

Additional practice questions

1 *This question is about the theory of the firm.*

1.1 **According to Grossman and Hart (1986, ‘The Theory of Vertical and Lateral Integration’) why do firms exist, and what limits the scope of the firm?**

Suggested answer: A first-class student will present Grossman and Hart’s property rights model in some detail, showing intuition as well as algebra, and clearly explain the ideas of incomplete contracting, relation-specific investments, hold-up and the division of surplus in the event of an uncontracted contingency, and the impact of this division of surplus on ex-ante investments, which are assumed to be hidden and thus not contractible. If the downstream firm buys its supplier, it will lessen the ability for the upstream firm to ‘hold-up’ production and extract rents in the event of an uncontracted contingency. According to this theory, ownership leads to greater control and bargaining power. Such power comes from the fact that the firm’s heads could fire the managers and employees of this division if they do not perform. Without integration a downstream firm will be reluctant to invest in a relationship (such as by physically locating nearby) with its most efficient supplier, and may make investments (or inefficiently allocate its sourcing) in other less efficient suppliers, so that in the event of an uncontracted contingency the downstream firm will have outside options and bargaining power. The supplier may also make such wasteful ‘rent-seeking’ investments (see rent-seeking investment below) to increase its own market power. If acquisition eliminates the potential for hold up, it will encourage efficient (but hidden) investments in the relationship between the supplier and downstream firm, and discourage inefficient rent-seeking investments. A first-class student will also clearly emphasize the *disadvantages* of integration within this model, namely, the fact that the downstream firm may ‘hold up’ its supplier after integration, and thus discourage (e.g., cost-saving) relationship-specific investments (again involving hidden action and/or information and thus not contractible).

For a more complete discussion, see lecture notes 8-9

1.2 **Describe two modern theories of the firm other than Grossman and Hart (1986), explaining the difference between each theory, and explaining how they differ from Grossman and Hart (1986).**

Suggested answer: Modern theories of the firm include Transactions costs and rent-seeking (e.g., Williamson, 1971), ‘Incentive systems’ (e.g., Holstrom and Milgrom, 1991)

, . and Adaptation' (e.g., Simon, 1951; Klein and Murphy, 1988). For a more complete discussion, see lecture notes 8-9.

2 This question is about 'alternative' models of the behaviour of agents in organizations.

2.1 Traditional principal-agent theory assumes that agents are interested primarily in financial rewards. Describe and present a model using an alternative assumption, such as 'intrinsic motivation' or the 'desire for impact.' What does this alternate model tell us about the nature of optimal contracts and optimal design of organizations?

2.2 What empirical evidence is there that workers are motivated by factors other than the desire for financial rewards?

3 This question is about the theory of the firm

3.1 "If the market mechanism works so well, why do firms exist?" Answer the above questions by explaining and assessing two modern theories of the firm other than Grossman and Hart (1986) and other than the classical theory of the technical advantages of scale and scope.

Answer guidelines: 1. A 'first' student should cite at least two theories of the firm and give conditions for when these theories are appropriate, and clearly explain how they work, both precisely and intuitively. She will also critique these theories, perhaps on the lines below, and point out difficulties that arise from integration. She will offer economic models using algebra or numeric examples, and preferably give some intuition for these examples. She will also cite at least one finding from the literature or case from the business world. The essay will be clearly written and demonstrate a clear understanding of the material.

2.1. A 2.1 student will do most of what a first student will do, but may fail to include one or more of the requirements of the previous paragraph. She should offer some algebraic or numeric model, but it might not be fully fleshed out. She may fail

to understand one small point about one of the theories of the firm or its applicability.

2.2 A 2.2 student will still basically understand more than one of the models, but may fail to give a precise (algebraic or numeric) example, and/or fail to cite evidence or literature.

3. This student will show some understanding of the theory of the firm but there are major gaps in her understanding. Or she may show some evidence of a good understanding but fail to demonstrate this in a clear way.

Suggested Answer: *Note: the student need not offer all of these theories, but should touch on two or more of these.* Grossman and Hart define the scope of the firm as ‘those assets [not including its employees] that it owns or over which it has control.’ This is our working definition.

A complete theory of the firm needs to explain both why firms exist (and not just agents who freely trade in a market), and also why integration is not absolute— why firms often choose *not* to merge (tackled in the next part of the question). There are various theories of why firm’s exist. These include market power issues: the inefficiency of double marginalization (hence vertical integration); the potential to collude and exercise market power (hence horizontal integration). These also include issues of incomplete information (adverse selection) and hidden actions (moral hazard). Finally, there is the problem that contracts may be incomplete or unverifiable, which can lead to ‘hold-up’ problems. However, integration (mergers) can raise problems of their own and make firm’s *less* profitable, hence we have many firms rather than one big global firm.

