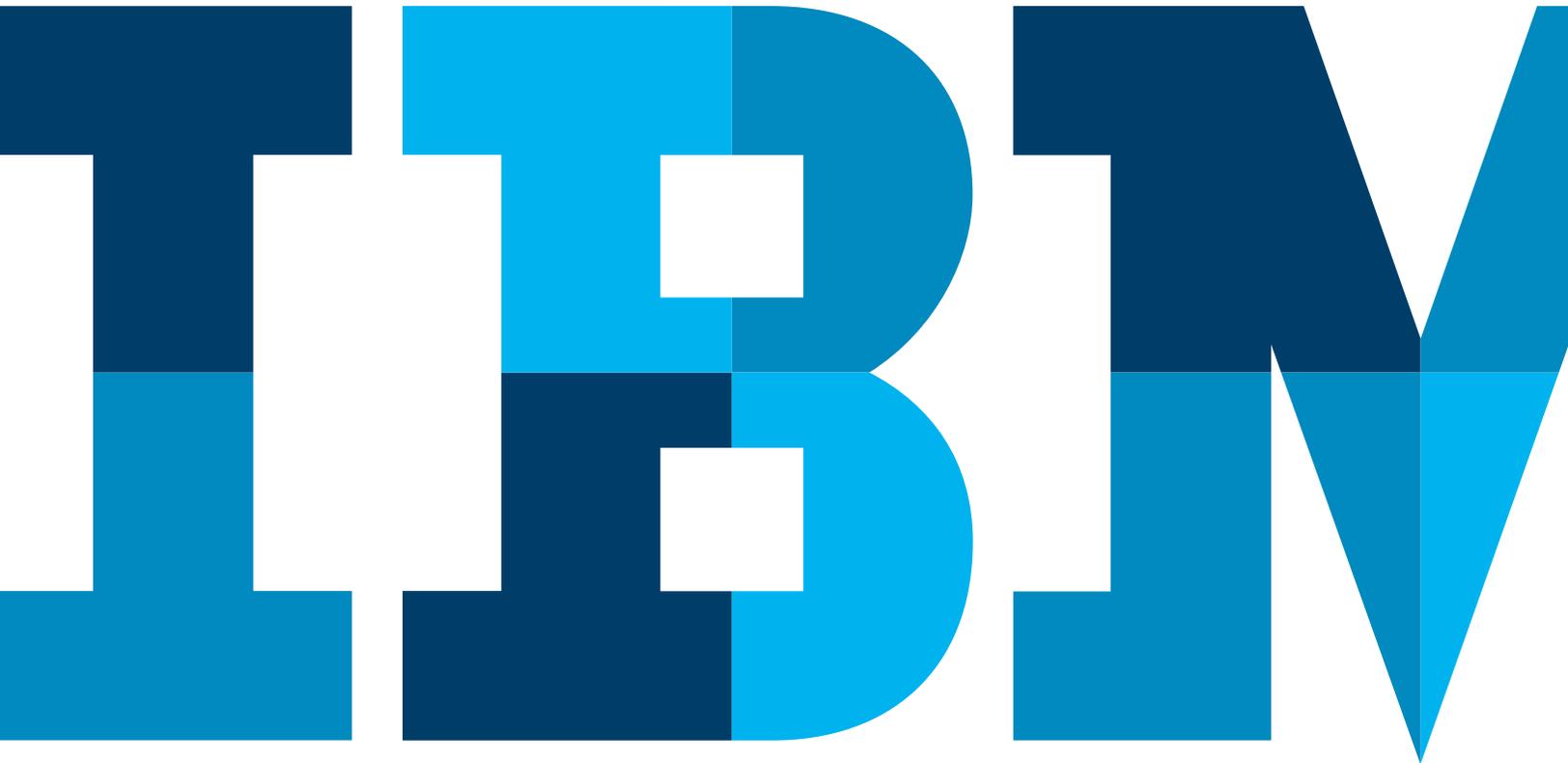


# Mastering Risk with Business Forecasting

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## Introduction

In the first paper in this business forecasting series, we dealt with the issue of error. Our key message was that error is your friend because it tells you where and how to improve the forecasts that you rely on to steer your business.

