Intermediated Asymmetric Information, Compensation and Career Prospects.

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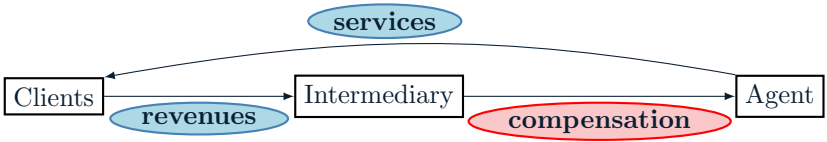
13^{th} conference of the Paul Woolley Centre
in collaboration with the Bank of International Settlements

Employment Intermediation



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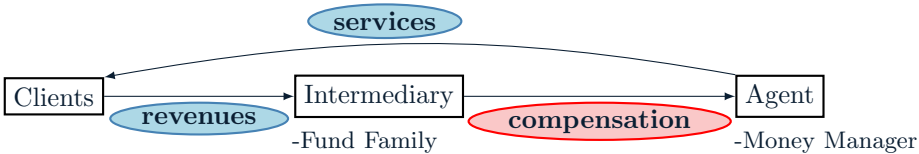

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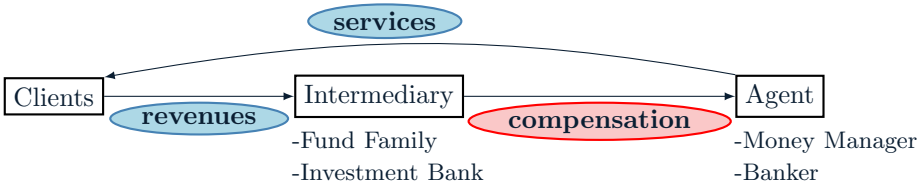

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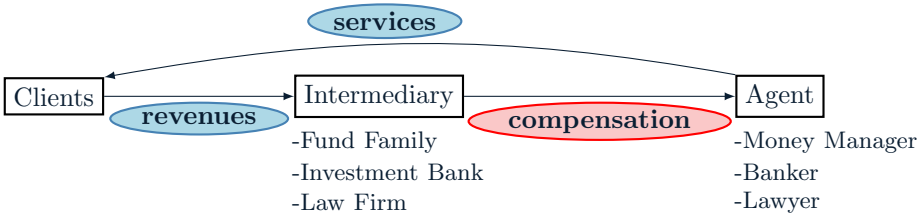

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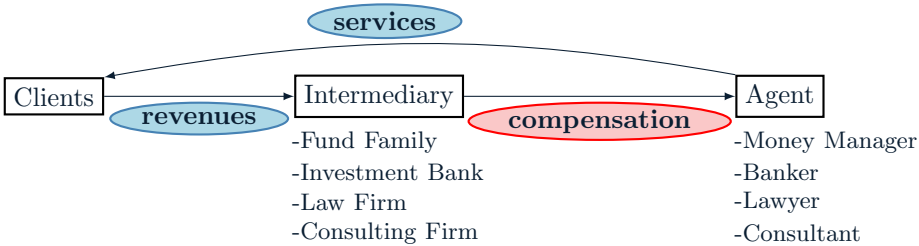

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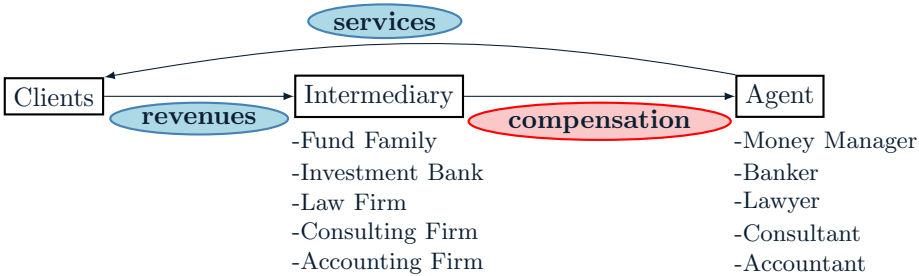

- Labor intermediation is common in professions where skill is important.
- All parties learn about ability from the quality of past services.
  - But the intermediary knows more about the agent than the clients.
- Limited transparency:
  - clients do not observe agent's compensation but do observe if agent is retained

