Climate Risk Mitigation

David Possen
DIS Environmental Economics
Session 5

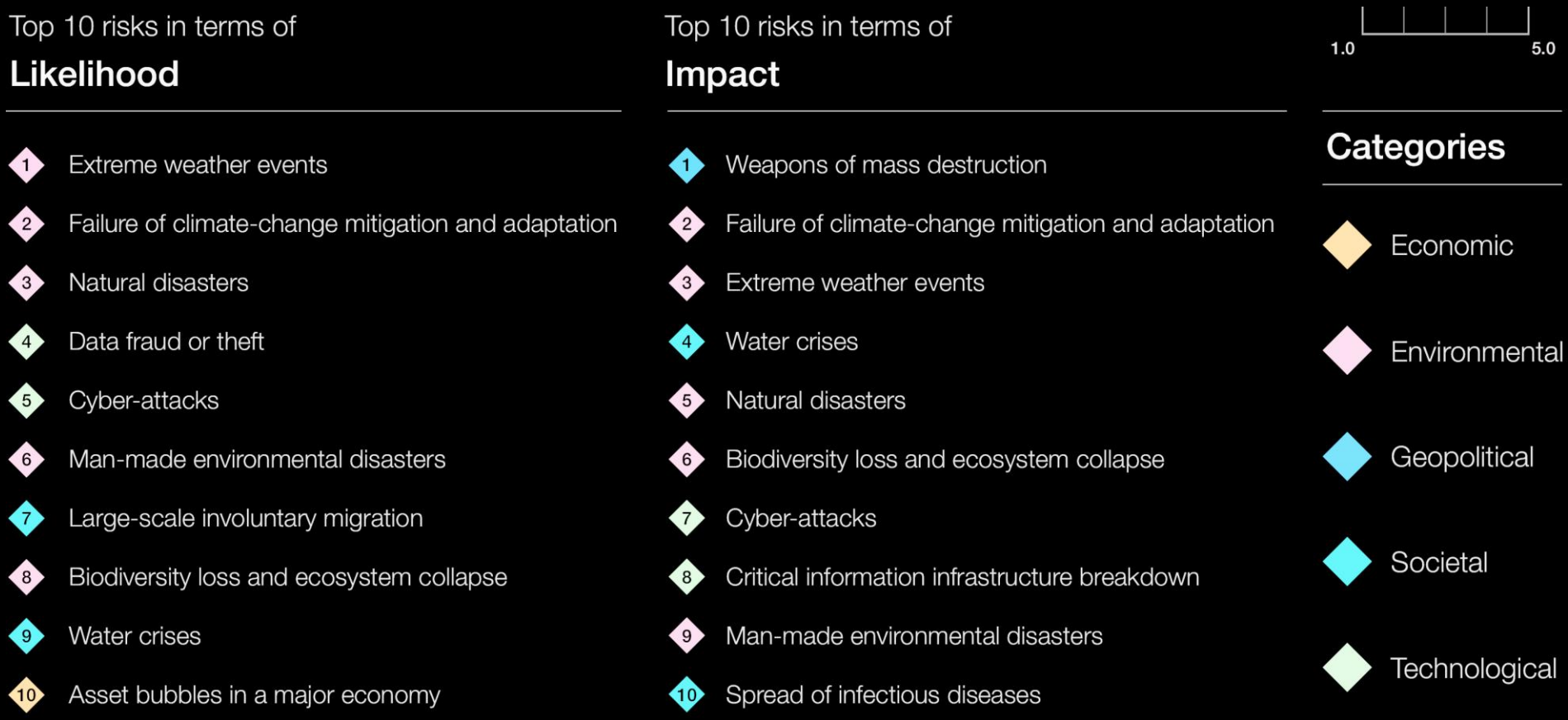
Plan of this lecture

0. The risks we face (2019) and faced (2015)
1. Risks and rewards
2. Risk mitigation: identifying asset classes
3. Risk mitigation: forecasting returns
4. Climate risks: stranded assets
5. Climate opportunities?
6. An ethical headache: doesn't "mitigating" climate risks just mean passing them on?

Plan of this lecture

0. The risks we face (2019) and faced (2015)
1. Risks and rewards
2. Risk mitigation: identifying asset classes
3. Risk mitigation: forecasting returns
4. Climate risks: stranded assets
5. Climate opportunities?
6. An ethical headache: doesn't "mitigating" climate risks just mean passing them on?

0. The risks we face (WEF, 2019)



Source: World Economic Forum, *The Global Risks Report 2019*, 14th ed. (WEF, Geneva), p. 5, Figure I.

0. The risks we faced (WEF, 2015)

Top 10 risks in terms of **Likelihood**

1. Interstate conflict
2. Extreme weather events
3. Failure of national governance
4. State collapse or crisis
5. Unemployment or underemployment
6. Natural catastrophes
7. Failure of climate-change adaptation
8. Water crises
9. Data fraud or theft
10. Cyber attacks

