Cream Skimming in Financial Markets

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How do I respond to a congressman who asks if the financial sector in the United States is so important that it generates 40% of all the profits in the country, 40%, after all of the bonuses and pay? Is that a reflection of all your financial innovation, or is it just a reflection of how much you pay? What about the effect of incentives on all our best young talent, particularly of a numerical kind, in the United States?
Wages in the financial sector relative to non farm private sector (Philippon and Reshef)
Three further motivating observations

• Philippon and Reshef (2008) and Phillipon (2011, 2012)

Financial industry accounts for increasing share of GDP even after controlling for exports
  • Growth accelerates after 1980

Growth accompanied by a substantial increase of spending in IT

In retail there is a similar increase in spending in IT but accompanied by a decrease of share of GDP
Finance and IT

Source: Th. Philippon: “Finance vs. Walmart: Why are Financial services so expensive?”
Retail and IT
Growth of financial industry

- Is the financial industry extracting too much rent?
  - Is it attracting too much talent?
- Growth in remuneration in finance industry has taken place in investment banking, derivatives, OTC trading...
  - Relatively opaque markets where information is particularly valuable.
- In model, financial markets segmented into two broad types
  - Organized, standardized transparent markets (exchanges)
  - Opaque markets where informed (talented) dealers provide “bespoke” services (OTC)
  - Emphasis on distinguishing the information flow in OTC vs. exchanges
  - Nothing to add to mechanics of OTC markets.
Elements of the model

- Some agents choose becoming (OTC) dealers or entrepreneurs.
- Entrepreneur’s projects can be good or bad.
  - Partially depends on effort.
- Agents subject to liquidity shocks and distressed entrepreneur will, in equilibrium, sell her project.
- Dealers invest in information technology and can identify good projects.
- Entrepreneurs can sell projects to OTC dealers or in a competitive market to uninformed investors.
  - In extension, allow for the presence of informed traders in exchange.
- OTC price is determined by bargaining and entrepreneur’s threat point is the price in the exchange.
Elements of the model

- Each transaction in OTC market is bilateral and information is not transmitted through prices. (compare with Grossman and Stiglitz)
- Presence of dealers may induce entrepreneurs to make efficient amount of effort.
- However dealers *cream-skim* and reduce the quality of the average project in the uninformed market.
- Lowers threat point of entrepreneurs.
Summary of results

- When it is optimal for dealers to exist (to provide incentives), then all equilibria are generically inefficient and in an equilibrium in which incentives are effective, there are (generically) too many dealers.

- If an increase in the number of dealers has a small effect on their bargaining power, the entry of an additional dealer increases dealers’ wages.

- There are too many dealers and their wages are too high.

- If informed traders are present in the exchange, there are too many dealers relative to informed trader in any equilibrium in which informed traders and dealers coexists.
Examples

• Allegory
  • Forwards vs. Futures
    • commodity producers
  • Private placements....
Literature

- Literature on the mechanics of OTC (search based, Duffie et al.)
- Murphy, Shleiffer and Vishny (1991)
- Philippon (2008), entrepreneurs have project with higher social than private value.
- Glode et al. (2010)
  - Investment in information as a way to strengthen a party’s bargaining power
- Lagos et al. (2010) a model of OTC markets with some common elements with ours, but focus on liquidity.
The model: Agents

- \( t = 0, 1, 2 \), an investment phase, a period where liquidity shocks occur, and one where payoffs are realized.
- Type 1 agents have endowment \((0, 1, 0)\) and utility function \( u(c_1, c_2) = c_1 + c_2 \).
  - Supply liquidity in exchange. Many type 1 agents
- A unit interval of type 2 agents with endowment \((1, 0, 0)\) and utility function \( u(c_1, c_2) = \delta c_1 + (1 - \delta) c_2 \), where \( \delta \in \{0, 1\} \) is i.i.d. across agents and \( \Pr(\delta = 1) = \pi \). Agents learn their realization of \( \delta \) at \( t = 1 \).
- Agents can save their endowment.
- Agent of type 2 choose at time \( t = 0 \) to become an entrepreneur or dealer.
  - In generalization also an informed trader
The model: Entrepreneurs

- Entrepreneur keeps endowment or invest in indivisible project with payoff (at $t = 2$) of either $\rho > 0$ or $\gamma \rho$, $\gamma > 1$. Probability project yields $\gamma \rho$ is $a \in (0, 1)$
- $a = a_h$ if entrepreneur exerts high effort at (utility, private) cost $\psi$. Otherwise $a = a_\ell < a_h$
- Parameters so that investing is always better and,

\[(\gamma - 1)\rho(a_h - a_\ell) \equiv (\gamma - 1)\rho \Delta a > \psi.\]

- Impatient entrepreneurs may sell their project to a patient type 2 that chose not to invest on project and if unsuccessful in an exchange at a uniform price.
- Collateral value of project is $\rho$.
- At time 1, entrepreneur only knows her $a$. 

