Asset Opacity and Liquidity

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November 13, 2013

Motivation I/II

- opacity and (il)liquidity had key role during the recent financial crisis

→ policymakers argue that lack of transparency harmed liquidity

- information availability and processing capacity improved tremendously in the decades prior to the crisis

→ puzzling prevalence of opacity

This Project

- analyze *endogenous* nature of opacity and its relation to liquidity

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- securitization practices in financial markets still not fully understood

→ 'Puzzles of Securitization' (c.f. Gorton and Metrick (2012))

- why did issuers source and securitize *correlated* assets

→ common sense suggests optimality of *diversification*, i.e. of sourcing and securitizing uncorrelated assets

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- analyze the asset pool composition choice of issuing institutions
- relate opacity to optimal correlation choice

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- opacity affects information acquisition by investors which in turn determines asset liquidity

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- Main Findings
  i. U-shaped relationship between opacity and liquidity
  ii. highly opaque assets may also be liquid
  $\rightarrow$ increase in opacity can be welfare improving
  iii. banks may have incentives to securitize correlated assets when opacity is low
  $\rightarrow$ transparency regulation can lead to more correlated assets in the financial system

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Related Literature

- Opacity/Transparency in the Financial System

  Cordella and Levy-Yeyati (1998), Fecht and Wagner (2006), **Pagano and Volpin (2012)**, Monnet and Quintin (2013), Dang, Gorton, Holmström and Ordonez (2013)

- Security Design

  DeMarzo and Duffie (1999), Dang, Gorton and Holmström (2011, 2013), Farhi and Tirole (2013), Stenzel (2013), Yang (2013)

- Securitization/Asset Pool Composition

  Gorton and Metrick (2012), **Dang, Gorton, Holmström and Ordonez (2013)**

Related Literature: P&V and DGHO

- Pagano and Volpin (RFS 2012)
  - investors differ in *ability to comprehend information*
  - coarse information enhances primary market liquidity but may cause secondary market adverse selection by leaving scope for private information acquisition
- Dang, Gorton, Holmström and Ordonez (2013)
  - information beneficial for optimal continuation decision but harms liquidity in secondary market due to cash-in-the-market pricing
  - provide rationale for banks to step in as 'secret keepers'
  - pooling uncorrelated assets minimizes information acquisition incentives
  - information acquisition as 'all-or-nothing'

The Model: Basic Idea

- a bank decides on the opacity level of assets to sell
  - → opacity refers to size of set of states which contains payoff states
  - → high opacity $\hat{=}$ large set of states $\hat{=}$ higher uncertainty about which states are payoff states
- an investor acquires the securitized asset
  - → subsequently investor may acquire costly private information
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  - → anticipated private information acquisition leads to adverse selection
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Model Setup I/III

- time: $t = 0, 1, 2$
- three agents: owner of project/asset O, investor I, market M

$$\begin{array}{rcccccl} U^O & = & C_0^O & & & & \\ U^{I,P} & = & C_0^{I,P} & + & C_1^{I,P} & C_2^{I,P} & \text{patient w/ prob } \pi \\ U^{I,I} & = & C_0^{I,I} & + & C_1^{I,I} & & \text{impatient w/ prob } (1-\pi) \\ U^M & = & & & C_1^M & + \; C_2^M. & \end{array}$$

- $n \in \mathbb{R}_+$ equally likely states of the world $(f(s) \sim U[0, n])$
- at $t = 0$ owner owns asset, which pay 1 in $l \leq n$ states at $t = 2$
- investor has endowment $\omega^I > \frac{l}{n}$ at $t = 0$
- market has endowment $\omega^M > 1$ at $t = 1$

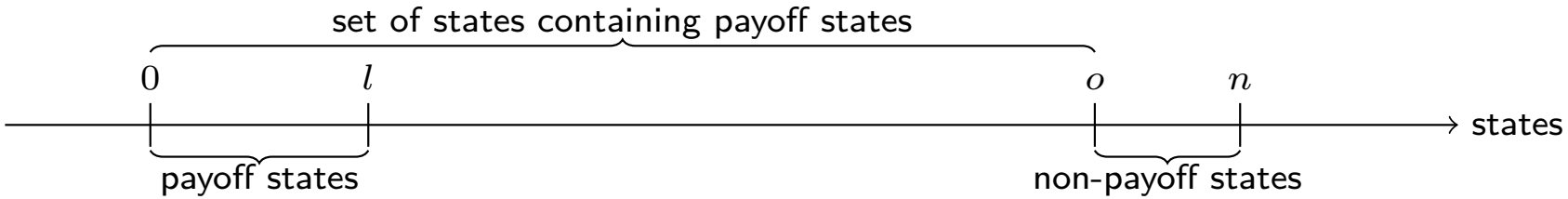
Model Setup II/III

- investor may privately acquire information and reduce private opacity
- technology: per-state cost k of ruling out non-payoff states

