How to make the best use of non-perfect weather forecasts

Weather forecasts are not always right, sometime very bad. But. . .

1. Meteorologists can judge if their current forecast is certain or uncertain, also with respect to parameter (temperature, wind, precipitation . . .)

2. The certainty or uncertainty of the forecasts varies in time, not because of the meteorologist on duty, but because of the atmosphere itself, the character of the weather patterns

3. As a user of the weather forecasts, you do not benefit from any attempt to conceal the uncertainty, on the contrary you benefit from knowing about the current uncertainties

To illustrate this with hard numbers, assume we are in a region with adverse weather 9 days/month or 122 days/year = 30% of the time.

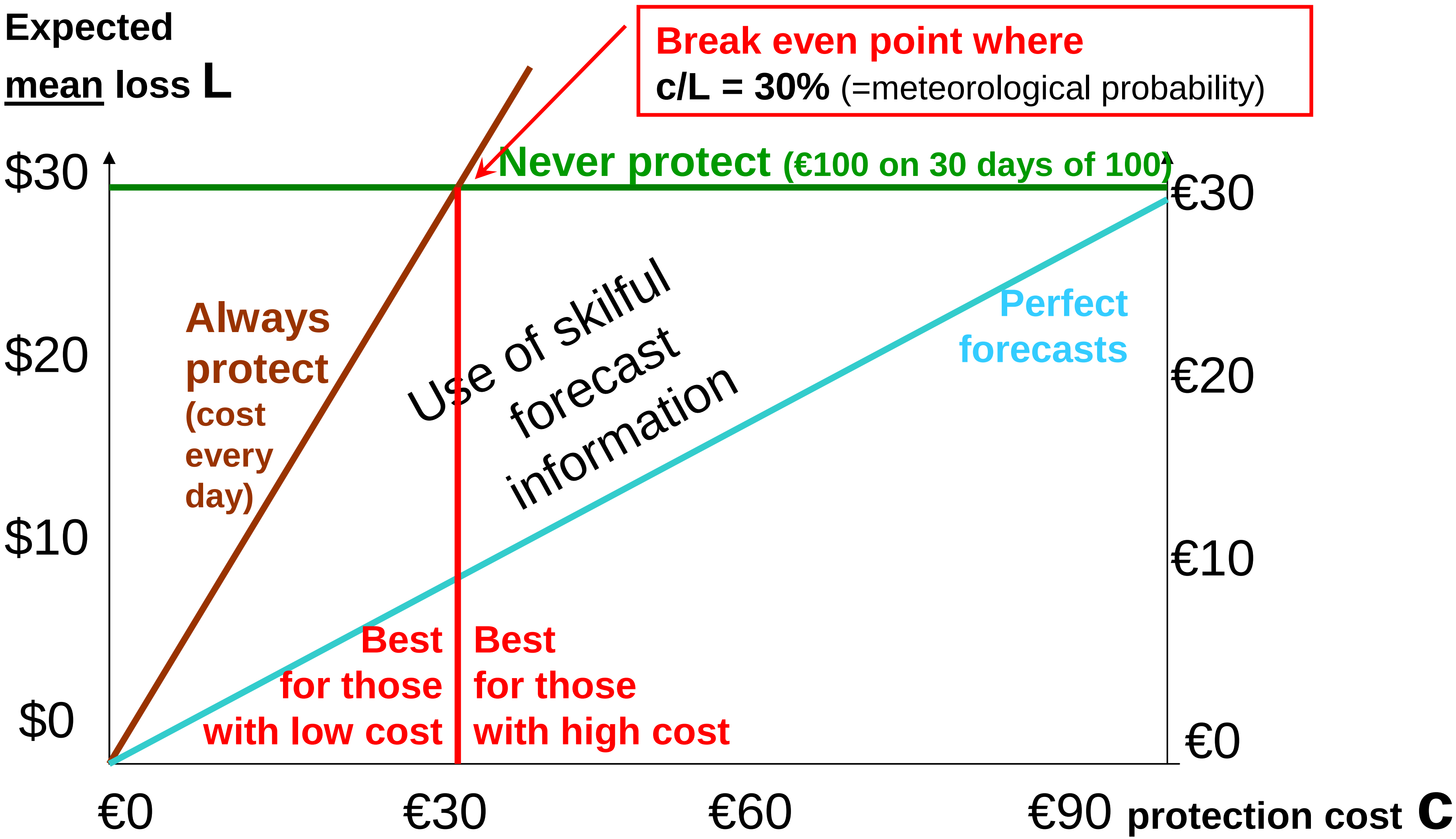
Assume that adverse weather on a certain day will cause a loss **L = €100**

