

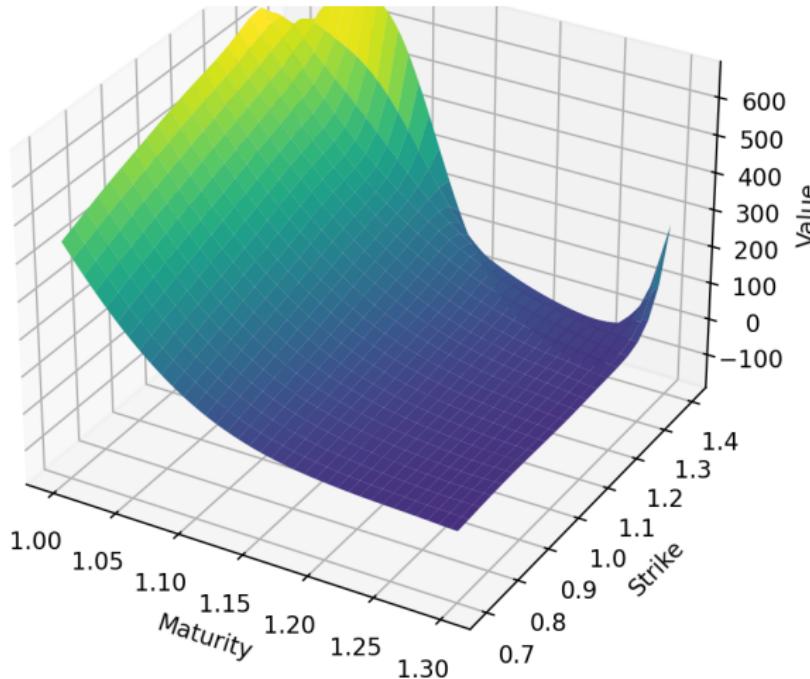
Methods for Recovering the Call Surface

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Orthogonal Polynomials and ℓ^2 minimization

- Orthogonal polynomials on strikes K and Maturities T of product $P(K)Q(T)$
- ℓ^1 -minimization from signal processing



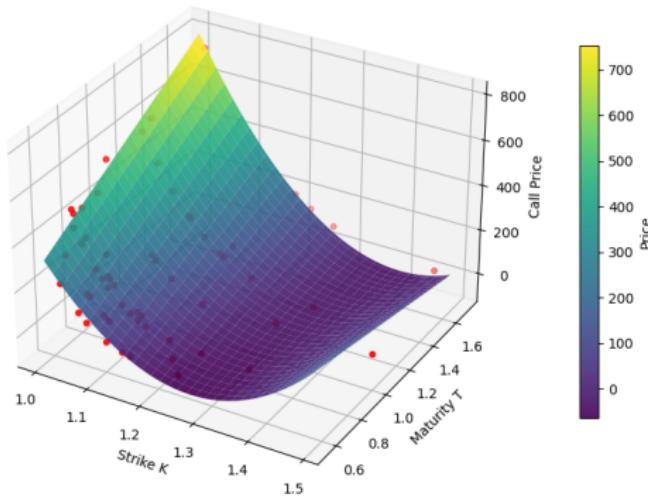
Practitioner's Black Scholes (PBS)

Regression to surfaces in two dimensions.

- (PBS 1) $C(K, T) = b_0 + b_1 K + b_2 K^2 + b_3 K T + b_4 T$
- (PBS 2) $C(K, T) =$
 $b_0 + b_1 K + b_2 K^2 + b_3 K T + b_4 T + b_5 K^3 + b_6 K^2 T + b_7 T^2$

$$\text{PBS 1 : } C(K, T) = b_0 + b_1 K + b_2 K^2 + b_3 K T + b_4 T$$

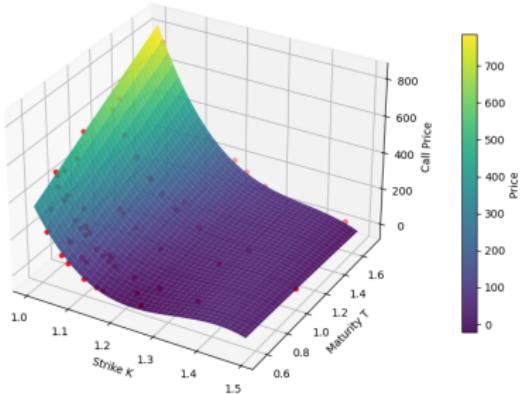
● observed



Practitioner's Black Scholes (PBS 2)

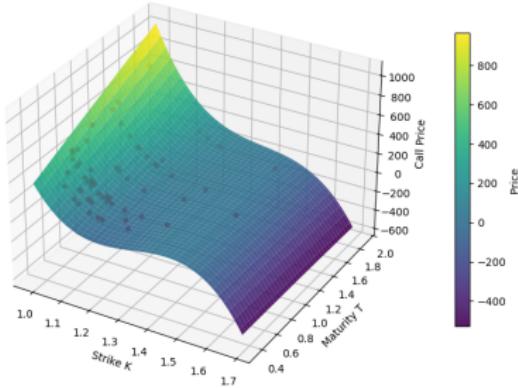
$$\text{PBS 2 : } C(K, T) = b_0 + \dots + b_7 * T^2$$

