

Package Name: OPTIONPDF

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Add-in Type: Global

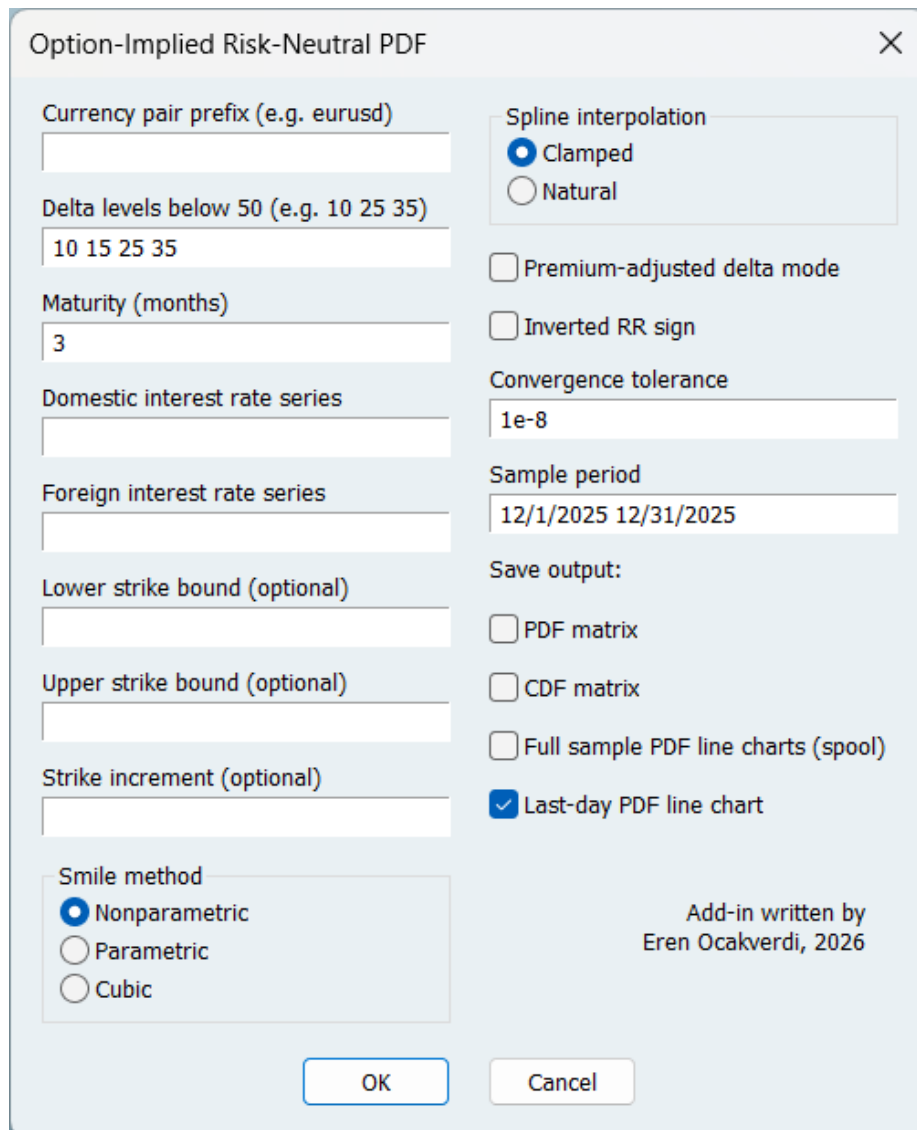
Default Proc Name: optionpdf

Default Menu Text: Option-Implied Risk-Neutral PDF

Interface: Dialog and Command Line

Description: This add-in estimates the option-implied risk-neutral probability density function (PDF) of a foreign exchange rate from daily OTC option quotes (ATM volatility, butterfly, risk reversal).

Dialog: Upon running the add-in from the menus or the command line, a dialog will appear:



The dialog box is titled "Option-Implied Risk-Neutral PDF" and features a close button (X) in the top right corner. It is organized into two main columns of controls. The left column contains text input fields for "Currency pair prefix (e.g. eurUSD)", "Delta levels below 50 (e.g. 10 25 35)" (with the value "10 15 25 35" entered), "Maturity (months)" (with the value "3" entered), "Domestic interest rate series", "Foreign interest rate series", "Lower strike bound (optional)", "Upper strike bound (optional)", and "Strike increment (optional)". The right column contains a "Spline interpolation" section with radio buttons for "Clamped" (selected) and "Natural", followed by checkboxes for "Premium-adjusted delta mode" and "Inverted RR sign". Below these are a "Convergence tolerance" field (set to "1e-8") and a "Sample period" field (set to "12/1/2025 12/31/2025"). A "Save output:" section includes checkboxes for "PDF matrix", "CDF matrix", "Full sample PDF line charts (spool)", and "Last-day PDF line chart" (which is checked). At the bottom left, a "Smile method" section has radio buttons for "Nonparametric" (selected), "Parametric", and "Cubic". At the bottom right, text reads "Add-in written by Eren Ocakverdi, 2026". At the very bottom are "OK" and "Cancel" buttons.

