The Index Investor

Broadly Diversify…and Wisely Manage Downside Risk

Contents

There And Back Again: A Journal's Tale

From 1997 to 2011, *The Index Investor* provided independent analysis and insight on asset class valuation, portfolio construction and downside risk management to a global audience of investment managers, financial advisors, family offices, and sophisticated individual investors.

In 2011, we suspended publication when our key writers moved on, either to other publications, or, in the case of contributing editor Tom Coyne, to spend four years on the Good Judgment Project team, which won the Intelligence Advanced Research Projects Activity's forecasting tournament, with forecast accuracy that was more than 50% better than the tournament's control groups. The team's experience is described in Professor Philip Tetlock's book, "*Superforecasting*."

Tom later co-founded Britten Coyne Partners, a firm that provides education courses and consulting services on strategic risk management and governance. It helps clients to better anticipate, more accurately assess, and adapt in time to emerging strategic threats to their survival.

We left the Index Investor website up five years, and all our back issues are still freely available so that investors can continue to benefit from

our content.

Our new **Research Library** is also free. Investors can browse our curated content on a wide range of issues affecting medium and long-term asset class valuation, including technological, economic, environmental, national security, social, demographic, and political trends and uncertainties, as well as potential "grey swan" wildcards like environmental, infectious disease/antimicrobial/biowar, and cyber/electromagnetic events.

Now we're back publishing again. Why?

- Because, as former Bank of England Governor Mervyn King has so aptly described it, we now live in a world of radical uncertainty, that has become a much more dangerous place for investors. In recent years information overload, anxiety, and fear have grown exponentially worse, and the meaning of everything that is happening around us has become harder than ever to discern.

- Because index investing is more popular than ever, even though too many index funds aren't passive at all, but rather just a cheaper version of traditional active investment products.

- Because too many investors' economic situations are more precarious than ever before, and getting their investment strategy right has never been more important.

- Because there still seem to plenty of people and publications telling investors how to earn higher returns, but hardly any that focus on helping them avoid the large losses which are mathematically devastating to long-term portfolio returns.

- And because the Good Judgment Project has finished, and we think our analytical and predictive methodologies are better than

ever (though as our early warnings ahead of the 2008 and 2000 crises showed, our forecasting was pretty good back then too).

Our New Value Proposition

Most human beings, and investors in particular, have strong aversions to uncertainty and loss. Yet most investment research and commentary focuses on upside ideas and opportunities. Too often, this results in advisors and fund managers struggling to construct and update narratives about evolving downside risks and how they are being managed.

We help subscribers to meet this challenge, using proven forecasting techniques from the Good Judgment Project and elsewhere. Our goal is to provide timely warning of potentially large downside moves in key asset classes, as we did in March 2000 and May 2007, and "two step ahead" forecasts of what could happen after a large downside move, over a time horizon that is longer than those used by automated analysis approaches based on correlational, sentiment, and semantic methods.

Pilots and air traffic controllers use a term — "having the bubble" — to describe having a sure sense of how a complex dynamic situation is evolving. This is no less important for investors and their advisors — but in today's world it has become much more difficult. We're relaunching *The Index Investor* because we want our subscribers to "have the bubble" in a rapidly changing world where threats to their investment goals and strategies abound.

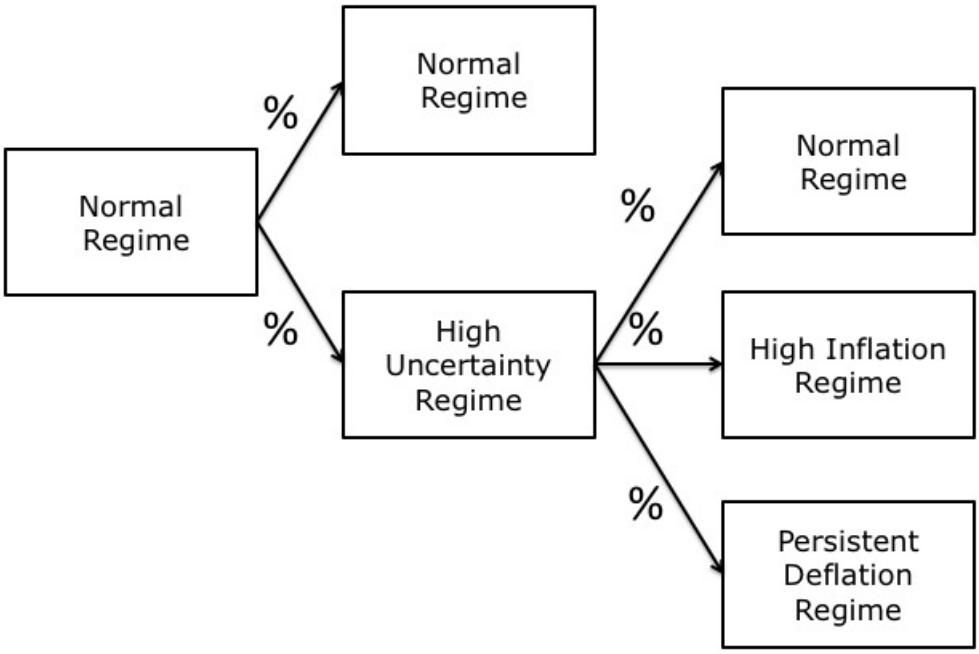
Our goal is to help our subscribers anticipate these threats, accurately assess them, and adapt to them in time to avoid large losses.

