

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.**

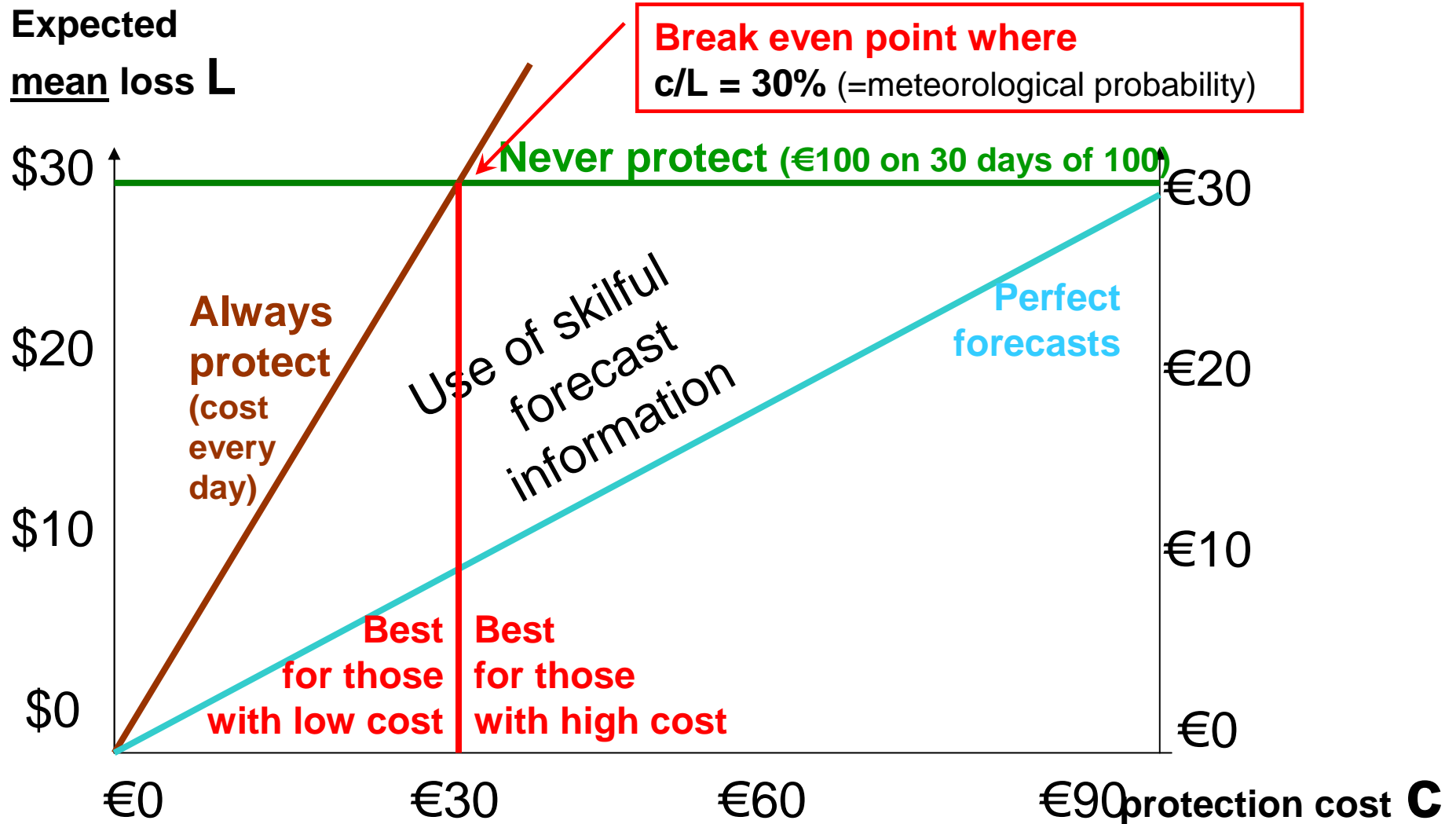
Assume that adverse weather on a certain day will cause a loss $L = \text{€}100$

