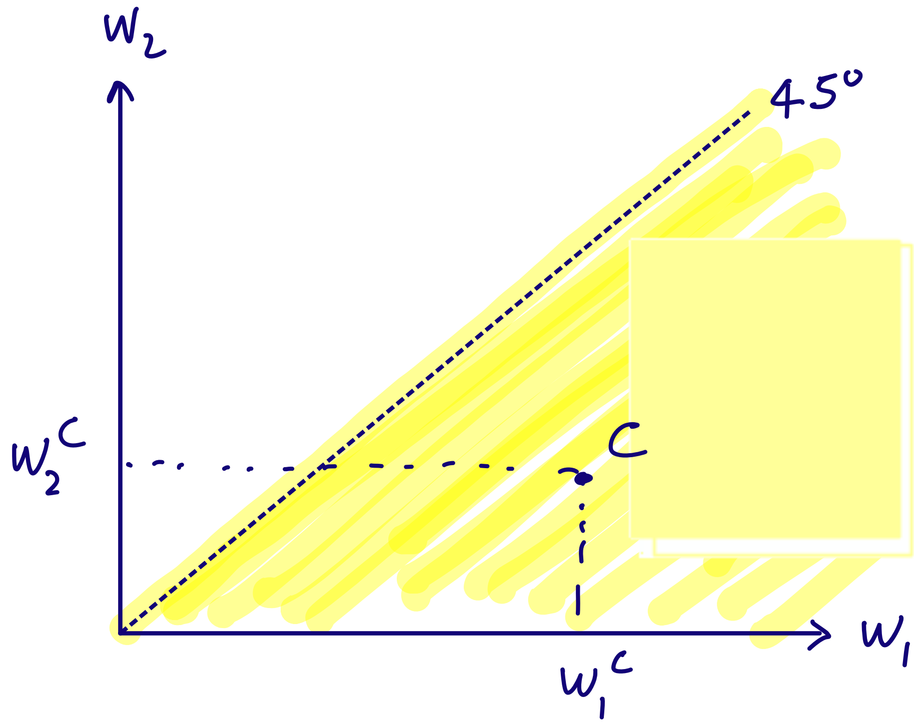
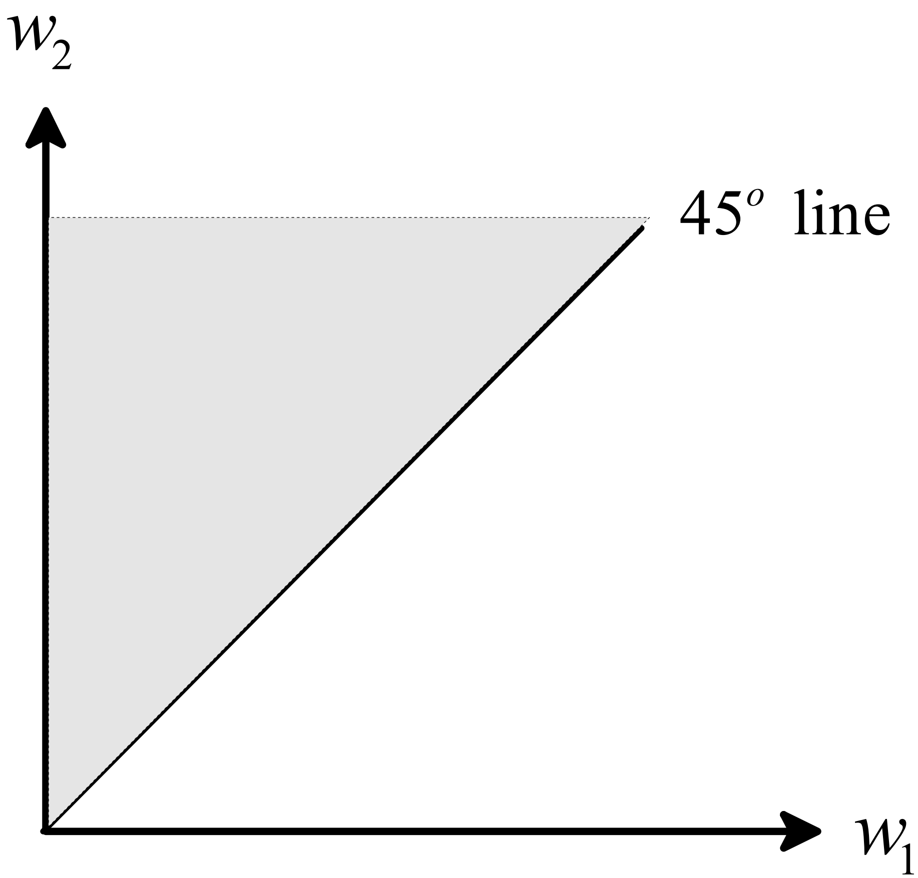


$$u_A(m,e)=\begin{cases}U_A(m) & \text{if } e=e_L\\ U_A(m)-c & \text{if } e=e_H\end{cases}$$


w_2
45^o line
w_1

Identify those contracts that are

1. individually rational and

2. Pareto efficient.

A contract C is **individually rational** if, for each party, signing the contract is at least as good as not signing it.

$\hat{r}_P$ = reservation utility of the Principal

$\hat{r}_A$ = reservation utility of the Agent.

C is individually rational if

(1)

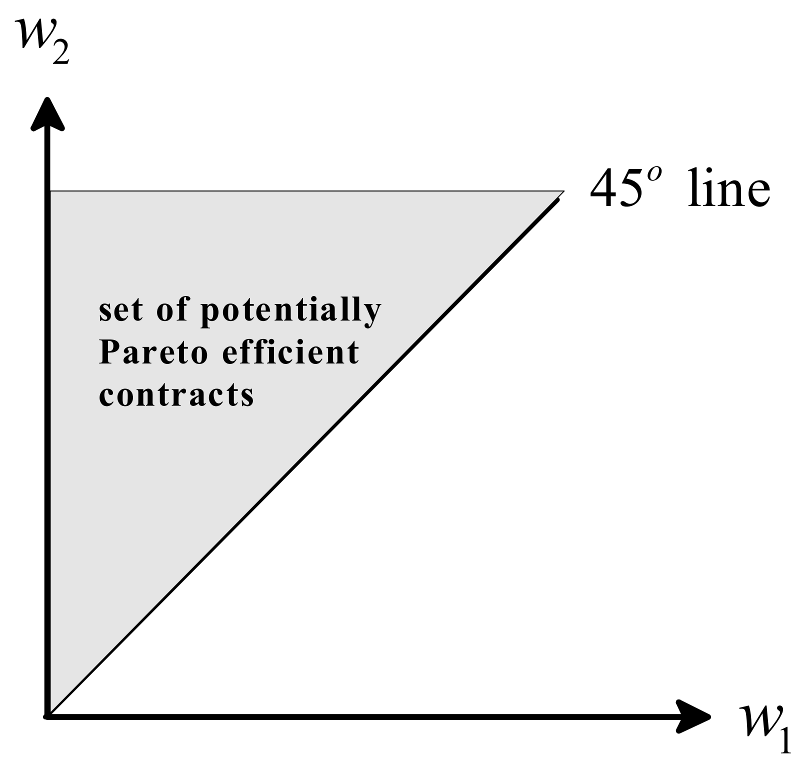
(2)

