QUARTZ

QZ&A

A Cambridge professor on how to stop being so easily manipulated by misleading statistics

Akshat Rathi | March 26, 2016

There are many ways to say the same thing. (Akshat Rathi)

"There are three kinds of lies: Lies, damned lies, and statistics." Few people know the struggle of correcting such lies better than David Spiegelhalter. Since 2007, he has been the Winton professor for the public understanding of risk (though he prefers "statistics" to "risk") at the University of Cambridge.

In a sunlit hotel room in Washington DC, Quartz caught up with Spiegelhalter recently to talk about his unique job. The conversation sprawled from the wisdom of eating bacon (would you swallow any other known carcinogen?), to the serious crime of manipulating charts, to the right way to talk about rare but scary diseases.

When he isn't fixing people's misunderstandings of numbers, he works to communicate numbers better so that misunderstandings can be avoided from the beginning. The interview is edited and condensed for clarity.

Quartz: **You have one of the most unique jobs in the world. What does your job involve?**

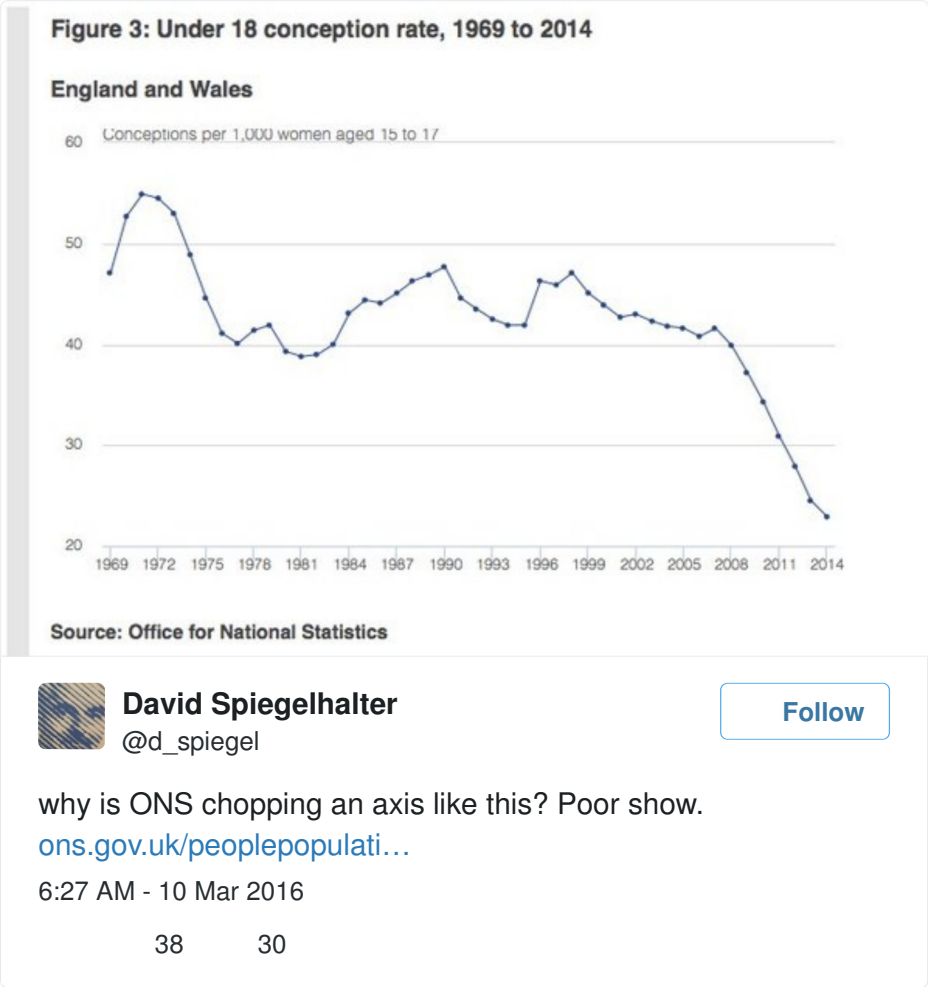
Spiegelhalter: Most of the time I'm working on quantitative and qualitative evidence. I give a lot of talks, write books, and advise people who want to communicate numbers. I also get called by the media to talk about numbers and whether we can believe them. So although my post is called "professor for the public understanding of risk," I interpret it as professor for the public understanding of statistics.

In terms of research, my work is mostly collaborative, working with psychologists, mathematicians, and others who are trying to find ways to communicate risk. My current project, for example, is working on a website for families with babies that have congenital heart disease.

