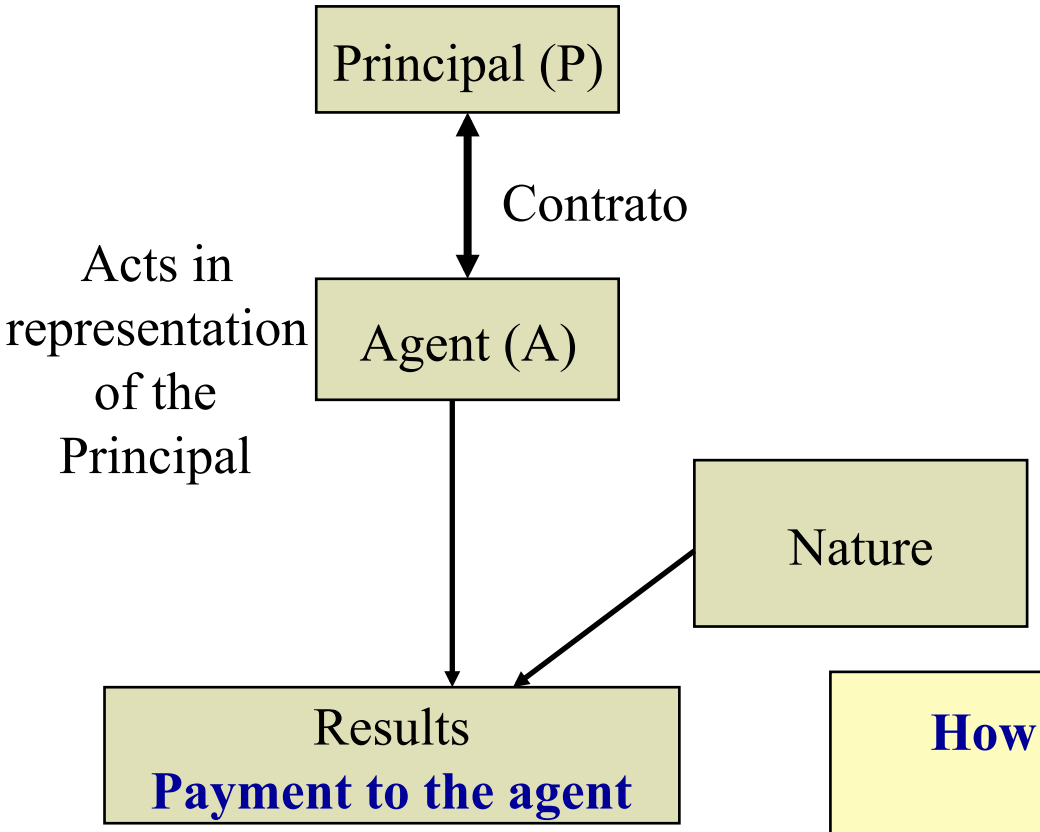
Economics of Information

1. Economics of information

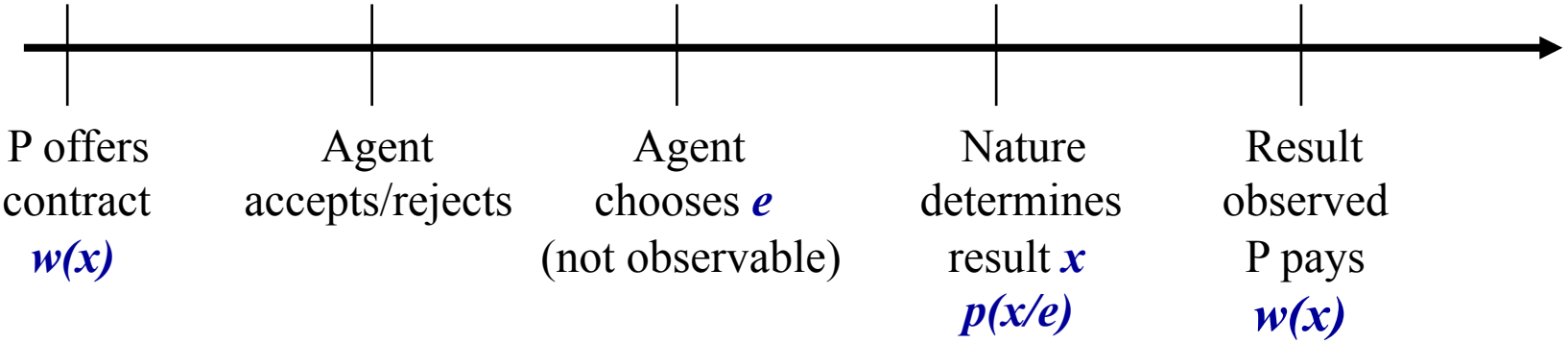


Main elements:

- Conflict of interests
- Assimetry of information

