

Privacy Protection: When Does Hiding in Plain Sight Work?

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Prince Harry and Meghan Markle: In pursuit of privacy

The Guardian, 5 October 2019

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The Guardian, 5 May 2020

Framework outline

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- | Technological constraint precludes perfect protection of compromising information.
- | The realised level of protection is private to the hider.

Results preview

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- | The optimal protection level for compromising information is increasing in the default protection, thus making these two types of protection complementary.
- | 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
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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 \(2016\)](#)

Model

- | The hider commits to the level of selective protection, parametrized by $\alpha_1 > 0$. The level of default protection $\alpha_0 > 0$ is exogenous.

Model

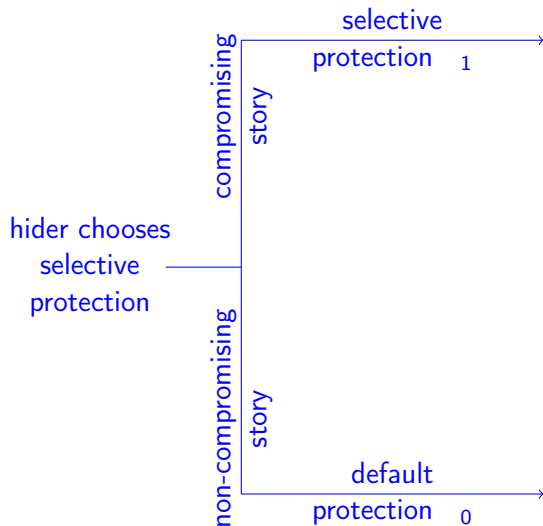
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- | The hider gets involved in a story of type $\theta \in \{0, 1\}$
 - | $\theta = 1$: compromising story
 - | $\theta = 0$: non-compromising story

The seeker knows α_0 and α_1 , and believes $\Pr(\theta = 1) = p$

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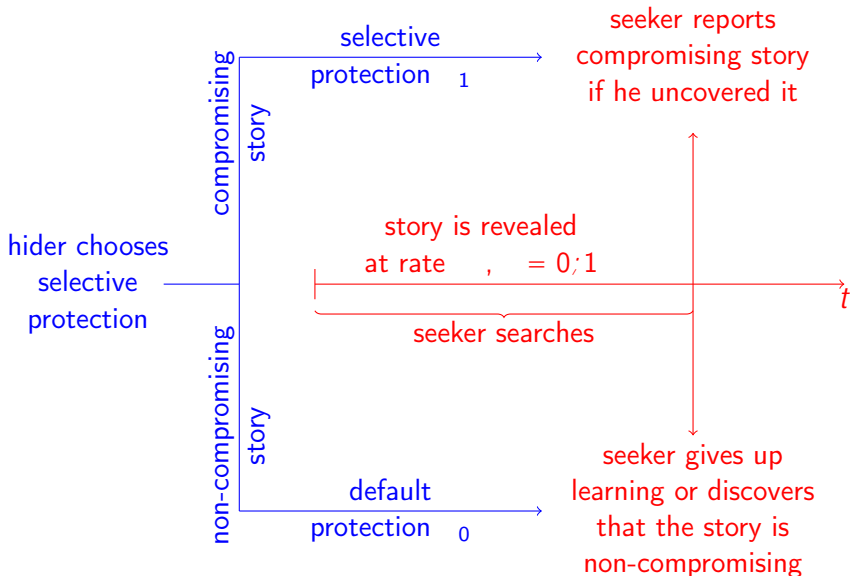
| $\theta = 0$: non-compromising story

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| The seeker gets 1 if he reports a compromising story and negative payoff if he reports a non-compromising story. To report the story, the seeker has to learn it.