But only short-term error can help you in this way.

We tend to give another name to long-term forecast error: we call it ‘risk’. Because we often cannot afford to wait to find out about this kind of error, we need to manage risk in a different way than we manage short term error. This is the subject of this second paper.

## Background

There is little doubt that, now more than ever before, there is a greater appreciation of the importance of understanding and managing risk, particularly amongst those charged with forecasting business performance.

We do not need to look far for the reasons.

Recent years have seen a global economic collapse, the demise of several major banks around the world and the possibility (some would say probability) of sovereign default. Companies that were once household names have disappeared, or are a shadow of their former selves, while others that were once industry leaders are now very vulnerable. The whole American motor industry has recently endured a near-death experience. On the other side of the coin, companies such as Google and Facebook, both no more than 10 years old, dominate their segments of the market and Apple has gone from a basket case to the largest company in the world over the same period of time.

Unsurprisingly, a minor industry in risk management has grown up - in society in general and in business in particular. While engineered products such as automobiles, airplanes and domestic appliances are safer than they ever have been, our institutions seem to be significantly less resilient despite the enormous investment that banks and other organizations have made in “business safety.” Their sophisticated enterprise risk management systems seem to have offered little protection from recent economic storms. Furthermore, there seems to be little idea about how to factor risk into forward-looking processes such as forecasting that businesses ought to be able to rely upon to steer a safe course.

What is the reason for this? Could risk simply be an unavoidable feature of our modern world? Perhaps the pace of change is such that we should not expect companies to survive for more than a few decades. Alternatively, should we pin the blame on human fallibility or weakness? Or is it that our processes are not up to the job?

All of these factors provide part of the answer, but in this paper we will show how a better understanding of the phenomenon lies at the very center of effective risk management practice. We will also demonstrate that by developing a more sophisticated understanding of risk and building the management capabilities to match we can build organizations that can prevail and prosper in turbulent times.

We will set out our program for cultivating organizational resilience in four key steps. These steps address the practical challenge of incorporating risk into business forecasting — the process used to steer performance on a month-by-month basis.

Step one involves defining common terms—a more helpful way of talking about risk than the casual language that often tends to be used. Second, we will describe some traps that can and do snare the unwary. We will then describe how to measure risk, a prerequisite for the final and most important step: effective risk management practice.

### **Step 1: Defining common terms**

So what exactly is risk?

One danger associated with the recent development of “risk management” as a discipline - with its own set of terms and tools—is that managers come to see risk as a complex thing that should be isolated and “left to the experts.” In fact, risk isn’t exotic or remote; it is an inevitable and unavoidable part of life, not just business. Not only is it with us all, all of the time, but it needs every one of us to be fully engaged in order to manage it properly, as we will see. And in order for the whole organization to be constructively engaged, we need some clear thinking and common sense rather than a plethora of complex tools or techniques.

For a start, in order to think clearly about risk we need to get the terms we use straightened out and tightened up. The word “risk” is itself part of the problem. In essence, risk is simply the likelihood that things will turn out different from what we expected (or forecast); a fact so banal as to be meaningless.

Instead of using the word “risk” as a catchall, we believe it is important to distinguish between two very different types of unknown outcomes, which have very different causes and consequently need to be managed in very different ways.

### **Type 1: Variation or ‘predictable risk’**

Then US Secretary of Defense, Donald Rumsfeld, when describing the challenges faced by the US military in Afghanistan, talked about “known unknowns” and “unknown unknowns.” The media responded to this as if he was having some kind of a psychotic episode, but in fact he was expressing a highly respectable idea that has been around for some time. The distinction was first made in 1921 by Frank Knight, the eminent Chicago economist who recognised that there was a big difference between “risk” which is knowable and predictable in aggregate (if not in detail) and “uncertainty,” which is not.

Since the words ‘risk’ and ‘uncertainty’ have some unhelpful baggage attached to them, we use two different words to describe the same concepts. Instead of “risk” we will use the word “variation.” Instead of “uncertainty,” we will talk about “discontinuities.”