Contract C is **Pareto efficient** if, for every other contract D,

-

-

To simplify, assume that $\hat{r}_P = \hat{r}_A = 0$ so that every contract (w_1, w_2) with $0 \leq w_1 \leq X_1$ and $0 \leq w_2 \leq X_2$ is individually rational. This assumption allows us to concentrate on the issue of Pareto efficiency.

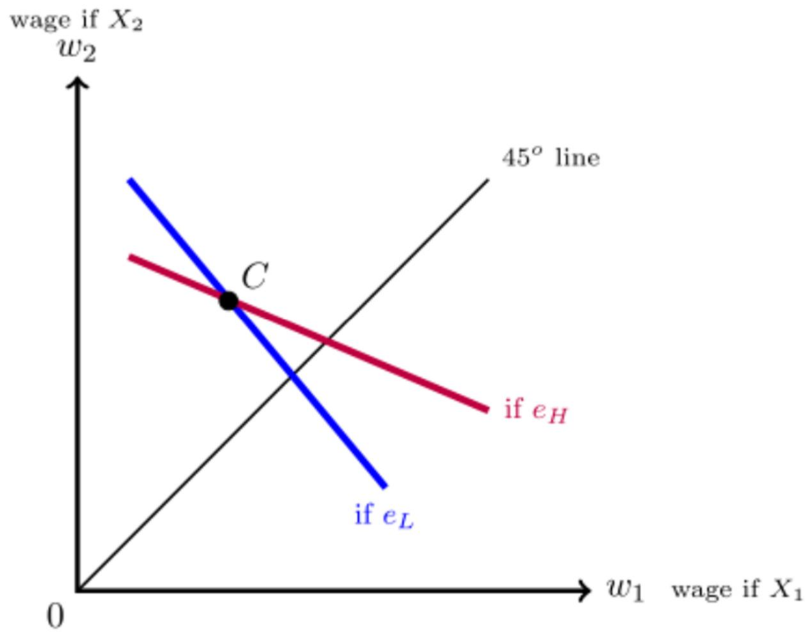


Fix any contract C in the shaded area. Then, for each individual, there are two indifference curves that go through point C: one corresponding to the case where the Agent chooses e_L and the other corresponding to the case where the Agent chooses e_H.

Let us begin with the risk-neutral Principal. Let $C = \left(w_1^C, w_2^C\right)$ and $D = \left(w_1^D, w_2^D\right)$ be two contracts. Let $\bar{X}_L = p_1^L X_1 + \left(1 - p_1^L\right) X_2$ and $\bar{X}_H = p_1^H X_1 + \left(1 - p_1^H\right) X_2$

- **Conditional on the Agent choosing** e_L, the Principal is indifferent between C and D if and only if

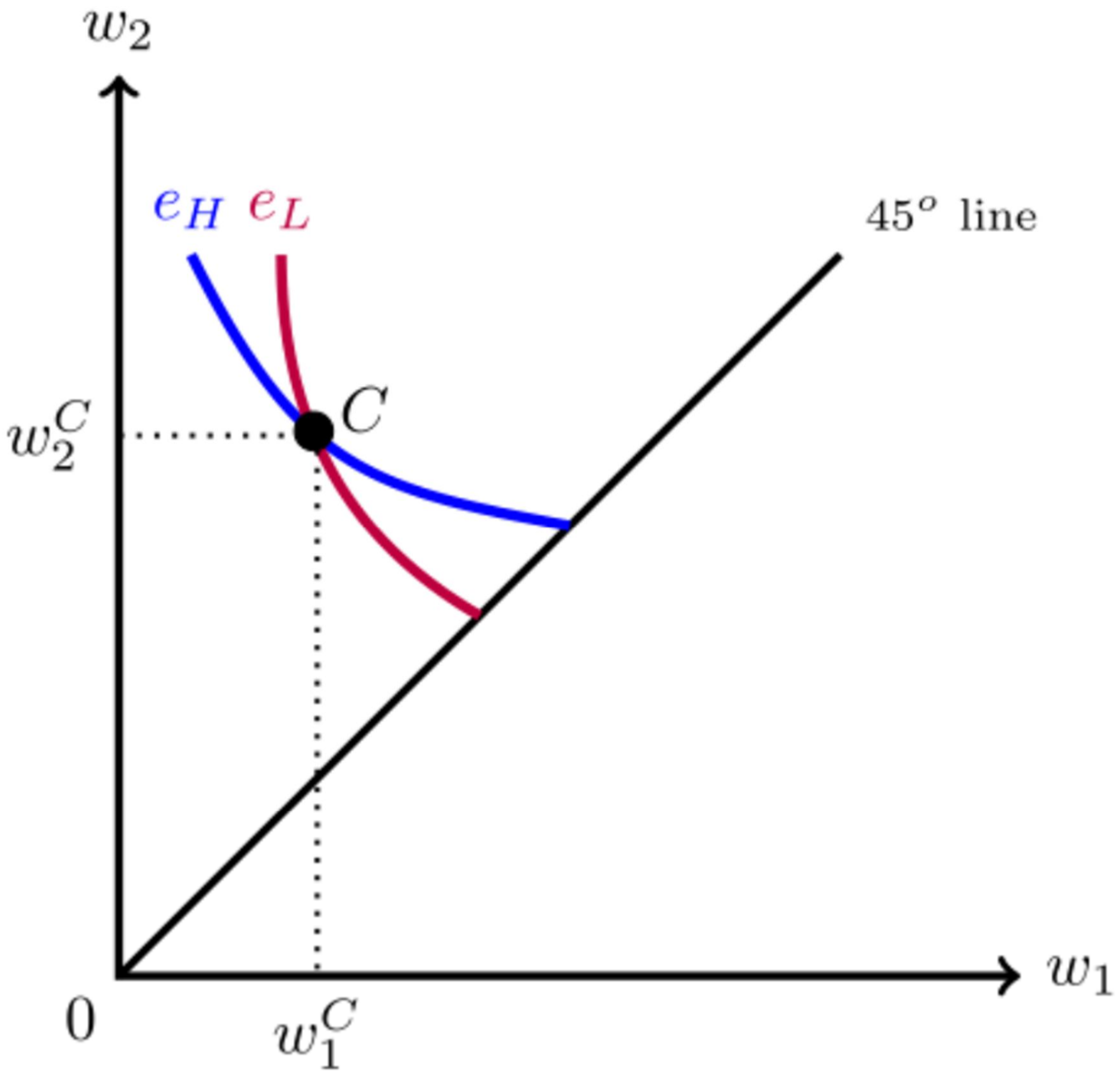
- **Conditional on the Agent choosing** e_H, the Principal is indifferent between C and D if and only if



