

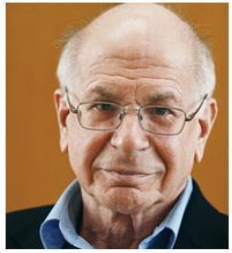
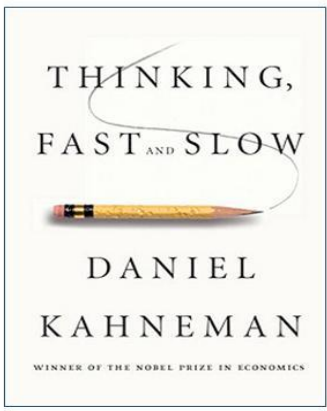
# Anders Persson's Moscow seminars 17 May 2016

- 1. Decision making from probability forecasts**  
*– turning a weakness into a strength*
- 2. Kalman filtering of computer forecast output**  
*– self learning equations?*
- 3. A new look at the Coriolis Effect** – *it is not an optical illusion!*
- 4. Rossby's planetary waves** – *and “group velocity thonking”*

# 1. Decision making from probability forecasts – *turning a weakness into a strength*





# A surge of books on uncertainty and intuitive statistics

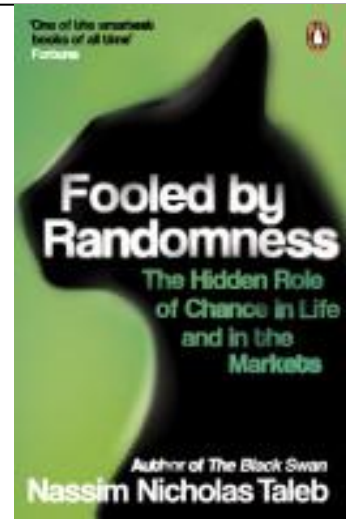
But above of all this "international best-seller"



Selected by the *New York Times Book Review* as one of the best books of 2011. A *Globe and Mail* Best "Books of the Year 2011". One of *The Economist's* 2011 "Books of the Year". One of *The Wall Street Journal's* "Best Nonfiction Books of the Year 2011"

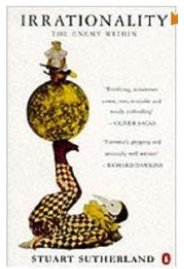
Hydrology 16 July 2013

the theory  that would not die   
 how bayes' rule cracked  the enigma code, hunted down russian submarines & emerged triumphant from two  centuries of controversy  
 sharon bertsch mcgrayne

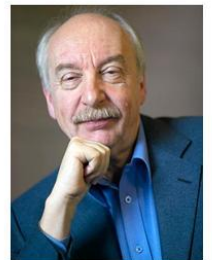


Good books on "intuitive statistics" and "rational thinking":

Stuart Sutherland (1994): Irrationality – The Enemy Within

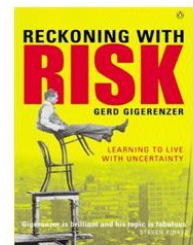


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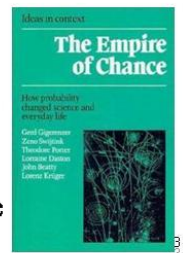


Gerd Gigerenzer on risk and chance

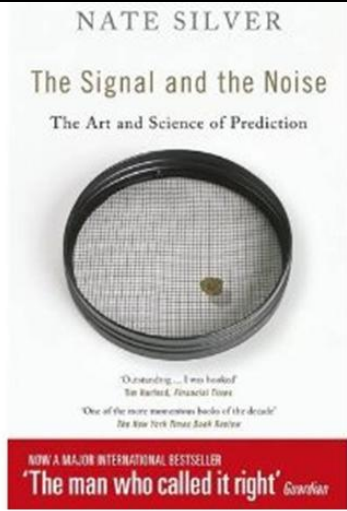
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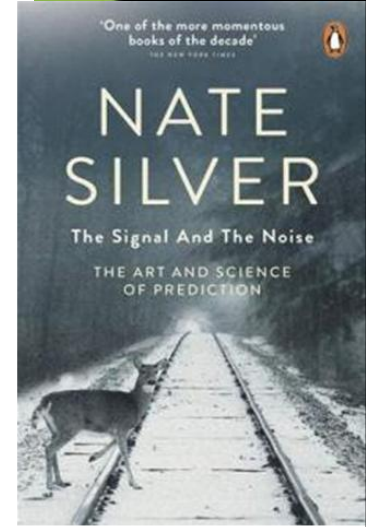
Hydrology 16 July 2013  
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# Some common pitfalls

1. Over-confidence
2. The Halo Effect
3. Representativeness bias
4. Confirmation bias
5. Availability effect
6. Misleading forecast consistency
7. Probability forecasts

# Some common pitfalls

1. -It will surely rain in six days time!
2. -Model A is usually best!
3. -It either rains or it is dry – not half dry!
4. -It rains - at least in Riga!
5. -Model A has nicer graphics – in colour
6. -Should we really change the forecast?
7. **-They do not tell me what to do!**

**Probability forecasts really tell us what to do!**

**Assume we are in a region with  
adverse weather 30% of the time**

9 days/month or 122 days/year.

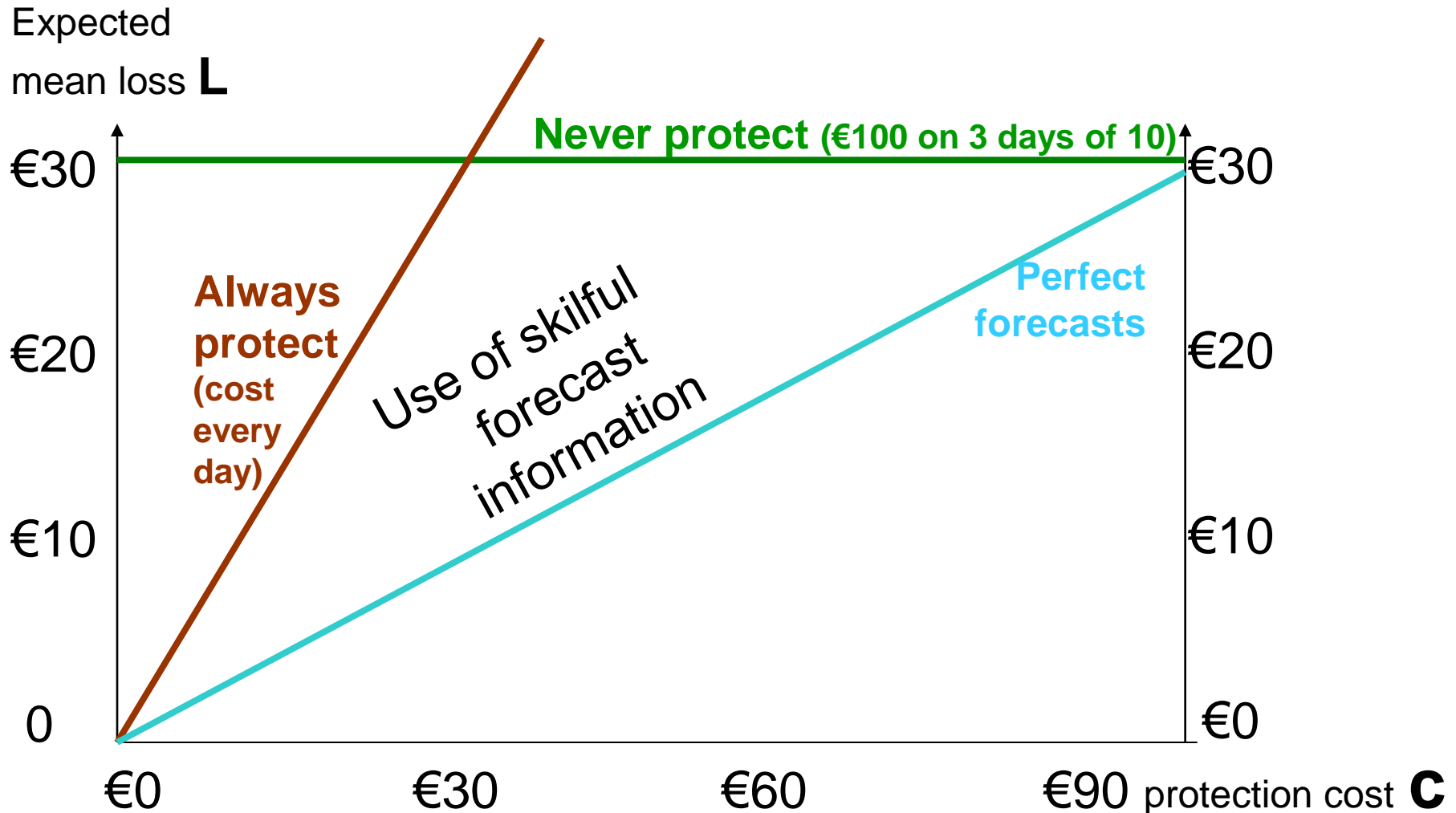
**There is generally a 30%  
probability of rain**