Here's what subscribers will get each month:

- Narrative forecasts and quantitative probability estimates for negative asset class valuation changes of 20% or more over the

next 12 months. These periods of high uncertainty tend to be relatively short and transition to longer-lasting states/regimes.

- Given this, we also provide probability forecasts that contingent on the initial 20% loss/shift to the high uncertainty regime. Specifically, we provide narrative and probability forecasts for three subsequent outcomes: a return to the normal regime, a persistent deflation regime, and a high inflation regime. Our goal is to help subscribers have a good sense of what could happen not just one, but two or more steps ahead. These forecasts are based on methods learned on the Good Judgment Project and elsewhere, and can (and should) be combined with forecasts subscribers obtain from other sources to increase accuracy. Later in this issue, we discuss in more detail our forecasting concepts and process, including how accuracy can be further increased by extremizing combined forecasts.



- Our narrative forecasts include their causal logic, underlying evidence, and assumptions, and counterfactual analyses of why

they could be wrong (i.e., pre-mortem analyses) as well as the reasons for any month-to-month change in forecast probabilities (e.g., due to the receipt of early warning indicators and/or surprising information).

- Quantitative measures of fundamental asset class over/under valuation and financial market stress indicators, based on methodologies we successfully used in the past.

Our Methodologies

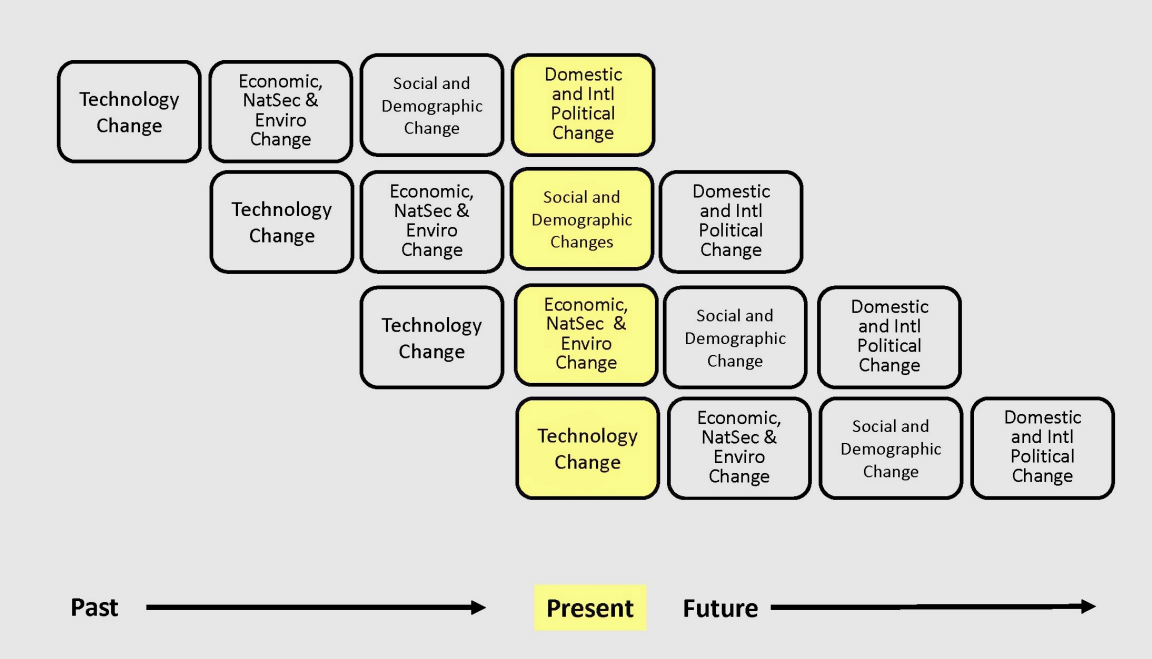
In this section, we'll begin with a review of the key concepts that underlie our forecasting approach, and then describe our forecasting process.