Option-Implied Risk-Neutral PDF

Currency pair prefix (e.g. eurUSD)

Delta levels below 50 (e.g. 10 25 35)

Maturity (months)

Domestic interest rate series

Foreign interest rate series

Lower strike bound (optional)

Upper strike bound (optional)

Strike increment (optional)

Spline interpolation

☒ Clamped

☐ Natural

☐ Premium-adjusted delta mode

☐ Inverted RR sign

Convergence tolerance

Sample period

Save output:

☐ PDF matrix

☐ CDF matrix

☐ Full sample PDF line charts (spool)

☒ Last-day PDF line chart

Smile method

☒ Nonparametric

☐ Parametric

☐ Cubic

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OK Cancel

In the first box, enter the currency-pair prefix as it appears in Bloomberg series names (e.g. USDTRY, EURUSD). The second box specifies the delta levels below 50 to be used in the smile (default 10, 15, 25 and 35). The third box specifies the option maturity in months. The next two boxes are reserved for the names of the domestic and foreign interest-rate series.

The next three boxes determine the strike grid: lower bound, upper bound and increment. If left empty, the bounds are set to 80%/120% of the observed spot range and the increment to 0.1.

The first radio button selects the smile-fit method (Nonparametric cubic spline vs Parametric Malz quadratic). The parametric option is typically more robust on extreme-smile data (emerging-market FX in stressed periods) but loses information from the deep-wing quotes, the nonparametric option fits every OTC knot exactly and is the standard for major-pair work.

The third option, Cubic regression, fits a single global cubic polynomial in delta space by ordinary least squares through all available (δ , σ) knots. Unlike the nonparametric spline it doesn't go through each knot exactly. Instead, it minimizes the sum of squared residuals across the 9 quotes. So the smile fit at each knot may differ by a few basis points from the market value. The benefit is a globally smooth $\sigma(\delta)$ function with no segment boundaries, which removes the cubic-spline knot-strike artifacts.

The second radio button selects the spline boundary condition (Clamped vs Natural). The two produce very different densities on extreme smiles, with clamped showing a sharp peak at the highest-delta knot and natural producing a smoother right tail. Default is clamped.

The choice of spline boundary condition can materially change the shape of the recovered density. The clamped condition makes the implied volatility curve flat at both wings, which is appropriate when the deepest-delta knots are believed to reliably bound the smile range. This is the typical choice, but can produce a sharp PDF spike at the wing-boundary knot strike on very steep smiles. The natural condition leaves the curvature unconstrained at the wings and typically produces a smoother tail at the cost of slightly less faithful pinning to the deep-wing quotes.

The premium-adjusted delta convention should be enabled ("Premium-adjusted delta mode") whenever the underlying pair is quoted that way on Bloomberg (the case for most emerging-market currencies, including USDTRY). When enabled, the strike inversion for each OTC knot uses the PA delta formula and the smile is fitted and iterated in PA-call-delta space. Without this flag the add-in fits and iterates in standard spot-delta space (appropriate for major pairs at typical Bloomberg conventions).

The "Inverted RR sign" checkbox handles the cases where the data source uses the opposite risk-reversal sign convention.

Output checkboxes control whether the full PDF/CDF matrices are saved, whether a full-sample spool of PDF line charts is produced, and whether the last day's PDF line chart is plotted. By default only the last-day chart is saved.

Command Line:

Syntax-1: optionpdf

Syntax-2: optionpdf(options)

Options:

Argument	Type	Explanation
pair	string	Currency pair prefix (e.g. usdtry, eurUSD)
deltas	string	Delta levels below 50, space-separated (default = "10 15 25 35")
maturity	numeric	Option maturity in months (default = 3)
rdom	string	Domestic interest rate series name
rfor	string	Foreign interest rate series name
lower	numeric	Lower strike bound (default = 80% of min spot)
upper	numeric	Upper strike bound (default = 120% of max spot)
inc	numeric	Strike grid increment (default = 0.1)
method	numeric	Smile fit method (1: Nonparametric clamped/natural cubic spline, 2: Parametric Malz quadratic, 3: Cubic regression)
spline	numeric	Spline type when method=1 (1: Clamped, 2: Natural)
tol	numeric	Convergence tolerance for spot-delta iteration (default = 1e-8)
sample	string	Sample period for daily PDFs
padelta		Use premium-adjusted spot delta convention (recommended for EM pairs)
rrsign		Invert risk-reversal sign (use when quote source flips the sign convention)
savepdf		Save the full PDF matrix as output
savecdf		Save the full CDF matrix as output
chartfull		Save full-sample PDF spool (line charts)
chartlast		Save last-day PDF line chart (default on)
prompt		Open the GUI dialog

Examples:

- 1) optionpdf(pair=usdtry,maturity=3,rdom=try3m,rfor=usd3m,padelta,chartlast)
- 2) optionpdf(pair=usdtry,deltas="10 25 35",maturity=1,rdom=try1m,rfor=usd1m,padelta,savepdf,chartfull)
- 3) optionpdf(pair=eurUSD,maturity=6,rdom=eur6m,rfor=usd6m,method=2,sample="12/31/2024 12/31/2024")

References:

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