Ec717a: Supervision, Collusion and Organizational Design

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**Contexts with Third-party Supervision**

**Principal** relies on advice of an **Expert/Supervisor** to transact with an **Agent** privately informed about cost/quality

- Shareholders / Directors / CEO
- Investor / Credit Rating Agency / Borrower
- Buyer / Broker / Seller
- Owner / Manager / Worker
- Employer/Referee/Job Applicant
- Government / Regulator / Public utility or Government / Auditor / Taxpayers
Collusion Problems

- S inspects or has specialized knowledge regarding A’s type; is expected to make a report to P which the latter uses in designing a contract for A
- A has an incentive to bribe S to affect the report
- Undermines the value of hiring S
- Necessitates design of organization and incentives to control collusion
Collusion Problems: Suggestive Evidence

- **CEO and Outside Directors:**
  - strong external social connections, associated with lower firm value (Fracassi and Tate (2012), Hallock (1997), Hwang and Kim (2009), Kramarz and Thesmar (2013), Schmidt (2015))
  - negative relation between excess compensation and firm value (Brick et al (2006))

- **Manager-Worker Alliances:** deter takeovers (Pagano-Volpin (2005)), associated with inefficient restructuring and excessive worker payments (Atanassov-Kim (2009), Cronqvist et al (2009))
Collusion Problems: Suggestive Evidence, contd.

- **Auditor-Client Alliances:**
  - ‘Revolving Door’ between credit-rating agencies and firms (Cornaggia et al. (2016)), SEC lawyers and prospective employers (de Haan et al. (2015))
  - Correlation between ‘revolving door’ and clean audit reports (Lennox (2005), Lennox-Park (2007))
  - Positive effect of auditor term limits on audit quality for firms located in states with weak legal institutions (Firth et al. (2012))

- **Bureaucratic Corruption in Developing Countries:** overview in Banerjee, Hanna and Mullainathan (2012)
Design Questions

- How to design contracts for S and A, incorporating prospect of collusion?
- When is it still valuable to appoint/consult S?
- What are costs of collusion?
Is delegation or ‘outsourcing’ (to S) an optimal response to collusion?

Would it benefit P if S had higher ‘authority’ or bargaining power vis-a-vis A? For instance, should
- Directors have the right to appoint/fire CEOs, or vice versa?
- auditees have the right to appoint their own auditors?
- workers be represented in company Boards?
- workers/auditees have access to appeals mechanisms to owners against adverse manager/audit reports?

If P could design information structure of S, how should this be done? (Asseyer, 2019)
Some Modeling Issues

- Information of S about A’s type:
  - symmetric or asymmetric (one-sided or two-sided)
  - hard (verifiable) or soft (not)
  - exogenous or endogenous

- Timing/extent of collusion: interim (only reporting) or ex ante (reporting and participation)?

- Side contracts:
  - exogenous or endogenous transaction costs
  - negotiation process (bargaining power)
  - enforcement (exogenous or self-enforcing)
Previous Literature


- Soft information, endogenous transaction costs, *ex ante collusion* (Mookherjee-Tsumagari (2004), Motta, Mookherjee, Tsumagari (2019)).

- Almost all assume one sided asymmetric information, exogenous enforcement of side contracts.
Outline of These Two Lectures

1. *(This Lecture:)* Interim Collusion context (FGM 2003, Celik 2009)

2. *(Next Lecture:)* Ex Ante Collusion context: (MMT 2019)
Model

- $P$'s return is $V(q)$ which is increasing (linear (indivisible good), or strictly concave (divisible good))
- $A$'s unit cost is $\theta$, private information of $A$
- Common prior distribution $F(\theta)$; either discrete set of types, or density $f(\theta)$ over $\theta$ on $\Theta \equiv [\underline{\theta}, \bar{\theta}]$, with monotone hazard rate $H(\theta) \equiv \theta + \frac{F(\theta)}{f(\theta)}$
- $S$ (as well as $A$) costlessly receive informative signal $\eta \in \Pi$ (finite set) about $A$'s cost $\theta$ (one sided asymmetric information)
- $P$, $S$ and $A$ are risk neutral, with zero autarkic payoffs
Centralized Mechanism (Grand Contract)

\[ GC = (X_A(m_A, m_S), X_S(m_A, m_S), q(m_A, m_S); M_A, M_S) \]