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

For a certain occupation the cost of protection per day may range from  $c = \text{€}0$  to  $c = \text{€}100$  (the same as the loss)

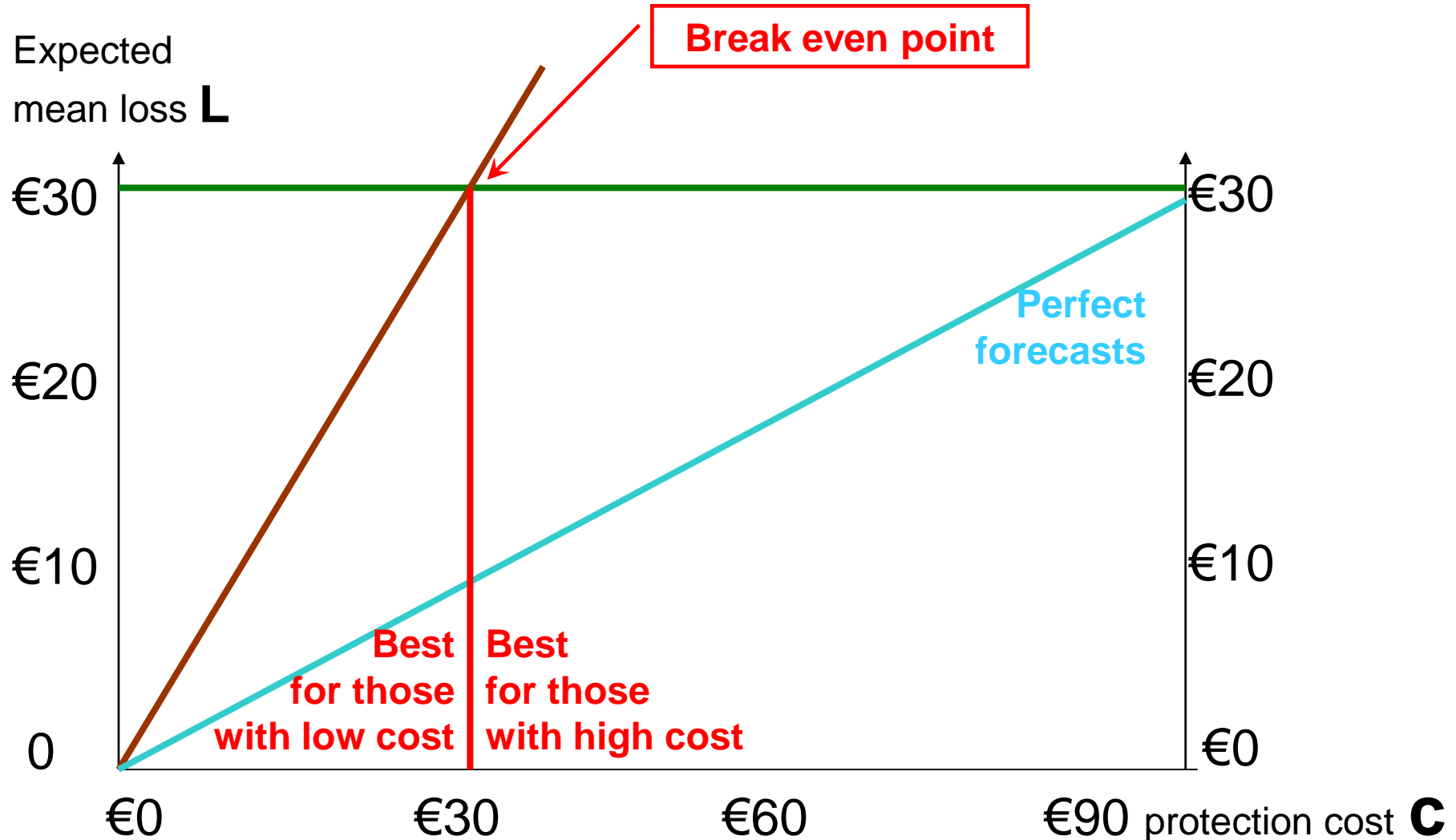
We can now calculate the average Expected Mean Loss per day, i.e. the average cost and loss per day if there is no forecast information

With no forecast information you can choose to  
a) protect every day or b) never protect





