LECTURE 11.0

PERFORMANCE EVALUATION

PERFORMANCE EVALUATION AT LINCOLN

Lincoln Electric Company was a successful company with a highly developed performance evaluation regime tied to remuneration.

There were two components to the employee incentive scheme:

- For production, employee wages were based on piece rates
- Year end bonus that was up to 100% of regular compensation

Performance Evaluation System

- The piece rate system: Note that this could be subject to manipulation, but there were well developed rules about how it was to operate
- Merit rating: Reflected the employees dependability, quality of output, ideas and cooperation etc as assessed by immediate supervisor.

PERFORMANCE EVALUATION AT LINCOLN

As noted Lincoln had operated successfully for many years.

There were a number of features of how it operated that made it successful:

- Evaluation systems were linked with the reward system – that is, the output from the performance evaluation system (pieces produced) were used in the reward system.
- Performance evaluation used both objective (units produced) and subjective (dependability and reliability) measures of performance.

Negative aspects:

- Failure to recognise how the three components of the firms organisational architecture (the decision rights system; its reward system and performance evaluation system) were closely linked led to large losses in new markets.

OUTLINE

11.0 Performance evaluation

11.1 Individual performance evaluation

11.2 Relative performance evaluation

11.3 Subjective performance evaluation

11.4 Team performance evaluation

11.5 Divisional performance evaluation

11.6 Transfer pricing

READING

Chapter 16, “Individual Performance Evaluation” in Brickley, Smith and Zimmerman (2006) *Managerial Economics and Organizational Architecture* (4th ed) (ignore pp. 525-27)

Chapter 17, “Divisional Performance Evaluation” in Brickley, Smith and Zimmerman (2006) *Managerial Economics and Organizational Architecture* (4th ed) (ignore pp. 560-64)

LECTURE 11.1

INDIVIDUAL PERFORMANCE EVALUATION

INDIVIDUAL PERFORMANCE EVALUATION

Recall the principal-agent problem.

Output is given by:

$$Q = \alpha e + \mu$$

Output (Q) depends on effort (e), productivity (α) and a random component (μ). The quantity and productivity are observable. Effort and the random component are unobservable.

A linear compensation scheme has the form:

$$Compensation = w_0 + \beta Q$$

We assume that Q is observable and contractible.

Employees must be paid a compensating differential the more risk they assume (the standard assumption is that employees are risk averse and employers risk neutral).

INDIVIDUAL PERFORMANCE EVALUATION

What β should the firm set?

Consider 'Conrad', for whom:

$$Q = 5e_c + \mu_c \qquad (1)$$
$$\mu_c \sim (0, \sigma^2)$$

What types of things might cause μ_c to change?

- Receipt of low quality parts
- Delays in receiving parts
- Distractions on the job

INDIVIDUAL PERFORMANCE EVALUATION

What might you do if (1) is unknown?

You might use a ‘time and motion’ study:

- Might have to be redone periodically
- Expensive
- Potential bias

Analysis of historical data:

- Leads to a perverse incentive associated with the ‘ratchet effect’ associated with basing this year’s standard of performance on last year’s performance

MEASUREMENT

Usually measuring output or effort is costly even if done imperfectly. The firm should balance the cost of measuring with the benefits of doing so. The choice of β and the choice of how much to spend measuring performance should be jointly determined

Recall the informativeness principle. Whenever low cost information is available, it should be used in assessing performance. Benefits include reduction in risk premium that must be paid to employees.

If it is difficult to measure Q, it may be feasible to base the reward on some other measure, call it Y. The problem with structuring incentives around what is observable (Y) rather than what is desirable (Q) is that you end up getting what you pay for: *Y.*

- Employees may be incentivised to take the wrong type of action. Consider some examples in Brickley: typists at Lincoln Electric paid by characters typed produced useless pages of gibberish, refuse collectors paid by weight of rubbish collected hosed the rubbish before weighing.
- Also be aware of unintended consequences – such as penalising Quarterbacks for intercepts.

Horizon problem:

- Employees near retirement age may focus on the short-term at the expense of longer term effects on the firm.