- \( M_A \) and \( M_S \): message sets (cross-reporting)
- \( X_A \) and \( X_S \): transfers from \( P \) to \( A \) and \( S \)
- \( q \): output decision of \( P \)
- \( M_A \) and \( M_S \) include exit options \( e_A, e_S \)
- \( X_S(m_A, e_S) = 0 \) for any \( m_A \)
- \( X_A(e_A, m_S) = q(e_A, m_S) = 0 \) for any \( m_S \)
(NC1) A observes $\theta$ and $\eta$. S observes $\eta$.

(NC2) $P$ offers grand contract GC.

(NC3) A and S play GC non-cooperatively.
(NC1) $A$ observes $\theta$ and $\eta$. $S$ observes $\eta$.

(NC2) $P$ offers grand contract $GC$.

(NC3) $A$ and $S$ play $GC$ non-cooperatively.
(C1) $A$ observes $\theta$ and $\eta$. $S$ observes $\eta$.

(C2) $P$ (independently) offers grand contract $GC$ to $S$ and $A$

(C3)* $A, S$ (independently) accept or reject; if both accept continue.

(C4) $S$ offers a side-contract to $A$, or third party with objective
\[ \alpha \Pi_S + (1 - \alpha) \Pi_A \] offers side-contract to $S, A$ (side-contract is not observable to $P$)
\[ SC(\eta) = (m(\theta | \eta), t(\theta | \eta); \Theta(\eta)) \] where $m = (m_A, m_S)$ and $t$ is side-payment

(C5) If $SC(\eta)$ is accepted, it is played ($A$ chooses $\theta' \in \Theta(\eta)$, and $m(\theta' | \eta)$ is reported to $P$ associated with a transfer $t(\theta' | \eta)$ from $A$ to $S$). Otherwise $A$ and $S$ play $GC$ non-cooperatively.
Points to Note

- **Weak collusion, or No Extortion**: No one can commit to how to play GC if A rejects SC; papers studying *Strong Collusion* allow also extortion.

- **Delegation**: special case where P contracts only with S; contract with A is null ($M_A = \emptyset, t_A \equiv 0$).

- A’s non-cooperative payoff in GC is A’s **outside option** while negotiating side-contract (zero in delegation; *otherwise endogenous*).

- In centralization (not in delegation), P can manipulate collusion outcomes by controlling A’s outside option.
Organizational Alternatives

- **No Supervision** (*NS*): null grand contract for *S*
- **Delegation to Supervisor** (*DS*): null grand contract for *A*
- **Centralized Supervision** (*CS*): non-null grand contract for *A* and *S*
Interim Collusion

Equilibrium Concept

- **Perfect Bayesian Equilibrium (PBE):** Possibility of multiple equilibria, owing to arbitrariness of off-equilibrium path beliefs (of S when A rejects side-contract offer)

- Most papers restrict attention to PBE with *passive beliefs*: no updating (but this does not really turn out to matter)

- If $P$ can freely select the PBE, collusion can be costlessly deterred (create coordination problem between $S$ and $A$)

- Hence for collusion to have any bite, $S$ and $A$ (or the third party) should be able to choose continuation equilibria

- **Refinement Criterion:** Pareto-undominated (for the coalition) PBE
$P$ can anticipate continuation play of the side contract game and the resulting outcomes.

Can equivalently offer these outcomes directly, in which case $S$ and $A$ would no longer have an incentive to enter into a non-null side contract.

**CP Principle** w.l.o.g. $P$ can confine attention to *collusion-proof* mechanisms in which there is no scope for $S$ and $A$ to enter into a Pareto-improving side contract, so they play the GC noncooperatively (and accept, and report truthfully).

Delegation is a special case of Centralization, so it cannot dominate Centralization.

The question is: can Delegation generate the same payoff to $P$ as in Centralization?

In that case, $P$ can attain the same payoffs by contracting with only one party rather than two (and economize on contracting and communication costs with $A$).

