



**RPI Library Documentation**

**Version 1.0.3**

Options

# RPI Library Documentation

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## DESCRIPTION

The RPI Library is a library of Microsoft Excel Add-Ins functions designed by Alpha Options LLC to value and measure the risks of futures and options contracts written on relative performance indexes. A relative performance index is a measure of the relative risk-adjusted performance of a target security relative to a benchmark. The relative risk-adjustment factor for the index is defined as  $b$  and the index updating rule is defined as:

$$I_{t+1} = I_t \times \frac{(1 + \text{daily return on security}_{t+1})}{(1 + \text{daily return on benchmark}_{t+1})^b}$$

where the daily returns include both price appreciation and dividend income. The functions are based on the analytical formulas contained in:

Sagi, Jacob S. and Whaley, Robert E., Trading Relative Performance (May 11, 2011):  
Available at SSRN: <http://ssrn.com/abstract=1692738>

This documentation describes how to use the valuation and risk measurement functions contained in the RPI Library.

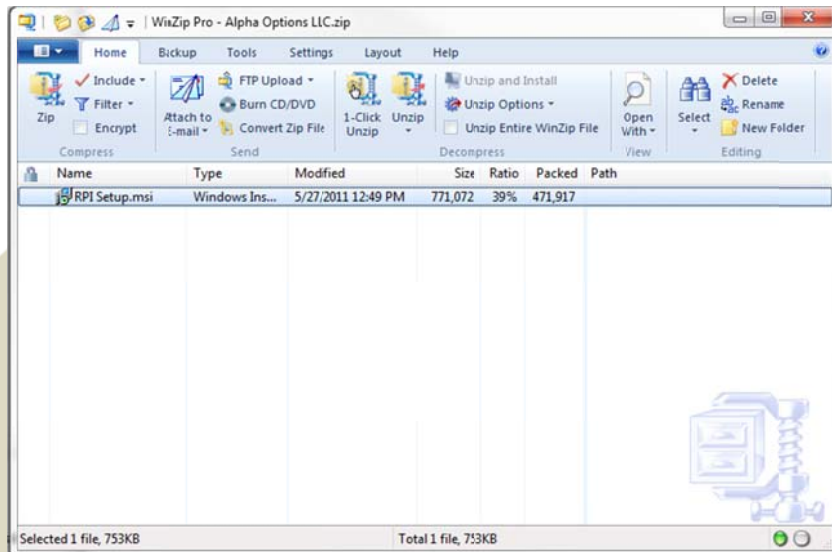
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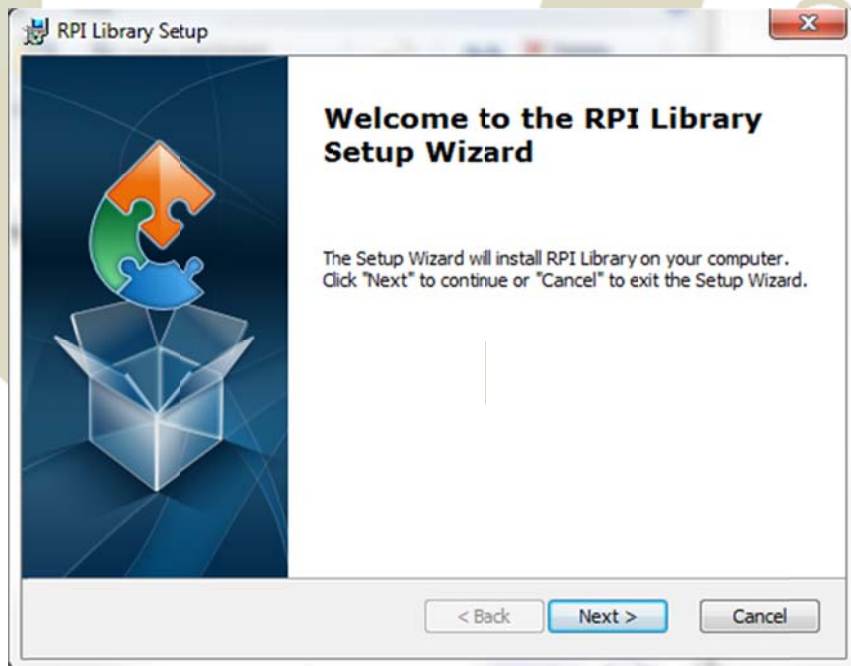
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## INSTALLATION INSTRUCTIONS

- 1) The file **Alpha Options LLC.zip** is a zipped file containing the installation program for the **RPI Library**. Click on **Alpha Options LLC.zip**, and the following screen will appear. Double click on **RPI Setup.msi**.



