

Distribution Charts and Tables: Probability Distribution Tool

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In This Issue

- 1. Learn about the three tools available for quickly generating distribution charts and tables
- 2. Become familiar with the different capabilities of each tool

"How do I compare the PDF and CDF of different distributions, compute the probabilities of certain outcomes, or compare the shape and size of the same distribution with different parameters?"

Contact Us

Real Options Valuation, Inc.

4101F Dublin Blvd., Ste. 425 Dublin, California 94568 U.S.A.

admin@realoptionsvaluation.com www.realoptionsvaluation.com www.rovusa.com *Distributional Charts and Tables* is a Probability Distribution tool that is a very powerful and fast module used for generating distribution charts and tables (Figures 1 through 4). Note that there are three similar tools in *Risk Simulator* but each does very different things:

- Distributional Analysis—used to quickly compute the PDF, CDF, and ICDF of the 45 probability distributions available in **Risk Simulator**, and to return a *probability table* of these values.
- *Distributional Charts and Tables*—the Probability Distribution tool described here used to compare *different parameters of the same distribution* (e.g., the shapes and PDF, CDF, ICDF values of a Weibull distribution with Alpha and Beta of [2, 2], [3, 5], and [3.5, 8]; overlays them on top of one another) as well as *different parameters of different distributions* (e.g., normal versus beta distributions).
- Overlay Charts—used to compare different distributions (theoretical input assumptions and empirically simulated output forecasts) and to overlay them on top of one another for a visual comparison.

Procedure

- Run *Risk Simulator* | *Analytical Tools* | *Distributional Charts and Tables*, click on the *Apply Global Inputs* button to load a sample set of input parameters or enter your own inputs, and click *Run* to compute the results. The resulting four moments and CDF, ICDF, PDF are computed for each of the 45 probability distributions (Figure 1).
- Click on the Charts and Tables tab (Figure 2), select a distribution [A] (e.g., Arcsine), choose if you wish to run the CDF, ICDF, or PDF [B], enter the relevant inputs, and click Run Chart or Run Table [C]. You can switch between the Charts and Table tab to view the results as well as try out some of the chart icons [E] to see the effects on the chart.
- You can also change two parameters [H] to generate multiple charts and distribution tables by entering the From/To/Step input or using the Custom inputs and then hitting Run. For example, as illustrated in Figure 3, run the Beta distribution and select PDF [G], select Alpha and Beta to change [H] using custom [I] inputs and enter the relevant input parameters: 2;5;5 for Alpha and 5;3;5 for Beta [J], and click Run Chart. This will generate three Beta distributions [K]: Beta (2,5), Beta (5,3), and Beta (5,5) [L]. Explore various chart types, gridlines, language, and decimal settings [M], and try rerunning the distribution using theoretical versus empirically simulated values [N].

Figure 4 illustrates the probability tables generated for a binomial distribution where the probability of success and number of successful trials (random variable X) are selected to vary [O] using the From/To/Step option. Try to replicate the calculation as shown and click on the Table tab [P] to view the created probability density function results. This example uses a binomial distribution with a starting input set of Trials = 20, Probability

(of success) = 0.5, and Random X, or Number of Successful Trials, = 10, where the Probability of Success is allowed to change from 0, 0.25, ..., 0.50 and is shown as the row variable, and the Number of Successful Trials is also allowed to change from 0, 1, 2, ..., 8 and is shown as the column variable. PDF is chosen and, hence, the results in the table show the probability that the given events occur. For instance, the probability of getting exactly 2 successes when 20 trials are run where each trial has a 25% chance of success is 0.0669, or 6.69%.