$\rightarrow$ pay $k \cdot a$ to reach private opacity $o - a$

$\rightarrow$ $a \in [0, o - l]$

Opacity and Information Acquisition



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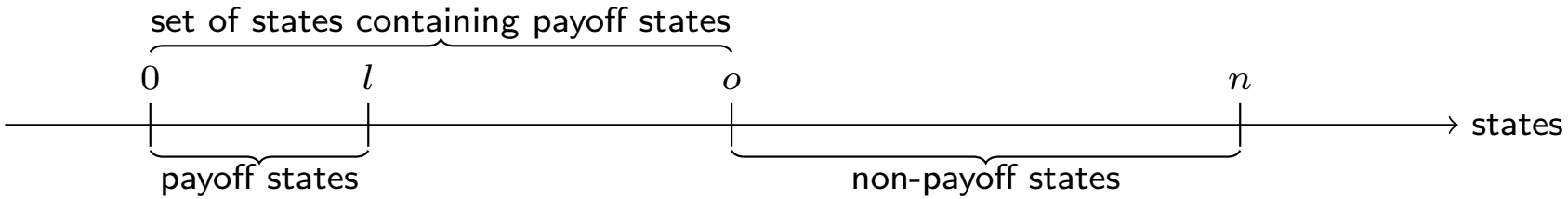

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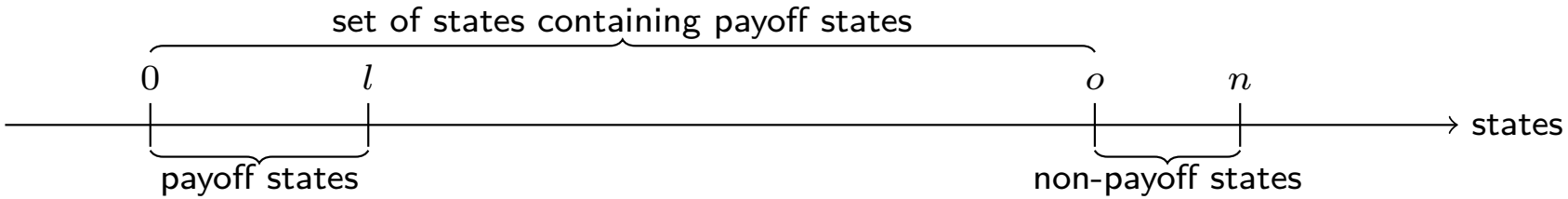

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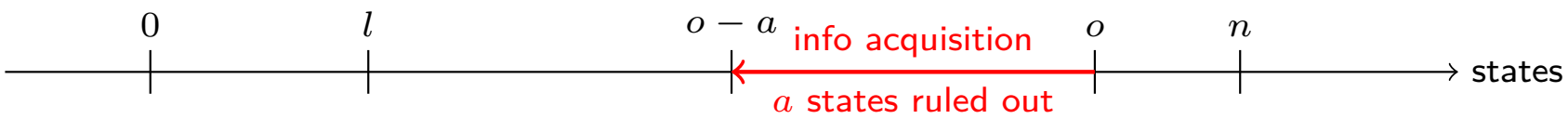

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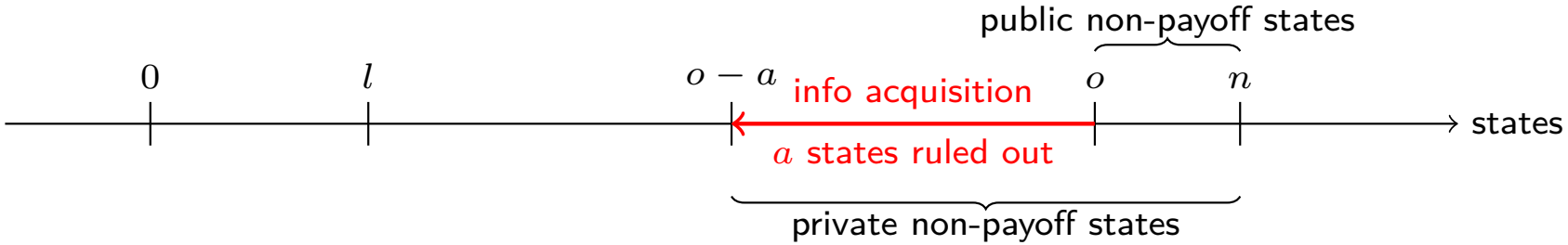