# Customers with a $c/L$ equal the climate (30%) will benefit most from the forecasts



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

**All forecasts were well tuned:**

**The number of rain forecasts (30) over 100 days matches**

**the number of observed rain days (30)**

	Obs rain	Obs dry
Fc rain	<b>20</b>	<b>10</b>
Fc dry	<b>10</b>	<b>60</b>

This matrix also reflects the actions and their consequences

	Obs rain	Obs dry
Fc rain	<b>20</b>	<b>10</b>
Fc dry	<b>10</b>	<b>60</b>

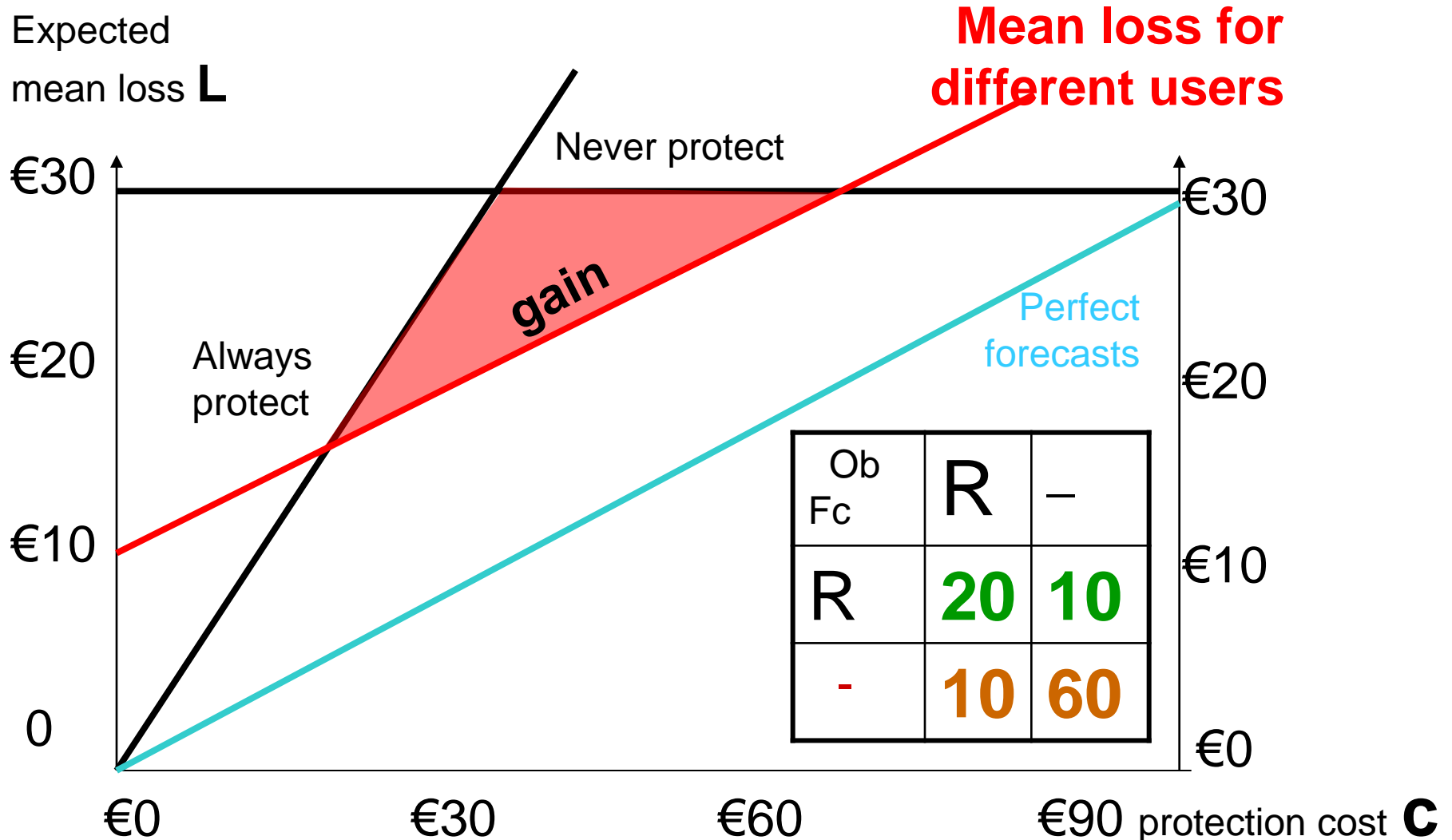
Losses

← Actions were taken

← No actions were taken

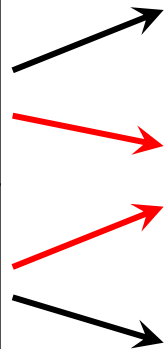
From this it is possible to calculate the Expected mean loss

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



**If the forecasters had chosen to become less categorical it could also have served *both* low and high cost-loss customers**

	Obs rain	Obs dry
Fc rain	<b>20</b>	<b>10</b>
Fc dry	<b>10</b>	<b>60</b>



	Obs rain	Obs dry
Fc rain	<b>10</b>	<b>0</b>
???	<b>20</b>	<b>20</b>
Fc dry	<b>0</b>	<b>50</b>

50-50%

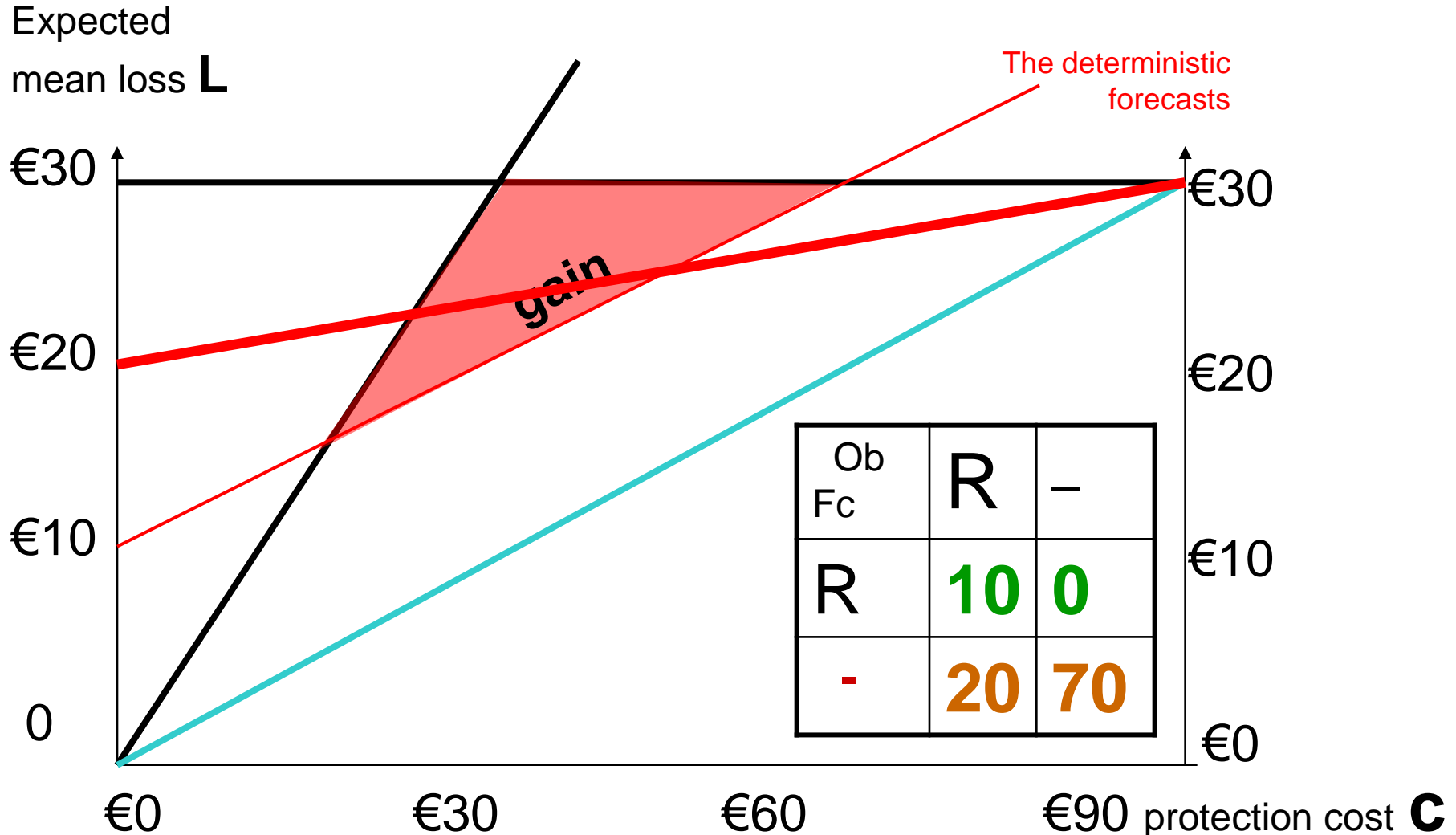
It allows those who are not sensitive to rain to interpret the **???** as “it might not rain”

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



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

These are the expected mean loss for those who interpreted ??? as “it might not rain”



It allows those who are sensitive to rain to interpret the **???** as “it might rain”