LECTURE 11.2

RELATIVE PERFORMANCE EVALUATION

RELATIVE PERFORMANCE EVALUATION

The performance of others may provide useful information.

Consider employees Conrad and Dina:

$$Q_C = 5e_C + \mu_C$$
$$\mu_C \sim (0, \sigma^2)$$
$$Q_D = 5e_D + \mu_D$$
$$\mu_D \sim (0, \sigma^2)$$
$$corr(\mu_C, \mu_D) = \rho > 0$$

Observing Dina's performance provides information into the performance of Conrad.

RELATIVE PERFORMANCE EVALUATION

Consider a group of welders:

- Assume 40 is the expected number of welds on an average day.
- Suppose that on a given day, average output is 43 which implies:

$$\mu=3$$

- Then, if the performance of Dina or Conrad was 41, then we might infer that they have slackened off and adjust compensation downwards.

Relative performance evaluation reduces risk to employees by netting out common shocks

However there are challenges, such as the incentive to for co-workers to “punish” extremely productive employees. Employees may also collude to reduce the performance benchmarks.

RELATIVE PERFORMANCE CONTRACT

Consider the following linear contract:

$$Compensation = w_0 + \beta(Q - \gamma\bar{Q})$$
$$Q = \alpha e + \mu$$
$$\mu \sim (0, \sigma^2)$$

Where w_0 and β are fixed parameters; Q is the employees own output and $\bar{Q}$ is the average output of a reference group – such as other salesmen/women.

- If $\gamma = 0$, the output of others has no impact on your own pay. That is, there is no use of relative output in the contract.
- If $\gamma = 1$, pay is based on a simple difference between your output and that of your coworkers. That is, relative performance is crucial.

RELATIVE PERFORMANCE CONTRACT

How to choose optimal γ?

- γ determines the risk to the employee
- w_0 can be adjusted to determine average pay (and hold expected compensation constant)
- If effort is independent of γ, choose γ to minimise employee risk

Since expected compensation can be same for any $\boldsymbol{\gamma}$ and effort choice not affected by $\boldsymbol{\gamma}$, then the efficient contract will be one that minimises risk to employee.

RELATIVE PERFORMANCE CONTRACT

In some cases effort is independent of γ. Assume:

- Employees effort doesn't affect that of other employees
- Employee has constant absolute risk aversion *r*.

Then his/ her certainty equivalent is given by:

$$Certainty\ equivalent = E\ [w_0 + \beta(Q - \gamma\bar{Q})] - 0.5rs^2 - C(e)$$
$$= w_0 + \beta(\alpha e - \gamma\bar{Q}) - 0.5rs^2 - C(e)$$

- The first term is expected compensation
- The second term is risk premium, where s^2 is the variance of compensation
- The third term is the cost of effort

[You won't be asked in the exam to replicate this maths.]

RELATIVE PERFORMANCE CONTRACT

So what will an employee do?

They will choose effort to maximise certainty equivalent wrt to e:

$$FOC: \beta Q' = C'^{(e)}$$

γ doesn't enter into this expression. Optimal effort choice does not depend on γ.

RELATIVE PERFORMANCE CONTRACT

We can show that the variance of compensation is minimised when:

$$\gamma^* = \frac{Cov(Q, \bar{Q})}{Var(\bar{Q})}$$

γ* measures the informativeness of Q as a signal of individual output

The numerator is a measure of the relationship between the employee's own output and that of other workers. When this is high the information from other workers is valuable (because it tells firms more about common shocks experienced by workers) and the signal is better. Conversely, when it is equal to zero then the output of other workers provides no information about the shocks experienced by the employee. So when the numerator is large we want to have a high weight on the output from other employees – relative performance is informative.

The denominator is the variance of average output. If this is high then there is a lot of noise in the average output and it contains less information about an individual's own effort. Hence when the denominator is large we want to have a small value of γ and not place a great deal of weight on how the individual performs relative to others.

LECTURE 11.3

SUBJECTIVE PERFORMANCE EVALUATION

SUBJECTIVE PERFORMANCE EVALUATION

Recall the problem of multitasking.

$$Q\text{=(task 1) + (task 2) + } \mu$$

$$Y\text{=(task 1) + } \emptyset$$

Q is what the firm cares about, but Y is measureable.