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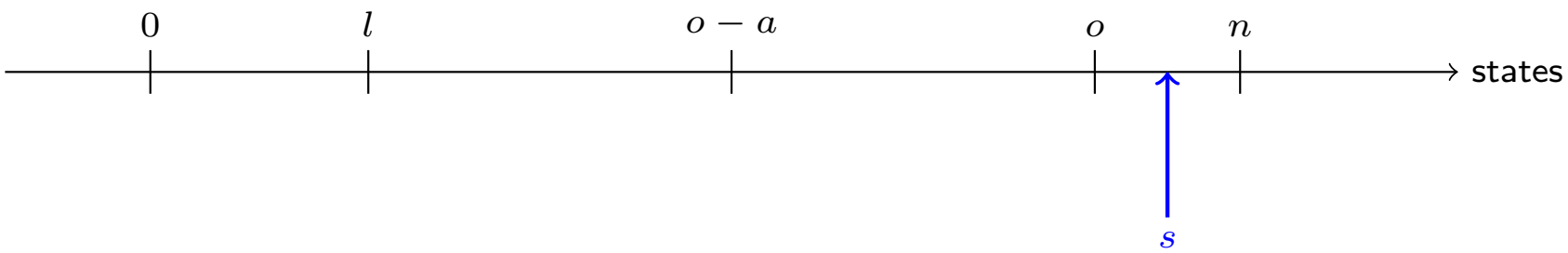

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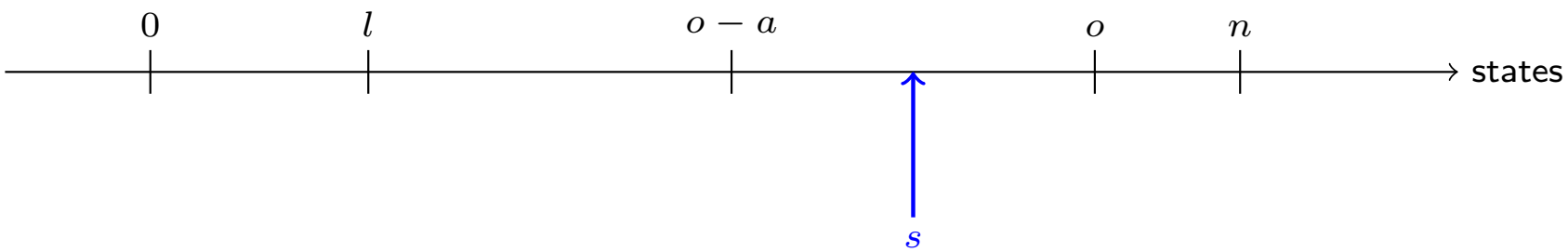

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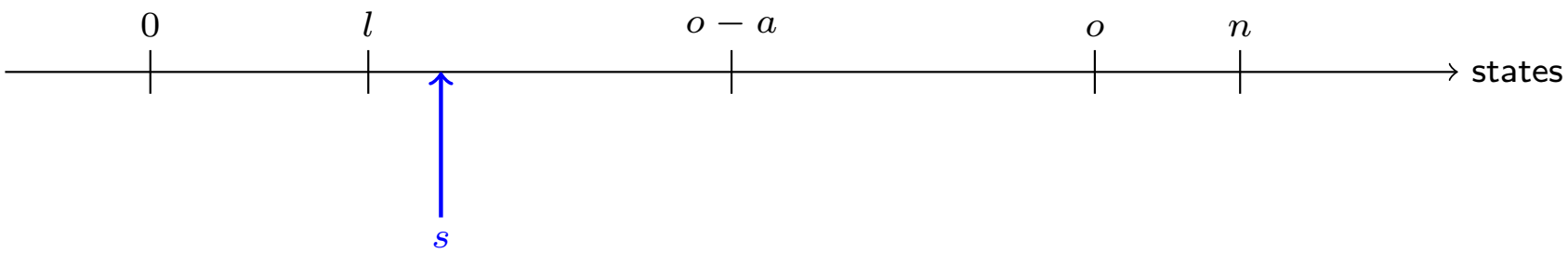

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$s \in (o-a, o]$: investor knows that security does not pay, market believes it pays with $\frac{l}{o}$

$s \in [0, o-a]$: investor believes security pays with $\frac{l}{o-a}$, market believes it pays with $\frac{l}{o}$

