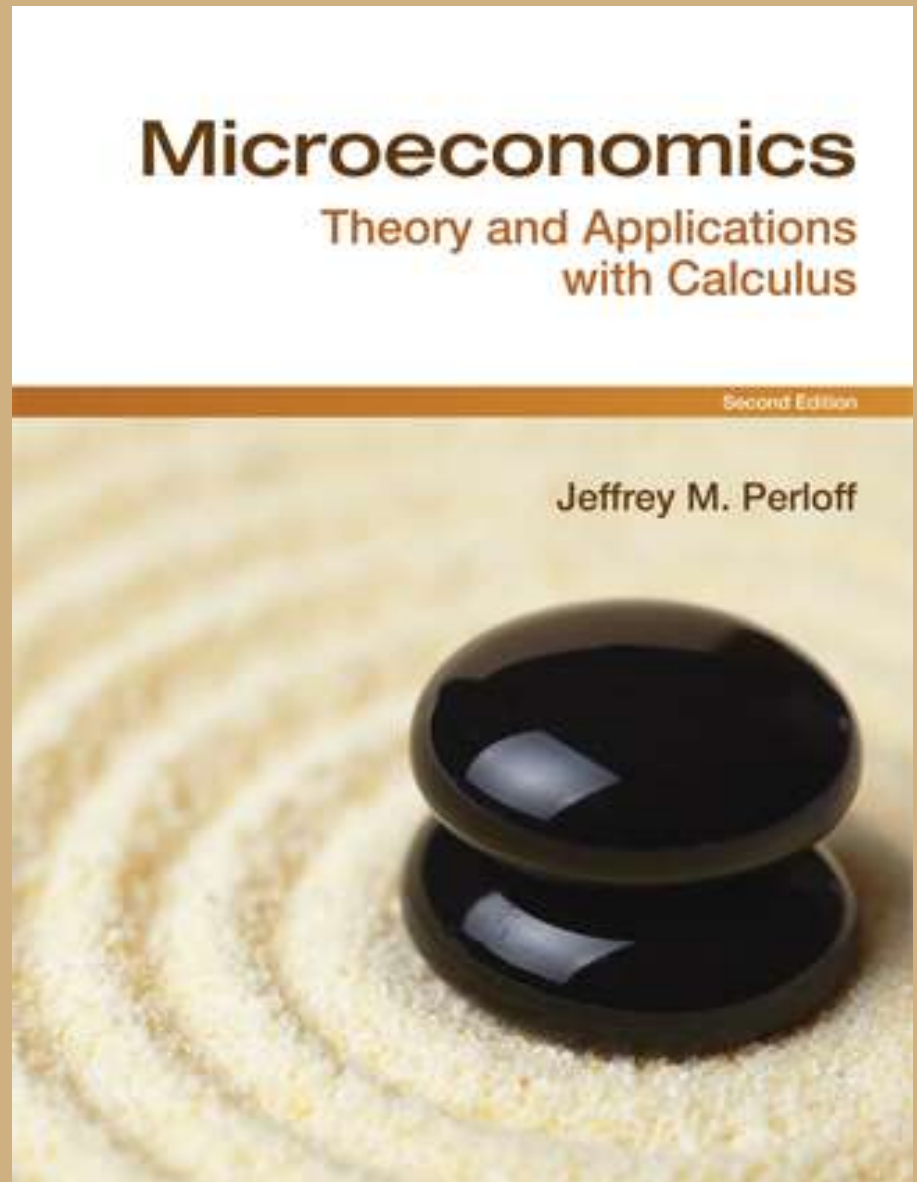


Chapter 19

Contracts and Moral Hazards

The contracts of at least 33 major league baseball players have incentive clauses providing a bonus if that player is named Most Valuable Player in a Division Series. Unfortunately, no such award is given for a Division Series.



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Chapter 19 Outline

- 19.1 Principal-Agent Problem
- 19.2 Production Efficiency
- 19.3 Trade-Off Between Efficiency in Production and in Risk Bearing
- 19.4 Payments Linked to Production or Profit
- 19.5 Monitoring
- 19.6 Contract Choice

19.1 Principal-Agent Problem

- The *principal*, such as an employer, contracts with the *agent*, such as an employee, to take some *action* that benefits the principal.
- If the principal cannot monitor an agent constantly, the agent may steal, shirk responsibilities, or engage in other opportunistic behavior that lowers productivity.
 - This is the ***principal-agent problem***.
 - Example: You pay someone by the hour to prepare your tax return, but don't know whether he/she worked all the hours that were billed.