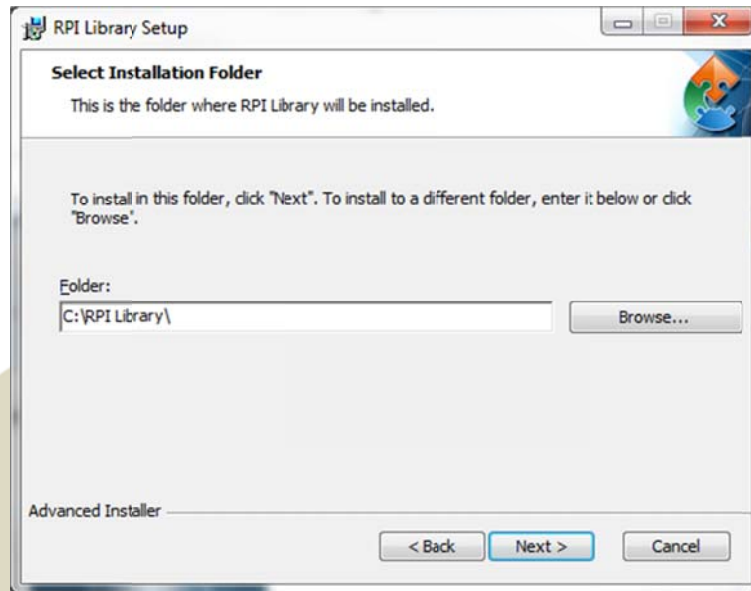
- 2) Click on **Next**.



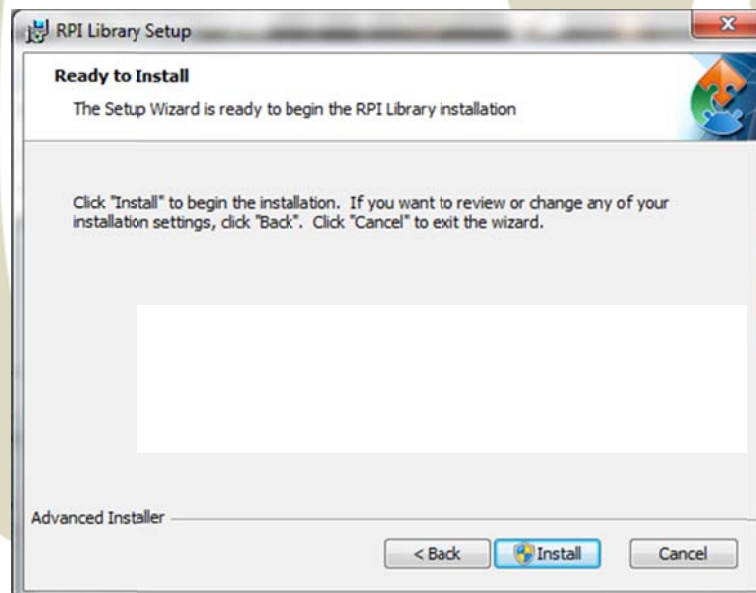
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- 3) Unless specified otherwise, the program files will be installed in the subdirectory, **RPI Library**, on your C: drive. Click on **Next**.