The cost of protection on a certain day may be between c = **€0** to c = **€100** **(the same as the loss)**

Common sense notion 1: **if the cost c is <u>low</u> we <u>always</u> protect**

Common sense notion 2: **if the cost c is <u>high</u> we <u>never</u> protect**

With no forecast information what are the consequences of always protecting and **never**?



The local weather forecasters make very good forecasts with 80% being correct.

	Obs rain	Obs dry
Fc rain	20	10
Fc dry	10	60

All forecasts are well tuned:

Actions were taken with cost

The number of

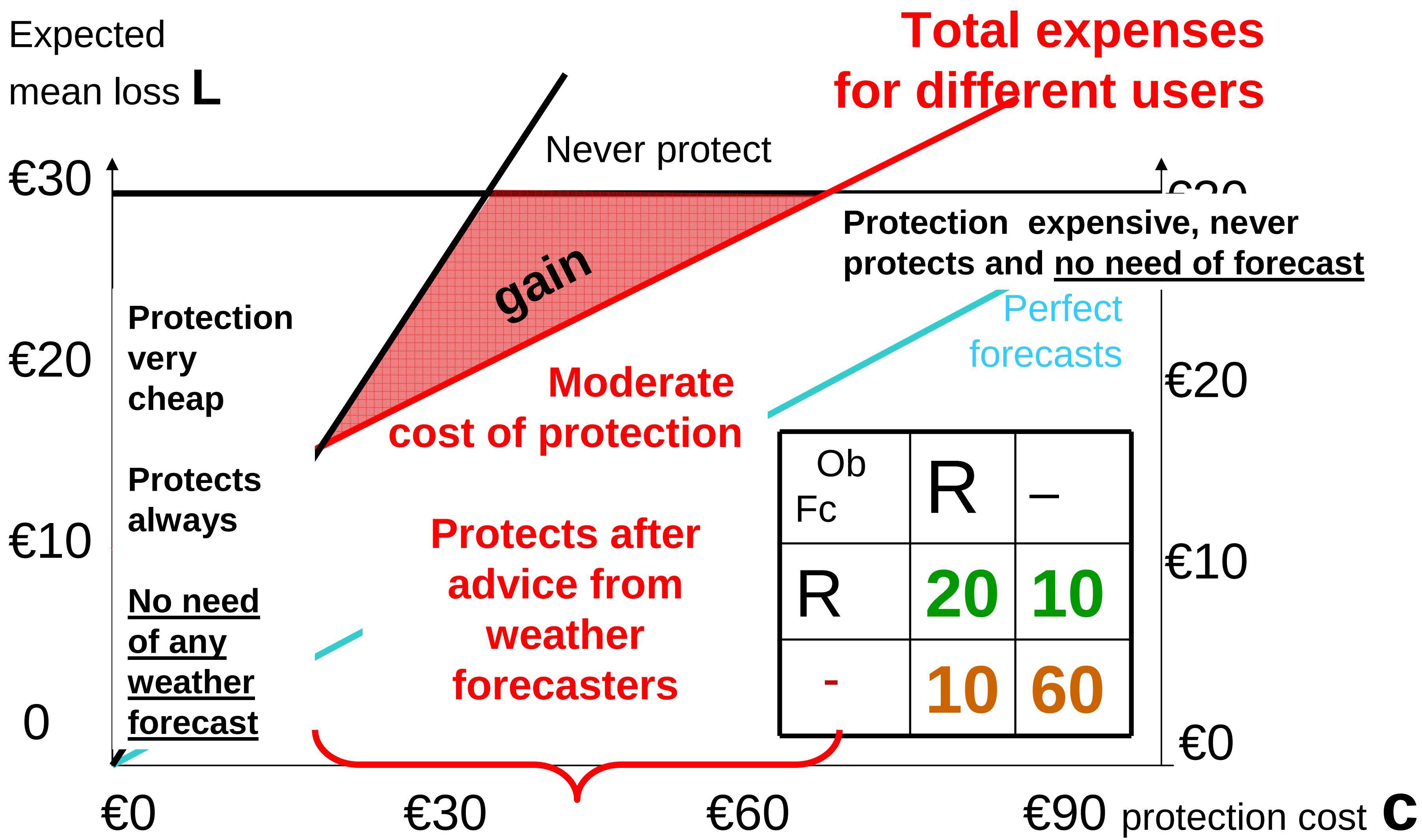
No actions with no cost

over 100 days matches

th… ber of observed rain days (30)

Losses

The expected loss per day for different protection costs c



Ob / Fc	R	–
R	20	10
-	10	60

3. How can we improve on this?

Paradoxically by telling the customer/public when the forecasts are less good and in what respect.