19.1 Types of Contracts

- Three common types of contracts:

1. Fixed-fee contracts

- Payment to the agent is independent of the agent's actions, the state of nature, or the outcome.
- Principal keeps the residual profit

2. Hire contracts

- Payment to the agent depends on the agent's actions as they are observed by principal.
- Types include *hourly rate* and *piece rate*.

3. Contingent contracts

- Payments to principal and agent depend on state of nature, which may be unknown when contract is written.
- In a *sharing contract*, payoffs to each person are a fraction of total profit.

19.1 Efficiency

- Type of contract used depends on what the parties observe.
 - Hire contract used if principal can easily monitor agent's actions.
 - Contingent contract used if state of nature observed after work is completed.
 - Fixed-fee contract has no observation requirements.
- An **efficient contract** has provisions that ensure no party can be made better off without harming the other party.
 - Results in **efficiency in production**, where combined payoffs are maximized.
 - Results in **efficiency in risk bearing**, where person who least minds risk bears more of the risk.

19.2 Production Efficiency

- The type of contract that an agent and principal use affects production efficiency.
- To be efficient and maximize the joint profit of the agent and principal, a contract needs two properties:
 1. Contract must provide large enough payoff that agent is willing to participate in the contract.
 2. Contract must be ***incentive compatible*** in that it makes the agent want to perform assigned tasks rather than engage in opportunistic behavior.

19.2 Production Efficiency Example

- Buy-A-Duck store sells wooden duck carvings
 - Paula is the principal (owner) and Arthur is the agent (manager)
 - Joint profit is a function of the number of ducks sold (a), which is determined by Arthur's actions and the marginal cost of producing one more carving, m :

$$\pi(a) = R(a) - ma$$

- How many ducks must Arthur sell to maximize joint profit?

- FOC:

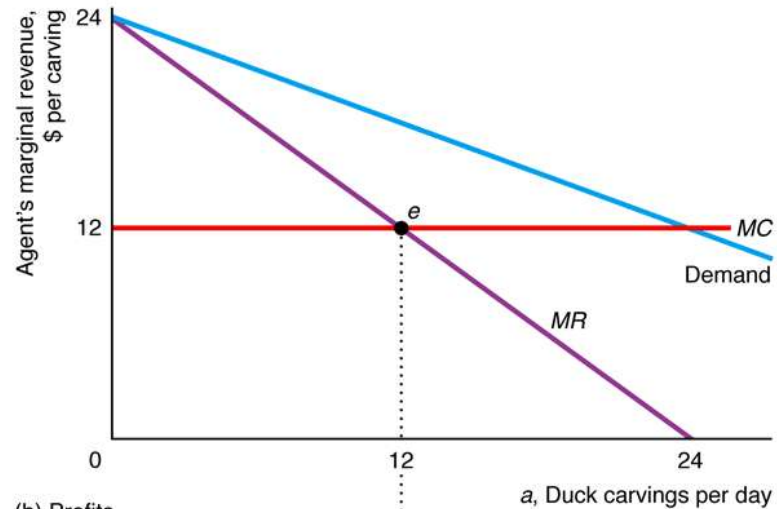
$$\frac{d\pi(a)}{da} = \frac{dR(a)}{da} - m = 0$$

- We can analyze this graphically with a few assumptions.