Intuition for possible optimality of Delegation: $S$ and $A$ are going to side-contract anyway, in both settings (and thus undo whatever $P$ may do to deter collusion).

Based on a kind of implicit ‘Coase Theorem’ argument: relevant outcomes of (intra-coalition Pareto-efficient) side contracting will be the same (no matter what $P$ can do, or bargaining weights etc).
However, one problem with this argument: Coase Theorem applies in contexts of bargaining with symmetric information.

Here there is asymmetric information between $S$ and $A$.

Can $P$ exploit this (endogenous) friction/‘transaction cost’ to her advantage?
Interim Collusion: Centralization versus Delegation, contd.

- Answer turns out to depend on the precise information structure between $S$ and $A$

- **Faure-Grimaud, Laffont and Martimort FGLM (RES, 2003):**
  - $A$ has two possible types $\{\theta_H, \theta_L\}$ and $S$ receives one of two partially informative signals $\{\eta_H, \eta_L\}$ satisfying MLRP
  - Second-best collusion-free outcome can be achieved in both delegation and centralization

- **Celik (JET, 2009):**
  - $A$ has three possible types $\{\theta_H, \theta_M, \theta_L\}$ and $S$’s information is the partition $\{\theta_H, \{\theta_M, \theta_L\}\}$
  - Second-best outcome may not be achievable; centralization can generate strictly higher payoff than delegation
FGLM, Celik results: Intuition?

- Difficult...

- In delegation, $S$ designs side-contract for $A$ and has to pay latter information rents, which comprise procurement costs for $S$.

- $S$ is privately informed vis-a-vis $P$ about these procurement costs, so can potentially earn delegation rents.

- However, in an interim collusion setting $S$ learns actual procurement costs only after agreeing to participate.

- At the participation stage, $P$ can try to tax away these delegation rents, depending on how much information $S$ has at the \textit{ex ante} stage, which depends on the correlation between signal and cost.
Correlation structure differs between the two models

In FGLM, each cost type of $A$ co-exists with two different signals for $S$

In Celik, each cost type corresponds to unique signal (more correlated)

In FGLM, $P$ has more ‘instruments’ to extract $S$’s delegation rents at the participation stage

In Celik’s model, delegation ends up worse than not having a supervisor at all, but a centralized contract allows $P$ to compare $S$’s reports with $A$’s and therefore control collusion better
Problems with the Interim Collusion Model

- Timing Assumption: at the interim stage (when they already have received their signals), $S$ and $A$ independently decide whether to participate.

- Then after they agree, they meet and collude over reports.

- Motta (2010) argues in such settings that collusion can be costlessly eliminated by using a different kind of mechanism.

- $P$ can elicit information of $S$ and $A$ at the participation stage itself — why wait for them to meet and collude?
Defense of Interim Collusion Modeling Assumptions?

- IC modelers don’t really have a good answer to this criticism
- Restriction on Message Spaces at the participation stage — why is it ok for $S$ to send reports later?
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- $S$’s collusion rents can then be ‘taxed’ away by $P$ at the participation stage (auction off the right to supervise/manage/audit).
Defensive of Interim Collusion Modeling Assumptions?

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- $S$’s collusion rents can then be ‘taxed’ away by $P$ at the participation stage (auction off the right to supervise/manage/audit).
- Maybe $S$ is subject to limited liability, which should then be built into the model assumptions.
One ‘Fix’: Ex Ante Collusion

- If $S$ and $A$ already know each other before $P$ approaches them, they can collude over both participation and reports.
- This limits the opportunity for $P$ to ‘divide and conquer’ at the participation stage.
- Or to tax away the collusion rents of $S$ at the participation stage.
- Endogenously creates a kind of limited liability, for the coalition.
‘Consulting Collusive Experts’ (MMT 2019): Timing

(EAC1) A observes $\theta$ and $\eta$. $S$ observes $\eta$.

(EAC2) $P$ (independently) offers grand contract $GC$ to $S$ and $A$,

(EAC3) Side-contract offered: $SC = (m(\theta \mid \eta), t(\theta \mid \eta); \Theta(\eta))$

$(m = (m_A, m_S)$ include participation decisions$)$

(EAC4) If $SC$ is accepted, it is implemented ($A$ sends internal report $\tilde{\theta}$ determining $(m_A, m_S)(\tilde{\theta}))$; otherwise $A$ and $S$ play $GC$ non-cooperatively.