The cost of protection on a certain day may be between $c = \text{€}0$ to $c = \text{€}100$ (the same as the loss)

Common sense notion 1: if the cost C is low we always protect

Common sense notion 2: if the cost C is high we never 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

Losses

All forecasts

are well tuned:

Actions were taken with cost

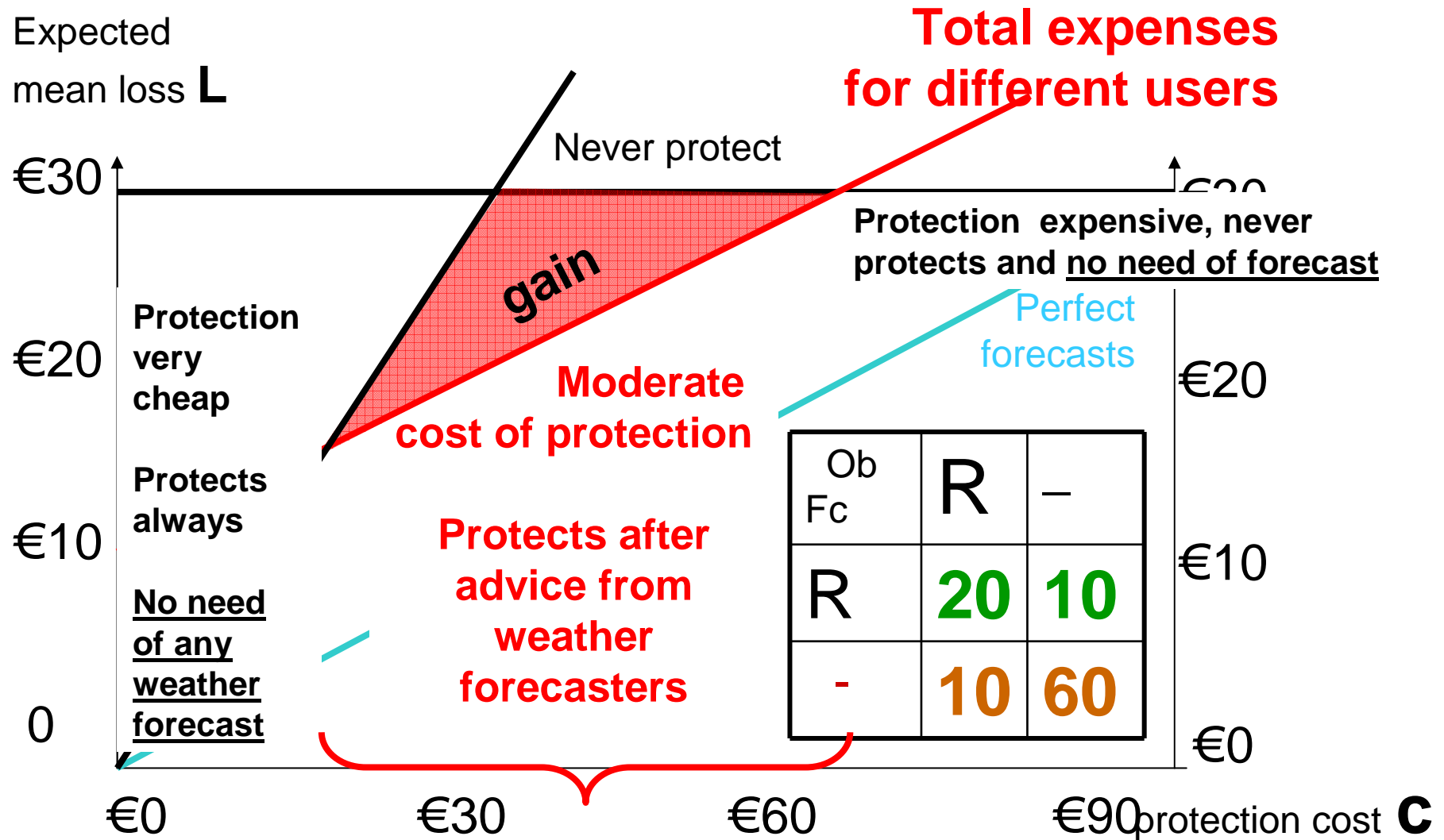
The number of

No actions with no cost

over 100 days matches

the number of observed rain days (30)

