Advanced Forecasting Techniques and Models:
J-Curve and S-Curve

Short Examples Series

using

Risk Simulator

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File Name: *Forecasting – Exponential J-Growth Curves*
Location: *Modeling Toolkit | Forecasting | Exponential J-Growth Curves*
Brief Description: *This sample model illustrates how to use Risk Simulator for running a simulation model on the Exponential J-growth curve where the growth rate is uncertain over time, to determine the probabilistic outcomes at some point in the future*
Requirements: *Modeling Toolkit, Risk Simulator*

In mathematics, a quantity that grows exponentially is one whose growth rate is always proportional to its current size. Such growth is said to follow an exponential law. This implies that for any exponentially growing quantity, the larger the quantity gets, the faster it grows. But it also implies that the relationship between the size of the dependent variable and its rate of growth is governed by a strict law, of the simplest kind: direct proportion. The general principle behind exponential growth is that the larger a number gets, the faster it grows. Any exponentially growing number will eventually grow larger than any other number that grows at only a constant rate for the same amount of time. Figure 1 shows an exponential growth curve.
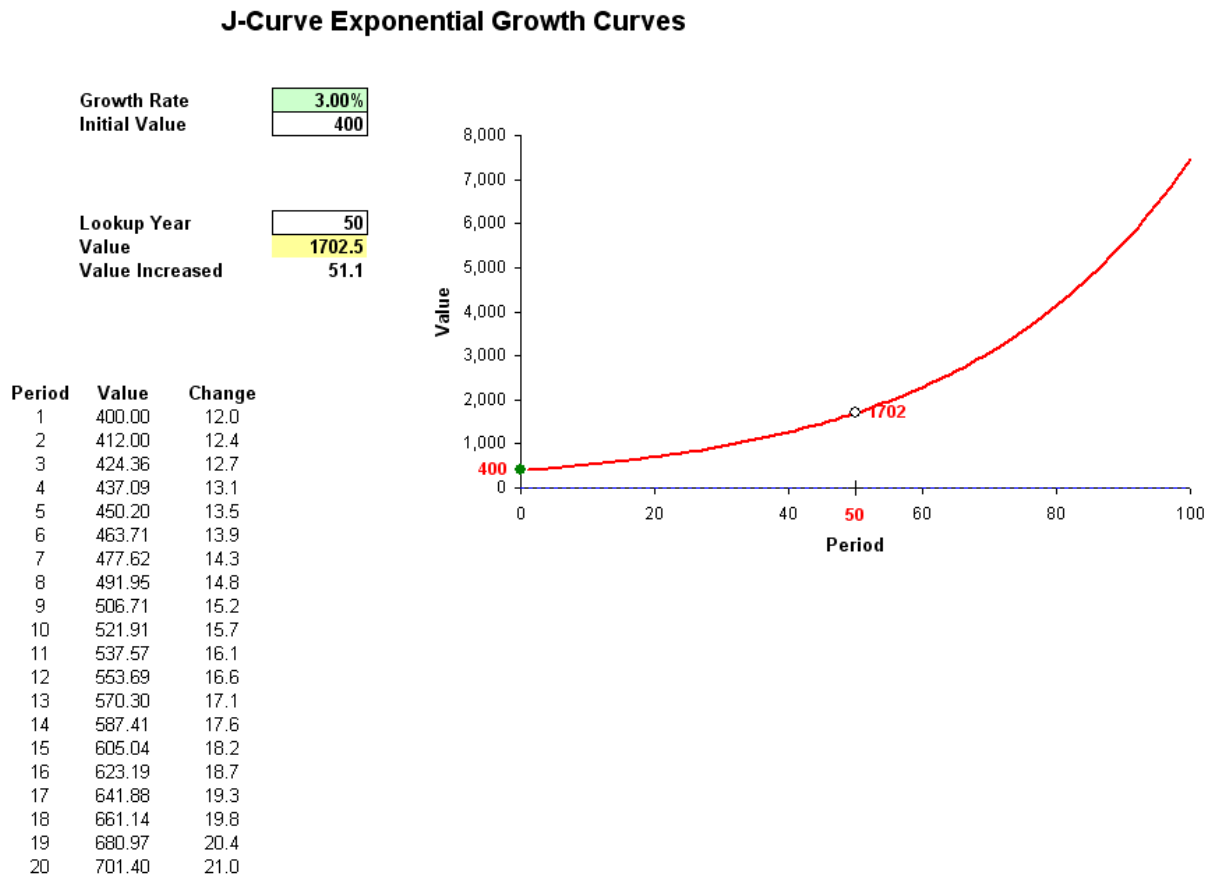