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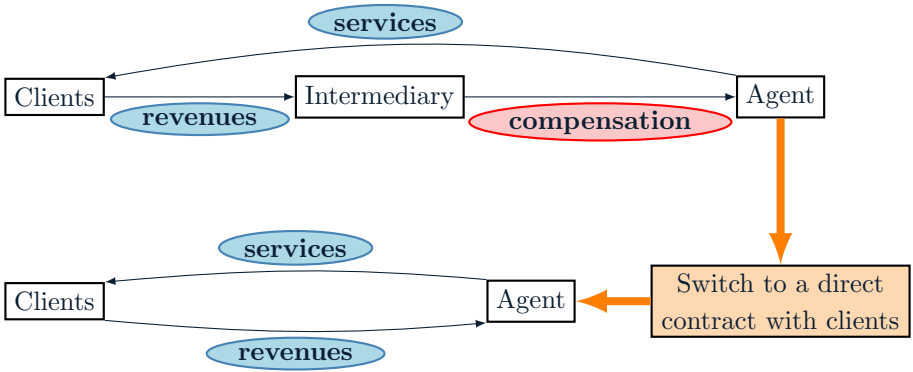

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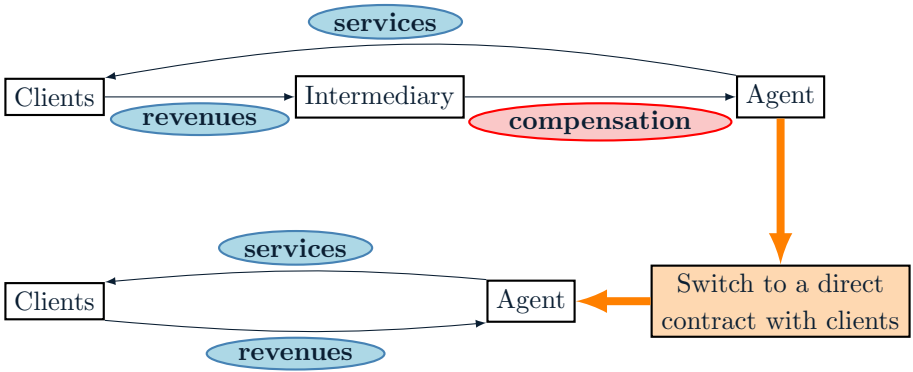

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  - Implication of lateral moves is similar.
- Intermediary benefits from high revenues and low compensation costs.

Intermediary's Advantage in Identifying Talent

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- High asymmetric information: the intermediary can expropriate the agent's talent.
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  - This profit wedge declines as information asymmetry reduces asymmetric information.
- Low asymmetric information: **the intermediary speeds up information revelation** by churning lower skilled agents.
  - This is profitable - **high skilled agents pay for reputation** building.
  - Even though asymmetric information is reduced even faster.

Related Literature From Many Fields

- **Finance Labor Market**: Berk, van Binsbergen, and Liu (2017), Deuskar, Pollet, Wang, and Zheng (2011), Strobl and Van Wesep (2012), Gao, Wang, and Yu (2019).
- **Labor Markets with Frictions**: Greenwald (1986), Farber and Gibbons (1996), Acemoglu and Pischke (1998), Chevalier and Ellison (1999), Postel-Vinay and Robin (2002), Tervio (2009).
- **Adverse Selection**: Spence (1973), Noldeke and Van Damme (1990), Fuchs and Skrzypacz (2010), Daley and Green (2012), Fuchs, Green, Papanikolaou (2016).
- **Career Concerns**: Berk and Green (2004), Holmström (1999), Board and Meyer-ter-Vehn (2013).