The expected loss per day for different protection costs **C**



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”

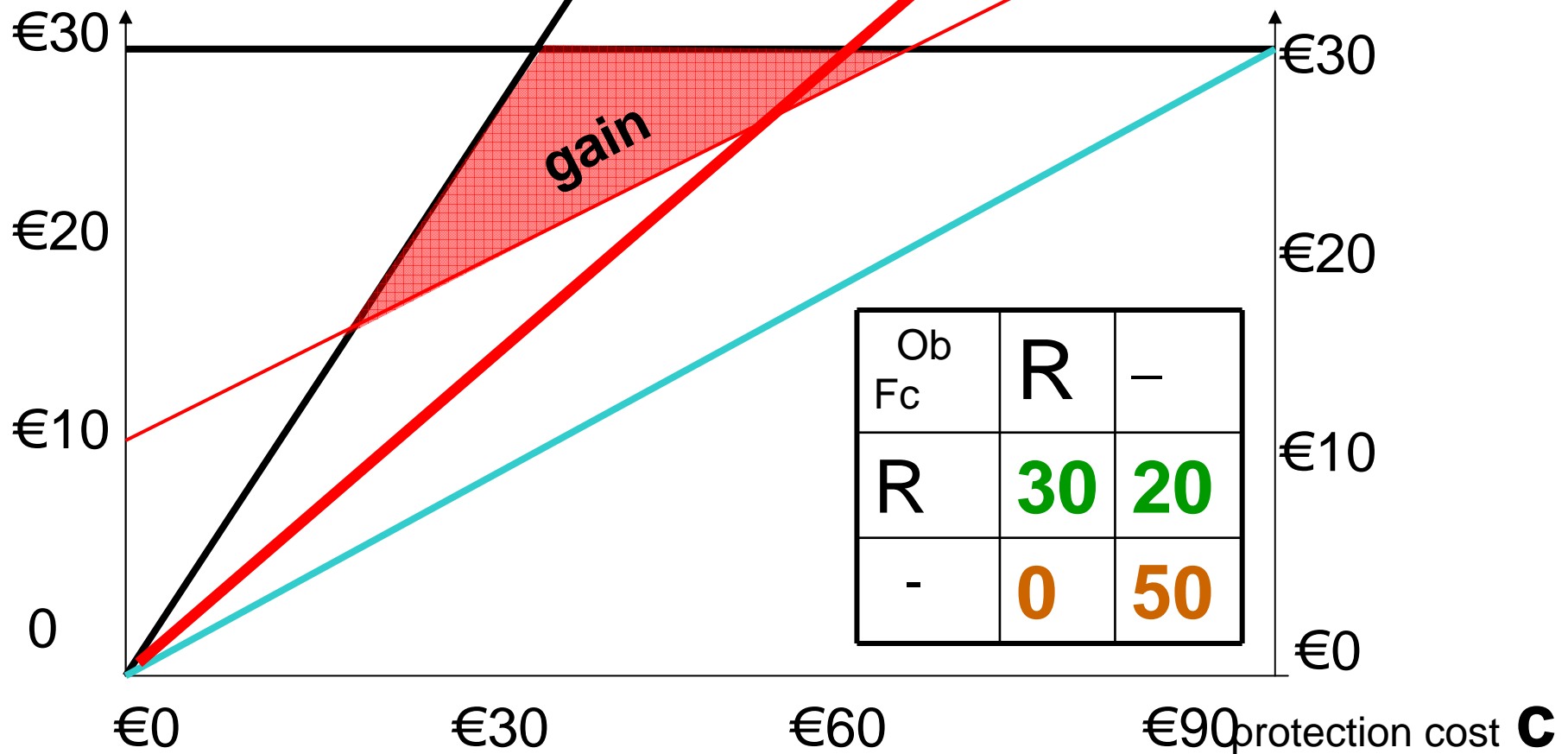
	Obs rain	Obs dry
Fc rain	10	0
???	20	20
Fc dry	0	50



