

# 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

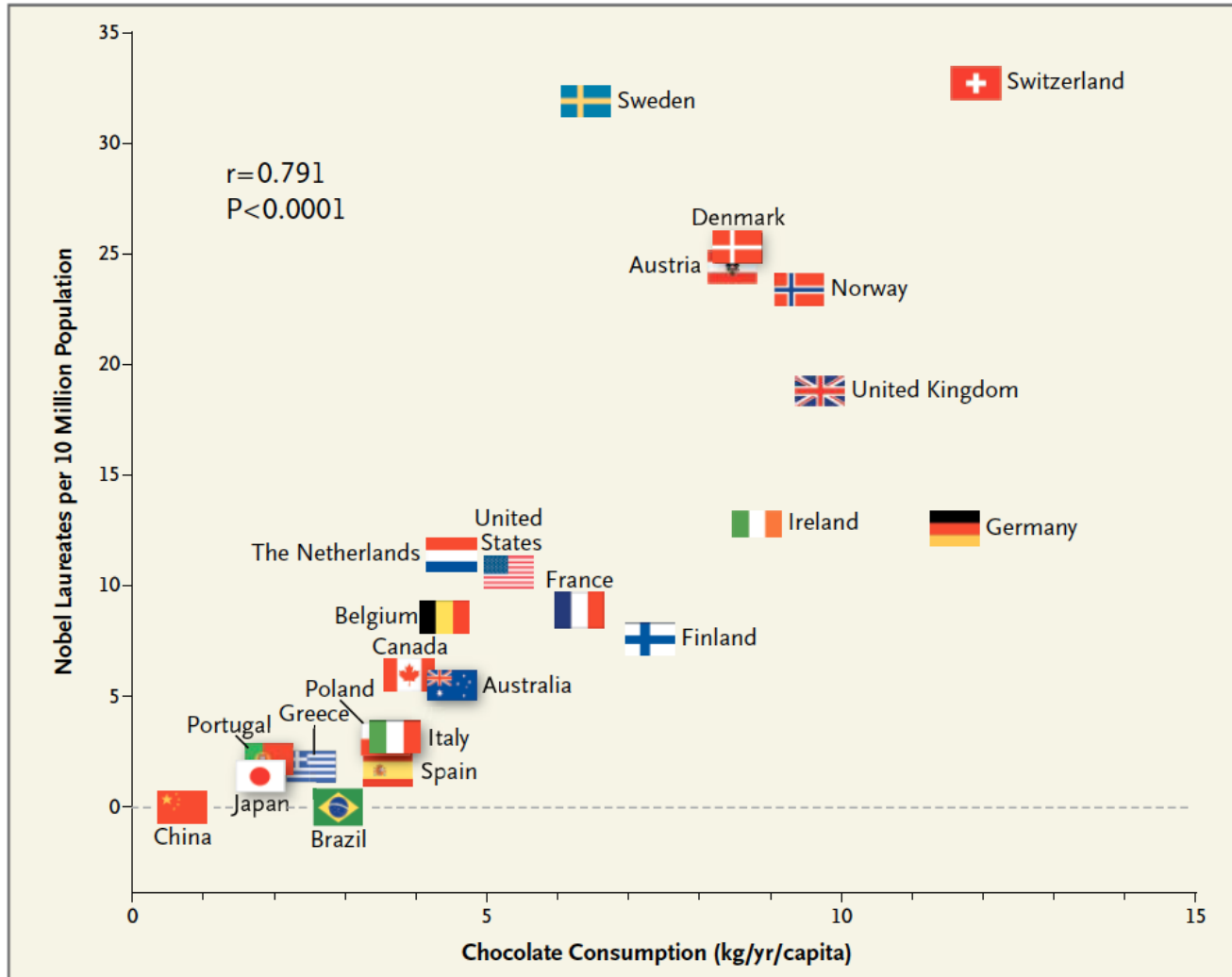
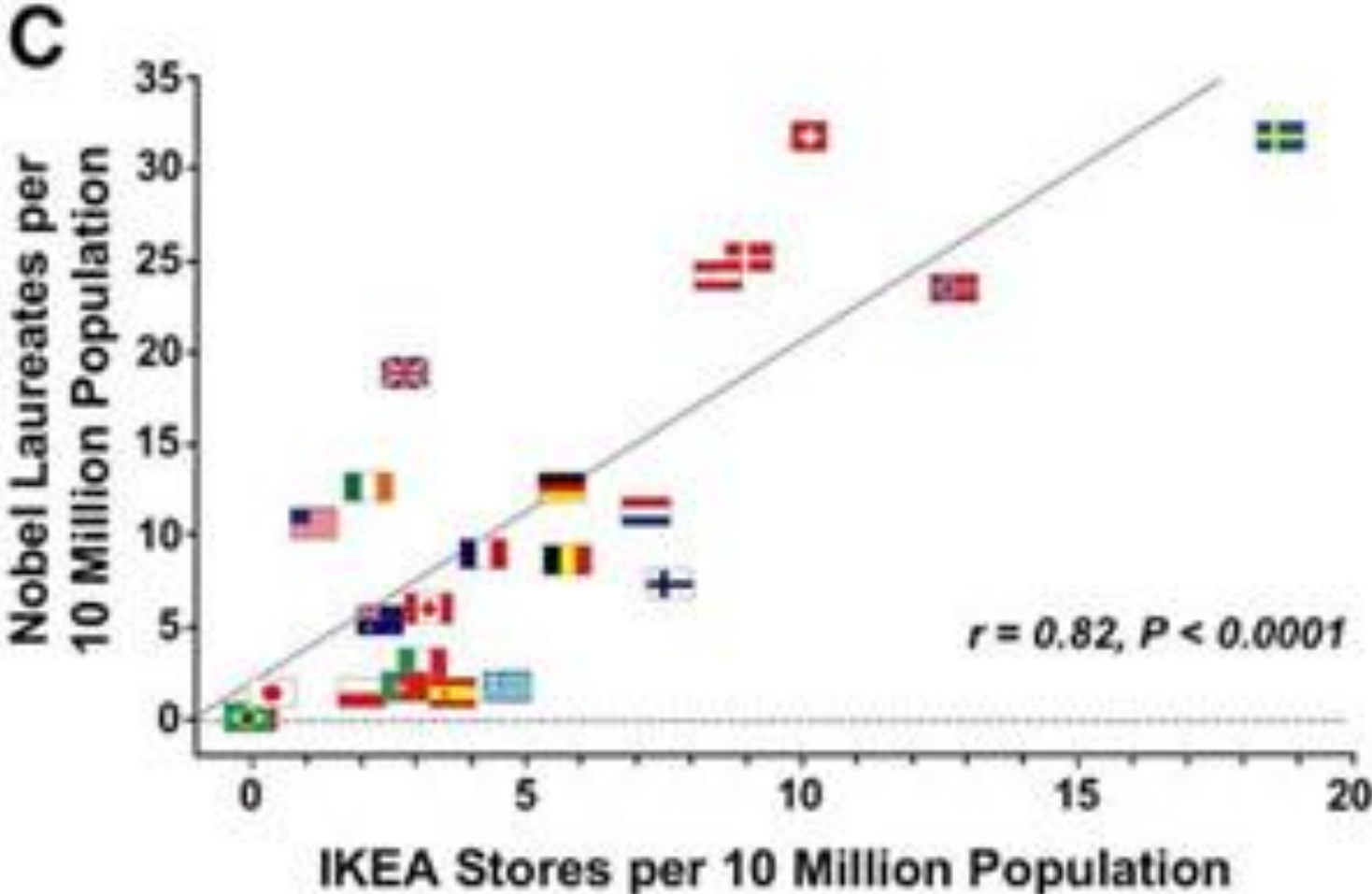