Model Setup III/III

- Timing

$t = 0.0$ O chooses o with $l \leq o \leq n$ at cost $c(n - o) \geq 0$

$t = 0.1$ O offers assets characterized by o to I

$t = 0.2$ I accepts or not

$t = 1.0$ I decides on repeated information acquisition

$t = 1.1$ state of the world s is revealed

$t = 1.2$ I learns whether patient or not

$t = 1.3$ I may offer assets to M at competitive price

$t = 2.0$ security pays out (iff $s \leq l$)

Model Setup: Robustness

- Qualitatively Similar Predictions when...
  1. ...payoff states are discovered with positive probability (instead of ruling out non-payoff states)
  2. ...states are discrete and analyzed one-by-one
  3. ...marginal utilities differ for early and late investors (and where there are thus additional costs of adverse selection)
  4. ...loss-states instead of payoff-states are discovered
  5. ...different cost structures for opacity reduction and information acquisition are in place

Last Stage I/II

- competitive market pays 'fair value' conditional on offer
  - $\rightarrow$ conditional expected value given beliefs $\widetilde{a}$ about a and beliefs about types of investors who offer (patient/impatient, informed/uninformed)
- in equilibrium of last trading stage: beliefs about types of investors who offer coincide with offer decision *given beliefs* $\widetilde{a}$
- in equilibrium of whole game: $\widetilde{a} = a$

Last Stage II/II

- unique pure strategy equilibrium characterized by
  - (i) no offer (or trade at price of 0) for $s > o$
  - (ii) conditional offering otherwise: impatient investors and patient investors who know that security has zero value ($s \in (o-a, o]$) strictly prefer to offer, patient investors who observe $s \in (o-a, o]$ prefer not to offer
  - (iii) price depends on beliefs $\widetilde{a}$:

$$p(\widetilde{a}, o) = \frac{1-\pi}{o - \pi(o - \widetilde{a})} l$$

Information Acquisition Stage I/III

- expected utility of I given beliefs $\tilde{o}^I$ of market

$$u(a,\widetilde{a}) = \frac{o}{n}\left(\underbrace{(1-\pi+\pi\frac{a}{o})}_{\substack{\text{sell if impatient} \\ \text{or negatively informed}}} p(\widetilde{a},o) + \underbrace{\pi\frac{o-a}{o}}_{\substack{\text{keep if} \\ \text{positively informed}}} \frac{l}{o-a} \right) - k\cdot a$$

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$$\forall \hat{a} \in [0, o-l] : u(a^*,a^*) \geq u(\hat{a},a^*)$$

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Information Acquisition Stage II/III

- marginal net benefits of information acquisition

$$\frac{\partial u(a,\widetilde{a})}{\partial a} = \underbrace{\frac{\pi}{n}p(\widetilde{a},o)}_{\text{benefit}} - \underbrace{k}_{\text{cost}}$$

- $u(a,\widetilde{a})$ linear in a
- relation of k and $\frac{\pi}{n}p(\widetilde{a},o)$ determines sign

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$$\underset{a\in[0,o-l]}{\operatorname{argmax}}\, u(a,\widetilde{a}) = \begin{cases} 0 & \text{if} \quad p(\widetilde{a},o) < \frac{kn}{\pi} \\ [0,o-l] & \text{if} \quad p(\widetilde{a},o) = \frac{kn}{\pi} \\ o-l & \text{if} \quad p(\widetilde{a},o) > \frac{kn}{\pi} \end{cases} .$$

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Information Acquisition Stage III/III

- interior equilibrium:

$$\frac{kn}{\pi} = p(\widetilde{a}, o) \Leftrightarrow \widetilde{a}(o) = \frac{(1-\pi)}{\pi}\left[\frac{\pi l}{kn} - o\right]$$

Proposition 1

The equilibrium level of information acquisition a^* for given initial opacity o is

$$a^*(o) = \begin{cases} 0 & \text{if} \quad o \geq \bar{o} \\ \frac{(1-\pi)}{\pi}\left[\frac{\pi l}{kn} - o\right] & \text{if} \quad o \in (\underline{o}, \bar{o}) \\ o - l & \text{if} \quad o \leq \underline{o} \end{cases}$$

with $\underline{o} = \pi l + \frac{(1-\pi)\pi l}{kn}$ and $\bar{o} = \frac{\pi l}{kn}$ such that $\widetilde{a}(\underline{o}) = \underline{o} - l$ and $\widetilde{a}(\bar{o}) = 0$.

