- That risk is an important feature of the economy, and that most people are risk-averse.

- Why diminishing marginal utility makes people risk-averse and determines how much premium they are willing to pay to reduce risk

- How risk can be traded, with risk-averse people paying others to assume part of their risk

- How exposure to risk can be reduced through diversification and pooling

- How special problems are posed by private information—situations in which some people know things that other people do not

The Economics of Risk Aversion

- In general, people don't like risk and are willing to pay a price to avoid it.

  - For example: insurance

- But what exactly is **risk**? And why don't people like it?

- To answer these questions, we need to look briefly at the concept of *expected value* and the meaning of uncertainty.

Expectations and Uncertainty

- A **random variable** is a variable with an uncertain future value.
    - e.g. a person's medical expenses for the coming year.

- Let's assume that there's a 50 percent chance that this person will get sick and his high medical expenses will materialize.

- He may face medical expenses of $10,000.

Expectations and Uncertainty

- The **expected value** of a random variable is the *weighted average of all possible values*, where the weights on each possible value correspond to the probability of that value occurring.

- In this example, the expected value of the medical expenses is:

$$(0.5 \times \$0) + (0.5 \times \$10{,}000) = \$5{,}000$$

Expectations and Uncertainty

- To derive the general formula for the expected value of a random variable, we imagine that there are a number of different **states of the world**.

- A **state of the world** is a possible future event.

- Then the expected value of the random variable is:

$$EV = (P_1 \times S_1) + (P_2 \times S_2) + \ldots + (P_N \times S_N)$$

Expectations and Uncertainty

- **Risk is uncertainty about future   es. Most people prefer, other things equal, to reduce risk.**

- **We'll focus here on financial risk, in which the uncertainty is about monetary   es, as opposed to uncertainty about   es that can't be assigned a monetary value.**

- **But, why do people feel that risk is a bad thing?**

The Logic of Risk Aversion

- The answer to the question of why people feel that risk is a bad thing lies in the concept of diminishing marginal utility.

- To understand how diminishing marginal utility gives rise to risk aversion, we need to look not only at the medical costs but also at how those costs affect the e the family has left after medical expenses.

- If we assume that the family e is $30,000, the expected e after medical expenses is:

- (0.5 $\times$ $30,000) + (0.5 $\times$ $20,000) = $25,000.

The Logic of Risk Aversion

- **Expected utility is the expected value of an individual's total utility given uncertainty about future es.**

- **Expected utility of the family is less than it would be if the family didn't face any risk and knew with certainty that its e after medical expenses would be $25,000.**

- **The following graph and table illustrates this point more clearly...**

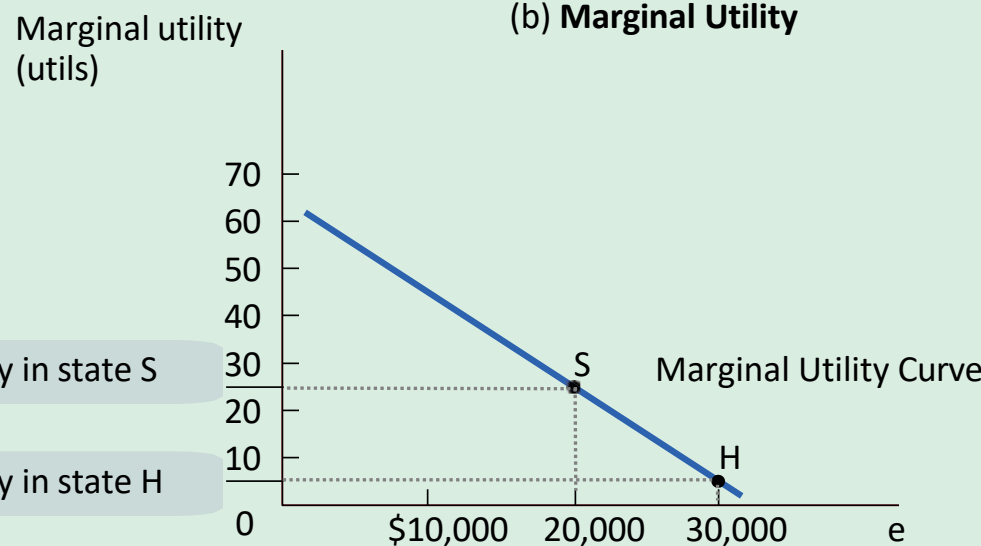# The Utility Function and Marginal Utility Curve of a Risk-Averse Family