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- | The seeker learns the story through Poisson process with rate λ and low cost $c > 0$.
- | The seeker gets 1 if he reports a compromising story and negative payoff if he reports a non-compromising story. To report the story, the seeker has to learn it.
- | The hider minimizes \Pr the seeker reports the story.
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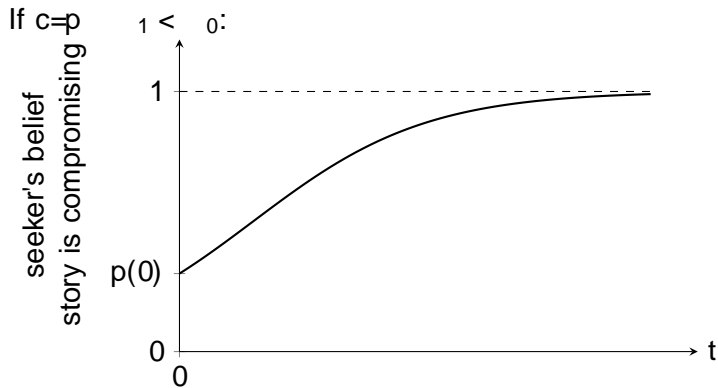
Model

- | The hider commits to the level of selective protection, parametrized by $\gamma_1 > 0$. The level of default protection $\gamma_0 > 0$ is exogenous.
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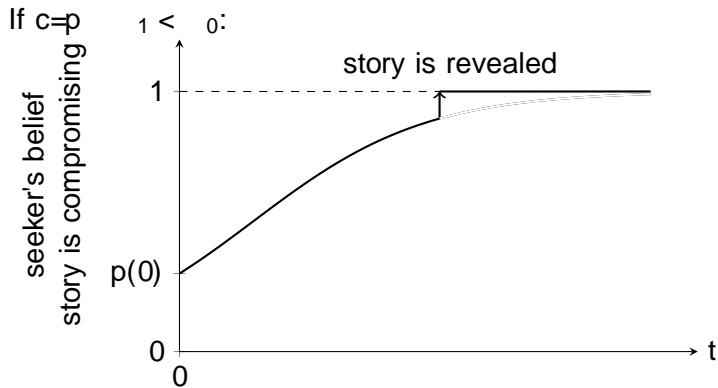
Assumption

The hider can choose any γ_1 such that $\gamma_1 \leq c/p$

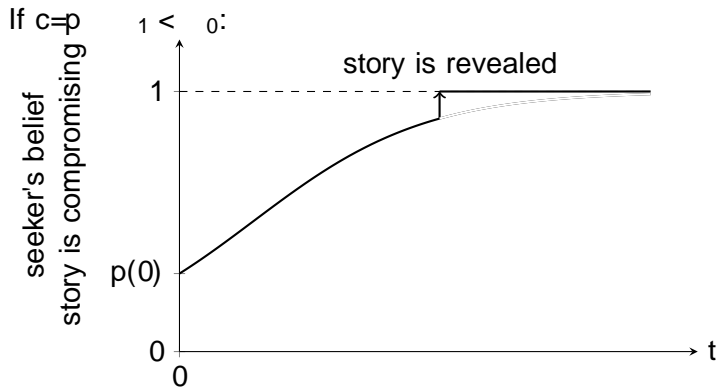
Results



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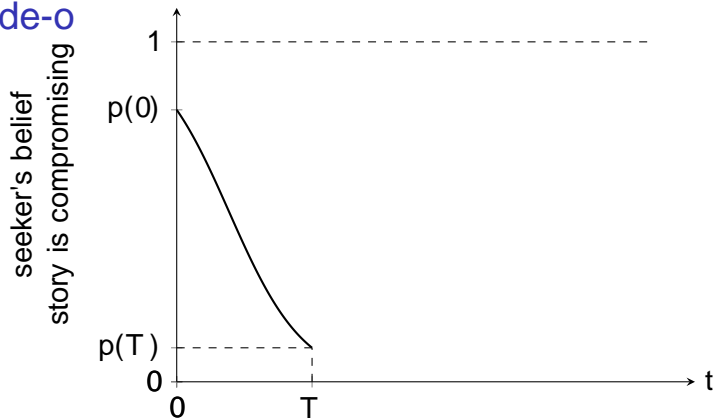
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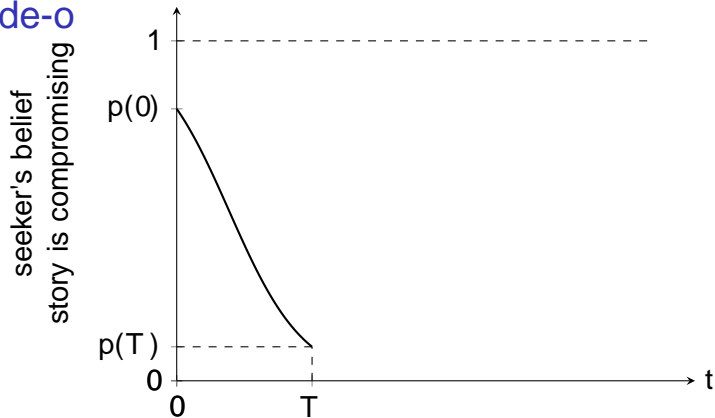
Main result