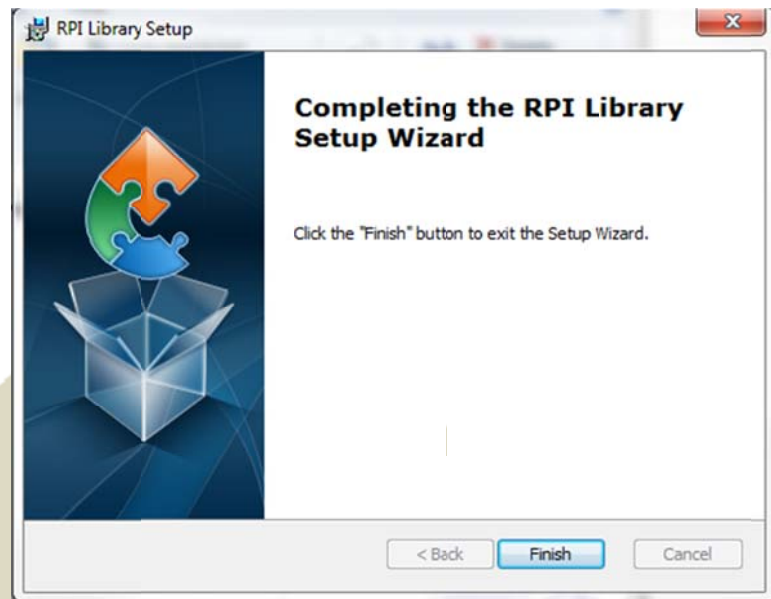
- 4) Click on **Install**.



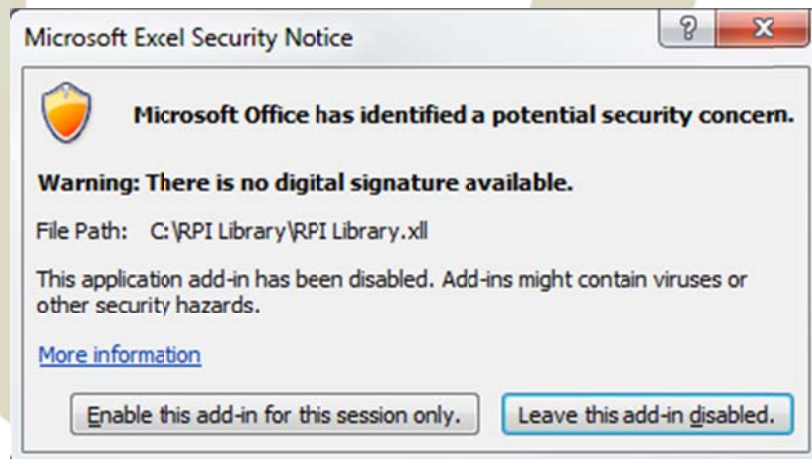
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5) Installation is complete.



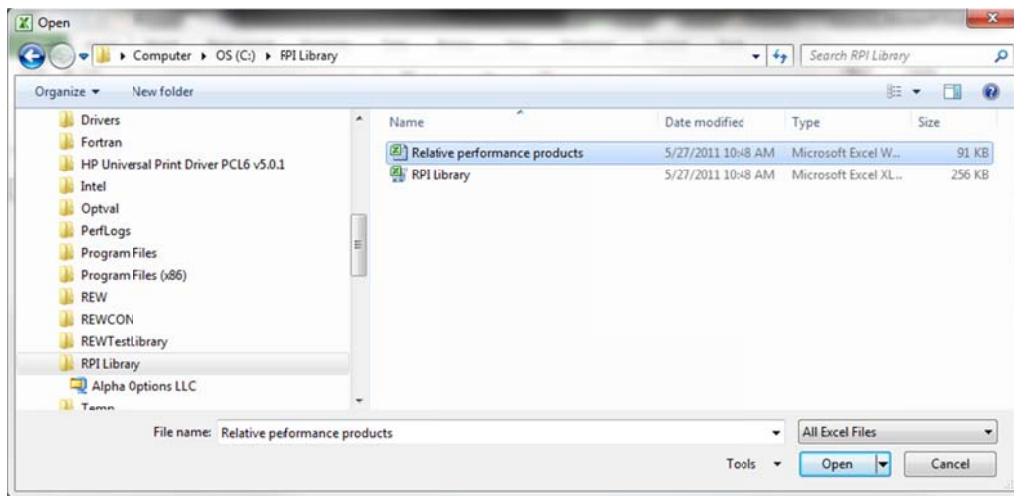
6) An icon  $\alpha$  will appear on your desktop. Double-click on the icon  $\alpha$  and then on **Enable this add-in for this session only**. The RPI Library will then load into Excel.



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7) From Excel, open the file **Relative performance products.xls**.