(a) Total Utility

Total utility (utils)
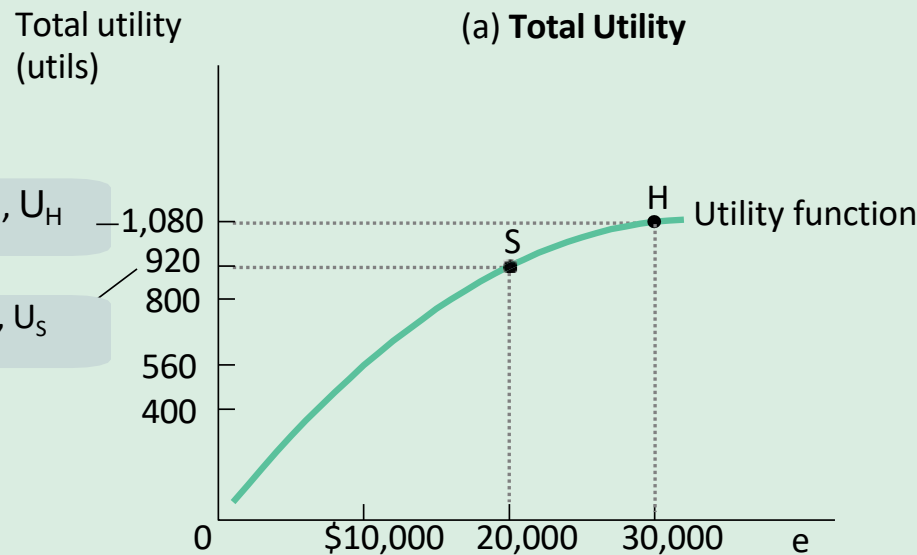
Utility in state H, U_H

Utility in state S, U_S

1,080
920
800
560
400

H — Utility function
S

0    $10,000   20,000   30,000   e

e	Total Utility (utils)
$20,000	920
21,000	945
22,000	968
23,000	989
24,000	1,008
25,000	1,025
26,000	1,040
27,000	1,053
28,000	1,064
29,000	1,073
30,000	1,080

(b) Marginal Utility

Marginal utility (utils)

Marginal utility in state S

Marginal utility in state H

70
60
50
40
30
20
10

S   Marginal Utility Curve
H

0    $10,000   20,000   30,000   e

The Logic of Risk Aversion

- Most people in real life, are risk-averse: they will choose to reduce the risk they face when the cost of that reduction leaves the expected value of their   e or wealth unchanged.

- They would be willing to purchase a fair insurance policy for which the premium is equal to the expected value of the claims.

