STRATEGIC ECONOMIC DECISIONS

Leaders in the Economics of Uncertainty

PROFILE

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Superior Performance via Superior Price Forecasting

– A Professional Lacuna, and an Opportunity –

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Superior Performance via Superior Price Forecasting

– A Professional Lacuna, and an Opportunity –

Investment managers of all stripes have a single goal: to earn their living by generating above-market returns on their investors' money. "Passive" managers are the only exception to this rule insofar as they are not expected to earn excess returns. The success of active managers will always be a function of one and only one variable: *how well they forecast security prices,* whether in the very short run via momentum investing or via an AI algorithm, or in the long run via a Warren Buffett value strategy. *Investments of every kind are explicitly or implicitly a bet on the future of asset prices, since returns are always mathematical functions of changes in prices.*

Active managers rarely admit this fact, and rarely discuss the need for good price forecasting as a goal of its own. Instead, they claim to add value by "exploiting market inefficiencies" – today's trendiest selling point, or more traditionally by identifying undervalued securities that will be discovered by the market in the future, or by claiming to create smart beta. But such strategies only succeed in boosting returns to the extent that they are supported by superior forecasts of future *price* movements, or else superior forecasts of the *timing* of such price movements. On rare occasions when a client asks a manager to describe the model linking his "strategy" to future price movements, the answer is usually woolly.

At present, there is much discussion of the underperformance of many hedge funds. A principal explanation for this performance is the use of poor forecasting models. When on the road, the author often sees this in practice. Therein lies the opportunity for superior returns, of course.

The Paradox: With all this in mind, it is a striking paradox within the investment industry how little investors understand about price forecasting, *and how little they choose to learn about it.* What exactly does good forecasting require in simplest terms? There are two components.

First, there is the need to forecast the values of those *non-price events* that drive security prices, whether fundamental or technical in nature. For example, to forecast bond prices, an investor needs to assess the odds on future inflation *and* on future monetary policy *and* on the evolution of market expectations about yields. His resulting bond price forecast will implicitly or explicitly be the mean of the probability distribution of future prices implied by this underlying three-driver pricing model.

Second, there is the need for a good model that transforms the probability of events into the probability of prices. For example, if other things are equal, what will be the impact on the US stock market of a Trump victory in November?

From our experience, most investment professionals are not very adept at either price or event forecasting. *But why should they be good at either?* A doctor does not operate on a human body and a plumber does not adjust valves without ongoing training in what they need to know to succeed in their endeavors. But what are investment managers ever taught about price much less event forecasting? Last time we checked, the CFA program does not cover forecasting despite its critical importance. What about courses offered by economics and finance programs at top schools? While catalogues overflow with courses in econometrics and statistics, price forecasting proper is curiously missing from the offerings.

Worse, for reasons to be seen, those statistically-based regression models students learn to create are assumed to be adaptable to forecasting problems, even though they are typically useless for making *price* forecasts. In the case of event forecasts (e.g., the odds of Hillary Clinton winning the US election, or the odds of a fast versus slow recovery), regression models cannot even be defined in many cases. This is because the most relevant variables are non-quantifiable. Moreover, even when a regression model can be defined and the data are quantifiable, it will prove useless should "History's sample" become irrelevant due to structural changes in the environment.

The Reality: So how *do* investment managers cope given their lack of training in their most important job? The reality is that they are expected to "pick up on-the-job" what they need to know about forecasting. But how much can they learn in doing so? Given the cacophony of today's trading rooms and news media, they will find it difficult to transcend the news of the day – news that is inevitably short-term in nature, and news that is known to contain very little performance-enhancing value. Of course, they have to stay on top of the news, if only to avoid missing some news announcement that triggers a short-term market sell-off, a sell-off that usually reverses itself within days.

> *Yet none of this "experience" can substitute for proper training in the difficult science of proper forecasting, a subject about which there is in fact a lot to learn. One might think that the top executives of investment firms would require ongoing training focusing on price forecasting alone. But we know of no such effort in any firm.*

Suppose it were the case that there *is* nothing to learn about how to arrive at superior forecasts. Then we would have another paradox: managers would have to admit to making investment decisions by seat-of-their-pants-experience, and by not much else. In decades gone by, they could have claimed to have had inside information, but this is no longer possible. But if this is the case, and if managers admit that they are not good at price forecasting, then how can they justify their fees? And how convincing would they be?

For this reason, professionals do admit to making forecasts, if somewhat grudgingly. Yet at a much deeper level, they actually make such forecasts every day, often without thinking about it. For a principal result of modern decision theory is that, whenever a person makes a *choice* (e.g., selling one stock and buying another), he will do so because of the "subjective probabilities" he assigns to future event and/or price movements. Such probabilities *always* exist and are the basis of his actions. Moreover, these betting odds on price can always be assessed. [These two statements represent fundamental theorems in modern decision theory.] So it is possible, and in his self-interest, for an investor to *justify* his subjective forecast, and to be proud of it, rather than to cover it up or complain that "forecasting is too difficult to undertake."

Purpose of Essay

The purpose of this ***PROFILE*** is to summarize what makes for good versus bad forecasting, based upon sound forecasting theory and upon the author's own experience over two decades. Part A sets forth some preliminary observations about forecasting in general. Parts B and C discuss event forecasting and price forecasting respectively. These sections are necessarily somewhat technical, although we use no math in the exposition.

Part D is quite different, and it is non-technical. It can be read on its own by readers not interested in how to construct valid price forecasting models in the manner suggested in Sections B and C. Here we set forth three case studies of poor forecasting, each analyzed as to what went wrong. *In all cases, poor logic led to an emphasis on the wrong variables*. The three examples are macroeconomic in nature, and they include **(i)** fallacies about the impact of changing foreign asset preferences (e.g., "capital flight") on US interest rates; **(ii)** fallacies about Lawrence Summers' concept of "secular stagnation" in the US; and **(iii)** fallacies about the true causes of the severe slowdown of growth both in Europe and in the developing world including China. Our analyses here will hopefully demonstrate why much macro-economic forecasting has been so disappointing in recent years.

The ways in which this should be relevant to clients should be obvious: investment managers should be able to improve their decisions and thus their returns, and asset holders should improve their ability to judge the performance they are paying for.

A. Preliminaries

1. Connecting the Right Dots: At the deepest level, a forecasting model requires a specification of what "dots" (variables) are most relevant to forecasting the price/event in question, and of how those dots should be interconnected and weighted as to their importance. *The problem today is that investors are swimming in a sea of models in which the wrong dots are being connected in the wrong way.* More specifically, most forecasting models generate price forecasts in which the resulting forecast is not clearly linked to the probabilities of those events (dots) that largely determine future prices.

