

# ***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

<b>New York State</b>				
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	
<b>Total New York State Market Size</b>			<b>\$72,981,818</b>	

# *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
	<b>Total New York State Market Potential</b>			<b>\$72,981,818</b>



# *The Monte Carlo Method* (cont.)

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

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

# *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

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

# *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.