Players and Setup

- **Intermediary** employs at most one agent at any given time.
  - **knows more about the agent's ability than clients**;
  - sets compensation $\tilde{w}_t$ privately;
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  - outside option of leaving the industry is normalized to L.
- **Clients'** demand for services is increasing in their perception of agent's quality

$$\text{Firm Revenue} = \boldsymbol{A}\big(\mathrm{E}_t\left[\theta\right]\big).$$

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$$r_I = \mu - f - \lambda(1 - \mathrm{E}_t\left[\theta\right]) - g(\boldsymbol{AUM_t}),$$

$$\Rightarrow \quad \boldsymbol{AUM_t} = g^{-1}(\mu - f - \lambda - r_I + \lambda \cdot \mathbf{E_t}\left[\boldsymbol{\theta}\right]).$$

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- Intermediary's revenue is

$$\boldsymbol{A}(\mathbf{E_t}\left[\boldsymbol{\theta}\right]) \stackrel{def}{=} f \cdot g^{-1}(\mu - f - \lambda - r_I + \lambda \cdot \mathbf{E_t}\left[\boldsymbol{\theta}\right]).$$

Performance and Private Information in the Poisson Model

- When agent is hired, intermediary and agent observe a private signal about θ.
  - Identify agent's type with his private belief about θ, denoted by $\tilde{p}_0 \sim F(\cdot)$.
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- Publicly observable performance signals follow a negative Poisson process for tractability:

$$X_t \overset{def}{=} \mu\, dt - dN_t^\theta.$$

  - Perfect bad news: N^θ has arrival intensity $\lambda(1-\theta)$.

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- Intermediary and agent also learn from performance signals

$$\tilde{p}_t \overset{def}{=} \frac{\tilde{p}_0}{\tilde{p}_0 + (1-\tilde{p}_0)e^{-\lambda t}} \cdot \mathbb{1}\{X_t = \mu t\}.$$

- Clients do not observe $\tilde{p}_t$, but learn from performance and retention.

Value of Opening Own Firm

- Clients' belief about the agent who opens his own firm at time t is

$$k_t \stackrel{def}{=} \mathrm{P}_t(\theta = 1 \,|\, \tau = t)$$

  - In equilibrium, k_t is the lowest type of agent still employed on path.
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- Agent's expected value of opening own firm if his belief is $\tilde{p}_t$ but clients' belief is k_t is

$$U(\tilde{p}_t, k_t) \overset{def}{=} \max_{\hat{\eta}} \mathrm{E}_{\tilde{p}_t} \left[\int_t^{\hat{\eta}} e^{-\rho(s-t)} A\left(\frac{k_t}{k_t + (1-k_t)e^{-\lambda(s-t)}} \right) ds + e^{-\rho(\hat{\eta}-t)} L \right]$$

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- Clients' belief about agents who are retained by the intermediary

$$q_t \overset{def}{=} \mathrm{P}_t\big(\, \theta = 1 \,\big|\, \tau > t, X_t\big) = \mathrm{E}\left[\, \tilde{p}_t \,\middle|\, \tilde{p}_t > k_t \right] \overset{def}{=} Q(k_t, t).$$

  - Adverse selection implies a wedge $q_t = Q(k_t, t) > k_t$.

Equilibrium Definition

The equilibrium is a stopping time τ, type-specific private wage process $(\tilde{w}_t)_{t\geq 0}$, and processes $(q_t)_{t\geq 0}$ and $(k_t)_{t\geq 0}$ such that

(i) **Optimality**: τ and $\tilde{w}$ are optimal for the intermediary

$$\left(\tau, \tilde{w}\right) \in \arg\max_{\hat{\tau},\hat{w}} \mathrm{E}_{\tilde{p}_0}\left[\int_0^{\hat{\tau}} e^{-rt}\left(A(q_t) - \hat{w}_t\right)\, dt + e^{-r\tau}\cdot \boldsymbol{V}\right]$$

subject to the retention constraint in every history

$$\mathrm{E}_t\left[\int_t^{\tau} e^{-\rho(s-t)}\hat{w}_s\, ds + e^{-\rho(\tau-s)}\cdot U(\tilde{p}_\tau, k_\tau)\right] \geq U(\tilde{p}_t, k_t).$$

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(ii) **Stationarity**: intermediary's continuation value V is determined in equilibrium

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(iii) **Belief Consistency**: belief processes $(k_t, q_t)_{t\geq 0}$ are consistent with τ.

