

Extended Assignment 2 Solutions

1. The table below is an example of a principal-agent problem. Fill in the shaded spots on the table. A “forcing” contract is simply a salary when the principal can observe effort and fire the employee.
  - a) For the incentive pay you are to determine how much of a “base” is needed for the “profit sharing” and what payment the firm would receive in the “franchising”. For determining compensation assume that on average the employee must earn at least enough to cover average disutility.

| Effort Level                     | Gross Profit |                 | Expected Gross Profit | Disutility      | Expected Net Profit |              |    |
|----------------------------------|--------------|-----------------|-----------------------|-----------------|---------------------|--------------|----|
|                                  | 100          | 50              |                       |                 |                     |              |    |
| High                             | 0.8          | 0.2             | 90                    | 45              | 45                  |              |    |
| Medium                           | 0.6          | 0.4             | 80                    | 39              | 41                  |              |    |
| Low                              | 0.2          | 0.8             | 60                    | 30              | 30                  |              |    |
|                                  | Effort Level | Compensation    |                       | Employer Profit | Worker Profit       | Total Profit |    |
| Observable Effort                |              |                 |                       |                 |                     |              |    |
| Forcing Contract                 | High         | 45              |                       | 45              | 0                   | 45           |    |
| Unobservable                     |              |                 |                       |                 |                     |              |    |
| Salary                           | Low          | 30              |                       | 30              | 0                   | 30           |    |
| Incentive Pay                    |              | Base or Payment | Compensation          |                 |                     |              |    |
|                                  |              |                 | $\pi=100$             | $\pi=50$        |                     |              |    |
| Profit Sharing (1/2 Profit+Base) | Medium       | 0               | 50                    | 25              | 40                  | 0            | 40 |
| “Franchising” (Profit-Payment)   | High         | 45              | 55                    | 5               | 45                  |              | 45 |

The most difficult contract to figure out is the profit sharing. To see that the employee will only engage in medium effort note that if the employee increases effort from low to medium, gross profits increase by 20 on average. Then his compensation, on average, increases by 10. This is greater than his increase in disutility of 9 so he will be willing to engage in medium rather than low effort. Now if he does high instead of medium gross profit increases by 10 and he would get 1/2 or 5. This is less than his increase in disutility of 6 so he would not choose high effort.

The base is 0 with profit sharing because on average he earns  $40 = .6*100 + .4*50 > 39$ , his disutility with medium effort so we don't need to get him a base.

- b) Discuss and give some indication of how much you would be willing to pay for a supervisor if the supervisor could observe effort and therefore fire any employee not providing effort.
  - With franchising zero.
  - If you were forced to use salary for payment, then you would pay up to \$15, the difference between profits with the forcing contract and without it.
  - If you could use profit sharing, you would pay up to \$5, the difference between profits with forcing contract and profit sharing.

2. A computer manufacturer that distributes its computers for sale at numerous retail outlets within the same market is reconsidering its current distribution practices. Currently it sells a fixed quantity of computers to each outlet at the beginning of the month with the number of computers based, in part, on the past month's sales. Innovations that have reduced the length of time in production and distribution may make it more feasible to allow outlets to simply purchase computers from the manufacturer at any time they desire, thereby no longer having to commit to purchasing a set amount of computers each month.

Bearing in mind that the profits of the manufacturer are related to the price the outlets can charge consumers for the computer, would you recommend that the manufacturer should switch from requiring a fixed purchase of computers by the retail outlets to a system in which they can order any number of computers at a fixed price per machine?

Should the manufacturer switch to allowing outlets to order computers? Explain.

*No, the system he has in place in which the outlets must commit to orders in advance leads to quantity competition. A firm cannot fill all orders at all prices.*

*The alternative is the framework for price competition as the firm can pick a price and fill all orders.*

*As quantity competition has higher profits than price competition, the firm would want to stay with that.*

3 Consider a city that has two firms selling a particular good. Economies of scale prevent the entry of other firms.

Firms can set a high or low price and advertise or not advertise. If neither firm advertises their products will be perceived as identical. If one firm advertises and the other does not, the firm that advertises will be perceived as higher quality. If both firms advertised, their products will be perceived as having unique characteristics.

Table 1 lists the payoff structure for the strategies. The first number in the cell is the payoff (profits) to firm 1; the second refers to firm 2.

| Table 1                   |                             | Firm 2 Strategy             |                          |                            |                         |
|---------------------------|-----------------------------|-----------------------------|--------------------------|----------------------------|-------------------------|
|                           |                             | High Price,<br>No Advertise | High Price,<br>Advertise | Low Price, No<br>advertise | Low Price,<br>Advertise |
| F<br>i<br>r<br>m<br><br>1 | High Price,<br>No Advertise | 100, 100                    | 25, 125                  | -25, 150                   | -25, 125                |
|                           | High Price,<br>Advertise    | 125, 25                     | 50, 50                   | 25, 25                     | -50, 25                 |
|                           | Low Price, No<br>Advertise  | 150, -25                    | 25, 25                   | 0, 0                       | -25, -25                |
|                           | Low Price,<br>Advertise     | 125, -25                    | 25, -50                  | -25, -25                   | -50, -50                |

a) Firms are simultaneously making a decision about what strategies in which they can engage. Assume that each firm will chose a strategy without knowing the choice of the other firm but knowing the payoff structure of the other firm. Also assume that once a strategy is chosen, the firm can not change it (a one period game). What should firm 1 do to maximize expected profits? Explain your choice of strategy. Intuitively, why is the choice of strategies profit maximizing?

*The triangles are the best responses for Firm 1 and the rectangles are the same for Firm 2. Equilibrium strategy, then, is High Price, Advertise for both firms. This makes sense because the firms are able to product differentiate thereby creating customer loyalty and charging a higher price.*

b) Now suppose that the choice of strategy made by the firm is not irrevocable, that is, it can change its strategy every quarter, for example. In which case is it more likely that you will observe advertising, when firms must commit to long term strategies or can change them on a frequent basis? Explain and justify your answer.

*In the long term, when firms, can change strategies and retaliate we might see a reduction in advertising but maintenance of high prices, that is, an equilibrium of [High Price, No Advertise; High Price, No Advertise;]. This might be possible because firms have the opportunity to retaliate if a firm cuts price or advertises.*