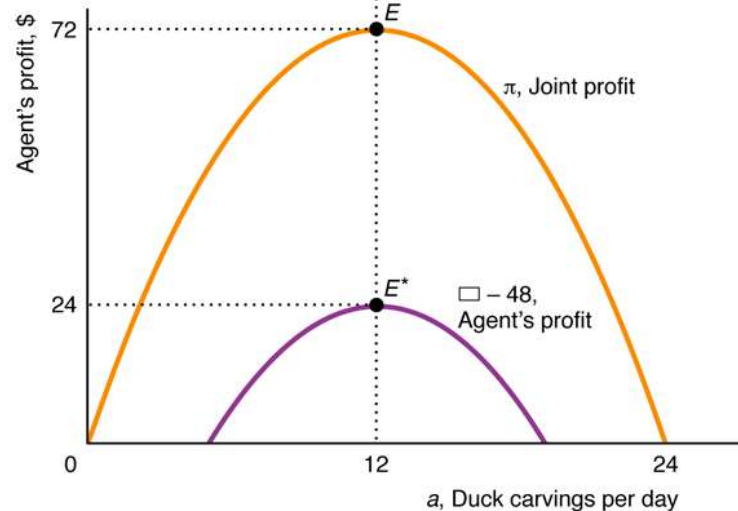
19.2 Production Efficiency Example

- Assuming $m = 12$ and inverse demand is $p = 24 - \frac{1}{2}a$, Arthur maximizes his profit and joint profit at $a = 12$.

(a) Agent's Problem



(b) Profits



19.2 Full Information: Fixed-Fee Contract

- Assume both Paula and Arthur have full information about Arthur's actions and the effect on profit.
- In this situation, are there incentive-compatible fixed-fee contracts that do not require monitoring and supervision?
 - Arthur earns a residual profit; profit less **fixed** rent he pays Paula.
 - FOC is unchanged, so profit is still maximized when Arthur sells 12 ducks.
 - This occurs because Arthur gets entire marginal profit from selling one more duck.

19.2 Full Information: Hire Contract

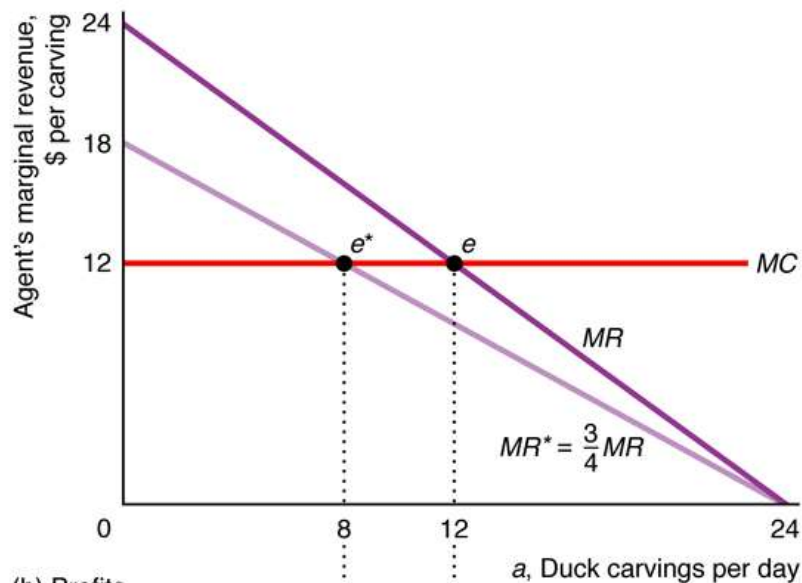
- Now suppose Paula contracts to pay Arthur for each duck he sells (a hire contract).
 - If she pays him \$12 per duck, Arthur just breaks even on each sale because $m = 12$.
 - Even if he agrees to this contract, he requires supervision because he gets no marginal profit from selling one more duck.
- Paula must offer Arthur more than m per duck for him to have incentive to sell as many as he can.
 - Such a contract is not incentive compatible.
 - Joint profit maximization requires $MR = MC$, and Paula's offer $> m$ means she directs Arthur to sell fewer ducks than is optimal.