## REMOVAL INSTRUCTIONS

The **RPI Library** can be removed from your PC using the **Uninstall a program** feature of the **Control Panel**.

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## PROGRAM USE

**Relative performance products.xlsx** is an Excel file with two worksheets that demonstrate the application of the RPI Library routines—one Protected and the other Unprotected. The Protected sheet does not permit editing other than for the input parameters on the left hand-side of the page. The Unprotected sheet permits editing of all fields so as to allow the user to experiment with the different valuation functions.

Below is the Protected sheet with the default input parameters. Note that the highlighted box has a reported futures value of 103.832. The syntax for this function call is

RPI\_FUTURES\_VALUE(i,b,vs,vm,rho,r,t)

where the futures value is computed based on the relative performance index level (i), the relative risk-adjustment coefficient (b), the target security volatility (vs), the benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r) expressed as an annualized rate and time remaining to expiration (t) expressed in years.

H3      fx      =RPI\_FUTURES\_VALUE(\$C\$11,\$C\$12,\$C\$4,\$C\$8,\$C\$9,\$C\$15,\$C\$19)

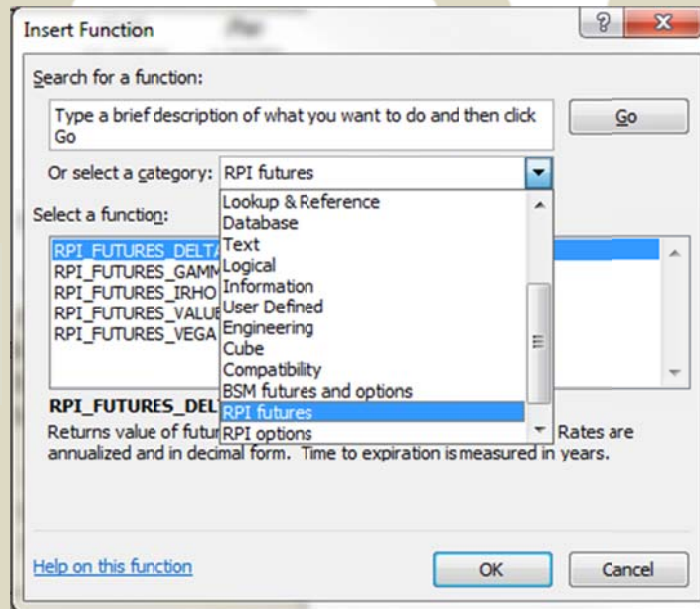
	A	B	C	D	E	F	G	H	I	J	K	L	M	N			
1	<b>Relative Performance Index Futures and Options Valuation</b>																
2	<i>Stock parameters</i>			<i>Futures</i>				<i>Options</i>				<i>Call</i>		<i>Put</i>			
3	Price		50.00	Value				103.83158	Value				27.56259	4.20290			
4	Volatility		30%	Implied correlation				0.10000	Implied correlation				-63.75385				
5																	
6	<i>Market parameters</i>			Delta - index				I	1.03832	Delta - index				I	0.83415	-0.18361	
7	Price		35.00	Delta - stock				S	2.07663	Delta - stock				S	1.66830	-0.36722	
8	Volatility		20%	Delta - market				M	-3.26328	Delta - market				M	-2.62161	0.57705	
9	Correlation		0.100														
10				Gamma - index				II	0.00000	Gamma - index				II	0.00756		
11	<i>Alpha Index</i>		100.00	Gamma - stock				SS	0.00000	Gamma - stock				SS	0.03023		
12	Risk-adjustment		1.10	Gamma - market				MM	0.19580	Gamma - market				MM	0.23195		
13				Gamma - cross				SM	-0.06527	Gamma - cross				SM	-0.09994		
14	<i>Other market parameters</i>			Gamma - cross				MS	-0.06527	Gamma - cross				MS	-0.09994		
15	Interest rate		2.00%														
16				Vega - stock				S	-2.28429	Vega - stock				S	19.17664	21.41571	
17	<i>Option contracts</i>			Vega - market				M	44.54375	Vega - market				M	51.58155	7.91983	
18	Exercise price		80	Vega - rho				R	-6.85288	Vega - rho				R	-10.49378	-3.77659	
19	Years to expiration		1														
20	Copyright 2010-11 © by Alpha Options LLC. All rights are reserved.																

