

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?

Broader Hierarchy/Governance Design Questions

- 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

- Early literature (Tirole (1986), Laffont-Tirole (1993), Kofman-Lawarree (1993)) considered contexts of **interim** collusion, **hard** information and **exogenous** transaction costs of collusion
- Subsequent literature examines **soft** information, **endogenous** transaction costs, **interim collusion** (Laffont-Martimort (1998, 2000), Faure-Grimaud, Laffont and Martimort (FGM 2003), Che-Kim (2006), Celik (2009))
- 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 θ , private information of A
- Common prior distribution $F(\theta)$; either discrete set of types, or density $f(\theta)$ over θ 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 θ (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

Timing - No Collusion (*NC*)

- (NC1)** A observes θ and η . S observes η .
- (NC2)** P offers grand contract GC .
- (NC3)** A and S play GC non-cooperatively.

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Timing - Interim Collusion (*)

(C1) A observes θ and η . S observes η .

(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

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

Collusion Proof Principle

- 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)
- Extension of the Revelation Principle: collusion-proof mechanisms satisfy coalition and individual incentive constraints

Interim Collusion: Centralization versus Delegation

- 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)

Interim Collusion: Centralization versus Delegation, contd.

- 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 *ex ante* stage, which depends on the correlation between signal and cost

FGLM, Celik results: Intuition?

- 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)
- 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 θ and η . S observes η .

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

(EAC3) Side-contract offered: $SC = (m(\theta | \eta), t(\theta | \eta); \Theta(\eta))$
 ($m = (m_A, m_S)$ 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 η 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 θ 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.

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- GC then determines:
 - payments t_A, t_S and output q as a function of $m(\theta)$;
 - associated payoffs

$$u_A(m(\theta)) = t_A(m(\theta)) - b(\theta) - \theta q(m(\theta)); u_S(m(\theta)) = t_S(m(\theta)) + b(\theta)$$

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$$u_A(m(\theta)) = t_A(m(\theta)) - b(\theta) - \theta q(m(\theta)); u_S(m(\theta)) = t_S(m(\theta)) + b(\theta)$$
- 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

Side Contracting Problem, contd.

- 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 $X(m) \equiv t_S(m) + t_A(m)$:

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

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

$$X(\theta, \eta) - \theta q(\theta, \eta) \geq 0 \quad (CPC)$$

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**)

Side Contracting Problem, contd.

- **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 θ , $\Lambda(\underline{\theta}(\eta) | \eta) = 0$ and $\Lambda(\bar{\theta}(\eta) | \eta) = 1$.

- The derivative of $\Lambda(\theta | \eta)$ is the Lagrange multiplier associated with (PC_A)
- 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 $z(\theta | \eta)$ such that

- Coalitional incentive constraint:

$$X(\theta, \eta) - z(\theta | \eta)q(\theta, \eta) \geq X(\theta', \eta') - z(\theta | \eta)q(\theta', \eta')$$

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:

$$X(\theta, \eta) - z(\theta | \eta)q(\theta, \eta) \geq 0$$

for any (θ, η)

- 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.

How Centralization Can Help

- 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 η^* , raising it above θ for some interval Θ_H and lowering it for some other interval Θ_L , both of which have positive probability given η^* .
- S's marginal benefit from output expansion in state θ equals $\frac{F(\theta|\eta^*)}{f(\theta|\eta^*)}$
- P's marginal benefit from output expansion in state θ 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 η^* such that both $\frac{f(\theta|\eta^*)}{f(\theta|\eta)}$ and $f(\theta | \eta^*)$ are strictly decreasing in θ 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 η^* (the 'good news') than any other state.

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

Implementation by Modified Delegation

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

Role of Appeals Mechanism

- 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

Allocation of Bargaining Power

- 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

Allocation of Bargaining Power, contd.

- 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 α affect P 's payoff?

Allocation of Bargaining Power, contd.

Proposition

The set of implementable allocations with weak ex-ante collusion is independent of α

- **Intuition:** *WCP* criterion: absence of incentive compatible deviations that are Pareto improving for the coalition
- This property does not vary with the welfare weight α
- 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*