- The purchase of a fair insurance policy increases expected utility and this is due to the concept of diminishing marginal utility. The reason is that a dollar gained when   e is low adds more to utility than a dollar lost when   e is high.
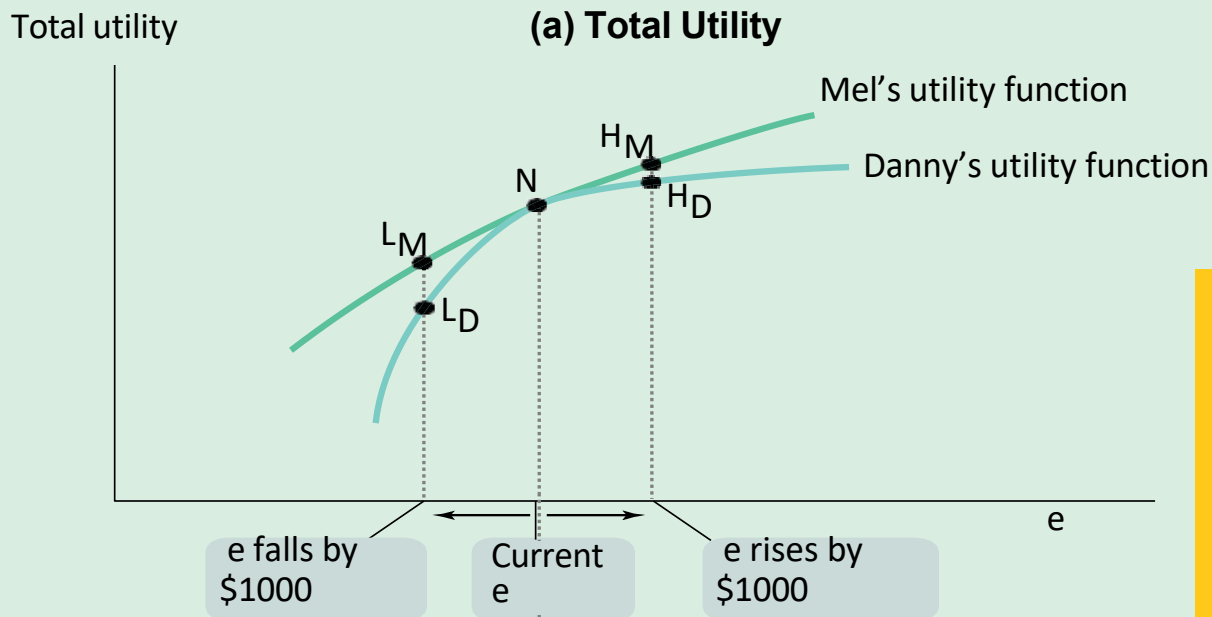
The Effect of Fair Insurance on the Lee Family's e Available for Consumption and Expected Utility

|	Income in different states of the world		Expected value of income available for consumption	Expected utility
	$0 in medical expenses (0.5 probability)	$10,000 in medical expenses (0.5 probability)		
Without insurance	$30,000	$20,000	(0.5 × $30,000) + (0.5 × $20,000) = $25,000	(0.5 × 1,080 utils) + (0.5 × 920 utils) = 1,000 utils
With fair insurance	$25,000	$25,000	(0.5 × $25,000) + (0.5 × $25,000) = $25,000	(0.5 × 1,025 utils) + (0.5 × 1,025 utils) = 1,025 utils

The Logic of Risk Aversion

- Almost everyone is risk-averse, because almost everyone has diminishing marginal utility.

- But the degree of risk aversion varies among individuals—some people are more risk-averse than others.

- Differences in preferences and in   e or wealth lead to differences in risk aversion.