Key Concepts

Complex Adaptive Systems

Like Professors Andrew Lo, Doyne Farmer and others, we regard financial markets as a complex adaptive system (CAS), that exist as part of a larger system of other CAS between which there are multiple feedback loops. These other systems include those that produce technology innovations, and economic, national security, social, demographic, and political outcomes.

We also find that these other systems tend to operate and generate effects in a rough chronological order, albeit with many feedback loops between them. The following chart highlights that the changes we observe in different areas at any point in time are actually part of a much more complex and integrated change process.



Complex adaptive systems have large numbers of heterogenous, interacting agents of different scales (e.g., individuals, groups, networks, organizations, etc.), which over time evaluate their performance adapt their behavior to achieve their goals. These adaptations often change the structure of the system itself. As such, a more accurate term for what we are dealing with is a complex adaptive evolving system of systems (CAESoS).

Complex adaptive systems are further characterized by multiple linkages between causes and effects, many of which are non-linear (i.e., driven by positive feedback) and/or time-delayed. As the economist Rudiger Dornbusch famously observed, "a crisis takes a much longer time coming than you think, and then it happens much faster than you would have thought." Actually, the ancient Roman philosopher Seneca observed this same phenomenon far earlier, noting that, "fortune is of sluggish growth but ruin is rapid."

A final important characteristic of complex adaptive systems is the power law distribution of the outcomes they produce. This is a critical point: in a CAS very substantial negative outcomes (e.g., depressions)

are far more likely to occur than they are in a system with normally distributed outcomes.

Common Individual, Group, and Network Phenomena

All of these complex adaptive systems involve individuals, groups, and networks whose behavior tends to emerge from the interaction of a limited number of rules that have deep evolutionary roots.

At the individual level, we tend to be over-optimistic and to attend and give greater weight to information that confirms our existing beliefs and supports our desired outcomes. These give rise to overconfidence in the accuracy of our beliefs and relative strength of our capabilities (to draw an important distinction, because of over-optimsm our estimate of the mean of a distribution is likely to be too high, while due to overconfidence our estimate of its standard-deviation is likely to be too low). In addition, as Dietrich Dorner, Nassim Nicholas Taleb, and others have found, human reasoning often struggles when confronted by processes that are non-linear and a range of possible outcomes that are not normally distributed (i.e., non-Gaussian).

In evolutionary terms, forming groups to facilitate cooperation is highly adaptive. However, some group-driven behaviors are not. As we are social animals, our brains automatically encode our relative status in a group, which gives rise to concern with how we are perceived by others. Evolution has also caused us to prioritize the allocation of our attention to stimuli that trigger negative and strongly arousing emotions. Uncertainty and adversity produce such emotions, which cause an enhanced individual desire to conform to the beliefs and behavior of the group, to avoid being cast out into a potentially dangerous environment.

Even in more normal circumstances, concern with other group members reactions can cause us to withhold information that is at odds with the group's dominant view, or challenge the accuracy of information provide by others. For this reason, groups usually pay more attention and give

more weight to information that is commonly held by all or most members.

Relative to individuals, groups are often more overconfident, not only because of the factors noted above, but also because overconfidence often boosts an individual's status within a group, triggering a positive feedback loop that drives average group confidence even higher.

In today's hyperconnected environment, these negative group tendencies have become much stronger. Thanks to rapid technological progress in multiple areas, individuals are now members of far more and far broader networks than they ever were in the past. This has fundamentally changed the nature of many complex adaptive systems. For example, thanks to the rapid transmission of information across networks, we are likely to be exposed to far more common information that we were in the past. Second, we are also likely to be far more exposed, and more quickly, to other people's views about what this information means.

These changes have vastly increased the potential for rapid shifts in opinion and behavior. Our starting point is Daniel Kahneman's distinction (made in his book, "Thinking Fast and Slow") between two modes of thought.

"System 1" is rapid, instinctive, based on association, and generally unconscious. It generates fast conclusions and emotions that prime us for actions (e.g., fight or flight) that, from an evolutionary perspective, have been highly adaptive for the survival and success of the human species. In contrast, "System 2" thinking is slower, deliberate, logical, and conscious. Because it is also more effortful, most human cognition is based on System 1, not System 2.

Drivers of rapid shifts in popular perception, opinion, and behavior are found in both System 1 and System 2.

In the case of the former, the most primal driver is our capacity to rapidly transmit fear, through a variety of non-verbal means, including

facial expressions and odor. System 2 can produce group "cascades" and "herding" when we observe or quickly learn about previous decisions made by other people. In fact, research has found that this type of "social learning" becomes increasingly effective as the decision environment becomes more complex and uncertain

Broadly speaking, decisions made by System 2 are based on three types of input: private information not available to everyone, public information, and social information. In cascades and herding, people will often disregard private information that is inconsistent with social signals. However, rapid changes in public perception and behavior can also be triggered by the appearance of a new public signal.

