

Fallacies

formal, informal,
rhetorical & statistical

Formal fallacies

- A logical *argument* that is not *valid*
 - Valid: The premises fit & prove the conclusion
 - For example:

All S is M.

All P is M.

 Therefore, all S is P.

Formal fallacies

- A logical *argument* that is not *valid*

– For example:

All rabbits run fast.

Homare Sawa runs fast.

 Therefore, Homare Sawa is a rabbit.

Formal fallacies

- A logical *argument* that is not *valid*

Compare a valid example:

All rabbits run fast.

Homare Sawa is a rabbit.

Therefore, Homare Sawa runs fast.



Rhetorical (informal) fallacies

- (Some) Attempts to convince without logic
 - People instead of premises, data

Everybody says it, so it must be true.

Stupid people say it, so it must be false.
 - Ignorance/knowledge instead of logic
- We don't know it's *not* true...
- This is a good idea, so it must be true.

Statistical fallacies

- Misunderstanding / misrepresenting statistics
It's significant ($p < 0.01$), so it's important.
The temperature has been going down since September. By June we'll be freezing.
- Calculating incorrectly, improperly
All my friends agree with me.
Therefore, everyone agrees with me.

Chocolate & Nobel Prizes

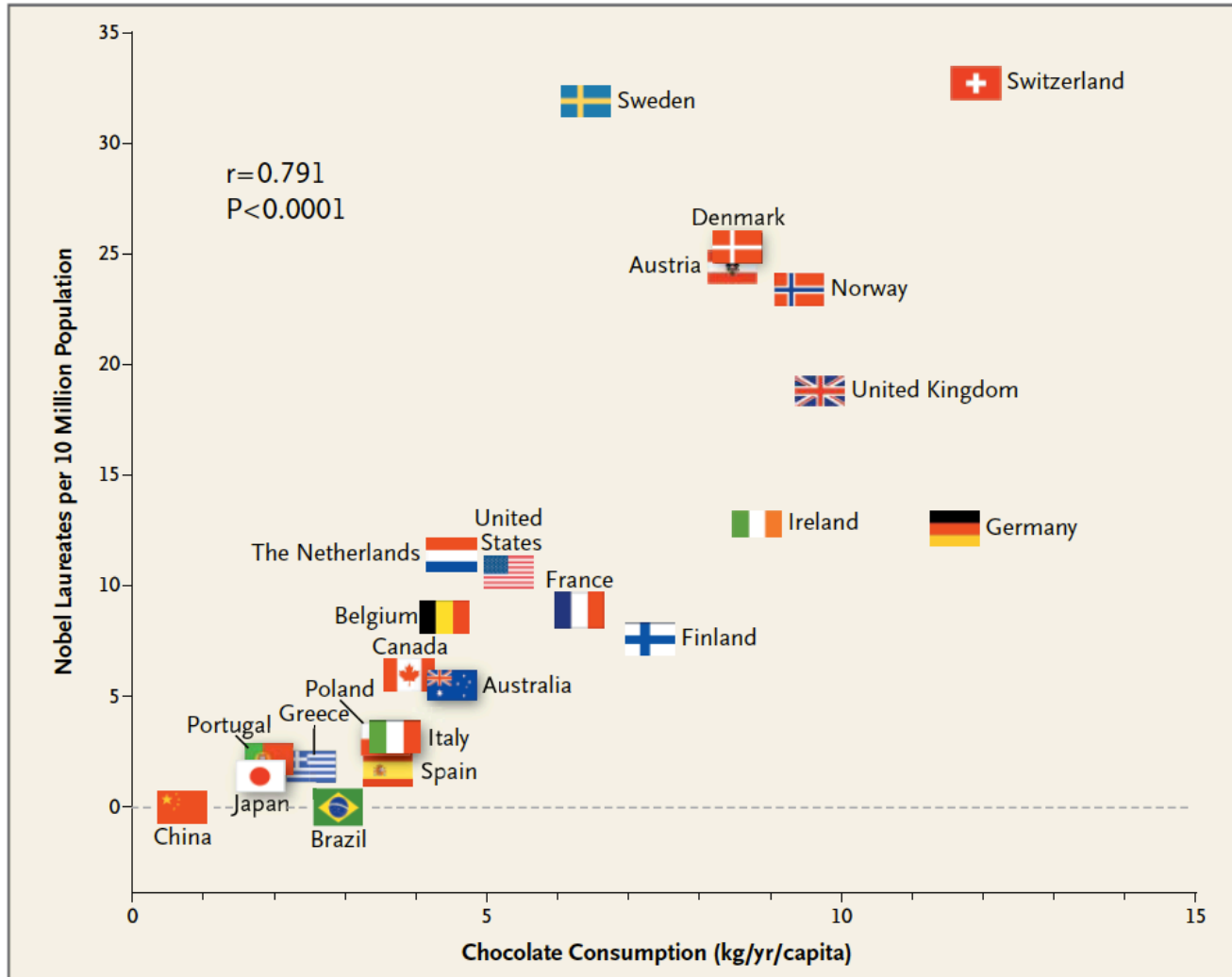
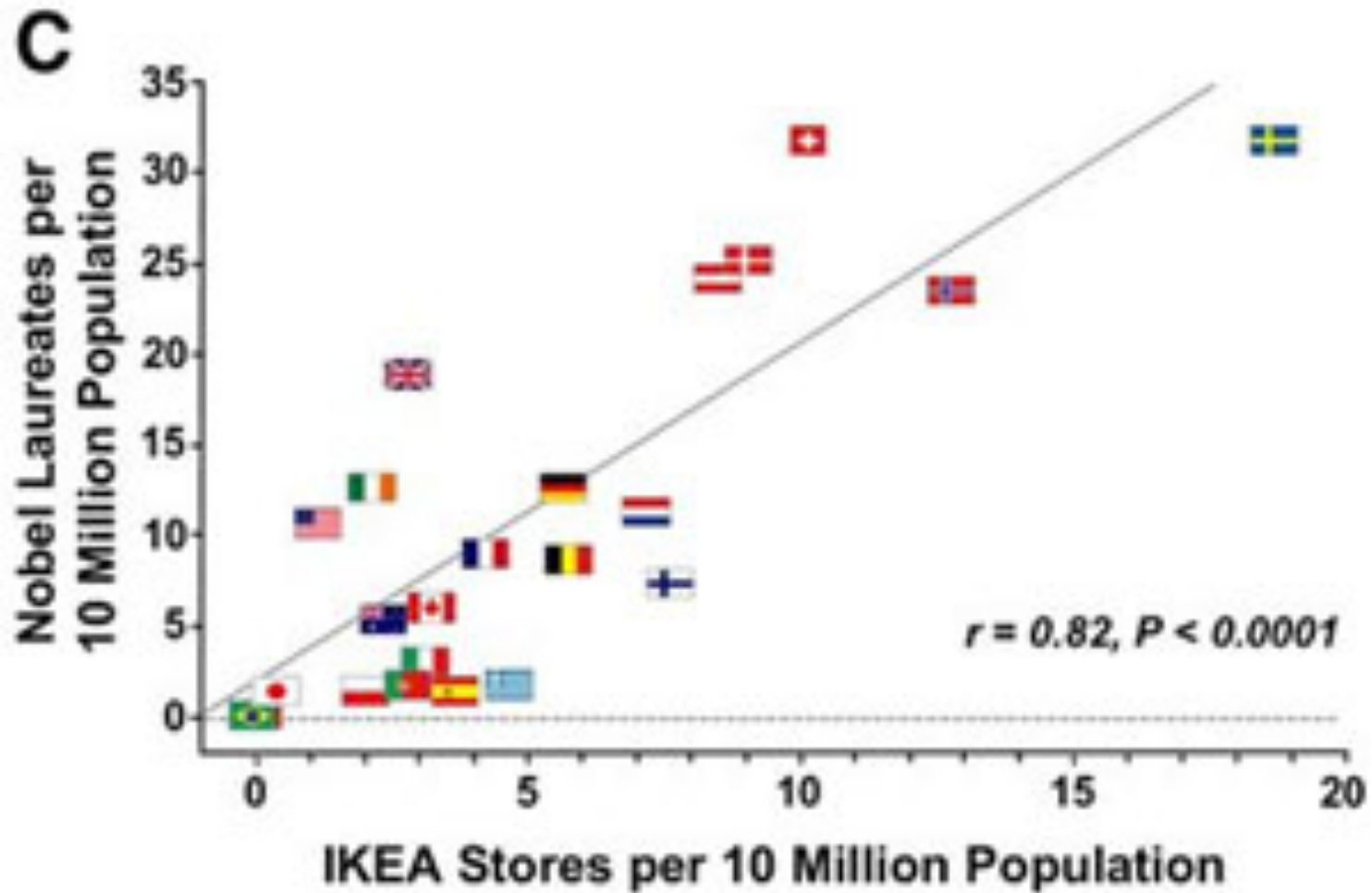
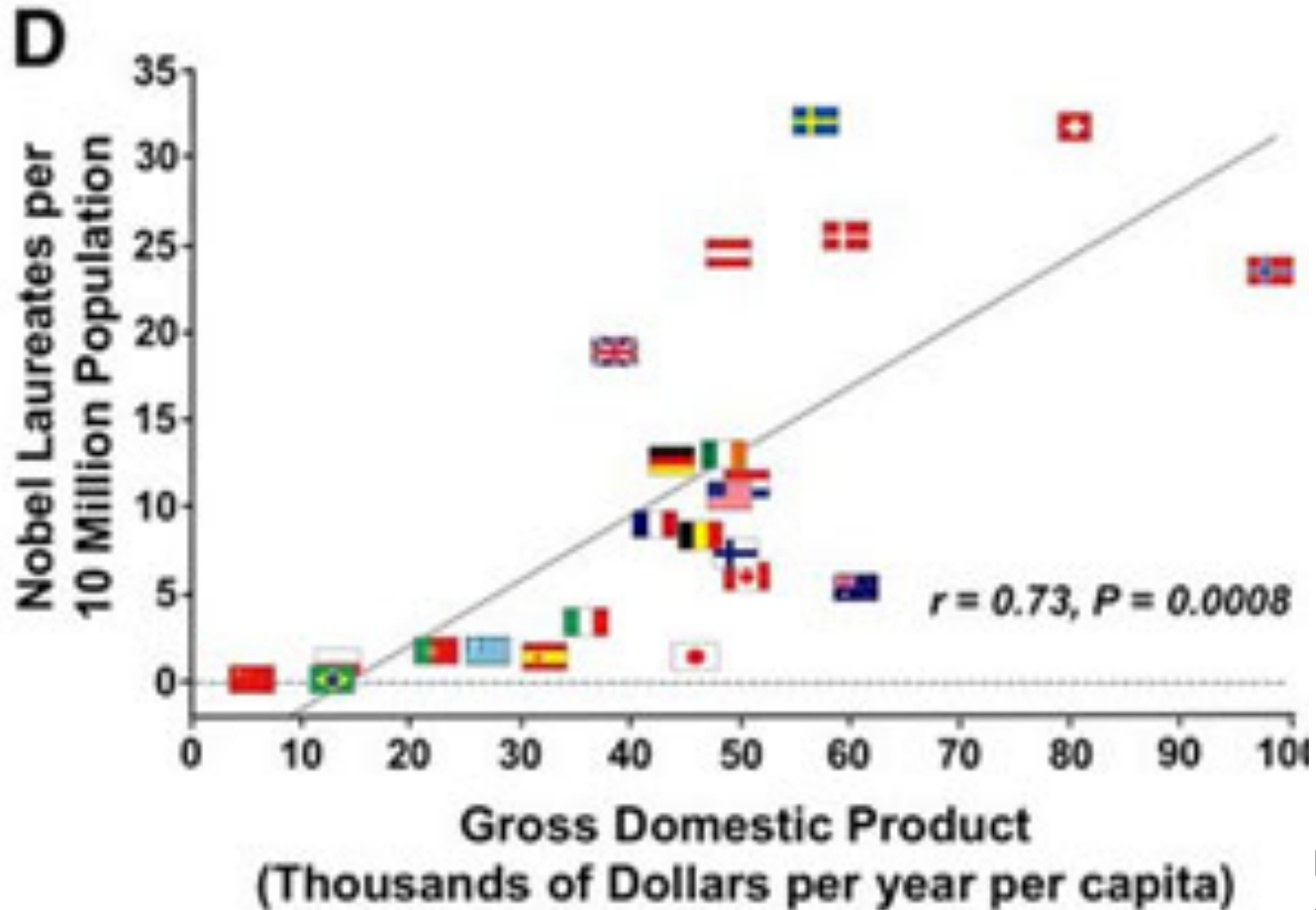