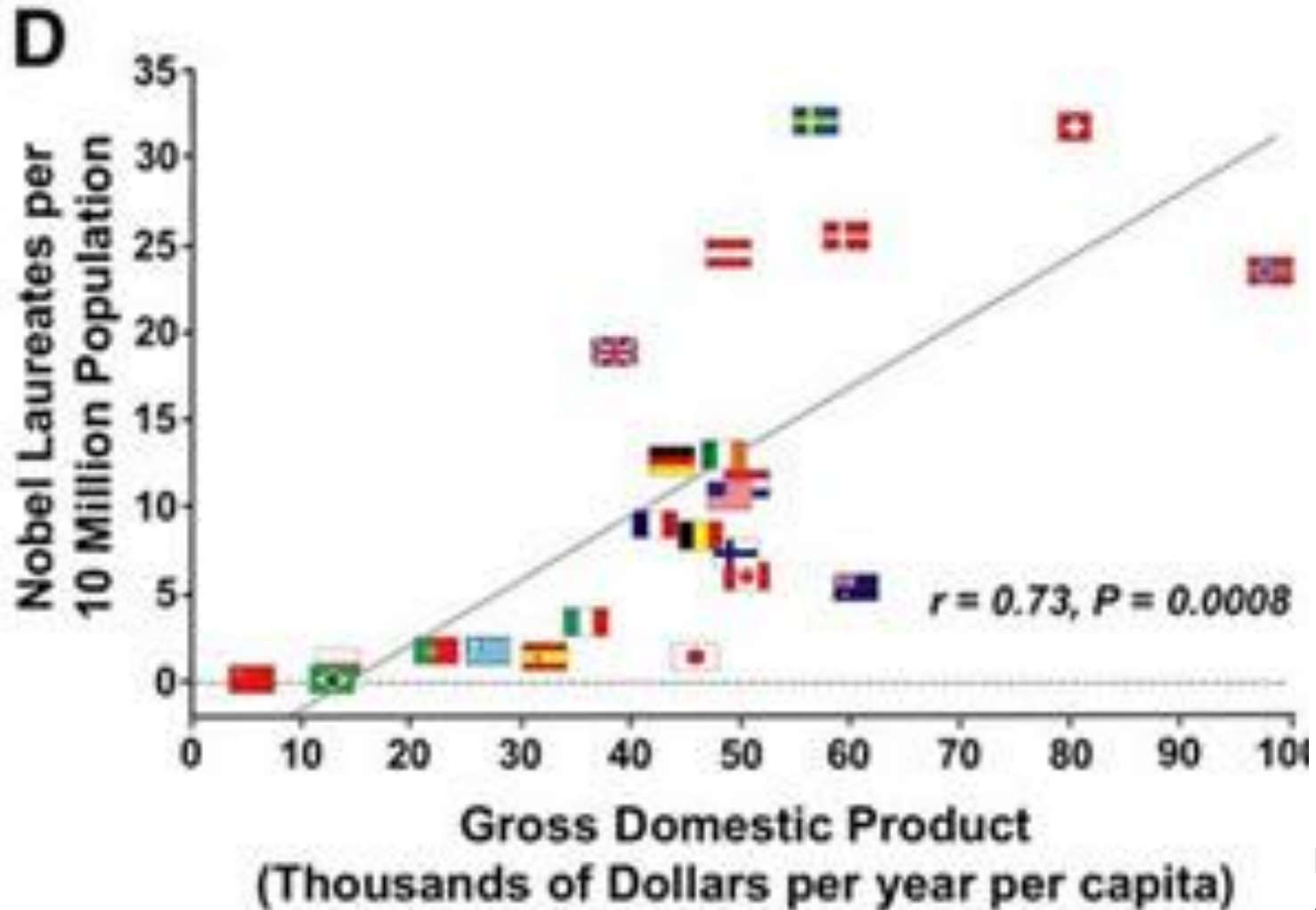
Figure 1. Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population.