If $\theta > c \neq p$ (default protection is weak), then the hider will not choose the strongest feasible selective protection: θ at the optimum.

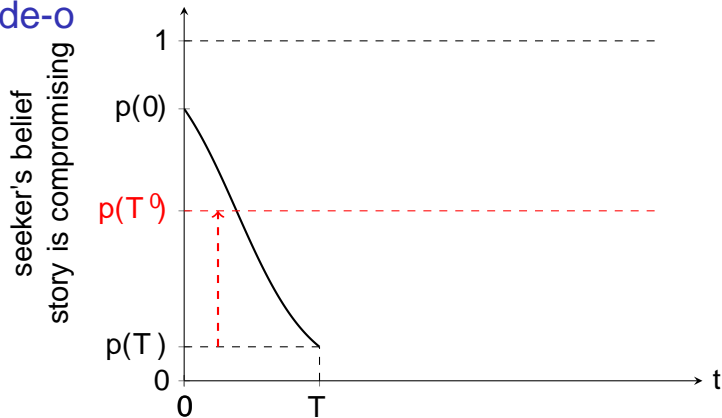
Trade-o



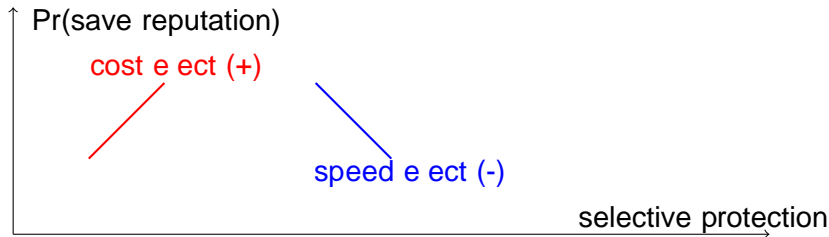
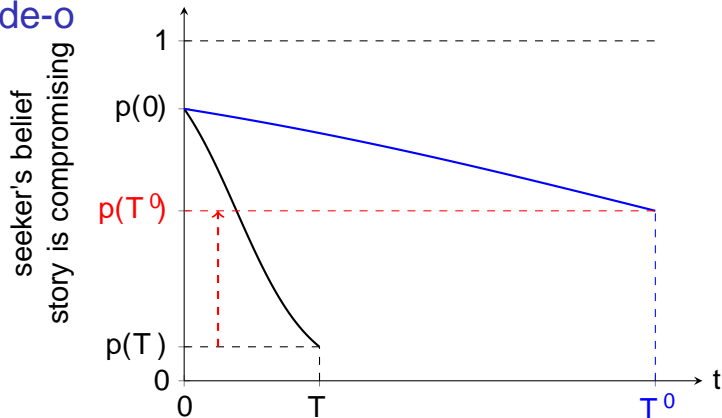