Figure 1. Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population.

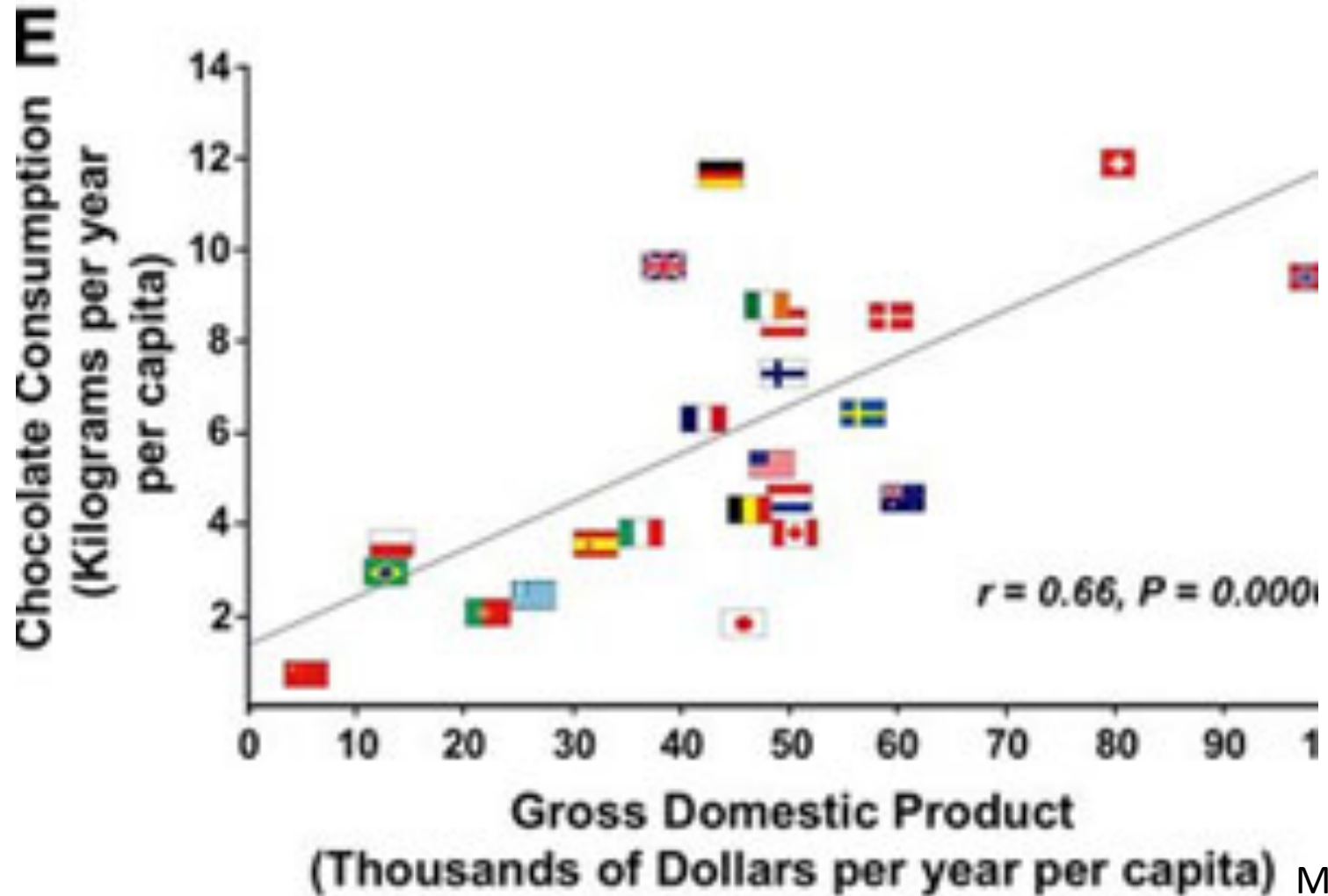
Chocolate & Nobel Prizes



Chocolate & Nobel Prizes

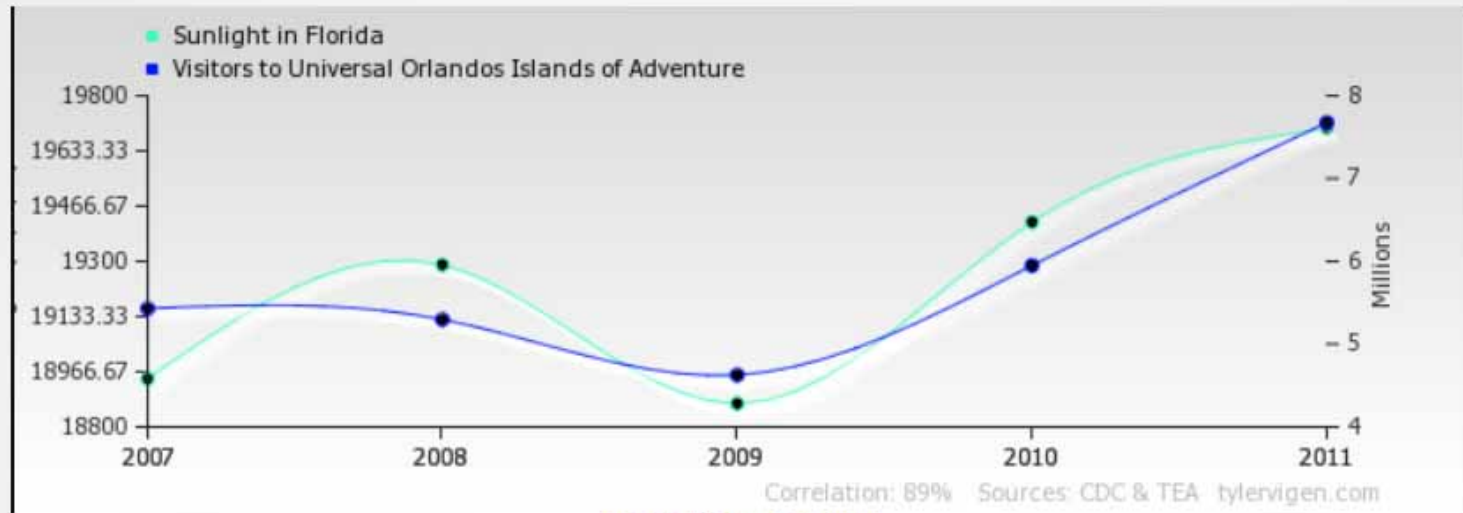


Chocolate & Nobel Prizes



Sunlight correlates with vacations

Sunlight in Florida correlates with Visitors to Universal Orlando's Islands of Adventure



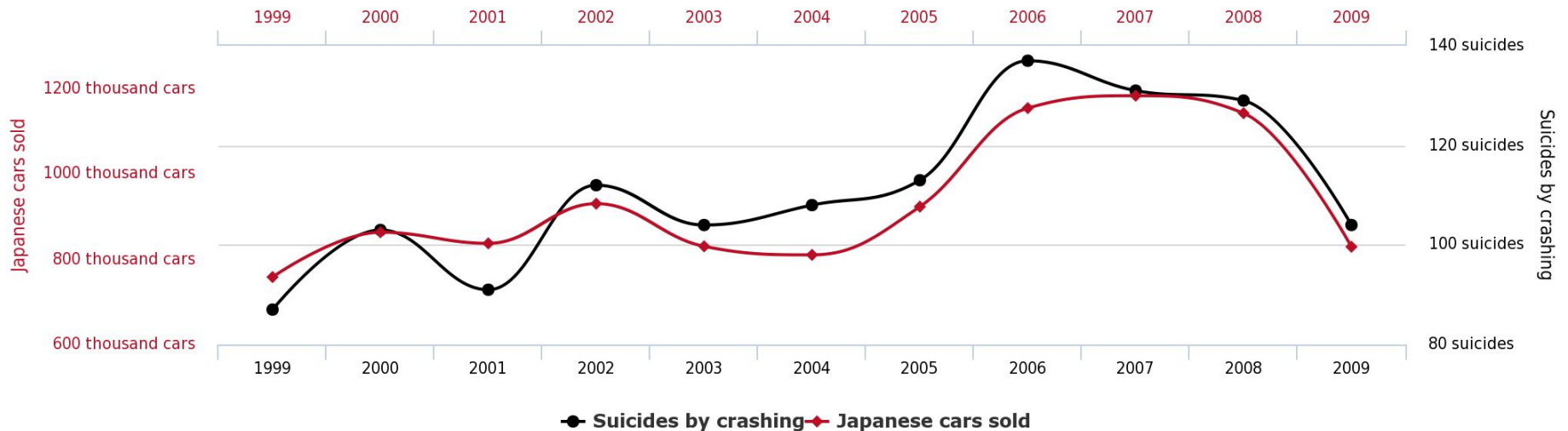
Upload this image to imgur

	2007	2008	2009	2010	2011
Sunlight in Florida Sunlight (KJ/sq.m) (CDC)	18945.54	19289.68	18870.38	19418.7	19700.78
Visitors to Universal Orlando's Islands of Adventure Millions (TEA)	5.43	5.297	4.627	5.949	7.674
Correlation: 0.89205					

Courtesy of
tylervigen.com

Japanese cars & US suicides

Japanese passenger cars sold in the US
correlates with
Suicides by crashing of motor vehicle



tylervigen.com

Courtesy of
tylervigen.com

Government

Can you spot the fallacy?