Now the Agent, who is risk averse with utility-of-money function $u_A(m,e) = \begin{cases} U_A(m) & \text{if } e = e_L \\ U_A(m) - c & \text{if } e = e_H \end{cases}$ with $c > 0$. Through any contract $C = \left(w_1^C, w_2^C\right)$ there are two indifference curves:

- a steeper one, corresponding to the case where the Agent exerts low effort e_L, whose slope at C is

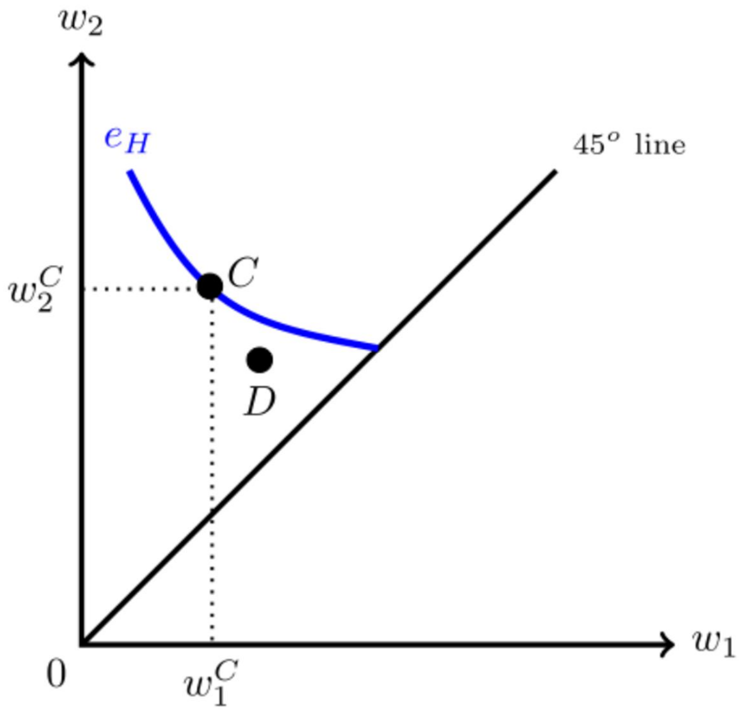
- a less steep one, corresponding to the case where the Agent exerts high effort e_H, whose slope at C is



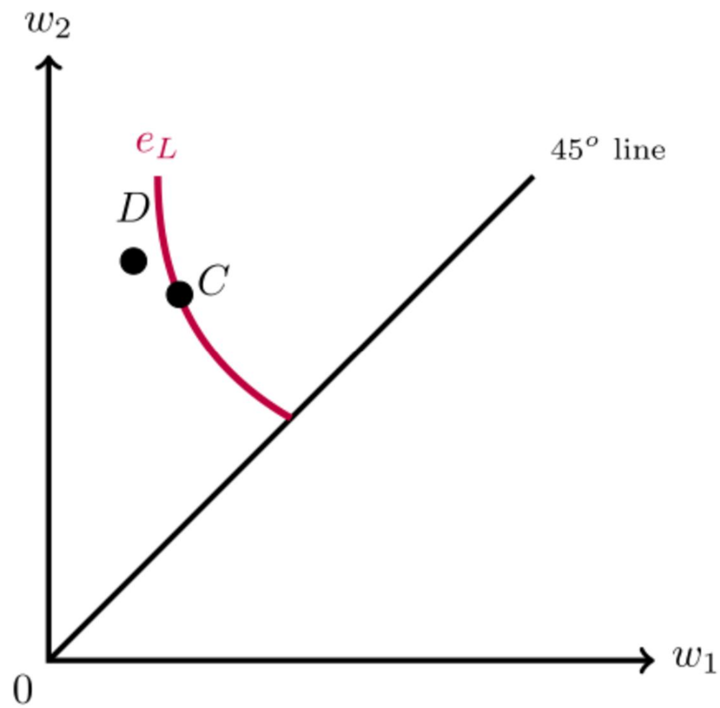
w_2
e_H
e_L
45^o line
w_2^C
C
w_1
0
w_1^C

How can we tell which of two contracts, *C* and *D*, gives higher utility?

For the Agent the direction of increasing utility is the North-East direction.

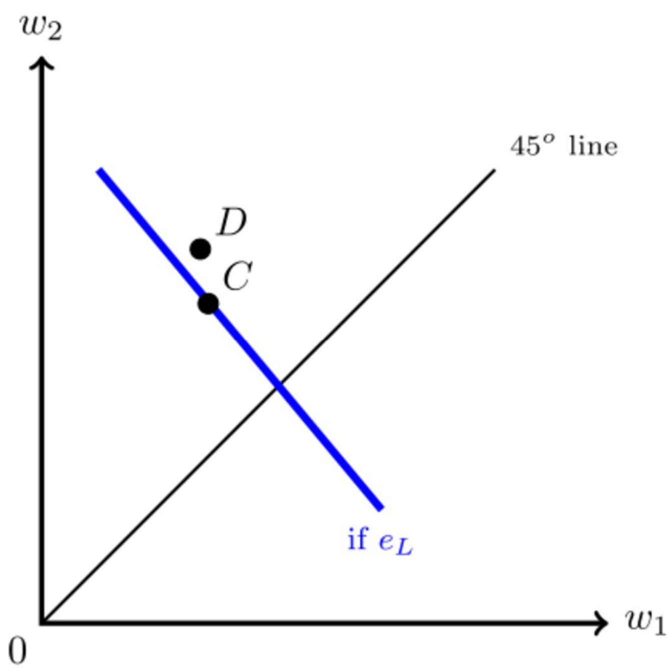
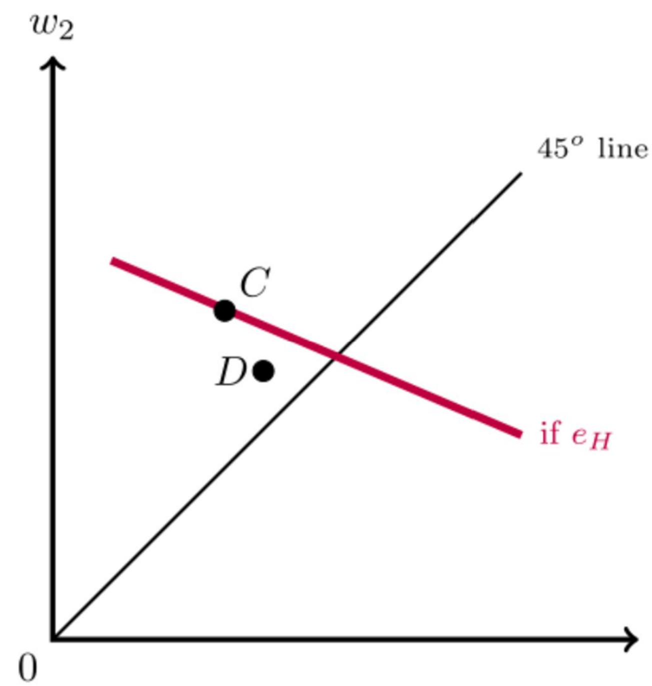