This is NOT to cover our backs but actually supplying additional valuable forecast information!

To illustrate this we will do something very strange or scandalous: **we will sometimes declare that we are so uncertain that we will not issue a forecast!**

	Obs rain	Obs dry
Fc rain	**20**	**10**
Fc dry	**10**	**60**

	Obs rain	Obs dry
Fc rain	**10**	**0**
???	**20**	**20**
Fc dry	**0**	**50**

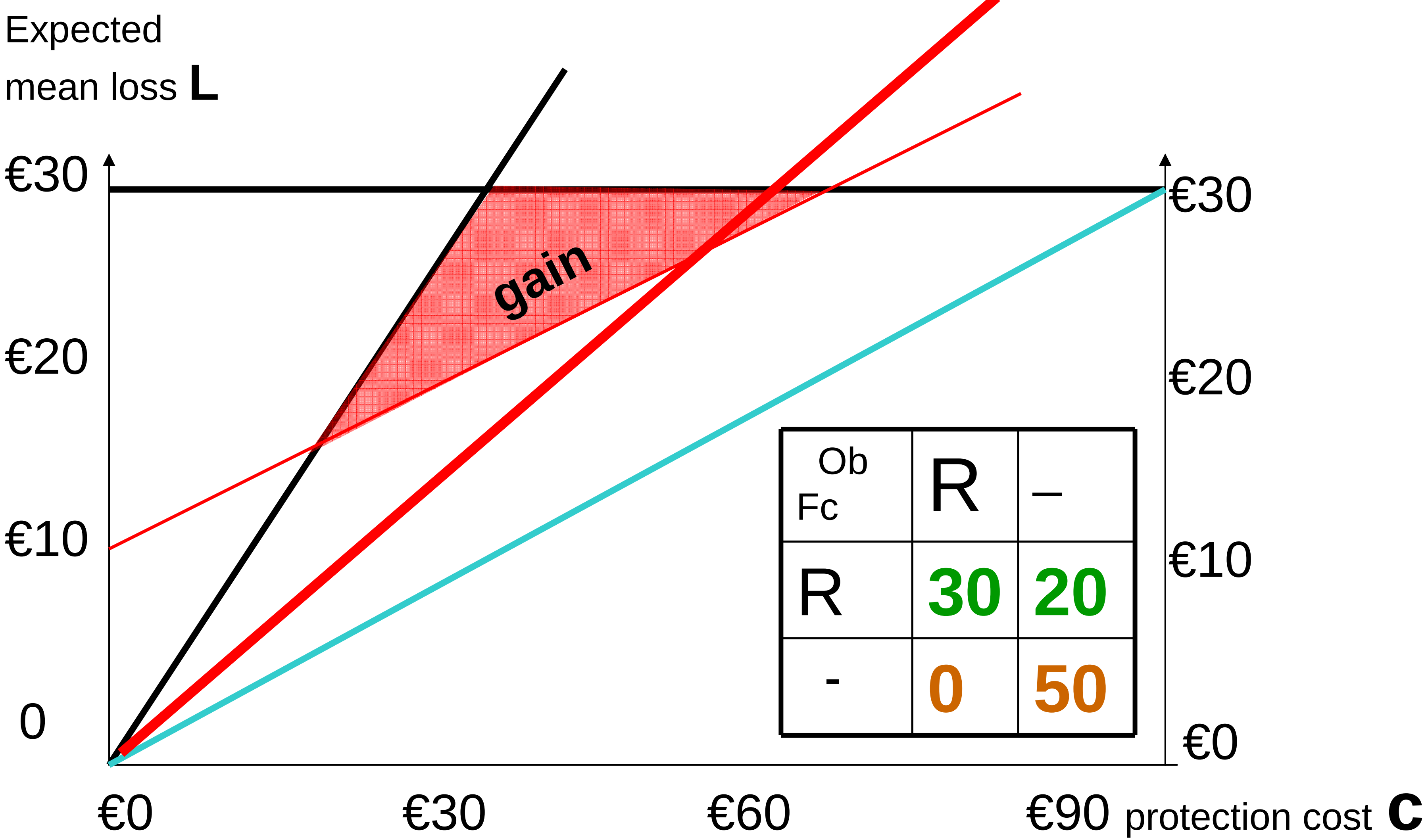
This allows those who are sensitive to rain to interpret the ??? as "it might rain"

