Distribution and Origination Incentives

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Motivation and introduction

- The years leading up to the crisis were characterized by several features:

  I. Progressive deterioration of mortgage underwriting standards

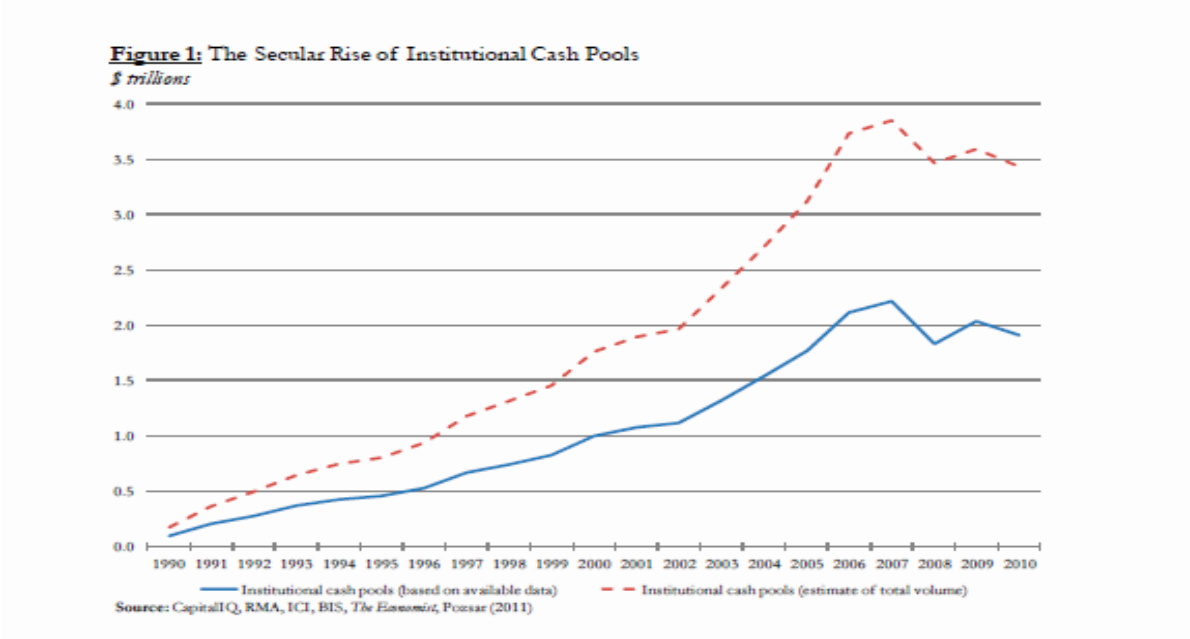
  II. Price compressions in tranches of different qualities, at least judging by the 2006 vintage ABX index.

  III. Leverage increase among intermediaries partially driven by repo transactions where the counterparties are agents such as money market funds.

- There are some narratives trying to make sense of these disparate facts but few, if any, formal treatments.

- Here we focus on a particular source of variation:
  - The growth of cash pools in the hands of investors seeking deposit-like instruments, safe and liquid and that the traditional banking system cannot supply.
    - Institutional cash pools: Corporates and mutual funds cash positions, securities lenders, ...
  - Growth of "uninformed funds:" These pools are not bundled with knowledge about, say, real estate risk.

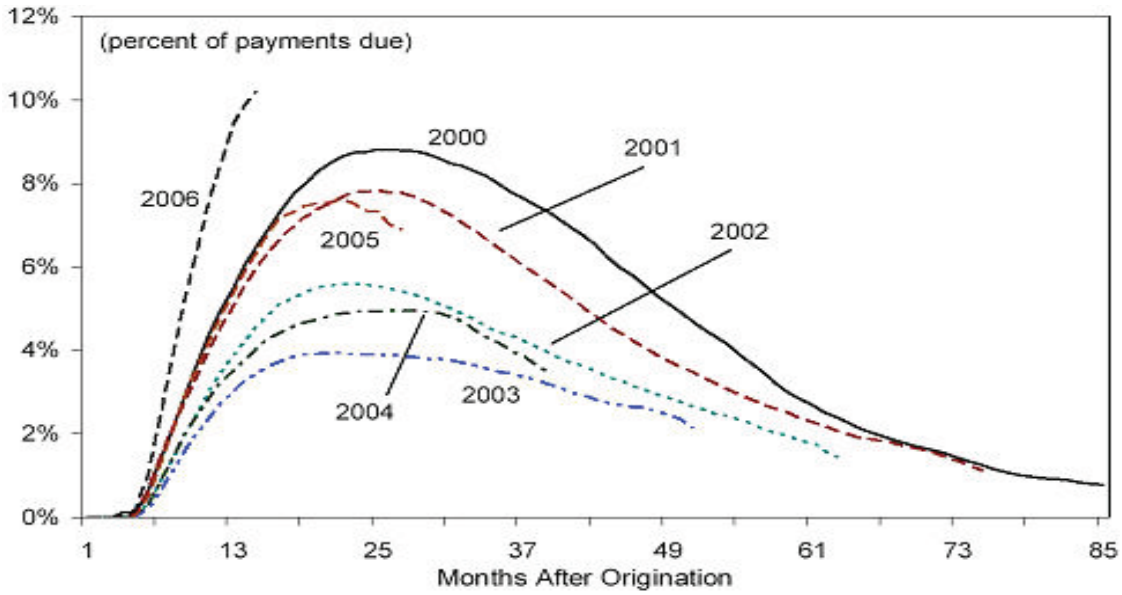
Figure 1: The secular rise of institutional cash-pools (Pozsar, 2011, Figure 1)



- Corporate cash, cash collateral for securities lenders, cash pools of long-term mutual funds (excluding MMMF), ...