British politicians' bargain

- 2011: British politicians say government wastes £10bn (¥2兆) per year
- Ben Goldacre read the report to check their calculation.

<http://www.badscience.net/2012/04/is-this-the-worst-government-statistic-ever-created/>

British politicians' bargain

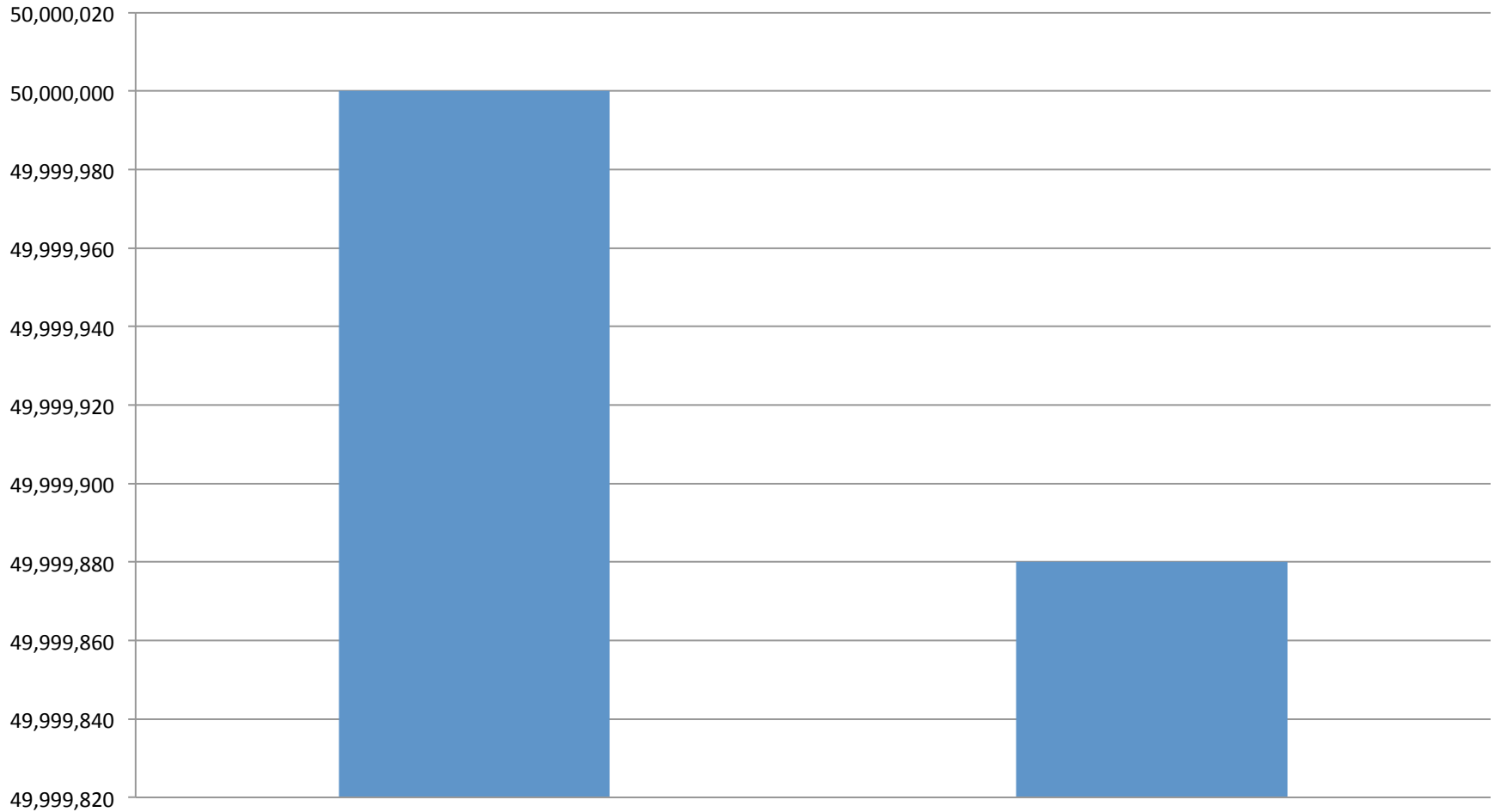
Government workers' mobile phones are from