	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”

Expected mean loss **L**



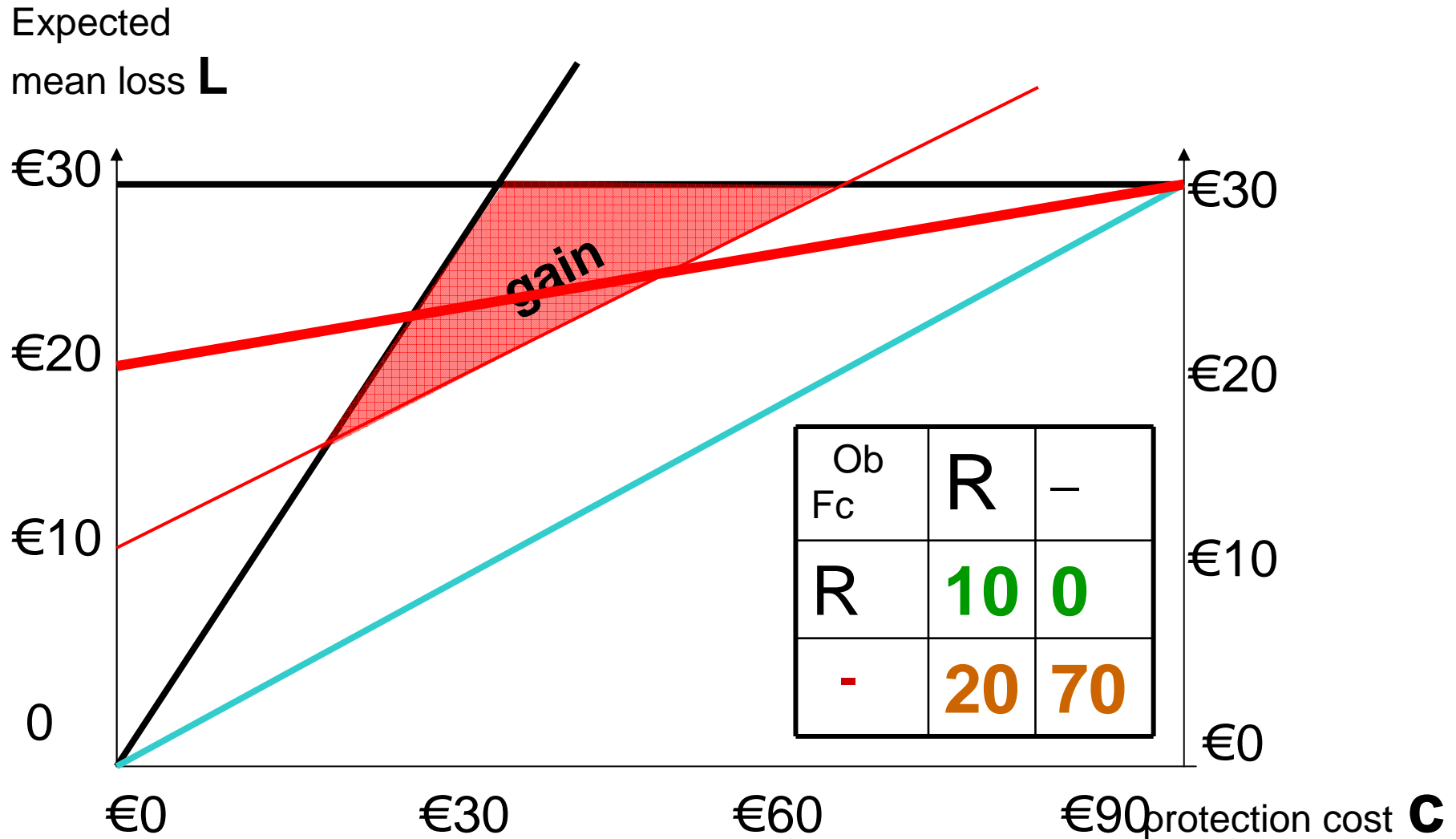
It allows those who are not sensitive to rain to interpret the **???** as “it might not rain”