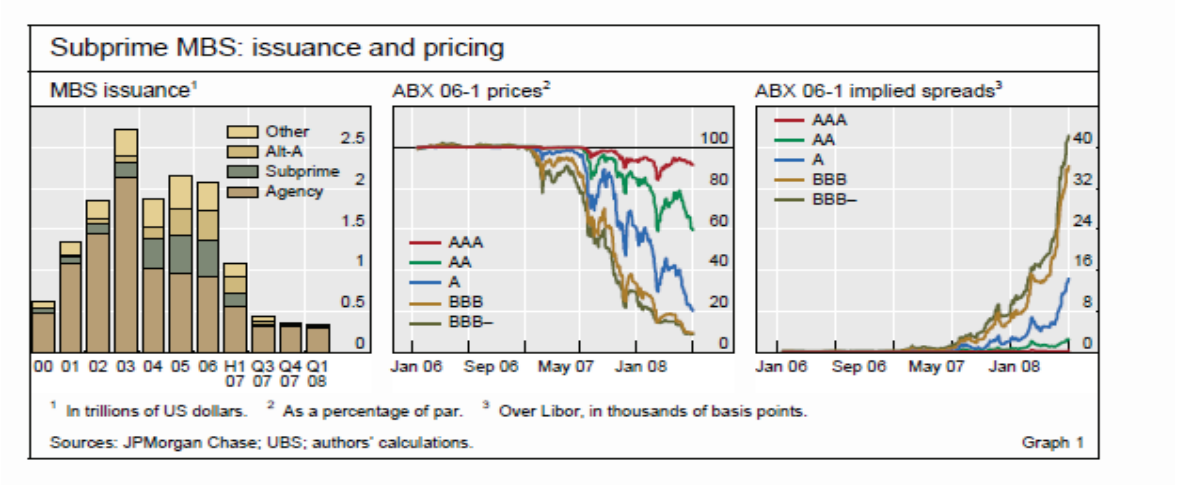
- Surveys indicate that over 90% of the cash pools are subject to written cash-policies, which safety of principal as the dominant consideration.

Figure 2: Percent of payments due after x of origination per year of vintage



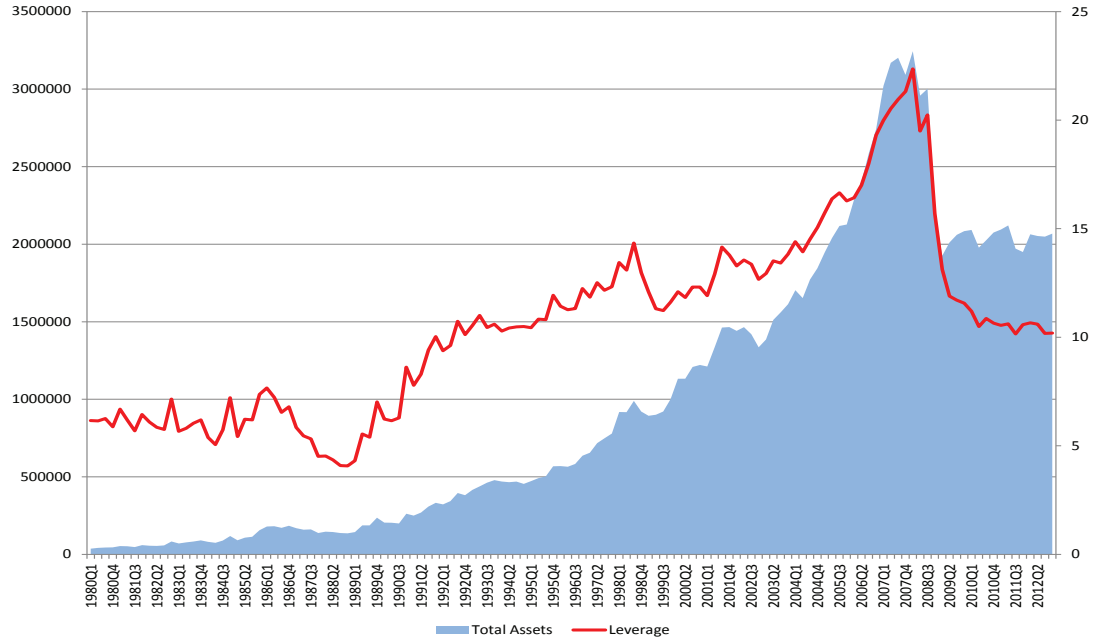
- Non linearities in quality: Mortgage vintages improved from 2001 to 2003 and then started deteriorating.

Figure 3: ABX 06-1: Prices as a percentage of par for the five different subindices (Source: Fender and Scheicher, 2008, Graph 1)



- ABX: Equally weighted portfolios of CDS referencing 20 subprime MBS.
- We are interested in the compression in the run-up to the crisis.

Figure 4: Securities broker dealer: Leverage (Total assets over equity) and Total Assets. Quarterly data: 1980Q1-2012Q4



- The above data is for broker dealer subsidiaries (not the holding companies)
  - Holding companies (and leverage can be constructed looking at the 10Ks) show a much milder increase in leverage.
- See Adrian and Shin (Journal of Financial Intermediation, 2010).

- Origination incentives and the joint distribution of knowledge and capital.
- The model has three ingredients:

  I. Endogenous origination quality: Moral hazard at origination.

  II. Rich market structure: Flows across different markets of funds and risks

  (A) "Uninformed exchange,"

  – Key feature: Cash-in-the-market pricing

  (B) "Private market,"

  (C) Markets for secured lending,

  III. Endogenous bundling of capital and leverage with knowledge

- In our model the growth of uninformed funds:

  I. Narrows price spreads across markets due to cash-in-the-market pricing

  II. which lowers the returns associated with uninformed trading.

  III. As a result some of the funds "spill over" to other markets:

    (A) Private markets: Markets for information

    (B) Repo markets: markets for collateralized lending

  IV. Non-monotonicity of origination incentives as a function of uninformed capital

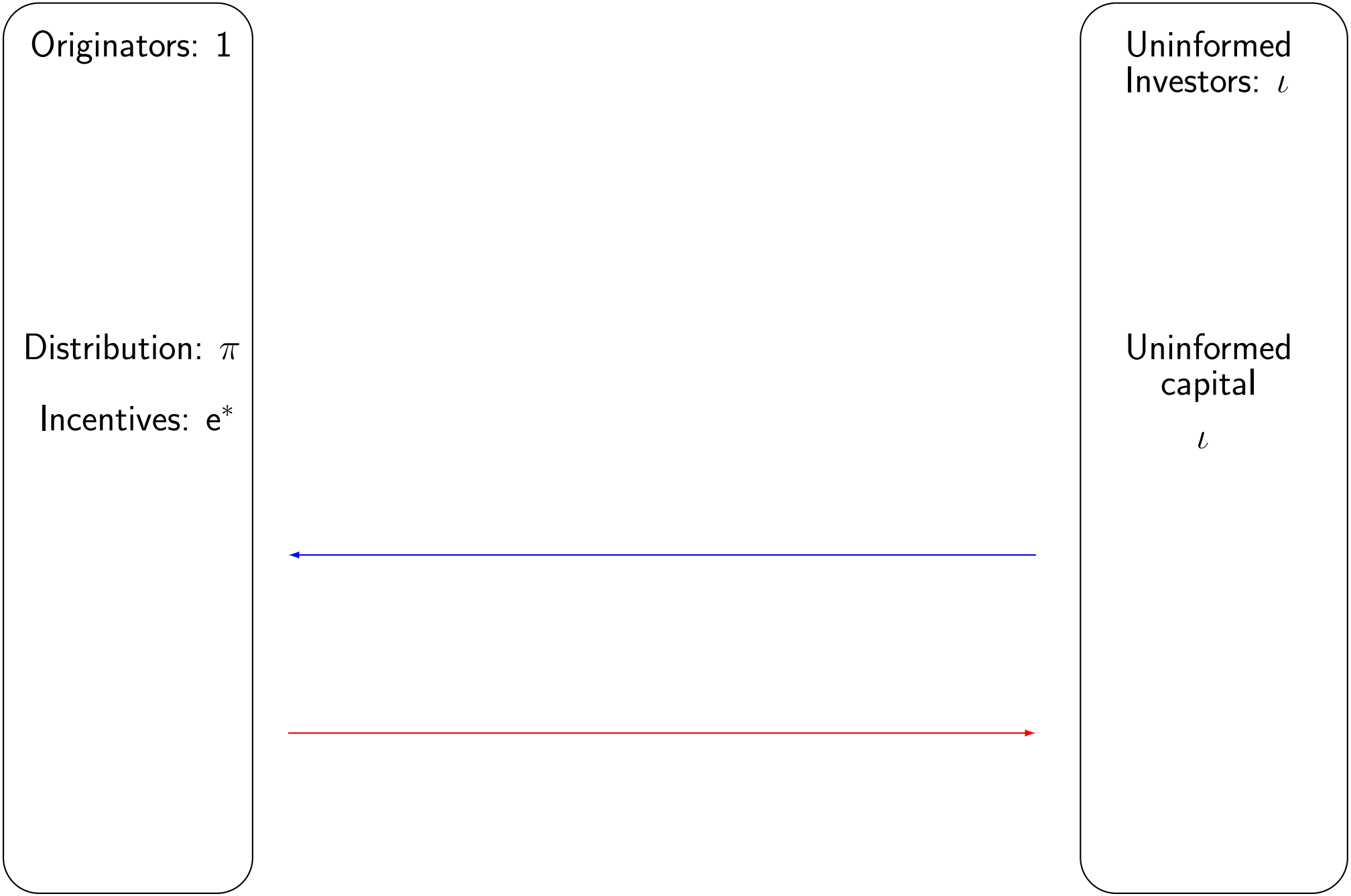
    (A) Incentives increase with informed capital

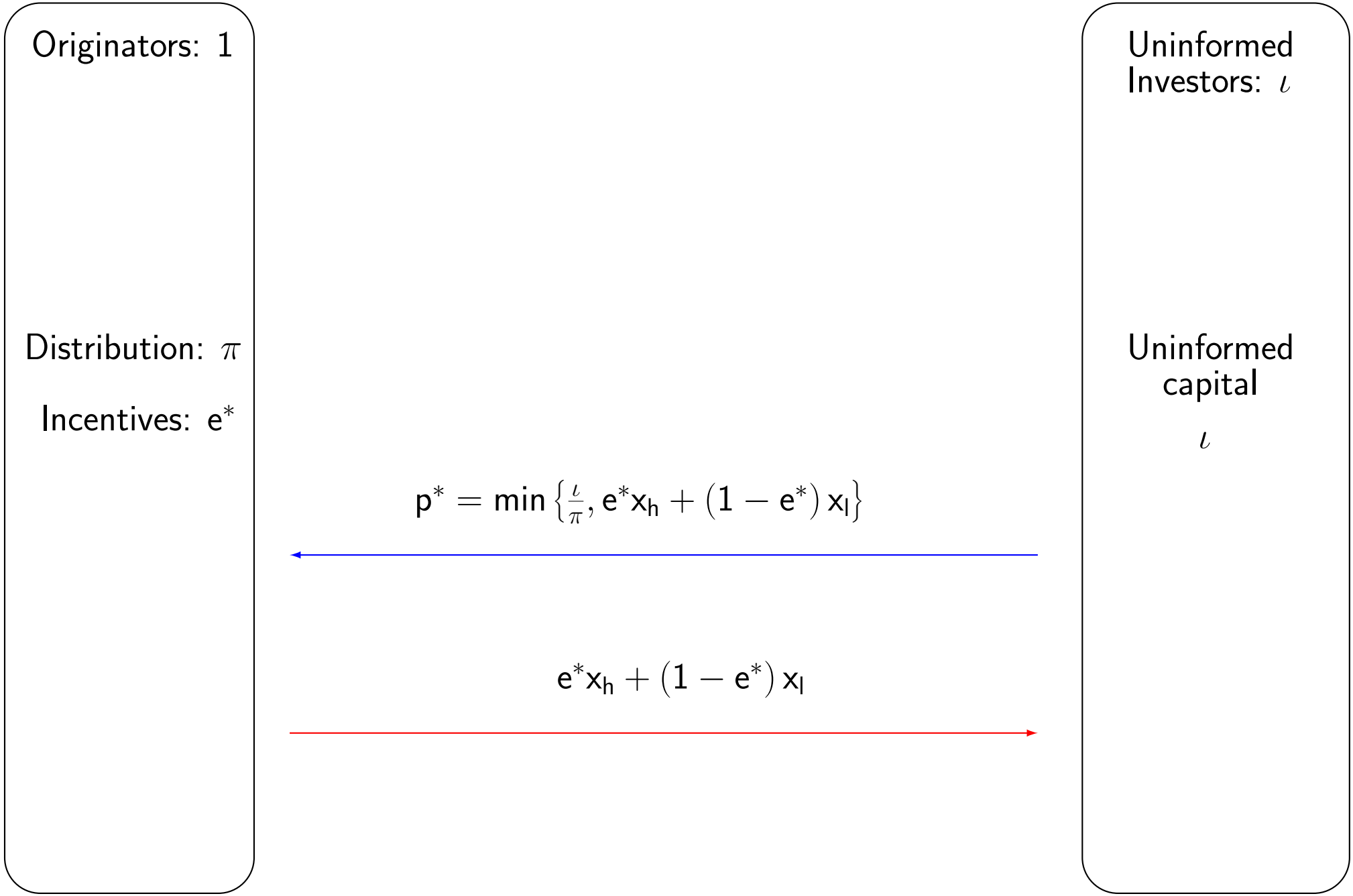
    (B) Incentives decrease as price spreads narrow