As described in the work of a number of researchers (e.g., David Tuckett, Robert Shiller, Paul Ormerod, and Marvin Cohen), in the face of high complexity and uncertainty, humans decide and act not on the basis of detailed quantitative analyses (which are impractical and often impossible), but rather based on so-called "conviction narratives" or, more simply, the stories we tell ourselves and others.

These narratives are based on our private, public, and social information, along with associated logic and assumptions. These narratives produce varying levels of certainty (or "conviction") about the accuracy of our perceptions, appropriateness of our proposed actions, and the likelihood they will achieve our goals in a given situation.

From the sum of individual conviction narratives and the strength with which they are held there emerges the phenomenon John Maynard Keynes called "animal spirits," or what we more generally call the level of public confidence in a given situation.

In many cases, people will have varying degrees of conviction about the accuracy and importance of the private information they possess, and, as we have noted, will often weigh social information more heavily when constructing narratives that explain the past and forecast the future.

However, a sufficiently surprising new public signal – say, the announcement that a high-ranking government official has been indicted for a crime, or that a key party is abandoning a coalition government – can quickly and dramatically change dominant narratives, and thus public perceptions, confidence, and behavior. And this process has now been supercharged by hyper-connectivity in today's densely networked world.

So, to sum up: Increasing uncertainty or adversity causes System 1 to prime us to conform to the views of the group. And that reaction goes into overdrive when uncertainty and adversity crystallize into threats, danger, and fear.

Thus primed, the interactions of System 1 with System 2 can rapidly produce dramatic shifts in public perceptions and behavior due to changes in social information (often originated by a relatively small number of people and rapidly amplified in our hyperconnected world) and/or by the appearance of a surprising public signal.

CAS States and Transitions

Complex adaptive systems can operate in significantly different states or regimes. When operating in one regime, there exist probabilities that, within a given period of time, a system will switch to another possible regime, or remain in the current one. These "transition probabilities" sometimes depend not just conditions in the current period, but also in those that preceded it (e.g., they are so-called "long memory processes"). Some researchers have also found that complex adaptive systems approaching regime transitions may display characteristic behaviors, such a reduced resiliency (slowness to return to a previous condition after being perturbed) and increasing autocorrelations (the extent to which period to period returns remain similar). This gives new meaning to colloquial references to "the calm before the storm."

In many complex systems, the number of possible states is limited (or only very slowly evolving), and there are a number of states to which the system tends to return time and again. These recurring states are called "attractors."

A roughly analogous physical example is the transition of water between three attractor states – solid, liquid, and gas -- as temperature and pressure conditions change over time (for the physicists reading this, I'm deliberately leaving out the two other possible states of matter, plasma and Bose-Einstein condensates).

The late economist Hyman Minsky famously described a similar state transition process in debt markets, in which borrowers begin with low levels of leverage, but take on increasingly more debt as the economy continues to grow and their confidence increases that it will continue to do so in the future.

Minsky's first phase change is from the regime where economic growth is sufficient to enable borrowers to repay debt interest and principle to one where they have taken on so much debt that they can only repay interest. The second phase change is to a regime where principal and interest can only be repaid if the value of the underlying assets financed by growing amounts of debt rapidly increases. Minsky called this the "Ponzi phase". And as we saw in 2008, once a financial system reaches this point, small changes can cause very large system level effects.

At *The Index Investor*, our methodology considers different regimes and transitions between them at two levels: One at the global system level, and the other in financial markets.

At the global system level, we focus on four high-level (or as they say in the world of complex adaptive system, "coarse grained") regimes, with transitions between them driven by the interaction of two sets of fundamental attractors. The first is between a system state that is highly ordered and one that is highly disordered (e.g., phase transitions driven by the second law of thermodynamics).

The second is a rough social equivalent, with the two attractors being a state characterized by high levels of cooperation (with high connectivity between different groups) and one by high levels of conflict (with fewer links between groups, and often denser connectivity within them).

While not a deterministic process, this interaction between two common attractors is one that repeats frequently enough to provide us with a coarse grained guide to a typical cyclical pattern in complex adaptive socio-technical systems.

Consider a system that starts in the most benign state (i.e., the one with the lowest level of uncertainty), with high levels of both order and cooperation. These conditions enable the development and implementation of relatively complex solutions to emerging problems; in fact, because such solutions must satisfy many different groups' needs, they are almost guaranteed to be complex.

However, these solutions create additional system complexity, including exponentially more interconnections and positive feedback loops. Every increase in system complexity is therefore accompanied by non-linear growth in both failure modes and ways for them to exponentially increase disorder.