# Chocolate & Nobel Prizes

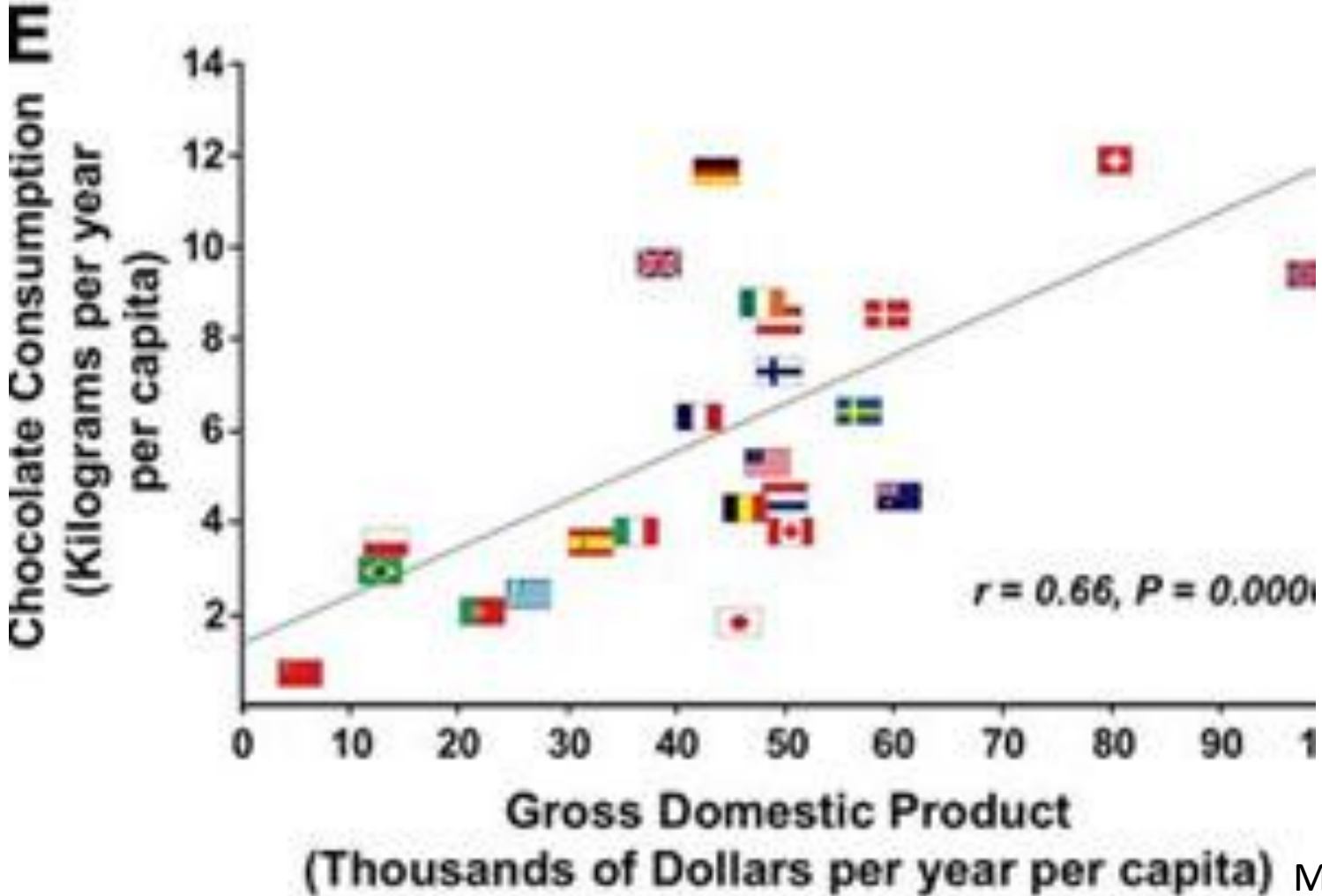




# Chocolate & Nobel Prizes



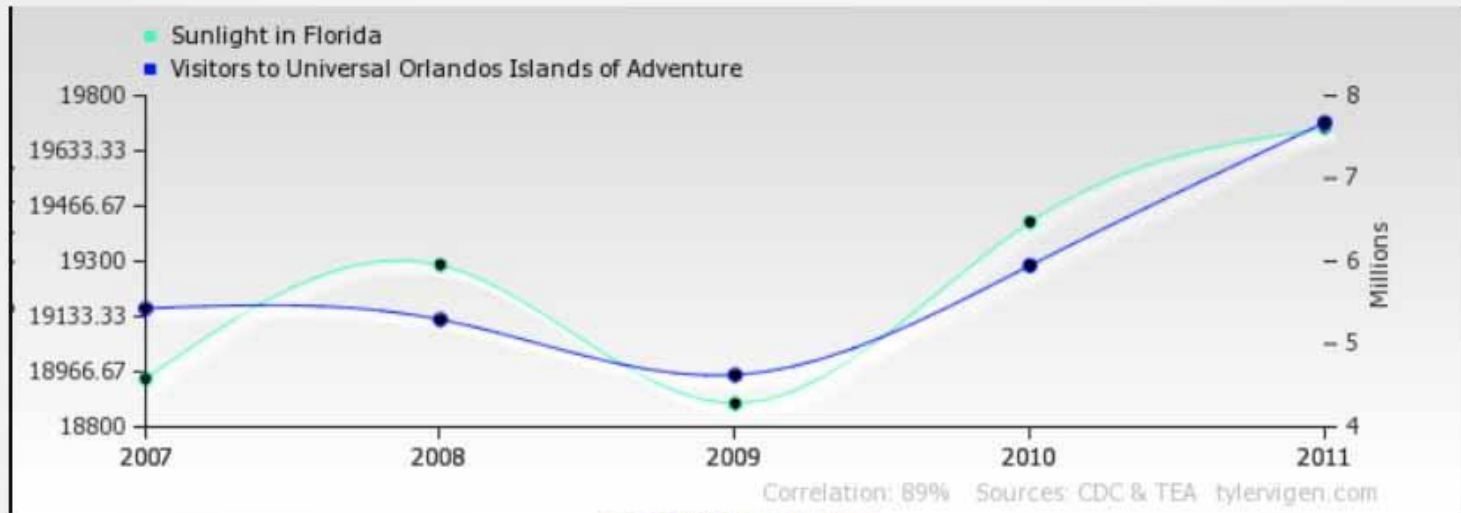
# Chocolate & Nobel Prizes



Maurage  
et al.  
2013