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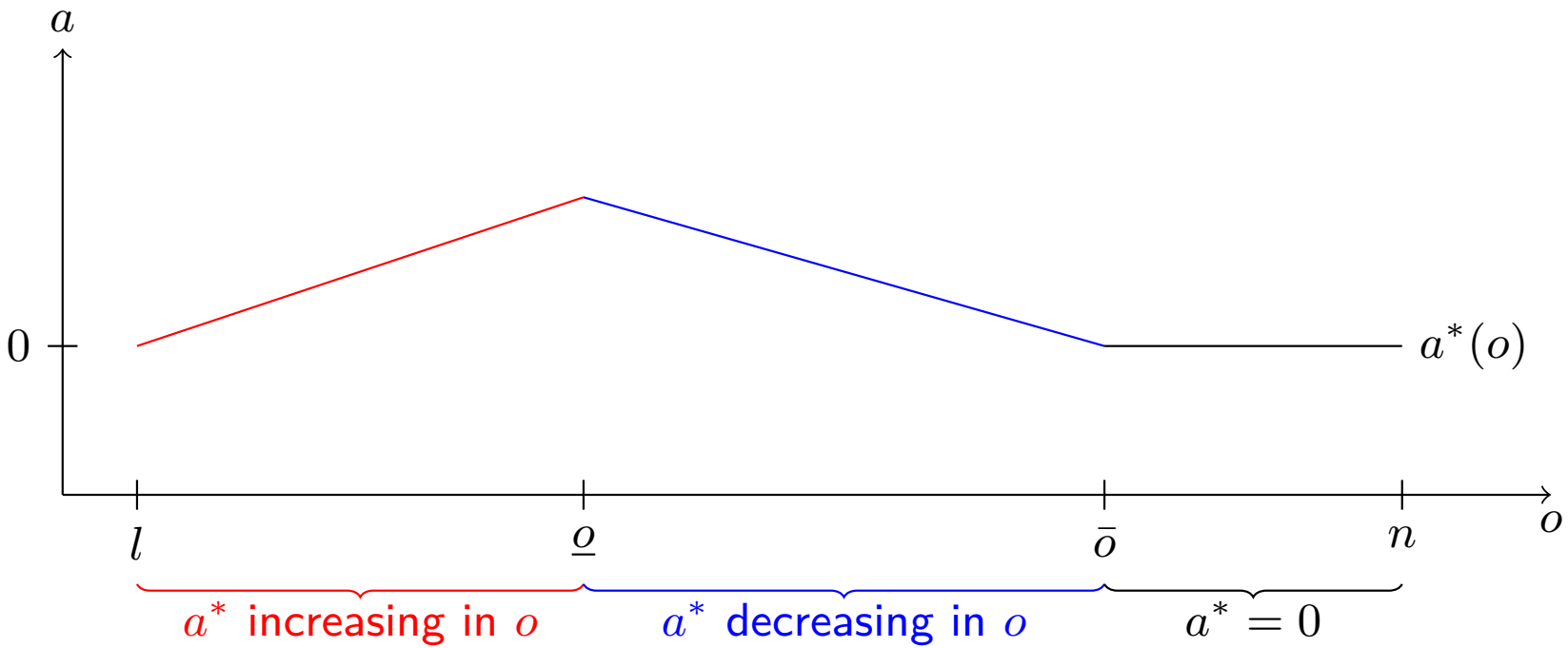
Equilibrium Information Acquisition



Optimal Opacity I/II

$$\text{Welfare: } W(o, a^*(o)) = \underbrace{u(a^*(o), a^*(o))}_{\text{exp. utility of } I} - \underbrace{k_o \cdot (n - o)}_{\text{costs of opacity reduction}}$$

$$= \frac{l}{n} - k \cdot a^*(o) - k_o \cdot (n - o).$$

- issuer extracts full rent from I, thus welfare maximizing o is optimal
- minimize total cost of information acquisition and opacity reduction

Optimal Opacity II/II

Proposition 2

The owner sells a completely opaque asset ($o^* = n$) if

(i) this deters information acquisition ($n \geq \overline{o}$), or

(ii) $k \cdot a^*(n) < k_o \cdot (n - l)$.

Otherwise, the owner chooses to sell a fully transparent asset ($o^* = l$).