This is the law of unintended consequences writ large. For a time, the cooperative social system is able to increase complexity quickly enough to keep disorder at bay. However, beyond a certain point the limit of the social system's capacity to discover and implement even more complex solutions is reached, and the level of system disorder (and uncertainty) begins to increase. This is a common theme in books about societal decline, such as the late Mancur Olson's "The Logic of Collective Action" and "The Rise and Decline of Nations" or Joseph Tainter's "The Collapse of Complex Societies."

Increasing system disorder eventually causes social cooperation to give way to social conflict, as intergroup ties fray and intragroup ties strengthen in response to higher levels of uncertainty, and, in some cases, fears about growing threats.

However, this increasing social conflict also produces increased system order (and a reduction in uncertainty), albeit on a smaller scale that previously. For example, large conglomerates (or empires) are broken up into smaller individual companies (or countries). Within companies, highly centralized structures give way to more agile decentralized ones, to enable broader exploration and faster implementation of smaller scale solutions to local problems. Even heightened levels of interstate conflict produce greater order, not only within each nation or alliance, but also in the post-war world.

Eventually, the resolution of social conflict allows for a return of cooperation, which returns uncertainty to its lowest level, and enables the system to once again design and implement increasingly complex solutions to its emerging problems and challenges.

In contrast to the aggregate macro level we just discussed, in financial markets, historical data from around the world highlights at least four possible regimes whose transitions are more complex: (1) normal times; (2) high inflation; (3) persistent deflation; and (4) high uncertainty (see, for example, our 2010 paper on "Understanding and Predicting Uncertainty Shocks". The key questions we focus on are:

- What is the probability of financial markets switching into a high uncertainty regime that would produce falls in equity index levels of 20% or more within the next 12 months?

- As high uncertainty regimes are usually relatively short, it is also critical to understand the probabilities that a high uncertainty regime could transition to either (a) a return to the normal regime; (b) a high inflation regime; or (c) a persistent deflation regime. We also estimate how long the transition away from the high uncertainty regime could take, how long each of the three subsequent regimes could last, and their respective implications for asset class returns.

A final set of key concepts in our methodology focuses on the drivers of transitions between system states/regimes. Broadly, we focus in three:

- From systems dynamics, we focus on how ongoing flows within a system (which tend to be the focus of most media stories) can push critical stocks beyond the system's ability to carry them any longer without major, disruptive change. A good example is Minsky's observations about critical thresholds for system debt capacity.

- The tendency of beliefs within a social system to become more ordered (i.e., less diverse) as uncertainty increases. As we have seen, this is a normal aspect of human nature. But it is also one that causes system beliefs and behavior to evolve to the point that they are non-linearly sensitive to any new information that undermines those beliefs (e.g., see Robert Shiller's work on narrative economics, and David Tuckett and his colleagues' work on conviction narrative theory, as well as Chapter 12 of Keynes' General Theory – "The State of Long Term Expectation").

- In some cases, this new information arises endogenously, due to increasing oscillations within the system itself (e.g., as over time technological change leads to economic and national security change, and then to social, demographic and political changes that eventually produce large financial market effects). In other cases (depending on how broadly a system's borders are drawn), it can arise exogenously (e.g., due to a severe shock created by an environmental, infectious disease, or solar weather event).

Forecasting Process

Our forecasting process is based on Mr. Coyne's research and experience, including fourteen years of macro analysis for *The Index Investor*, producing the first Latin America investment research at Chase Investment Bank, four years on the Good Judgment Project, and six years at Britten Coyne Partners.

We start with specific forecasting questions: (1) What is the probability that the value of an asset class will decline by 20% or more over the next 12 and 36 months? (2) If this happens, how long with this regime last? And (3) how deep will the value decline be?

For each forecasting question, we determine a base rate probability, ideally from historical data.

We then determine a situation-specific forecast probability, based on a range of approaches, including quantitative asset class valuation and system stress methodologies we have used in the past at *The Index Investor*, as well as qualitative causal and counterfactual analytical techniques. We also produce narrative forecasts that clearly state our underlying logic, evidence, and assumptions.

We next conduct a pre-mortem analysis of each forecast. We start with the assumption that it is some point in the future and our forecast has turned out to be inaccurate. Using "prospective hindsight", we ask why this happened. We use the results of our pre-mortem, as well as our forecasts themselves, to identify high value information to seek that will reduce critical uncertainties, as well as early warning indicators to monitor.