Variation is the kind of risk that the life or motor insurance industries understand very well. They will never be able to predict any single death or accident, and would never try to. But because of the frequency of these events and because everyone understands what causes deaths and accidents, they don’t need to. Instead, insurance companies help us manage our personal risks by offering insurance based on their understanding of the variation (risk profile) in aggregate.

### **Type 2: Discontinuities or unpredictable risk**

The second kind of risk (or uncertainty) we call “discontinuities.” Discontinuities are those outcomes which are a radical departure from what has gone before. The famous author Nassim Nicholas Taleb calls such radical and unexpected departures from the norm “black swans.”<sup>1</sup>

Because discontinuities are rare and often the result of unusual combinations of factors, it is impossible to predict them in detail—however obvious it sometimes seems after the event! We can never be sure whether or when discontinuities will occur or what their impact will be. As a result we cannot manage them in the same way as we do risk using statistical tables. And, as rare events, they often have a much larger impact than more common ones.

Now that we have established common terms for talking about risk, we have set up our base camp on our journey into risk territory. But before we take the next step, it is helpful to remind ourselves of some of the mistakes made by previous travellers so that we can avoid repeating them. In our last article we promoted the benefits of errors as a source of learning—and it is even better if the errors are not our own!

## **Step 2: Risk management taboos: Traps for the unwary**

### **Trap 1– The paralysing effect of fear**

Another piece of baggage associated with the word “risk” is its tendency to be used exclusively in a negative context. But outcomes can differ from forecasts in a positive way as well.

It is very natural for people focus on the downside. Human beings tend to ascribe greater value (what economists call “utility”) to the loss of something (say a sum of money) than to a gain. And in many situations this is perfectly rational because of the way that the consequences of risk are weighted. For example, product safety and flying are activities where our only concern is to avoid negative outcomes. However, because the word risk is normally only used to describe the possibility of bad things happening, we can be blinded to the positive opportunities associated with unexpected outcomes—luck and serendipity often play a key role in success. So eliminating risk isn’t necessarily good in business. Eliminating downsides —particularly when it is accompanied by the stultifying bureaucracy of some risk management processes - might mean forgoing upsides as well; and stifling experimentation and endeavour is a sure way to slow death.

In summary, we would argue that a certain level of risk is a positive thing —not negative —provided that it is (as our banks now appreciate) understood and managed properly.

### **Trap 2 – Losing sight of the goal**

Understanding risk is usually based on some form of measurement but it is easy to become immersed in the challenging task of risk quantification and lose sight of the fact that this is not the ultimate objective of the exercise.

Measuring risk is only the first half of the challenge. The second, and more crucial task is to manage risk: that is, deploying measures to help mitigate downside risk and exploit risk on the upside.

In particular, there is a tendency to assume that measuring risk and using it to take positions where the perceived risks are hedged is the end of the matter. This is dangerous, as we will discover.

### **Trap 3 – Getting bogged down by detail**

The third trap is a consequence of the fact that there is an almost infinite number of ways in which things can turn out differently than the way you expected or forecast. Most of these things will have an insignificant impact on your business, so it is important to focus your effort on the things that really matter.

While it is critical that we understand the *shape* of the “known unknown” risk by estimating the likely *aggregate* level of variation, there is little value in trying to catalogue every kind of way in which things can randomly vary around the norm. Car insurance companies don’t manage risk by listing all the intersections with a high concentration of traffic accidents.

Unfortunately this is what much of what passes for risk management involves. At best it is a waste of time. At worst it inures us to risk and can breed a dangerous form of complacency – “form filled out – job done.”

#### Trap 4 – Letting the quants take over

Finally, mathematics has an important role to play in helping us get a handle on variation. It has a much more limited role in helping us understand and plan for discontinuities, and since it is the discontinuities which will hospitalize your business, this weakness can be fatal. There are a couple of reasons why mathematical models can never give us all the answers:

##### 1. The past is no guide to the future.

There are few areas of economic activity where the historical record is long enough to enable a reliable statistical estimate of discontinuities to be made. Moreover, in a dynamic economy—for all but the most basic of commodities—patterns of behavior are constantly changing; there is no stable equilibrium to which the system inevitably returns. Arguably, it is also the primary role of management to make the future different from the past, so making any form of prediction based on the past is impossible!