The model: Dealers

- Occupational choice is exclusive. Dealers do not initiate projects and save period zero endowment.
- Agent $d \in [0, 1]$ has (utility) non-decreasing cost $\varphi(d)$ of learning to identify good projects. $\varphi(d) = \infty$, if $d \geq \bar{d}$.
- If $d' < d''$, and $d''$ chooses to become a dealer (rather than entrepreneur) then $d'$ would also make same choice.
- Let $\hat{d} < \bar{d}$ be the measure of dealers.
- Dealers can only supervise a single project
  - Capital constraint and unobservability of output.
- In current research treat leverage from type 1.
  - Type 1 risk-averse or cash in market pricing.
- Assume there are too many good projects relative to the measure of dealers. ($\bar{d}$ is small)
• We will examine equilibria in which all entrepreneur choose same effort $a$.
• Show that in equilibrium only entrepreneurs in distress put projects for sale.
• Entrepreneurs in distress with good projects (those that pay $\gamma \rho$) are randomly matched to informed dealers not in distress with probability

$$m(a, \hat{d}) = \frac{\hat{d}(1 - \pi)}{a(1 - \hat{d})\pi} \in (0, 1).$$

• This captures the fact that dealers have superior information that allows them to locate good projects, the only ones that attract dealers.
OTC markets

- Nothing novel to say about how matching is done.
  - Board and Maeyter-ter-Vehn (2011) in a job-search context
- Let $p$ be the price in the competitive exchange.
- Price in OTC given by asymmetric Nash bargaining solution where dealer’s threat point is endowment and of entrepreneur is $p$ and $0 < \kappa < 1$ is entrepreneur’s bargaining power.
  - 
    $$p^d = \arg \max_{s \in [p, \gamma \rho]} \left\{ (s - p)^\kappa (\gamma \rho - s)^{(1 - \kappa)} \right\},$$

  $$p^d = \kappa \gamma \rho + (1 - \kappa) p.$$ 
- Later show main result holds when $\kappa = \kappa(d)$, $\kappa' > 0.$
OTC markets

- Binmore, Rubinstein and Wolinsky (1986) provide extensive form justification of asymmetric Nash solution using probability that other party will abandon bargaining.
  - Dealer more likely to find another entrepreneur than entrepreneur finding another dealer, justifying small $\kappa$.
- Also assumption on parameters that guarantee that $p^d - 1 < \rho$, so dealers may borrow from type 1 agents enough to purchase project.
The Exchange

• Buyers are uninformed type 1 agents
• Show that in equilibrium only impatient entrepreneurs trade at exchange.
• The price of the asset in the exchange is

\[
p = \frac{a(1 - m)\gamma\rho + (1 - a)\rho}{a(1 - m) + (1 - a)}.\]

• Given \( a \) and \( \hat{d} \) (the fraction of dealers) can compute \( m, p \) and \( p^d \).
entrepreneurs
- Invest their endowment $1
- Exercise effort, $a$

dealers
- Costly information acquisition

Model
Discussion

- With risk averse entrepreneurs could replace liquidity shock by some entrepreneurs learning that they face new risks.
- Model emphasizes the liquidity provision and valuation roles of the financial industry. Downplays the financing role of real investments.
- Assume dealers are always on the short side in the OTC market
  - Able to extract informational rents
- Assumed everyone is equally good as entrepreneur.
  - Volcker’s remark on best talent.
- We will argue that “too big” result will survive in the case where $\kappa'(d) \geq 0$.
- In fact argue “too big” results only depends on dealers picking the best projects and keeping some of the surplus.
Equilibrium: $t = 1$.