What we are communicating are simple statistical issues, such as underlying risk, standard errors, and variability. But they are extremely difficult to communicate clearly, even to people with some training in statistics. So we spend a lot of time with patient groups, changing wording after wording, such that we end up with something that is understandable without being technical or misleading.

What's a recent example of misrepresentation of statistics that drove you bonkers?

I got very grumpy at an official graph of British teenage pregnancy rates that apparently showed they had declined to nearly zero. Until I realized that the bottom part of the axis had been cut off, which made it impossible to visualize the (very impressive) 50% reduction since 2000.



You once said graphical representation of data does not always communicate what we think it communicates. What do you mean by that?

Graphs can be as manipulative as words. Using tricks such as cutting axes, rescaling things, changing data from positive to negative, etc. Sometimes putting zero on the y-axis is wrong. So to be sure that you are communicating the right things, you need to evaluate the message that people are taking away. There are no absolute rules. It all depends on what you want to communicate.

Surely though, in your years of work, there must be some lessons that those involved in communicating risk—journalists, politicians, doctors and such—can take away. What are they?

There are. We know, for example, that "relative risks" can be used to look impressive. Twice a small number is still a small number. We know that talking in whole numbers—so many people out of 100—is clearer than talking in percentages or decimals. We know if done right, visual representation can often do a better job of

explaining numbers, especially to those with low numeracy.

We've used this knowledge, worked with psychologists around the world, to build guidelines for how people can best communicate risk. But there are still things that we haven't got a good answer to. For instance, we know that people think 30 out of 1,000 is bigger than 3 out of 100. We know that we make numbers look bigger by manipulating the denominator. As a statistician, the perception of numbers is new to me. I thought people would know that 3 out of 100 is equal to 3% is equal to 0.03. But they are very different!

The bottom line is that humans are very bad at understanding probability. Everyone finds it difficult, even I do. We just have to get better at it. We need to learn to spot when we are being manipulated. Changing axes on a chart is one way, but there are many other subtle ways to do it.

What if humans were perfect at understanding probability? How would things change?

Oh, we would be strange people I think. *laughs*

But maybe not. Take the example of lotteries. People know that the chance of winning a lottery is low. The probability of winning the UK jackpot is about 1 in 45 million.The way to illustrate that is: Think about a big bath, fill it to the brim with rice. That's about 45 million grains of rice. Then take one grain of rice, paint it gold, and bury it somewhere in there. Then you ask people to pay £2 to put their hand in and pull out that golden grain of rice.

That is a good image and it seems ridiculous. But people do win. Last year, there were two people who drew the winning number. So people care about the small but real chance of a huge change.

My hope would be, if we understood probability perfectly, then we would be less open to manipulation: people trying to sell things, scare others, or even falsely reassure someone. But it may not change behavior. All the studies show that, even with good risk communication, people carry on doing what they did before.

Is this why you say that, through your work, you only want to inform people, not change their behavior?

I don't particularly want to change behavior. I feel that it would be better if people lived healthier lives, so that they can see their grandchildren grow up. That would be a good thing.

But that's not my primary aim. My hope is that people are aware of the risks. That if they are doing something then they know the consequences.

This morning I was eating a carcinogen—bacon. It is classified in the same category as smoking, but I happily ate my carcinogen this morning. But I'm of aware that, if I eat bacon every day in substantial quantity, it does increase my risk of getting bowel cancer and dying earlier.

If rational decisions are not the outcome you are looking for, why bother?

Depends on what you mean by rational. I don't like that word. You could use other words like "value-congruent," which fit in with what people feel is the appropriate value. Those are the decisions they will make and not regret in the future. People will take the consequences if they feel they are autonomous human beings and have made a judgement on their own.

So not "rational" in the narrow sense of a logically perfect outcome. But if "rational" is taken to mean something broader, something in which your actions, emotions and value fit together in a coherent whole, then my hope is to that people will make rational decisions.

Poorly communicated risk can have a severe effect. For instance, the news story about the risk that pregnant women are exposing their unborn child to when they drink alcohol caused stress to one of our news editors who had consumed wine moderately through her pregnancy.

I think it's irresponsible to say there is a risk when they actually don't know if there is one. There is scientific uncertainty about that.

In such situations of unknown risk, there is a phrase that is often used: "Absence of evidence is not evidence of absence." I hate that phrase. I get so angry when people use that phrase. It's always used in a manipulative way. I say to them that it's not evidence of absence, but if you've looked hard enough you'll see that most of the time the evidence shows a very small effect, if at all.