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- Retaining all agents is optimal if profit wedge is sufficiently high

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- Performance gradually reveals agent's skill and reduces intermediary's advantage.
  - Mathematically, the worst agent belief k_t gets closer to $q_t = Q(k_t, t)$.
  - **Even as revenue $A(q_t)$ grows, the intermediary's profit wedge shrinks.**

Churning and Pay for Reputation

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$$\dot{k}_t = \underbrace{\lambda k_t(1-k_t)}_{\textit{learning from performance}} + \underbrace{\gamma(k_t, t)}_{\textit{learning from churning}}$$

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- Retained agents value reputation increases and are willing to pay for it:

$$w(\tilde{p}_t, k_t) = \underbrace{A(k_t)}_{\textit{reservation wage}} - \underbrace{\gamma(k_t, t) \cdot \partial_2 U(\tilde{p}_t, k_t)}_{\textit{pay for reputation}}$$

  - Selective retention by the intermediary is a signal of ability to the market: higher skilled workers are willing to pay for it.

Agent's Single-Crossing

Proposition:

An agent with a higher private belief about his skill is more sensitive to changes in clients' beliefs:

$$\partial_2 U(\tilde{p}', k) > \partial_2 U(\tilde{p}, k) \qquad \forall\, \tilde{p}' > \tilde{p}.$$

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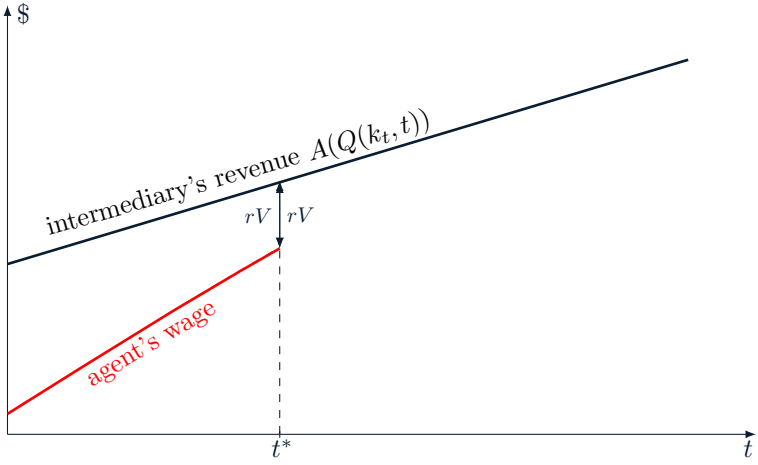
- Churning rate is determined by the profitability of the worst remaining agent

$$rV = A(Q(k_\tau, \tau)) - w(k_\tau, k_\tau) \qquad \Rightarrow \qquad \gamma(k_\tau, \tau) = \frac{rV + A(k_\tau) - A(Q(k_\tau, \tau))}{\partial_2 U(k_\tau, k_\tau)} > 0.$$

- In many cases the churning set $\mathbb{T} = [t^*, \bar{t}]$.

Compensation Dynamics



- While uncertainty is high, all agents are paid the same wage.

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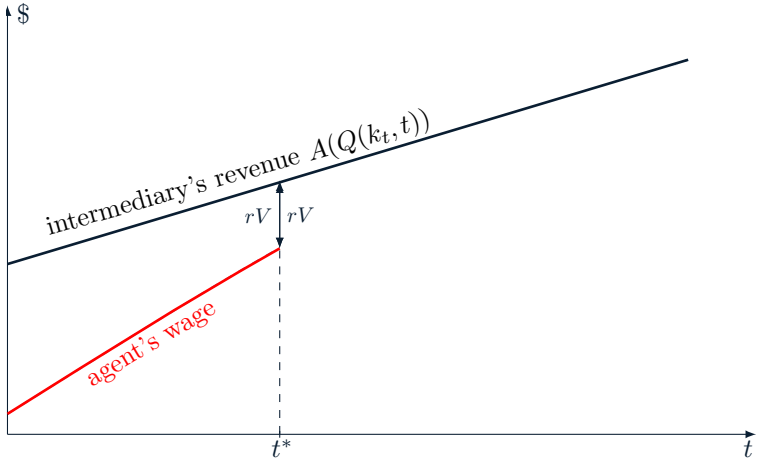
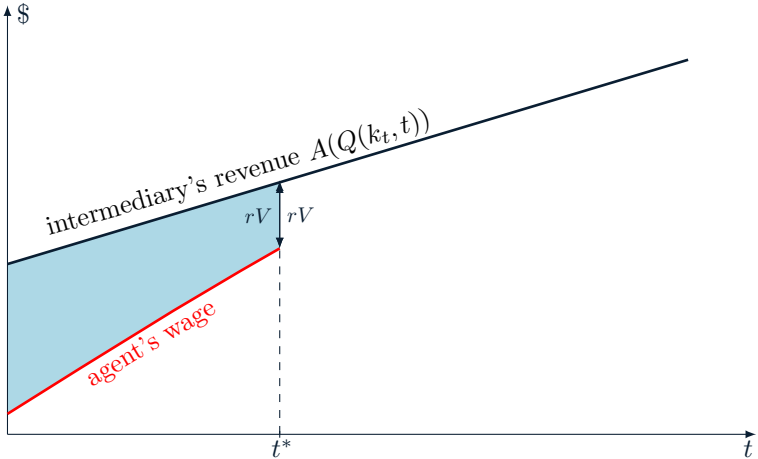