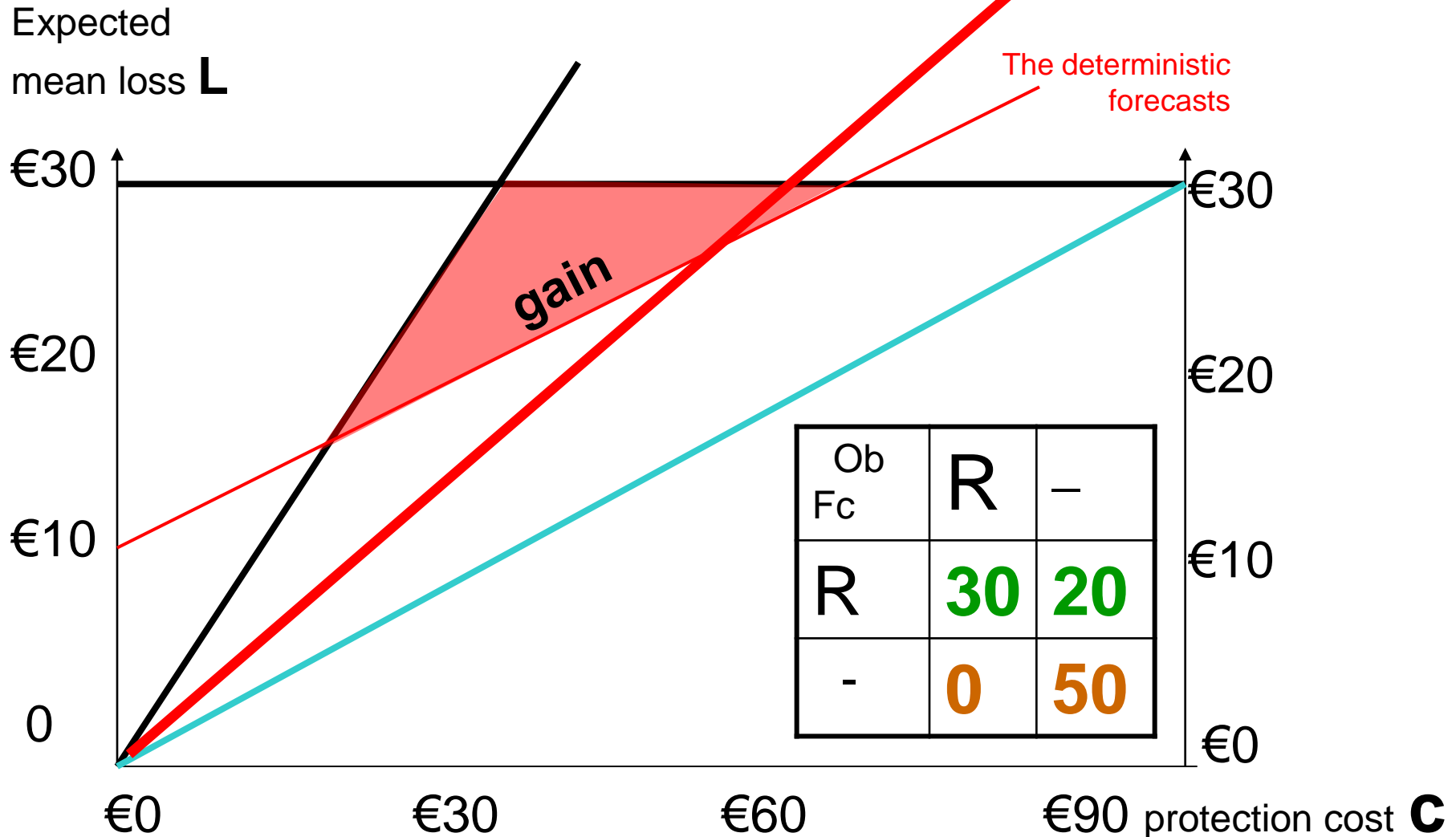
	Obs rain	Obs dry
Fc rain	<b>10</b>	<b>0</b>
???	<b>20</b>	<b>20</b>
Fc dry	<b>0</b>	<b>50</b>



	Obs rain	Obs dry
Fc rain	<b>30</b>	<b>20</b>
Fc dry	<b>0</b>	<b>50</b>

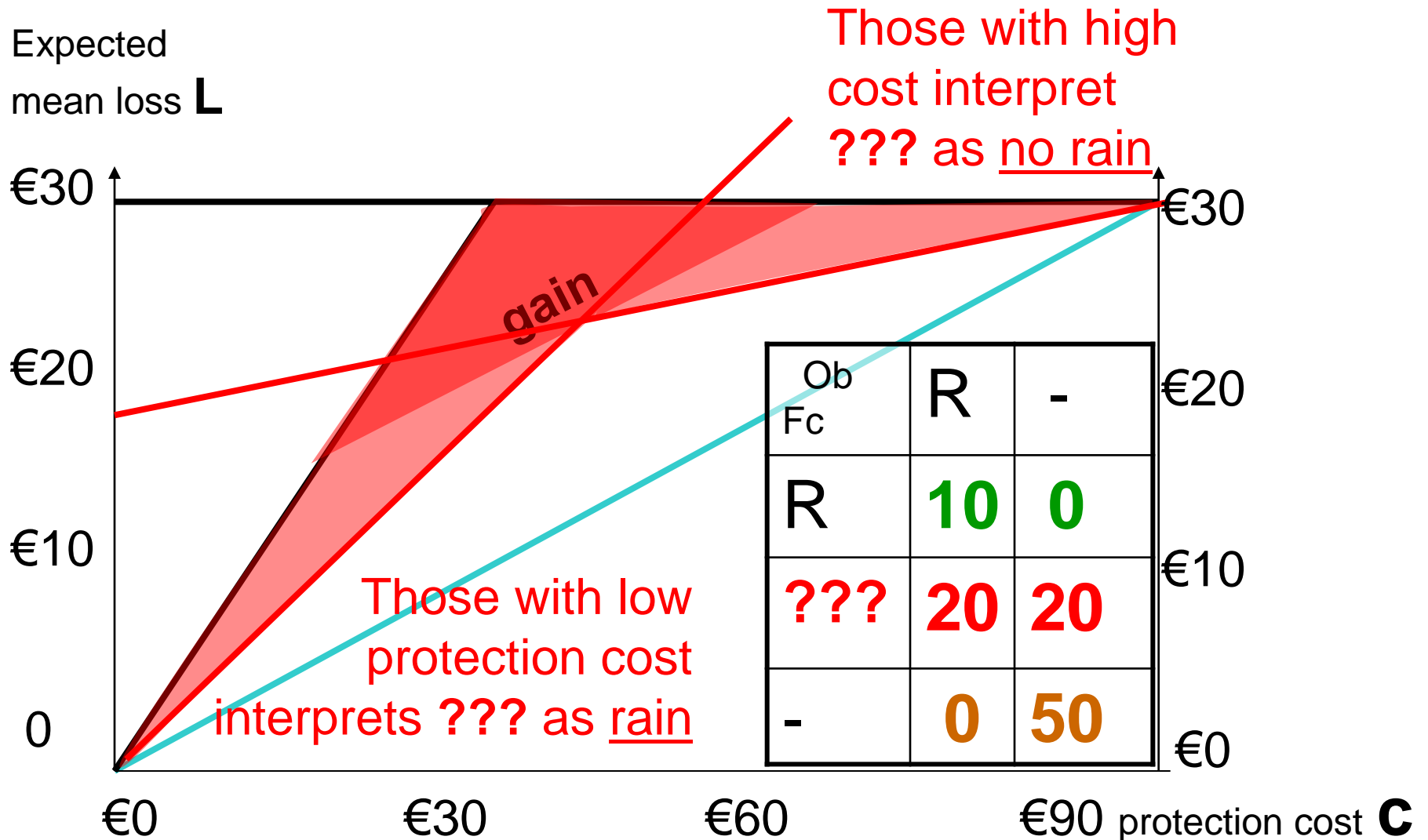


These are the expected mean loss for those who interpreted ??? as “it might rain”