(Participation decisions deferred to last stage (EAC4), where they are made jointly with reports conditional on participating)
Side Contracting Problem

- $S$ makes a take-it-or-leave-it offer of side contract (SC) to $A$ determining their messages to $P$ as function of internal type report $\tilde{\theta}$ of $A$ to $S$

- (When $S$ does not have all the bargaining power, modify with a third party making the offer (to avoid ‘informed principal’ problems))

- Invoke Revelation Principle: wlog can confine attention to SCs accepted by $A$, followed by an internal type report which is truthful ($\tilde{\theta} = \theta$)

- $P$’s GC will typically punish $S$, $A$ if their reports of $\eta$ do not match, so SC will submit coordinated reports that match ($\eta_A = \eta_S = \eta'$)
Side Contracting Problem, contd.

- Suppose $S, A$ of type $\theta$ coordinate on (joint) report of the state $m(\theta) \equiv (\theta', \eta')(\theta)$ along with decision to participate ($e_A(\theta) = e_S(\theta) = 1$) and side payment $b(\theta)$.
Side Contracting Problem, contd.

- Suppose $S$, $A$ of type $\theta$ coordinate on (joint) report of the state $m(\theta) \equiv (\theta', \eta')(\theta)$ along with decision to participate ($e_A(\theta) = e_S(\theta) = 1$) and side payment $b(\theta)$

- GC then determines:
  - payments $t_A, t_S$ and output $q$ as a function of $m(\theta)$;
  - associated payoffs
    \[
    u_A(m(\theta)) = t_A(m(\theta)) - b(\theta) - \theta q(m(\theta));
    u_S(m(\theta)) = t_S(m(\theta)) + b(\theta)
    \]
Side Contracting Problem, contd.

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- SC must satisfy:

  \[
  u_A(m(\theta)) \geq t_A(m(\tilde{\theta})) - b(\tilde{\theta}) - \theta q(m(\tilde{\theta})), \forall (\tilde{\theta}, \theta) \quad (IC_A)
  \]

  \[
  u_A(m(\theta)) \geq u_A(\theta, \eta), \forall (\theta, \eta) \quad (PC_A)
  \]

where outside option $u_A(\theta, \eta)$ is payoff of $A$ in noncooperative play of GC following rejection of SC by $A$
The Collusion Proof Principle implies w.l.o.g. $P$ can confine attention to GCs in which $S$ and $A$ do not have an incentive to enter into a non-null side contract.

The actual SC offered will maximize $E[u_S|\eta]$ subject to $(IC_A), (PC_A)$, provided this SC ensures a nonnegative payoff for $S$ ($E[u_S|\eta] \geq 0$).

Then we add (Coalition Incentive Constraint (CIC)): GC should be such that $S$ will have no incentive to offer such a non-null SC.

On the equilibrium path, $S$ and $A$ will end up playing GC noncooperatively.
Summary: Mechanism Design problem with EA Collusion

- Choice of GC must maximize $P$’s payoff subject to:
  - usual individual incentive compatibility and participation constraints for $A, S$ when they play GC noncooperatively
  - coalition incentive compatibility constraints: $S$ should not benefit from offering a non-null SC satisfying $(IC_A), (PC_A)$
Necessary Conditions for CIC

- If $m \equiv (\theta, \eta)$ coordinated joint report to $P$, and if $X(m) = t_S(m) + t_A(m)$:

  $$X(\theta, \eta) - \theta q(\theta, \eta) \geq X(m') - \theta q(m'), \forall m' \in M_S \times M_A$$

- In particular, since $M_S \times M_A$ includes the joint exit option, this includes a coalition participation constraint (CPC):

  $$X(\theta, \eta) - \theta q(\theta, \eta) \geq 0$$  \hspace{1cm} (CPC)

  Whenever $e_A(\theta) = e_S(\theta) = 1$ — this is effectively a (joint) limited liability condition, which will limit $P$’s ability to extract collusion rents upfront (main difference from interim collusion setting)
Observe: outside option of $A$ in SC equals noncooperative GC payoff of $A$, is endogenously chosen by $P$.