- Better agents are retained for longer but pay more for building reputation.

Intermediary's Profitability across Agents



- Intermediary's profit initially declines with uncertainty.

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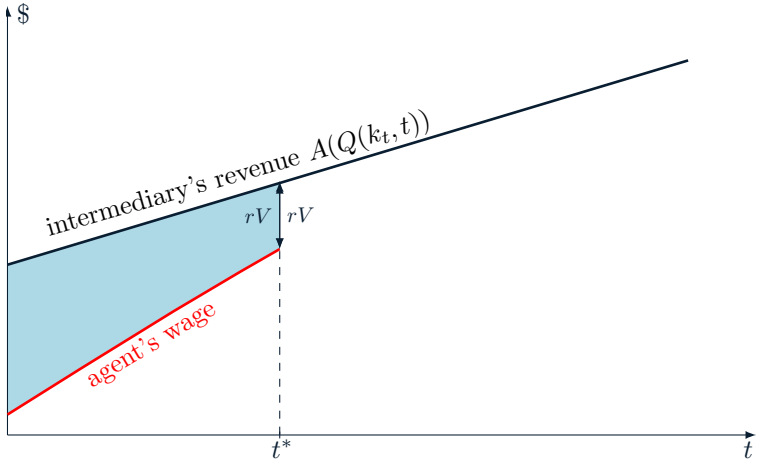

- As she begins to churn lower skilled agents, higher skilled agents pay for reputation.
- **Profits are non-monotone with respect to information asymmetry.**

Firm Value Fixed Point

- Intermediary's equilibrium value V determines her incentives to replace an agent.
  - V is the solution to a fixed point

$$\boldsymbol{V} = e^{-r\Delta} \cdot \mathrm{E}\left[\int_0^{\tau} e^{-rt}\left(A(q_t) - \tilde{w}_t\right) dt + e^{-r\tau} \cdot \boldsymbol{V}\right] - I$$

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- Intermediary's profits come from expropriation and pay-for-reputation.
  - Percent of profits resulting from the agents paying for reputation:

$$V_{pr}^{\%} \stackrel{def}{=} \frac{\mathrm{E}\left[\int_0^{\tau} e^{-rt}(A(\boldsymbol{k_t}) - \tilde{w}_t)\, dt\right]}{\mathrm{E}\left[\int_0^{\tau} e^{-rt}(A(\boldsymbol{Q(k_t, t)}) - \tilde{w}_t)\, dt\right]}.$$

Value given Stock of Private Information

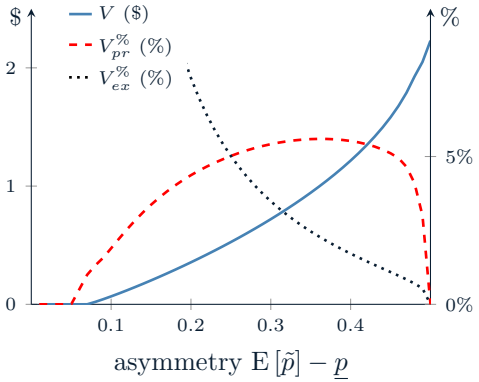
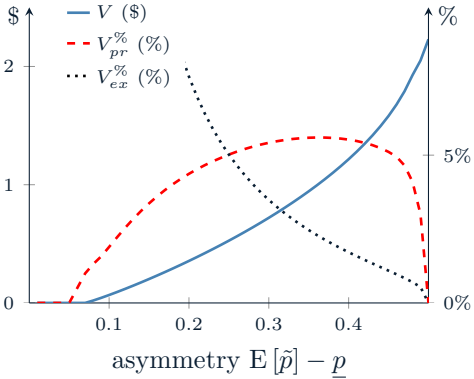


Figure 1: Equilibrium value V and percentage of revenues obtained from pay-for-reputation.