2. Meaning of a "Good Forecast" – and Its Relation to "Meaningful Risk Assessment": By a price forecast, we shall refer to the *mean* of the probabilities of future prices, where the probabilities represent our *best possible knowledge* about future prices *and* about the events that impact them. More formally, a price forecast (price being the dependent variable) will be a probabilistic function of several independent variables (events). Knowledge about these latter variables should be represented by appropriate probability distributions of each, e.g., the odds on a Clinton victory or of a rapid economic recovery. In equation **(1)**, the model by which these latter distributions are linked to the probabilities of price is indicated by the symbol **F**:

(1) pr (price) = F [pr (event 1), pr (event 2), pr (event 3)] + error term

where **pr** denotes "probability of." The function **F** usually takes the form of a linear regression model in practice. But it should not take this form. For the use of a regression model makes it impossible to arrive at the best possible betting odds on future prices (and hence on the best mean price) which is the principal goal of the forecast exercise.

What this implies for risk assessment is that the *only* risk captured when **F** is a regression model is that contained in the error term of the regression equation. Regrettably, this information about risk masks over any assessment of risk about the *events* — the most important source of price risk.

In short, by using the wrong forecasting model, invaluable information that an investor might possess or can obtain about those events that drive prices will be suppressed. A very poor probabilistic forecast of price (and of its mean) will be the result.

3. The Role of Luck: "Beating the market" is a binary event, like a coin flip. You do or you don't in any given year. Moreover, the number of times that you do outperform the market over a ten-year period is crucial for growing assets under management. Suppose, however, that an investor has odds of one-in-six rather than one-in-two in outperforming the market? That is, "success" is defined as rolling a dice and obtaining the facet marked 5. Now what is the magnitude of the role of luck in both cases? In the first case, the odds are surprisingly high that you will outperform the market by six or more times in a decade simply by flipping a coin. In the second case, the odds of getting facet five, six, or more times in a decade are infinitesimal. The point here is that luck plays a *very* large role in a *binary* process like beating/not beating the market.

Since this is true, and is becoming increasingly recognized, it is all the more important that an investment manager who succeeds can document *how* he arrived at his winning forecast, if only to establish that his success was not due to luck. That is, it is important for him to be able to show that *he was right for the right reason* in making his bet. That is, he can justify the forecast he used — and can explain it in clear English.

B. Event Forecasting

We shall now identify an approach to event forecasting that we have found most useful. It is always well-defined, and thus can always be utilized.

The over-arching concept to be used is that of *conditional probability expansion*, a concept often deemed to be *the* foundation of what we think we know. More specifically, virtually everything we say and do reflects our odds on event X happening *conditional* upon our odds of events Y and Z happening.

Worked Example: Consider a simple example. Suppose we wish to assess the odds of Hillary Clinton winning the election — an event that we believe will impact the stock market. Suppose also that we believe the odds of her victory will depend upon the state of the economy, and upon the degree to which voters find her economic program appealing, or not. Then utilization of the following "event tree" is indispensable in determining the odds of her victory.

FIGURE 1.A.: An Event Tree

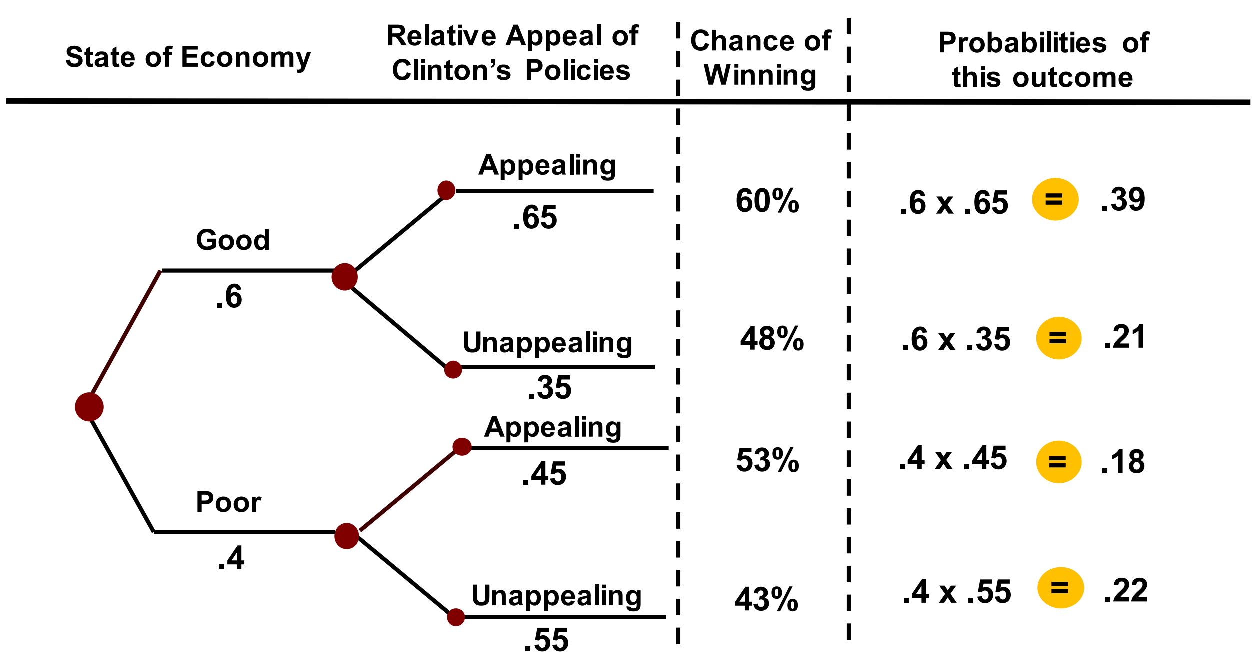
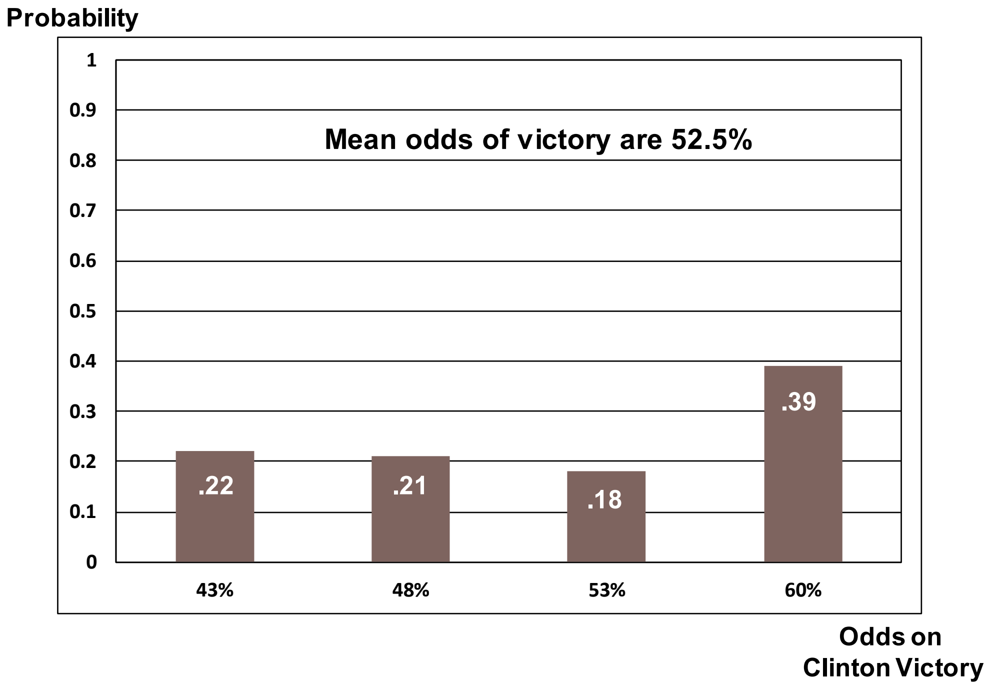