Contract *D* gives lower utility than contract *C*, *if the Agent exerts high effort under both contracts*. But it could be that contract *D* under low effort gives higher utility than contract *C*.



Contract *D* gives lower utility than contract *C*, *if the Agent exerts low effort under both contracts*. But it could be that contract *D* under high effort gives higher utility than contract *C*.

For the Principal the direction of increasing utility is the South-West direction.

	
Contract D gives **lower** utility to the Principal than contract C, *if the Agent exerts low effort under both contracts*. But it could be that contract D induces the Agent to choose high effort and gives the Principal higher utility than contract C.	Contract D gives **higher** utility to the Principal than contract C, *if the Agent exerts high effort under both contracts*. But it could be that contract D induces the Agent to choose low effort and gives the Principal lower utility than contract C.

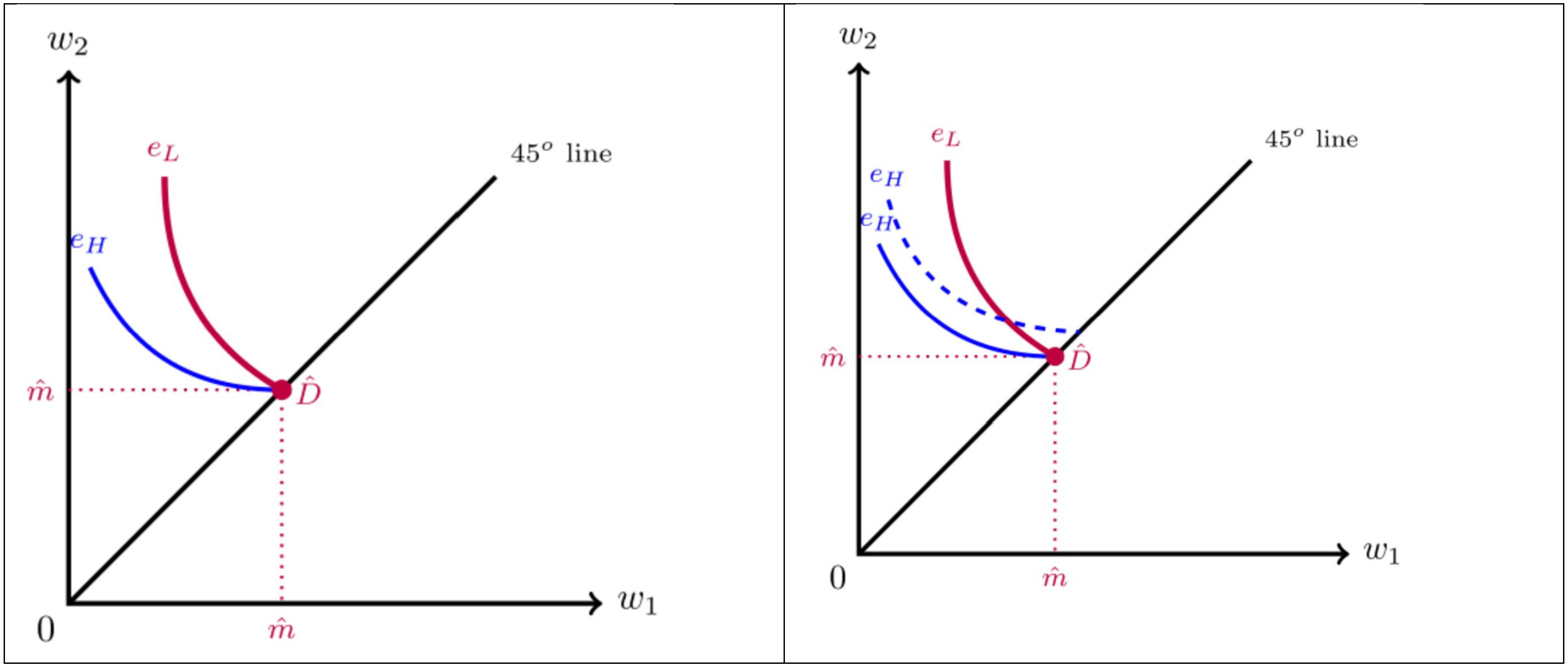
How do we determine which contracts are Pareto efficient?