- Look at equilibria where every entrepreneur takes the same action.
- Borrowing is constrained by minimum value of collateral $\rho$.
- At $t = 1$ given $(a, d)$
  1. All patient informed dealers purchase in OTC.
  2. No uninformed agent purchases in OTC,
  3. All impatient entrepreneurs sell (as opposed to borrowing.)
  4. Any patient entrepreneur that took the equilibrium action (weakly) prefers not to put his asset for sale.
Proposition:
(a) The matching probability $m(a, d)$ is increasing and convex on the measure of dealers $d$, (b) the price in the uninformed exchange $p(a, d)$ is decreasing and concave on $d$, (c) $p(a_\ell, d) < p(a_h, d)$, and (d) Entrepreneur’s surplus when selling to a dealer relative to selling in the exchange, $\kappa(\gamma \rho - p)$, increases with $d$.

Proposition:
(a) the utility of dealer $\tilde{d}$ is increasing and convex on the measure of dealers, $d$, and (b) The utility of an entrepreneur is decreasing and concave on the measure of dealers, $d$. 

Equilibrium: $t = 1$
Equilibrium

- Write $U(a|\hat{a}, \hat{d})$ for the expected utility at 0 of an entrepreneur that makes effort $a$ when all entrepreneurs are making effort $\hat{a}$ and the measure of dealers is $\hat{d}$.
  - Computing $U(a|\hat{a}, \hat{d})$ requires using the expressions for $m$, $p$ and $p^d$.
- Write $V(d|\hat{a}, \hat{d})$ for the expected utility at 0 of dealer $d$...
- $(a^*, d^*)$ is an equilibrium if

\[
U(a^*|a^*, d^*) \geq U(a|a^*, d^*) \text{ for each } a \\
V(d|a^*, d^*) \geq U(a^*|a^*, d^*) \text{ if } d < d^* \\
V(d|a^*, d^*) \leq U(a^*|a^*, d^*) \text{ if } d > d^*
\]
Entrepreneur’s incentive compatibility

- Let $\Delta U_\ell(d)$ denote the gains from deviating to $a_h$ when everyone is playing $a_\ell$ and there are $d$ dealers, not accounting for the cost $\psi$.
  - $\frac{\partial \Delta U_\ell(d)}{\partial d} > 0$.
  - IC of $a_\ell$ requires $\Delta U_\ell(d) < \psi$

- Let $\Delta U_h(d)$ denote the losses from deviating to $a_\ell$ when everyone is playing $a_h$ and there are $d$ dealers, not accounting for the savings of $\psi$.
  - $\frac{\partial \Delta U_h(d)}{\partial d} > 0$.
  - Deviator not found by dealer would choose to sell at exchange, even if not hit by liquidity shock.
  - $\Delta U_h(d) \leq \Delta U_\ell(d)$
  - IC of $a_h$ requires $\Delta U_h(d) \geq \psi$. 
Entrepreneur’s incentive compatibility

\[ (1 - \pi) \rho \Delta a(\gamma - 1) \]

\[ \psi' \]

\[ \psi \]

\[ \Delta U \]

\[ \Delta U_h \]

\[ \Delta U_l \]

\[ 0 \]

\[ \hat{d}_l \]

\[ \hat{d}_h \]

\[ 1 \]
Equilibria

• High effort equilibria has $d \geq \hat{d}_h > 0$.
• Low effort equilibria requires $d \leq \hat{d}_\ell$.
• No low effort equilibrium if $\psi$ small.
• Examples with multiple low effort and with multiple high effort equilibria
• Unstable equilibria
Equilibria with high effort

\[ \varphi(d) = 0 \text{ if } d < \bar{d}, \quad \varphi(d) = \infty \text{ if } d \geq \bar{d} \]
Constrained efficiency

- Ex-ante, before type 2 agents know their $d$.
- Planner can fix number of dealers $d^o$ but entrepreneurs would then choose individually rational action.
  - Can be achieved by fixing a number of licenses and subsidizing (taxing) dealers.
- If low effort is efficient, optimal $d^o = 0$.
- If high effort is efficient, $d^o = \hat{d}^h$.
- No reason for income of dealers and entrepreneurs to be equated at $\hat{d}^h$.
- If high effort is efficient choice all equilibria are inefficient for “most” parameter values.
Constrained inefficiency when high effort is (constrained) efficient: Genericity