There is an obvious problem in using Y as a basis of a contract. If pay is based on Y, workers will focus on task 1

This important for job design. It is not ideal to design a job where only one task is measurable and can be incentivised.

But if that is the case, subjective performance evaluation where employee performance is holistically reviewed may be used. It creates potential to assess on a more diverse range of tasks, some of which are difficult to measure - being part of a team, being cooperative etc.

SUBJECTIVE PERFORMANCE EVALUATION

Possible subjective measures include:

- Standard rating systems
- Goal based systems

Also, think about problems with subjective evaluation approaches:

- Shirking among supervisors: ratings compressions, leniency
- Influence costs: employees try to influence supervisors

LECTURE 11.4

TEAM PERFORMANCE EVALUATION

EVALUATING TEAM PERFORMANCE

Evaluating team performance is challenging. How do you separately identify the performance of an individual member of the team?

Consider if Conrad and Dina are part of a team

Individually:

$$Q_i = 5e_i + \mu, \quad i = c, d$$

For the team:

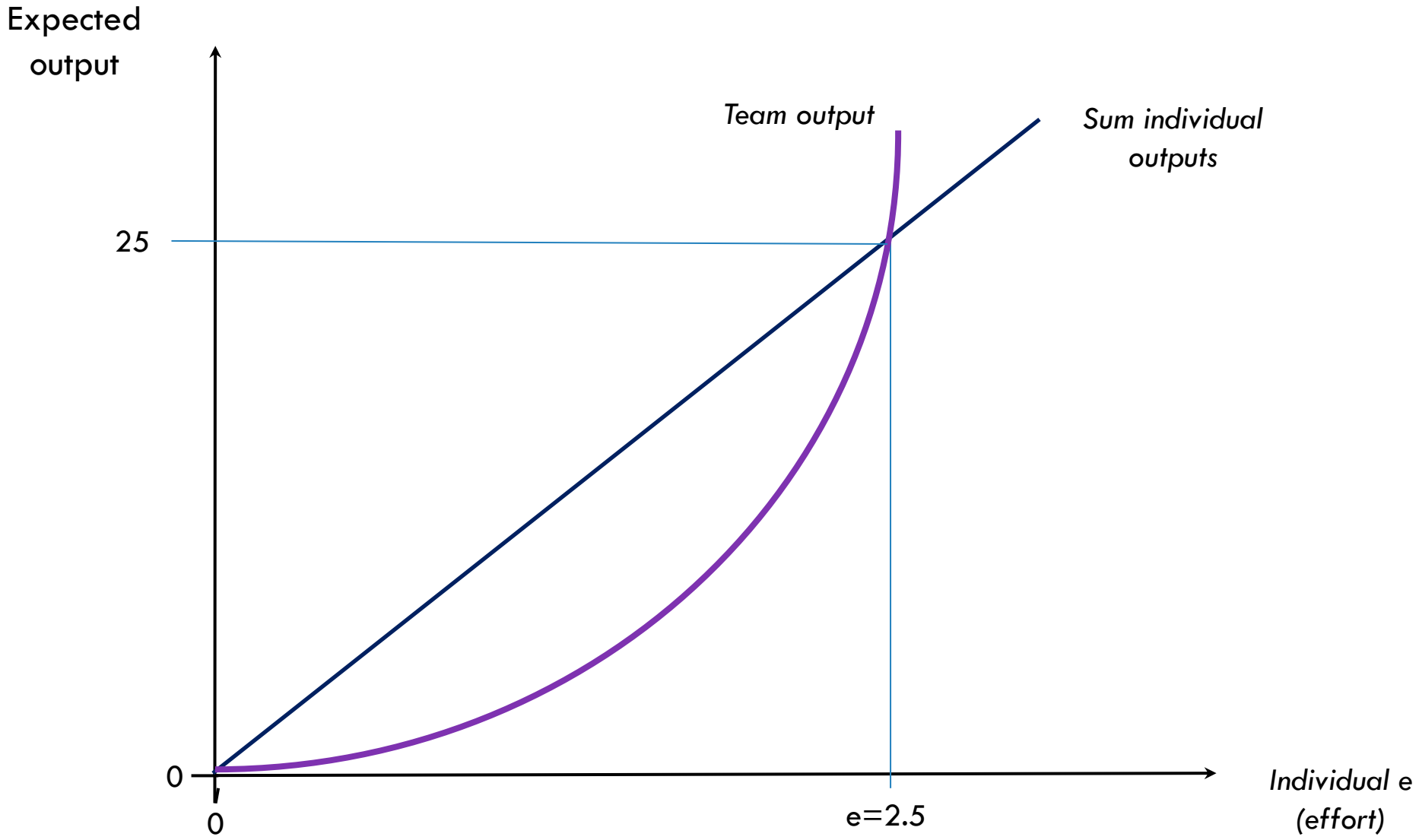
$$Q_t = 4e^2 + \mu$$

where $e = e_c = e_d$

So:

$$Q_t > Q_c + Q_d \;\; if \quad e > 2.5$$

That is, the total output from Conrad and Dina working as a team will be higher as long as they each exert a common effort level of 2.5 units.


Expected output
Team output
Sum individual outputs
25
0
0
e=2.5
Individual e (effort)

EVALUATING TEAM PERFORMANCE

The challenge for performance evaluation in teams:

- team output but not individual output is observed
- rewards based on team output encourage free-riding

Other subjective factors could be used

- the number of hours worked
- supervisor evaluations of effort
- peer evaluations

Team design can play an important role

- who has decision rights?
- how does the team evaluate member efforts?
- can the team sanction non-performers?

LECTURE 11.5

DIVISIONAL PERFORMANCE EVALUATION

DIVISIONAL PERFORMANCE EVALUATION

Recall that firms can be structured in various ways: U form, M form and Matrix form. The organisational structure of the firm determines:

- allocation of decision rights and job descriptions
- performance evaluation protocols
- compensation schemes

We will consider performance evaluations for different organisation structures

1. cost centres
2. expense centres
3. revenue centres
4. profit centres
5. investment centres

DIVISIONAL PERFORMANCE EVALUATION

