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Finance in the Fifth Dimension: Lessons in Logic for the Social Sciences

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Finance in the Fifth Dimension:

Lessons in Logic for the Social Sciences

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INTRODUCTION

Intentions

Economics is an odd science (or, for you academic purists, it is an odd *discipline*). Its roots lie in philosophy. It is highly political and inherently behavioral, and yet it is firmly grounded by mathematics. As economists, therefore, we mustn't limit ourselves to economics; in doing so we fail to understand how the science was originally synthesized and thus how it may be applied and how it may progress.

The purpose of this paper is to highlight lessons from various areas of academia that I feel would benefit all social science. I will discuss physics, biology, sociology, and more, doing my best to explicitly state their relationships to economics throughout the paper. I hope that the lessons learned here will together serve as a means for prescribing and evaluating solutions to social problems and assist in the development of models through a new level of methodological dimensionality where applicable.

Dimensionality

In physics and mathematics, a dimension is some measurable extent of the universe. With the addition of each dimension, therefore, our understanding of the world and how we fit into it increases.

In visualizing the first dimension, we plot two points on a single axis, which we perceive as a line. We can then add a second axis to form a plane and perceive two-dimensional space. Here, our universe can contain shapes such as triangles and squares. The third dimension gives our universe depth, and our shapes are allowed to become pyramids and cubes. It is here that we perceive the concept of space. In the fourth dimension, we extend our universe through time, allowing it to change. Our pyramids can crumble, and we can roll our cubes on the table for a Yahtzee. Much like plotting a point (x,y) on a two dimensional graph, we can plot an object's temporal position in three-dimensional space relative to time.

The fifth dimension is where things usually get tricky for physicists. Here, we see our universe, but we also see one slightly different. This alternate universe began with the Big Bang, like ours, and exists in the same position as ours, but embodies what our universe might have been. It is a product of possibility and thus grants us the power to observe the similarities and differences between two worlds, two outcomes, or two applications of the same theory.

I'll be using the fifth dimension to conceptually illustrate methodological approaches to interpreting and explaining economic phenomena, but it is worth noting that the fifth dimension—called probability space—does make scientific sense. The “multi-verse” or “many worlds” interpretation of quantum mechanics suggests that every possible outcome for our universe is equally

real, but we as observers can only see one of them at a time. None the less, we will focus on the theoretical applications of probability space as a way of thinking about and in examining social science. The fifth dimension will serve to metaphorically illustrate this new way of thinking, through which we will construct a theoretical framework that applies three lessons we'll learn from various realms of academia.

How to Blow a Bubble

In understanding the development of any useful model (and perhaps applying fifth dimension analytical principles to other models) it is undoubtedly crucial to understand the basics of bubble theory and why I include the factors that I do. So, a brief lesson is in order.

A financial bubble is a rapid inflation of an asset's price succeeded by a rapid contraction. In the discipline as a whole, there is not a uniform explanation as to what causes financial bubbles or why they pop when they do. There are, however, two main themes that are supported by the literature that play a complimentary role.

There is evidence to suggest that socio-psychological factors play a significant role in bubble formation—a role that is necessary but not sufficient to generating a bubble. The most prominent of these behavioral factors is momentum trading, the phenomenon in which investors buy and sell in the direction of the current market trend. This makes markets much more volatile

as positive feedback loops are established and subsequently abandoned. New technology can create a frenzied market culture of, say, internet fanatics that make large, frequent trades that increase volatility. Web-based companies in the late 1990's certainly sunk their teeth into investors propensity to react strongly to popular trends, resulting in the dot-com bubble. Since much of this behavior is culturally motivated, it can vary widely by asset class and across time.

Perhaps a more predictable cause of financial bubbles is excess liquidity. Liquidity is positively related to relaxed borrowing standards and high disposable incomes. In the case of the Great Recession, expansionary monetary policy reduced interest rates and lax regulation allowed unprecedented amounts of leveraged speculation. Large disposable incomes increased the trade volumes in asset and equity markets, and all this together made the markets vulnerable to short-term speculative practices. More generally, I turn to an explanation by Paul Krugman, who pointedly notes the problem with highly liquid markets:

“[Individual crises] aren't just a series of unrelated accidents... What we're seeing is what happens when too much money is chasing too few investment opportunities.”