##### 2. The techniques are not up to the job.

Most mathematical models of risk rely on questionable assumptions about the distribution of probabilities. The normal or Gaussian distribution, beloved of statisticians, is a good description of the properties of certain well defined groups of phenomena, i.e., variation, but it dangerously underestimates the likelihood of extreme events in many other contexts, including much of economics and business.

This is a fact, but a somewhat unpopular one among those who make a living in a Gaussian world. Benoit Mandelbrot, the father of fractal geometry, discovered this in the 1960's after he published the findings of research that demonstrated that the fluctuations of stock and commodity prices didn't conform to the predictions of the normal distribution.<sup>2</sup> It was many years

before the academic community came to terms with these findings and some of them (particularly economists who cherish the random walk as an explanation for stock market fluctuations) still haven't and simply choose to ignore it. It has, however, been proved time and time again that the probability distribution of real world economic events exhibits 'fat tails'—meaning the extreme events are far more likely than had hitherto been assumed. Nicholas Nassim Taleb, a former Wall Street trader, has popularized this idea in his book *The Black Swan*.<sup>3</sup>

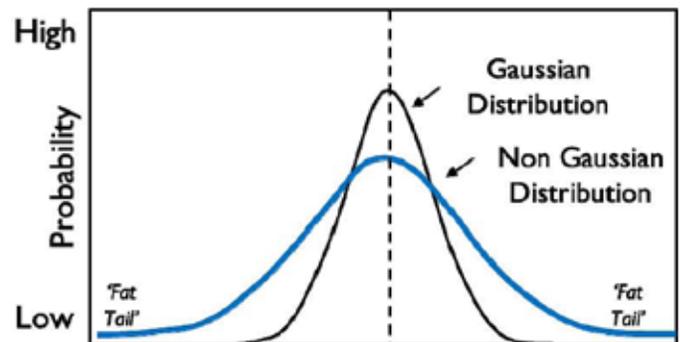


Figure 1: How the Gaussian distribution underestimates the risk in 'fat tails'.

Unfortunately, most of the mathematical modelling of risk, particularly that used by banks over the last decade, has been based on the assumption of normally distributed risk, partly because there is no obvious mathematical alternative.

So, while mathematics is an essential part of our risk measurement toolkit, it is important to exercise judgment in assessing the possible impact of risk in general, and discontinuities in particular. Placing blind reliance on mathematical models is dangerous.

Many businesses do not have the need, the time or the capabilities to extensively model risks in the way that the quants of the banking world have done over the last decade. Yet it is dangerous to pretend that risk doesn't exist or it doesn't matter. And using judgment completely unsupported by any kind of quantification is just as dangerous as using math without judgment, so what is the pragmatic manager to do?

This leads us to the third step in our journey: measurement.

### Step 3: Effective risk measurement

In some ways, the word “measurement” is a misnomer since it is impossible to measure something that hasn't happened (and may never happen) and in our daily lives we rarely use numbers to deal with our personal risk. However, some form of quantification is unavoidable if we are to manage risk in a large and complex organization.

There are essentially three types of techniques. The trick lies in using the right technique in the right context.

#### Technique #1 Error analysis

The first technique is based on quantifying past risk. This involves measuring how reliable your forecasts have been in the past, an approach that we broached in the first paper in this series.

In this context “risk” is synonymous with variation, and variation is the scatter of unsystematic error around the average that we normally measure by taking the mean absolute error (i.e., ignoring the sign). We can use this to estimate the range of likely risk in the future using a simple rule of thumb. Assuming that the level of variation does not vary, roughly 90% of future outcomes will fall within a range defined by the average absolute error multiplied by two.

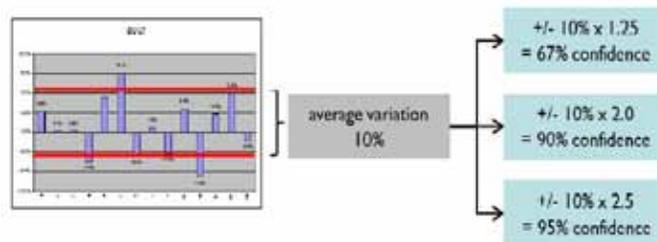


Figure 2: How average errors can be used to estimate confidence levels.