Figure 1: Exponential J curve

Procedure

You can run the preset simulation by clicking on **Risk Simulator | Change Profile** and selecting the *J Curve* profile, then, run the simulation by going to **Risk Simulator | Run Simulation**. Alternatively, you can set your own or change the underlying simulation assumption as well as the input parameters. The *Growth Rate* and *Initial Value* are the input values in the model to determine the characteristics of the J curve. In addition, you can also enter in the *Lookup Year* to determine the value for that particular year, where the corresponding value for that year is set as a forecast.

Using the initial model inputs and running the simulation yields the forecast charts shown in Figure 2. The expected value of Year 50 is 1717.63 units.
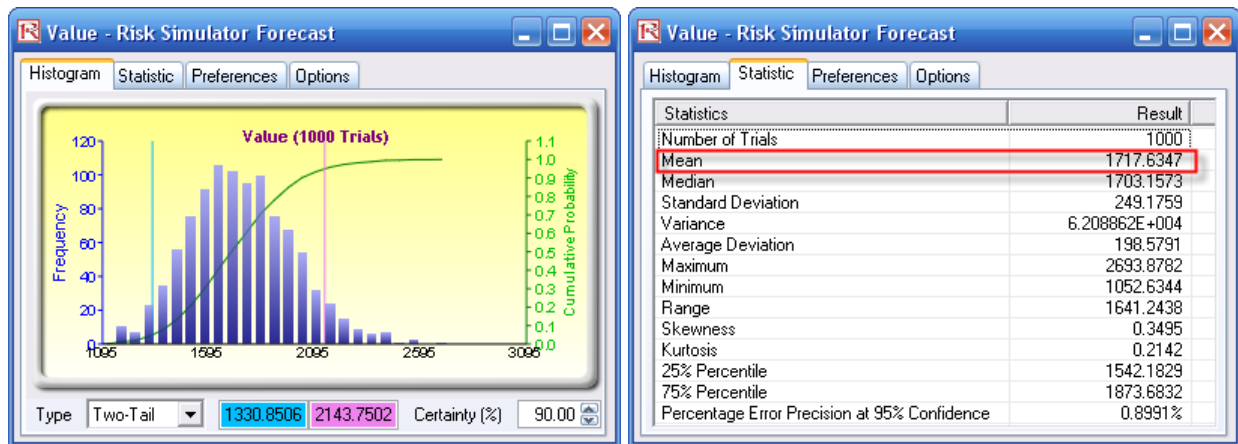

Figure 2: Simulated results of a J curve

Forecasting – Logistic S-Growth Curves

File Name: *Forecasting – Logistic S-Growth Curves*
Location: *Modeling Toolkit | Forecasting | Logistic S-Growth Curves*
Brief Description: *This sample model illustrates how to run a simulation model on the logistic S-growth curve where the growth rate is uncertain over time, to determine the probabilistic outcomes at some point in the future*
Requirements: *Modeling Toolkit, Risk Simulator*

A logistic function or logistic curve models the S-curve of growth of some variable. The initial stage of growth is approximately exponential; then, as competition arises, growth slows, and at maturity, growth stops (Figure 3). These functions find applications in a range of fields, from biology to economics. For example, in the development of an embryo, a fertilized ovum splits, and the cell count grows: 1, 2, 4, 8, 16, 32, 64, etc. This is exponential growth. But the fetus can grow only as large as the uterus can hold; thus other factors start slowing down the increase in the cell count, and the rate of growth slows (but the

