Chapter 3
Correlation Between Porosity and Water Saturation

ABSTRACT

In oil/gas exploration, two important characteristics of rocks are porosity (percentage of "open space") and water saturation (fraction of water in the pore space). Empirical observations have indicated that these two characteristics tend to be negatively correlated. The model developed here uses simulation and structural properties to "derive" this negative correlation. The fixed and random inputs lead to the formulas for porosity and water saturation (through another output, formation factor). Two random models are tested. The first uses uniformly distributed input values, whereas the second uses triangular distributions. Applying this finding, a typical volumetric analysis for oil reserves would contain the product phi(1-Sw), where "phi" is porosity and "Sw" is water saturation. When modeling this (using the outputs from the current simulation as inputs for a model of oil reserves), the negative correlation should be considered.*

DOI: 10.4018/979-8-3373-0959-0.ch003

INTRODUCTION

Correlation

Correlation, in the finance and investment industries, is a statistic that measures the degree to which two securities move to each other. Correlations are used in advanced portfolio management, computed as the correlation coefficient, which has a value that must fall between -1.0 and +1.0.

- Correlation is a statistic that measures the degree to which two variables move to each other.
- In finance, the correlation can measure the movement of a stock with that of a benchmark index, such as the S&P 500.
- Correlation is closely tied to diversification, the concept that certain types of risk can be mitigated by investing in assets that are not correlated.
- Correlation measures association but doesn't show if x causes y or vice versa—or if the association is caused by a third factor.
- Correlation may be easiest to identify using a scatterplot, especially if the variables have a non-linear yet still strong correlation.

Correlation shows the strength of a relationship between two variables and is expressed numerically by the correlation coefficient. The correlation coefficient's values range between -1.0 and 1.0.

A perfect positive correlation means that the correlation coefficient is exactly 1. This implies that as one security moves, either up or down, the other security moves in lockstep, in the same direction. A perfect negative correlation means that two assets move in opposite directions, while a zero correlation implies no linear relationship at all.

For example, large-cap mutual funds generally have a high positive correlation to the Standard and Poor's (S&P) 500 Index or nearly one. Small-cap stocks tend to have a positive correlation to the S&P, but it's not as high or approximately 0.8.