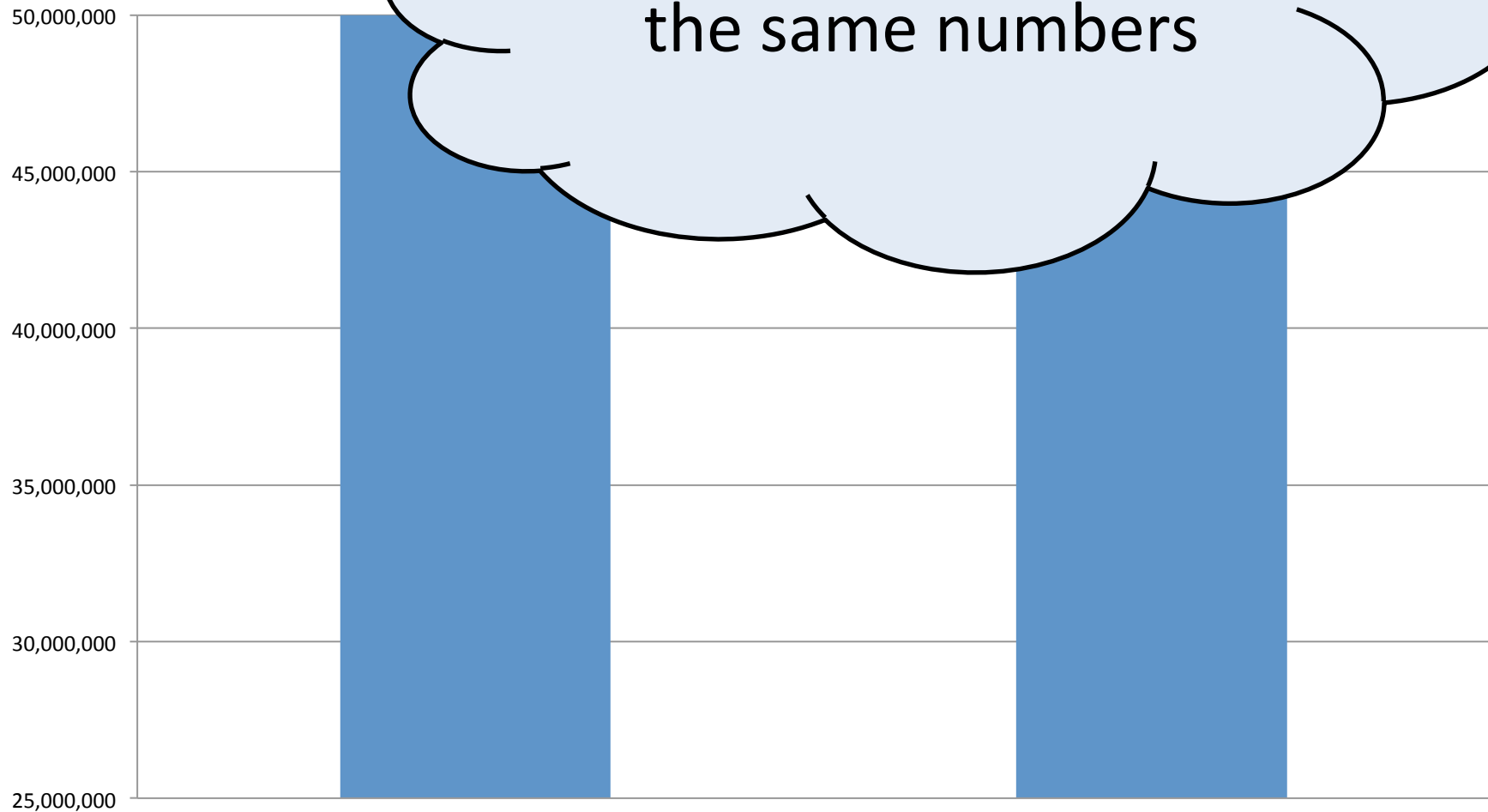
Most spending is not for mobile phones. Phones cost the government £600,000 per year. If they save 20%, that is £120,000 (£0.00012bn).

Extrapolation fallacy

programs. If they can save 20%, that is £10bn.