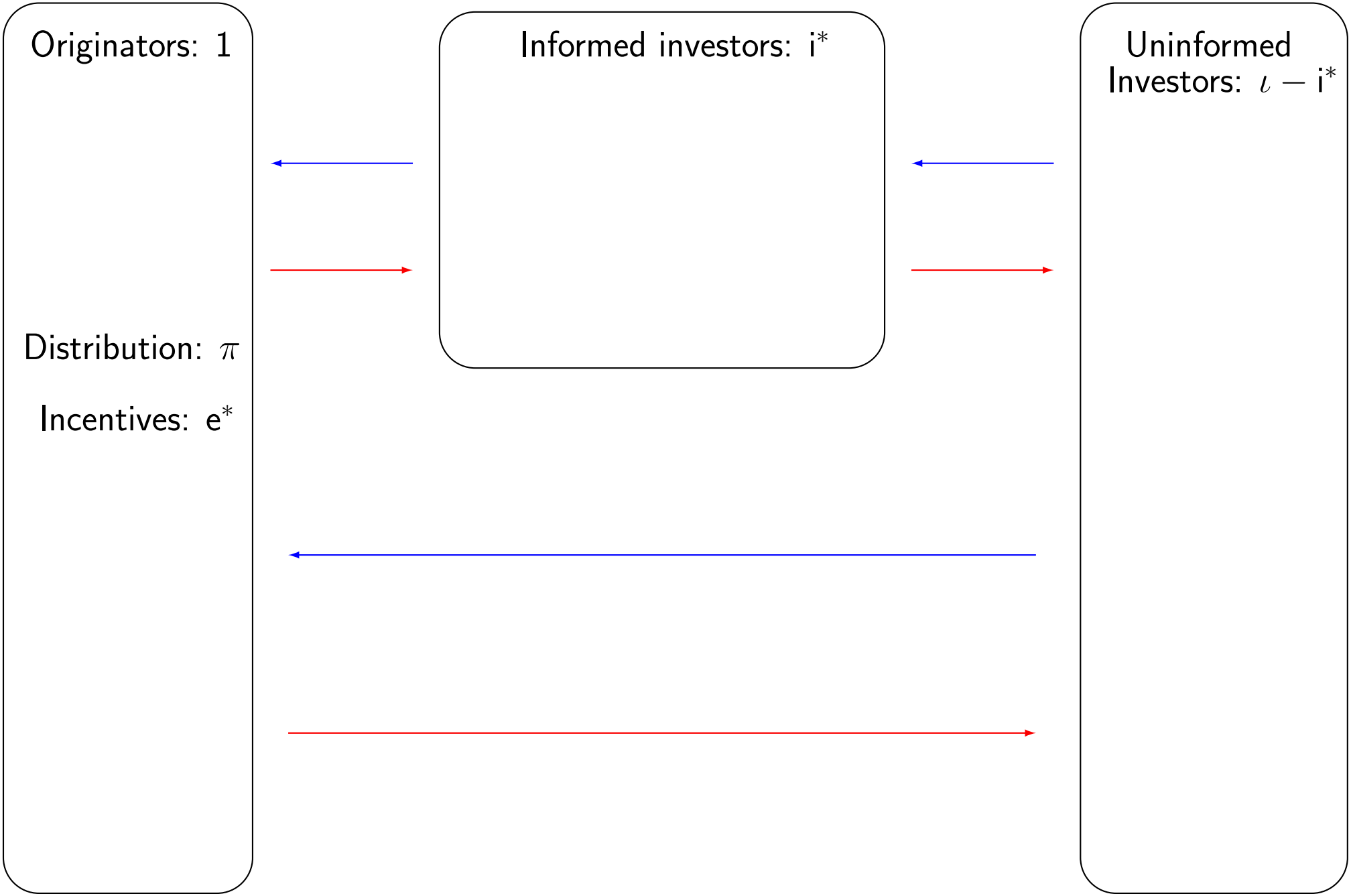
A simple model

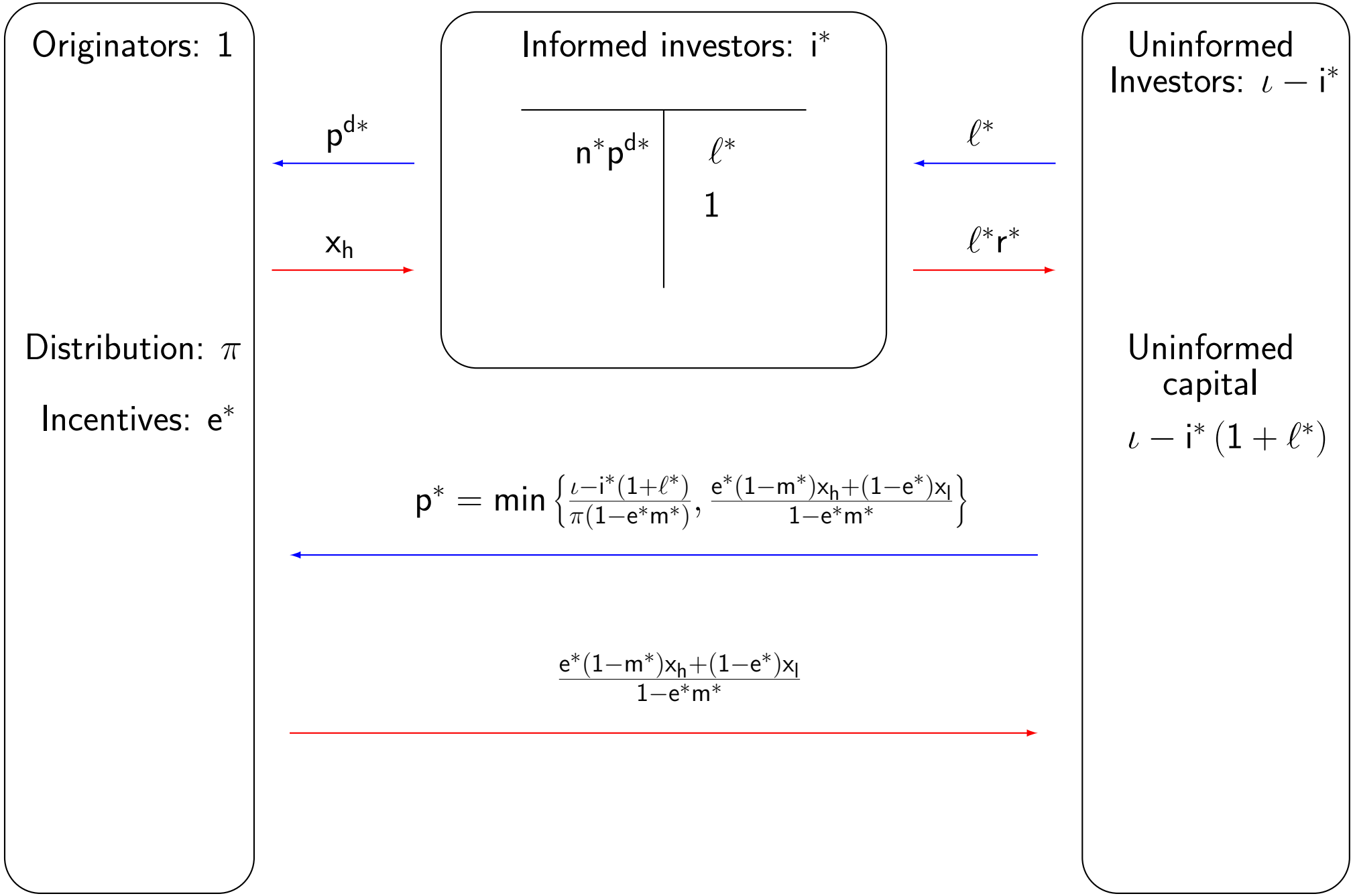
I. Timing: Three dates $t = 0, 1, 2$

- $t = 0$, origination and capital distribution across markets
- $t = 1$, distribution of originated assets
- $t = 2$ payoffs are realized.


Originators: 1
Distribution: π
Incentives: e^*
Uninformed Investors: ι
Uninformed capital
ι


Originators: 1
Distribution: π
Incentives: e^*
Uninformed Investors: ι
Uninformed capital
ι
$p^* = \min\left\{\frac{\iota}{\pi}, e^* x_h + (1 - e^*) x_l\right\}$
$e^* x_h + (1 - e^*) x_l$


Originators: 1
Informed investors: i*
Uninformed
Investors: ι − i*
Distribution: π
Incentives: e*


Originators: 1
Distribution: π
Incentives: e^*
Informed investors: i^*
$n^* p^{d*}$
ℓ^*
1
Uninformed Investors: $\iota - i^*$
Uninformed capital
$\iota - i^* (1 + \ell^*)$
p^{d*}
x_h
ℓ^*
$\ell^* r^*$
$p^* = \min \left\{ \frac{\iota - i^*(1+\ell^*)}{\pi(1-e^* m^*)}, \frac{e^*(1-m^*)x_h + (1-e^*)x_l}{1-e^* m^*} \right\}$
$\frac{e^*(1-m^*)x_h + (1-e^*)x_l}{1-e^* m^*}$

II. Agents

(A) Originators

- Unit measure of originators.
- Each originator can generate one and only one asset
- The quality of the asset can be high or low:
  - High quality asset that pays x_h at $t = 2$ with probability e or a low quality asset that pays $x_l < x_h$, with probability $1 - e$.
- Originators bear a private cost $\psi(e)$ of choosing a level of effort $e \in (0, 1)$.
  - $\psi(0) = 0$ and $\psi_e > 0$ and $\psi_{ee} \geq 0$.
  - The quality of the projects is independent across originators.

(B) Financial intermediaries

- ι: Measure of risk neutral financial intermediaries.

- Each intermediary i $\in [0, \iota]$ is endowed with
  - one unit of capital
  - and a technology to acquire information given by $\varphi(\mathrm{i})$ with $\varphi(0) \geq 0$ and $\varphi_{\mathrm{i}} > 0$.

- Intermediaries provide liquidity to originators at the interim stage and they can do so, as we will see, in either a public exchange or a private market.
  - It is access to this private market that entails incurring the cost $\varphi(\mathrm{i})$.