Top 10 risks in terms of **Impact**

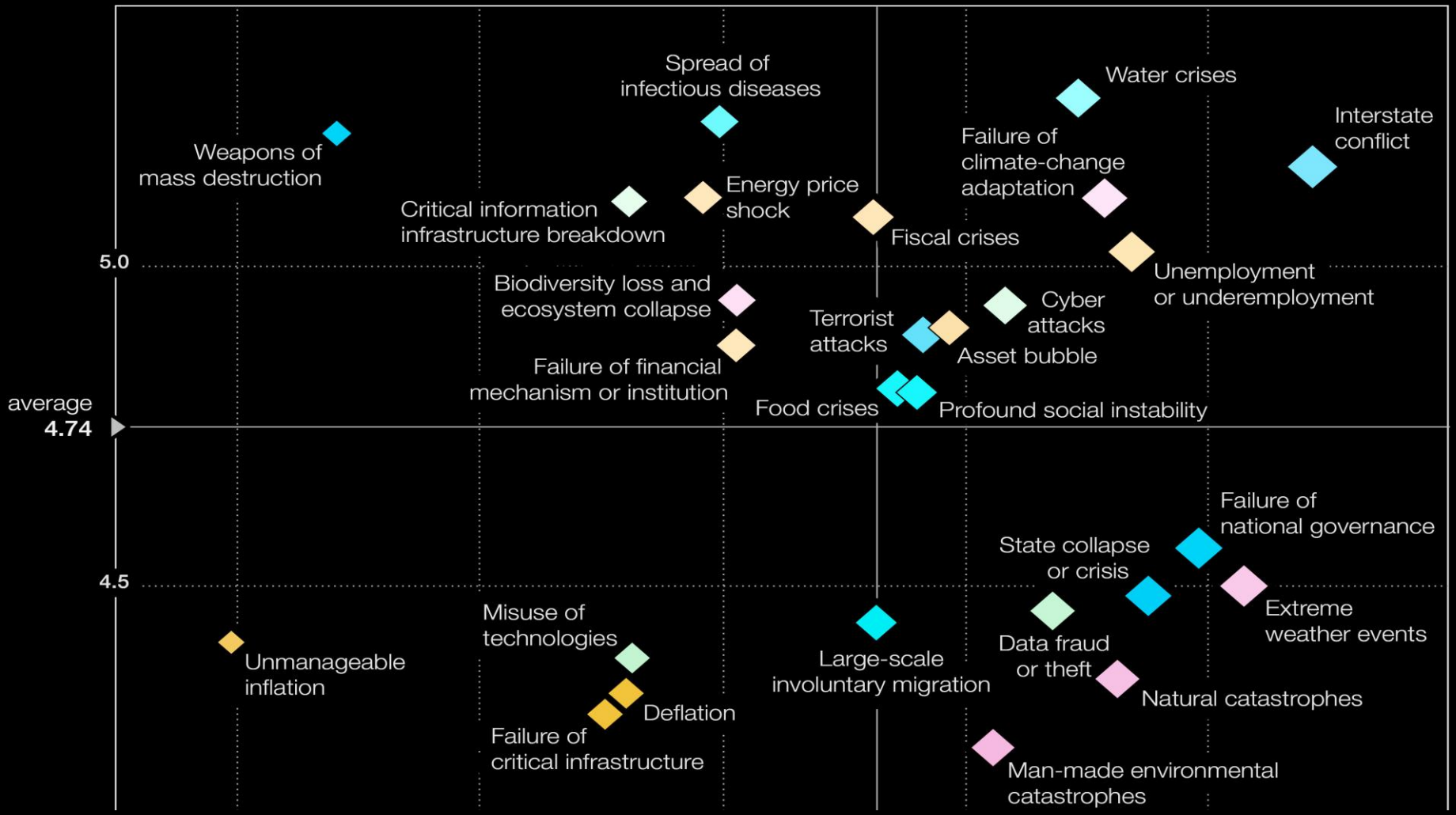
1. Water crises
2. Spread of infectious diseases
3. Weapons of mass destruction
4. Interstate conflict
5. Failure of climate-change adaptation
6. Energy price shock
7. Critical information infrastructure breakdown
8. Fiscal crises
9. Unemployment or underemployment
10. Biodiversity loss and ecosystem collapse

Categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

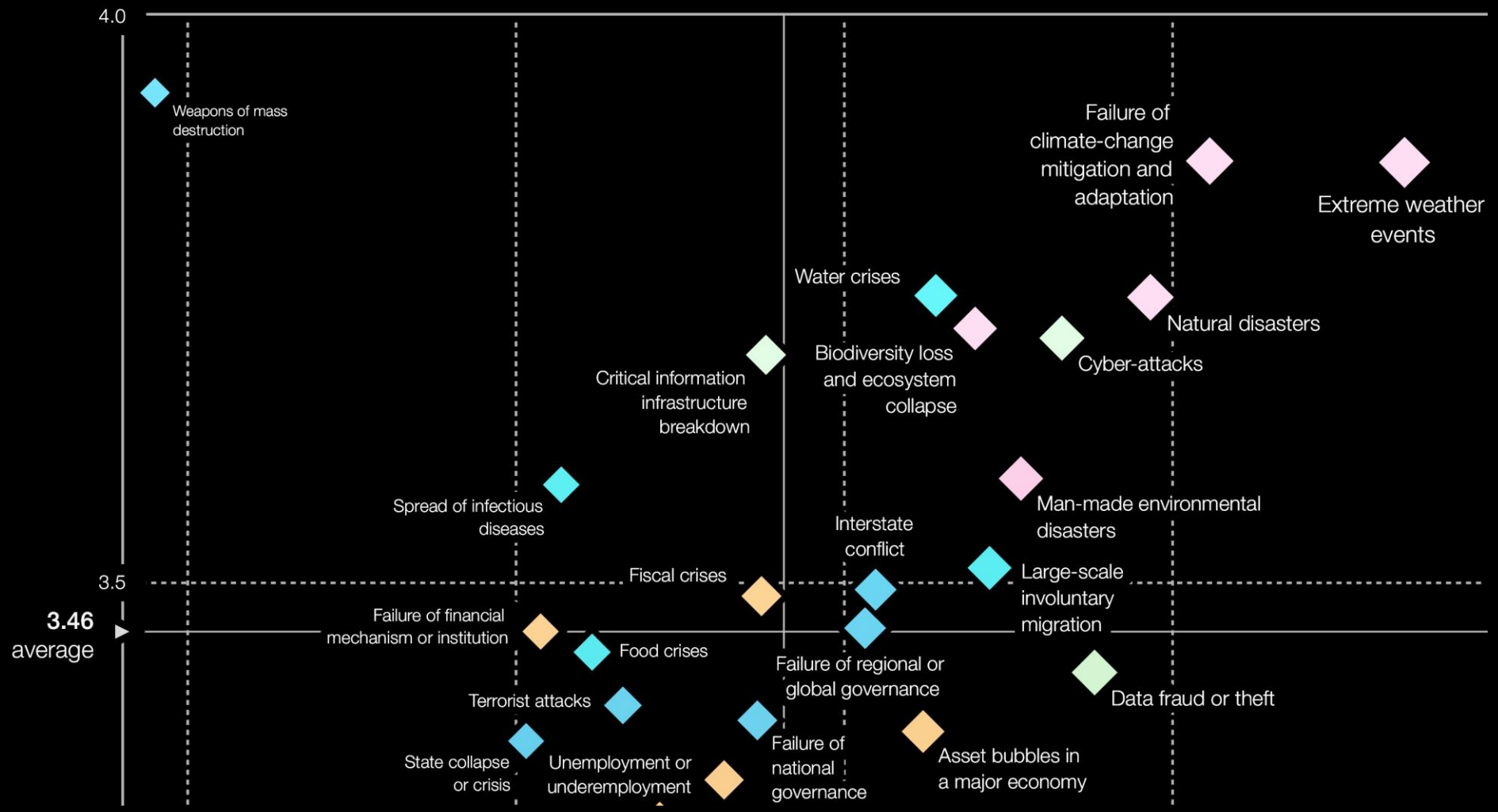
Source: World Economic Forum, *Global Risks 2015*, 10th ed. (WEF, Geneva), p. ii, Figure 1.

0. The risks we faced (WEF, 2015)



Source: World Economic Forum, *Global Risks 2015*, 10th ed. (WEF, Geneva), p. ii, Figure 1.