- sell fully opaque asset if
  - → this deters information acquisition
  - → inducing information acquisition is cheaper than eliminating opacity

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Optimal Opacity and Welfare: Comments

- U-Shaped Welfare and resulting opacity choice robust to modifications of the model
  - → natural suggestion: investor first rules out 'cheap' states, i.e. those which are easy to analyze
  - → bank may respond to this by ruling out cheap states to raise investor's costs
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Model Variation

- l, o and n are fixed

$t = 0.0$: O chooses whether its x assets are correlated or uncorrelated

$t = 0.1$: O offers the asset pool to I

$t = 0.2$: I accepts or not

$t = 1.0$: I decides on (repeated) information acquisition

$t = 1.1$: the true state of the world s is revealed

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Information Acquisition Incentives

- uncorrelated asset pool
  - information about one asset does not apply to $x-1$ remaining assets
  - costs paid once, benefits incurred once; as baseline case
  - net benefits
$$\frac{\partial u^U(a,\tilde{a})}{\partial a} = \frac{\pi}{n} p(\tilde{a},o) - k$$
  - but information acquired for all x assets

- correlated asset pool
  - information about one asset also applies to $x-1$ remaining assets
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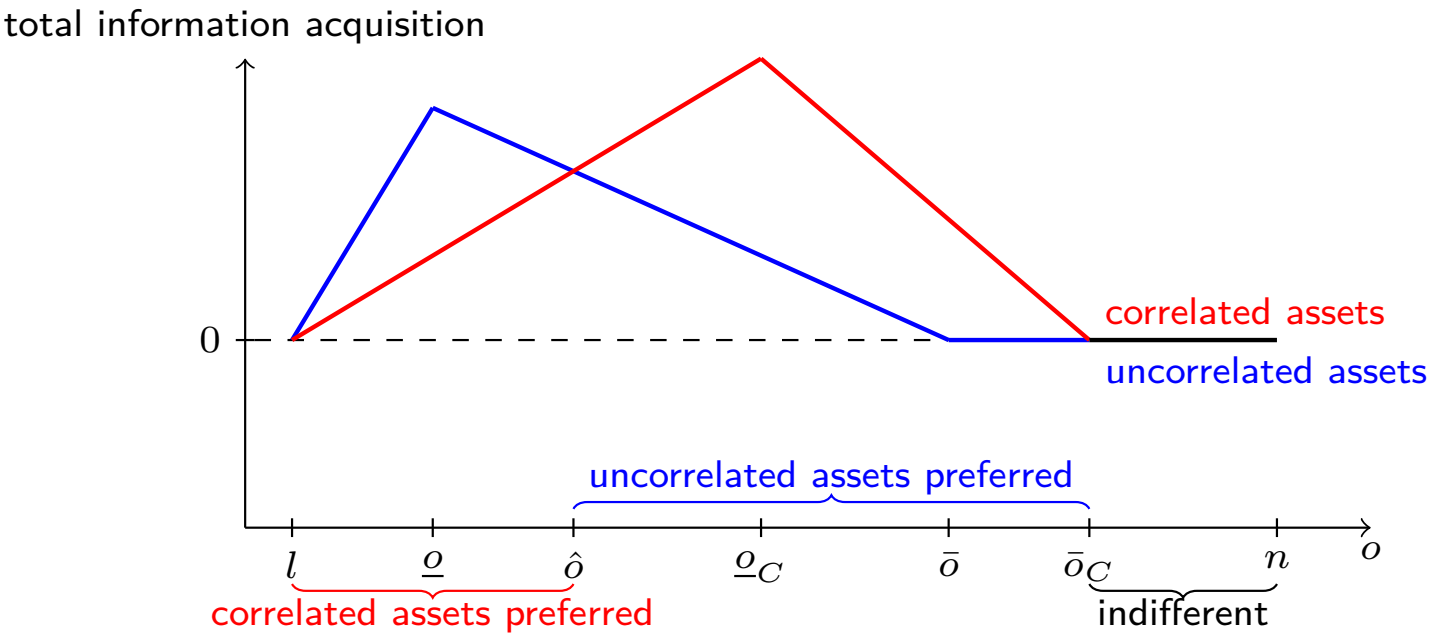
Total Information Acquisition