1. Cost centres:

- assigned the decision right to choose the mix of inputs to produce a stipulated output

Possible objectives to measure performance

- costs: minimise costs for a given output
- output: maximise output for a given budget

Challenges

- output of each cost centre must be measurable
- quality must be measurable
- central management must have knowledge needed to specify goals
- minimisation of average costs may not equate to value maximisation

DIVISIONAL PERFORMANCE EVALUATION

2. Expense centres:

- assigned the decision right to maximise output (often a service) with a fixed budget
- (relative to cost centres), output tends to be measured subjectively

Challenges

- output is usually subjective and difficult to measure
- if the goal of an expense centre is to maximise output, it's services are often over used
- e.g. human resources, IT
- managers may derive benefits from increasing the size of the center – 'empire building'

DIVISIONAL PERFORMANCE EVALUATION

3. Revenue centres:

- decision rights over how to maximise revenue with a given budget

Possible objectives to measure performance

- maximise revenue for a given price and budget

Challenges

- revenue centres consider revenues but not production costs, so they may not maximise value

DIVISIONAL PERFORMANCE EVALUATION

4. Profit centres:

- decision rights over input mix, product mix, prices (or output) to maximise profits with a fixed budget
- useful when knowledge of production and sales is specific to the division and costly to transfer

Evaluation

- profits relative to a budgeted profit for the division

Key issues

- how to price transfers of goods and services between divisions – ‘transfer pricing’
- externalities between divisions

DIVISIONAL PERFORMANCE EVALUATION

5. Investment centres:

- decision rights over capital expenditures
- often comprise several profit centres

Evaluation

- return on assets: ratio of net accounting income to total assets used by the investment centre

Issues

- evaluation is based on accounting profit, not economic profit
- assets are often measured at cost rather than market value

LECTURE 11.6

TRANSFER PRICING

TRANSFER PRICING

When one division transfers something (a good or service) to another, it usually charges a transfer price.

What should that price be?

Important because: “The choice of transfer-pricing method does not merely reallocate total company profits among business units, but affects the firms total profits”.

Transfer pricing determines incentives.