0. The risks we face (WEF, 2019)

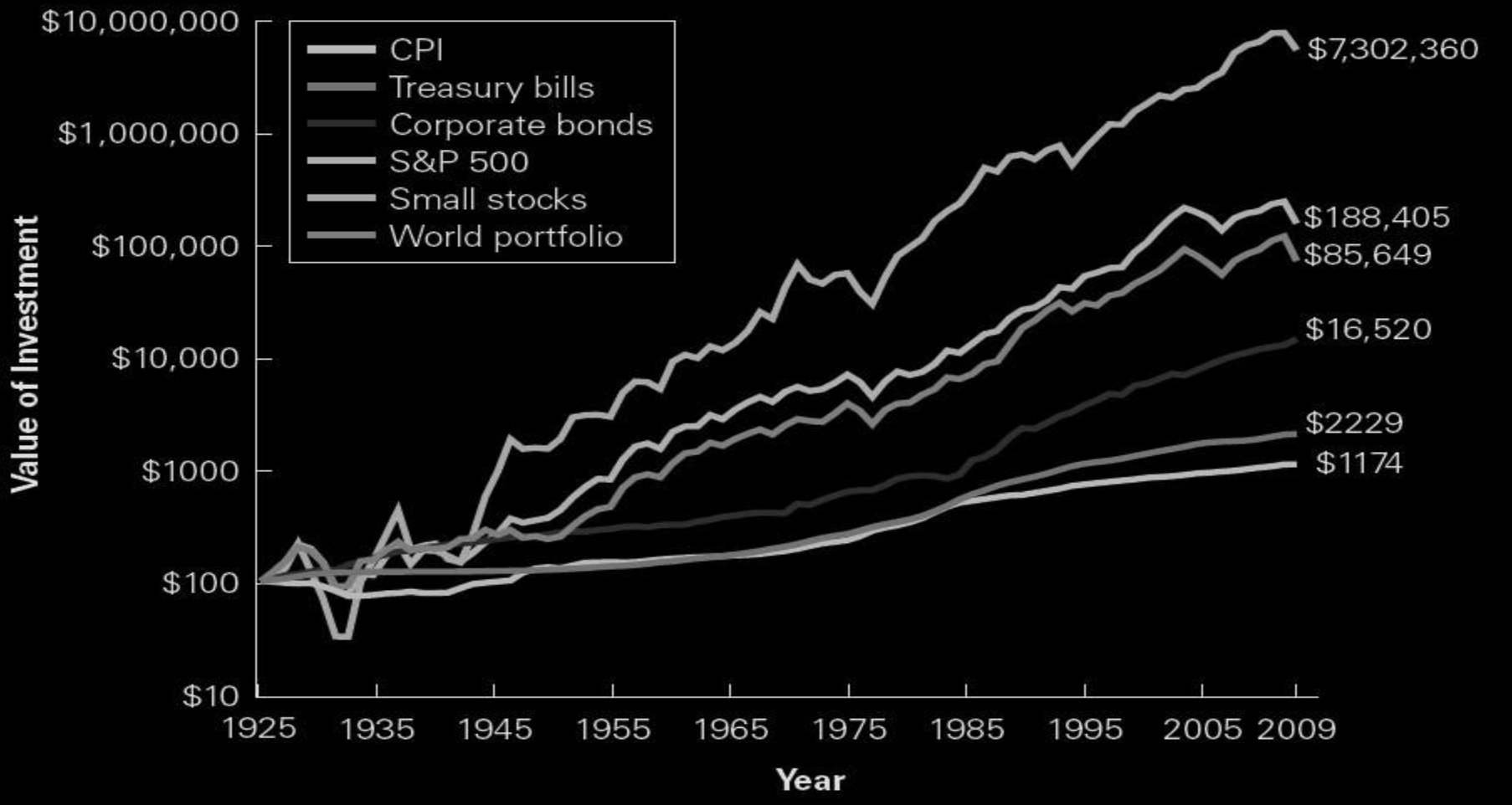


Source: World Economic Forum, *The Global Risks Report 2019*, 14th ed. (WEF, Geneva), p. 5, Figure I.

Plan of this lecture

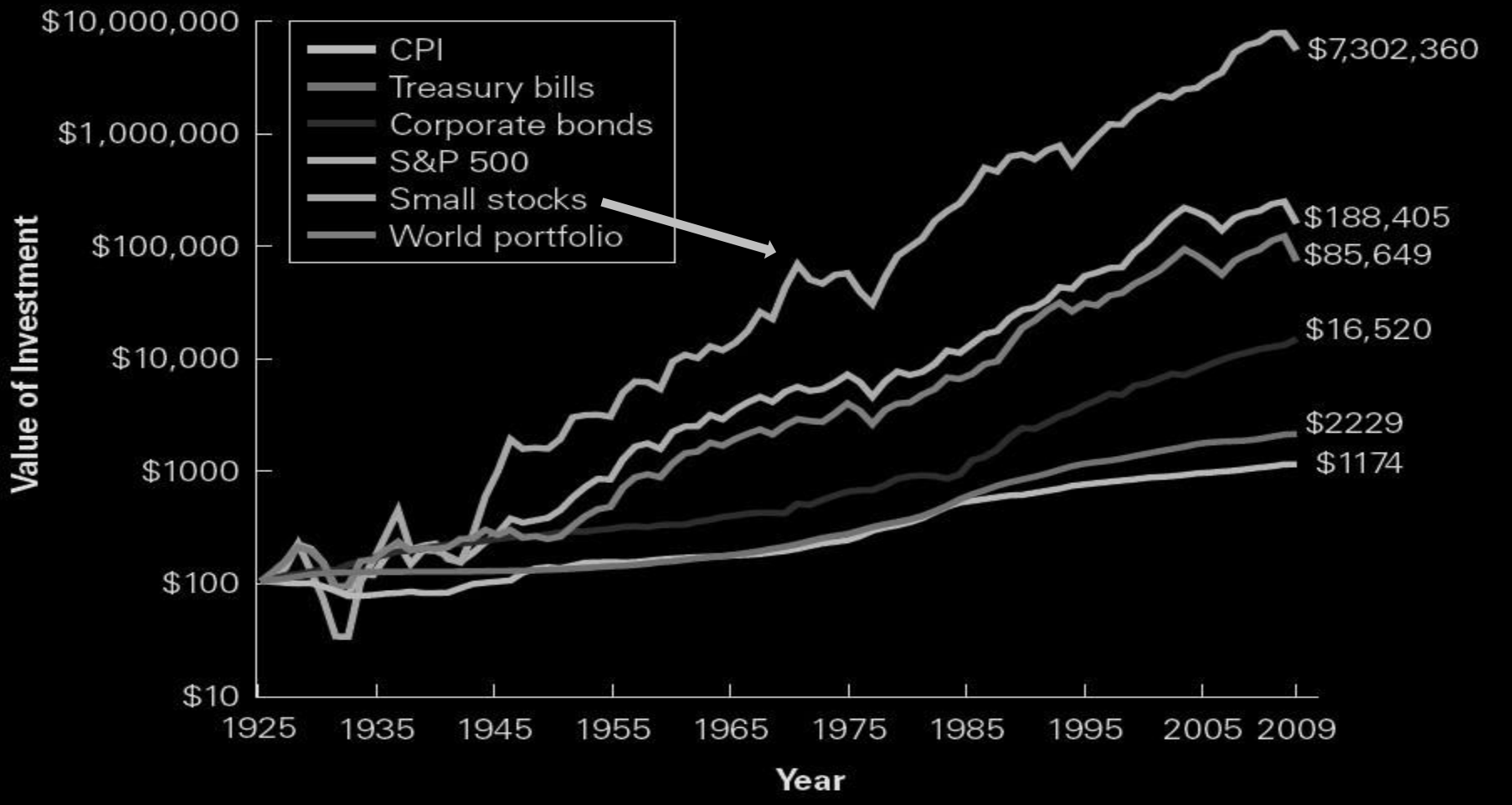
0. The risks we face (2019) and faced (2015)
1. Risks and rewards
2. Risk mitigation: identifying asset classes
3. Risk mitigation: forecasting returns
4. Climate risks: stranded assets
5. Climate opportunities?
6. An ethical headache: doesn't "mitigating" climate risks just mean passing them on?