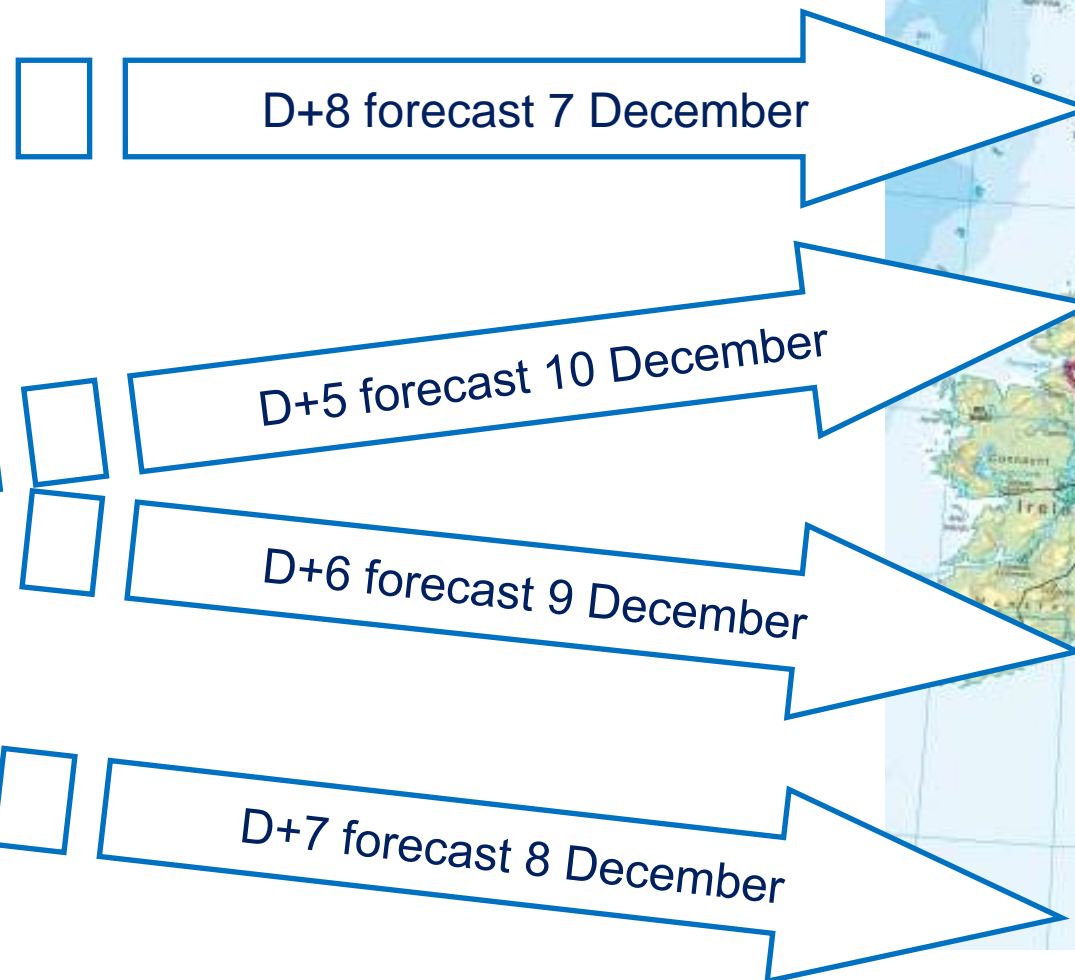


07/06/2016

# And them put them together . . .



In mid-December 2011 British meteorologists faced a difficult weather situation with great uncertainties of the track of a severe storm:



The jumpiness and uncertainty continued on D+4, D+3 and D+2

They took an active responsibility for the problem



“Some terrible weather will threaten us on Thursday-Friday”

The BBC forecasters avoided going into detail and did not show any of their normal isobar maps



# But not all of the 100 forecasts are certain

Categorical

Obs Fc	R	-
R	20	10
-	10	60

Non-categorical

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

Probabilistic

Obs Prob%	R	-
100	10	0
80	8	2
60	6	4
40	4	6
20	2	8
0	0	50

Can we quantify that uncertainty?

# What to do with a probability $p$ ?

1. If you do nothing there is a chance  $p$  to lose  $L$ .
2. On average the loss will be  $pL$  (“risk”)
3. If you take protective action it will cost  $c$
4. Only if  $p \cdot L > c$  is it worth while to take action
5. The “break even” point is  $p = c/L$