Although the literature offers a vast array of potential causes, liquidity and psychological factors are the most persistent, and the only ones necessary for the discussions to follow.

LESSONS

Curiosity and Crisis

“Why?” is a uniquely human question. Other animals are certainly curious, but they tend not to worry about the reasons or causes of things. In part, this quality is evolutionary—we must be curious in some respects because if we do not understand the mechanisms of the world around us, we surely won’t last long. Human curiosity, however, seems to puzzle many evolutionary theorists because we exhibit the quality in amounts that far exceed the requirement for survival (and often times get us into trouble). One popular belief amongst psychologists and evolutionary biologists is that explanation serves as a coping mechanism. That is, the better we think we understand something, the less we fear it.

This is, of course, an excellent means for optimizing behavior directly through one’s own trial and error or indirectly through the analysis of others. It isn’t until we misunderstand, however, that things don’t go our way.

In the years leading up to the Great Recession, for example, and even after the crisis had begun, many in the industry had no conception of the impending crash. The banks that sold bad CDO's (i.e. Lehman and Bear Sterns) had fundamentally miscalculated market risk and (in the former case) the government's willingness to act when the company's life was at stake.

Looking back, every person who misunderstood the financial terrain of the time could undoubtedly explain what went wrong and how their failures were manifested over a specific period of time. As a matter of fact, any high schooler who's seen the Big Short could tell you that the financial crisis was due to the housing crash. An economist might further explain that the crash in question is the popping of the subprime mortgage bubble—a product of low interest rates, financial innovation, securitization, lax regulation, and reckless lending—and that that in and of itself is a mere piece of the puzzle, as there were many complementary factors that contributed to the problem.

But suppose there were no crisis—that is, suppose all circumstances were the same, but the housing bubble settled, and the market was able to tolerate its own risk, and the banks did not fail—could the economist explain this? I pose that he could. Economists, after all, are an intelligent bunch.

Further, I suggest that his ability to explain both circumstances equally well represents a fundamental flaw in the social sciences. The problem is that the economist could make sense of both situations because he is explaining retrospectively, analyzing what happened and what caused it to happen rather

than what could've happened and what did or didn't cause it to not happen. If we asked him five years (or even five weeks) before the beginning of the Great Recession what the biggest threat to the American economy was at the time, could he have answered? Would his reasons be the same? Would he have predicted the collapse?

It is very likely that the answer to all of these questions is no, as there were very few economists, bankers, and financiers that were worried about the state of the economy at the time, and fewer still that predicted the housing crash.

Put more simply, after an event occurs, our explanation places far too much weight on what happened than on what could've happened but did not. And, given that it is human nature to analyze only that which is sufficiently interesting or important, we account for only a small portion of events that may contribute to our understanding and fail to consider whether this understanding is temporally consistent. This creates incalculable logical vulnerabilities, especially when reasoning through relatively isolated events such as financial bubbles and it is therefore imperative to limit these vulnerabilities so that our curiosity does not turn against us the dangerous tool that is our explanatory power.

In the next section, we'll take a step back from economics and analyze the logical complications of retrospection from a socio-psychological perspective.

The American Soldier

Sunday, December 7th, 1941: 353 Imperial Japanese planes launch from 6 aircraft carriers in the central pacific to attack Pearl Harbor, Hawaii. The attack kills more than 2,400 Americans in 120 minutes and leads to the formal entrance of the United States in WWII 24 hours later. Over the next 4 years roughly 11% of the US population, or 16 million Americans serve in the military and more than 400,000 of those Americans die.

During the war, a small, temporary branch of the Information and Education Division of the US War Department began conducting research. The agency completed 300 studies consisting of more than 600,000 interviews dealing with various stages of a soldier's life and military experience. In a 1949 review of the study, sociologist Paul Lazarsfeld presented his readers with various findings, three of which I will discuss:

- A. Soldiers from rural backgrounds were usually in better spirits during their Army life than soldiers from city backgrounds.
- B. Southern soldiers were better able to stand the climate in the hot South Sea Islands than Northern soldiers.
- C. White soldiers were more eager to become non-coms than black soldiers.

