

Market Size Forecasting Using the Monte Carlo Method

Multivariate Solutions

Applications and Goals

- The Monte Carlo market size forecast model is used primarily to determine the approximate size of product(s) in or one or several markets, either in the state, US, or globally.
- The Monte Carlo method is used for this purpose.
 - While it is a relatively straightforward matter to develop confidence intervals for each of the market size parameters taken alone, what is really at issue is the confidence interval for projected differences taken jointly.
 - Such a problem is best addressed through the use of so-called Monte Carlo methods.

Applications and Goals

- In a Monte Carlo simulation, a model in spreadsheet format is set up and the cells whose values come from the survey results are identified (and which are therefore subject to sampling error).
- For each of these cells, a distribution of possible values using the appropriate means and Bias Ply errors is specified. A series of trials is then generated, each one of which represents a possible outcome of the process.

Example Model

- To illustrate the use of survey data and the Monte Carlo method, we are going to show an example market sizing test.
- We will call our Radical Tire the *Radical Tire Company*.
 - They are a small player in the New York Tri-State market, hoping to grow.
- Radical Tires is looking to determine the approximate market size (\$) for three of their products:
 - Bias Ply Radical
 - Belted Bias Radical
 - Radial Radical
- Three markets
 - New York State
 - New Jersey
 - Connecticut

Calculation of Market Size

- Three Components are included in the calculation of the market size
 - Sales of a given Radical tire by state market
 - This is supplied by Radical Tire
 - Percentage of Radical Tire sales of by type within market (acquired through a Radical Tire survey).
 - Market penetration of Radical Tire in with this product is the specific market (acquired through a Radical Tire survey).
 - The approximate size for a given tires type for a market is calculated below. Below is an example for Bias Ply

$$\text{Market Size of Bias Ply in State Market} = \frac{\text{Statewide Sales of Radical Tires} \times \% \text{ Bias Ply}}{\text{Statewide market share of Radical Tire Bias Ply}}$$

Simple Calculation of Market Size

- Simple Spreadsheet of New York State Market Size

New York State	Radical Tire Sales	%Bias Ply Tires	%Market Share	Approximate Bias Ply Product Market Size
	\$6,300,000	63%	11%	\$36,081,818
	Radical Tire Sales	%Belted Bias Tires	%Market Share	Approximate Belted Bias Product Market Size
	\$6,300,000	10%	5%	\$12,600,000
	Radical Tire Sales	%Radial Tires	%Market Share	Approximate Radial Product Market Size
	\$6,300,000	27%	7%	\$24,300,000
			Total New York State Market Size	\$72,981,818

The Monte Carlo Method

- THE PROBLEM
 - The simple market size is simple the middle value.
- FOR EXAMPLE, New York State demand for Radical Tire products and Radical Tire sales and market share are reported, WHEN IN THE REAL WORLD:
 - The percentage of Radical Tire sales of Bias Ply tires is reported to be 40% in New York, when the confidence interval of that percentage indicates actual market share of Bias Ply tires is between 38% and 43%.
 - The market share that Radical Tire captures in New York State for Radial Radical tires was reported in the survey at 11%, when in actually be between 8% and 14%.
- MONTE CARLO allows the spreadsheet to act within the distributions of all the components.

The Monte Carlo Method (cont.)

- Example New York State Spreadsheet
 - Distribution values are built into the bright green cells
 - The light blue indicate forecast values

New York State	Radical Tire Sales	%Bias Ply Tires	%Market Share	Approximate Bias Ply Product Market Potential
		\$6,300,000	63%	11%
	Radical Tire Sales	%Belted Bias Tires	%Market Share	Approximate Belted Bias Product Market Potential
	\$6,300,000	10%	5%	\$12,600,000
	Radical Tire Sales	%Radial Tires	%Market Share	Approximate Radial Product Market Potential
	\$6,300,000	27%	7%	\$24,300,000
	Total New York State Market Potential			\$72,981,818

The Monte Carlo Method (cont.)

- New Jersey Spreadsheet
 - Distribution values are built into the bright green cells
 - The light blue indicate forecast values

New Jersey	Radical Tire Sales	%Bias Ply Tires	%Market Share	Approximate Bias Ply Product Market Size
	\$2,000,000	58%	11%	\$10,545,455
	Radical Tire Sales	%Belted Bias Tires	%Market Share	Approximate Belted Bias Product Market Size
	\$2,000,000	12%	1%	\$24,000,000
	Radical Tire Sales	%Radial Tires	%Market Share	Approximate Radial Product Market Size
	\$2,000,000	30%	7%	\$8,571,429
	Total New Jersey Market Size			\$43,116,883

The Monte Carlo Method (cont.)