Theories of the firm include: 1. Double marginalization / Collusion and market power over outsiders ...

Double marginalization Vertical integration between two monopoly firms: consider a single upstream and a single downstream firm: the upstream firm produces a single input that is converted one-to-one into final output by the downstream firm. Suppose that the costs of production of the upstream firm are zero. The upstream firm sets a price for the inputs it supplies to the downstream firm, and the downstream firm chooses how much inputs to buy. The demand is based on demand in the final market and the price of the input. We assume that the downstream faces a linear demand: $Q = 1 - P$. It now follows from simple calculations that the upstream firm will set price: $p_u = 1/2$, the downstream firm will demand $q = 1/4$ and the total profits of the firms are given by $3/16$. By contrast, if the two firms integrate and a single firm sets the optimal input price and final quantity then the profits of $1/4$ can be attained by setting the input price of 0, with the output level of $1/2$. This example suggests that the two firms would be better off by integrating. Moral: Markups over marginal cost cause inefficient behavior even for producers.

But even if the firms integrate this problem may persist, depending on how they structure transfer prices – this problem will be analogous to the government’s problem in regulating a natural monopoly. And another way to solve this problem might be through price discrimination; e.g., a fixed ‘subscription’ price that entitles the downstream firm to purchase at marginal cost.

Collusion and market power over outsiders ... This applies to firms that are ‘horizontal’: they both face the same buyers of their output, and/or they both purchase from the same suppliers.

Consider the case of Cournot (or Bertrand) duopolists. It is easy to see that if they set quantities independently then Nash equilibrium profits are (strictly) lower than the profits that a merged firm monopoly can make. (Too see this take a linear demand zero cost example and work out the duopoly output and profits and compare this to the monopoly profits.) Again this suggests that the firms would be better off by merging. This is the sort of merger that governments try to prevent, since it comes at the expense of consumers.

Similarly, if the firms both purchase from the same suppliers a merger could let them collude to exercise ‘monopsony’ or ‘oligopsony’ power. This theory suggests that the firms would be better off by merging, **if** collusion between firms is impossible (for legal reasons or because of failures of coordination), and if such pricing is possible when a firm controls the entire market.

2. Transactions costs and rent-seeking (e.g., Williamson, 1971)

If writing contracts is costly, organizing in a firm may save on these costs and/or the costs of disputes in the event of such contingencies. For various reasons, contracts between parties will be ‘incomplete,’ in that they do not specify what should be done in every relevant contingency. This incompleteness results from: 1. The costliness of specifying additional contingent clauses in a contract. 2. The difficulty of precisely specifying such clauses 3. The difficulty of verifying such contingencies to an outside party who can enforce these 4. An inability to foresee every possible contingency (the space of all possible events in the universe!) Some contingencies may lead the terms of the contract (say, the amount or type output produced or supplied) to become inefficient – there will be scope for renegotiation to increase the joint surplus. In the event of an unforeseen/uncontracted contingency a dispute over how to renegotiate a contract (especially the division of surplus) may itself be costly. If there is asymmetric information, the parties may fail to reach an efficient agreement.

These concerns (as well as the hold-up problems discussed below) are generally associated with the ‘transactions costs economics’ school (e.g., Williamson, 1985). According to Hart they fail to explain why haggling and hold-up are less of a problem in a merged firm, generally assuming that such a firm can ‘command and control.’

One explanation for why hold-up should be less of a problem after merger is that the owner will be able to dismiss any managers who do not execute the revised optimal policies. However, production may require some relationship-specific investments in the managers themselves, and thus these managers may continue to have some bargaining power, particularly if they have (or have cultivated) a good ‘outside option.’

3. ‘Incentive systems’ (e.g., Holstrom and Milgrom, 1991) I will provide a model answer based on this theory when I get a chance.

4. ‘Adaptation’ (e.g., Simon, 1951; Klein and Murphy, 1988) I will provide a model answer based on this theory when I get a chance.

3.2 “If doing business in firms is so advantageous, why don’t firms always want to merge?” Describe Grossman and Hart’s (1986) ‘Theory of Vertical and Lateral Integration,’ and use this to answer the question above.