So on the risks of drinking alcohol while being pregnant, the UK's health authority said that as a *precautionary* step it's better not to drink. That's fair enough. This honesty is important. To say that we don't definitely know if drinking is harmful, but to be safe we say you shouldn't. That's treating people as adults and allowing them to use their own judgement.

Science is a bigger and bigger part of our lives. What is the limitation in science journalism right now and how can we improve it?

The dedicated science journalists I know are very impressive people and they make a huge effort in putting out a balanced, accurate story. The problem is when science stories leave science journalists and get into the hand of general journalists. Then you do see ridiculous manipulation of evidence and story. So journalism about science has problems, especially when it leaves those who understand what's going on.

It is, of course, the ultimate challenge to be true to the facts, but also be vivid, to arouse enough emotion to make people read the story. It's terribly difficult. That's what I'm working at now. My job is to make rather unexciting things into a vivid enough story, like the effects of having alcohol or eating a bacon sandwich. Finding the drama in the mundane is the real challenge.

Currently the world is playing a waiting game on the evidence whether the Zika virus causes birth defects or doesn't. What do you think about risk communication in these conditions?

It's a classic case where precautionary measures would be better. I would say that there is sufficient evidence to take precautions, such as not getting pregnant if you or partner have been to an affected area.

It's a temporary holding measure, and it's an appropriate form of risk communication. In the future, we will be able to give a much stronger opinion. What it allows you to do is acknowledge scientific uncertainty. You don't need to claim a causal link and overstate the case, but that there is enough evidence to be cautious.

Though we don't know the exact incidence of microcephaly cases, we have an idea that the number will be low. Otherwise we would have had a much larger number of cases. On radio people talk about the "high risk" of getting microcephaly, but that's not the case. The risk is probably "higher" but it's not likely to have high absolute risk. This kind of risk communication will increase people's anxiety unnecessarily.

This is what we know. This is what we don't know. We don't know what the risks are. We are doing this to find out. In the meantime, to be on the safe side, you might want to do X, Y, and Z. That's self-empowerment if you are anxious about it. Then we will come back to you and our recommendation will change in the future. It's an adaptive and flexible strategy.

This has been the case for most pandemics. For instance, the cases of swine flu were wildly exaggerated when the outbreak began. That's not without reason, because that's precaution. But it's important to communicate that the figures are temporary and they will be updated as we gather evidence.

Read next: The WHO botched Ebola—but it's winning praise for handling the terrifying Zika epidemic

THE BIG PICTURE

Mesmerizing infographics stitched together from millions of selfies and snapshots

Anne Quito | 1 hour ago

Real data. (Pelle Cass/Used with permission. © Gestalten 2016)

The next frontier in infographics is already on your mobile phone.

In 2015, people around the world took a staggering 1 trillion photographs, according to research firm InfoTrends. By 2017, 4.9 trillion images will be stored online. But what good is this deluge of selfies, dog pictures, travel snapshots, and obsessive food photos? New York-based information designer Nicholas Felton thinks they could be the basis of a striking new kind of data visualization he calls "photoviz."

"We are awash in images and surrounded by cameras. As with data, the quantity of imagery produced today exceeds our capacity to understand it," writes Felton in the introduction to a new book he co-edited, titled *PhotoViz: Visualizing Information Through Photography*.

Best known for producing beautifully-printed annual reports about his personal activities and for designing Facebook's Timeline feature, Felton believes that photographs can help make sense of the world, with a different kind of precision from illustrated charts, diagrams and infographics.

"What I love about these projects is that they don't require their subject to be rigidly

quantified," Felton says to Quartz. "A subject like the stock market is inherently numerical, and representing it graphically is natural. For the rest of the world, a photographic approach can make more sense and precision takes different forms. A chart is accurate to its subject by preserving the numbers it represents. On the other hand, a photoviz of a person aging, or an athlete in motion retains a precision to its subject that would be lost in a conversion to data."

(Gestalten 2016)

The cover of the book, scheduled to be released by publisher Gestalten in the US in April, makes his point: A surreal "photo" shows a fleet of planes taking off simultaneously, created by stitching together 400 separate images that photographer Mike Kelly shot and composed over the course of 16 hours at the Los Angeles International Airport. Kelly's photorealistic image, inspired by a 2005 concept by Korean artist Ho-Yeol Ryue, dramatically illustrates activity in the fifth busiest airport in the world.

