LECTURE 10.0

INCENTIVE COMPENSATION

INCENTIVE SCHEMES GONE WRONG

Consider the experience of DuPont's Fibres Division in the late 1980s (as told in Brickley et al).

- Placed up to 6 percent of annual pay into an 'at-risk pool' for around 20,000 employees.
- Then, if profits beat forecasts, a bonus of multiples of the at risk pool was paid. Otherwise, the pool was lost.
- In 1990 real earnings growth of >4% had to be attained to have bonus paid

The plan was abandoned less than two years into its three year schedule when employees were faced with the entire loss of the 'at risk pool'

- The Gulf War of 1990 did not help with matters, nor did general economic conditions.

LESSONS FROM THE DUPONT EXPERIENCE

Possibility 1: Incentive plans often don't work.

Possibility 2: The scheme was simply poorly designed.

What problems might have characterised the DuPont plan?

- A weak relationship between effort and reward (including dilution among the many employees)? People might freeride.
- External factors beyond the control of any individual likely impacted on the probability the bonus was paid?

OUTLINE

10.0 Incentive compensation

10.1 The basic incentive problem

10.2 Incentives from ownership

10.3 Optimal risk sharing

10.4 The principal-agent model

10.5 Informativeness principle and group incentive pay

10.6 Multi-tasking

10.7 Incentive schemes

READING

Chapter 15, “Incentive Compensation” in Brickley, Smith and Zimmerman (2016) Managerial Economics and Organizational Architecture (6th ed)

Chapter 8, “Incentives” in Mcafee (2002) *Competitive Solutions* (Section on multitasking on p195-199. Link is to electronic version in library)

Reading or link to electronic version in library is in Canvas.

LECTURE 10.1

THE BASIC INCENTIVE PROBLEM

THE BASIC INCENTIVE PROBLEM

The basic incentive problem is one that have already discussed in the lectures on organisational design and the allocation of decision rights. There is an agency problem created by delegating decision rights.

- The interests of the owners and employees is not always aligned
- More generally, the interest of principals and agents is not generally aligned.

Consider the following example of AssemCo. from the readings.

- The owner wants the employees to put in higher effort and work diligently.
- Employees prefer to take breaks and work at a more leisurely pace.

How do you motivate an individual worker over a one-week period when they can potentially put in 40 hours of effort?

THE BASIC INCENTIVE PROBLEM

For Ian (the worker), his utility is a function of his income (*I*) and his effort (*e*, the hours actually spent working).

$$U(I, e) = \mathrm{I} - e^2$$

So utility is increasing in income (+ve) and decreasing (-ve) in effort

To induce someone to work for you, you usually have to offer some minimum compensation. Why?

Think about this as the *reservation utility,* with:

$$U_{res}(.) = 1000$$

THE BASIC INCENTIVE PROBLEM

For the firm more effort is better than less. Let's assume:

$$B = \$100e$$

They get $100 of output for every hour Ian works.

Assume that effort is observable at zero cost and it is verifiable so that a court could make a binding ruling about it. Effectively what we are saying is that it is possible to contract over effort. That is, it is contractible.

Here we are thinking of an explicit contract that is enforceable, but it doesn't have to be like this.

THE BASIC INCENTIVE PROBLEM

In this case, AssemCo. will offer Ian a contract requiring he puts in a specified level of effort $\hat{e}$. The contract will be acceptable to Ian if he receives at least his reservation level of utility. That is, the contract will be acceptable as long as it pays:

$$1000 + \hat{e}^2$$

If Ian accepts the contract he gets: $U(.) = 1000 + \hat{e}^2 - \hat{e}^2 = 1000$

AssemCo.'s challenge is to maximise profit. That is:

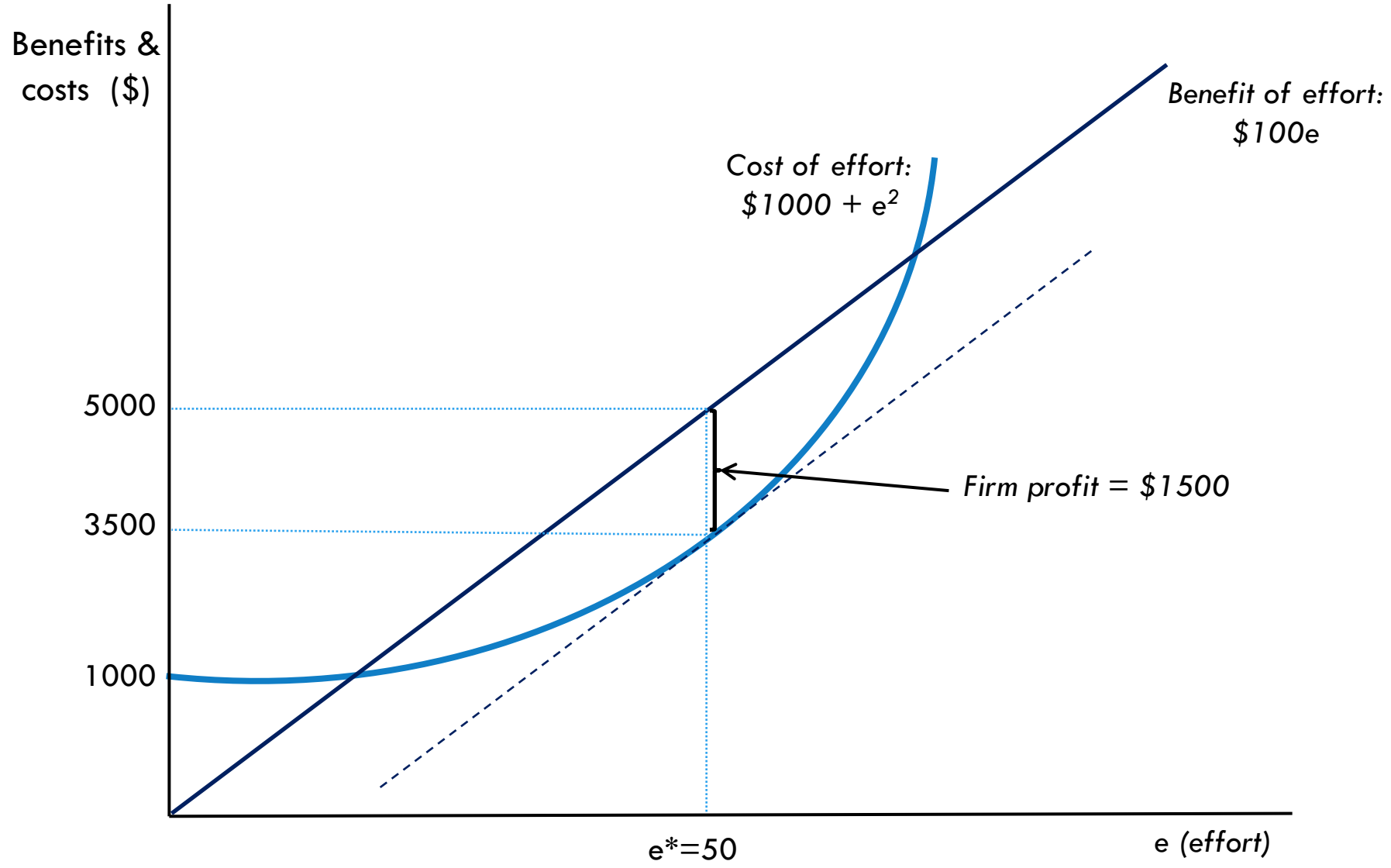
$$\max \ \pi_e = 100\hat{e} - [1000 + \hat{e}^2]$$

First Order Condition: $100 - 2\hat{e} = 0$

$$\hat{e} = 50$$

Payment = $1000 + \hat{e}^2 = 1000 + 2500 = 3500$

$$\pi = 50(1000) - 3500 = 1500$$


Benefits & costs ($)
Benefit of effort: $100e
Cost of effort: $1000 + e2
5000
3500
1000
Firm profit = $1500
e*=50
e (effort)

THE BASIC INCENTIVE PROBLEM

At effort level $\hat{e} = 50$, the marginal benefit of higher effort is equal to the marginal cost of inducing higher effort.

This can be seen in the diagram on the previous page.

Why not pay Ian more? After all it will induce higher effort.

What limitations are there to this story?

- For one, Ian's effort is usually not costlessly observable by AssemCo. , and therefore not verifiable by a court. Hence, in general the effort is not contractible over.

Why not just look at output?

- It may be difficult to measure. Even if it was measurable, it may not reflect effort. That is, its more likely that:

  $Q = 100e + \mu$

  where μ is some other effect.

THE BASIC INCENTIVE PROBLEM

There are at least three lessons that we can draw:

- Incentive problems exist because the interests of the firm/ employer and the employee diverge. The is known as the principal-agent problem.
- Incentive conflicts do not cause problems when effort is contractible. With DuPont they could have simply specified the appropriate level of effort for which a bonus was payable if it was the case that the actions of employees were costlessly observable.
- In choosing the optimal action the costs to the employee from higher effort and the benefits to the firm in terms of higher profits need to be balanced. Recall we have discussed the idea of compensating differentials previously.

LECTURE 10.2

INCENTIVES FROM OWNERSHIP

INCENTIVES FROM OWNERSHIP

There is a 'simple' solution to the problem: sell Ian the benefits of his efforts. If Ian owns the firm, he has an incentive to work hard (and balance benefits and costs).

In this case that would mean selling to Ian his output which is equal to $100e$ for a price of $1500. Why this amount?

Ian's problem then becomes:

$$max_e U(.) = I - e^2 \quad s.t.\ I = 100e - 1500$$

$$max_e U(.) = 100e - 1500 - e^2$$

First Order Condition: $100 - 2\hat{e} = 0$

$$e^* = 50$$

INCENTIVES FROM OWNERSHIP

In fact, this is what we see in the 'real world' all the time – many jobs are 'sold'.

- A majority of businesses (by number, not value) are owner operated
- Franchisees effectively buy the right to a future stream of profits generated by his or her efforts. What incentives do such arrangements provide? At the same time, what constraints are imposed on the franchisees?

Of course there are limits from such an arrangement.

- Wealth constraints: few managers (or individuals more generally) have the resources to buy their share of the firm
- Risk aversion: typically, individuals are risk averse. Owners expose themselves to the inherent risks associated with the business environment. Employees avoid (to some extent) the risk associated with risky environments
- Team production: Output or the results from an individual's efforts depend on not just the individuals own effort. Identifying the output from any one individual may be difficult or impossible.