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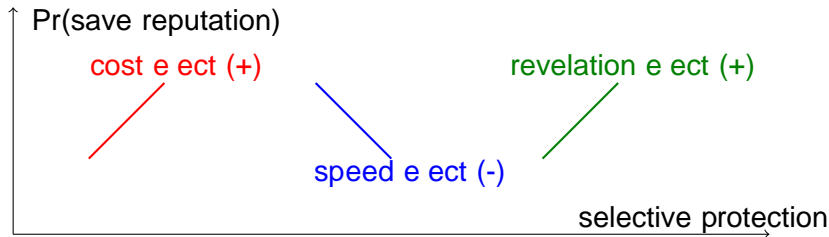
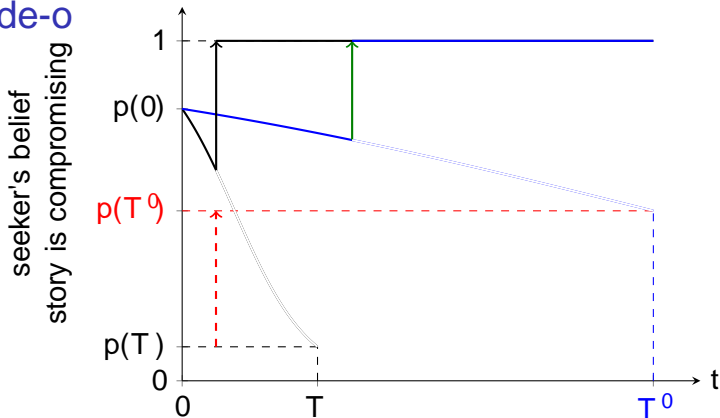
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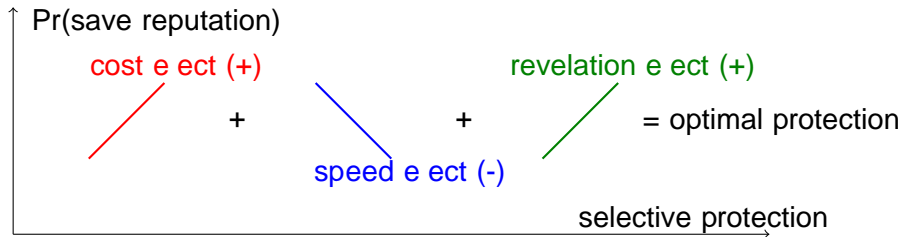
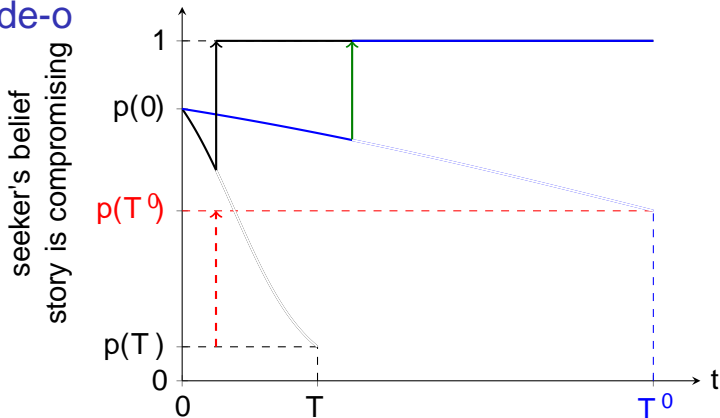
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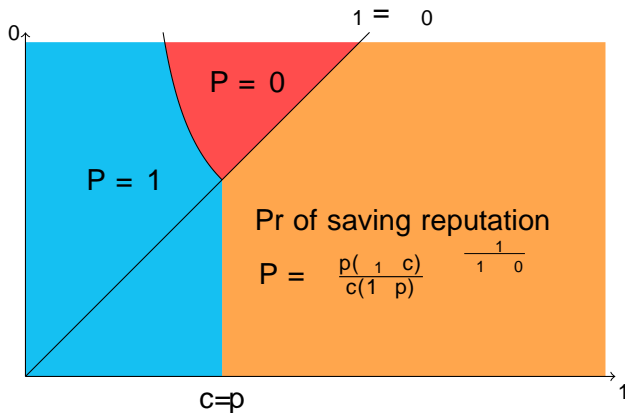