# Sunlight correlates with vacations

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



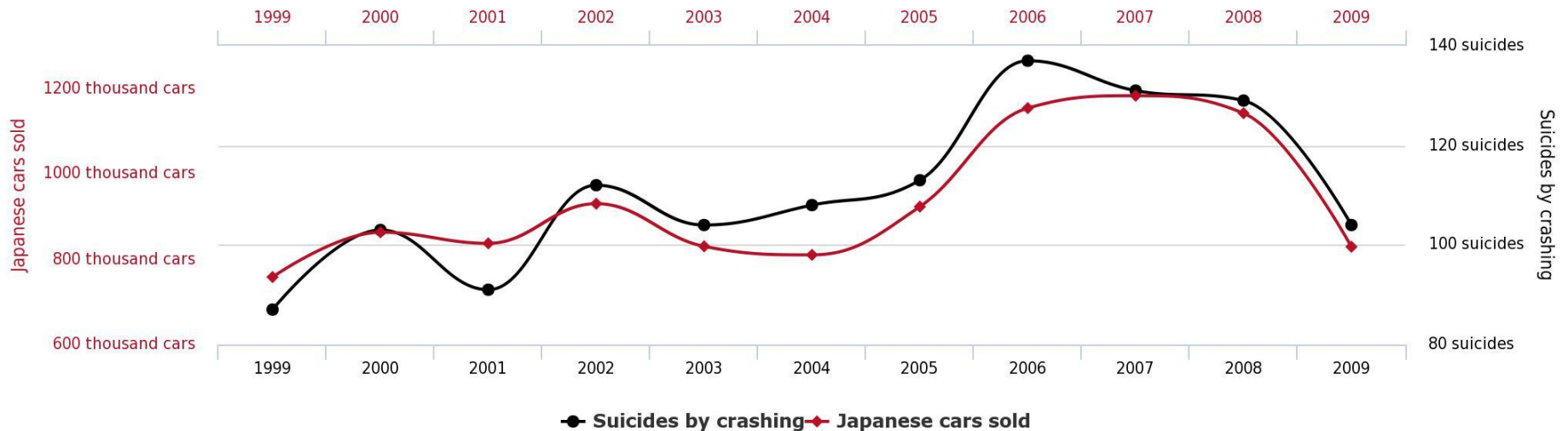
[Upload this image to imgur](#)

	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
<b>Correlation: 0.89205</b>					