# Decision matrix for different people with $c/L=100\%$

Ob Prob	R	-
100	10	0
80	8	2
60	6	4
40	4	6
20	2	8
0	0	50



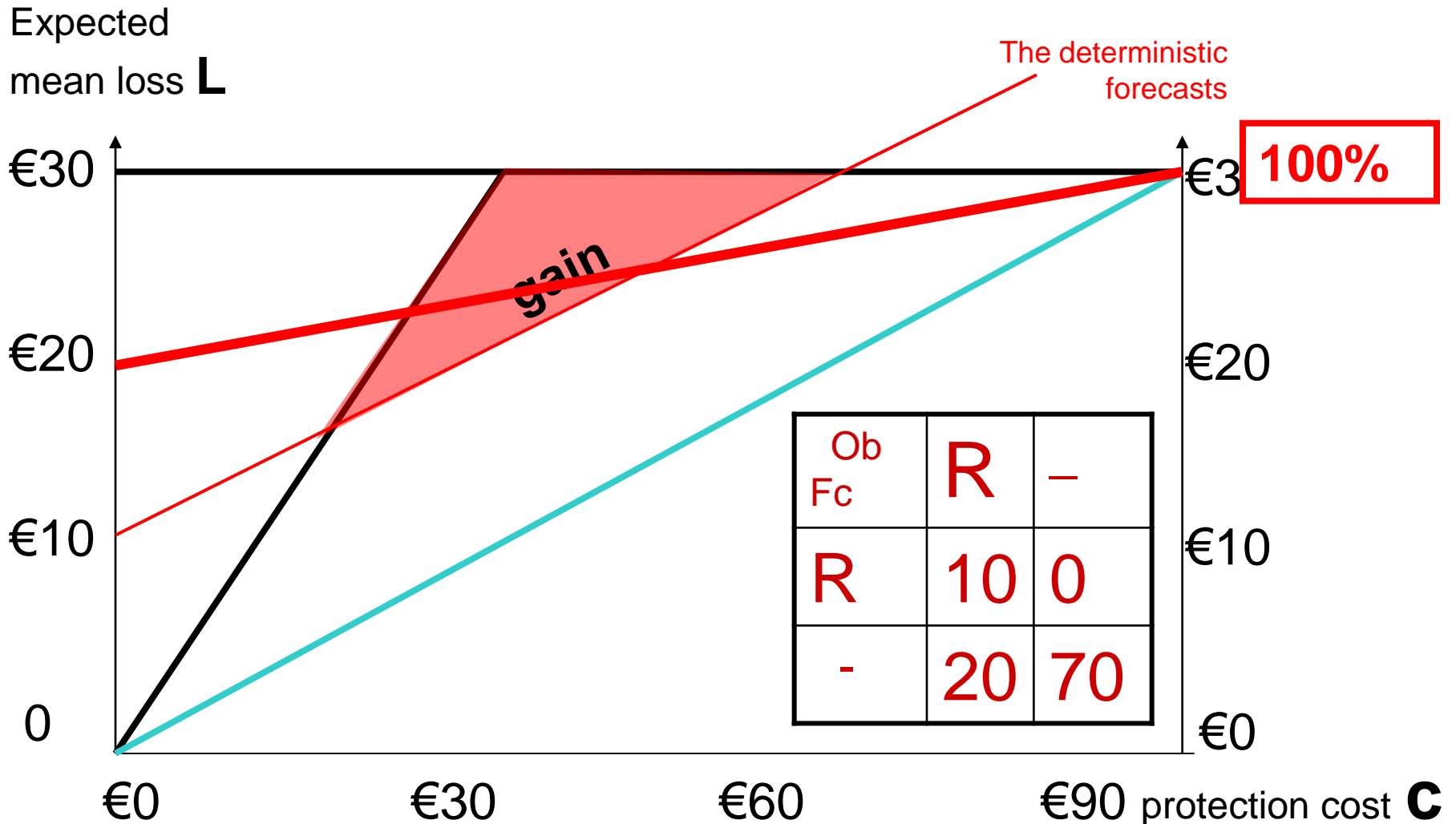
Ob Fc	R	-
R	10	0
-	20	70

Decision matrix

Probability matrix



# Gains for people with c/L almost 100%



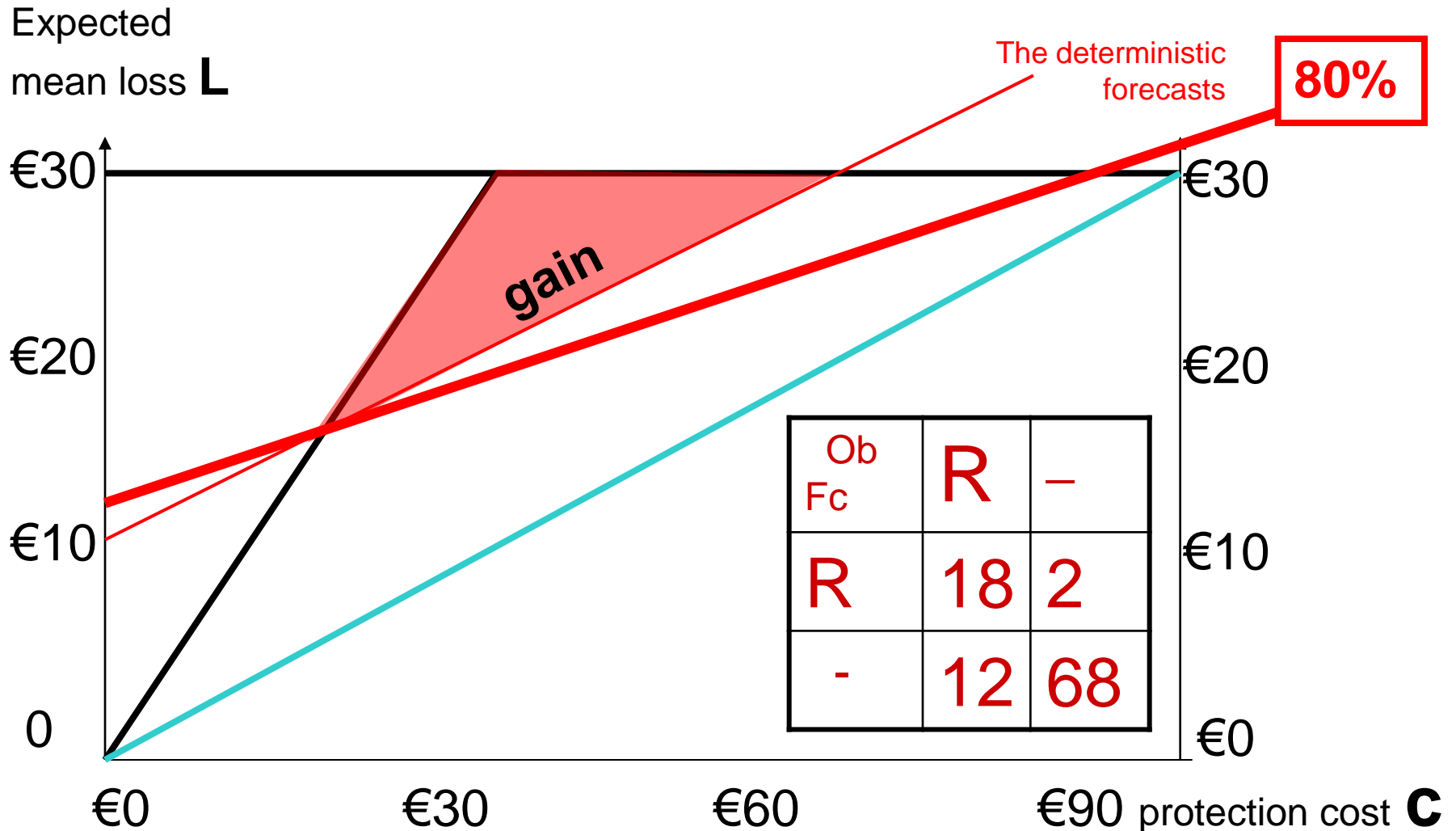
# Decision matrix for people with c/L around 80%

Ob Prob	R	-
100	10	0
80	8	2
60	6	4
40	4	6
20	2	8
0	0	50



Ob Fc	R	-
R	18	2
-	12	68

# Gains for people with c/L around 80%



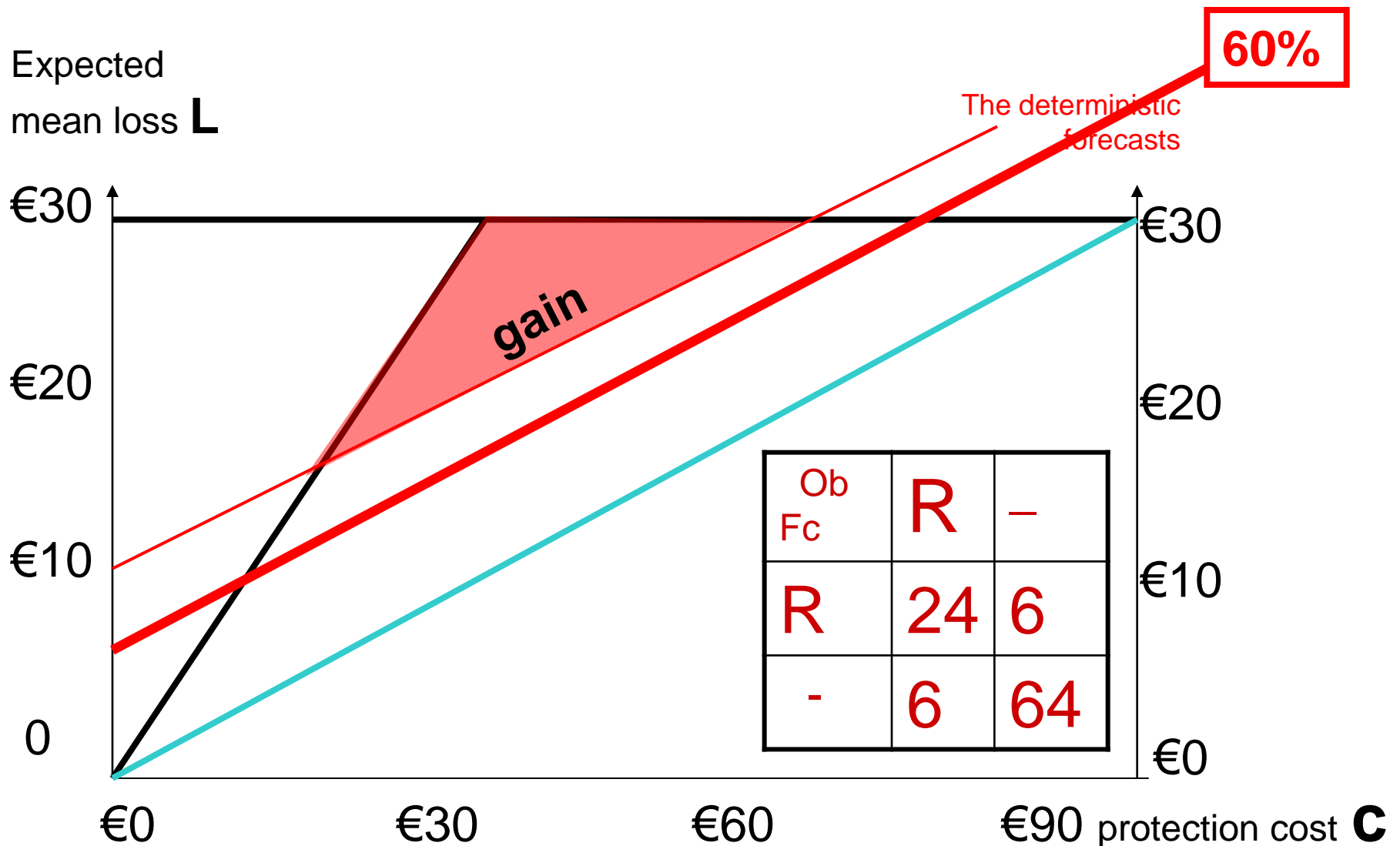
# Decision matrix for people with c/L around 60%