Suggested Answer Guidelines

A first-class student will present Grossman and Hart’s property rights model in some detail, showing intuition as well as algebra, and clearly explain the ideas of incomplete contracting, relation-specific investments, hold-up and the division of surplus in the event of an uncontracted contingency, and the impact of this division of surplus on ex-ante investments, which are assumed to be hidden and thus not contractible. If the downstream firm buys its supplier, it will lessen the ability for the upstream firm to ‘hold-up’ production and extract rents in the event of an uncontracted contingency. According to this theory, ownership leads to greater control and bargaining power. Such power comes from the fact that the firm’s heads could fire the managers and employees of this division if they do not perform. Without integration a downstream firm will be reluctant to invest in a relationship (such as by physically locating nearby) with its most efficient supplier, and may make investments (or inefficiently allocate its sourcing) in other less efficient suppliers, so that in the event of an uncontracted contingency the downstream firm will have outside options and bargaining power. The supplier may also make such wasteful ‘rent-seeking’ investments (see rent-seeking investment below) to increase its own market power. If acquisition eliminates the potential for hold up, it will encourage efficient (but hidden) investments in the relationship between the supplier and downstream firm, and discourage inefficient rent-seeking investments.

A first-class student will clearly emphasize the *disadvantages* of integration within this model, namely, the fact that the downstream firm may ‘hold up’ its supplier

after integration, and thus discourage (e.g., cost-saving) relationship-specific investments (again involving hidden action and/or information and thus not contractable). Simply put, the newly acquired supplier may know of potential cost-saving measures and innovations that the downstream firm is ignorant of, but it will not have the incentive to invest in such measures since if it does such rents will likely be ‘captured’ by the owners of the new firm. The ‘cost of control is the loss of initiative,’ and ‘using a formal instrument to stop one hold-up problem typically creates another hold-up problem’ (Gibbons). The student should grasp and model the two-way hold-up problem (e.g., as given below). Finally, the student should note that the ownership decision will be determined by the relative importance of the potential for each type of hold-up, and the importance of each type of relationship specific investment. However, a student may note one weakness of this firm is it treats the newly-acquired managers and employees as ‘drones’ and does not look extensively at mechanisms the firm could use to address the incentive problems previously discussed.

One relevant example of the potential for two-sided hold-up is the relationship between GM and Fisher-Body beginning in 1919 (see below). *Ownership as residual rights* As alluded to in the previous section, even if a producer merges with its supplier, it may require someone to manage this new ‘division.’ The firm needs to give this manager an incentive to produce efficiently. This may be complicated by the presence of hidden actions or hidden information. In these author’s ‘property rights’ theory of the firm, ownership represents residual rights over assets: the ability to make decisions regarding the use of assets in cases that are not explicitly specified in a contract. Contracts (e.g., between firms) are typically incomplete, (discussed in the previous section under transactions costs – if not specified there this should be denoted here)– they do not specify what is to occur in every contingency. In the event of an unforeseen contingency, the party who owns the asset decides what to do with it.

Rent-seeking investment (to gain bargaining power in the event of uncontracted contingencies): Imagine one downstream firm (D) and one upstream firm (U). The upstream firm makes an input that is of value Q to the downstream firm. However, there is an alternative use of the inputs, say firm A. Second, firm U can make investments and these investments can increase the value of Q and P . In what follows we will assume that $Q > P$. This assumption means that it is efficient for U and D to agree on a price and that U should not sell to A. What are the terms of trade between U and D? We assume that firm U and D can observe P and Q and so a simple way to proceed is to assume that the two have equal bargaining power. This means that they equally split the surplus: the price is then given by $(P + Q)/2$. This bargaining rule in turn generates incentives for U. Assume that $Q = a_1 + \epsilon$, while $P = a_2 + \delta$, where ϵ and δ are normally distributed with mean zero.

Under non-integration: If U sells to A it gets a price of P . This possibility creates bargaining power for firm U and may induce investments that increase P even if this

has no bearing on value of Q . To see this consider the case where Q is fixed in value however P can be increased by investments a_1 . Simple calculations then show that U will choose a^* such that $1/2 = c'(a^*)$, where $c(\cdot)$ is an increasing and convex cost function. This investment is simply a waste of resources since surplus generated is $Q - c(a^*)$. It follows that integration will resolve this problem: a take-over of U by D will mean that U will have no power to sell to A and so will have no incentive to make investments in P , which are wasteful.

This theory ties in with incomplete contracts, the theory of ownership as residual rights, and the hold-up problem. If contracts were complete, U would sign a complete long-term contract with D and would never have the opportunity to renegotiate to hold up D . Thus it would not be interested in making any investments in a_1 . In this setting, integration prevents U holding up D (or at least lowers the risk) – U owns the assets in the event of any contingencies, and thus U will have optimal incentives to make investments in the production process. However, as discussed earlier, getting managers to execute these policies may still be costly.