A few words of caution though.

- This technique works only when we have a reasonable number of short run errors measured in a consistent way. Small sample sizes can be dangerous, particularly if some of the measures are old.
- Also, comparing an actual with a forecast made many months previously risks mixing up forecast error with the result of actions taken in response to that forecast. This means that the technique can only be used to estimate risk over the short term.
- Finally, it is important to compare “apples with apples.” For example, it is wrong to attempt to combine errors from a forecast made one month ago with one made two months previously.

This technique is, however, a very simple way of getting a feel for the scale of variation—the large number of outcomes that fall within a tight range around the central forecast—thus we avoid the tedious and dubious practice of attempting to list every single source of risk.

This is a simple way of getting a handle on variation but not the impact of discontinuities which lurk in the “tail” of the distribution. How might we tackle these?

## Technique #2 Create scenarios

One way to get an understanding of possible discontinuities is to create a range of scenarios.

The best way to create scenarios is to identify the assumptions you made in creating your forecast and vary them to create a number of alternative forecasts. The key to creating effective scenarios is:

1. Successfully surfacing all of the key assumptions. Often the really important assumptions are not explicit—they are hidden. For example, behind an assumption of steady market growth might lay a much more important assumption—that there will be no disruptive innovation from a competitor. If this assumption is not surfaced and critically examined, your scenario could be missing a critical factor.
2. Ensuring that scenarios focus on discontinuities. It is possible to use scenario modelling to quantify variation, but it risks falling into one of the traps we listed earlier—putting a disproportionate amount of effort into modelling the many things that don't matter. A trap that many people fall into, however, is creating scenarios that don't properly explore the scope of potential discontinuities. Of course, it is highly unlikely that you will create an accurate forecast of what will actually happen, but it is important that your scenarios explore the tail of the distribution; that they are in some way 'extreme' and different from each other.

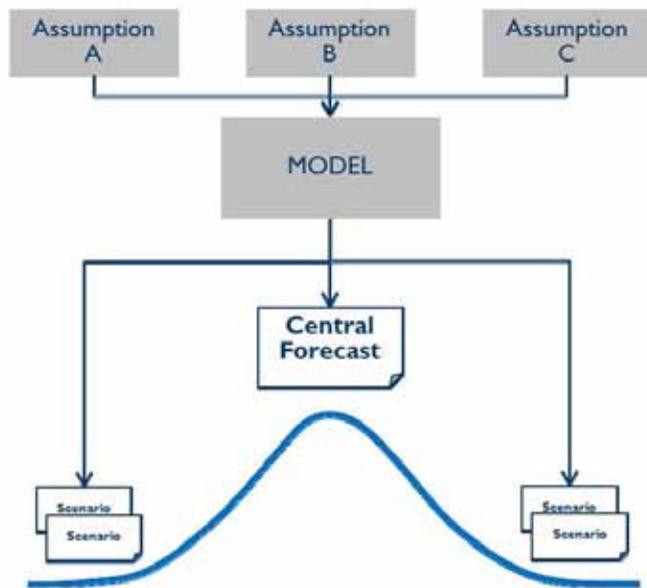


Figure 3: Vary model assumptions to create useful scenarios.

As useful as scenarios are, they have an important weakness: they depend almost entirely on judgment. We have no way of knowing for sure that we have created helpful and relevant scenarios and we cannot use them to provide us with an estimate of probabilities. Moreover, it is often the case that the judgment used in creating scenarios is that of a small group of

people with similar perspectives on the world or even a single individual. That is why it is important to find ways of involving a wide range of well qualified and knowledgeable people in the scenario building process. (For more on scenario planning see *The Art of the Long View: Planning for the Future in an Uncertain World*, by Peter Schwartz.)<sup>4</sup>

### Technique #3: Simulate risk

A third way in which risk can be quantified involves using statistically based simulation, with software such as IBM SPSS Modeler, which uses the Monte Carlo technique. Most situations that we face in business are complex—many interacting variables influence what might happen in the future. Monte Carlo simulation allows us to take estimates of the probability distribution of a range of factors and combine them statistically to produce an aggregate distribution. The end result is a forecast outcome along with the associated probabilities. So, for example, we can factor in judgments from multiple sources and combine them with probability distributions based on an analysis of historical errors to produce an analysis of combined risk in a manner that has mathematical integrity. In other words, we can combine measurements of normal risks mathematically with estimates of the impact of tail events to produce scenarios that reflect both.