Ob Prob	R	-
100	10	0
80	8	2
60	6	4
40	4	6
20	2	8
0	0	50



Ob Fc	R	-
R	24	6
-	6	64

# Gains for different people when $P = 60\%$



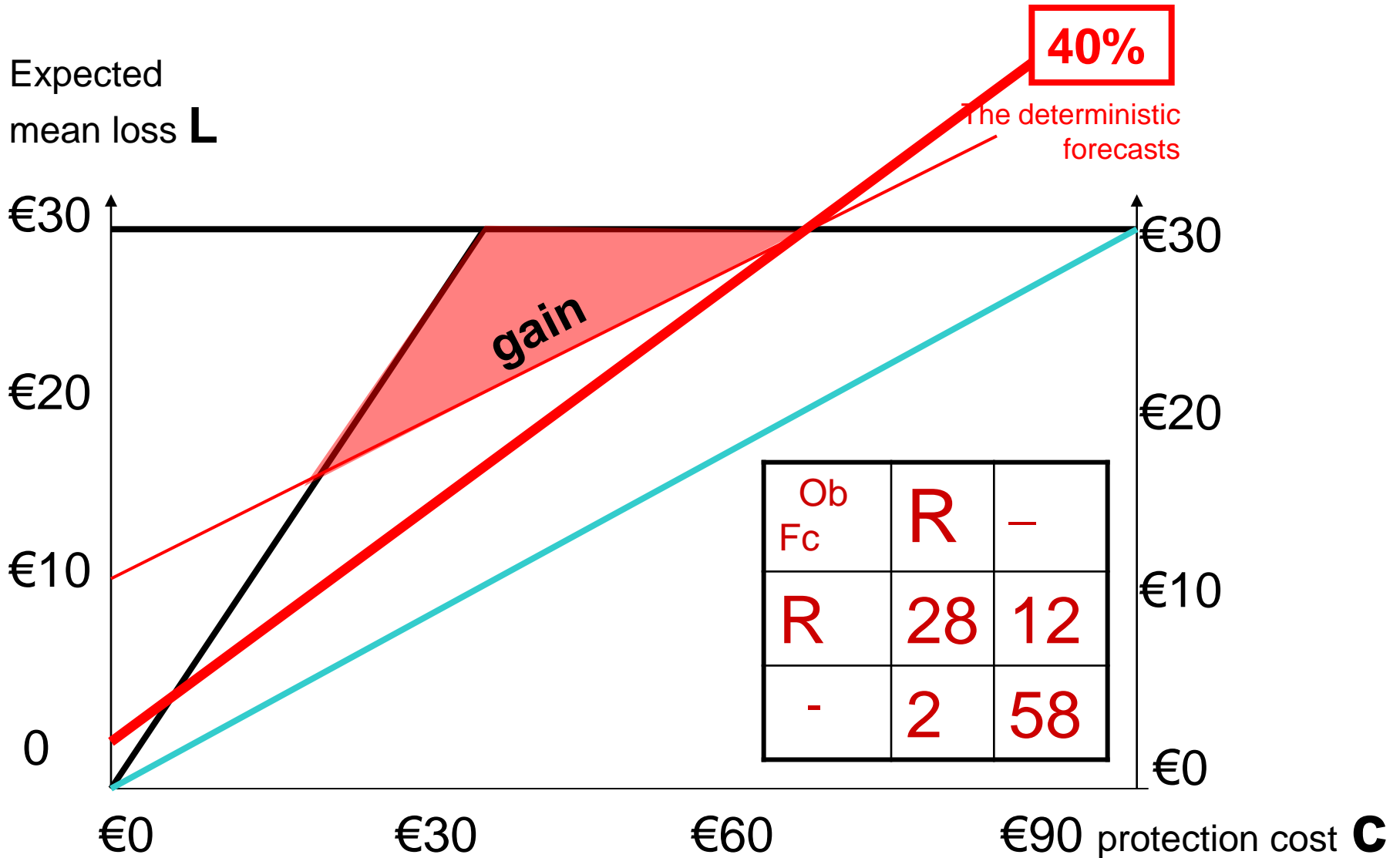
# Decision matrix for people with c/L around 40%

<b>Ob</b> <b>Prob</b>	<b>R</b>	<b>-</b>
<b>100</b>	<b>10</b>	<b>0</b>
<b>80</b>	<b>8</b>	<b>2</b>
<b>60</b>	<b>6</b>	<b>4</b>
<b>40</b>	<b>4</b>	<b>6</b>
<b>20</b>	<b>2</b>	<b>8</b>
<b>0</b>	<b>0</b>	<b>50</b>



<b>Ob</b> <b>Fc</b>	<b>R</b>	<b>-</b>
<b>R</b>	<b>28</b>	<b>12</b>
<b>-</b>	<b>2</b>	<b>58</b>

# Gains for people with c/L around 40%



# Decision matrix for people with c/L around 20%

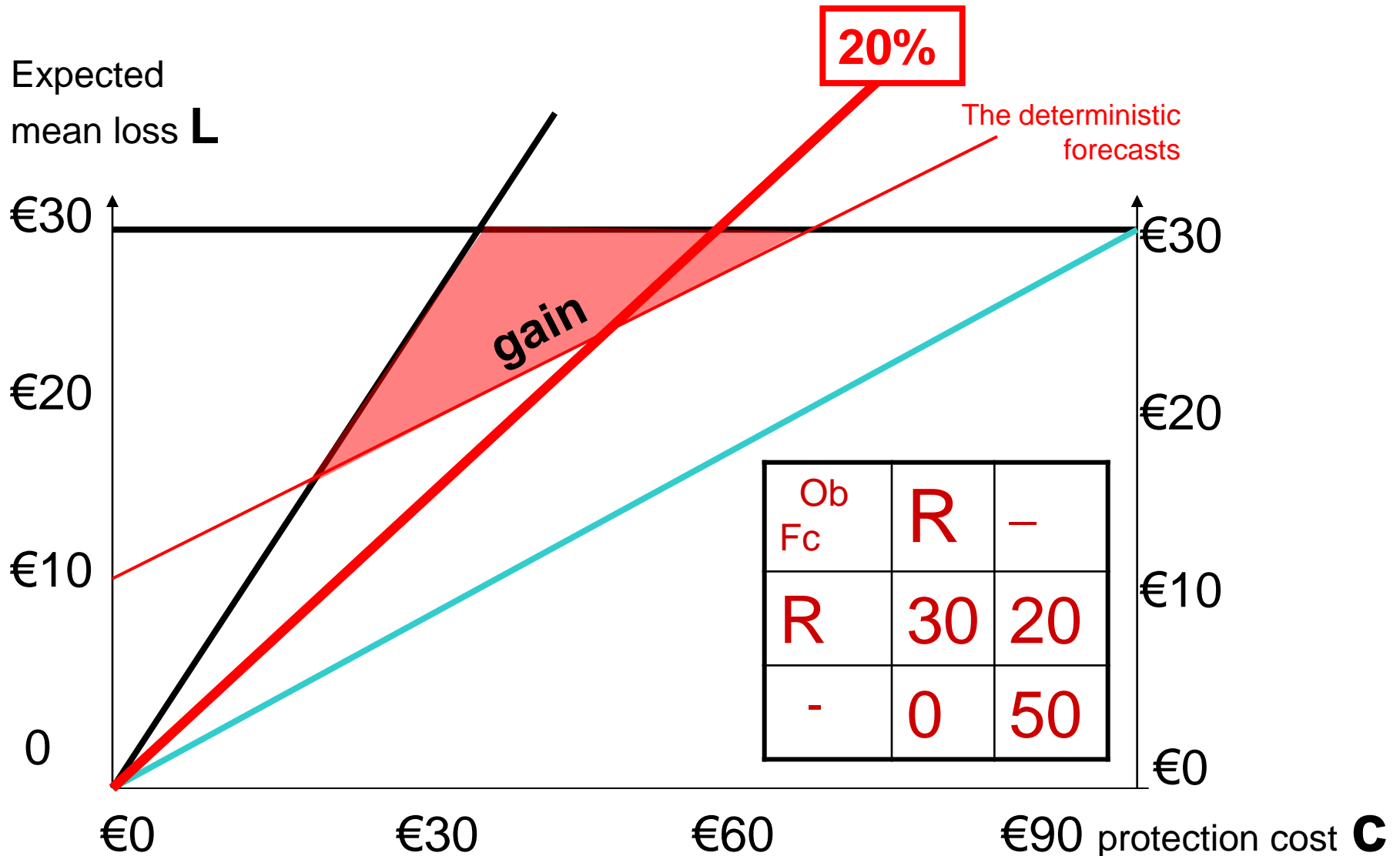
Ob Prob	R	-
100	10	0
80	8	2
60	6	4
40	4	6
20	2	8
0	0	50