1. Risks and rewards



Source: Jonathan B. Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Upper Saddle River, NJ: Prentice Hall, 2011), p. 293.

1. Risks and rewards



Source: Jonathan B. Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Upper Saddle River, NJ: Prentice Hall, 2011), p. 293.

1. Risks and rewards

Investment	Average Return	Standard Deviation
Small stocks	20.9%	41.5%
S&P 500	11.6%	20.6%
Corporate bonds	6.6%	7.0%
Treasury bills	3.9%	3.1%

Performance by asset class, 1926-2009

Source: Jonathan B. Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Upper Saddle River, NJ: Prentice Hall, 2011), p. 303.

1. Risks and rewards

Investment	Average Return	Standard Deviation
Small stocks	20.9%	41.5%
S&P 500	11.6%	20.6%
Corporate bonds	6.6%	7.0%
Treasury bills	3.9%	3.1%

ANALYSIS: "The statistics show … a positive relation between **risk** (as measured by standard deviation) and **average return** for portfolios of assets. However, ***this is not true for individual stocks***."

Source: Jonathan B. Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Upper Saddle River, NJ: Prentice Hall, 2011), p. 303.

1. Risks and rewards

Upshots (all easier said than done):

1. Risks and rewards

Upshots (all easier said than done):

- It takes time to make money. (Start saving ***now***.)

1. Risks and rewards

Upshots (all easier said than done):

- It takes time to make money. (Start saving ***now***.)

- It takes nerves of steel to make money. (Don't panic!)

1. Risks and rewards

Upshots (all easier said than done):

- It takes time to make money. (Start saving ***now***.)
- It takes nerves of steel to make money. (Don't panic!)
- It also takes money to make money. (Get rich parents.)

1. Risks and rewards

Upshots (all easier said than done):

- It takes time to make money. (Start saving ***now***.)
- It takes nerves of steel to make money. (Don't panic!)
- It also takes money to make money. (Get rich parents.)
- Once you have money, don't put all those eggs in one basket. (Diversify!)

1. Risks and rewards

Upshots (all easier said than done):

- It takes time to make money. (Start saving ***now***.)
- It takes nerves of steel to make money. (Don't panic!)
- It also takes money to make money. (Get rich parents.)
- Once you have money, don't put all those eggs in one basket. (Diversify!)
- And for that matter, don't stop with different baskets… (Mitigate risk by hedging across **asset classes**!)

Plan of this lecture

0. The risks we face (2019) and faced (2015)
1. Risks and rewards
2. Risk mitigation: identifying asset classes
3. Risk mitigation: forecasting returns
4. Climate risks: stranded assets
5. Climate opportunities?
6. An ethical headache: doesn't "mitigating" climate risks just mean passing them on?

2. Risk mitigation: identifying asset classes

The secret to pretty much all sophisticated investing strategies is diversification across asset classes.

2. Risk mitigation: identifying asset classes

The secret to pretty much all sophisticated investing strategies is diversification across asset classes.

Fine, but what are asset classes?

2. Risk mitigation: identifying asset classes

The secret to pretty much all sophisticated investing strategies is diversification across asset classes.

Fine, but what are asset classes?

Don't believe the hype. Asset classes didn't fall from the sky. People make them up and tweak them whenever convenient.

2. Risk mitigation: identifying asset classes

The secret to pretty much all sophisticated investing strategies is diversification across asset classes.

Fine, but what are asset classes?

Don't believe the hype. Asset classes didn't fall from the sky. People make them up and tweak them whenever convenient.

Asset classes are just a useful way of dividing up investments according to how they behave. We group investments that behave similarly into a single class. And we measure "similar behavior" by whatever yardstick seems appropriate.

2. Risk mitigation: identifying asset classes

The secret to pretty much all sophisticated investing strategies is diversification across asset classes.

REMEMBER: There's no right or wrong way to sort investments into asset classes, just ways that are **more or less helpful to investors** in diversifying in ways that effectively mitigate risk. **The proof is in the pudding (returns)!**

Asset classes are just a useful way of dividing up investments according to how they behave. We group investments that behave similarly into a single class. And we measure "similar behavior" by whatever yardstick seems appropriate.

2. Risk mitigation: identifying asset classes

For example, in the chart below, the asset classes considered are **small-cap stocks, large-cap stocks, private bonds, and T-bills.**

Investment	Average Return	Standard Deviation
Small stocks	20.9%	41.5%
S&P 500	11.6%	20.6%
Corporate bonds	6.6%	7.0%
Treasury bills	3.9%	3.1%

Source: Jonathan B. Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Upper Saddle River, NJ: Prentice Hall, 2011), p. 303.