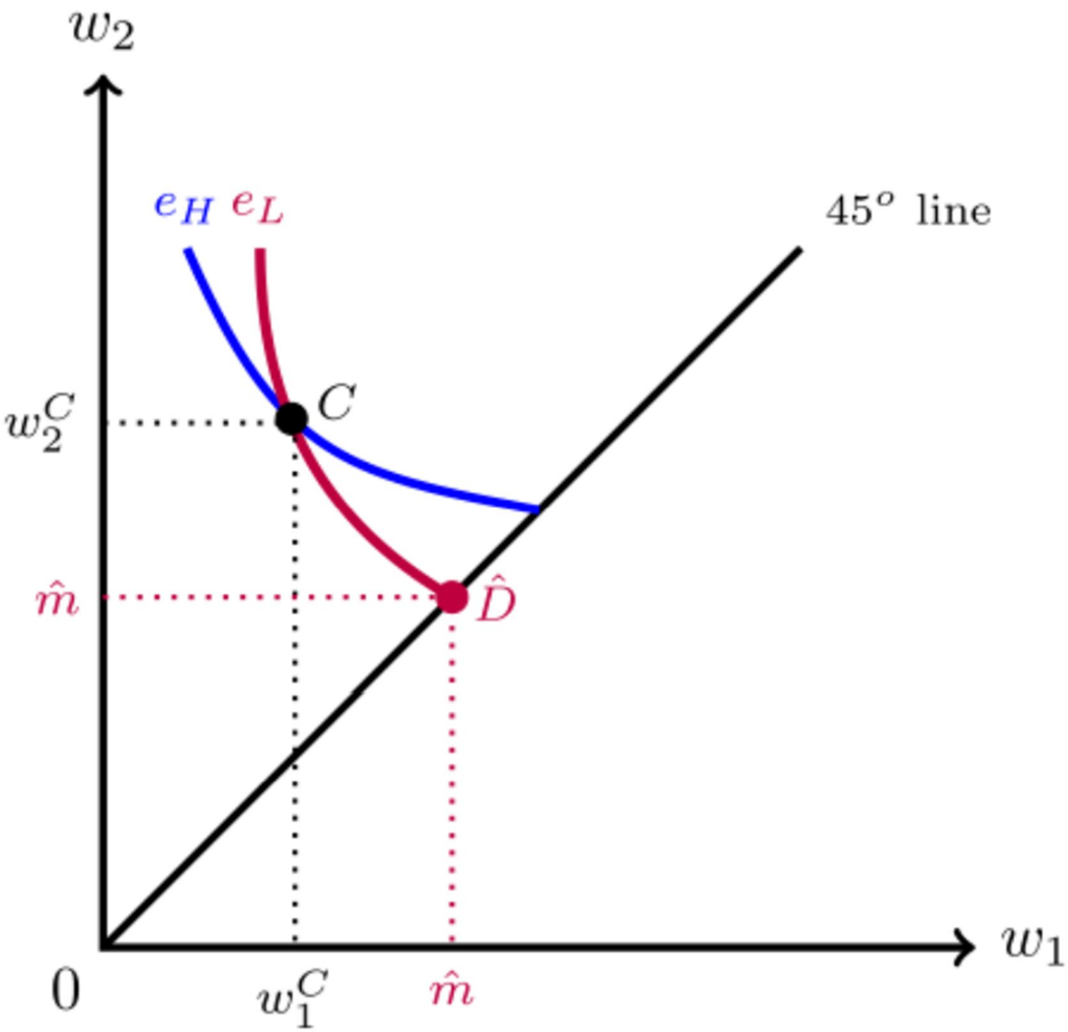
Step 1. Pick an arbitrary contract $\hat{D} = (\hat{m}, \hat{m})$ on the 45° line and let $\hat{u}$ be the Agent's utility from this contract. Then we know that

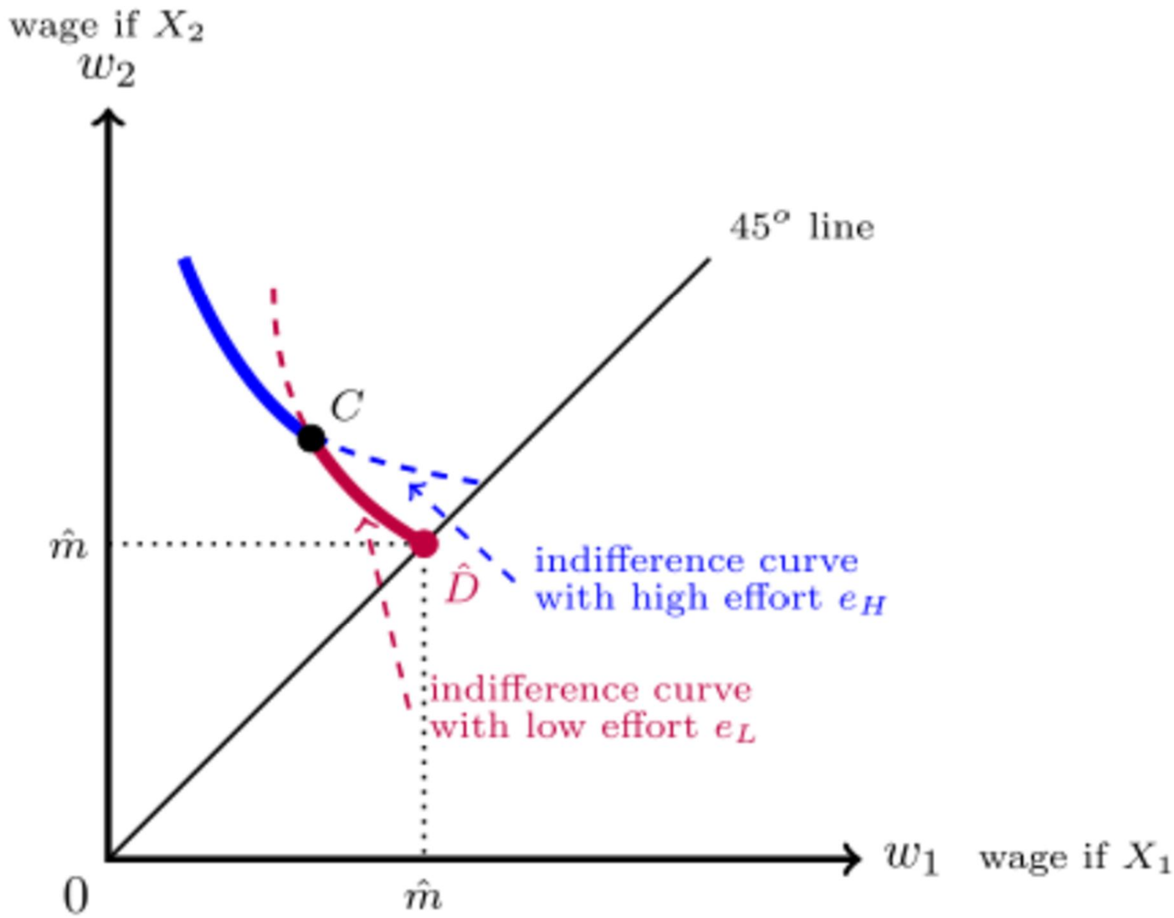
Step 2. Determine the set of contracts that give the Agent utility $\hat{u}$ when she chooses the best level of effort for each contract. Call this set the $\hat{u}$ *-utility locus* for the Agent.