Here's a sampling of further experiments with this perspective-shifting data visualization technique, from *PhotoViz*:

The passage of time

Claude Monet painted the Rouen Cathedral in France more than 30 times in two years, to produce his famous atmospheric series. In *PhotoViz*, artist Fong Qi Wei collaged together 36 pictures to capture sunset over the Seine river.

:alten 2016)

Using a slit-scan camera, Hungarian photographer Adam Magyar appears to freezes time with his elongated panorama-like tableau. The image documents activity in one sliver of the landscape over a period of time, with his camera fixed on one spot. The people on the far right of the frame passed his camera first, and the truck on the left rolled in last.

estalten 2016)

Below, Dutch web developer Babak Fakhamzadeh layered 19th century scenic postcards of Freetown, Sierra Leone over present-day snapshots to produce this efficient and revelatory image about the changes in the urban landscape over time.

n. © Gestalten 2016)

Getting old

Photographer Bobby Neel Adams reassembles photographs in a technique he calls “photo surgery” to vivify the aging process.

AGEMAPS & FAMILYTREE_
BOBBY NEEL ADAMS

WHEN I GROW UP

The passage of time and family relationships documented by tearing and recombining photos

Eschewing digital manipulation, Bobby Neel Adams uses what he calls photo-surgery to create these two-piece collages. Two photos of each subject in the same pose are scaled and printed, and then carefully torn and reassembled. The tears add an interesting organic, physical element to the resulting images, which sets them apart from other before/after visualizations. The technique can matter as much as the artist's intent, since a visualization is not just a means of transmitting data but also an aesthetic product. Had Adams simply split the paired images in half down the middle using Photoshop, the results would be far less engaging.

035

This meticulously composed self-portrait by Canadian interaction designer Dylan Mason was made by aggregating 365 selfies taken over the course of a year.

stalten 2016)

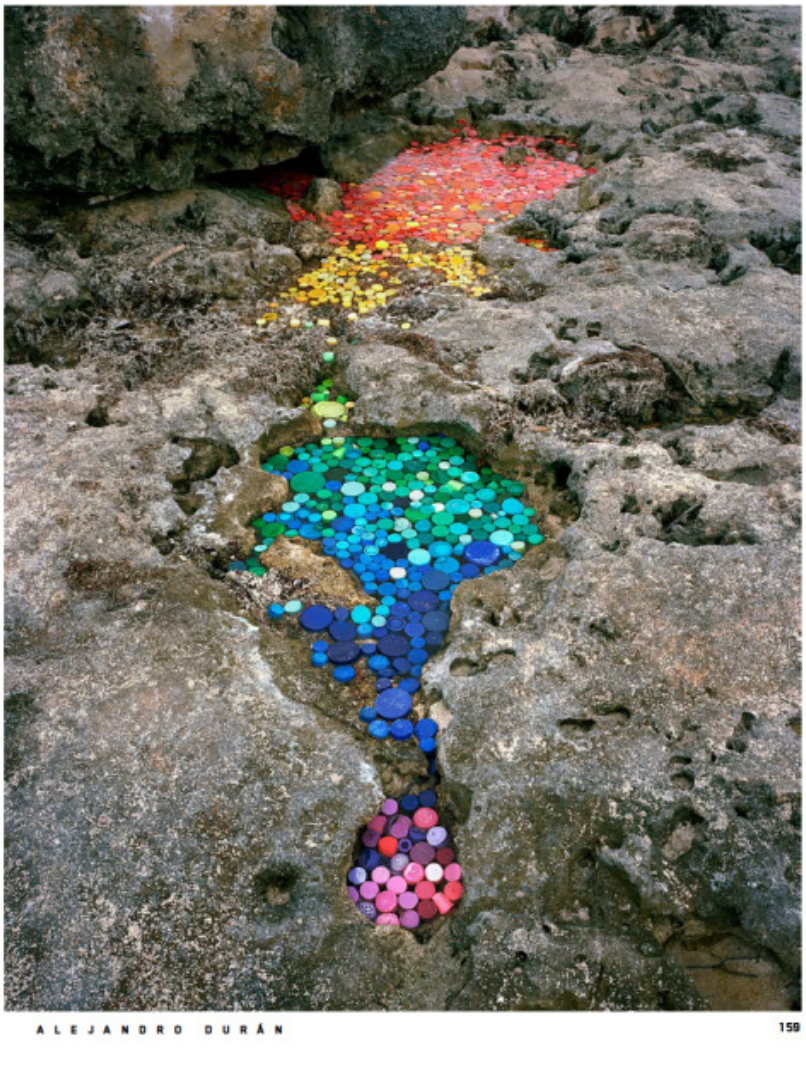
The things we touch

Reminiscent of the satisfying Tumblr blog Things Organized Neatly, ethnographer Paula Zuccotti creates evocative portraits by taking photographs of all the objects a person touched over the course of 24 hours, and arranging them in a neat grid.