	Obs rain	Obs dry
Fc rain	**10**	**0**
???	**20**	**20**
Fc dry	**0**	**50**

→

	Obs rain	Obs dry
Fc rain	**30**	**20**
Fc dry	**0**	**50**

These are the EMV (total cost) for those who interpreted ??? as “it might rain”



Ob / Fc	R	–
R	30	20
-	0	50

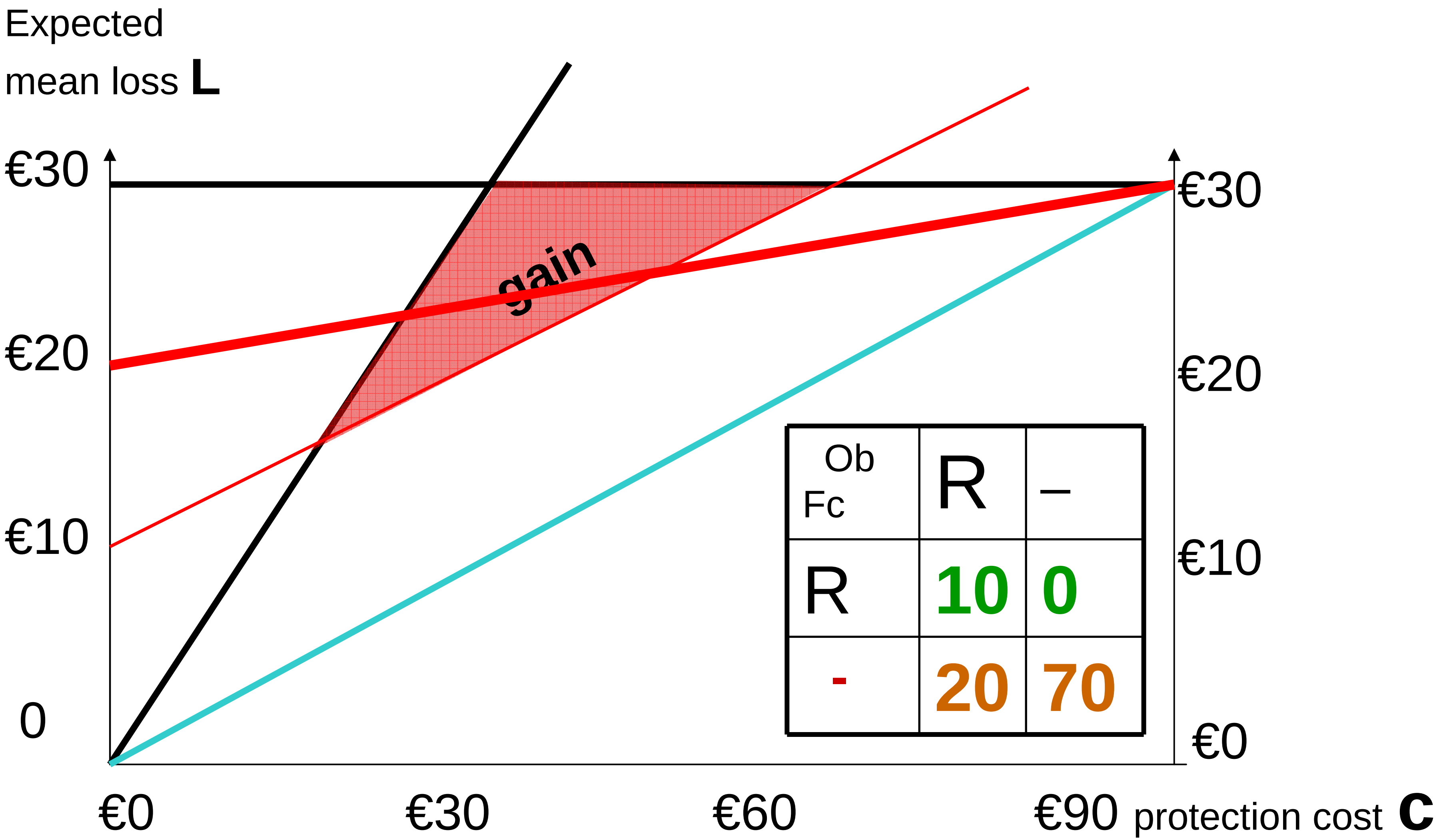
It allows those who are <u>not</u> sensitive to rain to interpret the ??? as "it might <u>not</u> rain"