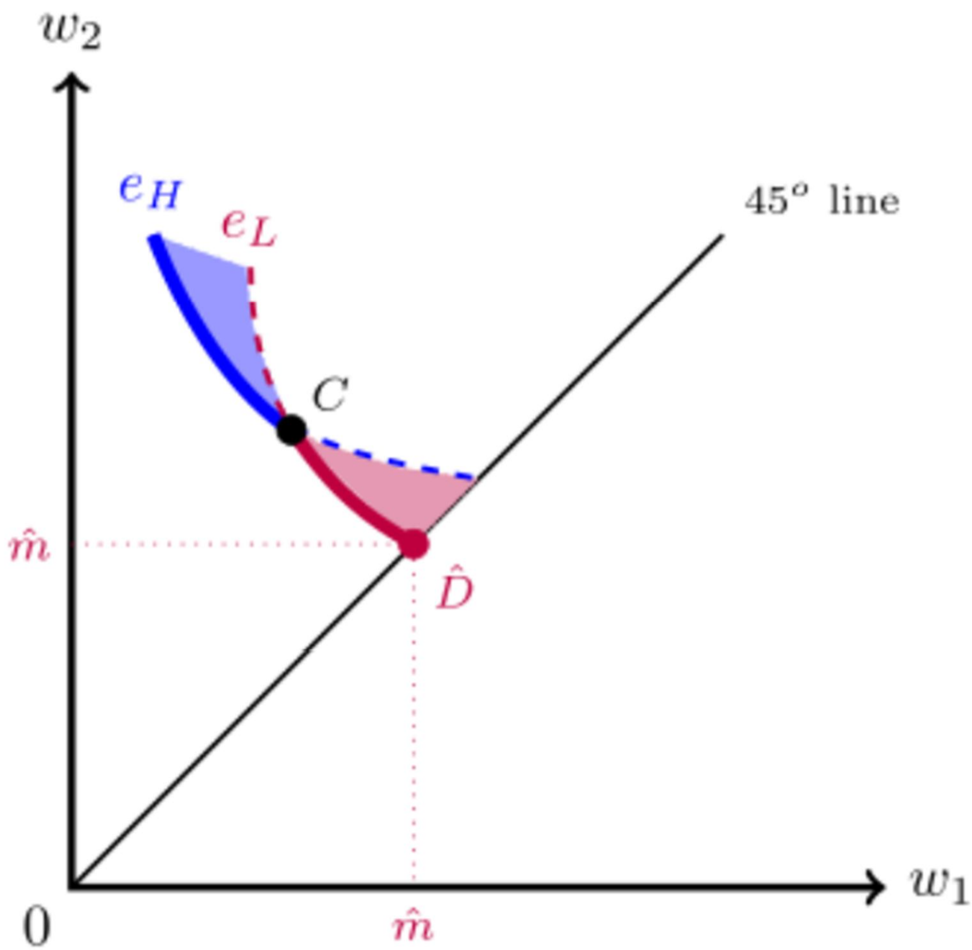
Step 3. Find which contracts on the $\hat{u}$ *-utility locus* are Pareto efficient.

The indifference curve corresponding to e_H that goes through contract $\hat{D}$ corresponds to a level of utility less than $\hat{u}$ (in fact, equal to $\hat{u}-c$).