Lazarsfeld explains that men from rural backgrounds are more used to poor living standards and demanding physical labor compared to city-dwelling men,

and therefore do not react as negatively when presented with harsh wartime environments. Southern soldiers could better adapt to the heat in the South Pacific because they were used to sweltering conditions back home. African Americans were heavily discriminated against in the 1940's. Jim Crow laws were still in place and the nation was heavily segregated—Martin Luther King Jr would not give his “I Have a Dream” speech for another *twenty* years. It makes sense, then, that black soldiers are not overzealous about fighting for a country that systematically repressed them. And it certainly makes sense that they would not be *more* motivated than white soldiers to seek promotion within an institution that asks them to die fighting for the rights of others when their family members at home could not eat at the same restaurants, go to the same schools, or apply for the same jobs as everyone else.

This all seems obvious. Or, at least, it all makes sense. It makes so much sense, in fact, that Lazarsfeld's readers are shocked to find that the results presented to them by the author are actually the exact opposite of the study's true findings. That is, men from city backgrounds, not men from rural backgrounds, are typically in better spirits during wartime. Southern soldiers had, at the very least, just as much trouble adapting to the heat of the South Sea as northern soldiers, and blacks were significantly more motivated to attain higher ranks than their white counterparts.

Thinking through this new information, we should be able to explain it with relative ease. I urge you to first reason through all three findings on your own,

but we will analyze finding A together: During their time in the Army, city men are typically in better spirits than rural men because they are more used to crowded living conditions and strict chains of command, both of which are prominent aspects of military service.

This makes sense. One can imagine, even, that if presented with this finding and its explanation in place of its aforementioned opposite, then it would seem obvious. Herein lies the problem with retrospective reasoning. We could've taken either the true finding or the false finding as fact and justified each equally well. None of this is to say that retrospective reasoning is of insignificant value, nor does it imply that social scientists are in some way mistaken in its usage. What it does suggest is that, although this is a very necessary logical tool, it is also a very dangerous one, and social scientists are often mistaken in its application—Hindsight may be twenty-twenty, but we may be looking far too closely.

A Defense of the Reviled

Given an example of conflicting retrospective analyses in simple terms, we can now ask what led many revered economists and organizations to so grossly misjudge the economic conditions of 2007 and 2008 and fail to predict the impending crisis.

“It is not just that they missed it, they positively denied it would happen.”

--Franklin Allen, Wharton School of Business

In order to do the crisis retrospective justice, I won't explain it myself. Instead, I'll let former Federal Reserve Chairman Ben Bernanke give his assessment of the period's macroeconomic conditions. The following statements are selected according to relevance from the Semiannual Monetary Policy Report to Congress before the Committee on Financial Services in June of 2007. At this time, housing prices had already begun to fall, and worries were mounting in the subprime mortgage industry.

“After having run at an above-trend rate earlier in the current economic recovery, U.S. economic growth has proceeded during the past year at a pace more consistent with sustainable expansion... the demand for labor has remained solid, with more than 850,000 jobs having been added to payrolls thus far in 2007 and the unemployment rate having remained at 4-1/2 percent...

To a considerable degree, the slower pace of economic growth in recent quarters reflects the ongoing adjustment in the housing sector... Although a leveling-off of home sales in the second half of 2006 suggested some tentative stabilization of housing demand, sales have softened further this year... Sales should ultimately be supported by growth in income and employment as well as by mortgage rates that--despite the recent increase--remain fairly low relative to historical norms...

“Consumption outlays are likely to continue growing at a moderate pace, aided by a strong labor market. Employment should continue to expand, though possibly at a somewhat slower pace than in recent years... Real compensation appears to have risen over the past year, and... should rise further as labor demand remains strong and productivity increases... Like consumption spending, business fixed investment overall seems poised to rise at a moderate pace, bolstered by gains in sales and generally favorable financial conditions. The global economy continues to be strong. Supported by solid economic growth abroad, U.S. exports should expand further in coming quarters...

For the most part, financial markets have remained supportive of economic growth. However, conditions in the subprime mortgage sector have deteriorated significantly, reflecting mounting delinquency rates on adjustable-rate loans. In recent weeks, we have also seen increased concerns among investors about credit risk on some other types of financial instruments. Credit spreads on lower-quality corporate debt have widened somewhat, and terms for some leveraged business loans have tightened. Even after their recent rise, however, credit spreads remain near the low end of their historical ranges, and financing activity in the bond and business loan markets has remained fairly brisk...