● observed



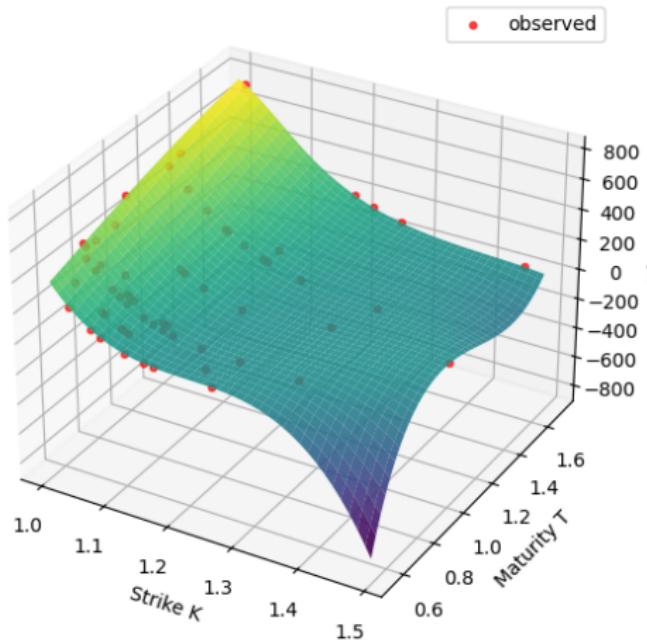
$$\text{PBS 2 : } C(K, T) = b_0 + \dots + b_7 * T^2$$

● observed

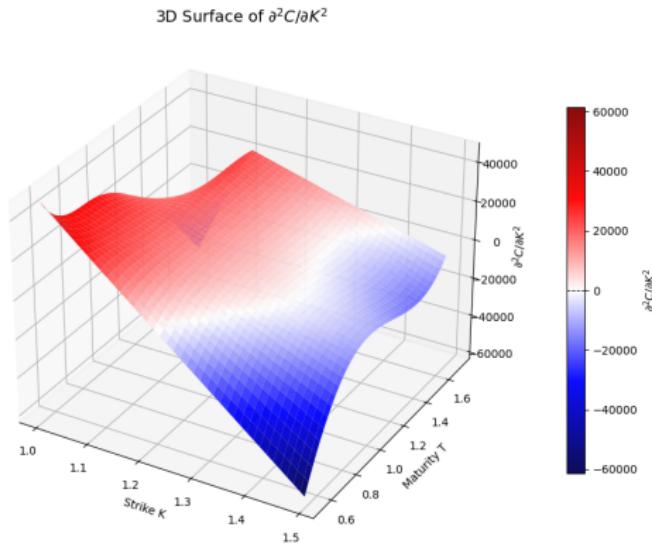


Interpolation

SmoothBivariateSpline Fit to observed Call Price $C(K, T)$

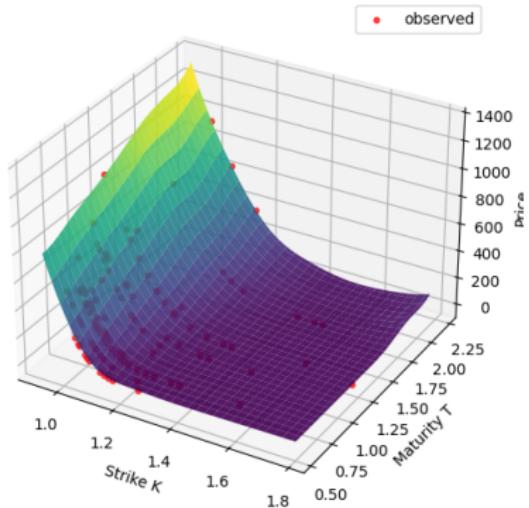


Interpolation

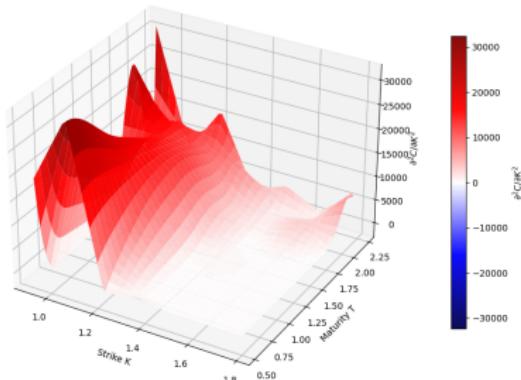


Interpolation with No-Arbitrage Constraints

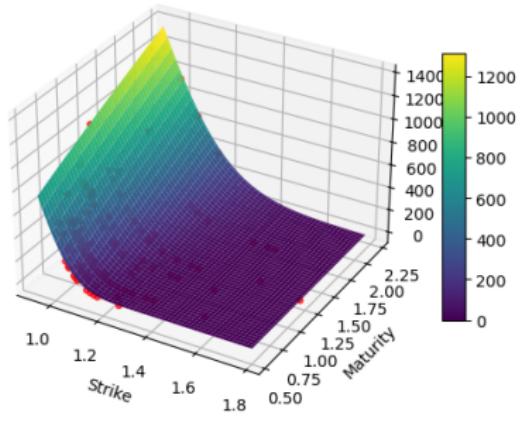
Constrained B-spline fit (convex in K , monotone in T)



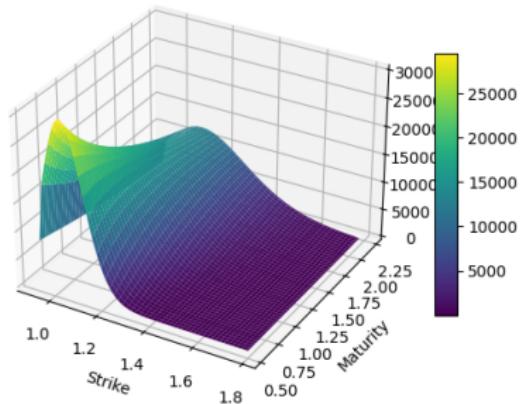
3D Surface of $\partial^2 C / \partial K^2$ (from constrained B-spline)



Black Scholes



Second derivative wrt Strike ($\partial^2 C / \partial K^2$)



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Thank you!