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

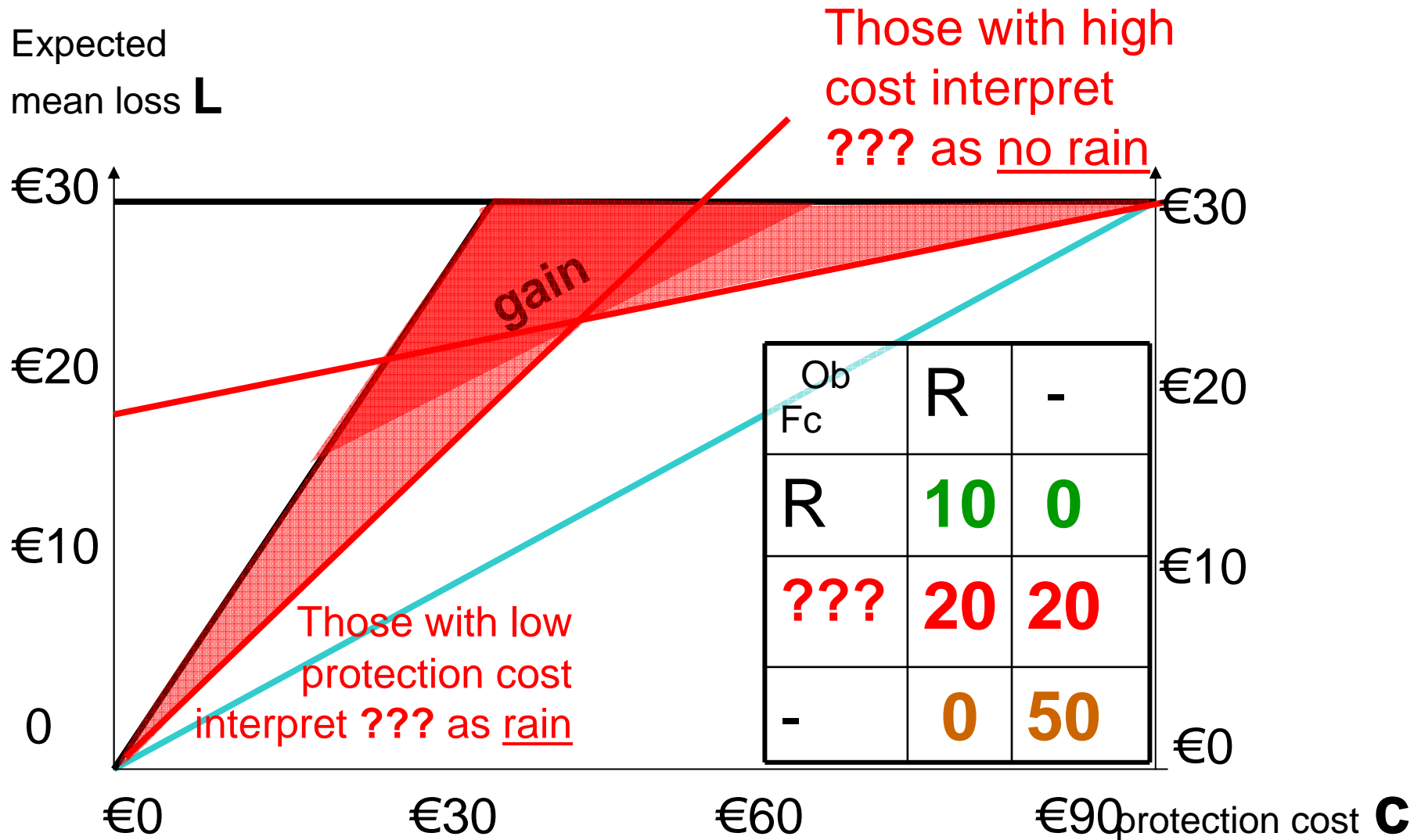


USWB	Obs rain	Obs dry
Fc rain	10	0
Fc dry	20	70

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



And then put them together . . .