Overall, the U.S. economy appears likely to expand at a moderate pace over the second half of 2007, with growth then strengthening a bit in 2008...

Federal Reserve has been active in implementing, interpreting, and enforcing consumer protection laws... Promoting access to credit and to home ownership are important objectives, and responsible subprime mortgage lending can help advance both goals... Financial losses

have subsequently induced lenders to tighten their underwriting standards. We are conducting a top-to-bottom review of possible actions we might take to help prevent recurrence of these problems...

We already have improved a disclosure that creditors must provide to every applicant for an adjustable-rate mortgage product to explain better the features and risks of these products... In coordination with the other federal supervisory agencies, last year we issued principles-based guidance on nontraditional mortgages, and in June of this year we issued supervisory guidance on subprime lending. In addition, we reviewed our policies related to the examination of nonbank subsidiaries of bank and financial holding companies for compliance with consumer protection laws and guidance...

Agencies will collaborate in determining the lessons learned and in seeking ways to better cooperate in ensuring effective and consistent examinations of and improved enforcement for nondepository mortgage lenders..."

The sections I've pulled from Bernanke's speech are lengthy, but I feel that this length is necessary to communicate the actions and understanding of the government. The Fed was not oblivious to the risks that underlay the market, but these risks seemed to be limited by both a strong economy and increased regulatory action. Based on Bernanke's assessment of the economy and the strides taken to mitigate its vulnerabilities, I pose that we could've explained 2008 equally well if the financial crisis never happened. Bernanke's statements are not ignorant or ill informed. The outlook is not only optimistic, but macroeconomically supported. So, in general, the only reason people stopped believing that the economy was not only stable but would continue to expand is because the crash *did* happen. That is, just as Lazarsfeld's initial list of "facts" led us to conclude untrue statements about specific characteristics that were logically compatible with the false notion that rural men were often in better spirits than city men during the war, the theory that US banks in the late 2000's had limited risk through securitization and that high housing prices could be supported by economic growth led many economists to

conclude that the financial practices of the time posed no major threat to the banking system or the economy overall.

Lesson 1: Retrospection.

In assessing the past, we must reconcile what was with what could've been in order to splice out pushing and pulling forces and isolate meaning variables. This also could allow us to establish a factor hierarchy—That is, determine which market forces may supersede the others in times of instability.

Retrospection in the Fifth

Appealing to the fifth dimension can allow us to beneficially utilize the powers of retrospection. In the cases above, we used comparative retrospection to isolate important variables and determine their relative importance, but we can attempt to use this same concept to gain insight into the future. That is, given various future realities, we attempt to explain them using future-to-present retrospective logic. In some sense we do this all the time, but more commonly we attempt to travel forward using a specific line of reasoning. The latter method is not a bad way to start, but it is almost always deterministic and definitive. So, instead of allowing for a few possible outcomes and

assigning them probabilities, it follows a series of events or considers a number of factors that lead to a single outcome.

Of course, many mathematical models are probability based and can give the likelihoods of a variety of outcomes. The reason for incorporating retrospective dimensionality, then, is not only to assign probabilities to outcomes, but to determine how well a model can explain an outcome given that it is the only outcome. If a model cannot explain an outcome that it has been programmed to consider, given inputs conducive to that outcome's realization, then the model could be flawed in its inclusion or exclusion of relevant variables. Thinking backwards, given a state of the world, can allow us to consider factors that we previously did not.

In modeling a bubble, lesson 1 posits that we must reconcile what was with what could've been. That is, in sourcing data, the isolated event that is the crisis period should not be analyzed as if it were the only possible outcome because crises are in no way inevitable, and triggers are difficult to determine. Just as Instead, we should retrospectively determine the probability of the crisis given the severity of the vulnerabilities and the probability of the trigger.

Lesson 1 is especially important in considering a model for bubbles because bubbles are almost exclusively defined in retrospect. Bubbles are essentially just large, positive price deviations from an asset's intrinsic value. If you are someone who believes that an asset has an intrinsic value irrespective of what people are willing to pay for it, then its intrinsic value is nearly

impossible to determine in the real world due to speculative growth potential, brand equity considerations, etc. So, the only real way to know if something is a bubble outside of a controlled experiment is if it pops, and retrospectively deterministic models therefore far more likely to be biased.