- Can be strategically chosen to manipulate the outcomes of collusion.

- This instrument is not available in delegation, where $u_A \equiv 0$ (if $A$ rejects SC, has no option to get some contract from $P$).

- Centralization is analogous to the role of legal rules and courts in affecting out-of-court settlements: the former exercises an influence indirectly by affecting outside options of negotiating parties.
Characterization of Ex Ante Collusion-Proof Mechanisms

- **Main Technical Step:** Extend standard characterization a la Myerson of IIC allocations: the problem reduces to $P$ contracting with a single ‘composite’ agent with a ‘virtual’ cost $z(\theta | \eta)$ defined as (the “ironed” version of)

$$z(\theta | \eta) \equiv \theta + \frac{F(\theta | \eta) - \Lambda(\theta | \eta)}{f(\theta | \eta)}$$

where $\Lambda(\theta | \eta)$ is non-decreasing in $\theta$, $\Lambda(\bar{\theta}(\eta) | \eta) = 0$ and $\Lambda(\bar{\theta}(\eta) | \eta) = 1$.

- The derivative of $\Lambda(\theta | \eta)$ is the Lagrange multiplier associated with $(PCA)$
- $P$ can select $z(\theta | \eta)$ by controlling $A$’s outside option $u_A(\theta, \eta)$. 
Characterization of Implementable Allocations

Allocation \((u_A(\theta, \eta), u_S(\theta, \eta), q(\theta, \eta))\) is implementable with weak ex-ante collusion if and only if there exists \(z(\theta \mid \eta)\) such that

- **Coalitional incentive constraint:**
  \[
  X(\theta, \eta) - z(\theta \mid \eta)q(\theta, \eta) \geq X(\theta', \eta') - z(\theta \mid \eta)q(\theta', \eta')
  \]
  for any \((\theta, \eta), (\theta', \eta')\) where \(X(\theta, \eta) \equiv u_A(\theta, \eta) + u_S(\theta, \eta) + \theta q(\theta, \eta)\) (the total payment to the coalition)

- **Coalitional participation constraint:**
  \[
  X(\theta, \eta) - z(\theta \mid \eta)q(\theta, \eta) \geq 0
  \]
  for any \((\theta, \eta)\)

- **\(A\)'s incentive constraint and \(A\) and \(S\)'s participation constraints (relative to autarky)**
Delegation to \( S \) vs. No Supervision

**Proposition**

*Delegation to \( S \) (DS) is strictly worse than no supervision (NS)*

**Reason:**

- In *NS*, \( P \) contracts with \( A \) with unit cost \( z(\theta | \eta) = \theta \)
- In *DS*, \( P \) contracts with \( S\)-\( A \) coalition with unit cost
  \[
  z(\theta | \eta) = h(\theta | \eta) \equiv \theta + \frac{F(\theta | \eta)}{f(\theta | \eta)}
  \]
- \( h(\theta | \eta) > \theta \): Double marginalization of rents problem (*DMP*) in *DS*, since \( S \)'s rents cannot be taxed away upfront in *ex ante* collusion
- Main result of FGLM does not extend: effect of coalitional exit option which prevents \( P \) from extracting \( S \)'s rent at participation stage.
The preceding result shows that $P$ needs to be ‘involved’ in some way to lower $S$’s rents.

One way to do so is to provide ‘countervailing incentives’: raise the outside option of $A$ while negotiating with $S$.

This lowers $z$, the (effective) unit cost of the coalition, which raises $P$’s payoff.

This lowers $S$’s rents, but we need to ensure that $S$’s participation constraint is not violated.