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

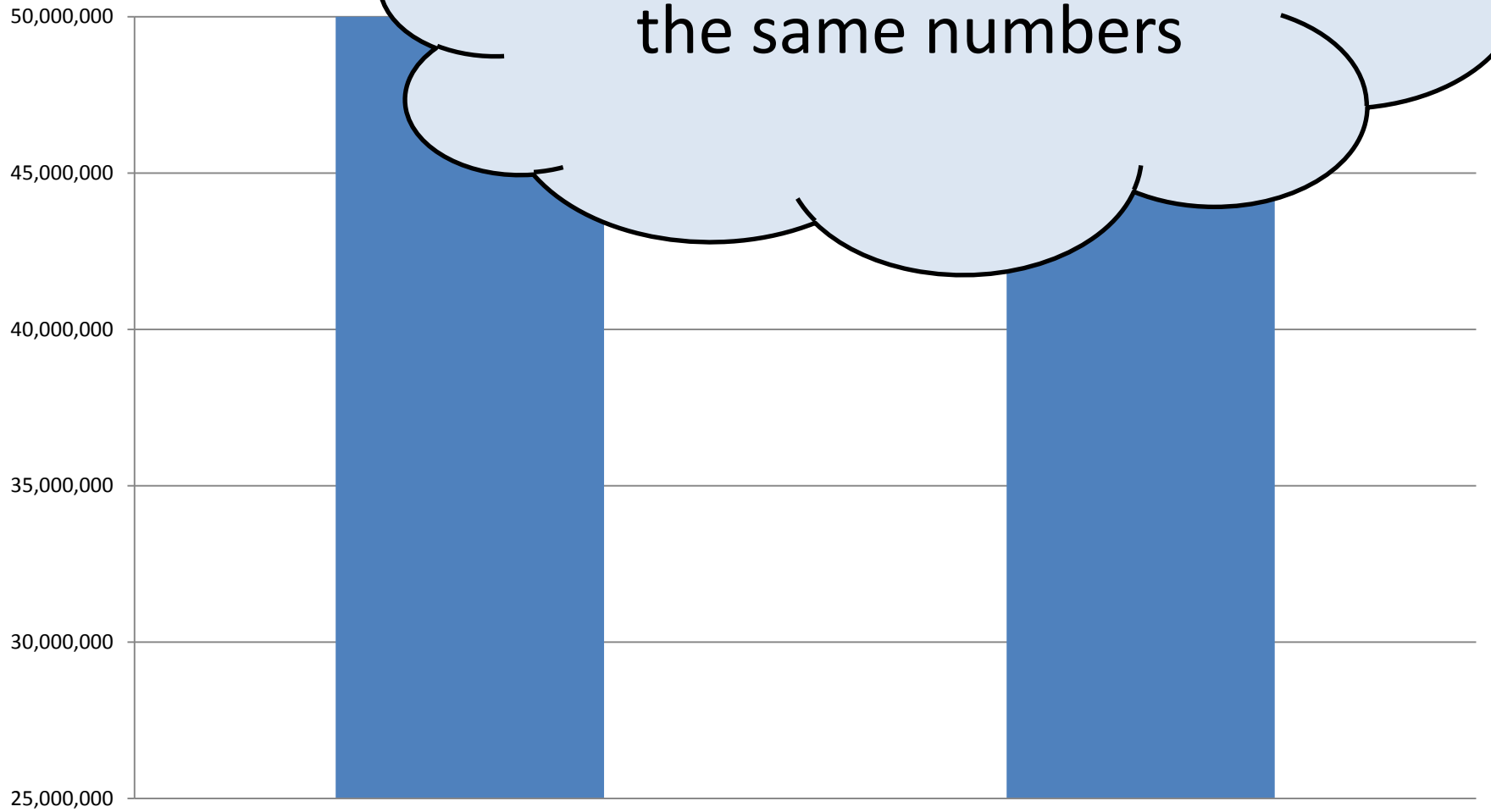
- 2011: British politicians say government wastes £10bn (¥2兆) per year
- Ben Goldacre read the report to check their calculation.