Each month, we seek this information, and are also highly mindful of new information that surprises us. In our experience we have found, and research has confirmed, that being mindful of the feeling of surprise in reaction to unexpected information is extremely important. While early warning indicators focus on parameters within your existing situation model, surprises often tell you that your model itself is incomplete and needs to be reexamined and respecified. It is also critical to write down surprising information you encounter. This is because our powerful System 1 reasoning process will quickly attempt to integrate surprising information into our existing mental models and belief structures to maintain their coherence. When this happens, the surprising information will typically disappear from our memory, and we will lose the opportunity to discover its deeper significance.

We use three types of information to update our forecast probabilities from month-to-month: (1) early warning indicators; (2) high value information that reduces critical uncertainties; and (3) surprising information that cause us to reconsider our situation models and the beliefs that underlie them.

The final step in our forecasting process is not one that we can take, but rather one that we strongly encourage our subscribers to take. Research has found that three steps can improve forecast accuracy. The first is seeking forecasts based on different forecasting methodologies, or prepared by forecasters with significantly different backgrounds (as a proxy for mental models and information). The second is combining those forecasts (using a simple average if few are included, or the median if many are). The final step, which significantly improved the performance of the Good Judgment Project team in the IARPA forecasting tournament, is to "extremize" the average (mean) or median forecast by moving it closer to 0% or 100%.

Forecasts for binary events (e.g., the probability an event will or will not happen within a given time frame) are most useful to decision makers when they are closer to 0% or 100% than the uninformative "coin toss" 50%. As described by Baron et al in "Two Reasons to Make Aggregated Probability Forecasts More Extreme", forecasters will often shrink their probability estimates towards 50% to take into account their subjective belief about the extent of potentially useful information that they are missing.

When you average multiple forecasters' estimates, you are including more information, which should increase forecast confidence and push the mean estimate closer to 0% or 100%. However, this doesn't happen when you use simple averaging. For this reason, forecast accuracy is increased when you employ a structured "extremizing" technique to move the mean estimate closer to 0% or 100%. You can **download** this model from our website to extremize forecasts. The "extremizing factors" in the model are those that the Good Judgment Project found maximized the accuracy of combined forecasts. Note that the extremizing factor is lower when average forecaster expertise is

higher. This is based on the assumption that a group of expert forecasters will incorporate more of the full amount of potentially useful information than will novice forecasters.

While extremizing is a powerful methodology, it only works when you have similar forecasts to combine, which is not always the case. As Philip Tetlock has repeatedly noted, far too many forecasters hesitate to provide quantitative probability estimates over defined time horizons, preferring instead to offer vaguely worded qualitative narratives.

However, US Intelligence Community Directive 203 (Analytic Standards) includes the following table for translating "words of estimative probability" into quantitative probabilities. This can be used as a rough tool to facilitate consistent averaging and extremizing of forecasts from multiple sources.

almost no chance	very unlikely	unlikely	roughly even chance	likely	very likely	almost certain(ly)
remote	highly improbable	improbable (improbably)	roughly even odds	probable (probably)	highly probable	nearly certain
01-05%	05-20%	20-45%	45-55%	55-80%	80-95%	95-99%

Analysts are strongly encouraged not to mix terms from different rows. Products that do mix terms must include a disclaimer clearly noting the terms indicate the same assessment of probability.

Where We Were in 2011 and Where We Are Today

The June 2006 edition of *The Index Investor* contained this assessment of evolving political and economic conditions:

> *"Three driving forces are at work. The first is falling barriers to the movement of goods, capital, and in many cases people around the world. The second is the development and adoption of low cost information and communication technologies that have substantially expanded the opportunities to exploit falling capital and trade barriers. And the third is the entry into the world economy of China and India, with their masses of relatively well-educated and ambitious workers.*
>
> *"Taken together, these three forces have combined to produce an enormous supply shock to the world economy, that has let loose powerful deflationary forces that are colliding head-on with the borrowing and asset price booms created by Western nations' repeated use of monetary stimulus to keep their economies growing strongly since the LDC debt crisis broke in 1982. I have no doubt that these forces will eventually precipitate a very deep economic, and perhaps political crisis.*
>
> *"Nobody can say in advance what will trigger it; suffice to say there are many possibilities…The way the eventual crisis turns out fundamentally depends on the attitudes and actions of three groups: Chinese peasants, Iranian youth, and the American middle class. Each of them faces choices that can lead toward more cooperative or more conflict-laden solutions."*

As it turned out, Chinese peasants' growing resentment of the nation's rapidly worsening and much more visible inequality was contained, initially through faster economic growth, and later through Xi Jinping's anticorruption drive and increased use of more sophisticated methods to repress dissent. As a result, China remained on a course that we predicted would lead to higher levels of conflict with the United States.

In 2009, Iranian youth launched their "Green Revolution", in an attempt to moderate the nation's policies. It was brutally suppressed by the Iranian Republican Guard Corps' Basij militia and other arms of the ruling regime. Iran thus remained on a conflict course with the United States.