  - Finally intermediaries only consume at date t $= 2$.

III. Markets

(A) Private markets

- An intermediary $i \in [0, \iota]$ gains access to this market by paying the cost $\varphi(i)$
- They cream skim the best assets, those that pay x_h.
- Price in this market p^d: As in Bolton, Santos and Scheinkman (2012)

$$p^d = \kappa x_h + (1 - \kappa)p,$$

  where p is the price in the exchange.

- n: Number of good assets acquired by each of the intermediaries in the private market.
- Originators get matched to one informed intermediary with probability

$$m = \frac{in}{\pi e}$$

(B) Public markets or exchanges

- Uninformed intermediaries acquire risks in the exchange

- Quantity of good and bad projects flowing into the uninformed exchange

$$\mathcal{S}_{\mathsf{h}} = \pi \mathsf{e}\,(1 - \mathsf{m}) \qquad \text{and} \qquad \mathcal{S}_{\mathsf{l}} = \pi\,(1 - \mathsf{e}).$$

- The expected payoff of the assets traded in the exchange is given by

$$\mathsf{p}^{\max}\,(\mathsf{i}, \mathsf{e}, \mathsf{n}) = \frac{\mathcal{S}_{\mathsf{h}} \mathsf{x}_{\mathsf{h}} + \mathcal{S}_{\mathsf{l}} \mathsf{x}_{\mathsf{l}}}{\mathcal{S}}$$

$\mathcal{S}$: Supply of assets available to uninformed investors after cream skimming

$$\mathcal{S} = \pi\,(1 - \mathsf{em})$$

- *Cash-in-the-market pricing:*
  - The cash available to absorb asset sales in the uninformed exchange is

$$\iota - (1 + \ell)\,\mathsf{i}$$

    where ℓ is the amount borrowed by each of the informed intermediaries.
  - Total number of projects flowing to the exchange is given

$$\mathcal{S} = \pi\,(1 - \mathsf{em})$$

  - Cash-in-the-market prices, $\mathsf{p}^{\mathsf{cim}}$,

$$\mathsf{p}^{\mathsf{cim}} = \frac{\iota - (1 + \ell)\,\mathsf{i}}{\pi\,(1 - \mathsf{em})}$$

- Thus the equilibrium price in the exchange is:

$$\mathsf{p} = \min\left\{\mathsf{p}^{\mathsf{cim}}, \mathsf{p}^{\max}\right\}$$

(C) Markets for secured lending

- Intermediaries in the uninformed exchange can lend to those in private markets against collateral.