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

# British politicians' bargain

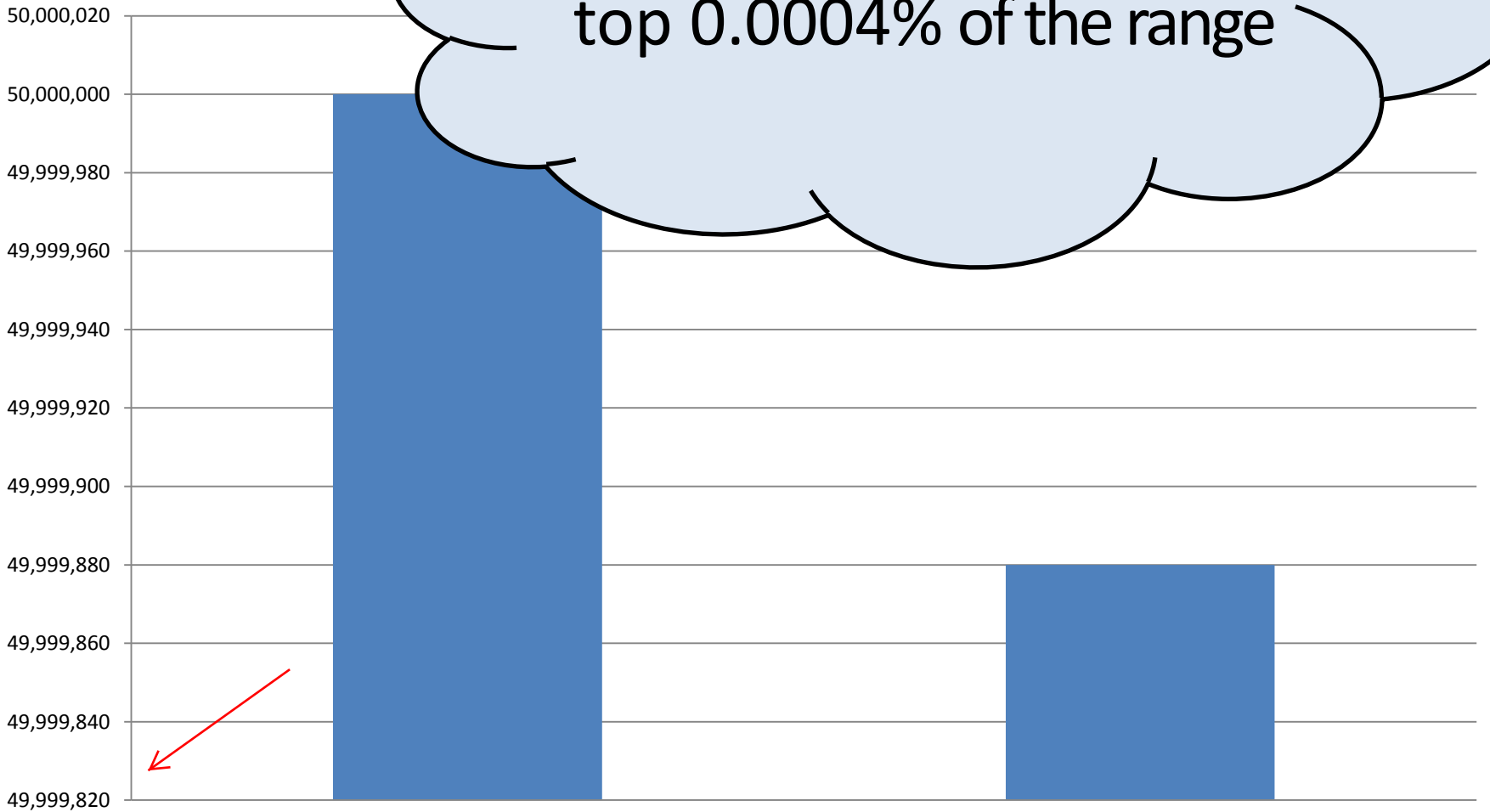
***Government workers get mobile phones from an expensive company. If their mobile phones were from a different company, they would be 20% cheaper.***

***City government spends £50bn per year on all programs. If they can save 20%, that is £10bn.***



Both charts based on  
the same numbers





But this one is only the  
top 0.0004% 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**

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

(Sometimes called the False Dilemma)

**did not dislike *hoist* or *rejoiced*. Therefore, people who dislike the word *moist* dislike its meaning, not its sound.**