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To understand how to call such functions from the RPI Library, place the cursor **Formulas** in the menu bar.



Click the **Insert Function** button at the top left hand-side of the page. The menu below will appear. In the window to the right of the label **Or select a category:**, select either **RPI futures** or **RPI options**, which include the valuation/risk functions for RPI futures and RPI options, respectively. Click **OK**.

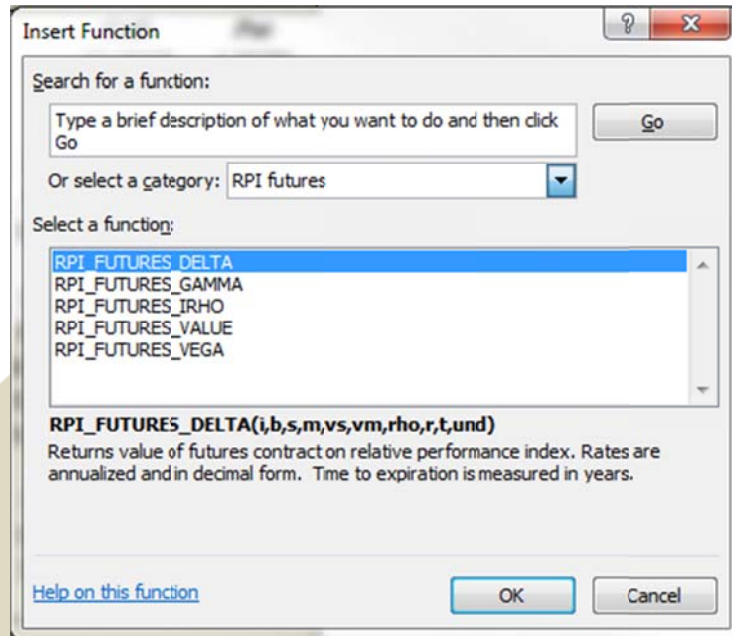




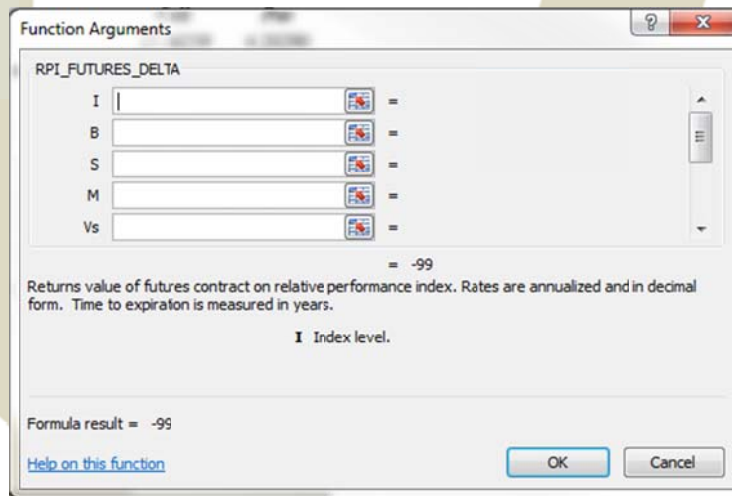
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If you click RPI futures, the futures functions appear. Choose from the list (e.g., RPI\_FUTURES\_DELTA).



After a particular function is called, the User is prompted for the necessary input parameters (or Function Arguments, as Excel refers to them).



A complete list of the available function descriptions is contained in the following pages.

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## FUTURES VALUATION FUNCTIONS - Syntax

RPI\_FUTURES\_VALUE(i,b,vs,vm,rho,r,t)

Returns futures price given relative performance index level (i), relative risk-adjustment coefficient (b), target target volatility (vs), benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r) and time remaining to expiration (t).

RPI\_FUTURES\_DELTA(i,b,s,m,vs,vm,rho,r,t,und)

Returns futures delta given relative performance index (i), relative risk-adjustment coefficient (b), per share target price (s), per share benchmark price (m), target volatility (vs), benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r), time remaining to expiration (t), and underlying indicator (und). Set underlying indicator to "I" for delta with respect to relative performance index, "S" target price, and "M" benchmark price.