- ℓ the amount borrowed by each of the intermediaries present in private markets. Leverage constraint is:

$$(1-\eta)\,\mathsf{np} \geq \ell, \qquad \text{with} \qquad \eta \in (0,1)$$

- The balance sheet of the intermediaries in private markets is:

$$\mathsf{np}^{\mathsf{d}} = 1 + \ell.$$

- Combining these two expressions:

$$\ell = \frac{(1-\eta)\,\mathsf{p}}{\mathsf{p}^{\mathsf{d}} - (1-\eta)\,\mathsf{p}} \qquad \text{and} \qquad \mathsf{n} = \frac{1}{\mathsf{p}^{\mathsf{d}} - (1-\eta)\,\mathsf{p}}$$

Payoffs and definition of equilibrium

I. Payoffs

(A) Originators: Choice variable: e

$$U^{e}(e|i) = -\psi(e) + \pi\left[emp^{d} + (1 - em)\, p\right] + (1 - \pi)\left(ex_{h} + (1 - e)x_{l}\right)$$

- Interpretation of π: Skin in the game: Extent of distribution

(B) Financial intermediaries: Choice variables: Information acquisition, ℓ and n.

$$V(\tilde{i}) = \begin{cases} r & \text{if} \quad \text{trading in the uninformed exchange} \\ -\varphi(\tilde{i}) + R + \ell(R - r) & \text{if} \quad \text{trading in the private market} \end{cases}$$

where

$$R = \frac{x_{h}}{p^{d}} \qquad \text{and} \qquad r = \frac{e(1 - m)\, x_{h} + (1 - e)\, x_{l}}{p(1 - em)}$$

II. Definition of equilibrium

- A measure of intermediaries present in private markets, i^*,
- an effort action, e^*,
- a leverage ratio, ℓ^*,
- a number of good assets bought by each intermediary present in private markets, n^*,
- prices, p^{d*} and p^*, (and thus returns R^* and interest rates r^*)

such that agents maximize and markets clear.

III. Comparative statics

- Comparative statics with respect to the measure of intermediaries ι: $e^*_\iota = \frac{\partial e^*}{\partial \iota}$

The effect of the pool of uninformed funds, ι, on the measure of informed capital i^*

- Marginal informed intermediary: Indifferent between trading in the exchange or in the private market:

$$r^* = -\varphi(i^*) + R^* + \ell^*(R^* - r^*) \tag{1}$$

- We are interested in

$$\frac{\partial i^*}{\partial \iota} = \frac{\frac{\partial \ell^*}{\partial \iota}(R^* - r^*) + (1 + \ell^*)\frac{\partial}{\partial \iota}(R^* - r^*)}{\varphi_i}$$

- Given that $\varphi_i > 0$ and that under some conditions

$$\frac{\partial \ell^*}{\partial \iota} > 0 \qquad \text{and} \qquad \frac{\partial}{\partial \iota}(R^* - r^*),$$

an increase in an uninformed funds increases the amount of informed capital.

The effect of the pool of uninformed funds, ι, on originations incentives, e^*

- Consider the first order condition for effort:

$$\psi_e(e^*) = \pi m^* \left(p^{d*} - p^*\right) + (1-\pi)(x_h - x_l)$$

- Then the effort as a function of the measure of intermediaries ι is such that

$$e_\iota = \frac{\partial e^*}{\partial \iota} \propto \frac{m_\iota^* \left(p^{d*} - p^*\right) + m^* \left(p_\iota^{d*} - p_\iota^*\right)}{\psi_{ee}(e^*)}$$

- Under some conditions one can show that

$$m_\iota^* > 0 \qquad \text{and} \qquad p_\iota^{d*} - p_\iota^* < 0$$

- Thus the increase in the size of the funds of uninformed investors has an ambiguous effect on the incentives to originate good assets.

Example 1

- Assume that $x_l = 0$ and

$$\varphi(i) = \begin{cases} 0 & \text{if} \quad i \leq \mu < \iota \\ +\infty & \text{if} \quad \mu < i \leq \iota \end{cases}$$

- Under parametric conditions, there exists $\underline{\iota} < \bar{\iota}$ such that

  - For $\iota = \underline{\iota}$, $i^* = 0$, $e^* = e_{min}$, $m^* = 0$ and $p^* = \frac{\iota}{\pi}$.

  - For $\underline{\iota} < \iota \leq \bar{\iota}$, $i^* \in (0, \mu)$ and $i^*(\bar{\iota}) = \mu$ and $e^*_\iota > 0$, $m^* > 0$, $p^*_\iota > 0$ and $\ell_\iota > 0$

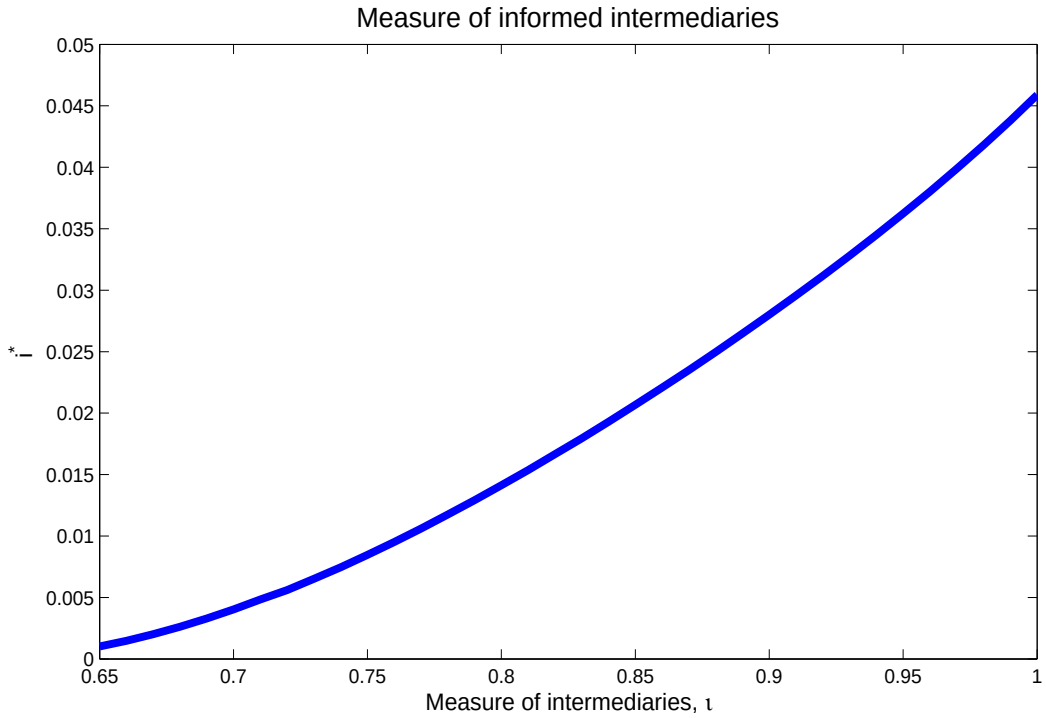
  - For $\bar{\iota} < \iota$, $i^* = \mu$, $e^*_\iota < 0$, $m^* > 0$, $p^*_\iota > 0$ and $\ell_\iota > 0$