Granovetter's Riot

Consider two societies—in each society there are 100 disgruntled citizens gathered outside their mayor's mansion peacefully protesting recent executive actions. Whether or not the peaceful protests escalate into violent riots is intuitively based on each person's willingness to join a riot. Because each person's chances of legal repercussions from taking violent actions are limited as the number of rioters increases (this is implicitly assumed as part of the model), each person's willingness to join the riot is based on the number of people currently rioting. Each person can thus be assigned a value N that is representative of this willingness and indicates the minimum number of people currently rioting required for that person to join. That is, if $N_i = 50$, then a person _{i} will join the riot only after 50 others do so before him.

In the first society, each individual has a unique N value ascending from zero such that $N_1=0$, $N_2=1$, $N_3=2$ and so on, up to $N_{100}=99$. This means that after the first person starts getting violent, the second person follows, then the third, then the fourth, until all 100 citizens are wreaking havoc in the streets.

Suppose the second society is nearly identical, however two citizens have N values of 6 and no citizen has an N value of 5. After the first rioter joins, as do citizens 2 through 5. But, no persons other than those already rioting are willing to join for any number of rioters less than 6. Thus, the society is 95% peaceful.

In assessing the outcomes of these two societies, an observer could point to any number of sociological factors. Perhaps society 1 is inherently more violent. Perhaps they have higher unemployment rates and thus decreased incentives to stay out of prison. Perhaps their diets make them more prone to hormonal fluctuations and emotional outbursts! There are infinitely many potential explanations based on distinguishable factors but suppose none of these factors differ from one society to the next. How can we possibly explain the vastly different results of the collective by modeling the decision-making process based on a single individual?

Lesson 2: The Micro-Macro Problem.

In the context of collective action, we cannot model behavior based on a representative agent because the behavior of the whole is emergent. Failure to correctly recognize emergent characteristic leads to inaccurate models in both the physical and social sciences.

Micro-Macro Fusion in the Fifth

In applying lesson 2, the question then arises how one might get from one level of reality to the next. Emergent behavior is something that many models in the natural sciences must contend with, and here the difficulty of reconciliation is explicit. We do not try to understand the human genome as if it behaves like a single gene, and we do not try to explain complex organism in terms of the cells that make them up, or the atoms that make up the cells. In fact, physics, chemistry, and biology each essentially operate by their own set of rules and regularities. In social science, however, we too often attempt to map collective behavior onto individual psychologies through the use of a hypothetical individual whose thoughts and actions can explain trends of the entire population. As Columbia University physicist and sociologist Duncan Watts puts it,

“No matter how it is done...the representative agent is only and always a convenient fiction.”

Although fifth dimension principles aren't necessary in developing something like, say, a threshold model, they can be helpful in estimating the likelihood of emergence and its effect on various outcomes. Moreover, the

retrospective aspects of fifth dimensional thinking can improve models that attempt to be both micro-sensitive and collectively representative.

Lesson 2 provides that investing behavior, like riot behavior, is the result of individual propensities or thresholds that manifest on a macro level. It is dangerous to assume that the psychology of trend investing can be modeled by a representative agent that responds to a trend when the agents themselves are the cause of the trend. To assume that the collective behaves like the average member of the collective is to claim that one can derive a realistic understanding of the human psyche based on working knowledge of individual neurons.

Granovetter, Continued

Now let's add to our analysis by implementing a structural component. Suppose that both societies are prone to the usage of Molotov cocktails—explosives that increase the violent tendencies of those in close temporal proximity to ignition and effectively decrease the N value for the first five individuals considering joining the riot succeeding its ignition by a single unit. So, if a cocktail is used after person 10 joins the riot, then the N values of persons 11, 12, 13, 14 and 15 decrease by one.

In both societies, a cocktail serves as a trigger, at which point person 1 begins rioting. In the first society only, each individual has a unique N value and all persons in this society riot as they do in Granovetter's original model regardless of the N -decreasing effects of the trigger.

The second society is the same as the first, except two citizens have N values of 6 and no citizen has an N value of 5. In this case, the cocktail ignites and the N values of persons 1-5 each decrease by 1 such that $N_1=-1$ rather than 0, and $N_5=3$ rather than 4. All other N values are unaffected and thus, again, society 2 behaves the same as the original model in which the first 5 citizens are the only ones to riot.