USWB	Obs rain	Obs dry
Fc rain	10	0
???	20	20
Fc dry	0	50

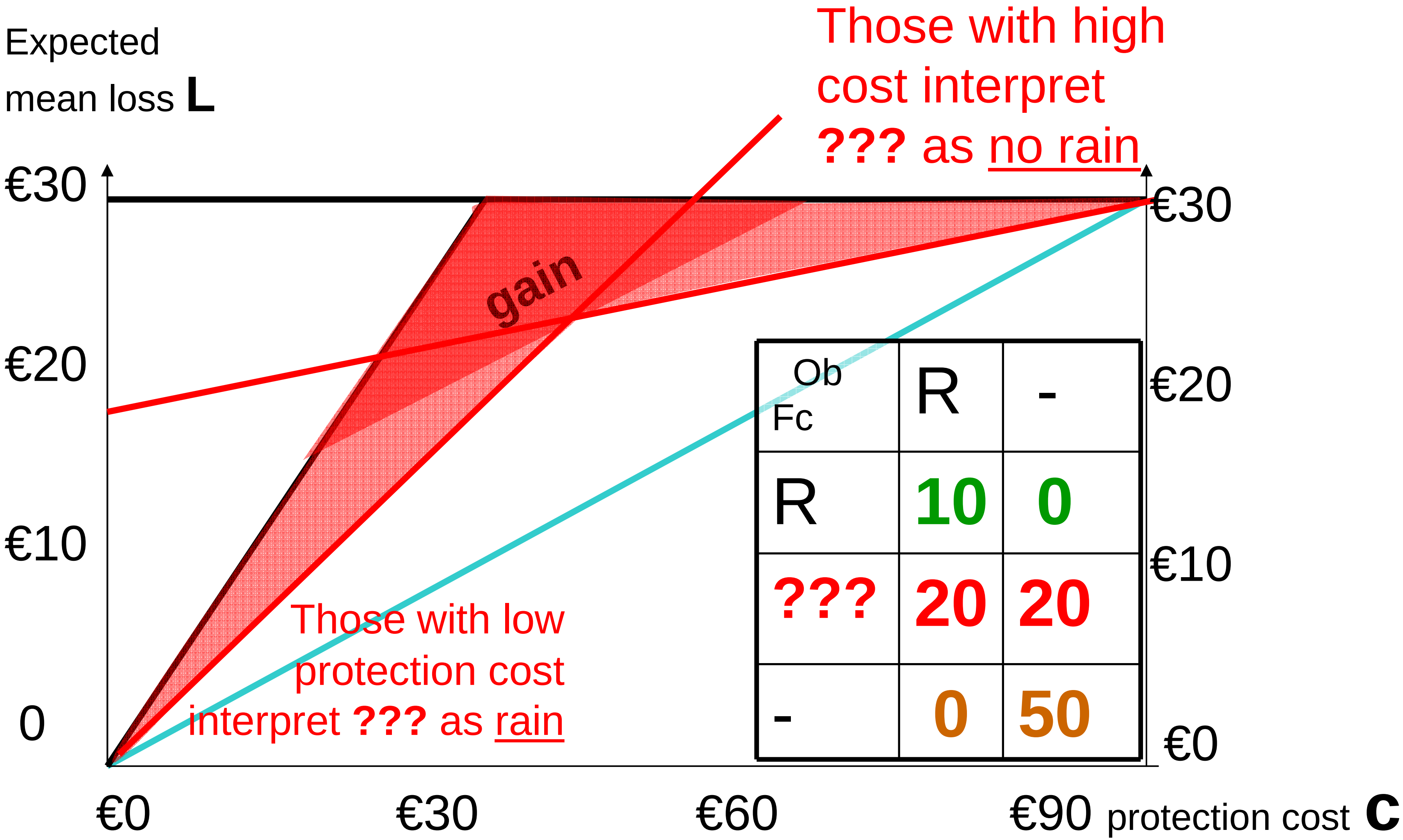
→

USWB	Obs rain	Obs dry
Fc rain	10	0
Fc dry	20	70

These are the EMV (total cost) for those who interpreted ??? as “it might not rain”



And them put them together . . .



Ob / Fc	R	-
R	**10**	**0**
???	**20**	**20**
-	**0**	**50**

This was a drastic example, an extreme scenario: *forecasters will never walk out on you.*

A much better way to convey uncertainty information is to use probabilities, in this case tell which ones of the 40 forecasts are more or less certain or uncertain.

Which ones of the 40 forecasts are more or less certain or uncertain?

Categorical

Obs / Fc	R	–
R	20	10
-	10	60

Non-categorical

Obs / Fc	R	-
R	10	0
???	20	20
-	0	50

Probabilistic

Obs / Confidence	R	–
certain	10	0
certain	0	50

Can we quantify that uncertainty?

Quantifying the (un)certainty . . .