- The following graph illustrates this point…

Differences in Risk Aversion

(a) Total Utility

Total utility

Mel's utility function

Danny's utility function

H_M

H_D

N

L_M

L_D

e

e falls by $1000

Current e

e rises by $1000

(b) Marginal Utility

Marginal utility

Mel's marginal utility curve

Danny's marginal utility curve

e

Current e

The difference (reflected in the differing slopes of the two men's marginal utility curves) means that Danny would be willing to pay much more than Mel for insurance.
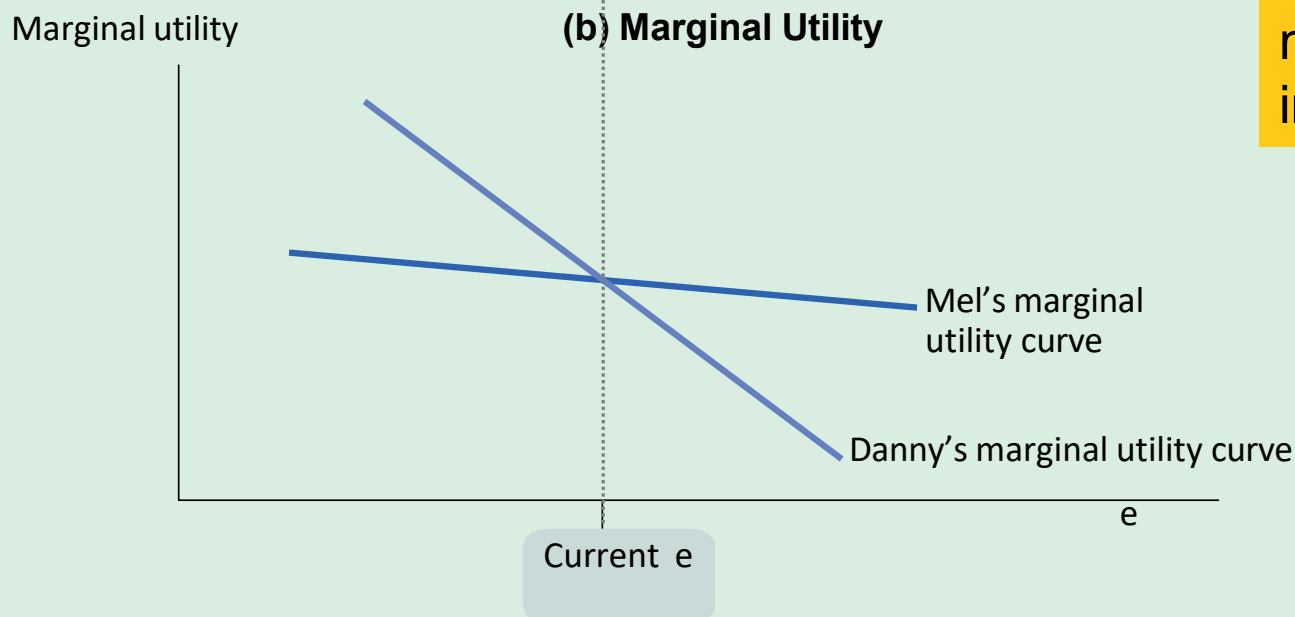
Paying to Avoid Risk

- Differences in risk aversion have an important consequence: they affect how much an individual is willing to pay to avoid risk.

- A **risk-neutral** person is completely insensitive to risk.

- Depending on the size of the premium, a risk-averse person may be willing to purchase an "unfair" insurance policy—a policy with a premium larger than the expected claims. The greater your risk aversion, the greater the premium you are willing to pay.

Buying, Selling, and Reducing Risk

- Lloyd's of London is the oldest existing commercial insurance company.

- Originally formed in the 18th century as a commercial venture to help merchants cope with the risks of commerce (i.e. storms, pirates, etc).

- Lloyd's matched ship owners seeking insurance with wealthy investors who promised to compensate a merchant if his ship were lost.

- In return, the merchant paid the investor a fee in advance; if his ship *didn't* sink, the investor still kept the fee.

Buying, Selling, and Reducing Risk

- Lloyd's performed the functions of a market.