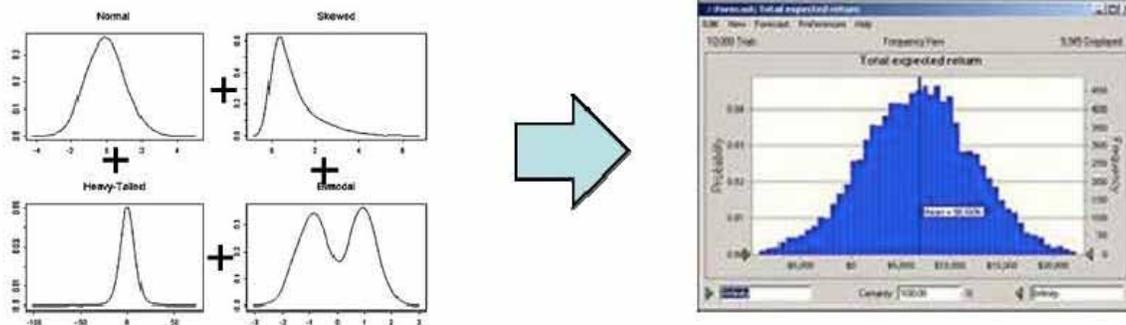


Figure 4: Use Monte Carlo analysis to combine risk profiles.

This approach overcomes most of the shortcomings of the first two approaches but has weaknesses of its own. It is complex, time consuming and, like all sophisticated tools, there are many ways in which its power can be misused or misapplied. Moreover, its apparent sophistication can lull us into a false sense of security since it is no less vulnerable to weaknesses in the assumptions upon which it is based. Finally, its sophistication may frighten us to the extent that we are scared to challenge the results of the analysis, even if it violates common sense—as many investment bankers have recently discovered.

Nonetheless, such approaches do have a place, particularly in helping us understand the risk associated with large, complex innovations where we have no experience to draw upon to help assess and manage the associated risk.

#### Understand probability math

Even if the only tool that your organization uses is judgment, it is important that anyone involved in assessing risk has a basic grasp of the basic principles of probability math and in particular how to combine judgment to produce sound consolidated estimates of risk.

Consider the following example used by Sam Savage in his excellent book, *The Flaw of Averages*.<sup>5</sup>

Suppose you are painting the ceiling of a room and plan to use an old stepladder. It would be wise to first give it a shake to assess how safe it is to use. Let us say you decide, based on this test, that there is a 10% chance of it falling over.

$$10\% \times 10\% = 1\%$$



Figure 5: Combining the probability of independent variables.

Now assume that a friend is coming to help and you introduce a second set of old stepladders. If just one ladder looked like it was going to fall over, the other person might help stabilize it. But what is the chance of two similar stepladders falling over?

The answer is 1% ( $10\% \times 10\%$ ). This is because the failure of one ladder does not have any impact on the failure of the other; the fate of the two ladders is independent of each other.

But what if the two ladders were attached by a plank of wood nailed between them which both of you stood on? Now the chances of both falling over at the same time are much higher—something close to 20 times higher (roughly  $10\% + 10\%$ ). This is because the fate of the two ladders is now completely dependent on each other.

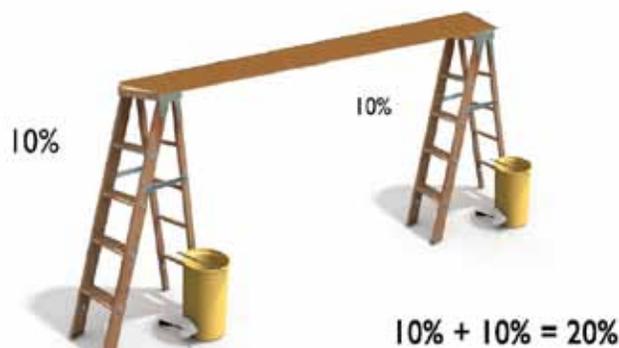


Figure 6: Combining the probability of dependant variables.