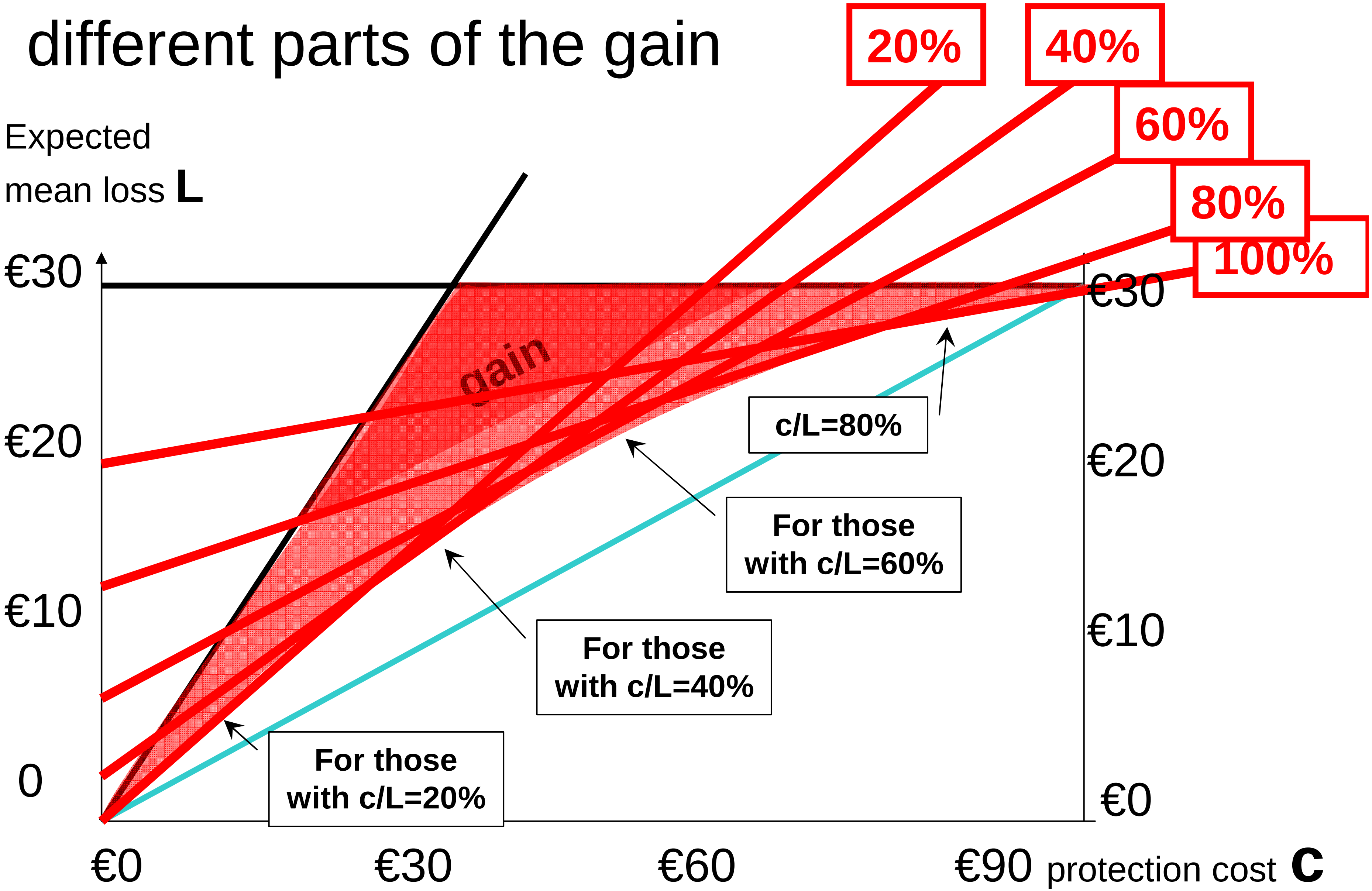
Obs Confidence	R	–
certain	10	0
almost certain	8	2
rather certain	6	4
rather uncertain	4	6
very uncertain	2	8
certain	0	50