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Optimal Protection

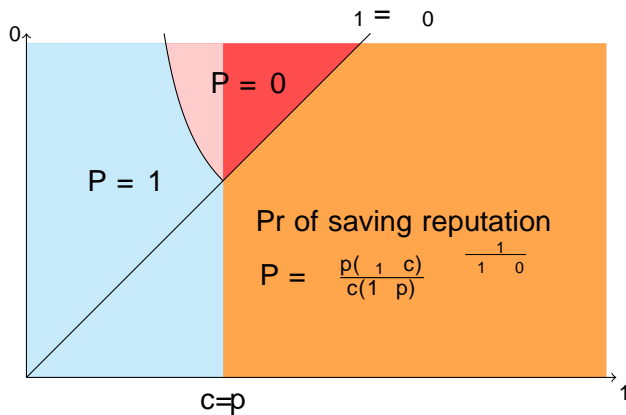
Theorem



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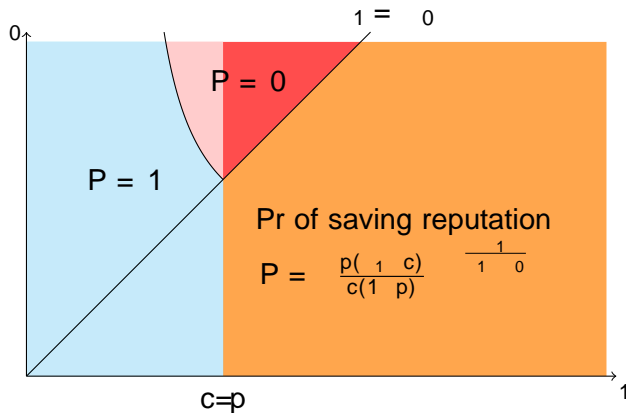
Under assumption 1 $c=p$,



Optimal Protection

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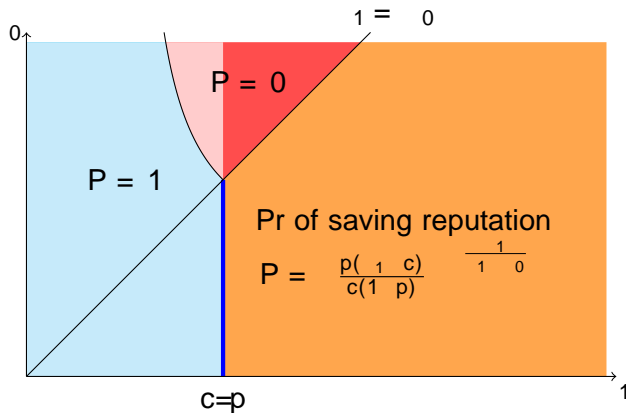
Under assumption $c > p$, the optimal selective protection is characterized by P_1 , which is a function of θ_0 , c , and p .



Optimal Protection

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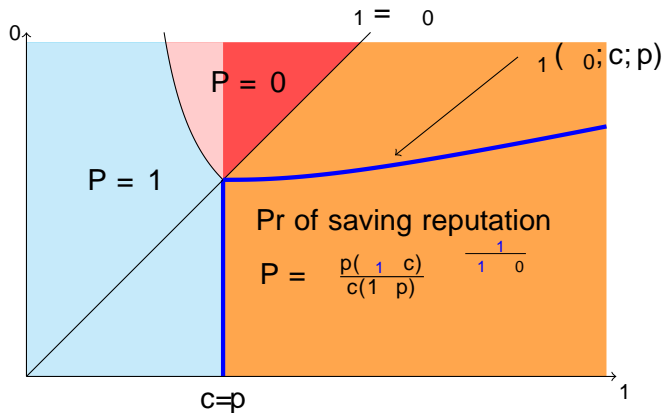
If $c > p$, then $\beta_1(0; c; p) = c/p$.



Optimal Protection

Theorem

If $c < p$, then $p_1(c; p) = c$. If $c > p$, then $p_1(c; p) > c$ uniquely solves $\frac{p(1-c)}{c(1-p)} - \frac{1(1-c)}{p(1-c)} = 0$.



Comparative Statics

$\pi_1(\theta; c; p)$ balances Speed vs Duration of learning

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$\lambda_1(\theta_0; c; p)$ balances Speed vs Duration of learning

Prior Belief

$\lambda_1(\theta_0; c; p)$ is increasing in p .

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Comparative Statics

$\partial \theta / \partial c; \partial \theta / \partial p$ balances Speed vs Duration of learning

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Cost

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Default Protection

$\partial_1(\theta_0; c; p)$ is increasing in θ_0 .

- | " θ_0) # speed of learning" ∂_1 to increase speed
- |) 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

Privacy International

Question Could providing tools for selective protection be a solution?

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Question Could providing tools for selective protection be a solution?

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 θ 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 $\beta_1 = c=p$, 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

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Fall after news

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