Relationship-specific investments by upstream firm or division This continues from the model above. Assume that integration involves D buying all rights to the equipment and hence output of U . In particular then once integration takes place U has no rights to sell to A . Now suppose that $Q = a_2 + \epsilon$ and P is fixed in value. Upon take-over U has no rights to surplus and so U has no incentives to make any investments at all. However, non-integration provides incentives to firm U , since it then gets a price $1/2(Q + P)$, and so will choose an action \bar{a}_2 such that $1/2 = c'(\bar{a})$. If $Q(\bar{a}) - c\bar{a} > Q$ then non-integration is optimal.

Investment, hold-up, and incomplete contracting – the General Motors-Fisher Body Example ('property rights')

The case of GM and Fisher Body illustrates the idea of a two-sided hold-up problem. In 1919 General Motors decided to switch from open body cars to (present day) close body cars. It approached Fisher Body a leading body producer to supply these new bodies. The production of these bodies required substantial investments on the part of Fisher Body. However, once these investments were in place it feared that General Motors may insist on only buying bodies at marginal costs, leading to large losses. To provide proper incentives to Fisher Body, General Motors entered into a contract in which explicit provision was made for fixed costs and investment costs, by providing for a mark up above variable costs. Faced with this contract, however, Fisher Body had an incentive to inflate its costs via overstaffing. General Motors had no option but to pay prices corresponding to the inflated costs, given the contracts. At the end, these costs proved to be too high and GM bought out Fisher Body. It is worth noting that the price of this buy-out was high since Fisher Body had a strong bargaining position based on high expected profits given the contract in place.

This case shows how a contract designed to stop GM from holding-up Fisher Body creates the possibility that Fisher Body can hold-up GM in turn. Could the contract have been better written? The theory of ‘Incomplete Contracts’ claims that contracts cannot plan for every possible contingency. According to the simpler theory, under integration the integrated firm has ‘ownership,’ and thus the right to make the decision what action to take if an unforeseen contingency arises.

The problem of hold-up can be very serious. If an unforeseen or uncontracted contingency arises; let’s say some vehicle is invented that replaces the car, and GM needs to change the bodies of its cars slightly to make them military-ready, as the military is the only remaining demand. If the contract did not specify what should happen in such a contingency, Fisher would not be obligated to make this change to the body – it could claim this is too expensive. If GM would face virtually no demand with its current specifications, and it would take years to get another body producer equipped to work with GM, then Fisher would have a great deal of market power. Fisher could ‘hold-up’ GM for virtually all its expected profits from the new military vehicles. Knowing that such contingencies are ‘likely’, GM may be reluctant to sign any contract with an outside firm to manufacture its bodies if this involves any degree of lock-in. Put another way, GM may not be willing to make productive but relationship-specific investments in its relationship with Fisher if it means that Fisher may capture a great deal of the joint surplus in the event of an unforeseen contingency.

4 This question is about incentive problems in the firm

4.1 “In attempting to manage and control employees and divisions, firms face problems inducing efficient behaviour similar to those problems faced by government regulators and policymakers.” Discuss the statement above. Your answer should include economic modeling as well as offering intuition and citing real-world evidence and economic literature.

Suggested Answer:

Introduction

It is widely suggested that the public sector is less efficient than private industry. Government has limited information about its employees, and its suppliers. In many cases, in the public sector, the person responsible for making key decisions is not efficiently rewarded for the success or failure of these decisions. And government

employees seem to have a reputation for working less than they ‘should,’ and in some cases for outright corruption. Governments attempts to regulate natural monopolies also face many problems – in particular, it is difficult for the government to know what price it should require the monopolist set, and given the price regulation difficult to ensure quality. And firms may be reluctant to enter as a regulated natural monopoly, because it is unclear whether the government will keep its promises; as the supreme law, the government may always change the regulations or even nationalize a firm. However, firms, particularly large firms face similar problems as do policymakers and regulators in ensuring that their employees are working efficiently, and their divisions are producing efficiently.