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

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

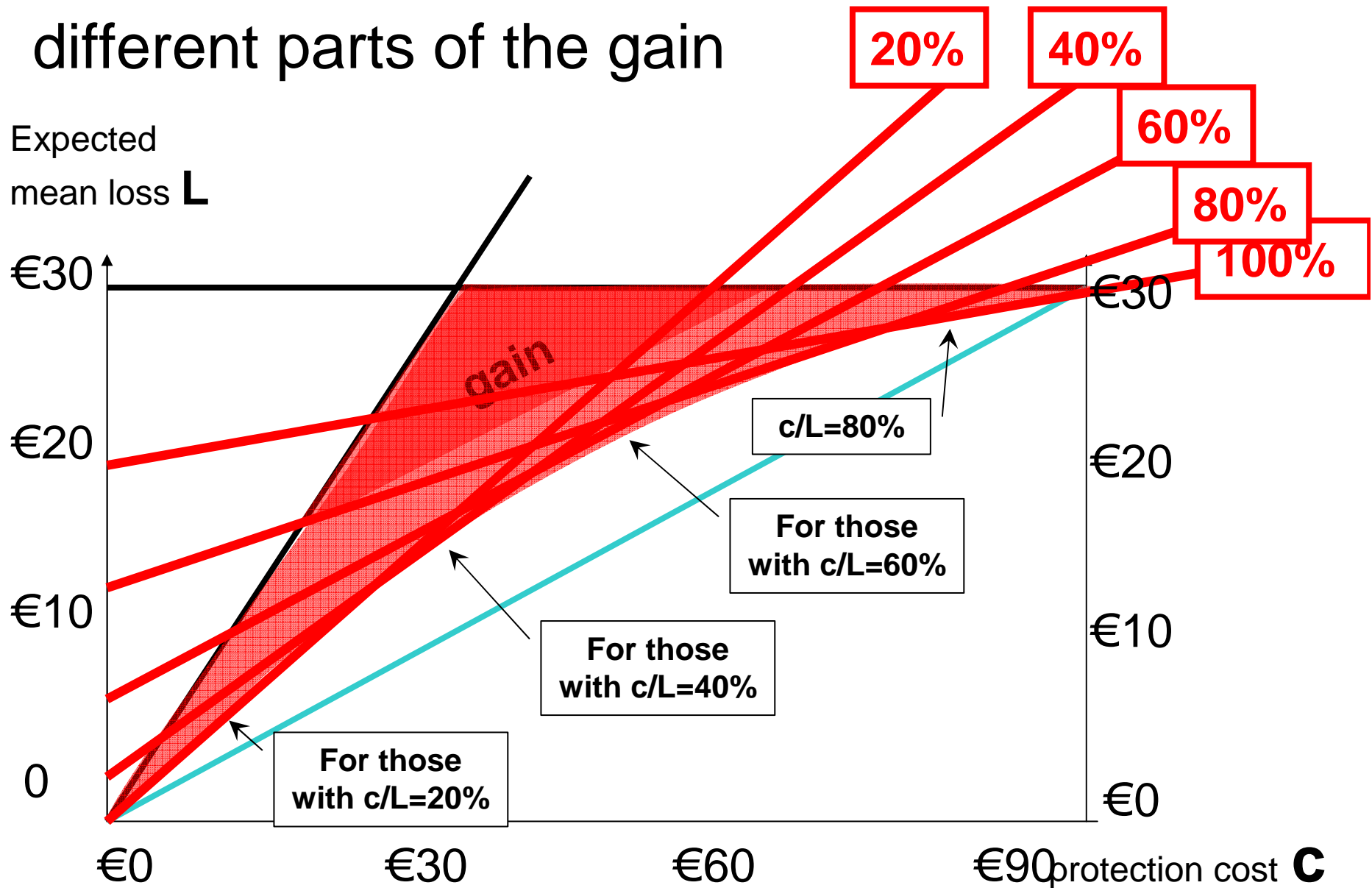
Only when the probability >

your c/L

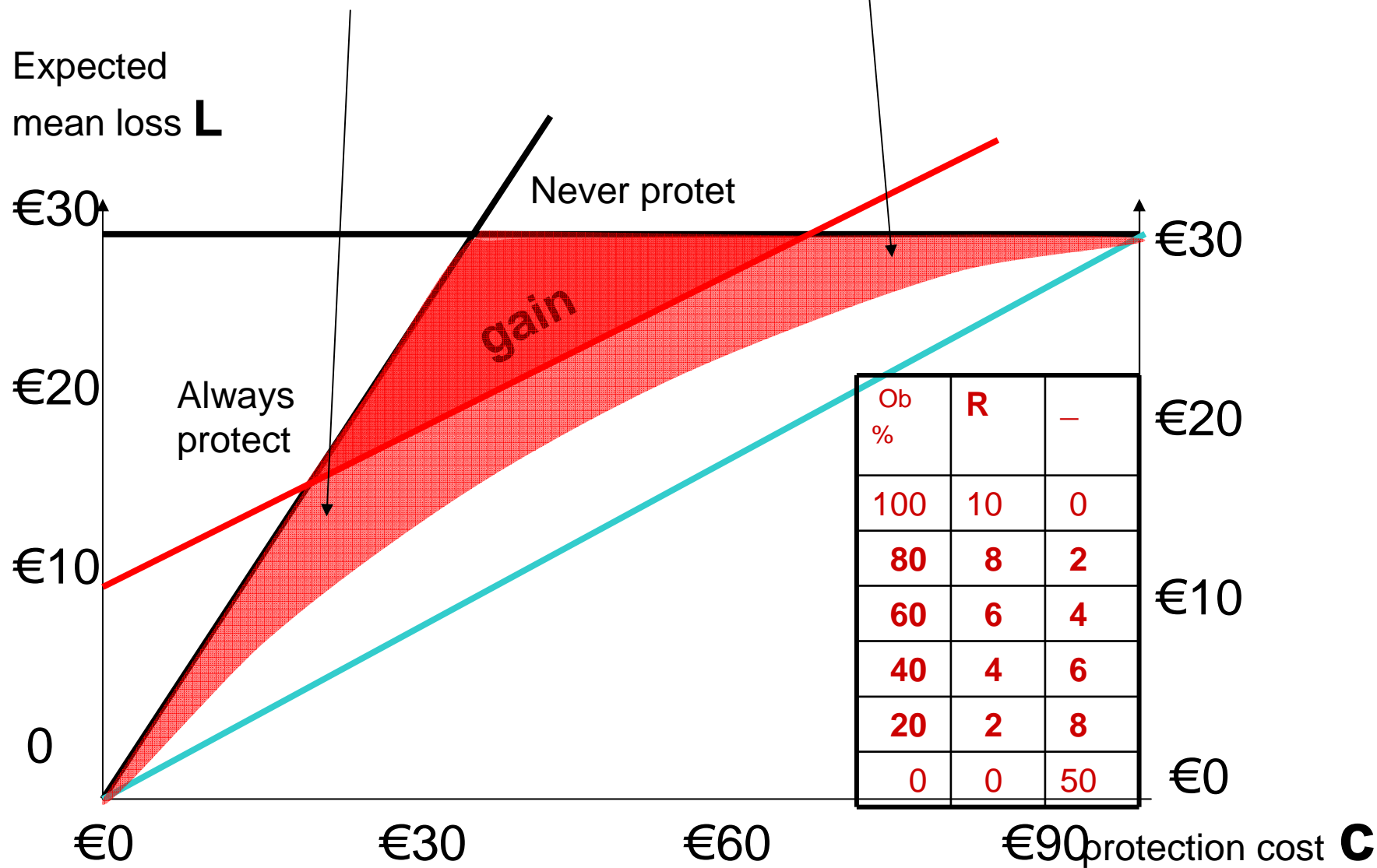
Trento Meeting 6 Feb 2015

Anders Persson

Different users benefit from different parts of the gain



Probabilities yield gains for all protection costs



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