estalten 2016)

Picturing pollution

For a series called “Washed Up,” Mexican multi-media artist Alejandro Duran collects bits of plastic trash that washes up along the coastline of a protected reserve, and arranges them by color to draw attention to the worsening pollution of the world’s oceans.



Gestalten 2016)

Gestalten 2016)

Constructed coincidences

“Nothing has been changed, only selected,” wrote Boston-based artist Pelle Cass about his startling compositions that depict fake coincidences. This park overrun by dogs was created with 300 exposures over an hour, and recomposed in 150 layers in Photoshop.

lten 2016)

Reflecting on the growing number of photoviz-type images that he collects on his Tumblr, Felton thinks that our stance about hoarding photographs and terabytes of data will change over time. “I hope that this means we start to treat photographs as a more disposable medium. Historically, the cost and effort of producing a photograph imbued it with value that made it hard to dispose of,” Felton says on Gestalten’s website. “When photography is free and universal, it might be best to let our understanding of photography evolve as well, allowing photographs to be more transient.”

WELL ACTUALLY

Trump says he would halt oil

imports from Saudi Arabia, but could the US survive without them?

Melvin Backman | 3 hours ago

What's the big deal? (Reuters/Jim Bourg)

Was that just Donald Trump's trademark bluster on display when he told the New York Times (paywall) that he would "probably" be willing to cut off US oil imports from Saudi Arabia until the Saudis sent in ground troops against ISIS? Or is it feasible that the US would suddenly stop buying crude from its second-biggest foreign supplier?

Well, as Trump himself points out, the idea isn't as crazy as it once seemed. For starters, the US is producing a lot more oil than it used to, thanks to all the shale drilling that's going on now. As Trump notes:

"You know, we needed, we needed oil desperately years ago. Today, because –

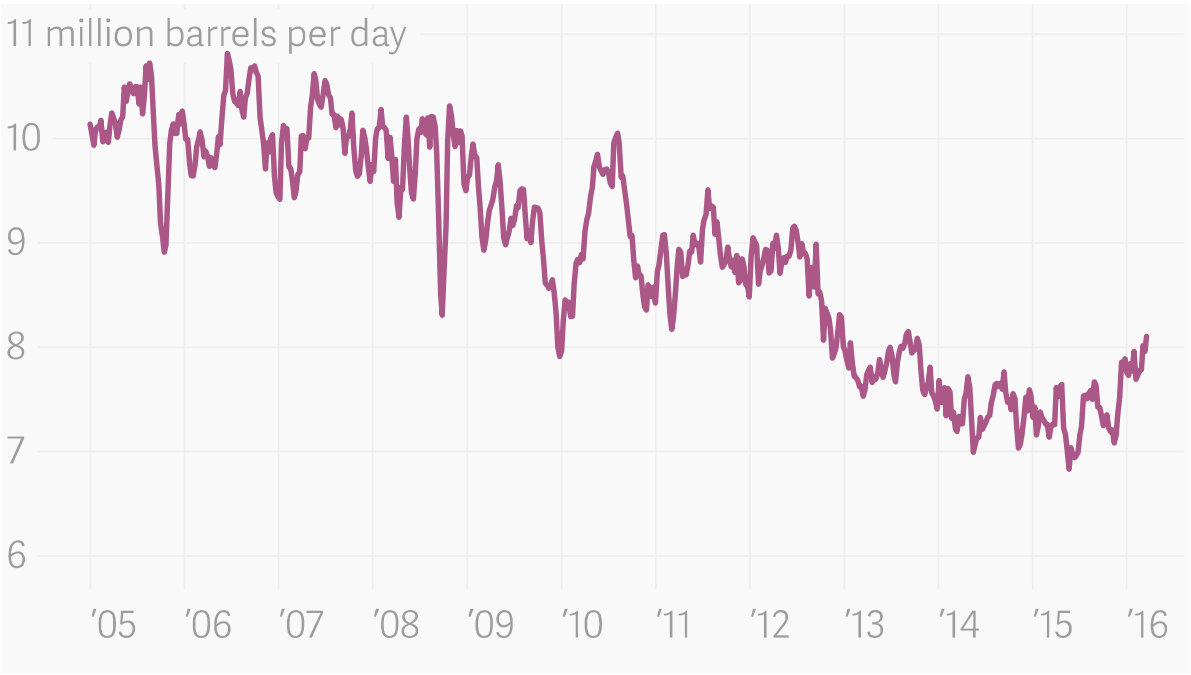
again, because of the new technologies, and because of places that we never thought had oil, and they do have oil, and there's a glut on the market, there's a tremendous glut on the market, I mean you have ships out at sea that are loaded up and they don't even know where to go dump it. But we don't have that same pressure anymore, at all."