Incentive problems in the firm

Economists have come up with many theories to explain the potential advantages of the firm, and of firms integrating; efficiencies (from the firm’s perspective) are possible, at least if a firm’s manager could exert total control and had complete information. But this is a big if. With incomplete information, integration may cause a *loss* of efficiency. This can occur for many of the reasons discussed in the principal-agent models: with unobserved effort, moral hazard could lead to inefficient behavior, and to induce efficient effort the manager may have to compensate the agent for risk-bearing (if the agent is risk-averse) or offer a limited-liability rent (if the agent’s liability is limited). Before integration, the agent may have reaped the net profits herself, and thus would have put in the efficient effort. *[Student should discuss moral hazard or hidden-information/ adverse selection problems more extensively here, giving some intuition and preferably some numeric/algebraic models]*

After integration, the principal may also be unable to observe the cost structure of the agent, or the potential for cost-savings. If the agent (the division in the firm producing the input, say) is given a flat wage, she has little incentive to produce more than the minimum required or to cut costs. If the agent is allowed to charge any transfer-price she desires, she is in effect a monopolist and we are back to the case of double marginalization. If the agent is payed based on some imputed marginal cost, the agent has an incentive to inflate these costs, or at least not to put in effort to innovate and bring costs down. The manager could tell the agent that she will be able to keep any savings from cost-cutting, but this promise may not be credible, and the manager might claim the cost savings occurred from an external factor. The following model (extending the model in 4) illustrates this:

Assume that integration involves D buying all rights to the equipment and hence output of U. In particular then once integration takes place U has no rights to sell to A. Now suppose that $Q = a_2 + \epsilon$ and P is fixed in value. Upon take-over U has no

rights to surplus and so U has no incentives to make any investments at all. However, non-integration provides incentives to firm U, since it then gets a price $1/2(Q + P)$, and so will choose an action \bar{a}_2 such that $1/2 = c'(\bar{a})$. If $Q(\bar{a}) - c\bar{a} > Q$ then non-integration is optimal.

Note: In addition to the theories mentioned above, the student may also discuss 'behavioral' theories and evidence, such as 'intrinsic motivation,' or the 'desire for impact.'

4.2 Discuss some potential 'remedies' to the management problems mentioned previously, and the obstacles these remedies may face. Consider situations where a firm may allocate different employees to the same or similar tasks, and situations where employees are asked to perform multiple tasks. Your answer should include economic modeling as well as offering intuition and citing real-world evidence and economic literature.

Suggested Answer:

Possible Remedies

Student may discuss:

Hidden information – Optimal contracts, trading off for efficient production for information rents

Hidden Action – Optimal contracts, trading off for efficient effort levels for risk premia or limited liability rents

The equal compensation principle:

For all activities that cannot be monitored, marginal rate of return to time spent on each activity must be equal. Otherwise agent spends no time on activity with lower marginal rate of return. As a result, if there is an activity for which performance cannot be measured, incentive pay cannot be used for any other activity. Of course, this begs the question of how you could *ever* get them to do such a task.

– Example: primary school teachers and test-based incentives ... 'teaching to the test'

Benchmarking: If effort is unobserved but various employees outputs are, a principal can compare or 'benchmark' agents performance to one another – this can induce optimal effort when there are common uncertainties (e.g., a good/bad market, weather, etc). If other output are informative about effort an optimal contract will have payments contingent on these 'signals' (Holstrom informativeness principle). However,

even with such benchmarking, the firm will have to pay a risk premium for ‘idiosyncratic’ risk (this contrasts with asset market pricing). This benchmarking also yields an additional problem called the ‘ratchet effect.’ If workers know they are being compared to each other or they may collude to keep performance low. This can be enforced by a collective punishment strategy (as in the folk theorem for infinite games) or by physical retaliation or other punishments. If workers are being benchmarked to their own previous performance, they have a disincentive to perform well. How to (somewhat) solve problem of ratchet effects? Reputation for commitment, Job rotation, Menu of contracts (mechanism).

Some potential evidence:

In, October 1988 Du Pont changed its payment schedule for nearly all 20,000 employees (including management)

6 percent of annual pay was placed into a ‘at-risk pool’. If business exceeded goals, employees would receive a multiple of the money as bonus. If business did not meet goals, employees would lose money. For instance, the fibers division had to achieve target of 4 percent real-earnings growth to recover their at-risk pay.

Was this plan a good one?

Poor economy led to high input prices and employees lost monies placed in bonus pool. Employees were unhappy.

Design problems of plan: Individual effort only small impact on output. Profits dependent on many random factors outside control employees. No additional information used, such as earnings-growth relative to other firms in industry, or market conditions.

On the other hand.... Lazear (2000, AER) studied reward schemes of the Safelite Glass Corporation. They changed from hourly wage rates to piece-rates.

Results: on average 44 percent higher output per worker, of which

Half due to incentive effects (workers producing more)

Half due to self-selection effects (hiring more productive workers)