19.2 Full Information: Contingent Contract

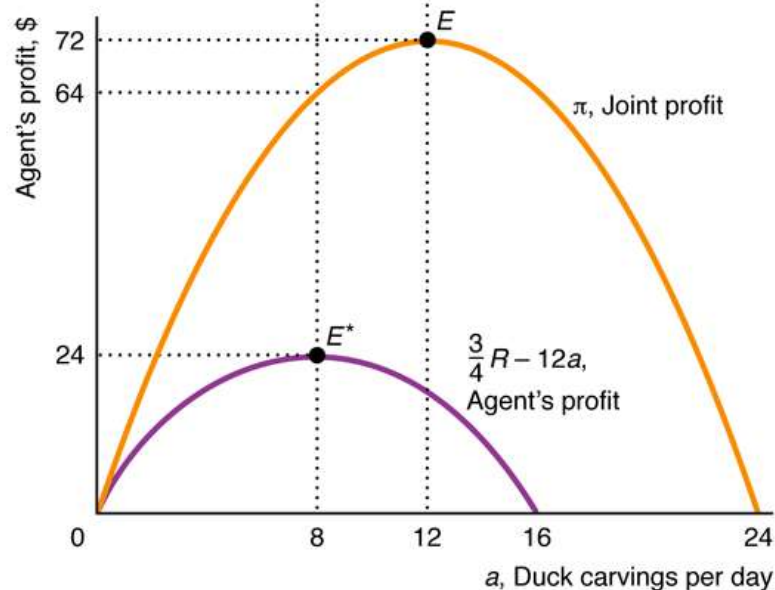
- Now suppose Paula and Arthur use a contingent contract to share the revenue.
 - Arthur receives $\frac{3}{4} R$; Paula receives $\frac{1}{4} R$.
- Under this revenue-sharing contract, Arthur's *MR* curve is below *MR* in a different type of contract.
 - For example, selling 12 ducks no longer brings in \$12 in additional revenue; 12 ducks brings in $\frac{3}{4} \$12 = \9 in *MR*.
- Thus, joint profit is not maximized when the agent maximizes his own profit in this type of contract.

