Anticipating the Economic Turnaround with S-curves

Theodore Modis, January 15, 2009

Fundamental scientific concepts can shed new light in predicting the economic turnaround. Biological models that describe growth in competition invariably involve S-shaped patterns, the so-called S-curves.

The population of rabbits multiplying in a fenced-off grass field grows exponentially in the beginning but later on slows down as the ecological niche is being filled to capacity. By the time the rabbits population reaches a ceiling (i.e. the maximum number of rabbits that can be sustained in the field) it will have traced out an S-shaped curve over time.

Besides rabbits and other species, S-curves also dictate the growth patterns in inanimate populations such as products and markets. Whenever there is growth in competition (survival of the fittest) a "population" will evolve along an S-curve, be it the sales of a newly launched product, the diffusion of a new technology or idea, an athlete's performance, or the life-long achievement of an artist's creativity. And because every niche in nature – and in the marketplace – generally becomes filled to completion, S-curves possess predictability.

In my career I have used S-curves to forecast diverse phenomena with considerable success. Most recently I was asked to estimate the timing of the turnaround from this economic crisis exported to us last year by the US.

Typical variables to monitor the economy are Gross Domestic Product (GDP), employment figures, and interest rates. Competition plays a central role in the evolution of all three thus justifying the use of S-curves.

A simple graph of the U.S. GDP confirms the suitability of S-curves to study its evolution. Since 1929 the evolution of the GDP depicts an exemplary S-shaped pattern. The thick gray line on the graph is a mathematically fitted S-curve. It is interesting to note that the data have now entered the second half of the S-curve, which implies that the days of maximal rate of growth witnessed in recent years are gone forever.

U.S. Gross Domestic Product

GDP in billion $
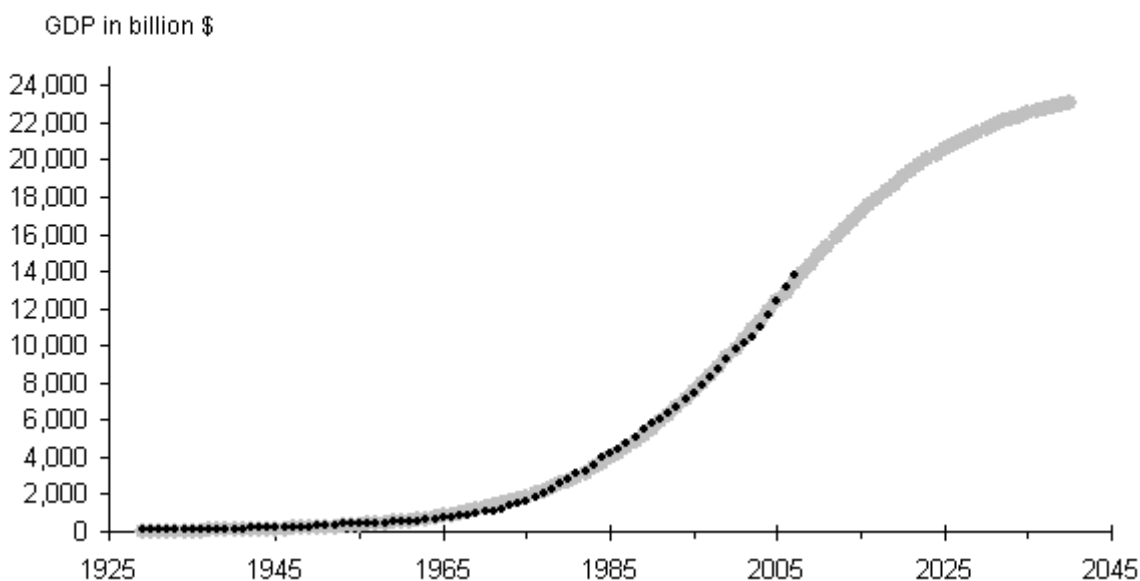
But more information can be extracted if we consider detailed semester-to-semester data and zoom into the small deviations above and below the theoretical trend. The data-to-trend ratio depicts a cyclical pattern of peaks and valleys of certain regularity, which permits us to estimate when the present downturn will bottom out.

The same approach can be used with the other two indicators, unemployment, and interest rates, both available in even more detailed monthly data. The former, documented by the employment-to-population ratio in percent, has also undergone an S-shaped growth step since the World-War-II days and has reached a ceiling of 63% in the mid 1990s, albeit with considerably larger fluctuations above and below the trend than those of GDP.

The latter, documented by the federal fund effective rate, has followed a bell-shaped curve that peaked around the early 1980s and now is back down where it was in the 1950s. This bell pattern, otherwise referred to as a lifecycle, reflects a *rate* of growth and is also deduced from an S-curve (in this case the S-curve is fitted to the *cumulative* federal fund rate).

All three variables have given two estimates each for the approaching bottom of the present downturn. The first estimate is obtained using the average peak-to-valley distance and the second using the average valley-to-valley distance. The table below lists the six estimates.

	Using peak-to-valley	Using valley-to-valley
	2nd qt	4th qt
US GDP forecasts.	2009	2011
Employment-Population Ratio. forecasts.	Aug-09	Aug-10
Interest Rates forecasts.	Jul-09	Jul-09

Averaging the six results we obtain February 2010 as the "official" answer. Of course this forecast is based on the *average* delays between the peaks and the valleys of the respective cyclical patterns. As much as the average may represent the best forecast (most probable outcome), the final outcome could turn out to be away from the average. From the six independent measurements the uncertainty can be estimated as ± 7 months.

The economic turnaround then in all probability and from the point of view of S-curves can be anticipated to begin in February 2010 ± 7 months.