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# Hyperbolic-Secant distribution

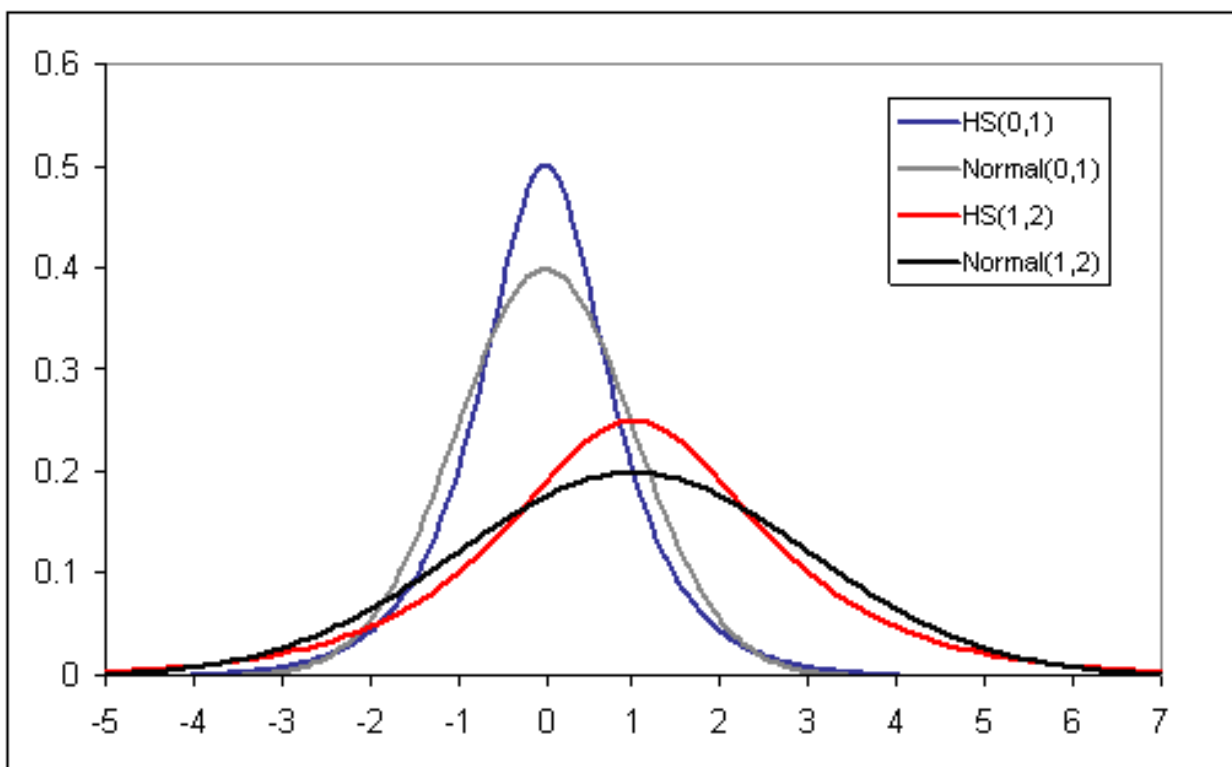
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**Format: HS(m, s)**

The Hyperbolic-Secant distribution is a symmetric distribution similar to the Normal distribution and defined by its mean and standard deviation, but with a [kurtosis](#) ([Kurtosis\(K\).php](#)) of 5, so it is more peaked than the Normal. Examples of the Hyperbolic-Secant distribution are given below, together with Normal distributions with the same mean and standard deviation:



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distributions are an option for data with wider shoulders than a Normal.

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The Hyperbolic-Secant distribution gets its (rather awful) name from the sech function in its [probability density function](#) ([Hyperbolic-Secantequations.php](#)).

[ModelRisk](#) (<http://www.vosesoftware.com/products/modelrisk/>) [functions added to Microsoft Excel for the Hyperbolic Secant \(HS\) distribution](#)

[VoseHS](#) ([DistributionsinModelRisk.php](#)) generates random values from this distribution for [Monte Carlo simulation](#) ([MonteCarloSimulationintroduction.php](#)), or calculates a percentile if used with a [U parameter](#) ([DistributionfunctionsandtheUparameter.php](#)).

[VoseHSObject](#) ([Modelingwithobjects.php](#)) constructs a distribution object for this distribution.

[VoseHSProb](#) ([Probabilitycalculationfunctions.php](#)) returns the probability density or cumulative distribution function for this distribution.

[VoseHSProb10](#) ([Probabilitycalculationfunctions.php](#)) returns the log10 of the probability density or cumulative distribution function.