US crude oil production

ATLAS | Data: US Energy Information Administration Share

And indeed, the sharp increase in domestic production has led the US to import a lot less oil than it used to.

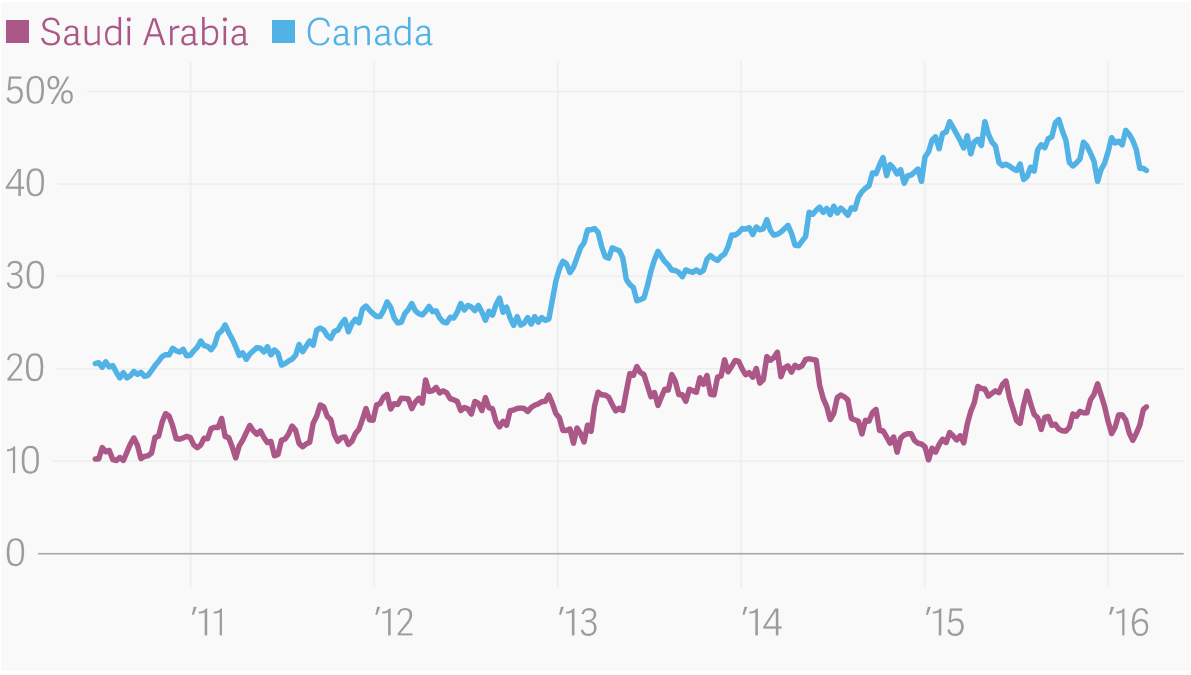
US crude oil imports, four-week average



ATLAS | Data: US Energy Information Administration Share

But when the US does import, it's looking first to Canada.