- incentives are stronger to acquire information for correlated assets

  $\rightarrow$ $\overline{o}_C > \overline{o}$, $\underline{o}_C > \underline{o}$



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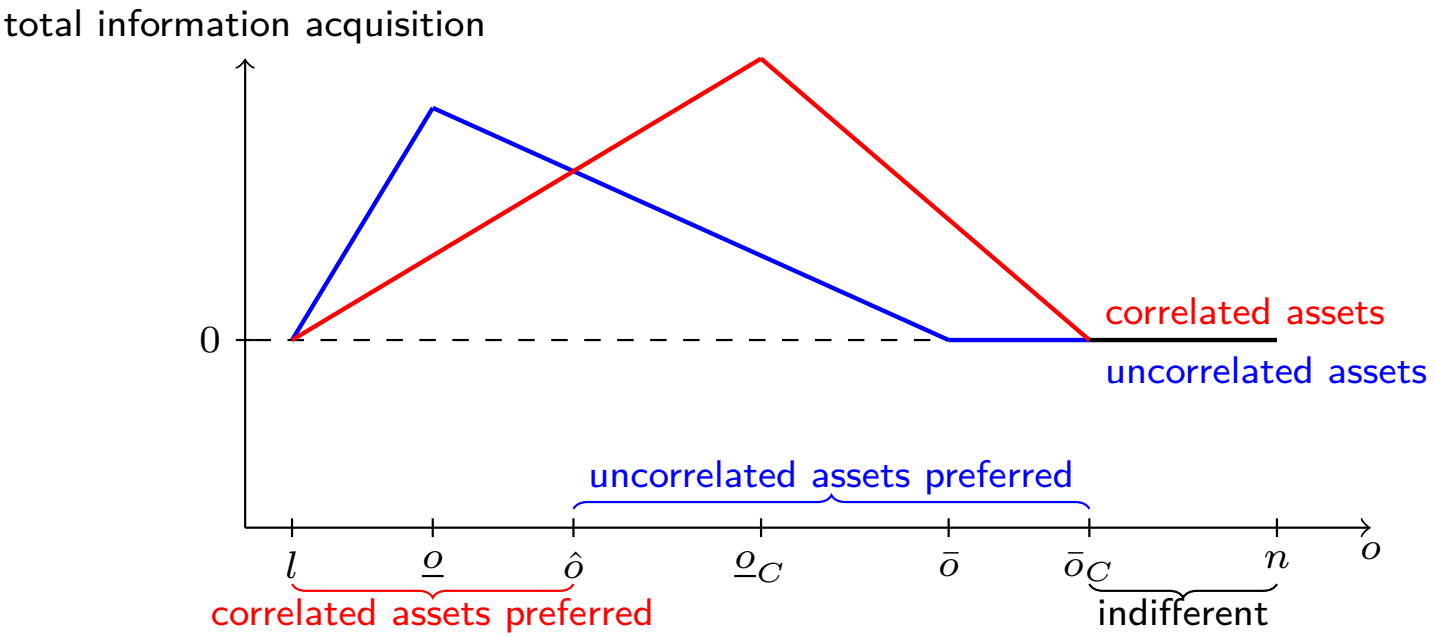

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Adverse Effects of Transparency Regulation

- suppose that high o has been chosen, which induces choice of uncorrelated assets and deters information acquisition

- regulation which fosters transparency may cause regime switch
  - $\rightarrow$ information acquisition can no longer be deterred
  - $\rightarrow$ correlated assets minimize extent of information acquisition
  - $\rightarrow$ potential negative externality (stability considerations)

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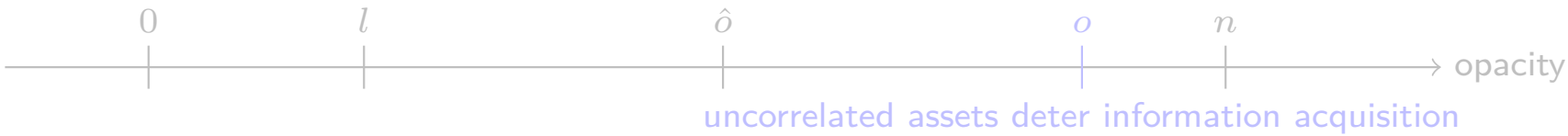

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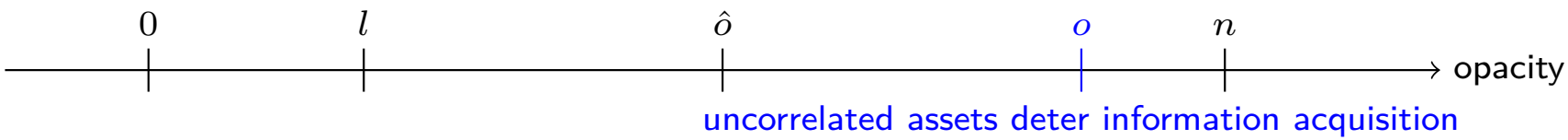