2. Risk mitigation: identifying asset classes

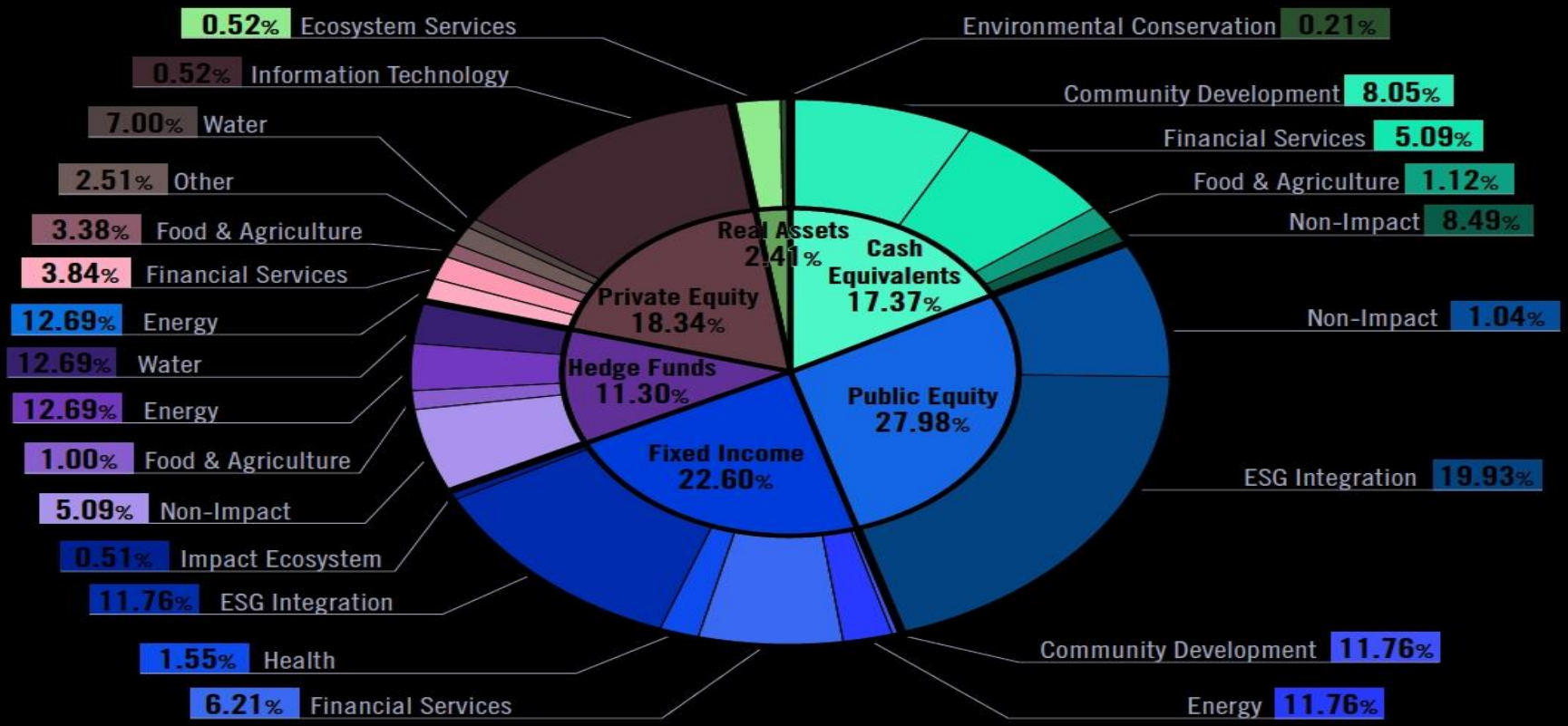
Here's a more sophisticated cut of asset classes:

Source: Sonen Capital, *Evolution of an Impact Portfolio: From Implementation to Results* (October 2013), p. 53.

2. Risk mitigation: identifying asset classes

Here's a more sophisticated cut of asset classes:

Figure 20: **KLF Asset Class Exposure and Impact**



Source: Sonen Capital, *Evolution of an Impact Portfolio: From Implementation to Results* (October 2013), p. 53.

2. Risk mitigation: identifying asset classes

Questions for you:

How does the Mercer report sort investments into asset classes?

How does Mercer justify its sorting procedure?

What do you think of Mercer's asset classification system?

Plan of this lecture

0. The risks we face (2019) and faced (2015)
1. Risks and rewards
2. Risk mitigation: identifying asset classes
3. Risk mitigation: forecasting returns
4. Climate risks: stranded assets
5. Climate opportunities?
6. An ethical headache: doesn't "mitigating" climate risks just mean passing them on?

3. Risk mitigation: forecasting returns

Deciding on a useful way of sorting possible investments into asset classes is the easy part.

Now comes the hard part: you need to predict the future. How will the various asset classes fare?

This means you have to peer into Donald Rumsfeld's three-part crystal ball: (https://www.youtube.com/watch?v=GiPe1OiKQuk)

known knowns	known unknowns
	unknown unknowns

3. Risk mitigation: forecasting returns

Now, as far as known knowns go, we have tried-and-true methods that rely on historical return data.

For example, we can look at an asset class's ***earnings yield*** over time (tracking the inverse of the aggregate P/E ratio). Then we "just" have to guess how long short-term trends will continue—and when to expect reversion to the mean.

known knowns	known unknowns
	unknown unknowns

3. Risk mitigation: forecasting returns

Of course, this guesswork brings into the territory of known unknowns: on what basis can we predict how long "return momentum" will last?

yield over time (tracking the inverse of the aggregate P/E ratio). Then we "just" have to guess how long short-term trends will continue—and when to expect reversion to the mean.

known knowns	known unknowns
	unknown unknowns

3. Risk mitigation: forecasting returns

When dealing with known unknowns (such as the impact of climate change), the crucial thing is to take account of all known possible futures via a ***simulation analysis*** that constructs and evaluates a variety of scenarios, most simply:

worst case *base case* *best case*

known knowns	known unknowns
	unknown unknowns

3. Risk mitigation: forecasting returns

But such schemes assume that we can correctly identify the "worst" and "best" cases and guess their likelihood.

worst case *base case* *best case*

known knowns	known unknowns
	unknown unknowns

3. Risk mitigation: forecasting returns

But such schemes assume that we can correctly identify the "worst" and "best" cases and guess their likelihood. In the case of a complex crisis like global warming, however, it's important to admit that we are at the mercy of Rumsfeld's unknown unknowns:

worst case? *base case?* *best case?*

known knowns	known unknowns
	unknown unknowns

Plan of this lecture

0. The risks we face (2019) and faced (2015)
1. Risks and rewards
2. Risk mitigation: identifying asset classes
3. Risk mitigation: forecasting returns
4. Climate risks: stranded assets
5. Climate opportunities?
6. An ethical headache: doesn't "mitigating" climate risks just mean passing them on?

4. Climate risks: stranded assets

The unknown unknowns of climate change have been vividly summed up by McKibben et al. as the “three-number problem”:

(1)

(2)

(3)

4. Climate risks: stranded assets

The unknown unknowns of climate change have been vividly summed up by McKibben et al. as the “three-number problem”:

(1) Anthropogenic warming by over **2°** Celsius is likely to be a total disaster.

(2)

(3)