- Consider parameters $\mathcal{A} = (a_h, a_\ell, \gamma, \rho, \kappa, \pi, \psi)$ and $\varphi^\beta = \varphi + \beta$.
- High effort socially efficient if
  \[
  [\rho (1 + a_h (\gamma - 1)) - \psi] \left(1 - \hat{d}_h\right) - \int_0^{\hat{d}_h} \varphi (u) \, du \geq \rho (1 + a_\ell (\gamma - 1)).
  \]

**Proposition:** Suppose that it is socially efficient to implement the high effort action. Suppose also that $\varphi$ is a smooth function in $(0, \bar{d})$. Then given any set of parameters $\mathcal{A}$ and any $\epsilon > 0$, there exists a $0 \leq \beta < \epsilon$ and vector $\mathcal{B}$ with $|\mathcal{B} - \mathcal{A}| < \epsilon$ and such that for all parameter values sufficiently close to $(\beta, \mathcal{B})$ all equilibria are inefficient and any high effort equilibrium features too many dealers in OTC markets.
Constrained inefficiency when high effort is (constrained) efficient: Genericity

Proof: First fix the vector $\mathcal{A}$. Consider the function

$$L(d, \beta, \mathcal{A}) := U(a_h | a_h, d) + \varphi_-(d) + \beta - 1 - (1 - \pi)(1 - \kappa)(\rho \gamma - p(a_h, d))$$

Since $L$ is smooth, the Transversality Theorem guarantees that for almost every $\beta$ the zeros of $L$ in $(0, \bar{d})$ satisfy

$$\frac{\partial L}{\partial d}(d, \beta, \mathcal{A}) \neq 0$$

and hence these solutions are isolated. Choose one such $\beta$ with $0 < \beta < \epsilon$, and such that $L(\bar{d}, \beta, \mathcal{A}) \neq 0$. Equilibria $d < \bar{d}$ are zeros of $L$ with $d \geq \hat{d}_h(\mathcal{A})$ and if $\bar{d}$ is an equilibrium $L(\bar{d}, \beta, \mathcal{A}) < 0$. 
Constrained inefficiency when high effort is (constrained) efficient: Genericity

**Proof:** Since high effort is constrained efficient,
\[ \Delta U_h(\hat{d}_h(A)) = \psi, \] and \( \hat{d}_h(\cdot) \) is differentiable. Choose
\[ B = (a_h, a'_l, \gamma, \rho, \kappa, \pi, \psi, \tilde{d}) \] with
\[ a_l - \epsilon < a'_l < a_l \] (notice we keep all other parameter values unchanged). Thus
\[ L(d, \beta, A) = L(d, \beta, B). \] Optimality of high effort is maintained, but \( \Delta U_h \) shifts up and thus
\[ \hat{d}_h(B) < \hat{d}_h(A). \] The usual \( \epsilon - \delta \) argument using the fact that
\[ \frac{\partial L}{\partial d}(d, \beta, A) \neq 0 \] can be used to show that there is a neighborhood \( \mathcal{O} \) of \((\beta, B)\) such that any solution to 
\[ L(\beta', B', d) = 0 \] with 
\[ (\beta', B') \in \mathcal{O} \] is larger than 
\[ \hat{d}_h(B'). \]
Constrained inefficiency when high effort is (constrained) efficient: Genericity

\[
\begin{align*}
d_m(\beta) & \quad \hat{d}_h(B) & \quad \hat{d}_h(A) & \quad d_h^* \\
m & \quad m
\end{align*}
\]
\[ \kappa'(m) > 0. \]

- When \( \kappa' > 0 \), the IC curves look exactly as before
- \( \kappa \) enters the gains (losses) for deviating from low (high) to high (low) effort multiplied by:

\[
(a_h - a_\ell) \times m_a \times (\gamma \rho - p_a)
\]

Each of these terms is positive, so when \( \kappa' > 0 \) the extra term added to the derivative of \( \Delta U \) is positive.
- Hence again high effort equilibria feature (generically) too many dealers.
- However, monotonicity of utilities with respect to fraction of dealers is no longer guaranteed.
Informed traders in the exchange