19.2 Full Information: Revenue Sharing

(a) Agent's Problem



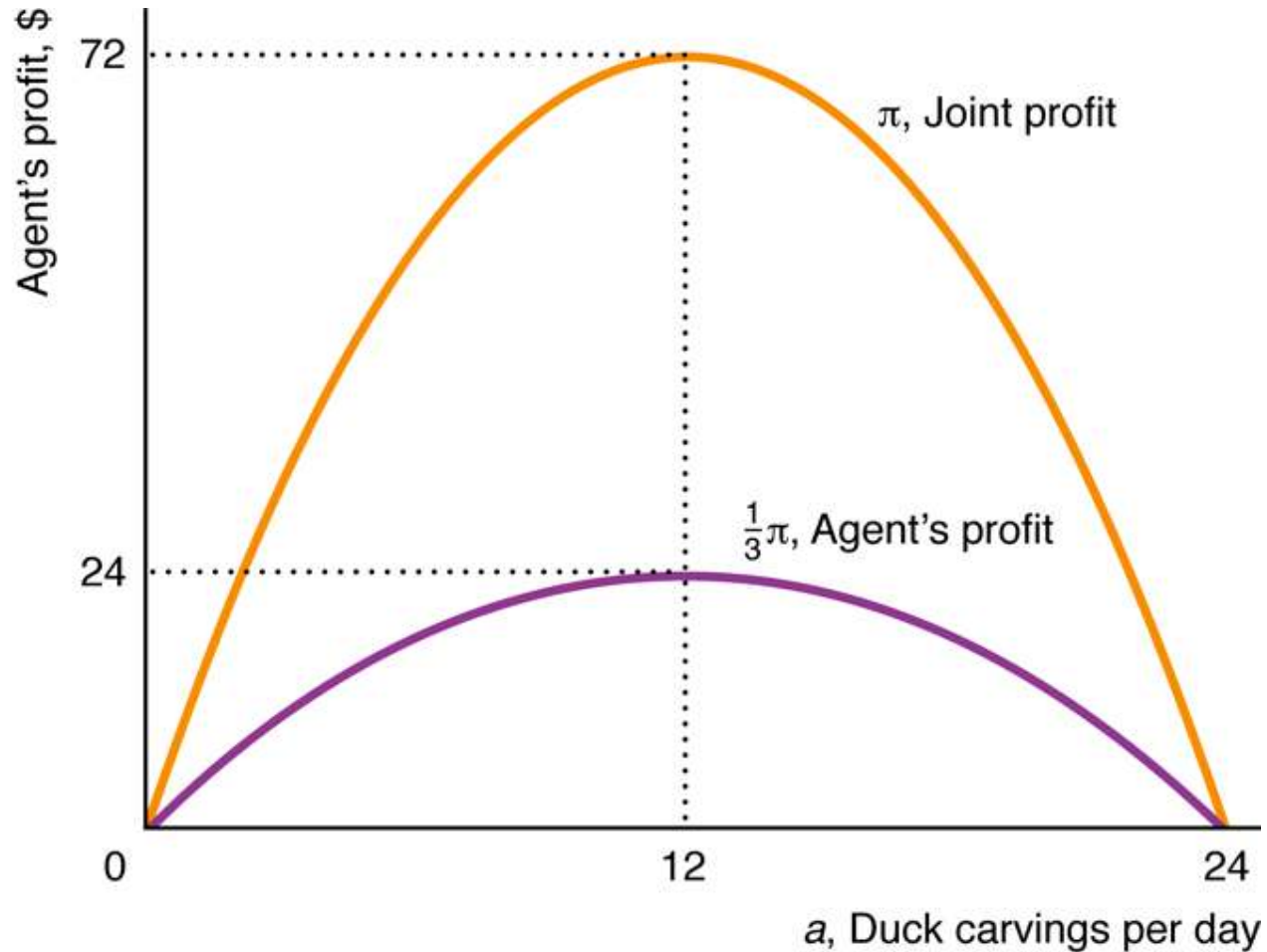
(b) Profits



19.2 Full Information: Contingent Contract

- Now suppose Paula and Arthur use a contingent contract to share the profit.
 - Arthur receives one-third of the joint profit.
- Under this profit-sharing contract, Arthur only earns one-third of the profit, but also only bears one-third of the *MC*.
- Joint profit is maximized when the agent maximizes his own profit; profit-sharing is efficient.

19.2 Full Information: Profit Sharing



19.2 Asymmetric Information

- Now assume that the principal, Paula, has less information than the agent, Arthur.
 - She can't observe the number of ducks he sells or the revenue.
- What occurs under the four different contract types?
 - **Fixed-fee contract** yields joint-profit-maximizing quantity.
 - **Hire contract** results in less-than-optimal quantity if Arthur is honest and greater-than-optimal quantity if he is not.
 - **Revenue-sharing contract** is still inefficient.
 - **Profit-sharing contract** is efficient if he reports revenue and cost to Paula honestly.

19.2 Production Efficiency Summary

- With asymmetric information, only fixed-fee contract is efficient and has no moral hazard problem.

Contract	Full Information	Asymmetric Information	
	Production Efficiency	Production Efficiency	Moral Hazard Problem
Fixed-fee rental contract			
Rent (to principal)	Yes	Yes	No
Hire contract, per unit pay			
Pay equals marginal cost	No ^a	No ^b	Yes
Pay is greater than marginal cost	No ^c	No	Yes
Contingent contract			
Share revenue	No	No ^b	Yes
Share profit	Yes	No ^b	Yes

^aThe agent may not participate and has no incentive to sell the optimal number of carvings. Efficiency can be achieved only if the principal supervises.

^bUnless the agent steals all the revenue (or profit) from an extra sale, inefficiency results.

^cThe agent sells too many or the principal directs the agent to sell too few carvings.

19.3 Trade-Off Between Efficiency in Production and in Risk Bearing

- Usually, a contract does not achieve efficiency in production and in risk bearing.
 - There exist trade-offs between these two objectives.
- Example: Contracting with a lawyer
 - Pam is the principal who has been injured in a traffic accident.
 - Alfredo is the agent and is her lawyer.
 - Pam faces uncertainty due to risk and asymmetric information.
 - Trial outcome depends on Alfredo's hours of effort, a , and attitudes of the jury (state of nature, θ).
 - Pam never learns θ , so if she loses the case, she doesn't know if it was because Alfredo didn't work hard enough.

19.3 Trade-Off Between Efficiency in Production and in Risk Bearing

- The choice of various possible contracts between Pam and Alfredo affects whether they achieve efficiency in production or in risk bearing.