4. Climate risks: stranded assets

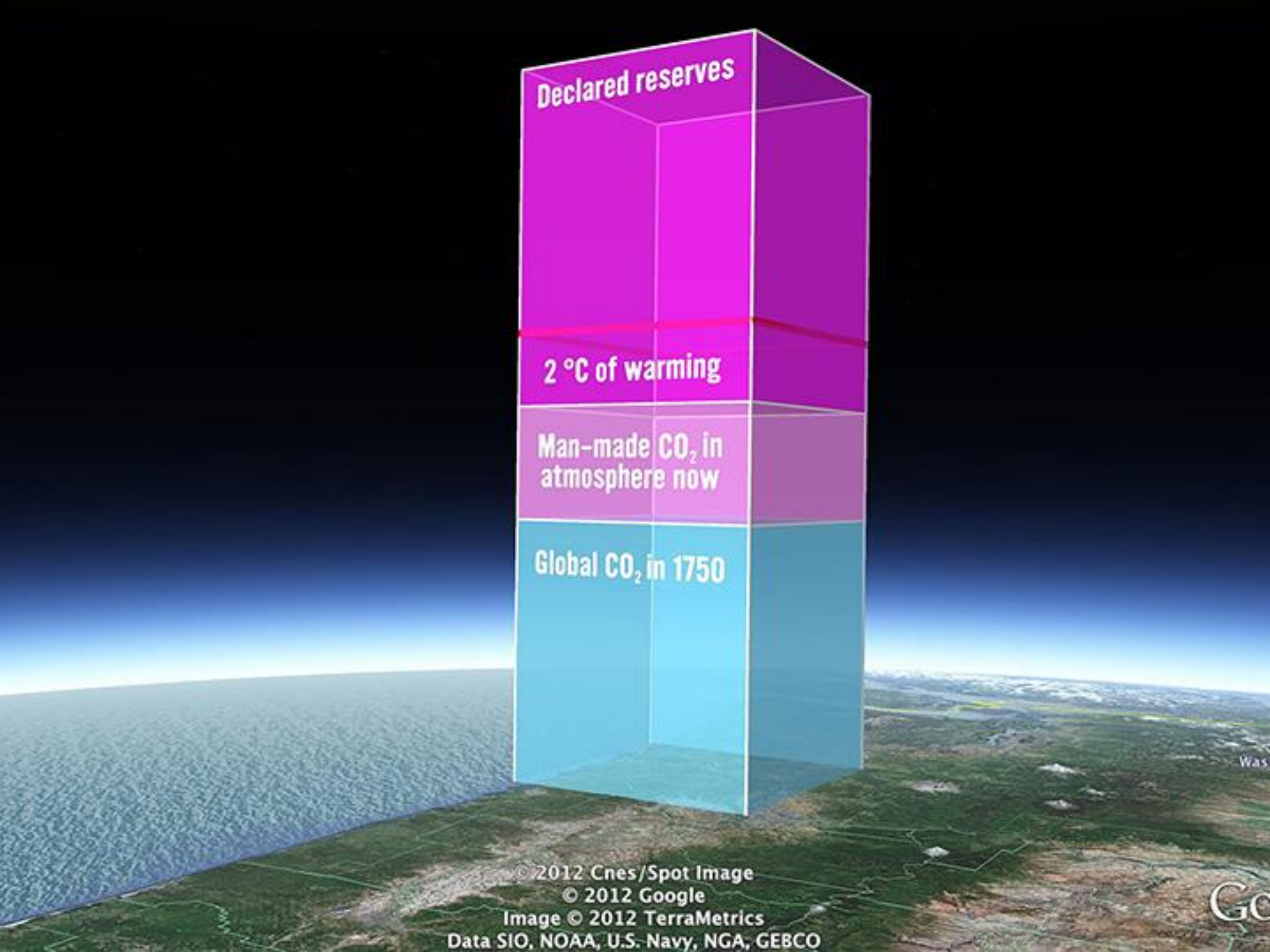
The unknown unknowns of climate change have been vividly summed up by McKibben et al. as the "three-number problem":

(1) Anthropogenic warming by over **2°** Celsius is likely to be a total disaster.
(2) That means we have to keep our total emissions down to **565** gigatons of CO_2.
(3)

4. Climate risks: stranded assets

The unknown unknowns of climate change have been vividly summed up by McKibben et al. as the "three-number problem":

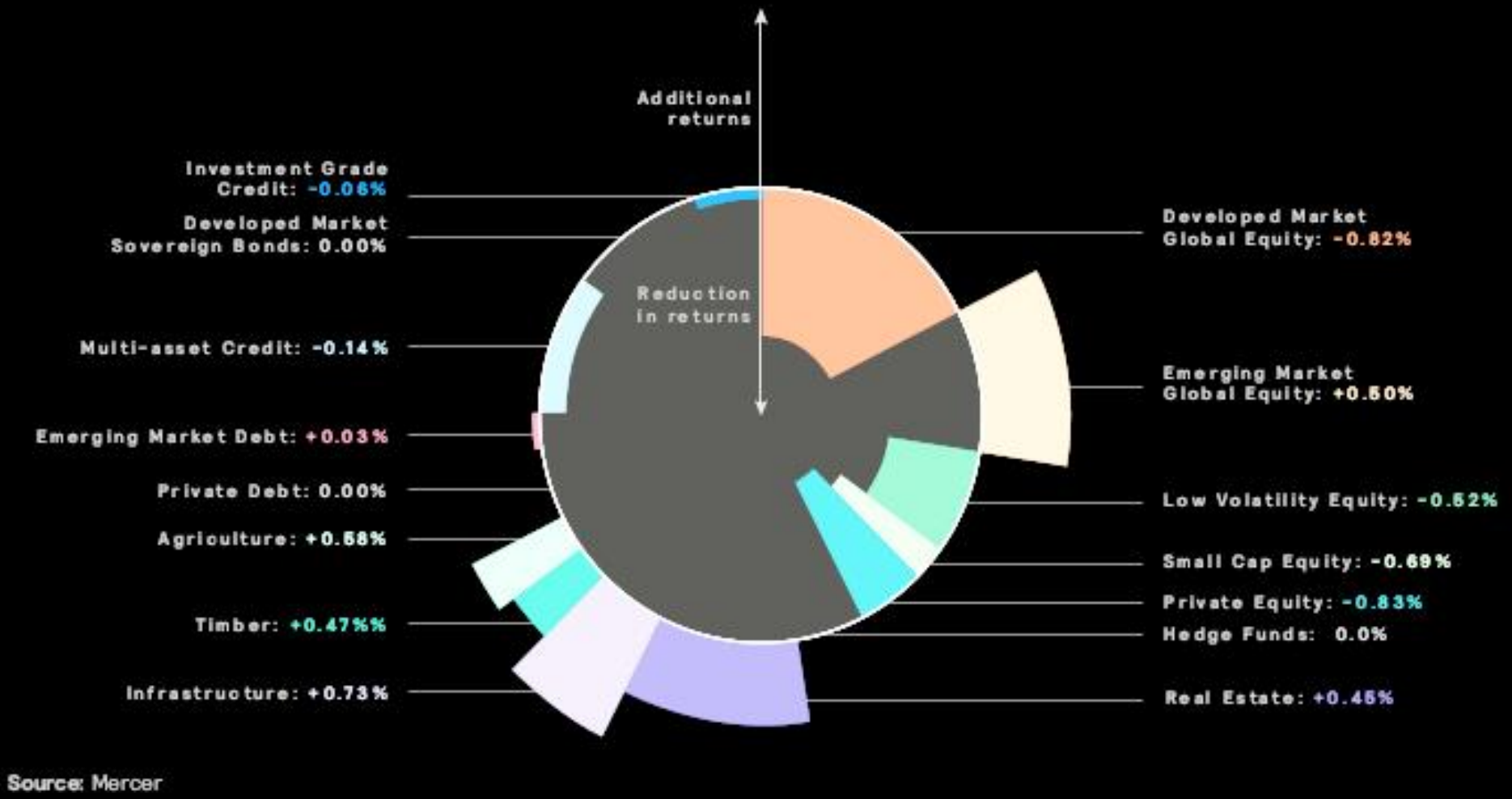
(1) Anthropogenic warming by over **2°** Celsius is likely to be a total disaster.
(2) That means we have to keep our total emissions down to **565** gigatons of CO_2.
(3) Scarily, the declared fossil fuel reserves of governments and private companies amount to **2,795** gigatons of CO_2!