- Low asymmetry $\Rightarrow$ a new agent is not that profitable $\Rightarrow$ $t^* \uparrow$, $V_{pr}^{\%} \downarrow$.

Value given Stock of Private Information



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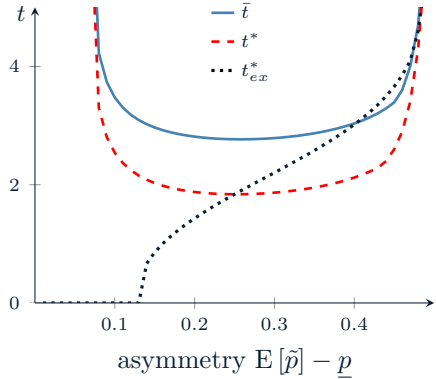

Figure 2: Churning start and end times.

- Low asymmetry ⇒ a new agent is not that profitable ⇒ $t^* \uparrow$, $V_{pr}^{\%} \downarrow$.
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Value given Persistence of Private Information

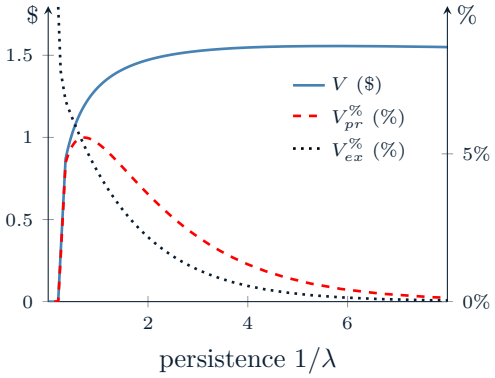

Figure 3: Equilibrium value V and percentage of revenues obtained from pay-for-reputation.

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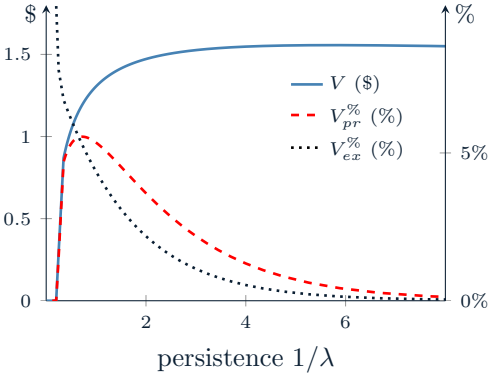

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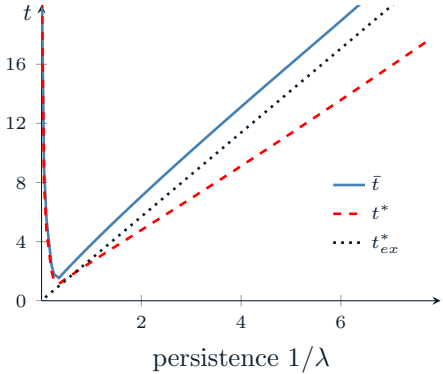

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Alternative Signaling, and Training

- **Alternative Signaling.** Allow agent to offer their services at discount $\beta(\tilde{p}, k) \Rightarrow \beta(\tilde{p}, k)A(\cdot)$.
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- **Pay-for-reputation dynamics hold**. And some additional insights:
  1. Multiple churning regions where churning happens after recent bad performance.
  2. Profit wedge/asymmetric information is increasing in performance.
  3. Agents who survive a "crisis" are better compensated going forward.
  4. Three-dimensional equilibrium dynamics, change-of-measure and parallel computing to obtain comparative statics.

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  - Efficiency can increase in intermediary's profits as it improves capital allocation.