Models.Behaving.Badly

Union Investment

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Summary

Epistemology: How do we understand the animate and inanimate worlds?
Theories, Models, Intuition, Data.

Theories stand on their own feet, rely on no analogies.
They try to provide absolute knowledge.

Models stand on someone else's feet.
They are metaphors that explain the world we don't understand in terms of worlds we do.

Models tell you what something is more or less like. **Theories** try to tell you what something is.

The **equations** of physics and finance resemble each other, but their semantics is very different.

Physics has astonishingly successful theories and some very good models.

Financial has only not-very-good models – analogies, idealizations that always sweep dirt under the rug. Responsible modelers have an obligation to make the the dirt explicit.

What are the consequences for finance, banking and society?

Ways of Knowing

- How do we approach understanding the world?

- The great triumph at the dawn of modern science: the understanding of gravitation and motion

- For millennia after the Greeks, scientists' prejudices led them describe all planetary movements in terms of circles about a stationary earth.

- But the motion of a planet, as seen from the orbiting earth itself, is too complicated for a single circle and so it needs circles moving on circles moving on

- Eventually, Copernicus pointed out that the earth wasn't stationary, that the earth and planets orbited the sun, and that the planets' weird apparently retrograde motions were not intrinsically theirs but rather a consequence of their being observed from the moving earth.

Kepler's Laws

- In the early 1600s Kepler examined the data on planetary positions and formulated his three astonishing laws of planetary motion:

    - planets move in ellipses about the sun;

    - the line between the Sun and a planet sweeps out equal areas in equal times;

    - the square of the orbital period is proportional to the cube of the distance from the sun.

Kepler's 2nd Law

- If you want insight into the miracle of discovery, think about Kepler's second law.

- The line between the Sun and a planet sweeps out equal areas in equal times;
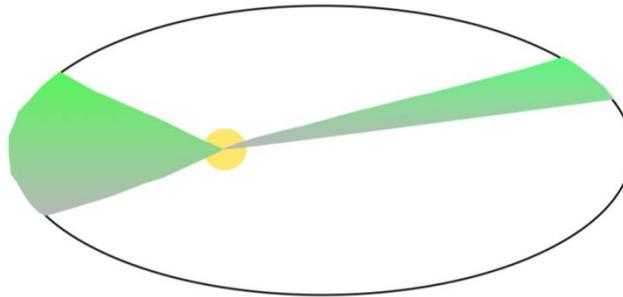
- This deep symmetry of planetary motion implies that the closer the planet to the sun, the more rapidly it moves, as shown.

- *There was no line* between a planet and the sun for Kepler to observe. His data consisted of planetary positions in the night sky.

- How then did he decide to describe the motion of the planets in terms of an invisible imaginary line?

- No one knows exactly, but it involved long immersion, struggle, and strange associative thinking that arose from somewhere inside him, and then - Aha! - intuition, followed by checking the data.

Newton

- Kepler's laws described the patterns of the planets, but not their causes.

- Newton found a cause; he showed that Kepler's laws were a mathematical consequence of Newton's own theories:

  - *Theory* of gravitation (the inverse square law of attraction) and

  - Laws of motion (Force = mass times acceleration).

- How did Newton discover his theories? For sure, the orbiting planets and falling apples didn't announce the laws that drove them.

Modes of Understanding 1: Intuition

- It takes intuition to discover the nature of the world.

    - Kepler, Newton, Ampere, Maxwell, Einstein, Dirac ...

- Intuition may sound casual but it takes intimate knowledge of the world acquired by careful observation and painstaking effort.

- Keynes on Newton:

  I fancy his pre-eminence is due to his muscles of intuition being the strongest and most enduring with which a man has ever been gifted ...I believe that the clue to his mind is to be found in his unusual powers of continuous concentrated introspection … His peculiar gift was the power of holding continuously in his mind a purely mental problem until he had seen straight through it.

- Maxwell on Ampére

  "We can scarcely believe that Ampere really discovered the law of action by means of the experiments which he describes. We are led to suspect, what, indeed, he tells us himself, that he discovered the law by some process which he has not shown us, and that when he had afterwards built up a perfect demonstration, he removed all traces of the scaffolding by which he had built it."

- The observer becomes so close to the object (or person) observed that he begins to experience their existence from both outside and inside them. Intuition is a merging of the observer with the observed.

Modes of Understanding 2: Theories

- Theories are deep descriptions of the laws of the world.

- They can be right, partially right or totally wrong.

- What all theories have in common is that, like God's voice to Moses in the desert, they proclaim:

I am what I am.

- Theories stand on their own feet. They are not analogies, but facts.

- Newton's laws have been supplanted by Einstein's, but that doesn't mean that Newton is an approximation to Einstein. Both Newton's and Einstein's are theories.

- Newton is to Einstein as cursive is to typing, or as navigation by the stars is to the Global Positioning System.

- Two different approaches reach the same end by different means, with different accuracies. One doesn't approximate the other. Both are theories that describe the facts.

- <u>Maxwell's Equations for light</u>

$$\nabla \cdot \mathbf{B} = 0 \qquad \nabla \cdot \mathbf{D} = \rho$$
$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \qquad \nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$$

- <u>The Dirac equation for the electron:</u> $(-i\partial\!\!\!/ + m)\psi = 0$

- When presented with a theory, you cannot ask: Why? It is what it is. Ask: Does it work?

- Goethe: One day we will realize that every fact is really a theory. Two sides of same coin.

A Non-Physics Theory …Spinoza's Theory of Emotions as Derivatives

- Spinoza's treats emotions like Euclid treats geometry: emotions are derivatives.

  - Primitives are Desire, Pleasure, Pain.