LECTURE 10.3

OPTIMAL RISK SHARING

OPTIMAL RISK SHARING

Consider two risk averse individuals. Suppose they each face a risky but independent payment/ income stream.

$$\alpha = 0.5 = probability\ of\ receiving\ \$10{,}000$$

$$(1-\alpha) = 0.5 = probability\ of\ receiving\ \$0$$

Now consider the probabilities and payoffs if the parties agree to split the payoff:

$$\$0\ with\ probability\ of\ 0.25$$

$$\$5000\ with\ probability\ of\ 0.5$$

$$\$10000\ with\ probability\ of\ 0.25$$

In both cases the expected payoff is equal to $5,000.

OPTIMAL RISK SHARING

Even though the expected payoff is equal to $5,000 in both cases, if the individuals are risk averse they are better off under the latter arrangement.

For one, the probability of receiving a low payment (i.e. a payment of zero) is halved.

Moreover the variability of the payoffs are reduced:

$$\sigma = \$3535$$
$$\sigma = \$5000$$

We know that individuals generally avoid risky outcomes: e.g. insurance, buying into mutual finds or share portfolios.

Moreover, there is an opportunity for a Pareto improving trade if those who are more risk tolerant can pay purchase the risky income stream for a fixed amount. Then the risk averse individual is better off (by being paid their certainty equivalent) and the risk lover is also better off by being compensated for taking on additional risk.

For example, one individual (the risk neutral one) could purchase the risky income stream (with expected value of $5000) for $4500. If the certainty equivalent for the risk averse person is <$4500, both parties are better off.

EFFECTIVE INCENTIVE CONTRACTS

What will an effective incentive contract do? At least two things:

- Provide incentives: that is it will motivate employees to put in greater effort. Pay should be related to performance.
- Share risk efficiently: This may require that employees are paid a fixed salary, or more likely that they will be compensated appropriately for the risk that they assume.

Clearly there is a tradeoff in achieving these two aims. When incentives are greater, so too will be the level of risk the employee is exposed to. Or in other words, by insuring the employee against risk, the incentive to perform is reduced

Essentially we have a moral hazard problem – when the employer 'insures' the employee against risk the incentive to perform is reduced.

LECTURE 10.4

THE PRINCIPAL-AGENT MODEL

PRINCIPAL-AGENT MODEL

The principal-agent model is a simple characterisation of the contracting process that illustrates the trade-offs between risk sharing and incentives. It provides insight into the design of compensation plans.

Consider the following (single-period) model. Assume that we have:

- Employer – a risk neutral principal
- Employee – a risk averse agent

'Erica' is an employee who has output given by the following.

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

$$\mu \sim (0, \sigma^2)$$

Where Q is the value of the output (*which is observable*); e is effort; α is her marginal productivity, and μ is some random effect.

PRINCIPAL-AGENT MODEL

Assume initially that effort (e) can be observed. In that case we might expect a contract that specifies a level of effort $\hat{e}$ for a fixed salary W

That contract would deliver profit of:

$$\pi = (\alpha\hat{e} + \mu) - W$$

But suppose neither e nor μ is observable. What might be a problem with paying Erica a fixed salary?

- Erica will have an incentive to put in low effort
- Erica could blame the low output on bad luck (a low μ), rather than her low effort.

PRINCIPAL-AGENT MODEL

We could instead provide an incentive to Erica by basing her compensation on output.

Consider her effort problem if faced by a linear payment schedule:

$$Compensation = w_0 + \beta Q$$

where $0 \leq \beta \leq 1$, w_0 is a fixed wage and β is the proportion of output received.

This might represent a typical compensation scheme.

PRINCIPAL-AGENT MODEL

Consider if:

$$w_0 = 1000 \text{ and } \beta = 0.2$$
$$Q = 100e + \mu$$
$$C(e) = e^2$$

Then:

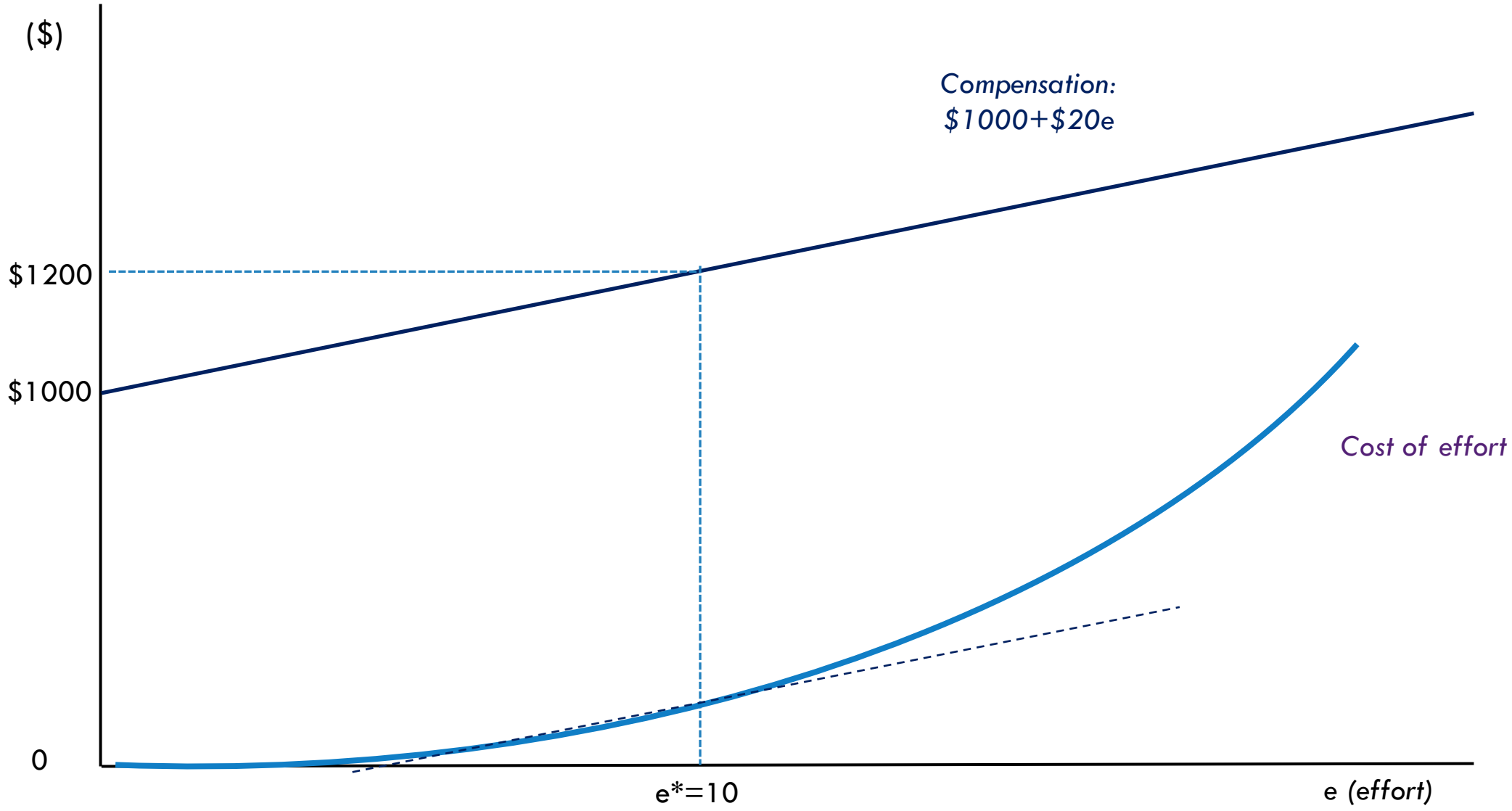
$$Compensation = 1000 + 0.2(100e + \mu)$$
$$Compensation = 1000 + 20e + 0.2\mu$$

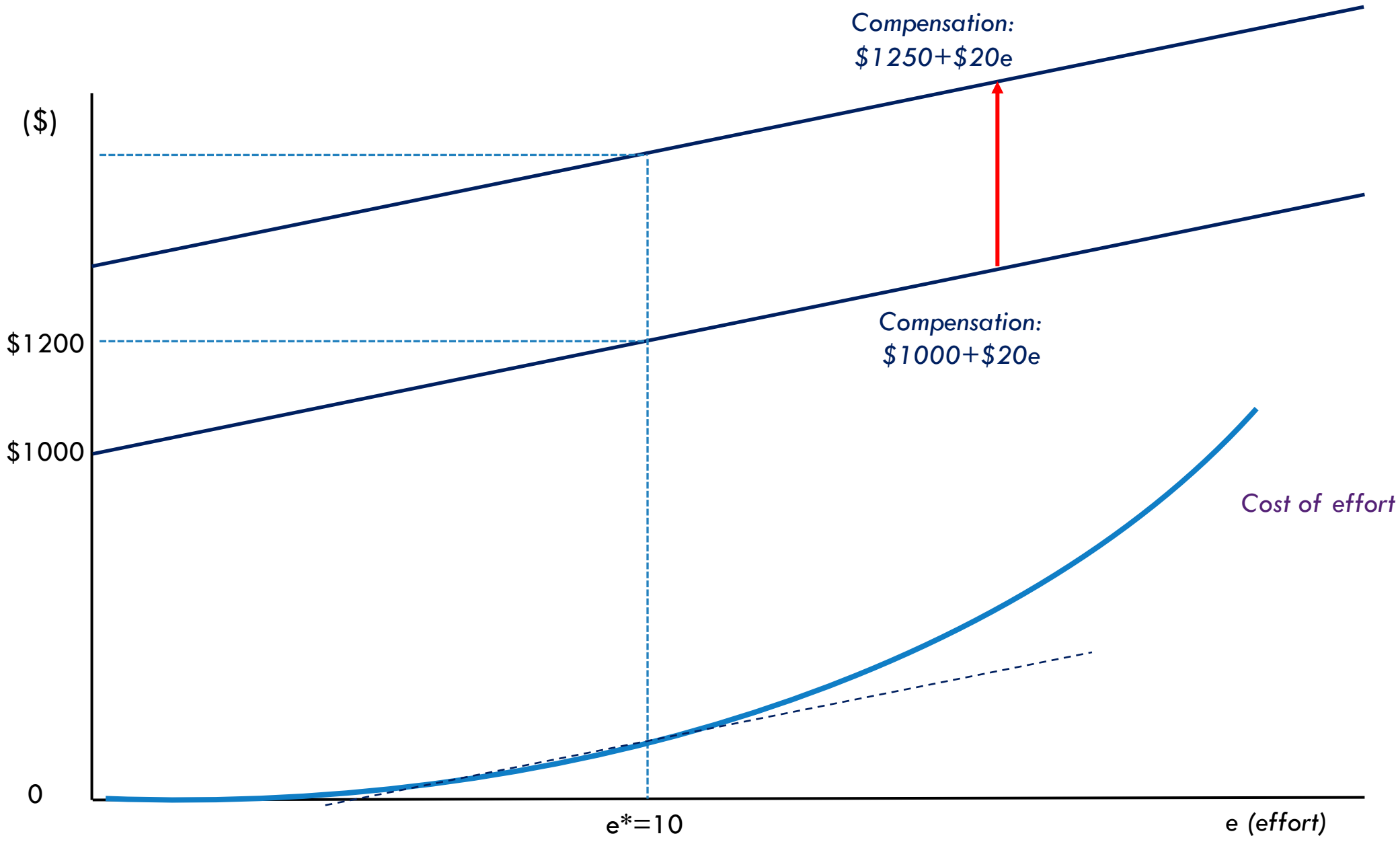
So in expectation:

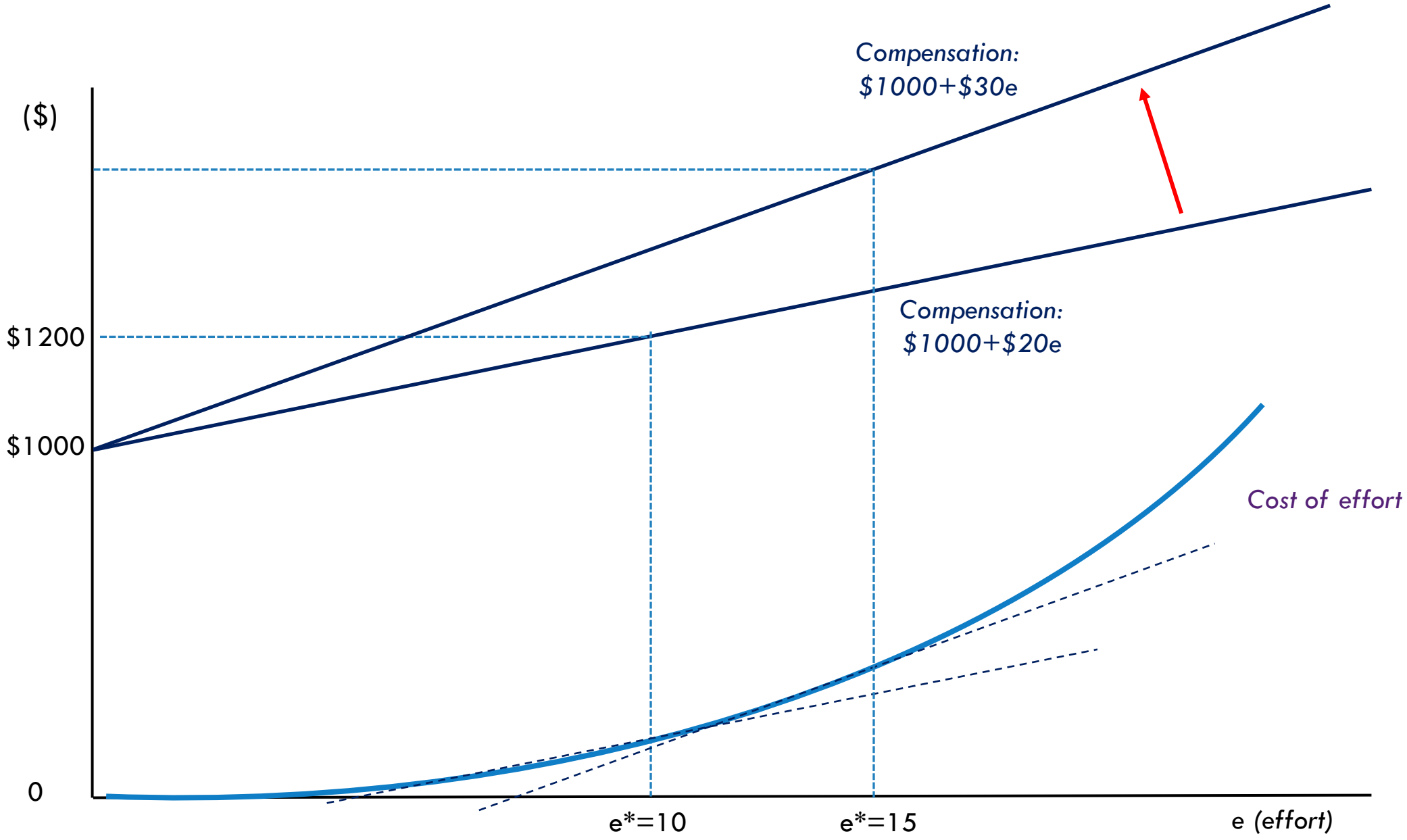
$$Compensation = 1000 + 20e$$

Why does the (μ) 'disappear' when we take the expectation?

What does the 'solution' look like in this case?