baby is still growing, of course). After a suitable time, the child is born and keeps growing. Ultimately, the cell count is stable; the person's height is constant; the growth has stopped, at maturity. The same principles can be applied to population growth of animals or humans, and the market penetration and revenues of a product, where there is an initial growth spurt in market penetration, but over time, the growth slows due to competition and eventually the market declines and matures.
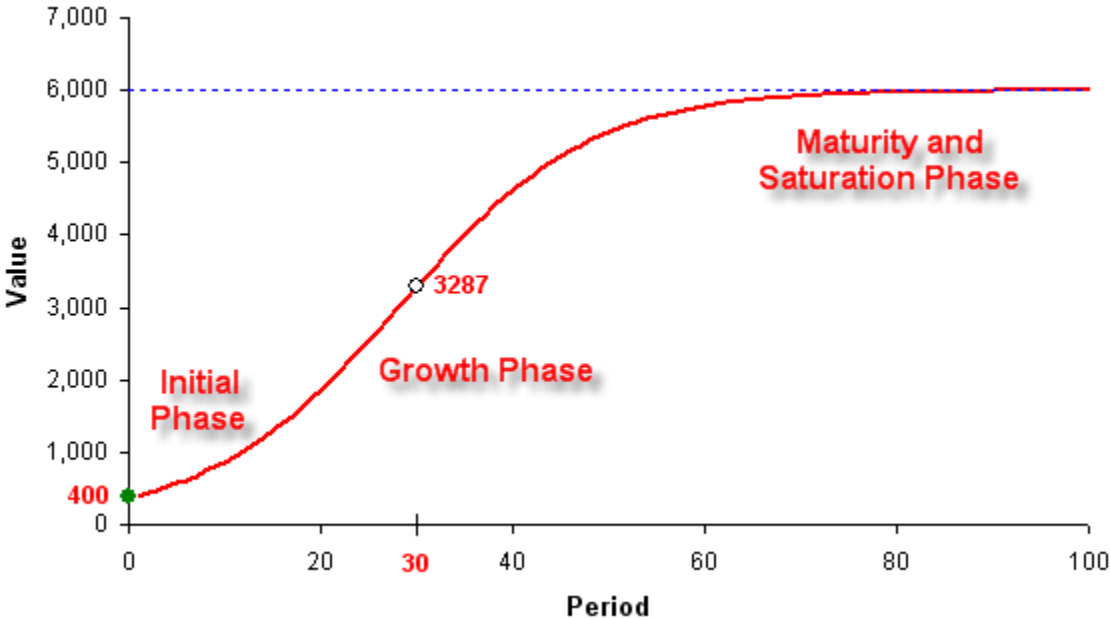

Figure 3: Logistic S-curve

Procedure

You can run the preset simulation by clicking on **Risk Simulator | Change Profile** and selecting the *S Curve* profile, then run the simulation by going to **Risk Simulator | Run Simulation**. Alternatively, you can set your own or change the underlying simulation assumption as well as the input parameters. The *Growth Rate*, *Maximum Capacity*, and *Initial Value* are the input values in the model to determine the characteristics of the S curve. In addition, you can also enter in the *Lookup Year* to determine the value for that particular year, where the corresponding value for that year is set as a forecast. Using the initial model inputs and running the simulation yields the forecast charts seen in Figure 4, where the expected value of Year 30 is 2054.88 units.
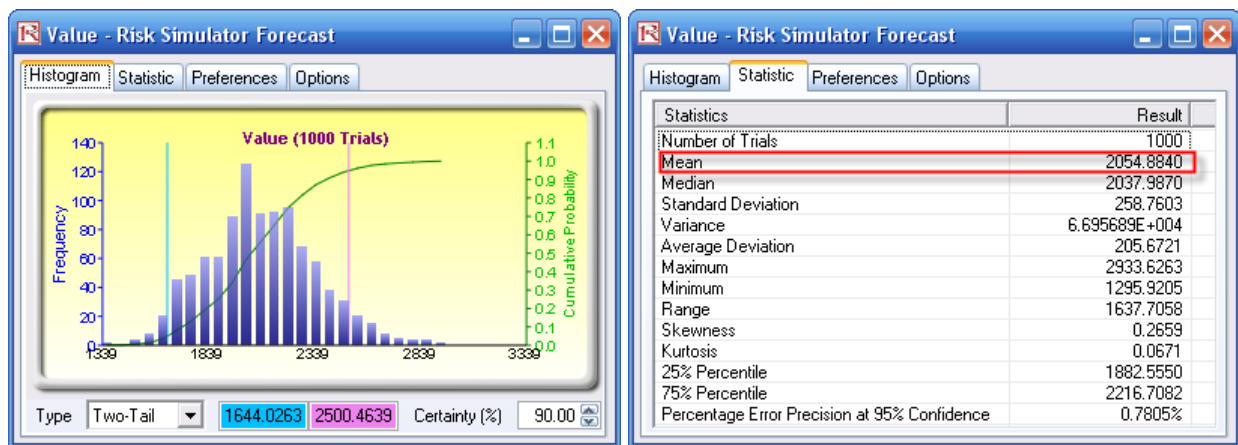

Figure 4: Simulated results on the logistic S-curve