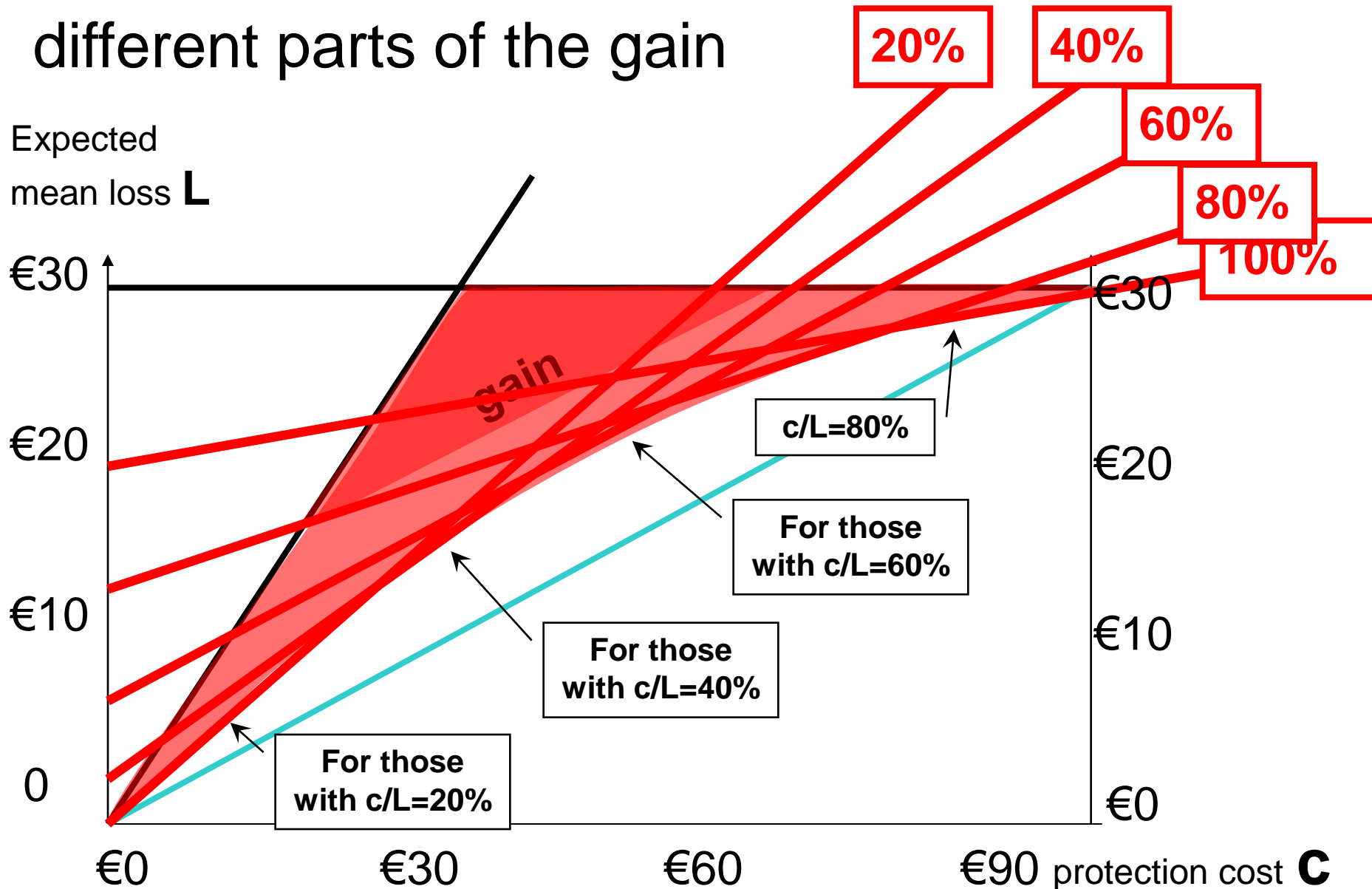
Ob Fc	R	-
R	30	20
-	0	50



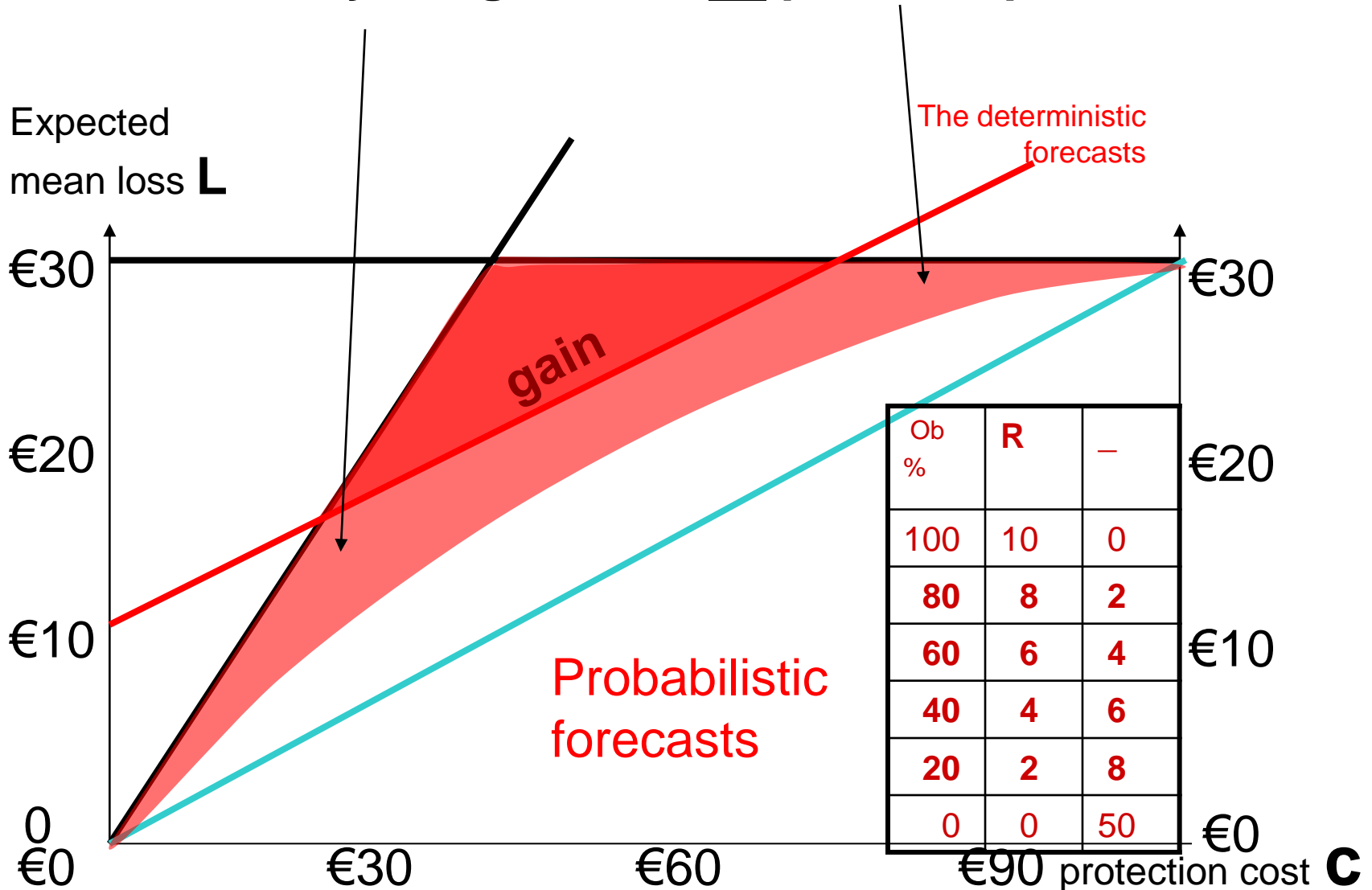
# Gains for people with c/L around 20%



# Different users benefit from different parts of the gain



# Probabilities yield gains for all possible protection costs



END