- The fact that British merchants could use Lloyd's to reduce their risk made many more people in Britain willing to undertake merchant trade.
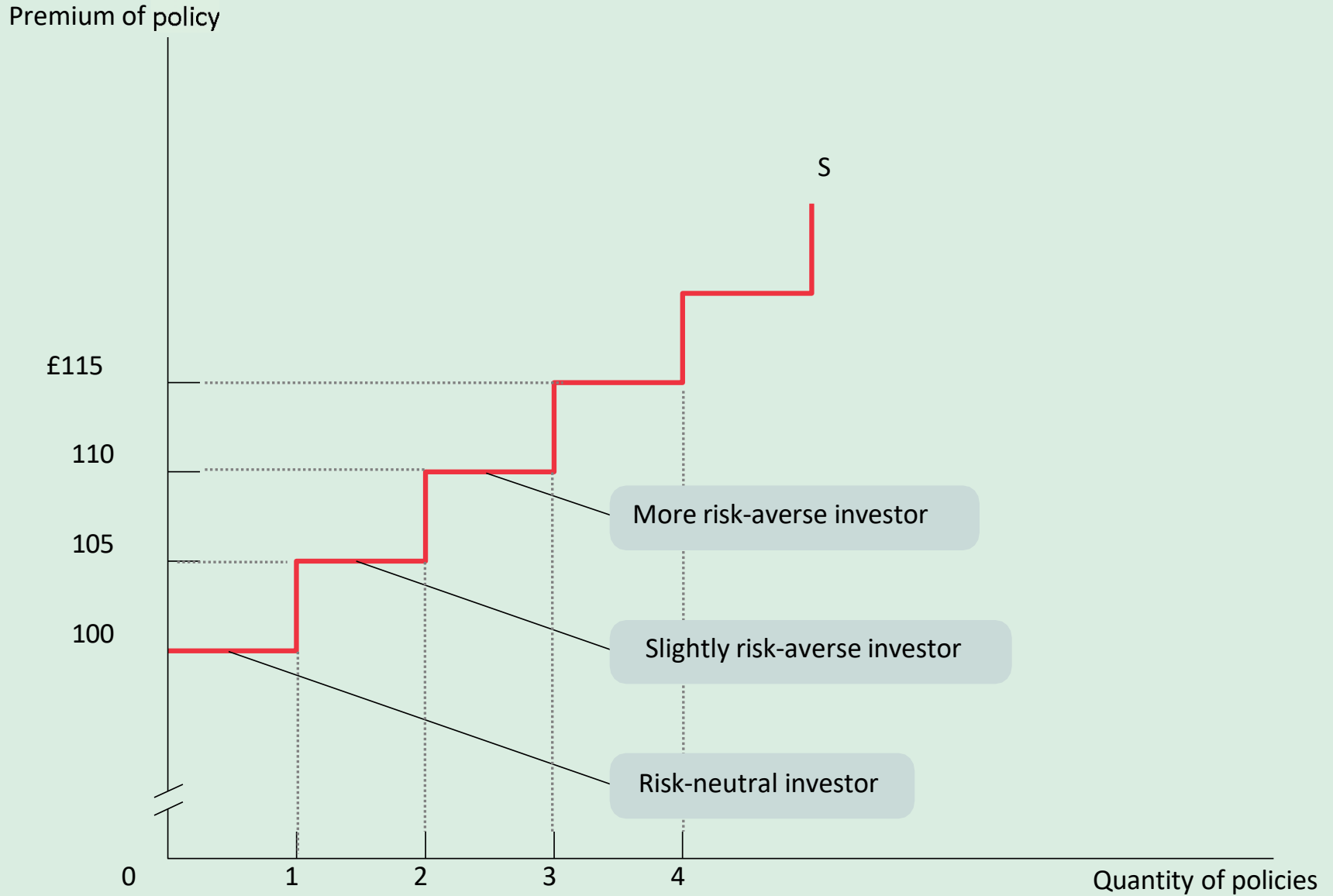
Buying, Selling, and Reducing Risk

- The insurance industry rests on two principles:

    - The first is that trade in risk, like trade in any good, can produce mutual gains from trade; in this case, the gains come when people who are less willing to bear risk transfer it to people who are more willing to bear it.

    - The second is that some risk can be made to disappear through *diversification*.