Now suppose that 10 years pass. The same 100 people with the same N values remain in each society, and again they gather in protest. This time, however, the materials for a Molotov cocktail only become available after a certain number of rioters begin wreaking havoc—let's call it 5. So, a Molotov ignites in response to person 5 joining the riot instead of igniting before person 1 joins the riot. In society 1, we already know that everyone will riot regardless of ignition, so the N -decreasing effects of the cocktail from persons 6 through 10 are irrelevant.

In society 2, however, this is not the case. The ignition's effects essentially bridge the gap that previously existed between persons 5 and 6 because N_6 now equals five. Each person then joins the riot in sequence after person 6 and the entire town is overcome with violence.

So, even if we know, as Granovetter did, the N value of each citizen, that each citizen behaves based on this value, and that a Molotov decreases the N values of the five persons succeeding its ignition, our model will not accurately predict the outcome of the last society if we do not account for the structural change that made cocktail materials more difficult to acquire.

Of course, predicting 5 out of 6 of the societies' outcomes correctly is quite good even if we do not understand the underlying processes at play. As Milton Friedman put it,

“The relevant question to ask about the “assumptions” of a theory is not whether they are descriptively ‘realistic,’ for they never are, but whether they are sufficiently good approximations for the purpose in hand. And this question can be answered only by seeing whether the theory works...”

A perfectly rational and undeniably common question to ask, then, is if a model can predict outcomes with a fair degree of accuracy, why do we care that it lacks explanatory power? And the answer is that in most cases we don't. Perhaps in most cases we really shouldn't care, because the purpose of a theory and its relevant models is, more often than not, to compile inputs in such a way that we can sufficiently attest to probable future problems.

We have now reached a point in time, however, that due to this structural change, the assumptions off which we base our model will cause systematic predictive failures and we will no longer be able to prescribe meaningful solutions.

Reconsider Friedman's excerpt. Essentially all that he has stated is that certain assumptions are only good unless they are bad. Which, as simple as it sounds, is not only very reasonable but quite useful in scientific and logical fact-finding. However, it would be an unprecedented failure of any social discipline to assume that what once was good or bad is still so—And herein lies a fatal flaw because now what the statement truly means is that certain assumptions are good not *unless* they are bad, but *until* they are bad.

Momentum and Molotovs

These examples are both abstractions and oversimplifications, and Granovetter's riot model is a highly specific situation in which the threshold explanation for collective behavior may carry some weight.

Interestingly enough, riot behavior is strikingly similar to the behavior whose result is a financial bubble. Consider the rise and fall of Bitcoin in the last half-decade. Cryptocurrency as recent as 2016 was not something the general population was even aware of, and the thing about currency is that if no one accepts it, then it holds no value. Like any asset, the price of currency ought to be based on its value. When crypto began to gain popularity, its

dollar-value increased, and investors began to notice. The hesitancy of the inexperienced investor was mitigated in proportion to the number of other investors who trusted the asset's stability or potential for growth. In other words, if you invest in something, then I am more willing to do so because its value is based on what people are willing to pay for it, and the price of an asset increases as its demand increases.

The issue was that the rate at which people were investing far outpaced the rate at which people were transacting. So, it was not unlikely that you knew 10 people holding cryptocurrency as an investment and zero people utilizing it as an asset. Therefore, when it came time to cash in, there were many people looking to sell and very few looking to buy, which drove the price down over 80% in a single year.

In most cases, bubbles excluded, small fluctuations in stock price do not cause frenzied trading. Perhaps, given a superficial dip, a few fickle investors will sell their shares, but most investors will not because their thresholds (i.e. their N values) are not sufficiently low. Structural changes on Wall Street, however, prove disruptive.

Cocktails as N -decreasing responses to a riot already initiated bare a curious resemblance to the program trading systems that helped cause the crash of 1987. These programs would automatically dump large quantities of stocks from a portfolio if prices decreased at a specified rate or to a specific amount. So, if investors sold off enough shares, the computer would

automatically pick up on the trend and sell more, driving the price down even further and worrying more investors, who would then sell more shares because the programs effectively decreased investor's N values.

No crisis is the same as the last because each time a crisis occurs, we run extensive analyses to determine its cause and act to prevent a second crisis in the same vein. But, because no crisis is the same as the last, it doesn't make sense to speculate on future crises using assumptions from the past model that are specifically tailored to the last crisis or are a product of the last few crises

Lesson 3: Adaptability

In economics, structural variation can change the rules of the game.