As the Democratic and Republican parties failed to agree on cooperative policy solutions that addressed the worsening challenges facing the US Middle Class, its frustrations continued to fester and grow, with conflict finally bursting out into the open during the 2016 presidential election.

Before The Index Investor suspended publication in 2011, we observed a global policy makers faced a Gordian Knot, composed of four factors:

(1) Insufficient and imbalanced aggregate demand;

(2) Deflationary pressures from excess supply in many industries, many of which contained significant numbers of non-market players (e.g., Chinese state-owned companies);

(2) Excessive debt levels (which made the potential consequences of deflation far more severe); and,

(4) A growing crisis of political legitimacy, as rising numbers of middle class voters in many Western nations grew frustrated with their respective governments' inability to address many of the worsening problems they faced.

Seven years later, those problems remain with us; despite aggressive use of monetary policy on an unprecedented scale the Gordian Knot has not been untied.

Going forward, our forecasts and probability estimates will be driven by the interaction of the trends and uncertainties – the "known knowns" and "known unknowns" -- that we confront today. These include the following, many of which will be subjects of our monthly in-depth analyses (and keep in mind that, per our previous discussion, each of

these areas is embedded in an ongoing chronological process, with multiple feedback loops between them):

Technology

- Technology trends and uncertainties appear at the start of a complex change process that ends with political change.

- The rate at which labor substituting technologies improve their capabilities. These include semantic and symbolic reasoning (which will enable artificial intelligence to move beyond correlational/associational learning, and on to causal and counterfactual analysis in complex, unstructured situations), as well as development of a "Machine Theory of Mind" (i.e., the ability to represents the mental states of others, including both humans and machines), and Generative Adversarial Networks (GANs), which in discrete applications have enabled rapid learning in different contexts.

- Social Network Analysis methods have rapidly advanced in recent years, which has led to increasingly sophisticated techniques for manipulating them. At the same time AI technologies are increasingly able to create highly sophisticated fake information. Growing uncertainty about information reliability, particularly in a hyper-connected world, will likely have a range of adverse consequences in many sectors. When combined with rapidly improving surveillance technologies, social network methods also have important implications for repression of dissent and societal control.

- The development of practical quantum computers will create a major discontinuity across multiple domains, including cryptography, simulation, and other computationally intensive tasks.

- Future improvements (or lack thereof) in two key societal technologies – education and healthcare – will also have

important effects. Particularly in the United States, the costs of both of these have been rapidly increasing in real terms, and have significantly contributed to middle class frustration. Improved education performance is also critical to higher productivity growth, as the diffusion of innovation is far easier when a workforce is more educated. The future cost effectiveness of the healthcare systems will have a major impact on government budgets as populations continue to age.

Economy

- Global aggregate demand continues to be weak relative to potential supply. In many countries, aging populations may depress it further. And the biggest discontinuity may come if rapidly improving technologies displace an unprecedented number of workers.

- Those same technological advances are increasing potential supply in many industries. The resulting deflationary pressure is made worse by continuing high levels of debt/GDP in many countries, while the distribution of these high debt loads is causing problems in different sectors (e.g., in the US, these include student loan debt, corporate borrowing, local government pension debt, etc.).

- Productivity growth continues to be weak in many nations, and there are widespread worries that, because of declining productivity and a shrinking labor force, the potential growth rates of many economies have fundamentally declined.

- Levels of concentration in many industries are at historically high levels, in some cases leading for historically high markups and margins. At the same time, growth of the "winner takes all" phenomenon, along with globalization, has put many business models under high stress. In many countries the rate of new business formation has declined. Yet at the same time, due in large part to winners' record profits, corporations' share of

national income is at or near record levels, while the opposite has happened to labor's share.

- All of these factors, and more, have contributed to sharp rises in income and wealth inequality.

National Security

- The growth of China's economy, along with rapid improvement in multiple technologies, has created a military "near peer" competitor for the United States, that has centuries of strategic learning on its side.

- The future actions of Russia and Iran continue to be uncertain.

- Contested national security domains have expanded to include space, cyber, and the homeland, while technological progress is expanding the range of possible strategies and operational concepts based on, among others, new autonomous and hypersonic weapons systems, and expanded sensor coverage and accuracy.

Social

- As documented in books like "Our Kids" by Robert Putnam, and "Coming Apart" by Charles Murray, the trend towards widening class differences and segregation in many developed countries (previously noted by writers like Bill Bishop in "The Big Sort") continues apace, and continues to weaken social capital and trust.

- For many, a growing sense of alienation and hopelessness has led to self-medication with increasingly powerful opioids and other drugs.