Declared reserves
2 °C of warming
Man-made CO_2 in atmosphere now
Global CO_2 in 1750
© 2012 Cnes/Spot Image
© 2012 Google
Image © 2012 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Plan of this lecture

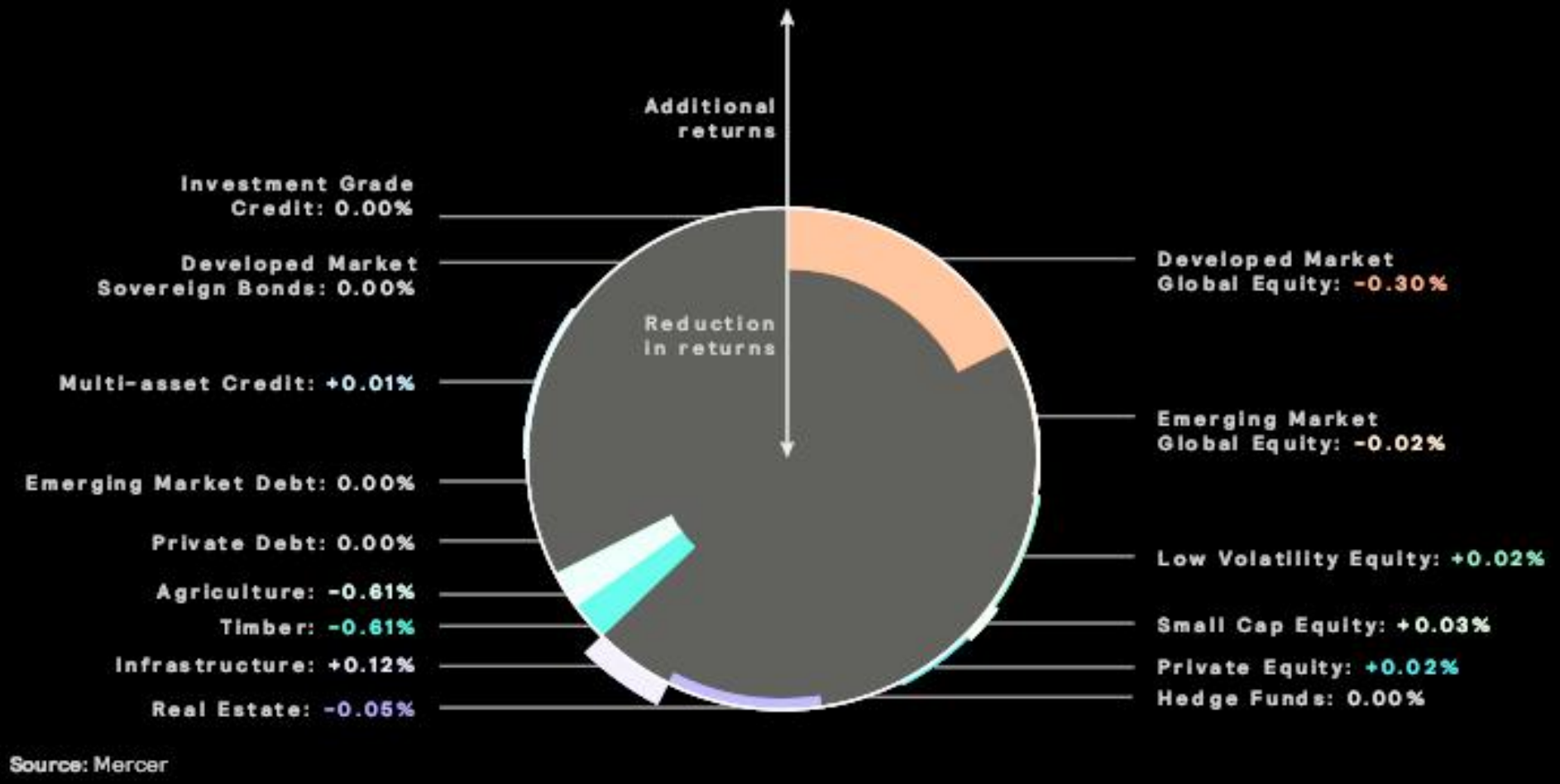
0. The risks we face (2019) and faced (2015)
1. Risks and rewards
2. Risk mitigation: identifying asset classes
3. Risk mitigation: forecasting returns
4. Climate risks: stranded assets
5. Climate opportunities?
6. An ethical headache: doesn't "mitigating" climate risks just mean passing them on?

5. Climate opportunities?



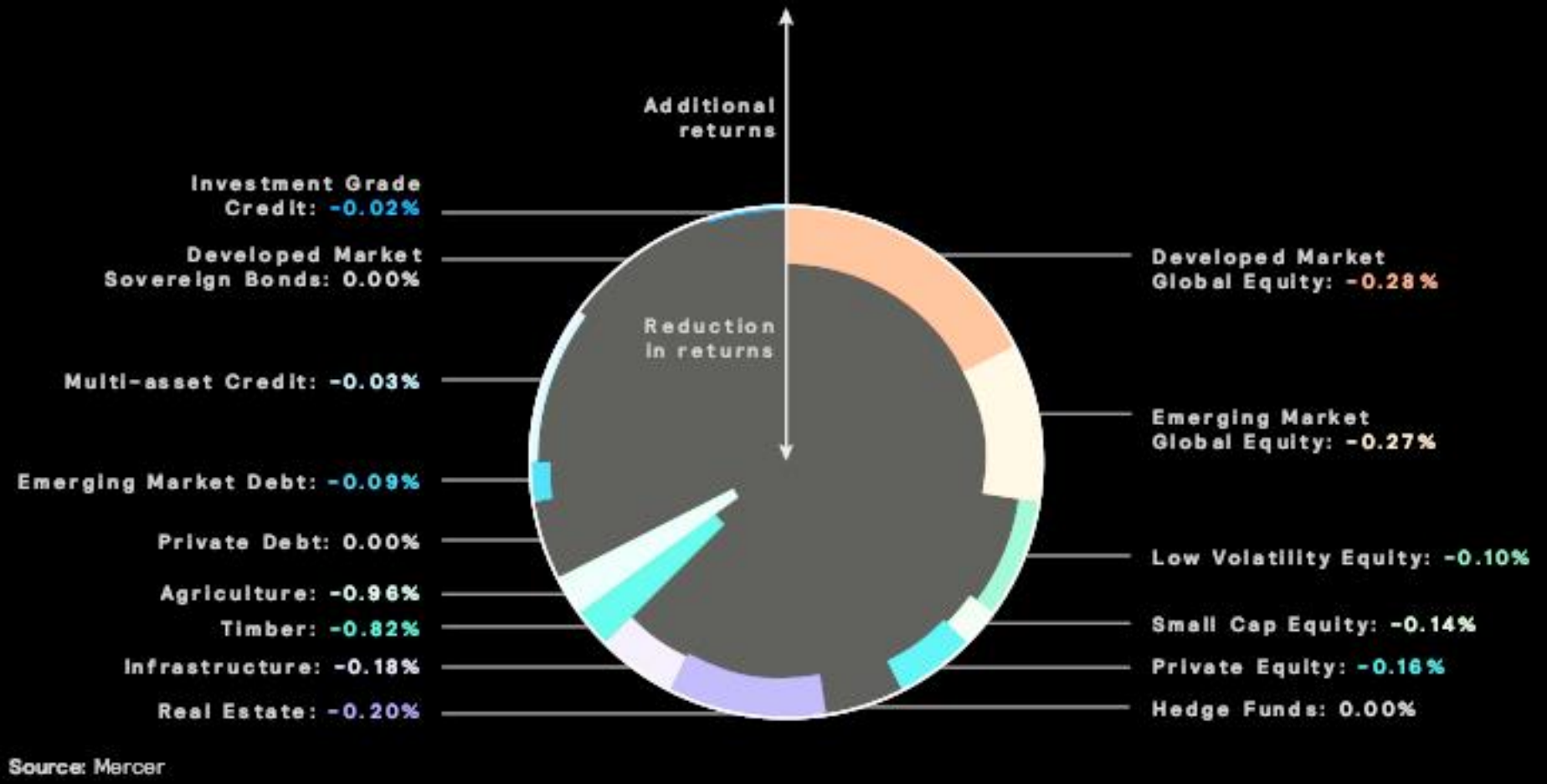
Source: Mercer & International Finance Corporation, *Investing in a Time of Climate Change* (2015), p. 67 ("Transformation").