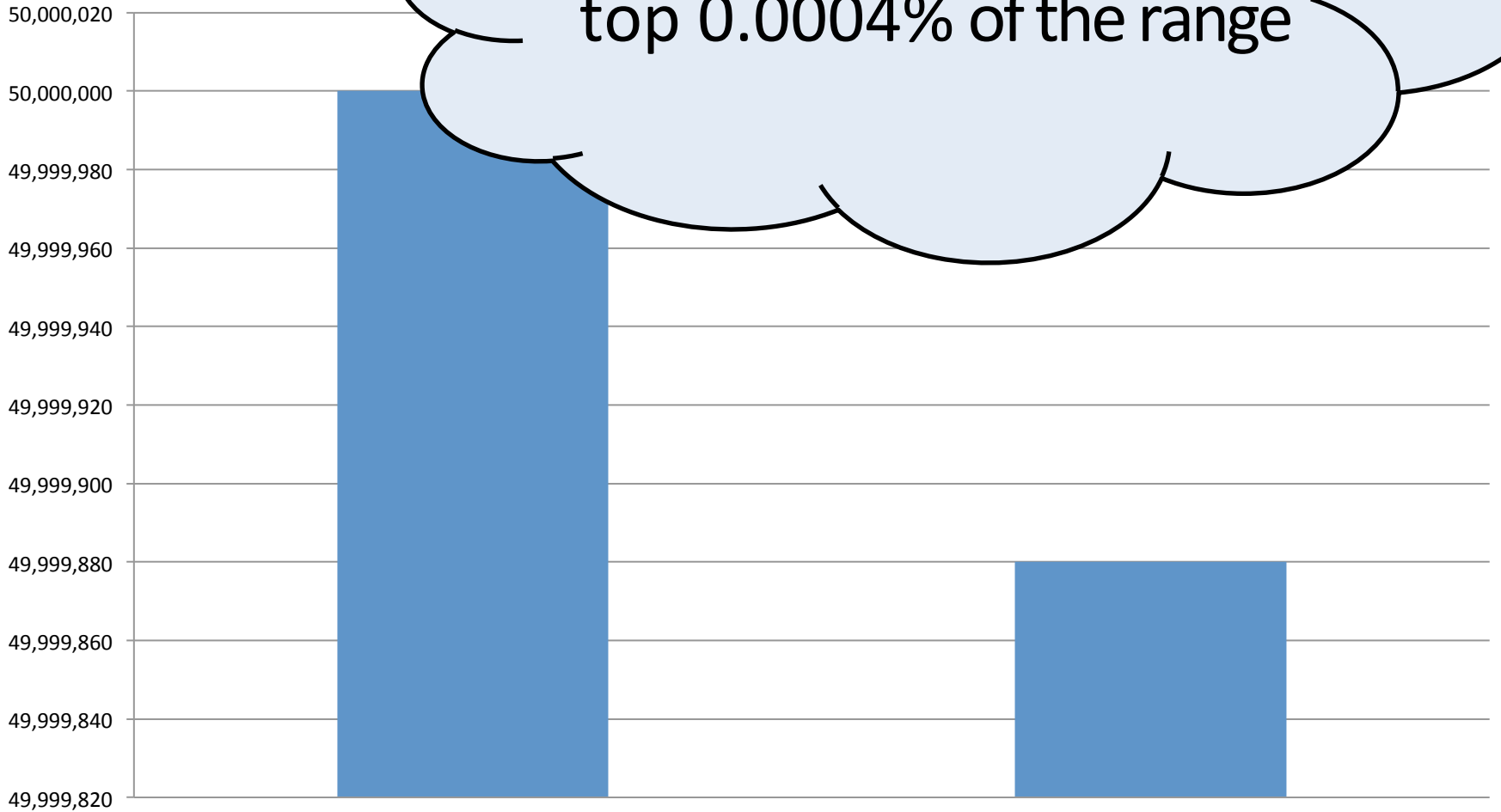
Bad charts

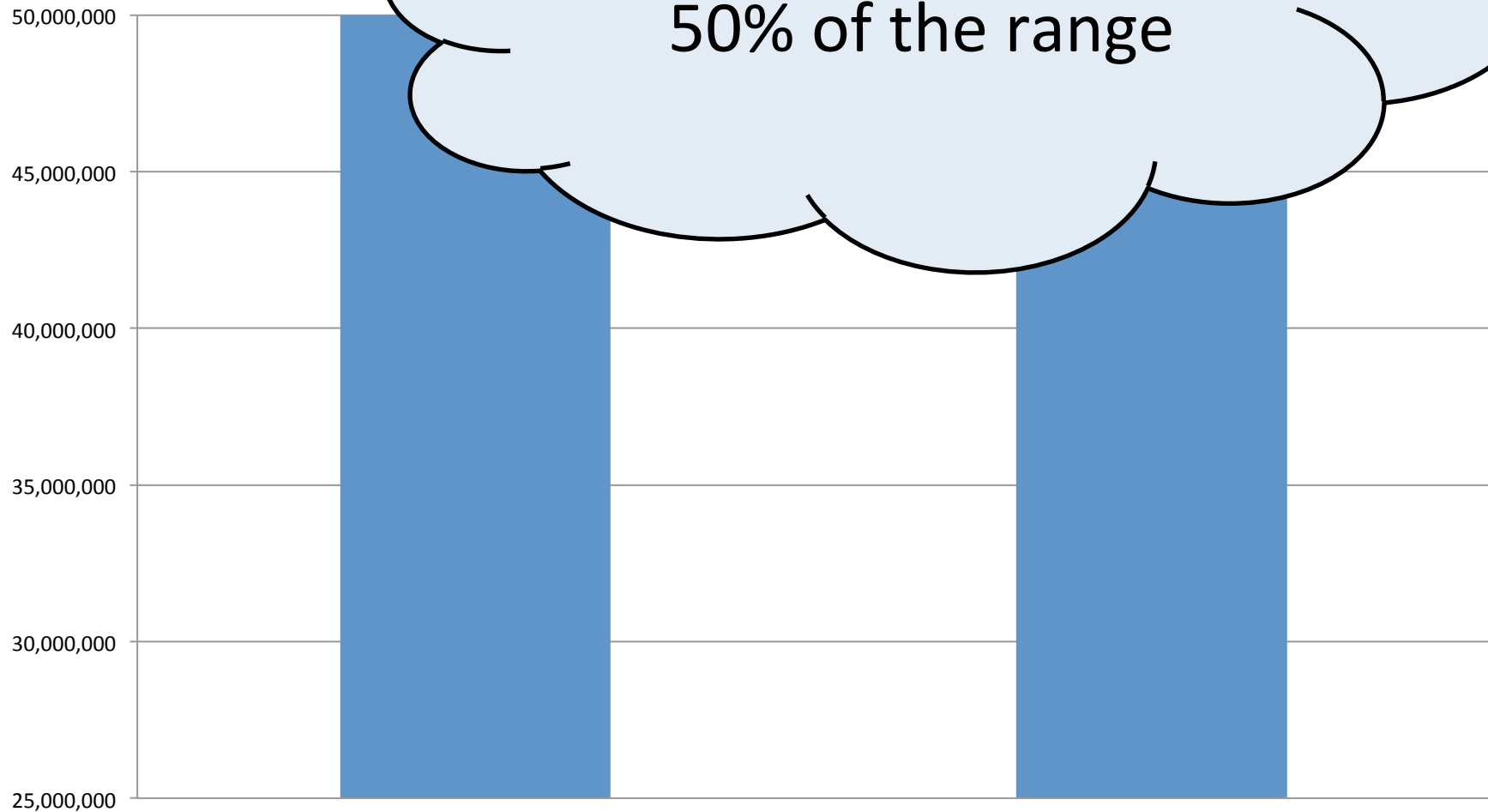




Both charts based on
the same numbers

But this one is only the
top 0.0004% of the range





This is the top
50% of the range

Language, Psychology

Can you spot the fallacy?

Word aversion

Many English speakers say they hate the word *moist*. They say they dislike its sound, but maybe they actually dislike its meaning. Thibodeau et al. (2015) asked people to rate whether they like or dislike several words. Although 21% dislike *moist*, those same people did not dislike *hoist* or *rejoiced*. Therefore, people who dislike the word *moist* dislike its meaning, not its sound.