Next result shows this can be done to increase $P$’s payoff in $CS$ above $NS$. 
Value of Supervision

Proposition

*P is strictly better off hiring S, compared to hiring no supervisor.*

Outline of argument:

- Start with the optimal NS allocation \((z(\theta|\eta) = \theta)\).
- Small variation in \(z(\theta|\eta)\) in some state \(\eta^*\), raising it above \(\theta\) for some interval \(\Theta_H\) and lowering it for some other interval \(\Theta_L\), both of which have positive probability given \(\eta^*\).
- S’s marginal benefit from output expansion in state \(\theta\) equals \(\frac{F(\theta|\eta^*)}{f(\theta|\eta^*)}\).
- P’s marginal benefit from output expansion in state \(\theta\) equals the unconditional inverse hazard rate \(\frac{F(\theta)}{f(\theta)}\).
- Difference in MRS between S and P: gains from trade
When Collusion is Costly

Proposition

Second best payoff is not achievable with the weak ex-ante collusion, if

(i) $\Theta(\eta) = \Theta$ for any $\eta \in \Pi$,

(ii) there exists $\eta^*$ such that both $\frac{f(\theta|\eta^*)}{f(\theta|\eta)}$ and $f(\theta | \eta^*)$ are strictly decreasing in $\theta$ for any $\eta \neq \eta^*$,

(iii) non-increasing ‘absolute risk aversion’ ($-V''(q)/V'(q)$).

Intuition: With collusion, expected rents of S are strictly higher in state $\eta^*$ (the ‘good news’) than any other state.

Conditions (i) - (iii) are standard and consistent with FGLM (2003).
Proposition

Any implementable allocation can be implemented as an outcome of the modified delegation in which $P$ transacts and communicates only with $S$ on the equilibrium path.

- $S$ is ‘normally’ expected to transact with $P$ on behalf of the $A$-$S$ coalition (delegation to $S$).
- $A$ has the option of bypassing this procedure and asking $P$ to take a centralized decision (via an appeals mechanism).
- This option ensures $A$ has enough bargaining power within the coalition.
- The option is not actually exercised on the equilibrium path.
These results provide a rationale for workers rights to appeal and communicate directly with the firm’s owners.

View the grand contract as an ‘appeal’ or ‘dispute settlement’ procedure, in the shadow of which S and A negotiate side-contract.

Echo informal arguments of some influential authors:
- Williamson’s (1975) view of such dispute settlement procedures as an advantage of hierarchies over market relationships.
- Hirschman’s (1970) view of organizations as including exit and voice options, versus market relationships which involve only exit.

In corporate governance, analogous role of emergency shareholder meetings called in the event of extraordinary disputes between outside Directors and CEO.
Next Question: if P could control allocation of bargaining power within the coalition, how should this be done?

Is it better if A offers the side contract to S? Or if bargaining power were symmetric (e.g., if a neutral third party assigning equal welfare weight to S and A were to select the side contract)?

Corresponds to procedures for appointment (can A choose S?), representation in company Boards (should workers be represented? as a minority or majority?)

Since collusion occurs with asymmetric information, Coase Theorem does not apply, so altering bargaining power could conceivably affect outcomes
Formally pose as follows

Suppose side-contract is designed by a third party who maximizes $E[\alpha u_A(\theta, \eta) + (1 - \alpha)u_S(\theta, \eta) \mid \eta]$. ($\alpha = \frac{1}{2}$ in Laffont and Martimort (1997, 2000))

- Side-contract has to satisfy participation constraints for both S and A
- Equilibrium refinement criterion underlying WCP definition: there exists no deviating non-null side-contract which raises welfare-weighted sum of ex ante payoffs of S and A
- How does a change in $\alpha$ affect $P$’s payoff?
Proposition

The set of implementable allocations with weak ex-ante collusion is independent of $\alpha$.

- **Intuition:** *WCP* criterion: absence of incentive compatible deviations that are Pareto improving for the coalition.

- This property does not vary with the welfare weight $\alpha$.

- An implication of weak collusion where outside options are independent of bargaining power.
Extensions

- **Altruism between S and A**: makes P worse off, so should not appoint S with social or personal connections with A

- **Strong Collusion: Implications of Extortion Threats**: S, A do not play GC noncooperatively if side-contract offer is rejected

- Instead, they can commit to threats regarding how they will play in the GC if the other party rejects SC

- This limits P’s ability to control outside options in coalitional bargaining

- Follow up paper (on my web-site): allocation of bargaining power between S, A now matters; for S to be valuable, must have more bargaining power than A