- In words
  - When the level of funds is low ($\underline{\iota}$) effort is at the minimum level
  - As funds increase informed capital starts flowing into private exchanges, which in turn provides incentives for good origination. Prices in the uninformed exchange increase and so does the leverage of informed investor.
  - There is a threshold above which all agents who can acquire information are already present in private markets: No more possibilities of informed capital though leverage still increases. After this threshold is crossed incentives for good origination start deteriorating again.
  - These effects are robust to any level of inside equity $\pi \in (0, 1)$
  - Is this just the fact that the maximum level of informed capital is finite? No

Example 2

- Consider the following parametric assumptions
  - First,
$$\pi = 1 \qquad \eta = .5 \qquad \kappa = .1,$$
  - The effort function is given by
$$\psi(\mathsf{e}) = \frac{\theta}{2}\mathsf{e}^2 \quad \text{with} \quad \theta = .01$$
  - The costs of becoming informed are given by
$$\varphi(\mathsf{i}) = .05 + \beta\mathsf{i} \quad \text{for} \quad \mathsf{i} \in [0, \iota] \quad \text{with} \quad \beta = 1.75$$
- $\pi = 1$: "Originate-and-distribute" economy
- Range $\iota \in [.65, 1]$.

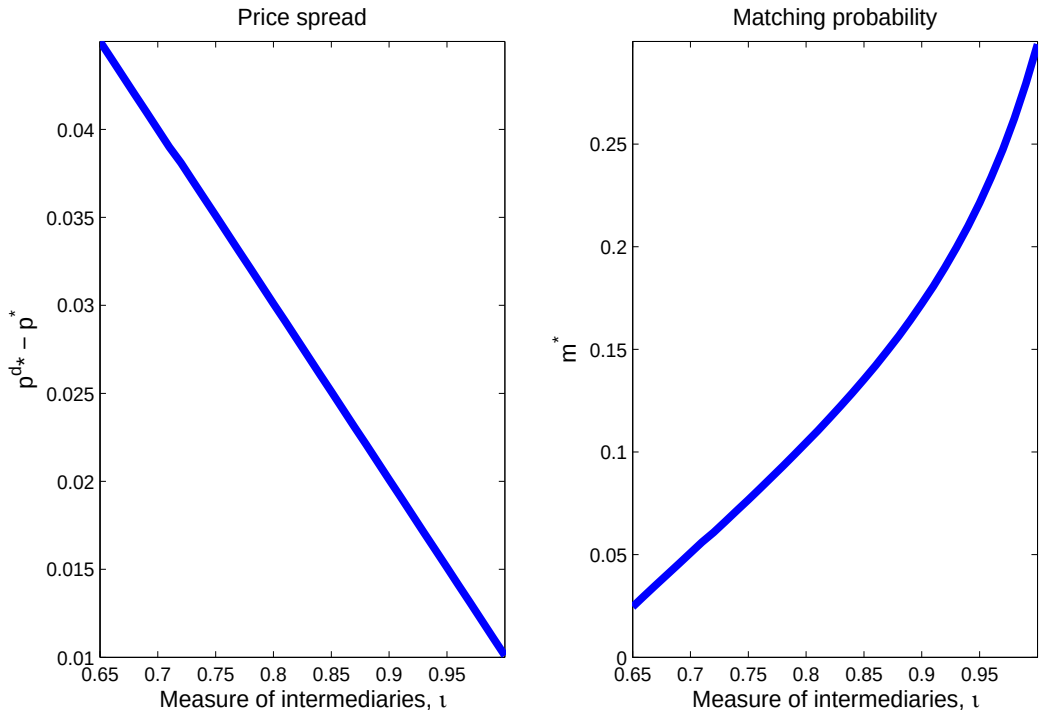
Figure 5: As ι increases so does the measure of informed intermediaries, i^*



- As the measure of uninformed intermediaries increase, more of those with better information acquisition technologies migrate to private markets.

- And thus the amount of *informed capital* increases:
  - As a result the fraction of good risks funded with informed capital increases.

Figure 6: The determinants of origination incentives as a function of the measure of intermediaries, ι



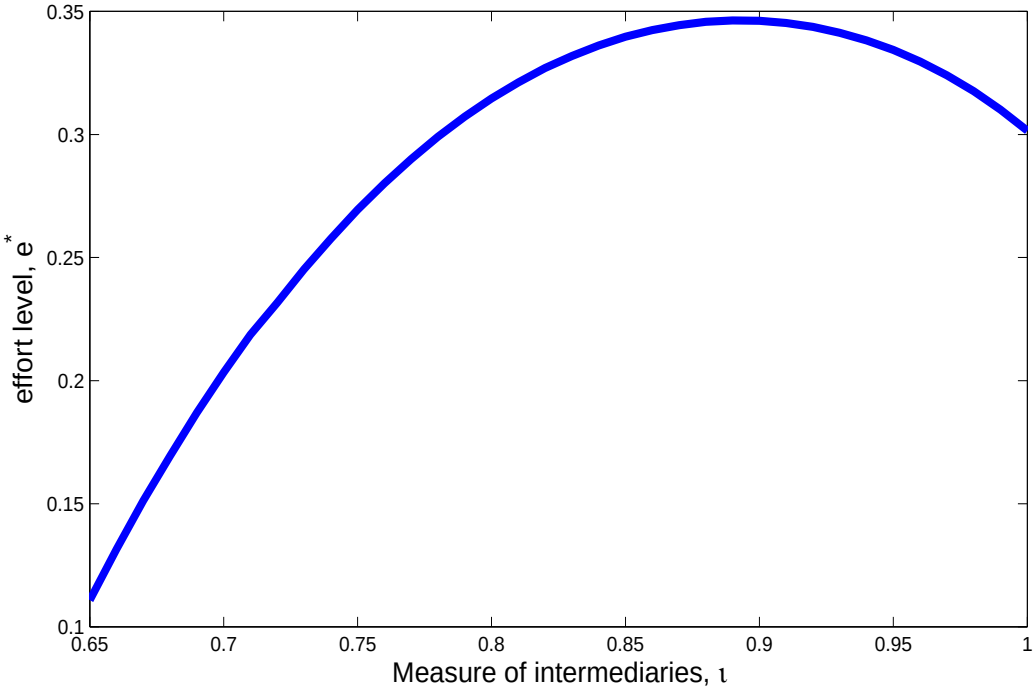
- First order condition for effort:

$$\psi_e = \pi m \left(p^d - p\right) + (1 - \pi)\left(x_h - x_l\right)$$

- ι affects both the price spread $p^{d*} - p^*$ and the matching probability m^*