RPI\_FUTURES\_GAMMA (i,b,s,m,vs,vm,rho,r,t,und)

Returns futures gamma given relative performance index (i), relative risk-adjustment coefficient (b), per share target price (s), per share benchmark price (m), target volatility (vs), benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r), time remaining to expiration (t), and underlying indicator (und). Set underlying indicator to "II" for gamma with respect to relative performance index, "SS" target price, and "MM" benchmark price. For cross-gammas, set indicator variable to "SM" or "MS".

RPI\_FUTURES\_VEGA(i,b,vs,vm,rho,r,t,vf)

Returns futures vega given relative performance index (i), relative risk-adjustment coefficient (b), target volatility (vs), benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r), time remaining to expiration (t), and volatility type (vf). Set volatility type to "S" for vega with respect to target volatility, "M" benchmark volatility, and "R" correlation between target and benchmark returns.

RPI\_FUTURES\_IRHO (i,b,vs,vm,fp,r,t)

Returns implied correlation between target and benchmark returns given relative performance index level (i), relative risk-adjustment coefficient (b), target volatility (vs), benchmark volatility (vm), risk-free interest rate (r), futures price (fp) and time remaining to expiration (t). If the futures price is not consistent with correlations between -1 and 1, then the function returns -9999 (if the implied correlation is less than -1) or 9999 (if the implied correlation is above 1).

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## OPTION VALUATION FUNCTIONS - Syntax

RPI\_OPTION\_VALUE(i,b,vs,vm,rho,r,x,t,cp)

Returns option value given relative performance index level (i), relative risk-adjustment coefficient (b), target volatility (vs), benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r), exercise price (x), time remaining to expiration (t), and call/put indicator (cp). Set call/put indicator to “C” for call option, and “P” for put option.

RPI\_OPTION\_DELTA(i,b,s,m,vs,vm,rho,r,x,t,cp,und)

Returns option delta given relative performance index level (i), relative risk-adjustment coefficient (b), per share target price (s), per share benchmark price (m), target volatility (vs), benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r), exercise price (x), time remaining to expiration (t), call/put indicator (cp), and underlying indicator (und). Set call/put indicator to “C” for call option, and “P” for put option. Set underlying indicator to “I” for delta with respect to relative performance index, “S” target price, and “M” benchmark price.

RPI\_OPTION\_GAMMA(i,b,s,m,vs,vm,rho,r,x,t,cp,und)

Returns option gamma given relative performance index level (i), relative risk-adjustment coefficient (b), per share target price (s), per share benchmark price (m), target volatility (vs), benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r), exercise price (x), time remaining to expiration (t), call/put indicator (cp), and underlying indicator (und). Set call/put indicator to “C” for call option, and “P” for put option. Set underlying indicator to “II” for gamma with respect to relative performance index, “SS” target price, and “MM” benchmark price. For cross-gammas, set indicator variable to “SM” or “MS”.

RPI\_OPTION\_VEGA(i,b,vs,vm,rho,r,x,t,cp,vf)

Returns option vega given relative performance index level (i), relative risk-adjustment coefficient (b), target volatility (vs), benchmark volatility (vm), correlation between target and benchmark returns (rho), risk-free interest rate (r), exercise price (x), time remaining to expiration (t), call/put indicator (cp), and volatility type (vf). Set call/put indicator to “C” for call option, and “P” for put option. Set volatility type to “S” for vega with respect to benchmark volatility, “M” benchmark volatility, and “R” correlation between target and benchmark returns.

RPI\_OPTION\_IRHO(i,b,vs,vm,op,r,x,t,cp)

Returns implied correlation between target and benchmark returns given relative performance index level (i), relative risk-adjustment coefficient (b), target volatility (vs), benchmark volatility (vm), option price (op), risk-free interest rate (r), exercise price (x), time remaining to expiration (t), and call/put indicator (cp). Set call/put indicator to “C” for call option, and “P” for put option. Implied correlations, in general, may not have a unique solution. Moreover, some prices are not consistent with correlations strictly between -1 and 1. In some instances, if there is more than one solution (or no solution) or the solution is very close (or equal) to one, the function returns -9999 or 9999.