Type of Contract	Fixed Fee to Lawyer	Fixed Payment to Client	Lawyer Paid by the Hour	Contingent Contract
Lawyer's payoff	F	$\pi(a, \theta) - F$	wa	$\alpha\pi(a, \theta)$
Client's payoff	$\pi(a, \theta) - F$	F	$\pi(a, \theta) - wa$	$(1 - \alpha)\pi(a, \theta)$
Production efficiency?	No*	Yes	No*	No*
Who bears risk?	Client	Lawyer	Client	Shared

*Production efficiency is possible if the client can monitor and enforce optimal effort by the lawyer.

19.4 Payments Linked to Production or Profit

- How might additional clauses be added to a contract to eliminate or reduce moral hazards?
- An employer might get employees to work hard by paying by the output they produce.
 - **Piece-rate** hire contracts explicitly reward productivity and thereby provide greater incentive to work hard than hourly wages.
- Workers with harder-to-quantify productivity may be rewarded with year-end bonuses based on increases in firm profit or stock value.

19.5 Monitoring

- When a firm can't use piece rates or rewards, they usually pay fixed-fee salaries or hourly wages.
 - These methods may encourage shirking and/or inflating work hours.
 - Firm can reduce shirking through increased monitoring.
- Monitoring eliminates the asymmetric information problem because both the employer and the employee know how hard the employee works.

19.5 Monitoring

- Types of monitoring:
 - Requiring punching a time clock
 - Installing surveillance cameras
 - Installing assembly lines (sets work pace)
 - Recording employees' voicemail, email, phone calls
 - Reviewing employees' computer files
- Monitoring is most common in the financial sector, in which 81% of firms use the above techniques.
- Monitoring may lower morale and, in turn, productivity.

19.5 Monitoring

- A direct approach to ensuring good behavior by agents is to require they deposit funds guaranteeing good behavior.
 - A **performance bond** is an amount of money that will be given to the principal if the agent doesn't complete assigned duties or achieve specific goals.
- Suppose worker's value on gain from shirking is $\$G$ and the worker must post a bond of $\$B$, which is forfeited if he is caught shirking.
 - If θ is the probability of being caught shirking, a risk-neutral worker won't shirk if $G \leq \theta B$ (gain \leq expected penalty).

19.5 Monitoring

- The minimum bond that discourages shirking is

$$B = \frac{G}{\theta}$$

- Bond must be larger the higher the value the employee places on shirking and the lower the probability of being caught.
- Employers like bonds because it reduces monitoring necessary to discourage moral hazards.
 - More commonly used to deter theft than shirking.
 - Workers may not have enough money to post a bond.

19.5 Monitoring

- Firms discourage shirking by raising an employee's cost of losing a job.
- An alternative is for the firm to pay an unusually high wage, called an **efficiency wage**.
 - If the going wage is \underline{w} , an efficiency wage is $w > \underline{w}$.
- The extra earnings, $w - \underline{w}$, serves the same function as the bond, B , in discouraging bad employee behavior.

$$w - \underline{w} = \frac{G}{\theta}$$

19.6 Contract Choice

- A firm may choose to concentrate on hiring industrious workers rather than on stopping lazy workers from shirking.
 - Such a firm seeks to avoid *moral hazard* problems by preventing *adverse selection*.
- Firms may be able to determine which prospective workers will work hard by giving them a contract choice.
 - Those who select contingent contracts, in which pay depends on how hard they work, signal they are hard workers.
 - Those who choose fixed-fee contracts signal they are lazy workers.

19.6 Contract Choice

- Workers sort themselves when the firm offers two different contracts.

	Contingent Contract (30% of Sales), \$	Fixed-Fee Contract (\$25,000 Salary), \$
<i>Hard Worker</i>		
Sales	100,000	100,000
– Salesperson’s pay	<u>–30,000</u>	<u>–25,000</u>
= Firm’s net revenue	70,000	75,000
– Office expenses	<u>–50,000</u>	<u>–50,000</u>
= Firm’s profit	20,000	25,000
<i>Lazy Worker</i>		
Sales	60,000	60,000
– Salesperson’s pay	<u>–18,000</u>	<u>–25,000</u>
= Firm’s net revenue	42,000	35,000
– Office expenses	<u>–50,000</u>	<u>–50,000</u>
= Firm’s profit	–8,000	–15,000