- Type 2 agents choose between being an OTC dealer (at cost $\varphi(d) > 0$) and an informed traders in the exchange (at cost $\lambda \varphi(d)$, $\lambda < 1$).
- To focus on tradeoff between the two types of informed agents fix the interval $0 \leq d \leq f$ of type 2 agents that will be either OTC dealers or informed traders, $f$ small.
- As before a large number of uninformed agents in exchange.
- To allow informed traders to make money, a measure $\mu$ of noise buyers are also present in the exchange.
Informed traders in the exchange: trading protocol

- All assets are put for sale at a price $p^u$.
- Informed traders can make a targeted bid on an asset.
- Noise buyers make a targeted bid $\phi \rho$ with $\gamma > \phi > 1$ on an asset.
- Uninformed buyers are informed of which assets got bids and the value of the bid - not whether the bid came from a noise buyer or an informed trader. They can then bid on these same assets.
- Any asset that receives a bid $\neq \phi \rho$, would receive a bid of $\gamma \rho$ by uninformed buyers.
- Informed traders bid exactly $\phi \rho$.
- Assume $\mu$ is large enough so that expected payoff (for uninformed) of asset that receives a bid is less than $\phi \rho$. 
Informed traders in the exchange

- As before traders that suffer liquidity shock have opportunity to sell to informed dealers.
- \( p^d = \kappa \gamma \rho + (1 - \kappa) p \), where \( p \) is the average price a good project gets in the exchange.
- \( q_g = a \pi [1 - f] - d(1 - \pi) \) and \( q_b = \pi (1 - a)[1 - f] \) good and bad projects for sale on the exchange.
- Assume \( f \) is small so that \( a \pi (1 - f) - f (1 - \pi) > 0 \)
- After informed traders bid, remaining pool has proportions
  \[
  \omega_g = \frac{\pi a (1 - f) - (1 - \pi) f}{\pi (1 - f) - (1 - \pi) f}, \quad \omega_b = \frac{\pi (1 - a)(1 - f)}{\pi (1 - f) - (1 - \pi) f}.
  \]
- Proportions only depend on \( f \). Note that noise buyers do not affect proportion of good and bad assets for sale.
- \( p^u = \omega_g \gamma \rho + \omega_b \rho \).
Informed traders in the exchange

- A good asset for sale on the organized exchange gets a bid from an informed trader with probability

\[ m_i = \frac{(1 - \pi) i}{a\pi (1 - f) - (1 - \pi) d} . \]

- If good asset does not get a bid from an informed trader, it gets a bid from a noise buyer with probability

\[ m_n = \frac{(1 - \pi) \mu}{\pi (1 - f) - (1 - \pi) f} . \]

Thus, the expected price of a good asset on the exchange

\[ p = m_i \phi \rho + (1 - m_i) \left\{ m_n \phi \rho + (1 - m_n) p^u \right\} , \]

- Increasing \( d \) (while holding \( f \) constant) decreases \( m_i \) while \( m_n \) stays constant. Hence \( p \) and \( p^d \) decrease.
Informed traders in the exchange

- In an equilibrium there exists $0 \leq d^* \leq f$ such that all agents with $0 \leq d < d^*$ are dealers and $d^* < d \leq f$ are informed traders.

- Suppose $0 < d^* < f$, $\varphi$ continuous.

- \[(1 - \pi) (\phi \rho - p_d (d^*)) = (1 - \lambda) \varphi (d^*) .\]

- $\phi \rho > p_d (d^*)$

- Decrease in $d^*$, keeping $f$ constant, increases expected payoff of good projects and keeps constant expected payoff of bad projects. Increases incentive to high effort.

- In any high effort equilibrium in which both dealers and informed traders are present, there are too many dealers.
Growth in OTC and information technology

- Model is static
- Changes in technology decrease cost ($\phi$).
- Entry on OTC market, higher compensation because of cream-skimming
- Compare with retail
- Changes in regulation
Conclusion

- A simple theory where OTC markets arise in the presence of well functioning exchanges.
- Cream-skimming.
- If OTC markets incentivize entrepreneurs to adopt high effort, then in equilibrium these markets are too large.
- Too much information being produced.
- If we had assumed that some entrepreneurs have a higher probability of finding dealers, these entrepreneurs would benefit disproportionately from the presence of OTC markets.
Conclusion

Companies from Caterpillar Inc. and Boeing Co. to 3M Co. are pushing back on proposals to regulate the over-the-counter derivatives market, where companies can make private deals to hedge against sudden moves in commodity prices or interest rates. WJS 2009.