What this example demonstrates is how important it is in risk estimation that we understand how a change in any one variable impacts another as the nature of the relationship has an enormous impact on the overall risk profile. Adding individual probabilities is likely to overstate the risk; multiplying them may well understate it. In particular, it is important to understand how such interdependencies between variables plays out in time, as the financial crash of recent years has demonstrated. The failure of Lehman's bank cascaded through the world's financial markets because of the high level of interconnections between institutions. As a result, the impact of the failure of a single bank went way beyond what one might have anticipated if one considered the risk attached to any single business in isolation. Size alone does not make any bank "too big to fail." It is the level of interdependence that such institutions have with each other which means that regulators have to consider the aggregate risk profile of the financial ecosystem as a whole.

In fact, the existence of “fat tails” in the distribution of economic phenomena is likely to be the result of this interdependence of risk. Small negative events do not have a major impact on other parts of the system and are likely to be offset by other small positive events so the body of the distribution looks like the normal bell curve. Large events can trigger changes in another part of the network and the cumulative impact will plow through the system like an avalanche.

#### **Step 4: Managing risk**

So we have measured the risk but, as we already know, this is only half of the job. It serves no purpose to measure risk and then resign yourself to your fate. What then, do we do?

There are two approaches to managing risk—the passive approach and the active approach.

#### **Passive risk management**

The first passive approach to risk management has much to commend it, but it is very rarely adopted as an explicit policy, in business performance management at least. This approach simply requires that we accept the risk.

A certain amount of variation is inevitable and at best it is a waste of energy and resources trying to understand it and suppress it. At worst, attempts to hide the inevitable fact that the world cannot be predicted precisely leads to manipulation of data and, in rare cases, to outright fraud. After all, we would never take out insurance against the risk of being 10 minutes late for work in the morning because we cannot control the weather, so why should we not be comfortable with relatively minor fluctuations in business performance? In addition, as we have already discussed, risk isn't always bad — it can be the source of opportunity and of learning.

Of course, accepting risk in this manner relies on us being able to measure the likely scale of the risk involved and, as events unfold, differentiate between variation, which we might not want to respond to, and a discontinuity, which we certainly would, which highlights the importance of measurement.

Other approaches to passive risk management involve mitigating risk, if that is what we feel we must do. One approach is to create some form of buffer, such as a financial reserve or a hedge, which is a deliberate attempt to take on risk which offsets the risk that you already have. Insurance is another form of buffer, but in this case one held by a third party.

Another passive approach is to eliminate the risk—by exiting a line of business, for example, or limiting the ability of managers in your business to make certain sorts of decisions. However, given that all forms of economic activity involve risk of some sort, eliminating risk is not necessarily a good policy. Not getting out of bed in the morning is a very good way to eliminate the risk of being run over by a car, but, as much as you value your employees, it probably doesn't make sense to encourage them to adopt this policy.

The problem with all these forms of passive risk management is that they come at a cost (even if the cost is only an opportunity cost) and they only deal with negative risks that we are able to specifically identify and quantify in advance. For that reason, it is sensible to develop active risk management capabilities.

## Active risk management

Active risk management involves taking positive steps to deal with unforeseen outcomes as soon as they become evident.

There are two prerequisites for this:

- The ability to quickly identify an unanticipated outcome.
- The ability to do something about it.

The ability to do something about it depends on:

- Knowing what to do.
- Having the ability to execute it in good time.

Let us take each of these things in turn, in reverse order.

Flexibility is the ability to make changes quickly. This is partly the product of the way in which your business works. So, for example, if all major decisions have to be ratified by the main board at their quarterly meeting, then your business has less flexibility than one where the power to make decisions is delegated to lower levels in the organization. Another way in which flexibility is constrained is by the rigid application of budgetary control which, in extremis, could delay responses for up to a year!