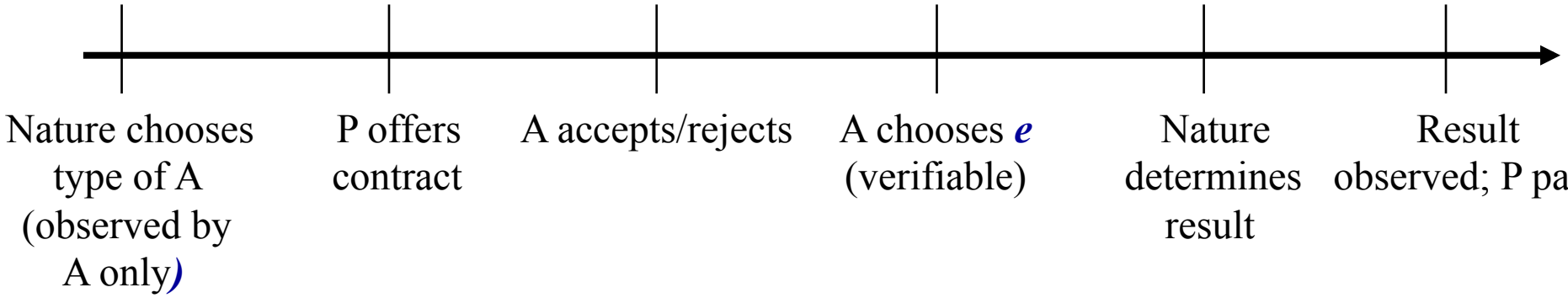
How do we write down a contract to alignthe agent's interests?

2. Moral hazard



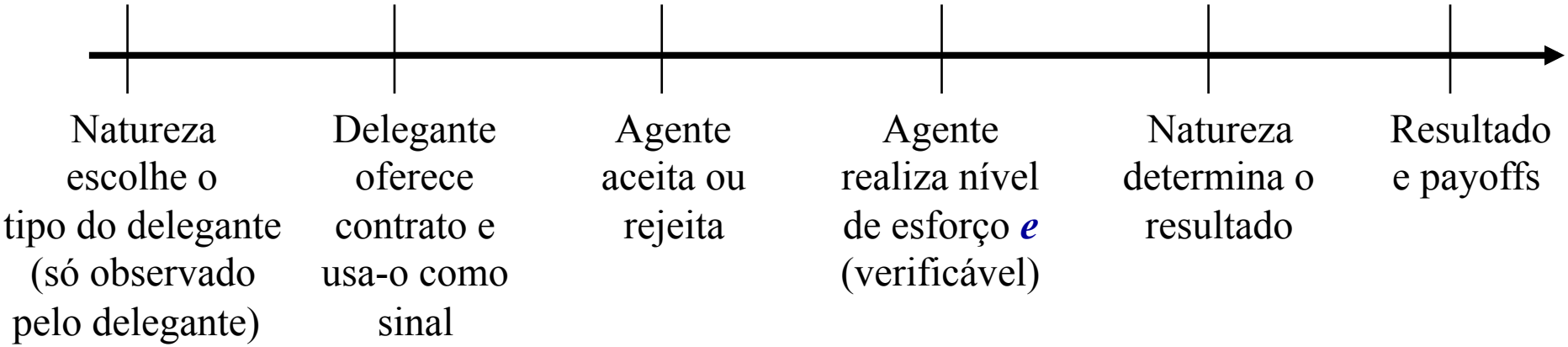
•How should the contract be designed so that A's interests are aligned with P's?