Obs Prob%	R	–
100	10	0
0	0	50

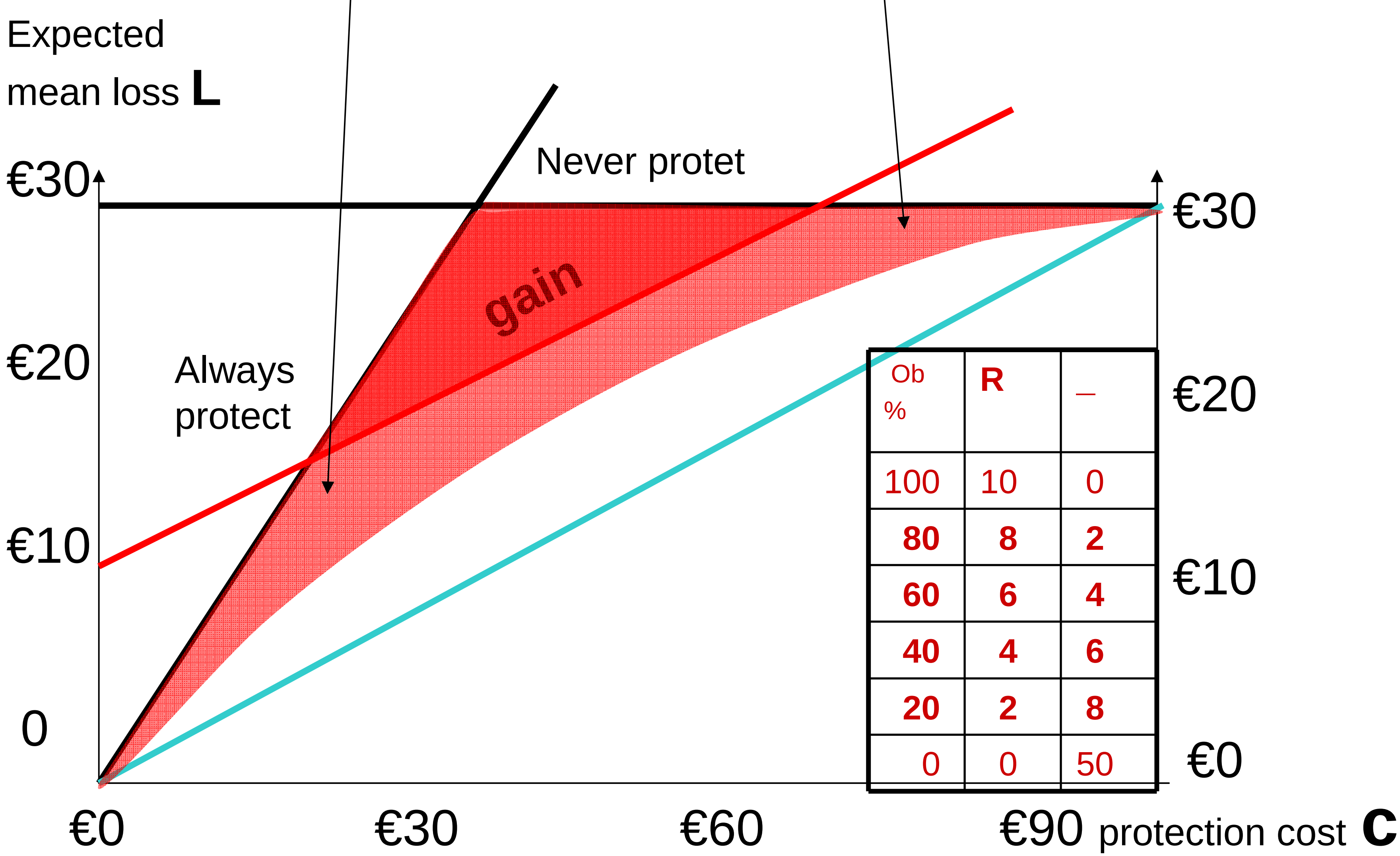
. . . heps you to decide when to take action:

Only when the probability > your c/L

Different users benefit from different parts of the gain



Probabilities yield gains for <u>all</u> protection costs



Ob %	R	–
100	10	0
80	**8**	**2**
60	**6**	**4**
40	**4**	**6**
20	**2**	**8**
0	0	50

Summary:

1. The (un) certainty of weather forecasts vary from day to the other

2. This (un) certainty, which can be estimated and expressed in different ways, provides a valuable “added value” to the forecasts

3. Expressing the (un) certainty in probabilistic terms provides the optimum information to make decisions about action or no action

END