ROV PROBABILITY D	DISTRIBUTIONS										×
Distributions Charts and	d Tables										
This tool lists all the prob	pability distribution	ns available in Real Optio	ons Valuation, In	ic.'s suite of produc	ts.						
Apply Global Ipputs	Minimum	10 Alpha	2	Location 10	Percentile DF	0.5	Mean	10 A	lpha 1 5	DF Numerator	10
Apply Global Inputs	Maximum	20 Beta	5 F	Probability 0.5			Stdev	2 A	lpha 2 5	DF Denominator	20
	MostLikely	15 Lambda	1.2	Factor 2	Trials	20	Successes	5 Pop	ulation 100	Pop Success	50
Arcsine		Bernoulli		Beta			Beta 3		Beta 4		<u>^</u>
Minimum	10	Probability 0.5		Alpha	Alpha 2		Alpha	2	Alpha	2	
Maximum	Maximum 20				5		Beta	5	Beta	5	
							Location	10	Location	10	=
									Factor	2	
Random X	12	Random X	0	Random X	0.6		Random X	10.25	Random X	10.8	
Percentile	0.5	Percentile	0.5	Percentile	0.5		Percentile	0.5	Percentile	0.5	
PDF	0.7958	PDF	0.5000	PDF	0.4	608	PDF	2.373	0 PDF	1.55	52
CDF	0.2952	CDF	0.5000	CDF	0.9	590	CDF	0.466	1 CDF	0.76	67
ICDF	15.0000	ICDF	ICDF 1.0000		0.2	644	ICDF	10.264	4 ICDF	10.52	.89
Mean	15.0000	Mean	0.5000	Mean	0.2	857	Mean	10.285	7 Mean	10.57	14
Stdev	3.5355	Stdev	0.5000	Stdev	0.1	597	Stdev	0.159	7 Stdev	0.31	.94
Skew	0.0000 Skew 0.0000		Skew	0.5963		Skew	0.596	3 Skew	0.59	63	
Kurtosis	-1.5000	Kurtosis	-2.0000	Kurtosis	-0.1	200	Kurtosis	-0.120	0 Kurtosis	-0.12	.00
Binomial	oomial Cauchy		Chi-Square		Cosine			Discrete Unifo	rm		
Trials	20	Alpha	2	DF	10		Minimum	10	Minimum	10	
Probability	0.5	Beta	5				Maximum	20	Maximum	20	
Random X	10	Random X	12	Random X	14		Random X	15.5	Random X	16	
Percentile	0.5	0.5 Percentile 0.5		Percentile	0.5		Percentile	0.5	Percentile	0.5	
PDF	0.1762	PDF	0.0127	PDF	0.0	456	PDF	0.155	1 PDF	0.09	09
CDF	0.5881	CDF	0.8524	CDF	0.8	270	CDF	0.578	2 CDF	0.63	64
ICDF	10.0000	ICDF	2.0000	ICDF	9.3	418	ICDF	15.000	0 ICDF	15.00	00
Mean	10.0000			Mean	10.0	000	Mean	15.000	0 Mean	15.00	00
Stdev	2.2361			Stdev	4.4	721	Stdev	2.176	2 Stdev	3.16	23
Skew	0.0000			Skew	0.8	0.8944 Skew		0.0000 Skew		0.0000	
Kurtosis	-0.1000			Kurtosis	1.2	000	Kurtosis	-0.593	8 Kurtosis	-1.22	- 00
Decimals:	4	Language: Englis	sh •	•					Run	Close	•

Figure 1. Probability Distribution Tool (45 Probability Distributions)







Figure 3. ROV Probability Distribution (Multiple Overlay Charts)

his to)verla	ol generates a prob y Chart tool. Distribution: Trials Probability Random X	Binomial 20 PC 0.5 CC 10 CC 0 Result 0	parative charts fo IF IF IF DF : 0.176197	r a chosen distribution as Charts and Tables Parameter:	Change Probabil s O 2; 5; 5	First Parameter: ty 0.2 To 0.5 Step 0.05	Change Randor	put parameters. To v Second Parameter: n X From 0 To 8 Step 1	Chart Chart Theoretic Simulated	utions, use Risk Simula al Distribution I Distribution Trials 100 Seed 123 Run Table Copy
hart	Table P Row Variable	e: Probability	1 0000	Column 1	Variable: Ran	dom X	5 0000	Тур	e: PDF	8 0000
1	0 2000	0.0000	0.0576	2.0000 5	2054	4.0000	0.1746	0.1001	0.0545	0.0222
2	0.2000	0.0022	0.0370	0.1309 0	12004	0.2102	0.2022	0.1695	0.1124	0.0222
2	0.2300	0.0032	0.0211	0.0009 0	0716	0.1097	0.2025	0.1000	0.1642	0.0009
4	0.3500	0.0002	0.0020	0.0100 0	0323	0.0738	0.1272	0.1712	0.1844	0.1614
- 5	0.4000	0.0000	0.0005	0.0031 0	0123	0.0350	0.0746	0.1744	0.1659	0.1797
6	0.4500	0.0000	0.0001	0.0008	0.0040	0.0139	0.0365	0.0746	0.1221	0.1623
7	0.5000	0.0000	0.0000	0.0002	0.0011	0.0046	0.0148	0.0370	0.0739	0.1201

Figure 4. ROV Probability Distribution (Distribution Tables)