FIGURE 1.B.: Probability of Outcome and Mean Forecast



The first node in the simplistic tree of Figure 1.A. denotes the future state of the economy. We allow two economic states although we could allow many more. The second node denotes the chances that her policies are deemed appealing relative to those of her electoral adversary. Note in the tree that the probabilities on this second node are *conditional*: that is, they differ depending upon the state of the economy at node one. Next we show the percentage odds of a Clinton victory for each path of events. At the very end of each branch of the tree are the probabilities of each outcome. These are known as the "joint probabilities" of the events along that particular path through the tree. This probability is simply the arithmetic *product* of the probabilities of these events. Thus, the probability for the top-most path equals the product .6 x .65 = .39 as is indicated at the far-right end of the tree.

Finally, we collect these four joint probabilities and arrange them in the histogram format of Figure 1.B. The mean of this forecast (52.5%) represents our point forecast of the odds that Hillary wins. Note that the histogram *is* the "risk assessment" underlying this forecast mean. In this sense, forecasting *is* risk assessment, as stated above.

The Three Reasons Why This Probabilistic Expansion Model is So Important

Universal Applicability: The forecast of a Clinton victory generated by the event tree cannot be obtained by any form of statistical analysis, in particular any regression model. Conversely, the forecast generated by a regression model can be obtained from a suitably constructed tree model. The problem is that the probabilities needed to replicate the regression forecast will usually be meaningless and misleading.

Moreover, with an event tree forecast, the information required need not be "hard" and quantifiable. In the real world, many critical events are "fuzzy" and not quantitatively measurable. Thus, if it is important whether Clinton's proposed policies are appealing, then there is no need in this model to quantify appealing. *All that is needed is to assess the subjective probabilities of her policies being found appealing* (conditional on the state of the economy). And as John von Neumann and subsequent decision theorists emphasized, the only quantitative data needed are the probabilities themselves. These always exist and can be assessed whether they are subjective or objective (data-based), as we learn in decision theory.

Proper Ordering of Information: Note the order of events in the tree. Moving left-to-right out the tree, the first node comes first because information about it will change the probabilities of the nodes to the right — but not vice versa. That is, if God told us the truth about the state of the economy, we would then know which odds to assign to the "relative appeal" outcomes. These would be conditional upon the economic outcome, *but not vice versa.* In short, the use of conditional probabilities in a left-to-right tree ordering permits and in fact requires us to construct the tree in a way that captures how we think about the "informational causality" involved, i.e., about the way in which information about a given variable changes our betting odds on other downstream variables. This is extremely important if "information" is to be taken seriously when constructing a forecast.

Decomposition of Expertise – The Right Expertise Incorporated in the Right Manner: The probability assessments for each node in the tree should be undertaken by separate experts, i.e., by those knowledgeable about that variable. For example, an investor's preferred economists should arrive at the odds of economic growth in node 1, whereas political strategists should assess the odds on the relative political appeal of Clinton's economic policies. But in this latter case, the political experts should only assess *conditional* betting odds, since their best judgment will depend upon what happens to the economy — but this is a subject about which they know little.

What we see here is the concept of an *optimal decomposition of expertise.* The overall forecast of Clinton's victory will reflect within it the separate expertise of experts in two very different areas, namely economics and politics. These different sources of expertise are conflated when performing those path multiplications that lead to the overall forecast of Clinton's victory seen in Figure 1.B. Because of the proper incorporation of subject-by-subject expertise, this forecast will in general be completely different from one derived from some "consensus" of experts as to who will win the election. For a patient to emerge healthy from an operation, the expertise of both a good surgeon and a good anesthesiologist are needed, both drawn upon in the right order and manner.

Caveat on the Role of Historical Sample Data: In certain cases, a sample of historical data will play the role of the best available expert. To wit, if the environment is stationary (there are no structural changes over time), and if the appropriate data are available, then the probability distribution implied by a suitable regression analysis will suffice. But note that, while such assessments might well suffice for assessing the odds at nodes 2 and 5 of some five-node tree, subjective expertise will be needed to arrive at the odds appearing on nodes 1, 3, and 4. When probabilistic expansion of the tree is carried out so as to arrive at a proper forecast of the variable in question, *then the investor can say he has made the best use of both historical data and human expertise, properly blended.* Thus there is no conflict between using historical or else subjective probabilities in preparing a forecast. Historical data can also be used to assess the *relative impact* of each independent variable (node) on the dependent variable. But it need not be used.

Summary: To conclude, if optimal use is to be made of the best topic-by-topic information available when making a forecast, then a model like an event tree must be used in most situations. Such a model is "quantitative" to the extent that it incorporates all relevant probabilities — even of fuzzy events — and it does so in the correct manner dictated by modern decision theory. While virtually all investment managers *talk* in event tree terms ("I bet the market will go up about 10% if the following four events transpire, namely…."), such trees are very rarely constructed for the simple reason that their integrative power is either unknown or underestimated.

C. Price Forecasting

Price forecasting is fundamentally different from event forecasting. There are three fundamental reasons why.

First – Quantifiability: While those *events* that matter to prices need not be quantifiable as we have just seen, prices are always positive real numbers. The reason that this distinction matters is that it is almost irresistible for an analyst to utilize regression analysis in constructing a forecasting model. For, with the dependent variable (price) being quantitative, and with his Excel spreadsheet sitting in front of him, the temptation is overwhelming to utilize quantitative data for the independent variables (events).

The rub here is that in doing so, the analyst must restrict himself to the subset of independent variables that are quantifiable *and* for which stable historical data exists. Those myriad non-quantifiable events (such as election outcomes) that often matter most for future prices are thus ignored. This temptation grows with each celebration of the Advent of the Age of Big Data.