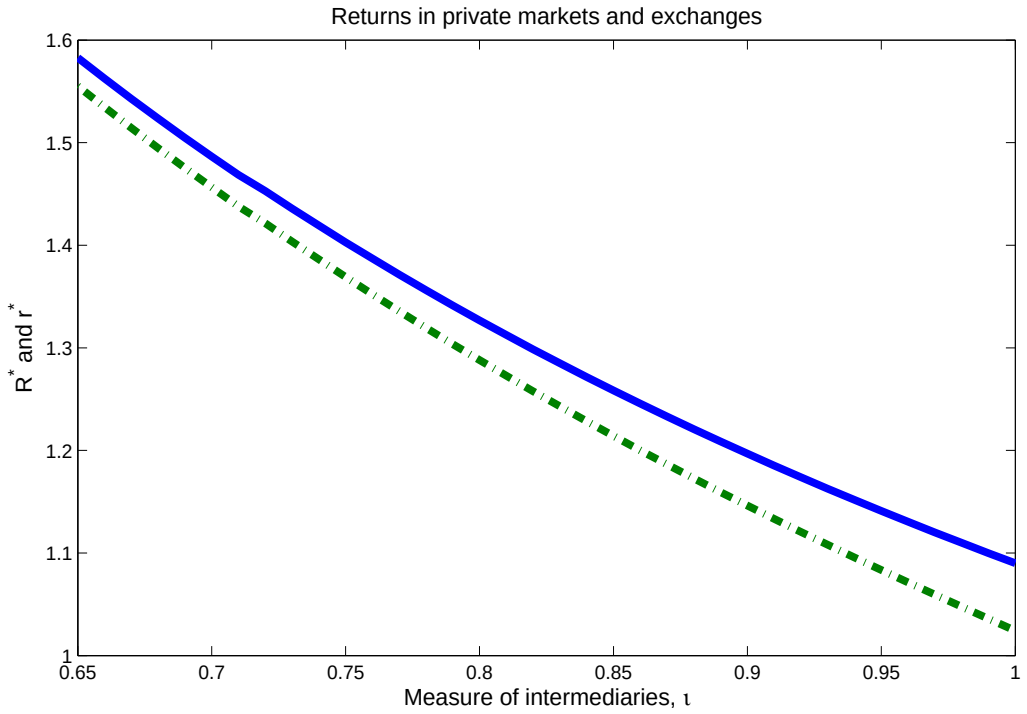
$$\Uparrow \iota \quad \Rightarrow \quad \Downarrow p^{d*} - p^* \qquad \text{and} \qquad \Uparrow \iota \quad \Rightarrow \quad \Uparrow m^*$$

Figure 7: Origination: Equilibrium level of effort, e^* as a function of the measure of intermediaries, ι



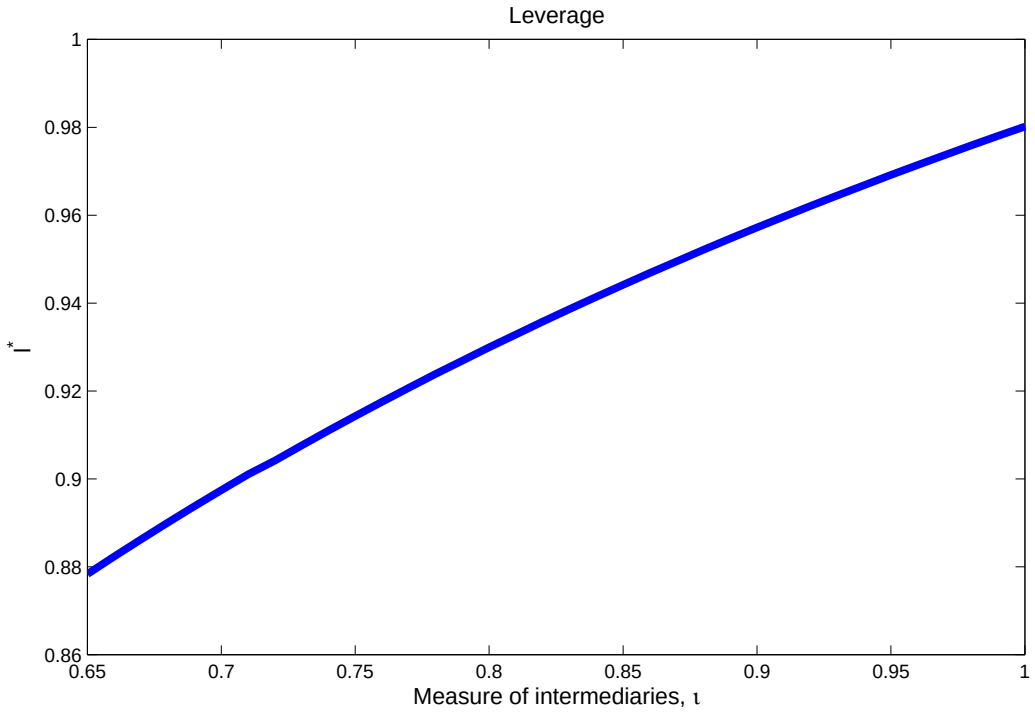
- Incentives for good origination improve initially as the level of informed capital increases only to diminish once the price improvement relative to the price in the exchange is sufficiently low.

Figure 8: Returns in private, R^*, and public markets, r^* (dashed line)



- As the measure of intermediaries increase rates of return drop throughout markets.
- The spread though increases: The rate in private markets R^* drops at a slower rate than the risk free rate r^*.
- This results in an increase in leverage.

Figure 9: Uninformed capital and the increase in leverage



- As the level of uninformed capital increases more of this capital finds its way to informed agents through leverage

Extensions and discussion

- Discount shocks and origination incentives
  - Price in the uninformed exchange: $p = E\left[\text{Expected payoff}\right] - \lambda \times \text{Risk}$
- Quality of information: Agents observe a signal s

$$\text{prob}\left(s = s_j | x = x_j\right) = \delta \in \left(\frac{1}{2}, 1\right) \quad \text{with} \quad j \in \{l, h\}$$

  - Leverage, imperfect information and informed intermediary distress
- Quantities
  - In the model, the quantity of originated assets is fixed: How does the quantity of originated assets depend on the growth of uninformed pools?

Conclusions

- An increase in the funds of uninformed investors:

  I. Increases uninformed prices and depresses price spreads

  II. pushing efficient intermediaries to private markets

  III. which first increases incentives for origination but, eventually, incentives deteriorate.

  IV. Simultaneously interest rates drop and repo transactions, as well as leverage, increase.

- Thus the model can help rationalize several features of the data apparent in the last cycle.

- The question though still remains: Origins of the growth of uninformed pools?