- At the same time, failure to adequately address middle class frustrations, including worsening intergenerational income and

wealth mobility, has led to declining confidence in institutions, and growing anger towards elites.

Demographic

- Many countries continue to experience increases in average longevity (aging).

- The deterioration of dependency ratios (the number of children, non-working adults, and retirees supported by each worker) is also worsening due to falling birth rates in many countries. This process could dramatically accelerate if technology improvements lead to far higher levels of unemployment.

- A growing percentage of the world's population is concentrated in cities, which creates infrastructure, health, and governance challenges.

- Climate change, replacement of human labor by technology, and weakening state governance capacity all could lead to a sharp increase in migration rates in the years ahead.

Political

- Political trends and uncertainties are often the end result of a complex change process.

- In many countries, centrist political leaders have lost the confidence of increasingly polarized electorates, who are increasingly susceptible to populist appeals from politicians on the right and left.

- Too many countries are also experiencing different types of political gridlock, which makes policy solutions far harder to design, approve, and implement, and contributes to falling public confidence in governing institutions, and political elites more

generally. The growing crisis of political legitimacy we noted in 2011 and before has not abated.

- Most governments are facing increasing budget pressures, driven by weak economic growth, and rising demands for greater healthcare, social safety net, and infrastructure spending.

Wildcard: Environmental and Energy Developments

- While our main forecasts are driven by the interaction of technology, economic, national security, social, demographic, and political factors over time, we also focus on a number of "wildcard" issues, where surprising developments could substantially affect financial markets.

- In the area of environmental and energy issues, these developments could include extreme climate events that trigger major losses of life and property, and/or food, water, and migration crises.

- Energy developments could include technology breakthroughs in areas including large-scale energy storage, cold fusion, and carbon capture and sequestration or reuse.

Wildcard: Infectious Disease, Antimicrobial Resistance, and Bio-Events

- Pandemic influenza remains only a few mutations away. Previous analyses have shown that anything approaching the virulence and lethality of the 1918 strain would have a very substantial, multiyear impact on the world economy.

- In comparison to the acute nature of a global influenza pandemic, antimicrobial resistance is akin to a slowly worsening chronic condition, that at some point could pass a critical threshold (e.g., AMR C.Diff and CRE bacteria are becoming serious infection control issues in a growing number of hospitals; if not controlled

this could sharply weaken confidence in the healthcare system, and, by extension, government).

- The increasing availability of genetic manipulation technologies (e.g, CRISPR), creates the opportunity for both nation states and terrorist groups to create and unleash new bioweapons. They also create the possibility that unlicensed and uncontrolled "biohacking" could accidentally unleash an organism that causes widespread damage and panic.

Wildcard: Cyber and Electromagnetic Events

- Calling today's world "The Information Age" is a misnomer; arguably, we have passed that stage. Our current age is better described as "The Connectivity Age", as in recent years the development of far denser communication networks rather than the richer flow of information that has arguably caused the most substantial change.

- For our purpose, one of the most important of these changes has been the exponential increase in potential failure pathways that have been created by the addition of network nodes (e.g., people and organizations with internet access) and links between them. As an analogy, consider a deck of 52 cards, and the simplest game of poker where a hand of five cards is dealt to each player. How many combinations of five cards exist? The mathematical formula is N!/K!(N-K)!. That yields 2,598,960 possible poker hands. Now what happens when each hand can have ten cards? The number of different hands (or in cyber terms, failure or attack pathways) in increases to 15,820,024,220.

- Now consider that in the real world the number of network nodes is vastly higher, and is forecast to reach 50 billion internet-connected devices (or all types) by 2020. And the number of links between them has also exponentially increased.

- In this world, cyber events with a negative impact on financial markets are inevitable. Moreover, assuming the internet functions as any other complex adaptive system, then the distribution of severity and losses from these events will follow a power-law, not a normal distribution. Unfortunately, in such distributions effects in the extreme tail (what Professor Didier Sornette has called "Dragon Kings") may be even larger than what a power-law would predict, because extreme events involve a different causal process than the rest of the distribution.

- Electromagnetic events include extreme space weather (solar storms) and deliberate human acts (e.g., the detonation of an electromagnetic pulse weapon high in the atmosphere). Both of these are wildcards that could have severe negative effects on space and earth-based electronic systems, thus a very large negative impact on financial markets.

What Happens Next?

We hope that this free introductory issue of The Index Investor has given you a much better idea what you'll get when you subscribe, the methodology and process that underlie our forecast, and the issues we will be analyzing in future feature articles.

Our first issue with asset class valuations, forecasts, and features analysis will be published the first week in September. If you subscribe before then, we will email it to you, as we will all subsequent issues. If you subscribe in October or later, you will be transferred to a private page from which you can download all our previous issues. You will still get all new issues via email.

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