To be fair, most analysts have no idea that an alternative price forecasting model exists that does not require the quantification needed for regression analysis (see below).[1]

Second – Role of the Law of Supply/Demand: While future prices are certainly *impacted* by future events, whether quantifiable or not, prices are not in fact *determined* by such events. For the Law of Supply and Demand intervenes. It provides the link between tomorrow's news about events and tomorrow's price. We have emphasized this point in our recent work on that particular price known as "the rate of inflation." We stressed that future price changes of any and every kind will be determined by the impact of events on the *location* of the future supply and demand curves. Period. What this implies for price forecasting is that "event tree" analyses such as in Figure 1 must be augmented by an appropriate supply/demand story. But how can these two modes of analysis be linked? We will soon show how this integration is possible.

Third – Forecasting the Price of Goods versus the Price of Assets: Two different kinds of price forecasting logic must be utilized depending upon whether the price being forecast is that of a good or service as opposed to that of a financial asset (stock, bond, currency). The law of supply and demand still works in both cases, but it works in entirely different ways. Specifically, goods price changes are determined by shifts in both the supply and/or demand curves. Asset price changes, however, are largely driven by shifts in the asset demand curve alone, e.g., changes in the demand by investors for long Treasuries. A failure to understand this point is the main reason why many market participants and many economists expected QE to achieve much more than it did, for reasons we have stressed during the past six years. For QE operated on the supply side, by restricting the supply of bonds via ongoing bond purchases. This had negligible impact.

We start off discussing how to forecast the future price of goods. Thereafter we turn to assets.

Price Forecasting Problem in the Case of Goods and Services

The ultimate goal here is to arrive at a price forecast that incorporates an investor's best information about *all* the factors that will determine future prices. In the past, the author has argued that the only kind of forecasting model that can do this is the "Arrow-Bayes" price forecasting model that he developed in the mid-1980s.[2] Most every other kind of forecasting model (including the classical and Bayesian linear regression model) can best be understood as a very special and usually problematic case of this new model. This point was demonstrated formally in the article.

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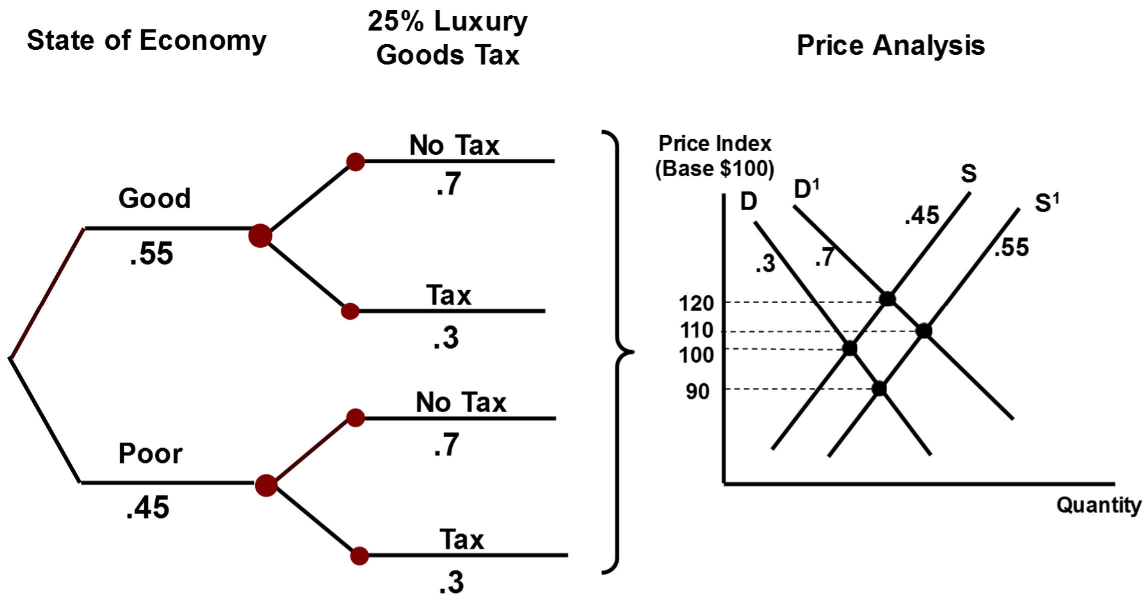
[1]Our criticism of regression forecasting models applies even when the regression model is a reduced-form model properly derived from an identifiable supply/demand structural model. Our criticism is much more fundamental, and epistemological in nature. To wit, no information relevant to future prices should be excluded simply because of the restrictiveness of the forecasting model used.

[2] "Arrow-Bayes Equilibria: A New Theory of Price Forecasting," by H. W. Brock, appearing in *Arrow and the Ascent of Modern Economic Theory*, Ed. G.R. Feiwel, The Macmillan Press, 1987.

The model can best be understood via the two graphs in Figure 2.A. where we forecast the price of a luxury goods index. We see here how different scenarios (paths through the event tree) will lead to different supply and demand curves. The different curves have probabilities attached to them. The probabilities on the supply curves are those of "good or poor" economies that impact supply and these must add to 1. So must the probabilities on the two demand curves: these are the odds on the passage of a luxury tax which will impact demand. *Ex post,* the actual future price will depend upon which pair of curves is the true one. The equilibrium price point at which these true curves intersect each other will be the actual price of the good in question. *Ex ante,* we do not know which curves will be the true ones, but we know the probabilities of the curves from the event tree.

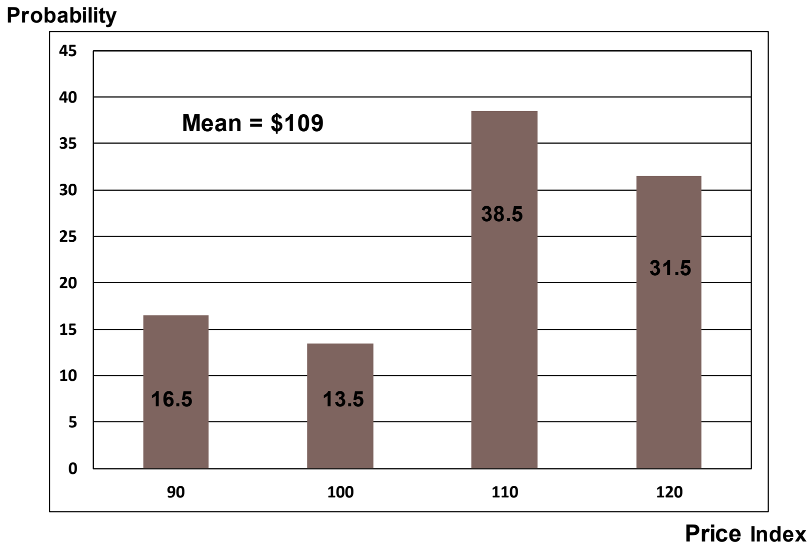
But how are the probabilities of price determined? We pass from the event tree to a price forecast histogram (Figure 2.B) as follows: *the probability of each possible price will be the arithmetic product of the probabilities of the two curves crossing at that point.*[3] These prices can be readily collated into a price forecast histogram as shown in the figure. The *mean* of this histogram will be the best point forecast of future prices.