3. Adverse selection



•How should the contract be designed so that A reveals her type?

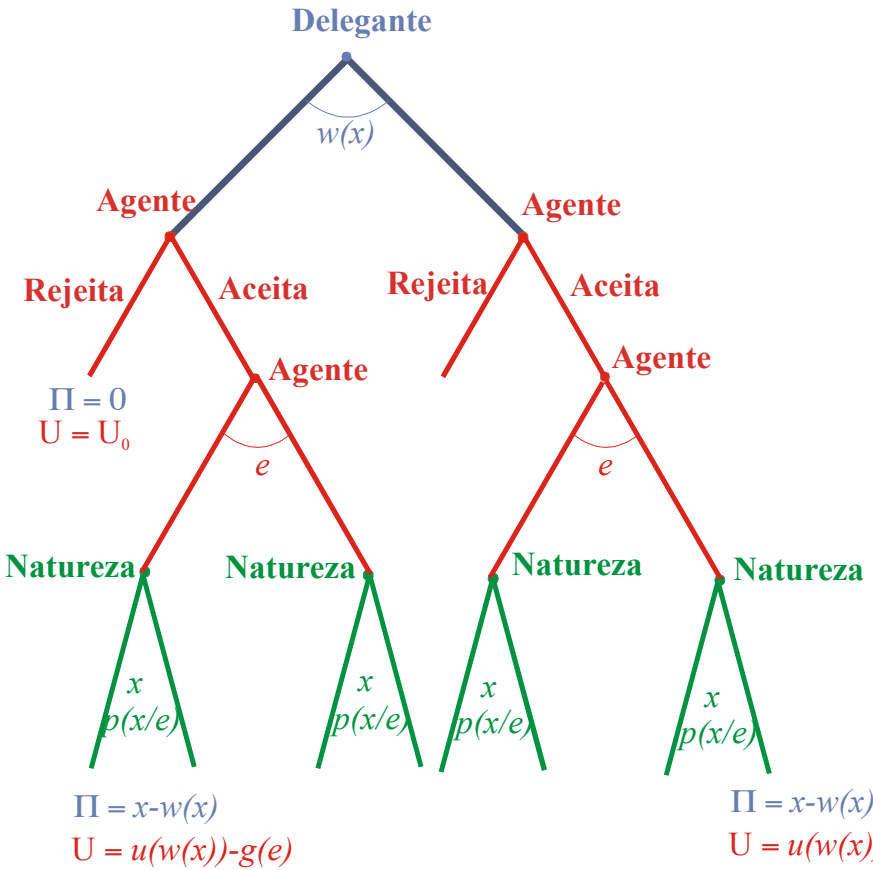
1. Teoria da agência – Modelos de sinalização