($)
Compensation:
$1000+$20e
$1200
$1000
Cost of effort
0
e*=10
e (effort)


Compensation:
$1250+$20e
($)
$1200
$1000
Compensation:
$1000+$20e
Cost of effort
0
e*=10
e (effort)


Compensation:
$1000+$30e
($)
Compensation:
$1000+$20e
$1200
$1000
Cost of effort
0
e*=10
e*=15
e (effort)

PRINCIPAL-AGENT MODEL

Note that an extra unit of effort always increases compensation by $20.

The random component or shock (μ) affects the total level of payment, but not the marginal impact of effort.

This means that the employee (Erica) can effectively ignore μ.

In this case the optimal choice of effort is equal to 10, keeping in mind that the cost of effort equals e^2

Obviously, if the parameters change so too will the solution.

PRINCIPAL-AGENT MODEL

Note the following implications of this model:

- A change in w_0 doesn't change incentives around effort. With a higher intercept the optimal choice of effort is unchanged. Why?
- A change in β changes the optimal effort level. With a higher slope the optimal choice of effort is increased. Why?

In both cases it reflects the fact that what is important is the marginal benefit and marginal cost of effort. What matters is how pay varies with effort.

Issues to consider:

- Recall our discussion at the very beginning of semester around the 'happy is productive' model. What does that model say about the principal-agent framework we have just spelt out?
- How does the model we have just described relate to the efficiency wage model described last week? Here there is a direct cost of not working hard. Your pay is lower! What happened when you didn't work hard in the efficiency wage model?

THE OPTIMAL CONTRACT

What should a firm do? Recall that it will want to try and maximise profit.

- It needs to ensure that the reservation level of utility is met, otherwise the individual will not work for the firm. One way to do this is to adjust w_0 (the base pay) to ensure this is the case. Recall the idea of the efficiency wage – the employee might want to avoid getting fired if this is sufficiently high and therefore it can actually help motivate effort.
- To induce effort, it will want to increase β , but this comes at a cost to the firm. Why?

There are two reasons:

- First with greater reward for effort we would expect that Erica will work harder– this should lead to higher payments for the firm.
- Second, with higher β the risk that Erica is exposed to is increased. For a risk averse worker this will generally mean that Erica will need to be compensated more so that she is willing to bear the higher risk.

THE OPTIMAL CONTRACT

What does all this mean? There are five factors that are important in deciding how closely to tie pay to performance:

- The relationship of output to the employees effort – when α is high then in general you want to tie pay to performance.
- The employee's risk aversion – when the employee is less risk averse, then in general you want to tie pay to performance.
- The level of risk that is beyond the control of the employee (σ^2)– when this is low, then in general you want to tie pay to performance because output depends largely on effort.
- The response of the employee to increased incentives – if the cost of effort is high for example, Erica might not respond to higher incentives.
- Measurability of the employee's output – the more costly it is to measure output, the less closely you want to tie pay to performance.

LECTURE 10.5

INFORMATIVENESS PRINCIPLE AND GROUP INCENTIVE PAY

INFORMATIVENESS PRINCIPLE

The informativeness principle states that all signals that are informative about agent effort should be included in a contract.

- In designing compensation contracts, theory suggests that it is productive to include all performance indicators that provide additional information about the employee's effort assuming that such indicators can be included at low cost. Doing so reduces the cost of inefficient risk bearing and generally leads to a more efficient effort choice.

So far in this week's lectures we have assumed that the only measure of the employees performance is output – this is clearly not the case.

For example, it may be useful to use information about the performance of co-workers, i.e. to include measures of relative performance.

What might have been the benefits of doing so in the case of DuPont? How might it have been implemented in the DuPont case?

GROUP INCENTIVE PAY

Payoffs can be tied to performance of teams, business unit, firm .

Performance can be measured by stock prices, accounting earnings or business unit costs

Why use this approach?

- Difficulty measuring individual performance
- Group pay may encourage cooperation and teamwork
- Performance monitoring can be encouraged among team members.
- Retention valued workers and it may increase the amount of firm specific investment by employees if it discourages quits
- Reduction in contracting costs by matching compensation with team performance – it may be the case that when an individual's performance is correlated with the that of the team, this type of remuneration automatically adjusts and helps retain staff who may be faced with external offers.

What might be some of the difficulties associated with such an approach?

- Free riding
- Limited incentives – witness the experience of DuPont

LECTURE 10.6

MULTITASKING

MULTITASKING

Most jobs have more than one dimension – for example, research, teaching and administration.

McAfee gives the example of a convenience store that wants fresh bread delivered twice daily. The tasks required might include:

- Planning the route
- Driving the truck
- Maintaining the truck

A firm might use an independent contractor to undertake the task, or they may use an employee

Q^n: What might be some of the implications of each approach?

MULTITASKING

Independent contractors: have authority where employees don't such as choice of route; owns truck; usually has some incentive payment; looks after truck and chooses whether to carry other items.

Employees: company may set route; company owns truck; hourly wage; truck maintained by company and company chooses what can and cannot be carried.

Think about why these arrangements are in place and what incentives they create:

- To look after truck
- Choose an appropriate route
- Incentives for side activities

Multitasking focuses on the challenge of designing an incentive compensation scheme when there are a myriad of potentially conflicting goals.