Empowerment and flexible resource allocation processes will make your organization more agile in the face of risk, but there are a number of other ways in which you can build flexibility into your decision making processes. For example, once you have made a commitment to a course of action, it

reduces your flexibility, so in the face of dynamic and uncertain environments it makes sense to defer commitment for as long as possible. Rather than commit up front to a course of action, you might consider breaking projects into multiple phases around major milestones, each of which provides an opportunity to stop or to change course.

Flexibility has little value in itself. When faced with an unforeseen series of events, it is important that we have a clear idea of what to do in order to mitigate the risk or exploit the events. Contingency planning is an important tool in these circumstances. While it is often not possible to predict the exact series of events, pre-existing contingency plans can usually be adapted to the particular set of circumstances, and defining in advance how and who make what decisions in extreme circumstances is never wasted effort. One form of contingency planning that many businesses find very helpful even in routine situations involves the creation of a “playbook” of decision making options which can be deployed in different combinations and at different times in response to an emerging situation. An additional benefit of contingency planning is that it speeds up decision making because most of the thinking has already been done.



*Figure 7:* Contingency plans are essential if large numbers of people are to be quickly moved out of the path of hurricanes.

Finally, active risk management relies on spotting an emerging situation before it is too late to do anything about it. Speedy information provision is part of the answer—businesses that report on a weekly cycle obviously have an advantage over those that report quarterly, but it is more subtle than that. Particularly in data-rich modern enterprises it is important to be able to distinguish between “signals” (early evidence of a discontinuity) and “noise” (random variation around the expected outcome).

So, speed and quantity of information is helpful but it is not a silver bullet—taking action when none is required because we have mistakenly treated “noise” as evidence of a signal (a discontinuity) can easily make matters worse. Firstly, tampering in this way introduces more noise into the system, so making it harder to spot what is really going on. Secondly, taking action where none is required can introduce new problems, which is why the medical profession invests so much effort in reducing the risk of “false positives” in cancer detection and why there is a presumption of innocence in the criminal justice system.

This first type of error is debilitating but it is the second type of error—failing to spot a signal because it has been treated as noise—which is usually the most costly. There are ways in which businesses can safeguard themselves against this. Firstly, understanding the level of variation associated with the forecast process (as described above) will help them spot something that is “abnormal.” Secondly, scenario generation—the creation of plausible alternative futures—can help prime the perception of management, making it more likely that abnormal patterns of performance will be quickly spotted for what they are.

We can now complete the forecasting lexicon we introduced in our last article:

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### A forecasting lexicon

- **Bias**—Systematic forecast error: the mark of a poor forecast process. Manifest as a sequence of errors with the same sign (positive or negative) which often change in an unpredictable manner.
- **Variation**—Unsystematic or random error – a pattern of errors which do not exhibit extended sequences of the same sign. In a given set of circumstances the level of variation is often predictable.
- **Risk**—The possibility that the future will be different from that expected or forecast
- **Discontinuity**—An (uncertain) outcome that is not consistent with the past behavior of a system.
- **Scenario planning**—An approach to assessing uncertainty. It usually involves the production of (radically differing) alternative scenarios by making completely different sets of assumptions about political, economic, social, technological or environmental factors.
- **Dependent risks**—Those risks which tend to vary in proportion to each other (strongly correlated). Dependent risks can be added arithmetically.
- **Independent risks**—Unrelated risks that do not vary in proportion to each other (not highly correlated). Independent risks cannot be added; they need to be combined statistically (or judgmentally).
- **Contingency plan**—A plan designed to mitigate or exploit a possible set of circumstances.

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### Conclusion

Error is the inevitable consequence of every kind of forecast. Given that forecasts are a critical component of decision making in business, it is vitally important that the probable nature and scale of future error—risk—be properly understood so that action can be taken to mitigate any downside potential, and exploit any upside potential inherent in the situation.

This paper sets out a framework which businesses can use to enhance their ability to measure, and crucially, manage risk. All the evidence suggests that this is will be an increasingly important capability for companies in these exciting—and unpredictable—times.

For more information about operationalizing these ideas on a large scale please consult the authors of this paper [steve.morlidge@satoripartners.co.uk](mailto:steve.morlidge@satoripartners.co.uk) or [steve@theplayergroup.com](mailto:steve@theplayergroup.com).

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