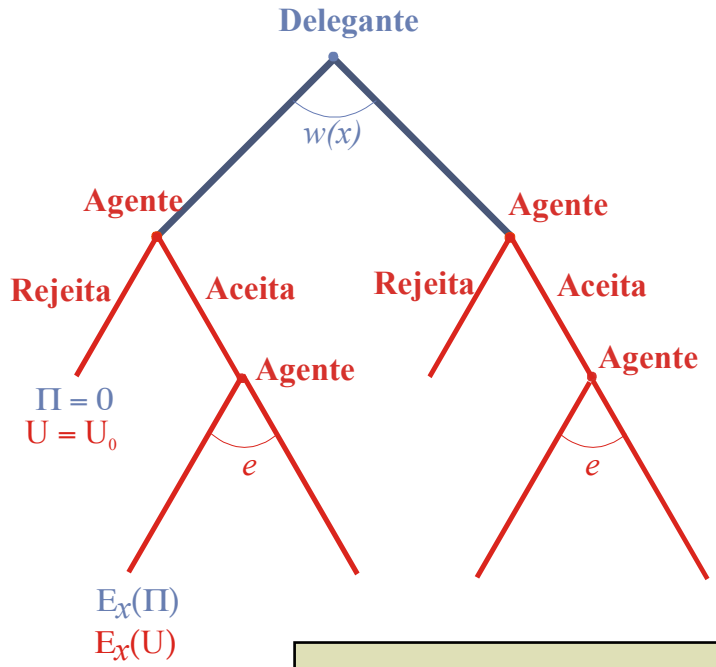


Modelo de sinalização

- Há assimetria de informação antes da relação se iniciar
- Aceitação depende das oportunidades alternativas do agente
- O delegante, que é quem oferece contrato, é que tem informação privada
- Será que delegante ganha em «revelar» a sua informação privada? Ou será que é preferível não revelar informação através do contrato?

The game in moral hazard problems





Exp. profit
Exp. utility

How do we solve this game?

4. Moral hazard with a risk neutral agent – exemples

Result of the project

Effort level	Sucess $x = 400$	No sucess $x = -100$	Gross Exp. Profit
$e = 2$	3/4	1/4	275
$e = 1$	1/2	1/2	150

$U(w,e) = w - 10\ e^2$

A's reservation utility is 15

If *e* is **verifiable**

- In this case, ***w*** can depend on ***e***

P knows that A only accepts the contract if, by choosing the optimal ***e***, he obtains:

$$U(w, e) = w - 10e^2 \geq 15$$

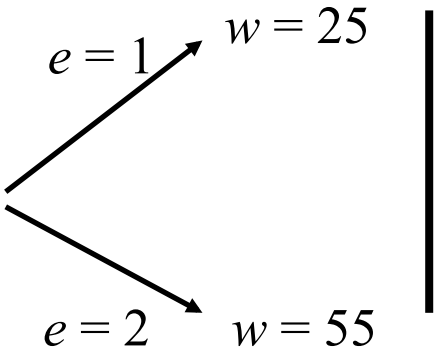
IR constraint

Exp. utility with contract

Reservation utility

If *e* is **verifiable**

$$U(w, e) = w - 10e^2 \geq 15$$



Why does this difference occur?

Optimal contract for P

1. Optimal contract (minimum cost) to induce effort
2. Effort level that maximizes profit

When *e* is not verifiable

Wage cannot depend on ***e***, but it can depend on ***x*** (why?)
If ***x = - 100, w =*** $\underline{w}$. If ***x = 400, w =*** $\overline{w}$

Optimal contract to induce ***e = 1*** → Constant wage $\underline{w} = \overline{w} = 25$

Optimal contract to induce ***e = 2*** → Constant wage will not work. Why?

$$\underbrace{\frac{3}{4}\overline{w} + \frac{1}{4}\underline{w} - 10 \times 2^2}_{\text{Exp. utility with } e=2} \geq \underbrace{\frac{1}{2}\overline{w} + \frac{1}{2}\underline{w} - 10 \times 1^2}_{\text{Exp. utility with } e=1}$$

IC constraint

When *e* is not verifiable

Optimal contract to induce ***e = 2***

If ***e = 2*** then ***w = 55***;
otherwise ***w = 0***

Optimal contract to induce ***e = 1***

Constant wage ***w = 25***

Optimal effort level?

$E(\Pi | e = 2) = 275 - 55 = 220$

$E(\Pi | e = 1) = 150 - 25 = 125$

P offers contrat ***w = 55*** if ***e = 2***; but ***w = 0*** se ***e = 1***.
A accepts and chooses ***e = 2***. Receives ***w = 55***.