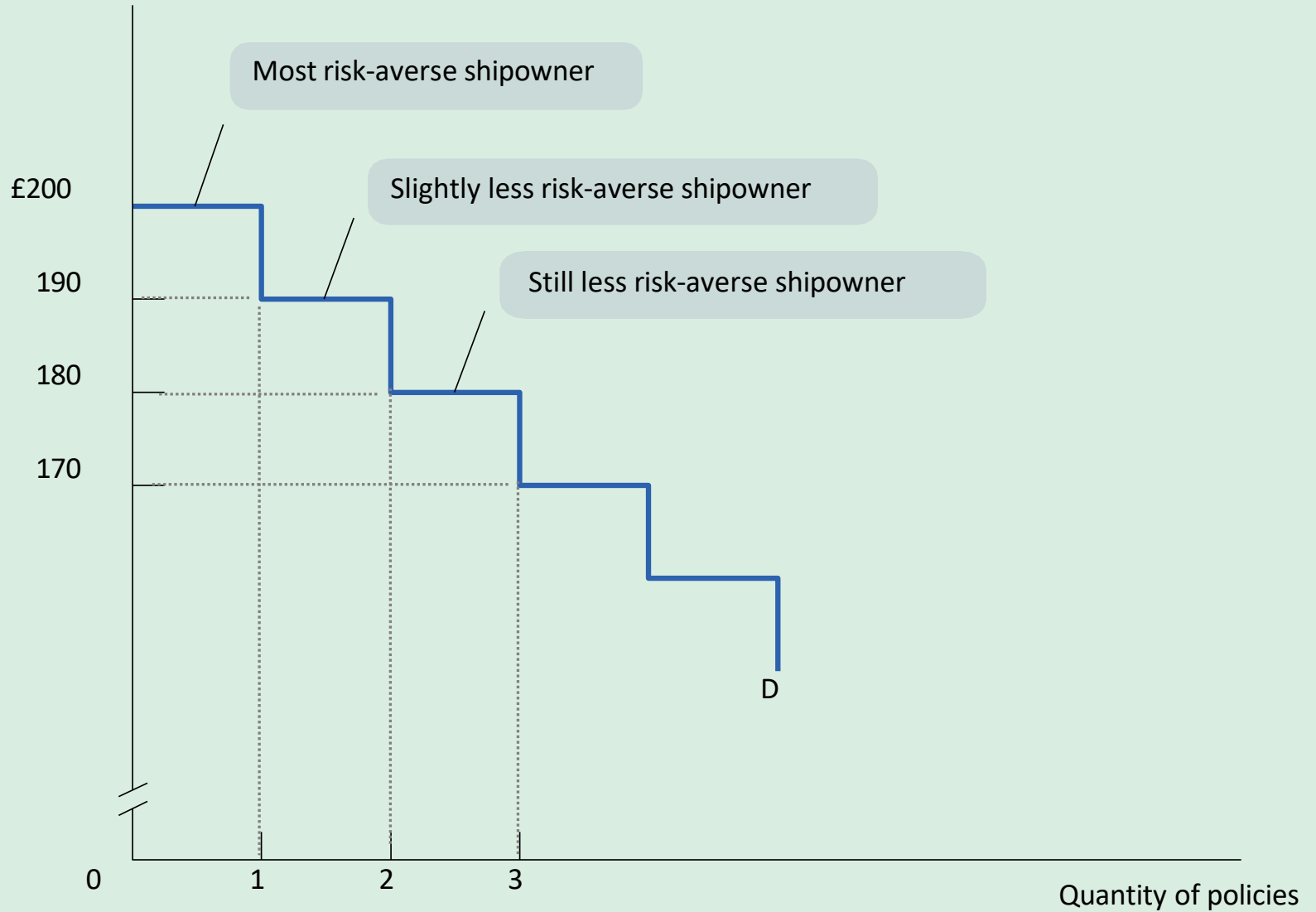- Let's consider each principle in turn…

Trading Risk

- The funds that an insurer places at risk when agreeing to provide insurance is called his or her **capital at risk**.

- There are gains from trade in risk, leading to an *efficient allocation of risk*: those who are most willing to bear risk place their *capital at risk* to cover the financial losses of those least willing to bear risk.

- Lloyd's made money by matching wealthy investors who were more risk-tolerant with less wealthy—and therefore more risk-averse—ship owners who wanted to purchase insurance.

The Supply of Insurance

The Demand for Insurance