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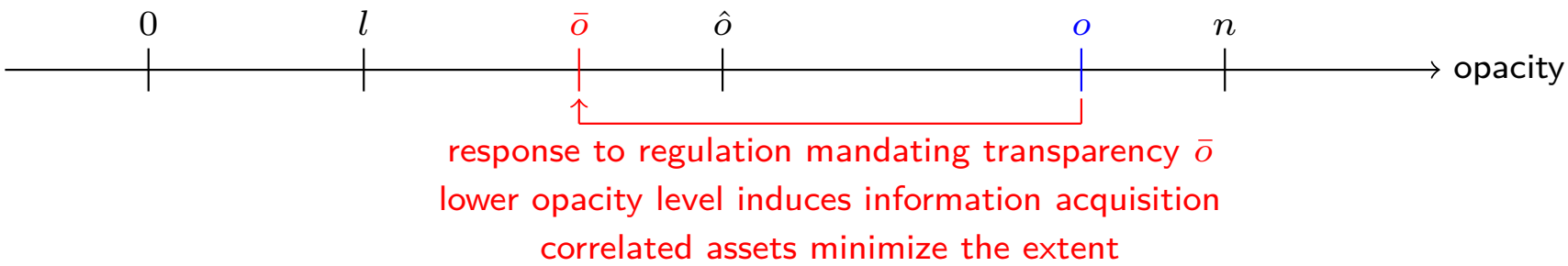

Conclusion

- developed tractable model where opacity is endogenously chosen by banks and information acquisition by investors sequential
  - → opacity can improve secondary market liquidity by avoiding costly information acquisition and hence adverse selection
  - → welfare may be increasing in opacity
  - → rationale for endogenous opacity
- used a variant of the model to analyze asset pool composition choices of banks
  - → correlated asset pool maximizes incentives to acquire information
  - → conditional on information acquisition occuring in equilibrium, correlated asset pool may minimize level of information acquisition
  - → regulation fostering transparency may have (adverse) consequence of regime-shifting: information acquisition can no longer be avoided; correlated risk is sourced and securitized

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Future Outlook

- relate theoretical predictions to empirical measures and test them
  - → opacity measures as in Morgan (AER 2002)
  - → liquidity measures as common in financial literature (e.g. spreads)
- Challenges:
  - → opacity is in fact endogenous
  - → isolation of liquidity from opacity is empirically nontrivial

Thank you for your attention and your input!

Robustness: Different Cost Structures

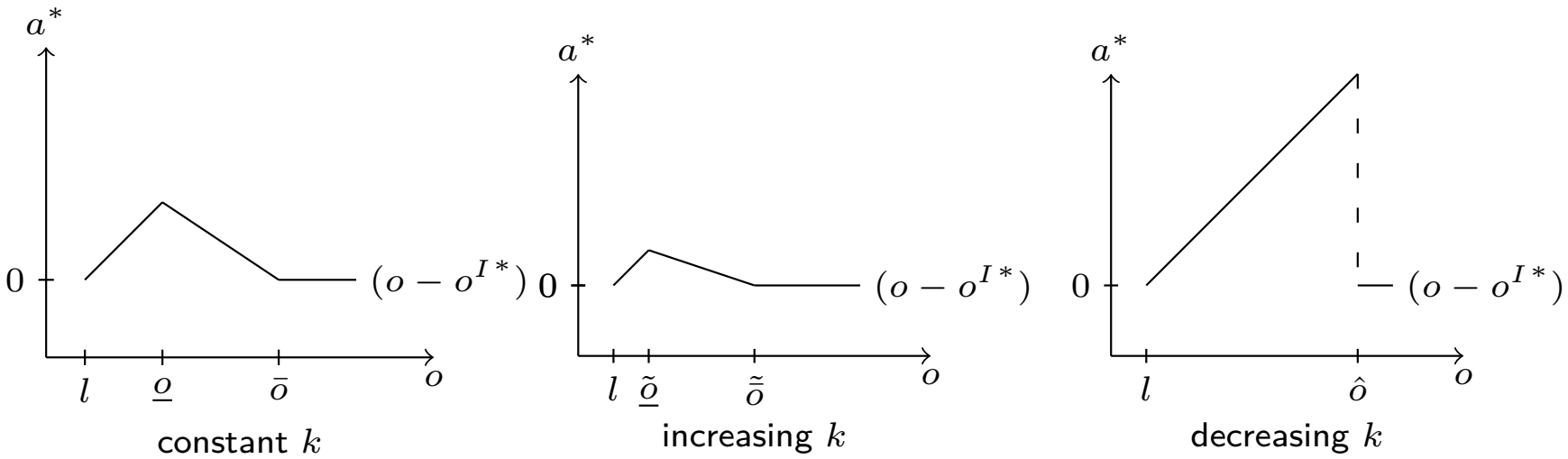

Figure: Information Acquisition as a Function of o