- *Good* is everything that brings pleasure, and *Evil* is everything that brings pain.

- Love: Pleasure associated with an external object.

- Hate: Pain associated with an external object.

- Envy: Pain at another's Pleasure.

- Hope: Expectation of future Pleasure tinged with doubt.

- Fear: Expectation of future Pain.

- Cruelty: Desire to inflict Pain on a someone Loved.

- Three more primitives:

  - Vacillation, Wonder, Contempt.

Spinoza's Theory of Emotions as Derivatives

Modes of Understanding 3: Models

- The next mode of understanding is a *model*.

- A model compare something we don't understand to something we already do. It's an analogy.

- When presented with a model, you must ask: Why? What justifies the analogy?

- The famous *liquid drop model* of the atomic nucleus pretends that the nucleus is a drop of water that can vibrate and rotate and even fission into two. Useful, picturesque, but not entirely true.

- Similarly, the *Black-Scholes financial option model* compares the uncertain movement of stock prices to the diffusion of smoke from a cigarette tip. Useful, up to a point -- but *not fact.*

- ***Theories tell you what something is. Models merely tell you what something is more or less like.***

- Models are metaphors, graven images of reality but not reality itself.

- Models are analogies whose incautious use can unleash all the dangers of idolatry that God warned against in the second of his commandments.

Modes of Understanding 4:
Data & Statistics

- There's one final mode of understanding: the statistical analysis that lies behind Big Data.

- Statistics seeks to find past tendencies and correlations in data.

- Often people assume they will persist.

- Correlation does not imply causation.

- Big Data is useful, but is not a replacement for the classic ways of understanding the world.

- It is most useful in corporate and political advertising, it's main triumphs so far.

- Darwin 1861: "About thirty years ago there was much talk that geologists ought only to observe and not theorize, and I well remember some one saying that at this rate a man might as well go into a gravel pit and count the pebbles and describe all the colours. How odd it is that anyone should not see that all observation must be for or against some view if it is to be of any service!"

- Data has no voice. There is no "raw" data. Choosing what data to collect takes insight; making good sense of it requires the classic method (cf. Kepler).

- You still need a model, a theory, or intuition to find a cause.

- Wittgenstein:
  "Philosophy is a battle against the bewitchment of our intelligence by means of language"
  I take that to mean that language can deceive our natural intuition, and we need philosophy to reclaim it.

- In a similar sense, science is a battle against the smothering of our intelligence by data.

Some Remarks
on
Social Science Models

1. Finance is Simple

- There is only one reliable "law." If you want to know the value of something, find something similar whose price the market tells you.

- Or more formally: Any two securities with identical future payoffs, no matter how the future turns out, "should" have identical current prices.

- If you want to know the value of a financial (*target*) security, use the known price of another *replicating portfolio* that's as similar to it as possible.

- To build a model:

  ① Specify all future scenarios that lead to payoffs (*science*).

  ② Prove similarity of payoffs of target and replicating portfolio (*engineering*).

- The *science* is the root of all troubles. There is no accurate theory for the future scenarios of people. There are only models. Specify your one.

2. The Right Way to Use Financial Models

- They are all wrong so assume as little as possible.

- Finance isn't math. Avoid axiomatization.

- In physics it pays to drop down deep, formulate a principle, then come back up again. In finance, shallow is better.

- Sweep dirt under the rug, but tell people about it.

- Think of models as *Gedanken* experiments.

3. The Financial Modelers' Manifesto

- I will remember that I didn't make the world, and it doesn't satisfy my equations.

- Though I will use the models I or others create to boldly estimate value, I will always look over my shoulder and never forget that the model is not the world.

- I will not be overly impressed by mathematics. I will never sacrifice reality for elegance without explaining to its end users why I have done so.

- I will not give the people who use my models false comfort about their accuracy. I will make the assumptions and oversights explicit to all who use them.

- I understand that my work may have enormous effects on society and the economy, many beyond my apprehension.

- MODELERS OF ALL MARKETS, UNITE!
  You have nothing to lose but your illusions.

4. A Digression About *Nudge*

- In the social sciences all models are wrong too, so beware of people using models on other people.

- ***Nudge* is Thaler and Sunstein's attempt to use psychology and economics to manipulate people's choices. Libpat.**

- If you grew up in South Africa, Russia, Eastern Europe, China, E. Germany under a totalitarian system, you hate to be controlled …

- In those countries, you wanted freedom from control, interference, from someone else (thinking) they know what's good for you.

- Therefore, I suspect, Nudge's appeal lies with W. Europeans and Americans, who haven't experienced government control yet.

- It's ironically logical therefore, that Nudge's biggest proponents are tenured academics who themselves are about as free of control as is possible, but apparently want to manipulate others.

- Let adults be adults. There's very little benevolent power in this world, and what there is doesn't last long.

5. Ten Principles I Like

1. Everyone is a grownup and no one is more grown up than anyone else.

2. Your words are as valuable as money.

3. A few things are illegal; the rest is up to you.

4. If you want the benefits of taking risk, you must also suffer the disadvantages.

5. Printing money cannot solve political or spiritual problems. It only postpones them.

6. Don't treat only some people's insolvency as illiquidity.

7. Optimization in human affairs is an illusion. (You always need more capital than you think)

8. Corporations are neither governments nor people. Limit their power.

9. Provide golden parachutes for no one; provide tin parachutes for everyone.

10. "If you believe that capitalism is a system in which money matters more than freedom, you are doomed when people who don't believe in freedom attack using money."*

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- * Quote courtesy of Edward Lucas' book *The New Cold War: Putin's Russia and the Threat to the West*.