MULTITASKING

Key issues to consider in multitasking:

- Measurement errors: can performance/ activities or output be measured accurately? For example, can you measure if the truck driven carefully? If not, can you define incentives that encourage such behaviour?
- Substitution across tasks: incentives for one task will tend to reduce performance on other tasks. Be careful of providing strong incentives on one dimension (such as delivery time for an employee) only.
- Risk: if risk is increased, then employees or independent contractors need to be compensated.

These considerations also have important implications for the design of jobs. You want to bundle tasks that have similar characteristics for monitoring activities.

MULTITASKING

Consider an employee who has two tasks: Assembly and quality check

The payment scheme provides for piece rates plus a bonus for quality. That is, both a quantity and quality component.

Let t_1 = hours per day allocated to assembly.

Let t_2 = hours per day allocated to quality assurance. So $t_2 = (10 - t_1)$

Aside: we are ignoring the potential problem of shirking.

Compensation is given by the following:

$$Compensation = \alpha_1(6{t_1}^{0.5}) + \alpha_2 t_2$$

$$Compensation = \alpha_1(6{t_1}^{0.5}) + \alpha_2(10 - t_1)$$

So effectively what this is saying is that the employee is paid in response to how much s/he produces (the first term on the RHS) and also an amount that reflect the quality of what s/he produces (second term on RHS).

For the employee, they will choose t_1 to maximise compensation

MULTITASKING

First Order Condition: $\alpha_1(3{t_1}^{-0.5}) = \alpha_2$

This is effectively the marginal benefit from higher output set equal to the marginal benefit from higher quality.

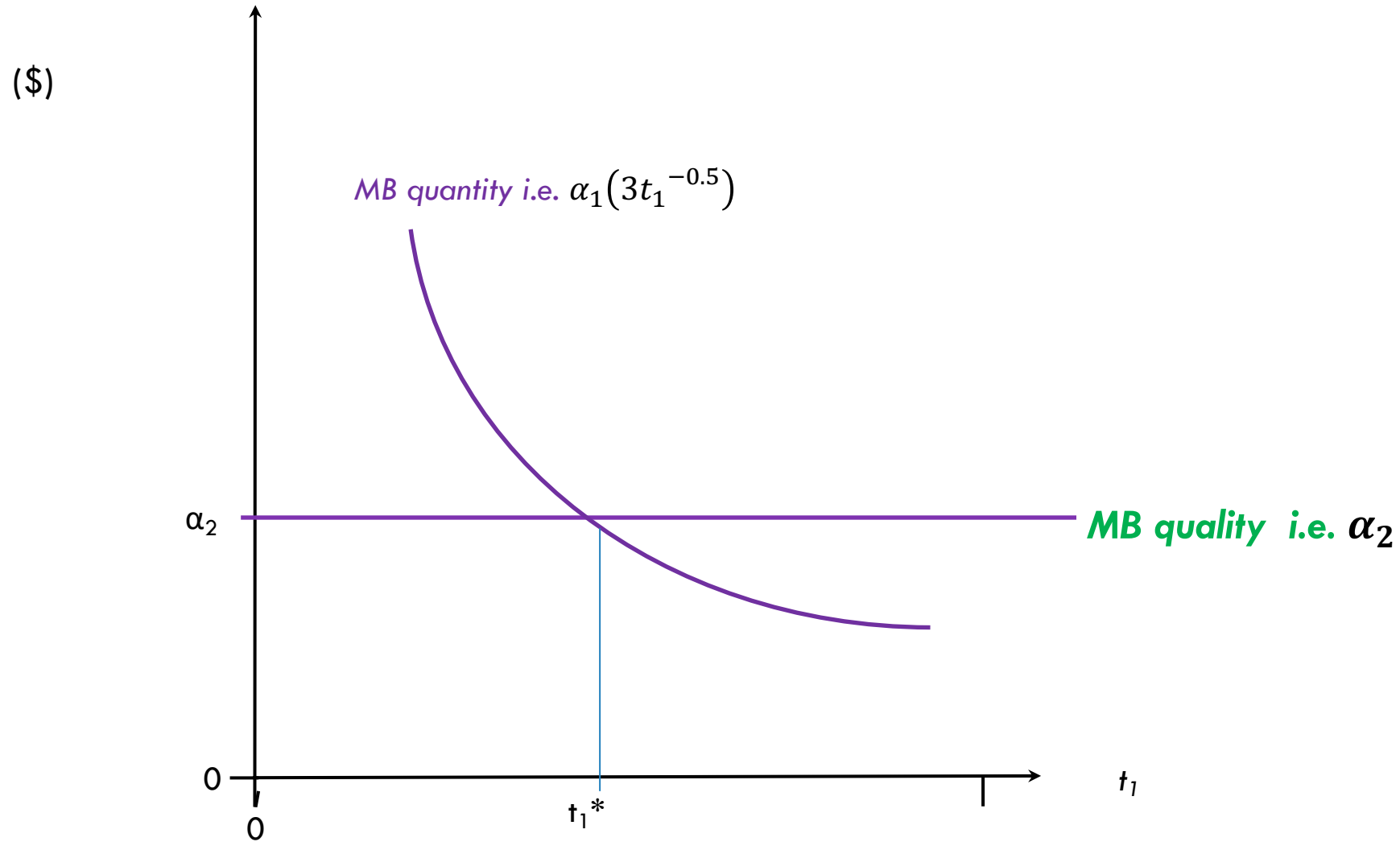
In other words, allocate time so that the marginal benefit (in terms of payoff) are equated across tasks.