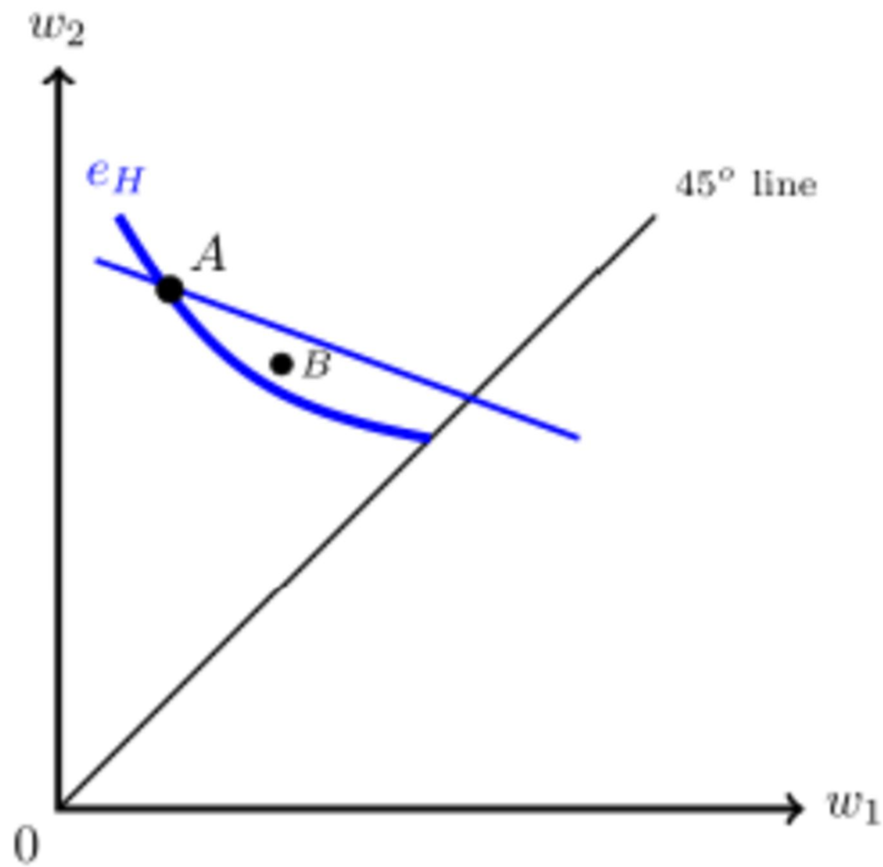



w_2
e_H e_L
45^o line
w_2^C
C
$\hat{m}$
$\hat{D}$
0
w_1^C
$\hat{m}$
w_1

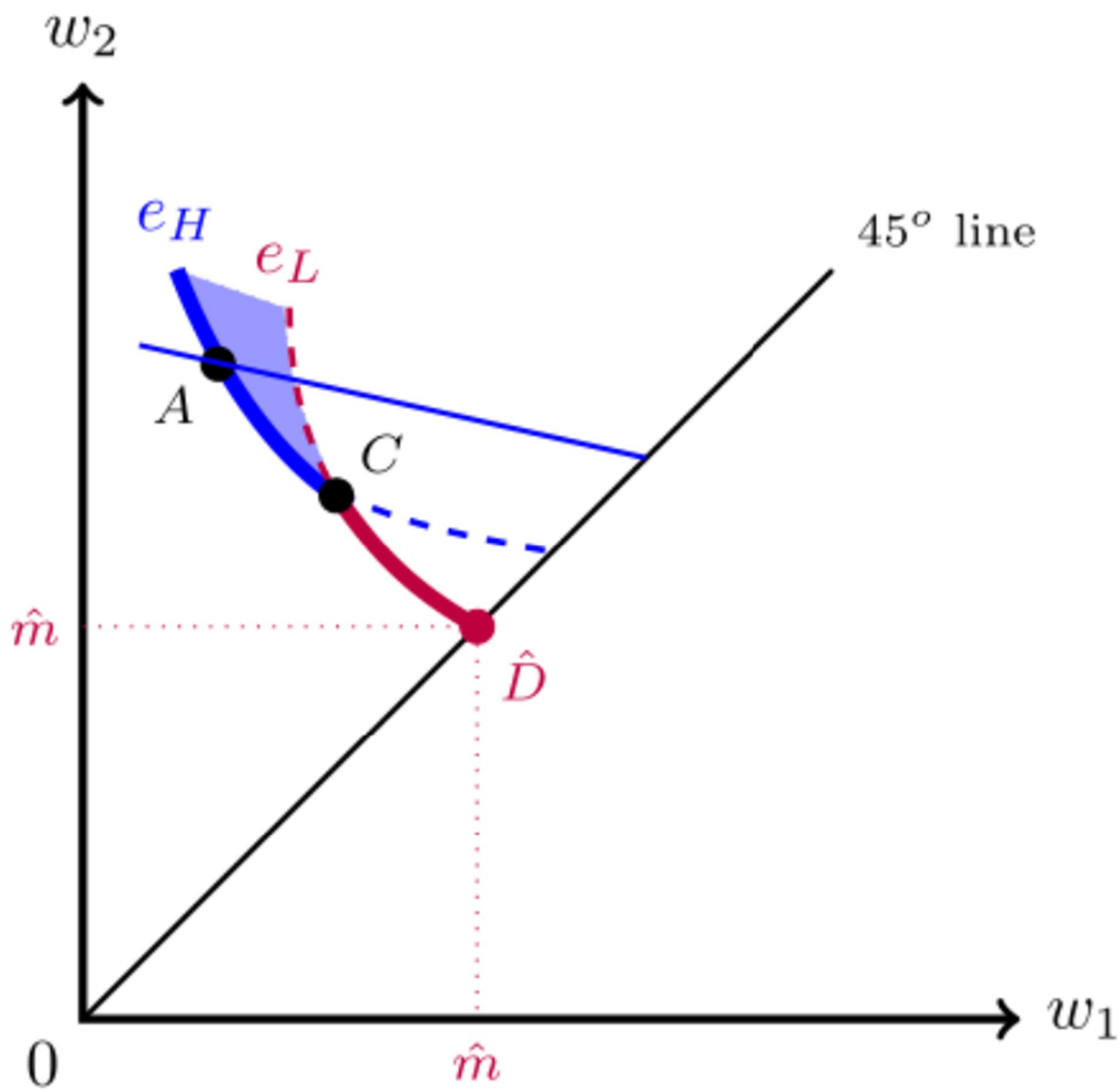

wage if X_2
w_2
45^o line
C
$\hat{m}$
$\hat{D}$
indifference curve
with high effort e_H
indifference curve
with low effort e_L
0
$\hat{m}$
w_1 wage if X_1