- May encourage inappropriate outsourcing if the price is set too high
- May encourage too much internal investment if the price is too low.
- We ignore tax issues, but note that these are likely to be important. For example, IKEA and firms that shift profits back to Ireland or Singapore…

TRANSFER PRICING – PERFECT INFORMATION

The optimal transfer price for a product or service is its opportunity cost: the value foregone by not using the product transferred in its next best alternative

Transfer pricing with costless information:

- Assume MC = $3 and that the US plant has excess capacity.
- Making in US and transferring it to Europe means it can be sold @ $5.
- Not manufacturing means saving $3 but foregoing $5 in European revenue
- Manufacturing in US and transferring gives net receipt of $2.
- Here the opportunity cost or resources foregone by transferring it from the US to Europe is $3 which in this case is the actual marginal cost of production.

TRANSFER PRICING – PERFECT INFORMATION

But what if the US division could sell the intermediate input for $6 in the United States? That is, the marginal revenue from selling it to an external firm in the United States is $6.

Further assume that it does not have excess capacity and so cannot sell in the US and to the European profit centre.

In this case, the opportunity foregone by transferring it to the European profit centre is not $3 (the MC of production), but rather $6 (which is actually the MR foregone).

Here, it would be optimal to sell externally rather than transfer.

By setting price equal to opportunity cost, the European division will purchase (and the US division sell) just the right amount.

TRANSFER PRICING – ASYMMETRIC INFORMATION

In this example we assumed we knew:

- Marginal cost of production
- Intermediaries external price
- European marginal revenue
- Excess capacity in the US.

These may be known or they may not be known. In a large organisation we would expect that that this information would be distributed among different individuals/ organisational units. Hence the decentralisation of decision rights.

However, individual divisions may be in conflict when setting transfer prices. Lets consider the problem when one part of a firm (call it the Manufacturing division) has some information which is important in context of a transfer pricing decision.

TRANSFER PRICING – ASYMMETRIC INFORMATION

Consider a monopolist with two divisions: Manufacturing and Distribution.

There are no fixed costs and MC = 10

Demand is given by:

$$P = 110 - 5Q$$

Under perfect information, the optimal price solves MR = MC:

$$MR = 110 - 10Q = MC = 10$$

$$Q = 10, P = 60, \pi = 500$$

TRANSFER PRICING – ASYMMETRIC INFORMATION

Now assume that manufacturing sets the transfer price. It effectively has monopoly power and its decisions cannot be monitored because of costly information. What does manufacturing do in terms of price and quantity?

Consider this as a two stage game

1. Manufacturing chooses transfer price (P_t) to maximise $\pi_m = Q(P_t - MC)$
2. Distribution chooses P to maximise $\pi_d = Q(P - P_t)$

TRANSFER PRICING – ASYMMETRIC INFORMATION

We solve by backward induction. The Distribution division faces a demand curve given by:

$$P = 110 - 5Q$$

Distribution sets MR = MC, where the marginal cost equal the transfer price:

$$110 - 10Q = P_t$$

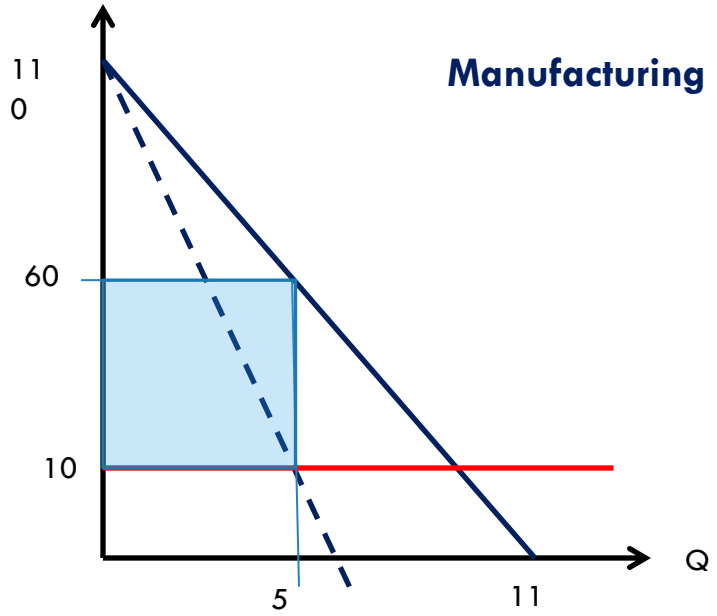
This is the reaction function for Distribution and the demand curve for Manufacturing. The manufacturer sets MR = MC, where MC=10:

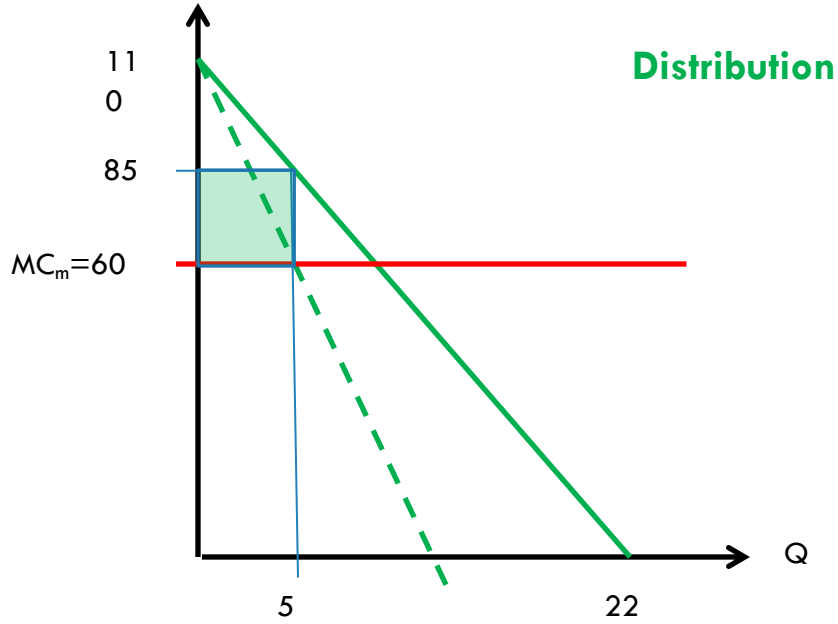
$$110 - 20Q = MC = 10$$

Solving gives:

$$Q = 5, P_t = 60,\ P = 85,\ \pi_m = 250,\ \pi_d = 125$$

TRANSFER PRICING – ASYMMETRIC INFORMATION





TRANSFER PRICING – ASYMMETRIC INFORMATION

When the transfer price of $10 was charged, firm profits equalled $500.

When they act in their own interests with private information, firm profits equal $375, with manufacturing reporting profits of $250 and distribution profits of $125.

We can think of this as a problem similar to double marginalisation. Successive monopolies (this time inside the firm) reduce the quantity traded and decrease overall profit. The optimal transfer price is MC = 10, but this gives no profits to the Manufacturing division.

With a transfer price of $60, the opportunity cost to the firm of producing extra units of output are overstated. The Manufacturing division does not consider the externality of its transfer price.

TRANSFER PRICING – ASYMMETRIC INFORMATION

There are a number of problems leading to this:

- Asymmetric information.
- Structure of rewards and performance evaluation – creates incentive to distort prices.
- Challenge associated with where relevant knowledge lies about the capacity of divisions to sell internally and externally which will impact on the opportunity cost calculation
- Who has the decision rights around pricing

HOW TO SET TRANSFER PRICES

How could cost information be approximated?

- Use market based prices by using a a competitive market as a benchmark: but the firm will produce internally precisely when competitive markets are less informative or unavailable
- Use marginal cost transfer prices: but will cost information be accurately revealed? How can manufacturing cover its fixed costs? What if the marginal cost if not constant?
- Use full-cost based transfer prices: accounting costs are verifiable, reducing information asymmetries, but they don't accurately reflect opportunity costs
- Use negotiated transfer prices: can help bound the transfer price between the marginal and market cost, and potentially enable the quantity to be set at that which maximises firm profit (to then be split). But can be costly and time consuming, relies on the skills of the negotiators and may potentially fail to find the firm profit maximising level.