[VoseHSFit](#) ([FittinginModelRisk.php](#)) generates values from this distribution fitted to data, or calculates a percentile from the fitted distribution.

[VoseHSFitObject](#) ([FittinginModelRisk.php](#)) constructs a distribution object of this distribution fitted to data.

[VoseHSFitP](#) ([FittinginModelRisk.php](#)) returns the parameters of this distribution fitted to data.

## Hyperbolic-Secant distribution equations



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Probability density function :	$f(x) = \frac{\text{sech}(y)}{2\sigma}$ where $y = \frac{\pi}{2\sigma}(x - \mu)$
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Cumulative distribution function :	$F(x) = \frac{2}{\pi} \tan^{-1}[\exp(y)]$
Parameter restriction :	$\sigma > 0$
Domain :	$-\infty < x < +\infty$
Mean :	$\mu$
Mode :	$\mu$
Variance :	$\sigma^2$
Skewness :	0
Kurtosis :	5

## ModelRisk

Monte Carlo simulation in Excel. [Learn more](#)

(<http://www.vosesoftware.com/product/modelrisk>)

The screenshot displays the ModelRisk Excel spreadsheet interface. The title bar shows "NPV of a capital investment.xlsx (Last saved by user) - Excel". The ribbon includes "ModelRisk" with various tools like "Select Distribution", "Correlation", "Aggregate", "Time Series", "Fit", "R. Expert", "Data Viewer", "More Tools", "Tools", "View Function", "Output", "Simulation", "Library", "ModelRisk Help", "Check for Updates", "Models", "Search", "E-Learning", and "Resource Center".

The spreadsheet content includes the Vose logo and the text "Putting numbers around risk". A red box highlights "NPV (10%) \$24,892,441.81". The main title is "NPV of a capital investment".

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b>Cash Flow</b>										
Total Revenue	\$ -	\$ -	\$ 16,251,783	\$ 18,683,109	\$ 21,531,987	\$ 18,527,363	\$ 16,987,820	\$ 16,291,203	\$ 16,741,914	\$ 21,510,953
Cost of Goods Sold	\$ -	\$ -	\$ 6,781,353	\$ 7,795,868	\$ 8,984,614	\$ 7,730,880	\$ 7,088,478	\$ 6,797,802	\$ 7,820,405	\$ 8,975,837
Gross Margin	\$ -	\$ -	\$ 9,470,430	\$ 10,887,241	\$ 12,547,373	\$ 10,796,483	\$ 9,899,343	\$ 9,493,402	\$ 10,921,509	\$ 12,535,116
Operating Expenses	\$ 3,417,538	\$ 3,464,848	\$ 3,432,029	\$ 55,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 25,000	\$ 25,000
Earnings Before Taxes	\$ (3,417,538)	\$ (3,464,848)	\$ 6,038,401	\$ 10,832,241	\$ 12,527,373	\$ 10,776,483	\$ 9,879,343	\$ 9,468,402	\$ 10,896,509	\$ 12,510,116
Tax Basis	\$ (3,417,538)	\$ (6,882,387)	\$ (843,985)	\$ 9,988,256	\$ 12,527,373	\$ 10,776,483	\$ 9,879,343	\$ 9,468,402	\$ 10,896,509	\$ 12,510,116
Income Tax	\$ -	\$ -	\$ -	\$ 3,495,889	\$ 4,384,580	\$ 3,771,769	\$ 3,457,770	\$ 3,313,941	\$ 3,813,778	\$ 4,378,541
Net Income	\$ (3,417,538)	\$ (3,464,848)	\$ 6,038,401	\$ 7,336,352	\$ 8,142,792	\$ 7,004,714	\$ 6,421,573	\$ 6,154,461	\$ 7,082,731	\$ 8,131,575
<b>Market Conditions</b>										
Number of Competitors	0	0	0	0	0	1	1	1	1	1
Unit Cost				\$2,429	\$2,523	\$2,609	\$2,695	\$2,795	\$2,898	\$2,997
Inflation Rate	3%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Tax Rate	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
<b>Sales Activity</b>										
Sales Price				\$5,822	\$6,047	\$6,253	\$6,459	\$6,699	\$6,944	\$7,182
Market volume				3,209	3,561	3,951	4,384	4,865	5,398	5,990
Sales Volume			2,892	3,209	3,561	2,963	2,630	2,432	2,699	2,995
<b>Production Expense</b>										

At the bottom, there is a large "Get spreadsheet" button with the Vose logo.

(<http://www.vosesoftware.com/products/modelrisk>)

## Tamara

Adding risk and uncertainty to your project schedule. [Learn more](#)

(<http://www.vosesoftware.com/products/tamara>)



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