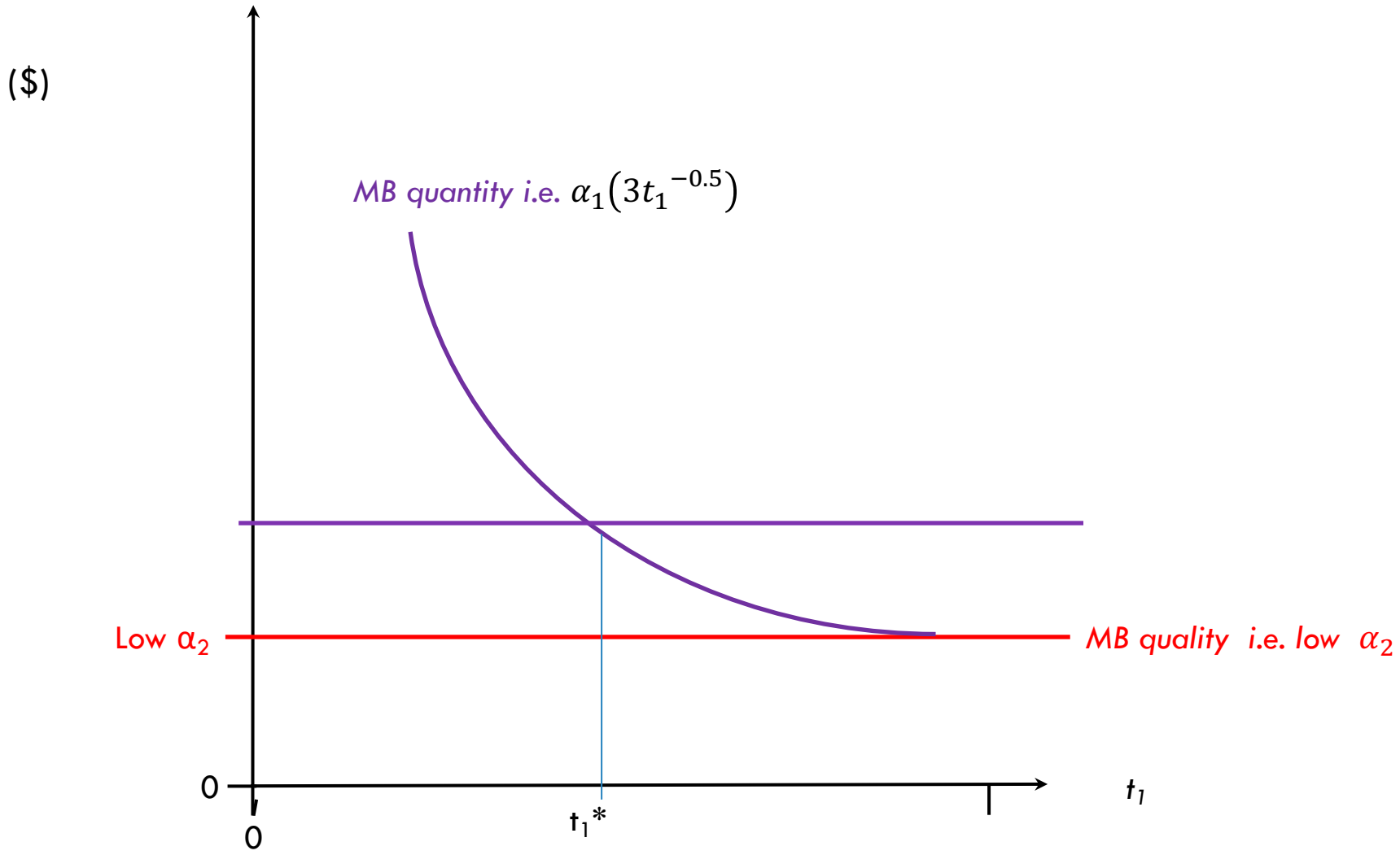
Solution: $t_1 = 9\left(\frac{\alpha_1}{\alpha_2}\right)^2$

So, for $\alpha_1 = \alpha_2$ spend 9 hours on quantity and 1 hour on quality.

Getting balance of incentives right is important and non trivial.

Need to be careful to avoid a corner solution by, for example, making α_2 too small.


($)
MB quantity i.e. $\alpha_1(3t_1^{-0.5})$
α_2
MB quality i.e. α_2
0
0
t_1*
t_1


($)
MB quantity i.e. $\alpha_1(3t_1^{-0.5})$
Low α_2
MB quality i.e. low α_2
0
0
t_1*
t_1

LECTURE 10.7

INCENTIVE SCHEMES

INCENTIVE SCHEMES

Incentive pay schemes take many forms:

- Piece rates and commissions
- Bonuses
- Prizes
- Promotions
- Profit sharing plans etc

Incentive schemes may be useful in eliciting information and resolving some other challenges for firms.

- What types of employees are likely to take on jobs with incentive based pay schemes?

Optimal compensation design considers both hiring/retention and incentives for effort

- Is it possible, for example, to design incentive based pay schemes so that only hard working individual, or high skilled individuals apply for jobs?
- Perhaps yes, thereby at least partially overcoming the information asymmetry associated with hiring and firing.

Do incentives work? Why or why not?