5. Climate opportunities?



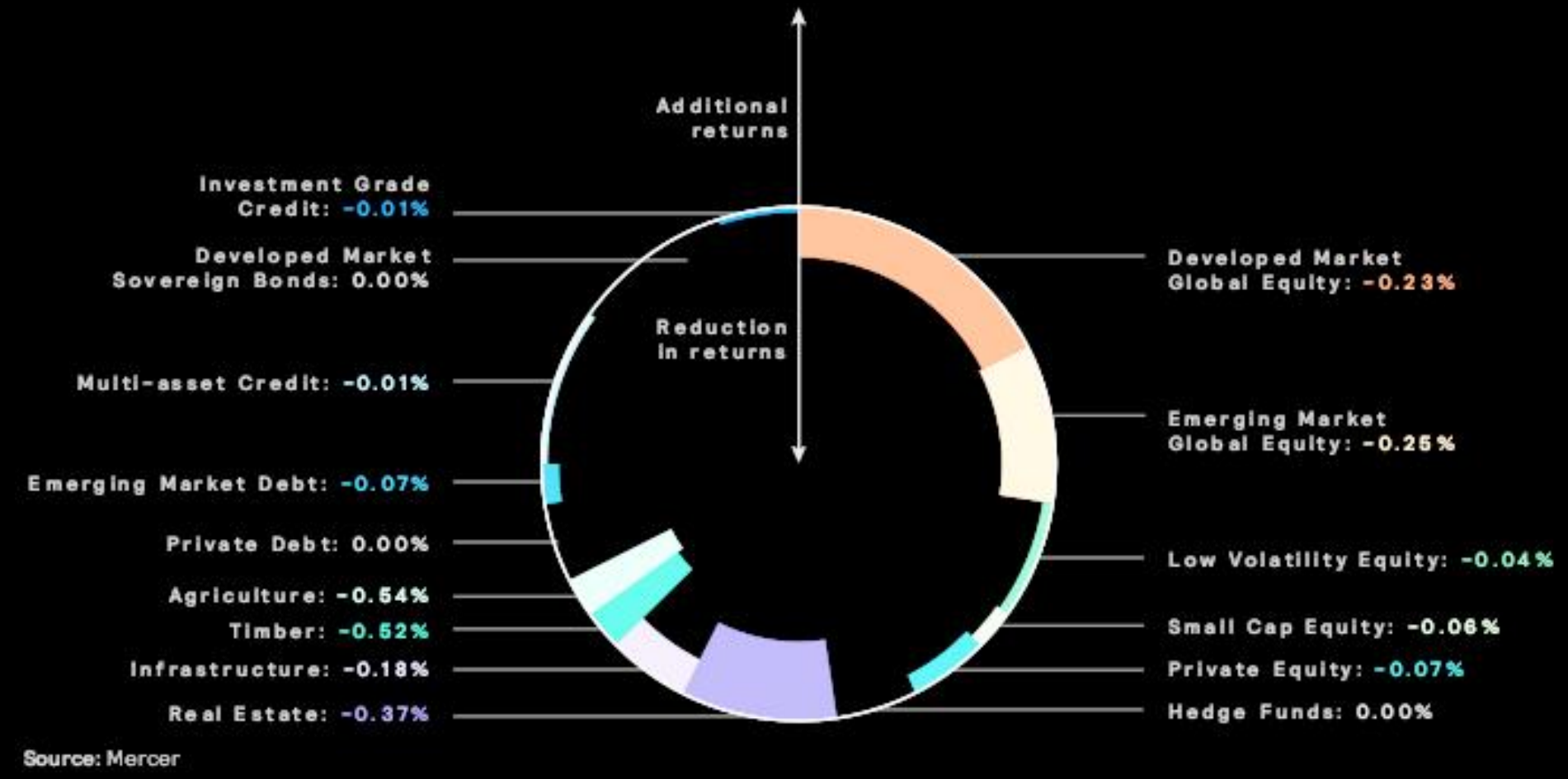
Source: Mercer & International Finance Corporation, *Investing in a Time of Climate Change* (2015), p. 68 ("Coordination").

5. Climate opportunities?



Source: Mercer & International Finance Corporation, *Investing in a Time of Climate Change* (2015), p. 69 ("Fragmentation—Lower Damages").

5. Climate opportunities?



Source: Mercer & International Finance Corporation, *Investing in a Time of Climate Change* (2015), p. 70 ("Fragmentation—Higher Damages").

Plan of this lecture

0. The risks we face (2019) and faced (2015)
1. Risks and rewards
2. Risk mitigation: identifying asset classes
3. Risk mitigation: forecasting returns
4. Climate risks: stranded assets
5. Climate opportunities?
6. An ethical headache: doesn't "mitigating" climate risks just mean passing them on?

6. An ethical headache

"Farmers with no responsibility for climate change should not have to shoulder the burden of climate risk transferred onto them from rich nations in schemes through which … shareholders profit from the effects of climate change for which their nations bear responsibility."

ActionAid, "Mind the Adaptation Gap: Why rich countries must deliver their fair share of adaptation finance in the new global climate deal," November 2015, p. 24.