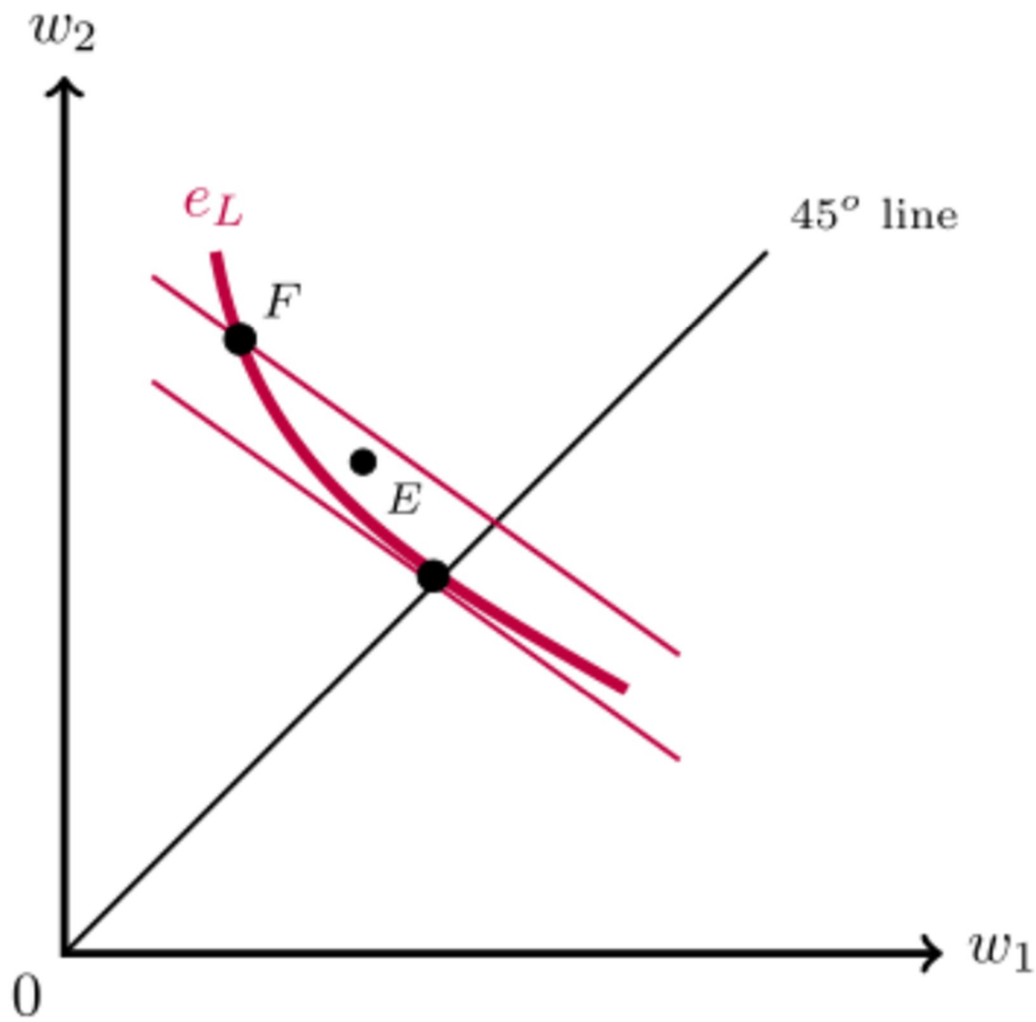


w_2
e_H
e_L
45^o line
C
$\hat{m}$
$\hat{D}$
0
$\hat{m}$
w_1

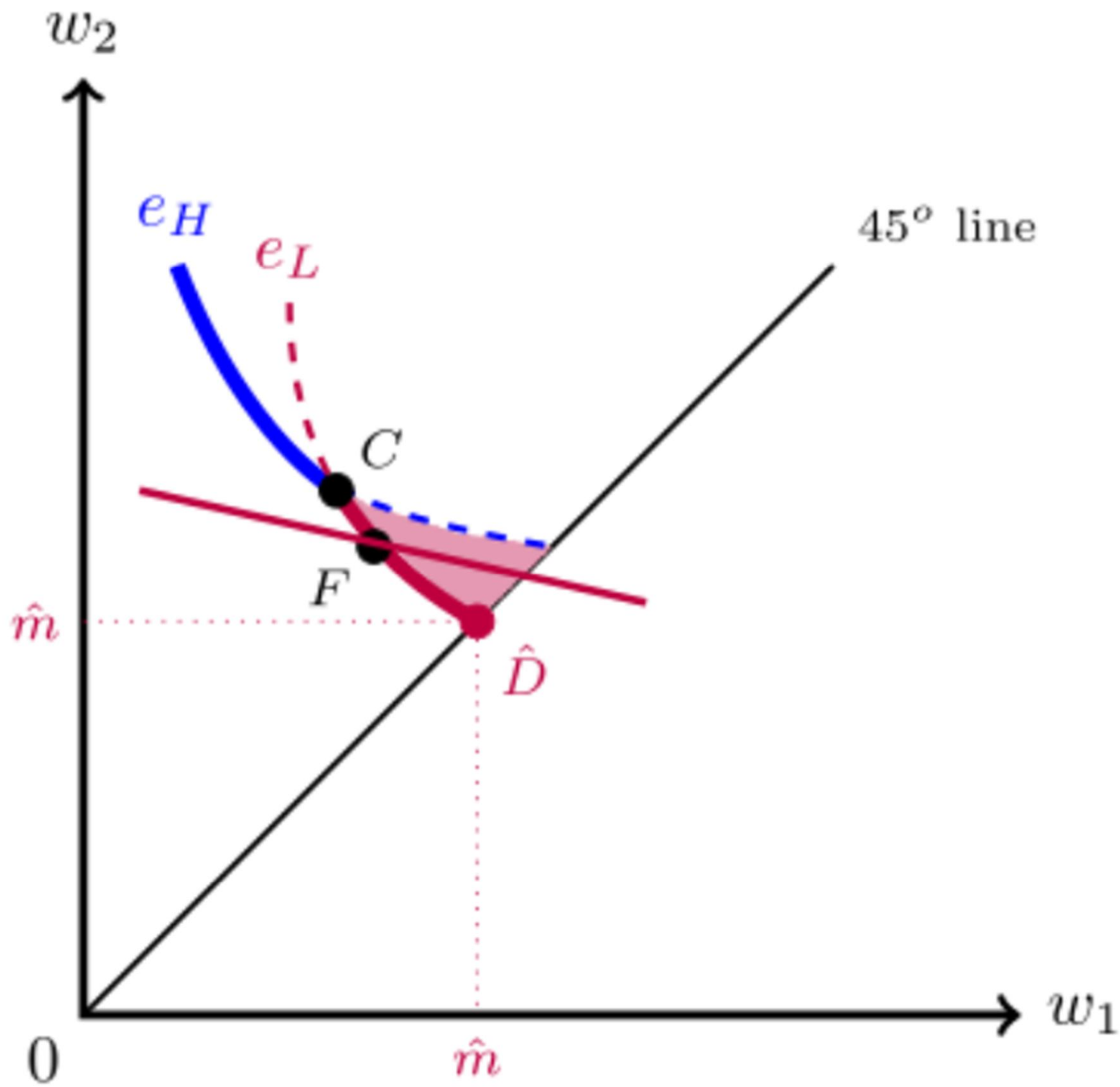


If the Agent chooses e_H *with both contracts A and B*, then both Principal and Agent strictly prefer *B* to *A*.

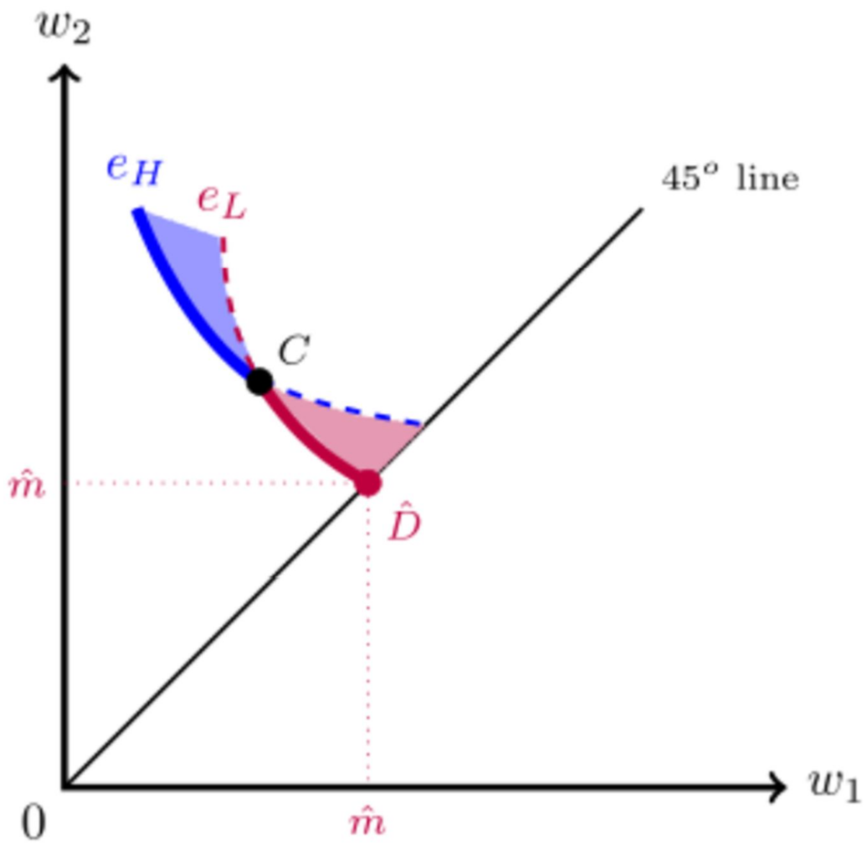

w_2
e_H
e_L
45^o line
A
C
$\hat{m}$
$\hat{D}$
w_1
0
$\hat{m}$



If the Agent chooses e_L *with both contracts E and F*, then both Principal and Agent strictly prefer *E* to *F*.



w_2
e_H
e_L
45^o line
C
F
$\hat{m}$
$\hat{D}$
0
$\hat{m}$
w_1



The only two candidates for Pareto efficiency on the $\hat{u}$ -utility locus are C and $\hat{D}$. Which of the two is Pareto efficient depends on how the Principal ranks them:

- if $\hat{D} \succ_P C$
- if $C \succ_P \hat{D}$