# Economics

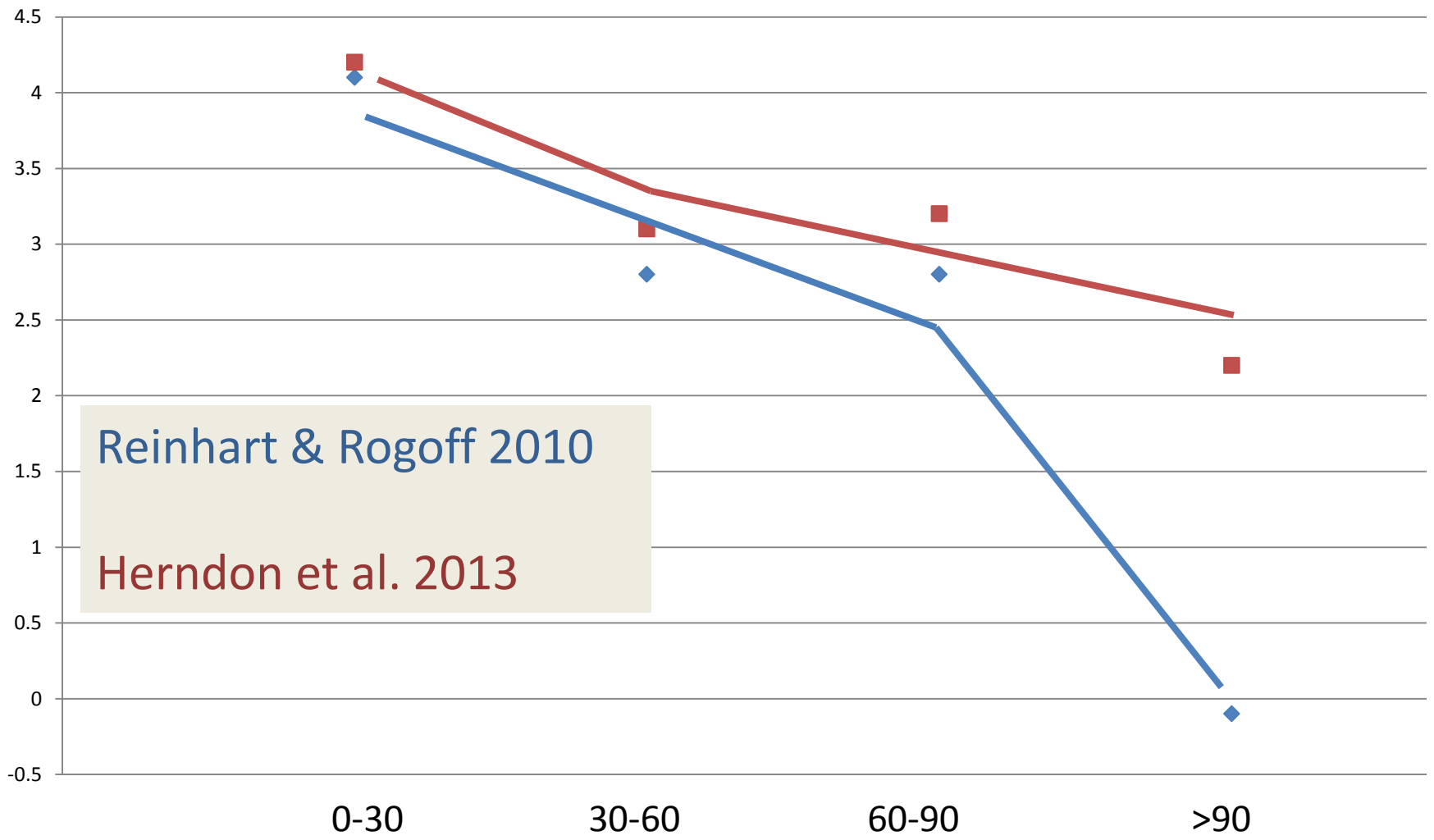
Can you spot the fallacy?

# 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



Reinhart & Rogoff 2010  
Herndon et al. 2013

# 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 opinions 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.”**

**Green asked *Science* to retract the paper.**

# The fallacy fallacy

- (This video and others are available on YouTube from PBS Idea Channel.)

<https://youtu.be/oGBO-WMrIIQ?list=PLtHP6qx8VF7dPqI3II1To4i6vEIPt0kV5>