Word aversion

Many English speakers say they hate the word *moist*.

“A is False” does not necessarily mean
“B is True.”

False Dilemma

people who dislike the word *moist* dislike its meaning,
not its sound.

Economics

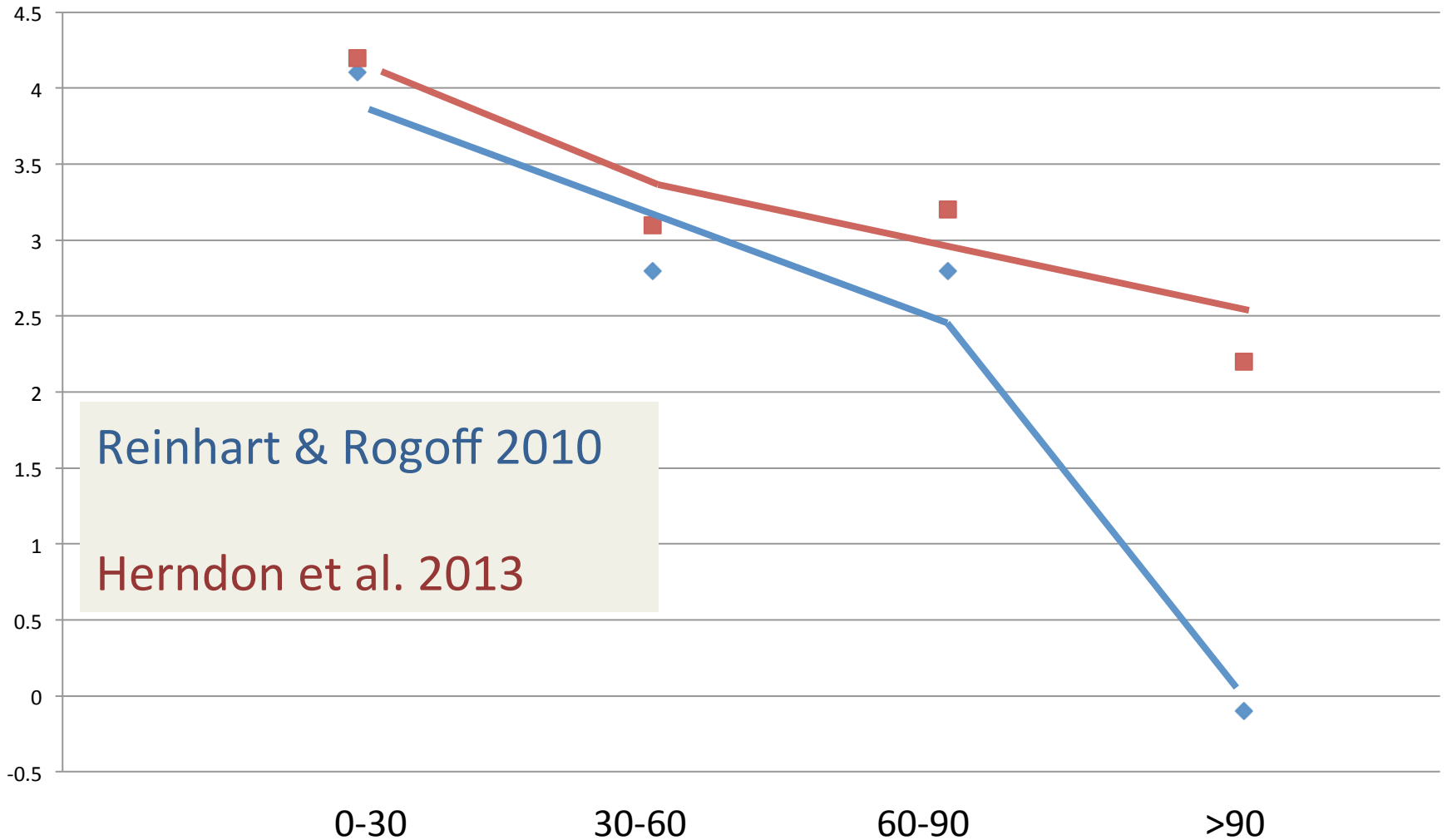
Can you spot the fallacy?

Growth vs. debt

Reinhart & Rogoff (2010) compared economic growth and government debt. They found little connection. But when debt is more than 90% of GDP, growth drops dramatically.

Herndon et al. (2013) couldn't duplicate Reinhart & Rogoff's findings. Eventually they found that Reinhart & Rogoff had made a computer error that caused their statistics to be calculated incorrectly.

GDP Growth vs. Public Debt



Growth vs. debt

Reinhart & Rogoff, who oppose big debt for political reasons, found that big debt is bad.

Herndon et al. found that big debt does not have much effect. (Small debt has a good effect, but politicians don't argue about that.)

1. Garbage in, garbage out
2. Beware of finding what you are looking for.

Sociology and Communication

Can you spot the fallacy?

Canvassing

People rarely change their political positions. Lacour & Green (2014) found that when an interviewer says that he or she is gay, the people being interviewed are more likely to change their positions about gay marriage.

Canvassing

This was not a fallacy – **it was a lie**. Lacour made up fake data to “prove” the effectiveness of his canvassing techniques.

The respected journal *Science* published the paper and peer reviewers accepted it in part because Green is a very well-known and respected scholar in this field. One reviewer said, “I trust anything Don Green says.”

When he discovered the lie, Green asked *Science* to retract the paper.

The fallacy fallacy



Videos are available on YouTube from PBS Idea Channel