FIGURE 2.A.: The Arrow-Bayes Price Forecast
– Luxury Goods Market –



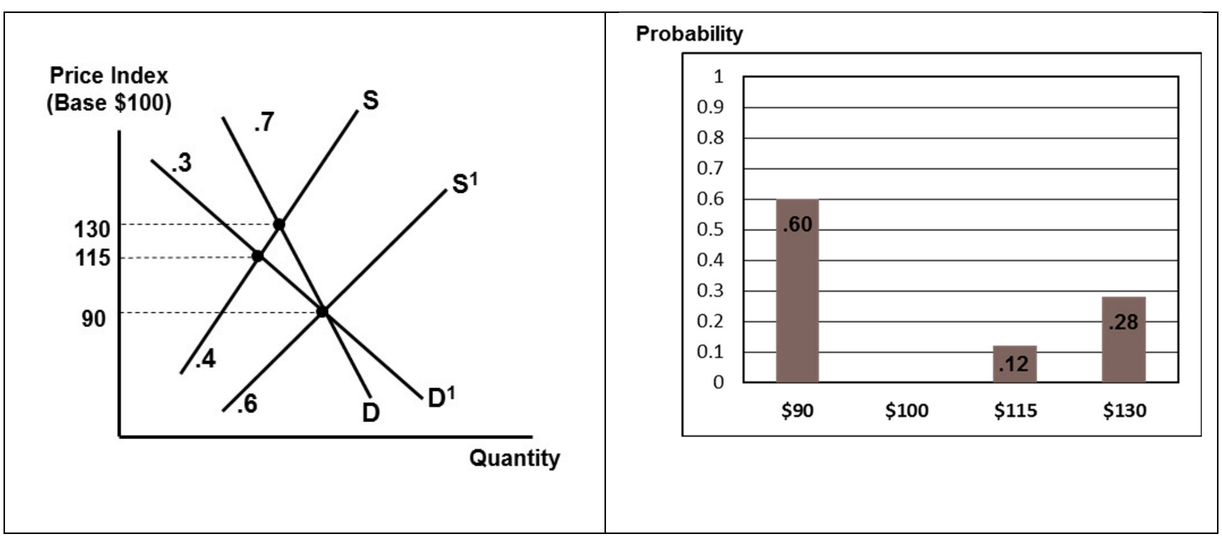
[3] Formally, this simple multiplication is only valid when the probabilities of the events driving demand are stochastically independent of those driving supply. But the model can be extended to deal with the case of dependence with no problem, as shown in the paper. Yet in reality, the two sets of drivers often are independent which simplifies matters.

FIGURE 2.B.: Probability of Price Index



Meaningful Risk Assessment: The entire price distribution constitutes *meaningful* risk assessment that explicitly incorporates the underlying risks surrounding those events that will determine future prices. Other forecasting models cannot generate meaningful risk assessments of this kind. To better understand this claim, consider Figure 3 where an Arrow-Bayes forecast is generated that could not be generated by any other model we know of.

FIGURE 3: Metal Price Forecast



This strange forecast was adapted from a copper price forecast the author undertook in the early 1980s. While the mean of the resulting price forecast is well defined, it is the distribution itself — the risk assessment — that is most important. For it provides the information that is most useful to the executive who decides whether to expand mining operations, or not.[4]

Believe it or not, the kind of changes in slope seen in the figure did occur when governments flip-flopped from communist to capitalist regimes, and/or from depression to boom. This happened in such copper-producing nations as Zambia, Chile and Peru. In a different context, we have shown in several past SED ***PROFILES*** devoted to the oil markets how event-driven shifts in the price elasticity of supply and/or demand can generate exaggerated oil price movements.

The Key Innovation of the Arrow-Bayes Model: The innovation here is that the probabilities of those key events shown in the tree are transformed into probabilities of different supply and demand *curves*.[5] That is, for each scenario of events impacting future prices, i.e., for each path through the tree, there will be one demand curve and one supply curve at the end of that path. This makes possible the computation of the likelihood of future prices as a direct consequence of the probability of the events determining them. The use of regression analyses does not permit the construction of forecasts of this kind — forecasts incorporating the best available information bearing on future events. Nor do regression models permit meaningful assessment of risk. For their "error terms" are mere statistical residuals, and do not convey information about the riskiness of those events that determine future prices. Indeed,

> *Brock (Chapter 18) shows how the Bayesian analysis in terms of states of nature can be used to estimate distributions of future prices. He correctly holds that….a true Bayesian distribution of future prices must be a transformation of the joint probability distribution of these basic factors.*
>
> Kenneth Arrow, in *Arrow and the Ascent of Modern Economic Theory*

Were more space possible, we could elaborate on how to construct this model in practice. But space is not available, so let us summarize.

Step 1: Create an event tree of those events driving demand, and then estimate the most likely demand curve for each path through the tree.

[4] Note that the probability of the low price is the *sum* of the probabilities of two S/D intersections at the same point. This is why there are three and not four price points shown.

[5] In virtually all other forecasting models, probabilities are attached to *numbers* (e.g., the number of tons of wheat produced, the odds of winning an election, etc.). Above, they are attached to *functions* (supply and demand functions). This represents a radical change in perspective. Focus is on future "states" not on regression "weights."

Step 2: Create an equivalent supply-side event tree.

Step 3: Superimpose on each other the two resulting sets of supply and demand curves to determine the sought-after distribution of future prices. For example, if there are 9 paths through each tree, then there will be 9x9 = 81 supply/demand intersection points that yield 81 possible future prices. The probability of each price will simply be the *product* of the probabilities of the two curves' intersecting there. These probabilities of future price will always sum to 1, as required.

We are assuming here independence between the supply and demand drivers. But as already noted, dependence can be introduced at the price of more elaborate event trees. This is demonstrated in the author's original article.

The Asset Price Forecasting Problem

When it comes time to forecast bond yields or the stock market or individual equity prices, the way in which supply and demand impact prices is quite different from that shown in most textbooks. Happily, it considerably simplifies the forecasting problem. That is because, as a general approximation, *shifts in the location of the supply curve do not matter.* The curve can be taken both as fixed and vertical. Thus the task of price forecasting reduces **(i)** to undertaking a probability assessment of where the future demand curve will lie, **(ii)** to noting the prices at which the different demand curves cross the given supply curve, and **(iii)** collating the resulting probabilities into a probability-of-price histogram as in Figure 2.B. The mean of this distribution of prices will be the desired future price of the asset in question.

But what exactly underlies this logic, and explains why the asset supply curve is approximately vertical and fixed? The story here is sometimes referred to as the "stock-versus-flow" story, or else as the "supply doesn't matter" story. We stress that this model is an approximation. But it is an approximation that is very useful in practice. The late Nobelist James Tobin of Yale University stressed the importance of this logic, and once told the author that most of the economics faculty of Harvard (his rival) did not understand it.