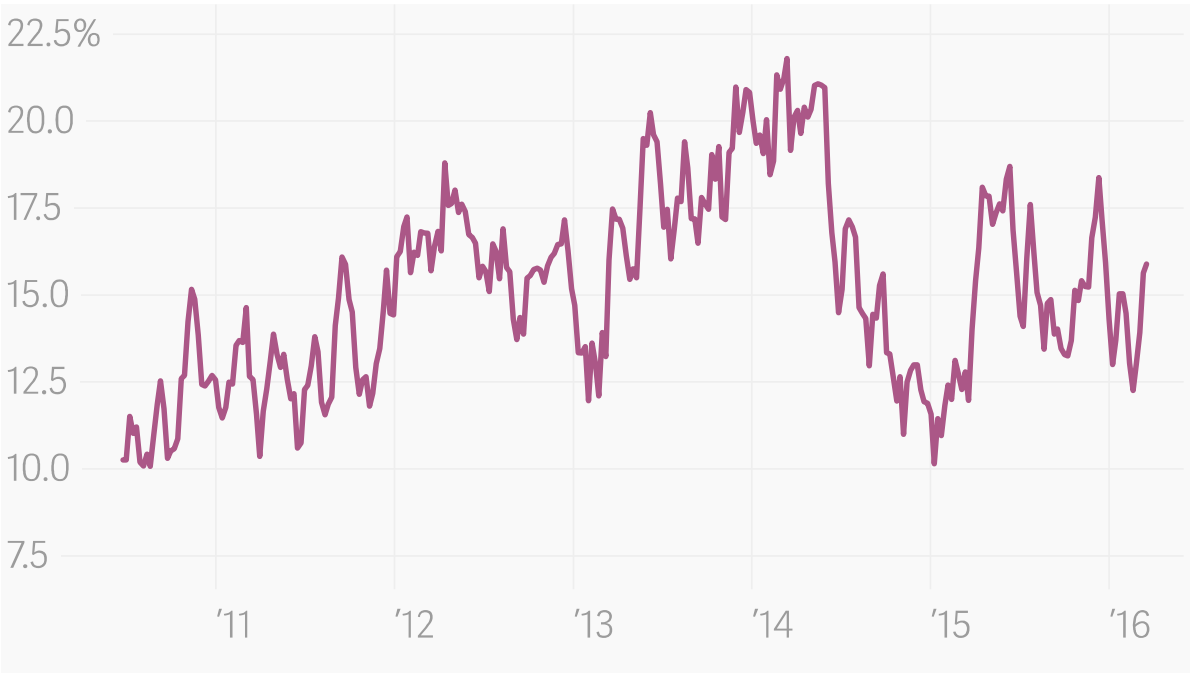
Share of US crude oil imports



ATLAS | Data: US Energy Information Administration Share

In fact, between the first quarter of 2014 and the beginning of 2015, the Saudi share of crude oil imports was cut in half, following years of gains.