Recognizing this and building models that incorporate at least the possibility of shifting foundations is an important factor in maintaining predictive power.

Adaptability in the Fifth

Time and the possibility for change are at the heart of the fifth dimension. The primary thing to consider is that we often do not know how significant the effects on our assumptions or behaviors are when structure does change. Because of this, we must do our best to include adaptable

assumptions or, at least decrease the weight of structurally dependent assumptions as the rate of structural change increases.

CONCLUSIONS

The Apple

There has been a steady push in recent history for the “scientification” of the disciplines. Most notably, you’ve likely heard the desperate cries of psychologists begging to be let into the science club. In economics, professionals and academics strive to better incorporate scientific principles into their research. For example, the gravity model of trade takes Isaac Newton’s law of universal gravitation and renames the variables to explain import and export volumes between two countries:

$$F_g = \frac{Gm_1m_2}{r^2} \quad T_{ij} = A \frac{Y_i \times Y_j}{D_{ij}}$$

(As it happens, this model predicts bilateral trade with a fair degree of accuracy)

So, we now have a quant-focused discipline of financial engineers and Masters of Science in taxation, and for the most part this is good. It is a beneficial shift to more uniform strategies and the satisfaction of the five basic requirements of a science:

1. Clearly defined terminology
2. Quantifiability
3. Highly controlled experimental conditions
4. Reproducibility
5. Predictability and Testability

I fear that without a five dimensional framework, this push to align the discipline more closely with the physical sciences can have dangerous implications, especially in crisis theory.

As the story goes, when an apple fell from a tree and struck young Isaac Newton in the head, he had an epiphany. Over the course of his research, he was able to model his theory and come up with one of the most simple, intuitive, and no doubt famous equations of all time (perhaps second only to Einstein's $E=MC^2$). Gravity today is scientific fact, and we use Newton's equation to accurately predict the flight path of objects millions of miles away and land rovers on distant planets. And yet, this is not rocket science (so to speak).

These fundamental truths of the physical sciences are the envy of many social disciplines. Wouldn't it be nice, for instance, if we had this sort of

predictive power to anticipate the economy's flight path from months away? Most investors couldn't even tell you whether next week's markets will be up or down or sideways, as Ben Bernanke so gracefully illustrated. And this isn't because they're not intelligent enough to figure it out, it is because there is an inherent difference between the physical and social sciences that prevents us from operating under the same rules.

Every single apple in the universe under the same conditions will behave in the same way. If I drop an apple out of my hand it will hit the ground with the exact same force in the exact same amount of time as every other apple of the same weight and dimension, and for this reason physical sciences do not often require fifth dimension analysis. Even if we had no conception of the physical processes that govern the universe, we would still know how an apple would behave if we'd seen another apple under the same conditions. In social science, however, the "apples" do behave differently. An "apple" dropped in 1987 and an "apple" dropped in 2008 will not take the same path to the ground, and for this reason we must make beneficial use of retrospective principles, as prescribed by lesson 1.

Moreover, the same laws that govern the behavior of Newton's apples govern the behavior of planets. In social science, however, the actions of a group cannot be modeled like the actions of an individual as illustrated in Granovetter's riot and explicitly stated in lesson 2.

Financial bubbles in particular are largely products of human behavior as opposed to mathematically sound economic fundamentals, but there are certainly mathematically sound financial incentives to behave in certain ways given certain conditions as evidenced by various liquidity theories. It is therefore very difficult to make rules for both aspects of economics together because not only are social standards of behavior in constant flux, but the physical makeup of the financial system changes as well. So, models based on a five-dimensional framework must, to the best of their abilities, be adaptable in accordance with lesson 3.

Final Thoughts

In physics and mathematics, a dimension is some measurable extent of the universe. With the addition of each dimension, therefore, our understanding of the world and how we fit into it increases.

Each of the concepts above are lessons in theoretic frameworks for any academic, and attempt to grant both future and past models a level of dimensionality previous unseen in social science. It is now up to the reader to contemplate and scrutinize these principles. It is also up to the reader, however, to analyze and apply them in ways they see fit in order to gain perspective, advance disciplines, and of course, increase our understanding of the world and how we fit into it.

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