The US Bond Market As an Example: The demand curve for bonds at any point in time depicts the quantity of bonds that investors would wish to hold in their portfolios at different levels of interest rates, other things (including rates of returns on other assets) being equal.

An outward shift in the demand curve signifies that private investors wish to own *more* bonds at any given interest rate than before. Equivalently, they now wish to reduce their holdings in, say, cash or stocks, and to increase their holdings in bonds. Conversely, a backwards shift in the demand curve represents a shift in asset allocation preferences away from bonds towards other forms of wealth.

What determines changes in the demand curve for bonds? The obvious variables would include changes in the Fed funds rate, changes in inflationary prospects, changes in US economic prospects, changes in the asset allocation preferences of foreign investors, and heightened risk from holding risky rather than riskless assets as during the financial crisis of 2008. These shifts can be very large, with trillions of dollars of wealth being reallocated when there is a global crisis.

The Supply-Side: By the supply of bonds, we mean the total stock of all old bonds outstanding at a point in time. The supply *curve* shifts outward when the Treasury must issue new bonds to finance a new fiscal deficit. Thus, if an investor expects the fiscal deficit to be $75 billion higher than expected, he might reasonably assume that this will shift the supply curve outwards causing interest rates to rise. It does do so, but the impact on interest rates is negligible. This is because the magnitude of new issues is *dwarfed* by the size of the existing stock of (old) bonds.

Recall that the total stock of all Treasuries outstanding is some $19 *trillion*. Assume that the Treasury issues $25 billion of long-bonds in financing the new $75 billion deficit. It finances the rest with shorter-term securities. This increase in bond supply will barely shift the supply curve outward at all since it represents a tiny fraction of the value of old bonds outstanding. For these reasons it is the movement of the demand curve — shifts in asset preferences by the public — that cause yields to rise or fall, not changes in supply.

The impact on interest rates from changes in demand is heightened by another reality, the fact that the supply curve itself is nearly vertical. This is because the Treasury deficit must be financed *regardless* of the interest rate level, so the amount of new supply is independent of interest rates.[6] Additionally, the size of the stock of pre-existing bonds is a "given" and not a function of interest rates. As a result, the supply curve is nearly vertical. Geometrically, the impact on price of a given shift in the demand curve will be *greatest* when the supply curve is vertical (Sketch this on a napkin to see it.).

Implications for QE: In a QE context, annual central bank bond-buying can be viewed as a move to reduce the outstanding supply of bonds. This makes bonds more scarce, and their prices should thus rise. But once again, the *degree* of increased scarcity is small given the huge stock of bonds outstanding. This point is amplified by the fact that, while the Fed bought-in Treasuries with one hand, the Treasury was issuing new notes and bonds to finance large *new* fiscal deficits with the other. As a result of such considerations, there is much debate over whether bond-buying really did achieve its end of higher bond prices and lower yields. Such doubts are now being openly admitted by central bankers in several different countries.

Consider the experience of Germany where QE was never used, and indeed where the concept of QE is *verboten*. Regardless of the lack of bond-buying, yields on the German bund fell more

[6] Of course, if the slope of the yield curve changes, the Treasury has the ability to alter the *mix* of long and short obligations it issues. But the impact of such choices on rates is very slight.

than almost anywhere else, stunning even the Bundesbank. Analogously in the US, the termination of bond-buying in December 2014 was widely expected to cause bond yields to rise. They did not rise, but fell a bit and continued to fall more thereafter. As in Germany, the driver of course was the increasing "flight to quality" on the part of private investors who reallocated some two trillion dollars of wealth to safe government securities.

The Resulting Asset Price (Yield) Forecast: Given these observations, the bond yield forecast will be the probability of prices (yields) generated by the points of intersection of the different possible demand curves with a fixed and vertical supply curve — a curve representing nothing more than the current stock in bonds outstanding. An event tree will of course be needed to arrive at the probabilities of the different *demand* curves. But no such tree will be required for the supply curve. For it is approximately fixed and given.

In this sense, when "stock" dominates "the flow of new securities," price forecasting becomes a lop-sided special case of price forecasting in general. All that matters are the probabilities of future asset allocation preferences on the part of private investors. An Arrow-Bayes model will often not be needed.

D. Case Study: Examples of Problematic Macroeconomic Forecasts – Poor Theory and the Wrong Variables –

In this final section of the paper, we review three examples where deficient event and price forecasting caused many investors to underperform the market. The most glaring deficiency throughout all these examples was the failure to utilize event tree logic to arrive at "best" forecasts. But we will not discuss this further. Rather we will concentrate on **(i)** the failure of many analysts to identify the most relevant variables (the wrong "dots" were identified), and **(ii)** their failure to connect these dots in the correct manner due to the use of poor economic theory as well as poor forecasting logic. *It is the interrelationship between these two failures that is most interesting, and that we will stress*. Proper theory will lead to an identification not only of the right dots, but of the right manner in which to connect them. *The result: better forecasts and superior performance.*

As a dividend from studying the following case studies, it will become clear why macroeconomic forecasting has become so unreliable in recent years. Standard macroeconomic logic of the kind embraced by Lawrence Summers fails to take into account wholly new variables (new dots), and how to connect these correctly.

1. US Interest Rates and "Capital Flight"

Consider what happened to US interest rates between 1985–1990. Around 1985, the tide turned against the US, and the dollar reached its high in early 1985. Sentiment about the US became negative, and there was widespread fear that foreigners would "pull out their money" thus driving US bond yields up. That was the forecast. But it proved wrong. Why? To begin with, it turns out that foreigners as a whole *cannot* pull their money out even if they wish to. For the net capital inflow into, say, the US, will always equal and indeed finance the trade deficit. ["The capital account equals the current account" in economics jargon.] When this constraint is taken into account and is coupled with the observation that current account deficits are "sticky," then then it turns out both in theory and in practice that rates will not rise. For there will be no reduction in capital inflows negatively impacting bond prices.

Rather, a fall in the dollar will do all the work. To understand why the dollar should have and did fall requires an understanding of the "duality" between interest rates and the value of the dollar in attracting foreign capital. When foreigners don't want to remain as invested in the US as they used to be, then they can be "bribed" in two different ways to keep funding the US current account deficit — which they must do. *First*, via higher yields. This did not happen. *Second*, via a reduced currency value. This did happen. A cheaper dollar makes it possible for foreigners to buy the same *fixed* amount of US bonds (or other US assets) required to fund a fixed current account deficit *with less of their own money.* Additionally, when foreigners buy US assets as the dollar falls, they are rewarded by a *reduction in currency risk*. [Buying after the dollar has fallen rather than when it is about to fall is obviously less risky.]