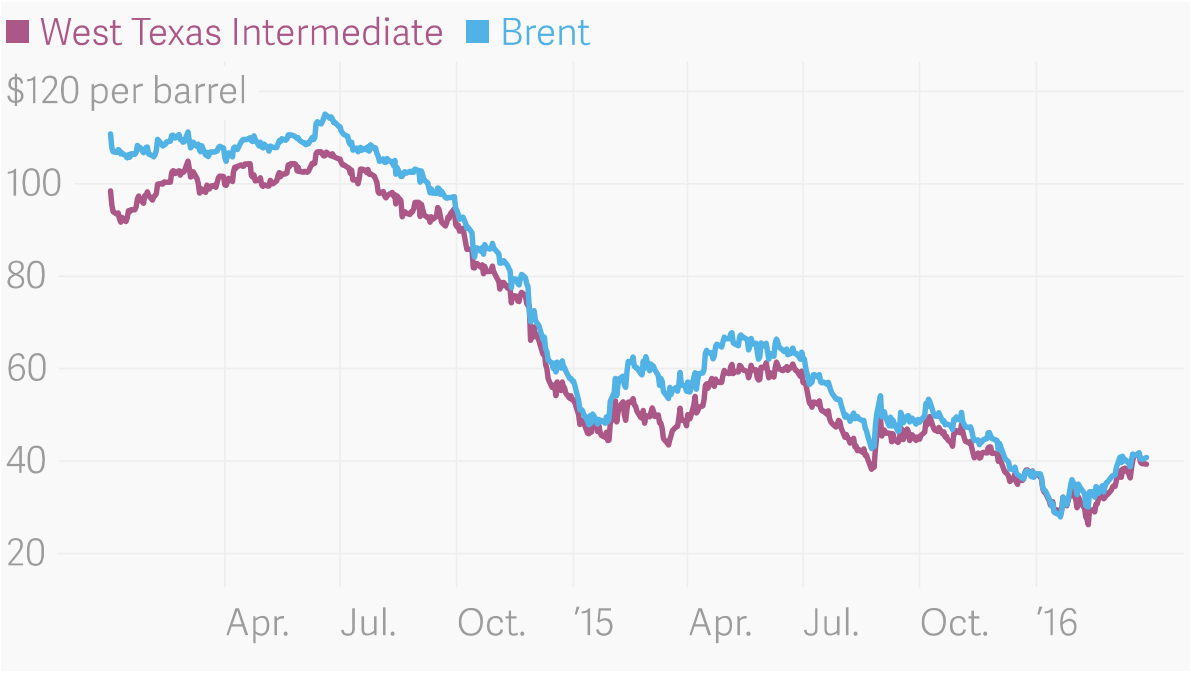
Saudi portion of US crude oil imports



ATLAS | Data: US Energy Information Administration Share

No surprise, when one of the world's energy consumers begins weaning itself off of foreign crude, it upsets the market. It certainly upset Saudi Arabia, which in turn use its OPEC stature to keep up production and battle US producers for market share. The decision to keep the spigot open sent oil prices crashing, and they've yet to fully recover.

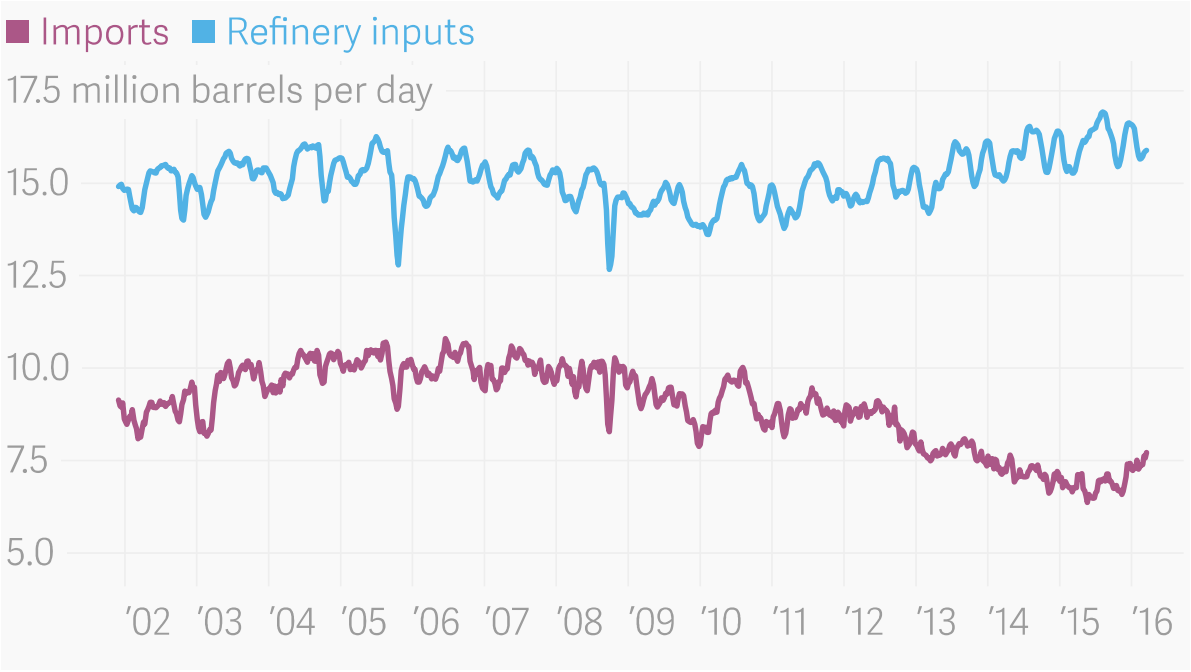
Crude oil futures price



ATLAS | Data: FactSet Share

So is Trump right? Can the US go ahead and finish the job that shale oil started? After all, America is far less dependent on crude imports than it was just a few years ago. Surely there's not much harm in cutting those imports by another 15%.

US crude oil imports vs. inputs, four-week average



ATLAS | Data: US Energy Information Administration Share

Never mind that Saudi Arabia's state-owned oil company controls the largest oil refinery in the US. Saudi Aramco's recently acquired Motiva facility in Port Arthur, Texas, can process up to 600,000 barrels of crude a day—but that's not even 4% of overall US refinery capacity.

However, assuming that a president Trump could somehow marshall the political capital to impose an embargo on Saudi crude, the possible costs would go far beyond that of oil. For example, how comfortable would the US be if Saudi Arabia were to retaliate by dumping its unknown but certainly sizable Treasury debt holdings or cutting off a lucrative market for US weapons manufacturers? And could Washington ever get comfortable depriving a key ally in the Middle East of a major export market for the product that provides almost all of its government revenue—before the OPEC leader's fledgling economic reforms can fully soak up a generation of educated, newly underemployed young men (paywall)?

The answer there is probably not.