, p) > \mu_0$ uniquely solves $\ln\left(\frac{p(\mu_1 - c)}{c(1-p)}\right) - \frac{\mu_1(\mu_1 - \mu_0)}{\mu_0(\mu_1 - c)} = 0$.



Comparative Statics

$\mu_1^*(\mu_0, c, p)$ balances *Speed* vs *Duration* of learning

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Default Protection

$\mu_1^*(\mu_0, c, p)$ is increasing in μ_0.

- $\uparrow \mu_0 \Rightarrow \downarrow$ speed of learning $\Rightarrow \uparrow \mu_1$ to increase speed
- $\Rightarrow$ general and selective types of protection are *complements*

Privacy Debate

- default protection (all information) — government responsibility
- selective protection (only sensitive information) — individual responsibility

Goal protection of sensitive information

Problem Default protection has high indirect cost since it limits access to big data

> *Your individual data is actually not that valuable. While the entire data market might be worth $3trn... it's access to huge aggregate data that is valuable.*
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Question Could providing tools for selective protection be a solution?

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Answer No! Tools that facilitate selective protection might not be used in practice in the absence of good default protection.

Extension: Many Seekers

- Suppose the hider cannot control μ_1 but can choose the number of seekers $n \geq 1$.
- Private learning: the seekers do not communicate with each other
- Competition: only the first seeker to report a compromising story derives a positive payoff (reports are public)

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Theorem

Under assumption $\mu_1 \geq c/p$, the optimal privacy protection is $n = +\infty$, that is, open access is optimal.

- Without discounting, speed effect always gets an upper hand over revelation effect
- With discounting, bang-bang solution

Reality check

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The Anti-Corruption Foundation

The ACF exposes corruption cases on the basis of publicly available data.

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Fall after news

A flurry of news about a company often follows by a fall in the stock price.