In an April 27, 1985 *New York Times* op-ed piece, the author set forth this logic and forecast exactly what did happen and why it would happen. Such a piece would never have been published were it not both convincing and totally out of the mainstream. The performance of those who followed this logic beat the market.

To sum up, the consensus forecast of higher yields was wrong because it failed to identify the three most relevant dots (reduced foreign appetite for US assets, the trade deficit, and interest rate/currency duality), and it connected the wrong dots in the wrong way. As a result, investors underperformed.

2. Lawrence Summers and Secular Stagnation

Larry Summers is the principal economist associated with the widely accepted concept that we face a decade or two of secular stagnation. Summers is very smart, and he rarely makes mistakes. Indeed, who can disagree with his prognosis that, if productivity growth really has fallen in half and the growth of the workforce will continue to slow, then real GDP growth will prove lackluster?

How then can one criticize Summers' views? We have three objections to his analysis. *First*, we disagree with one of his main policy recommendations, namely still-lower interest rates. *Second*, we believe he has identified the wrong dots by sticking to classical variables that supposedly explain growth, and by failing to understand the new macroeconomic world of today. To be sure, Summers correctly interconnects *his* dots. But when other and arguably more important dots are included in the analysis of growth, his model becomes highly problematic. *Third*, we believe he has been somewhat sloppy in utilizing his theory to forecast the future.

For example, what does he mean by demographic headwinds, and how are these related to stagnation? More broadly, what does he really mean by secular stagnation in GDP growth? While he focuses on real GDP growth itself, he fails to establish that real GDP per capita will also stagnate. He is also unclear on the relationship between reduced productivity growth and prospects for living standards. In what follows, we shall present an alternative story in order to demonstrate how the new dots must be connected. It turns out that the future may not be as depressing as he predicts, provided some wholly new policies are adopted. Moreover, the entire stagnation story must be rethought from scratch.

Problem 1 – Faulty Policy Recommendations: First, Summers believes that a principal way out of stagnation is to lower the interest rate to its "natural" or "full employment" level — a rate even lower than the current Fed funds rate. Here he revives a 115-year-old argument of the Scandinavian economist Knut Wicksell. Why will lower interest rates work? Because the US economy is suffering from inadequate aggregate demand — and here Summers is absolutely correct. This lack of demand is evidenced by the excess of savings over investment. Lower interest rates would therefore lead to greater investment spending and hence to greater aggregate demand. This is standard 1950's IS/LM textbook logic with which it is hard to disagree, *other things being equal*.

But other things are not equal. *First*, ten years of rock-bottom rates are leading to a disaster for pension funds, insurance companies, and savers. We believe this development could make 2008 child's play by comparison. Summers never mentions this dot. *Second*, endlessly lower rates have not stimulated private investment anywhere, so why would they now — regardless of their deleterious impact on savers and retirees which has already slowed growth? Indeed, since Summers first began talking about stagnation and the need to lower the natural rate, central bankers worldwide increasingly admit that "monetary policy can do little more than it has."

But he does not stop there. He stresses that an additional source of aggregate demand should come from a large government-coordinated infrastructure investment program. We fully agree. Yet he fails to point out that, when government decides to construct a new electric grid (or whatever) *interest rates do not matter* to those who carry out the construction of new projects. This is yet another reason why his call for even lower interest rates strikes us as problematic, if not dangerous.

Problem 2 – The Wrong Model: There are many other problems when Summers turns to his model of long run secular stagnation. To begin with, he accepts at face value government statistics on the apparent 50% drop in real GDP growth during the past half century. This is explained by an alleged collapse in productivity and a reduction in workforce growth. With respect to productivity growth, there is much debate about the nation's statistical base and its relevance today. Indeed, *The Economist's* excellent April 30th cover story "The Prosperity Puzzle" documented a dozen reasons why official measurements of US inflation, GDP, and productivity growth are highly misleading.

In addition, the link between productivity growth and living standards has become very weak. One reason why is that productivity growth measures the increase in output per worker hour in a world where the very meaning of "output" has become ever more problematic and increasingly irrelevant to living standards. What indeed is output when the classical concept of "more goods of the same kind (tons of steel)" is replaced by "ever better quality goods, and completely new goods — often free like smartphone apps"? We made many of the same points in our reports on inflation and productivity growth published in the past year.

The True Reasons for *Apparent* Stagnation: Let us focus on demographic challenges ahead, ignoring the productivity issue for the moment. The official data on workforce growth suggest that real growth *should* have fallen by half during the past half century, as it has in dropping from about 3.6% to 1.8%. For according to the US Bureau of Labor Statistics, workforce growth increased at an average annual rate of 2.15% during the 1960–1980 period. But it is now projected to grow at only 0.7% annually during the 2010-2020 decade, and at 0.5% during the 2020–2030 decade. *Then by simple arithmetic, real GDP growth should have slowed by 2.15% – 0.6% = 1.55% without any consideration of reduced productivity growth*. It did. Is this "stagnation"?

Perhaps — but perhaps not. After all, according to these data, the growth in real GDP *per worker* will have barely changed when the growth of both output and of the workforce has been cut in half. Another way of saying this is to ask whether we *need* to acknowledge a large drop in productivity growth to explain the drop in real GDP growth during the past fifteen years. The demographic contraction goes a long way toward explaining matters.

The Role of the Supply-Side: Above and beyond this cavil, the entire issue of stagnation requires an understanding not only of the "demand-side" of the economy that Summers restricts himself to, but of its "supply-side" as well. Summers never takes this dot into account, even though we believe it to be the most important dot of all. The supply-side story centers on the role of the ongoing digital revolution in pushing the nation's supply curve ever further outwards due to dramatic and never-ending cost reductions.[7] We explained this at length in our recent ***PROFILE*** on inflation and disinflation. *What mattered is that this revolution has been pushing the supply curve outwards <u>faster</u> than the demand curve.* This development provides a perspective totally different from that of Summers on the concepts of inadequate demand *and* of GDP stagnation *and* of ever-lower inflation *and* of stagnant wages. It also implies that

[7] Mathematically, a reduction in input costs causes firms' optimal level of production to *increase* at any given price point. Thus the entire supply curve shifts out.

stagnation is not inconsistent with either full employment or increasing living standards. More specifically:

> *Suppose that the supply curve continues to shift outward faster than the demand curve. Then the rate of GDP growth will keep decreasing and will ultimately turn negative and stay negative. Also, inflation will continue to fall and will turn into deflation, and wages will drop. Yet at the same time, living standards will paradoxically continue to rise as long as the primary reason for the outward shift in the supply curve is ever more efficiency-enhancing technology. Additionally, assuming that labor markets are flexible, there need be no rise in the unemployment rate despite the ongoing reduction of GDP growth — even when such growth is negative.*
>
> *These remarkable assertions will be established formally and also diagrammatically in our July **PROFILE**. The model underlying this analysis not only predicts what our future could look like, but it explains why inflation and nominal GDP growth and wage growth have been falling since 1985 — not just since the Global Financial Crisis and the decline of China. Moreover, our new logic holds true regardless of our demographic fate.*

Policy Implications – Including Money Printing: This new account also makes clear why we *must* increase aggregate demand, and how we can do so without waiting for a revival of investment demand — which may take years. *We need government to help shift the nation's demand curve for goods and services outward at a rate slightly faster than the supply curve is shifting outward due to ongoing technological efficiencies.* For if this condition holds true, then by the converse of the theorems cited above, GDP growth and inflation will continuously increase, not decrease as they will when **S** shifts outward faster than **D**. *This will make it possible for the nation to continue to service its private and public debt*, a very important point. All this will be proven in our forthcoming report.