- Connecticut Spreadsheet
 - Distribution values are built into the bright green cells
 - The light blue indicate forecast values

Connecticut	Radical Tire Sales	%Bias Ply Tires	%Market Share	Approximate Bias Ply Product Market Size
		\$1,100,000	52%	21%
	Radical Tire Sales	%Belted Bias Tires	%Market Share	Approximate Belted Bias Product Market Size
	\$1,100,000	18%	16%	\$1,237,500
	Radical Tire Sales	%Radial Tires	%Market Share	Approximate Radial Product Market Size
	\$1,100,000	30%	17%	\$1,941,176
			Total Connecticut Market Size	\$5,902,486

Forecast of Total Tri-State Area Market Size

- Forecasts for the Total Tri-State Market Size

New York State Market Potential	\$72,981,818
New Jersey Market Potential	\$43,116,883
Connecticut Market Potential	\$5,902,486
Total Tri-State Market Potential	\$122,001,187

The Monte Carlo Method Explained

- Expected market size represents a mid-point value (mean) outcome given the survey results. This might be the value shown in a simple spreadsheet.
- If the simulation is performed, say, 10,000 times, such a mid-point value (mean) outcome would represent only a small fraction of the total trials.
- When the confidence intervals are accounted for, the 10,000 outcomes of these trials can be arrayed in a cumulative distribution. The probability of percentage growth falling into any given interval can be read off as the number of trials with outcomes in that interval.
- The following distribution (next slide) explains how to interpret the cumulative charts.

The Monte Carlo Method

Distribution of 10,000 Outcomes of Model

Percentiles	Total Tri-State Market Size	Total New Jersey Market Potential	Total New York State Market Potential	Total Connecticut Market Potential
100%	\$0	\$0	\$59,100,741	\$5,199,190
90%	\$109,534,291	\$32,646,187	\$66,571,495	\$5,533,211
80%	\$113,583,138	\$35,359,672	\$68,603,021	\$5,658,706
70%	\$116,573,903	\$37,748,178	\$70,160,825	\$5,776,671
60%	\$119,663,542	\$40,285,537	\$71,688,908	\$5,895,914
50%	\$122,707,205	\$42,671,693	\$73,095,102	\$6,012,527
40%	\$126,396,964	\$46,132,617	\$74,559,932	\$6,134,959
30%	\$130,856,715	\$50,660,822	\$76,045,933	\$6,256,580
20%	\$138,684,516	\$58,325,690	\$77,752,091	\$6,377,839
10%	\$157,123,756	\$77,221,310	\$79,967,261	\$6,511,704
0%	\$20,815,461,255	\$20,738,788,528	\$92,647,349	\$6,980,336

- **Cumulative Distribution of Total Tri-State Market Size**
- **Reading of the 10,000 outcomes**
 - There is an 80% chance that the total Tri-State Market size is \$113.5m in sales, or greater. This is often the reported value.
 - There is a 50% chance (mid-point value) that the Total Tri-State market size potential is \$122.7m in sales, or greater. **This is the expected value.**
 - There is a 20% chance that the Total Tri-State market size potential is \$138.7m in sales, or greater. This is often the outer-limit of a reasonable market size.

The Monte Carlo Method – New York State

Distribution of 10,000 Outcomes of Model

Percentiles	Total New York State Market Potential	New York State Belted Bias Market Size	New York State Bias Ply Market Size	New York State Radial Market Size
100%	\$59,100,741	\$7,810,142	\$28,453,635	\$17,554,841
90%	\$66,571,495	\$10,581,627	\$32,602,173	\$21,344,589
80%	\$68,603,021	\$11,208,020	\$33,711,342	\$22,269,106
70%	\$70,160,825	\$11,693,771	\$34,558,596	\$23,009,405
60%	\$71,688,908	\$12,130,359	\$35,333,445	\$23,624,287
50%	\$73,095,102	\$12,545,711	\$36,092,444	\$24,243,444
40%	\$74,559,932	\$12,985,260	\$36,801,169	\$24,876,918
30%	\$76,045,933	\$13,481,940	\$37,560,038	\$25,587,210
20%	\$77,752,091	\$14,077,249	\$38,444,001	\$26,463,345
10%	\$79,967,261	\$14,991,735	\$39,688,448	\$27,686,871
0%	\$92,647,349	\$21,557,198	\$48,562,943	\$34,335,214

- **Cumulative Distribution of Total Tri-State Market Size**
- **Reading of the 10,000 outcomes**
 - There is an 80% chance that the total New York Market size is \$68.6m in sales, or greater.
 - There is a 50% chance (mid-point value) that the total New York market size potential is \$73m in sales, or greater.
 - There is a 20% chance that the total New York market size potential is \$77.8m in sales, or greater.