When *e* is not verifiable

Optimal contract to induce e = 2

$$\underbrace{\frac{3}{4}\overline{w} + \frac{1}{4}\underline{w} - 10 \times 2^2}_{\text{Exp. utility with } e=2} \geq \underbrace{\frac{1}{2}\overline{w} + \frac{1}{2}\underline{w} - 10 \times 1^2}_{\text{Exp. utility with } e=1}$$

IC constraint

$$\frac{3}{4}\overline{w} + \frac{1}{4}\underline{w} - 10 \times 2^2 \geq 15$$

Exp. utility with ***e* = *2***

Reservation utility

IR constraint

Optimal contract $\underline{w} = -35$ $\quad e \quad \overline{w} = 85$ → ***E(w) = 55***

When *e* is not verifiable

To induce ***e = 1***, ***w = 25***. To induce ***e = 2***, ***$\underline{w}$ = - 35*** ***and*** ***$\overline{w}$ = 85 ,*** but average wage is 55.

↓

Exp. profit and exp. utility as when e is observable.
Same level of effort (***e = 2***)
Toinduce ***e = 2***, wage must depend on the result of the project.

Moral hazard with a risk neutral agent – important intuitions

- Constant wage to give incentives for low effort.
- Wage must depend on result to to give incentives for high effort.
- Expected wage to giv incentives for high effort is higher to compensate for the additional disutility of effort.
- Optimal level of effort depends on the comparison of marginal benefits of effort (hogher gross expected profit) with marginal cost of effort (marginal desutility of effort)
- Assimetry of information does not have any costs

5. Moral hazard with a risk averse agent – exemple

Result of the project

Effort level	Sucess $x = 400$	No sucess $x = -100$	Gross exp. profit
$e = 2$	3/4	1/4	275
$e = 1$	1/2	1/2	150

$U(w,e) = 5\sqrt{w} - 5e^2$

Reservation utility= 25

If *e* is verifiable

IR constraint

$$U(w,e) = 5\sqrt{w} - 5e^2 \geq 25$$

$e = 1$ → $w = 36$

$e = 2$ → $w = 81$

+ 45 compensates for the additional disutility

Optimal effort level?

$E(\Pi | e = 2) = 275 - 81 = 194$

$E(\Pi | e = 1) = 150 - 36 = 114$

Optimal contrat ***w = 81*** if ***e = 2***; but ***w = 0*** if ***e = 1***.

When *e* is not verifiable

Optimal contract to induce ***e = 1*** → Constant wage $\underline{w} = \overline{w} = 36$

Optimal contract to induce ***e = 2***

$$\begin{cases} \frac{15}{4}\sqrt{\overline{w}} + \frac{5}{4}\sqrt{\underline{w}} - 5 \times 2^2 \geq \frac{5}{2}\sqrt{\overline{w}} + \frac{5}{2}\sqrt{\underline{w}} - 5 \times 1^2 \\ \frac{15}{4}\sqrt{\overline{w}} + \frac{5}{4}\sqrt{\underline{w}} - 5 \times 2^2 \geq 25 \end{cases}$$

IR constraint

IC constraint

$$\leftrightarrow \begin{cases} \sqrt{\overline{w}} - \sqrt{\underline{w}} \geq 12 \\ 3\sqrt{\overline{w}} + \sqrt{\underline{w}} \geq 36 \end{cases} \leftrightarrow \begin{cases} \overline{w} = 144 \\ \underline{w} = 0 \end{cases}$$

E(w) = 108

When *e* is not verifiable

Benefit to increase e:
Exp. gross profit increases
125 000 euros

Cost to increase e:
- Expected wage higher to compensate for additional disutility of effort– 45 000 euros
- Expected wage higher to compensate for risk, risk premium – 27 000 euros

Optimal level of e
e = 2

Optimal contract?
If project is successful ***w = 144***,
Otherwise ***w = 0***.

With risk aversion, asymmetric information has a social cost.

Moral hazard with risk aversion –important intuitions

- Tradeoff between **risk sharing** and **incentives**.
- Optimal level of effort depends on how marginal benefits of effort compare with the marginal costs of effort (marginal desutility of effort + risk premium).
- Assimetry of information has costs.
- Optimal level of effort under asymmetric information may be lower than when ***e*** is observable.