But how can the demand curve be pushed outwards without waiting for an investment boom? This can be achieved via a suitable increase in the money supply, financed *fiscally* by the Treasury and *not monetarily* by the Fed. This is a form of "helicopter drop" of money, and the resulting increase in the money supply will *by definition* shift the nominal demand curve outward. We discussed this strategy in our essay on inflation/deflation. Such a fiscal stimulus to demand can be achieved either by tax cuts or by direct credits to peoples' bank accounts.

Once again, the primary goal must be to shift the demand curve outward slightly faster than the supply curve, and to see that this is true every year.[8] Importantly, the degree of fiscal stimulus

[8] Could the government slow down the outward shift in the *supply* curve instead of focusing on demand? No. It cannot play the role of King Cnut and order the digital revolution to stop in its tracks. But it can and must stimulate *demand* as J. M. Keynes was the first to recognize.

needed to do so in the longer run — if any — can easily be controlled so that the market need not fear hyperinflation. Indeed, a 2% inflation rate should be targeted.

Summary: Current macroeconomic logic and the policies it implies fail to take into account many new dots. We have taken issue with some of Larry Summers' classical views since they are well known and provide a platform for discussing what is new, and why classical macroeconomic logic (e.g., his IS/LM model) is outdated when it comes to assessing today's new realities. Summers is rarely wrong in so far as he goes. He simply does not go far enough. His stagnation story is ill-defined and, in our view, does not fly. The wrong dots are connected in the wrong way.

3. The Severe Slowdown in Growth Overseas

Europe: Most observers attribute ongoing stagnation in Europe to the Global Financial Crisis. This view is incorrect. "Eurosclerosis" has been recognized and debated since the mid-1970s. What is needed to address it? To read the papers and to listen to politicians, all that is needed are even lower interest rates and additional QE. These monetary policies have not only failed to invigorate growth, but they should have failed. For the root problem of Europe's stagnation (with the exception of a couple of nations) has always been overly-regulated product and labor markets. These caused high unemployment and slow growth decades before the advent of the Global Crisis in 2008. Most governments have refused to take on their unions. Any good forecasting model of European growth should give much greater weight to the role of market reforms, and less weight to monetary policy. Once again, the wrong dots have been connected in the wrong manner.

China: The slowdown is proving to be deeper and longer than most observers predicted. The alleged causes are too much debt, wasteful investment spending, the failure to reform state-owned enterprises, and corruption. These factors have all contributed, to be sure. But economic growth theory points to much deeper problems that, if not addressed, will cripple China for many years and possibly bring about the end of Communist Party rule.

What exactly does growth theory say? In our pessimistic essay on China last year, we reviewed Walt Rostow's classic work *The Five Stages of Economic Development*. Rostow pointed out that, during the first three stages of development, a nation must invest in the infrastructure needed to pass from a low-investment, low-productivity, and agricultural economy to a much more productive consumption-based economy (just what China is trying but failing to achieve). But to make this transition during Stages Four and Five, the nation must abandon *top-down* "dirigiste" control, whether by a dictator or by the Communist Party.

This dictatorial modus operandi must be replaced by a *bottom-up* individualistic system where myriads of small businesses are founded every year, many morphing into big ones over time. But due to incentive structure considerations, this transition requires the institution of the rule of law, of property rights, of human rights, and of a judicial system in which judges cannot be bribed. Such improvements in civil society would not only encourage the most needed type of business formation, but would also dramatically reduce corruption.

In this latter regard, it is noteworthy that corruption reduces economic growth in the early stages of development much less than in the later stages. When Stalin ordered dams to be built in the Ural Mountains, they got built — corruption or no corruption. Growth was boosted accordingly. But in the later stages, corruption and the lack of the rule of law will impede the formation of myriad small businesses that are the bottom-up engines of growth. Growth suffers accordingly. Just consider the examples of North Korea and of the former East Germany. Contrast their dismal growth rates with those of their neighbors, South Korea and West Germany. The difference is almost wholly accounted for by good versus bad incentive structures, and not by “cultural differences.”

In short, China must abandon its rule by a corrupt Communist Party for a proper transition to the Hong Kong/Singapore type of economy that it seeks. *But how likely is it that those who hold power will relinquish it?* A proper forecasting model for Chinese growth will focus on the likelihood that suitable incentive structure reforms are introduced. Yet most consensus models do not address this issue. Once again, the wrong dots are being connected in the wrong manner.

The Developing Economies ex-China: We were very critical of James O’Neill’s forecast that the rapid development of the BRICS economies would propel global growth for decades to come. He seemed completely ignorant of the roles that corruption and adverse incentive structures play. These dots were overlooked. These ex-China economies now account for about 29% of Global GDP, more than the US, Europe, or China. Their growth was forecast by many to be around 9% during the 2005–2030 period. Add in continuing strong growth in China, and it was expected that the world’s economy would grow at about 6% annually. Well, the global economy is now barely growing at 3% and the non-China BRICS economies are growing at about the same rate.

The principal reason for the collapse of growth was an explosion of corruption throughout the world that has been almost unprecedented. Corruption of course implies a misallocation of capital, and thus reduced growth. What is happening in Brazil, Nigeria, Venezuela, Russia, and countless other countries is staggering. O’Neill’s forecasting model failed to forecast any such developments, and his analysis was largely extrapolatory in nature: “China will be the first of many nations that will propel the global economy to unknown levels of prosperity.”

4. Other Examples: Poor forecasting models due to poor logic have plagued the interpretation of monetary policy in recent years. Remember all those forecasts of high gold prices and hyper-inflation due to the “money printing” implied by QE? Remember the forecasts that large deficits increase bond yields? Remember the classical Phillips Curve whereby reduced unemployment implies higher inflation? [During the latter 1990s, unemployment fell below 4% and yet inflation kept dropping.] Over the years, we have discussed these and many other case studies not included above. In all cases, consensus forecasts were wrong because the wrong dots were being connected in the wrong way.

To point this out is not be to contrarian, which we are not. But it does make clear that, upon occasions, it is wise to bet against the consensus if your forecast is buttressed by good theory and good logic. Meaningful risk analysis and forecasting would also help!