MA 473 -REPORT

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Inputs

Stock price S0 = 50.0
Strike K = 50.0
Maturity T = 1.0 years
Risk-free rate r = 8.00%
Volatility σ = 30.00%
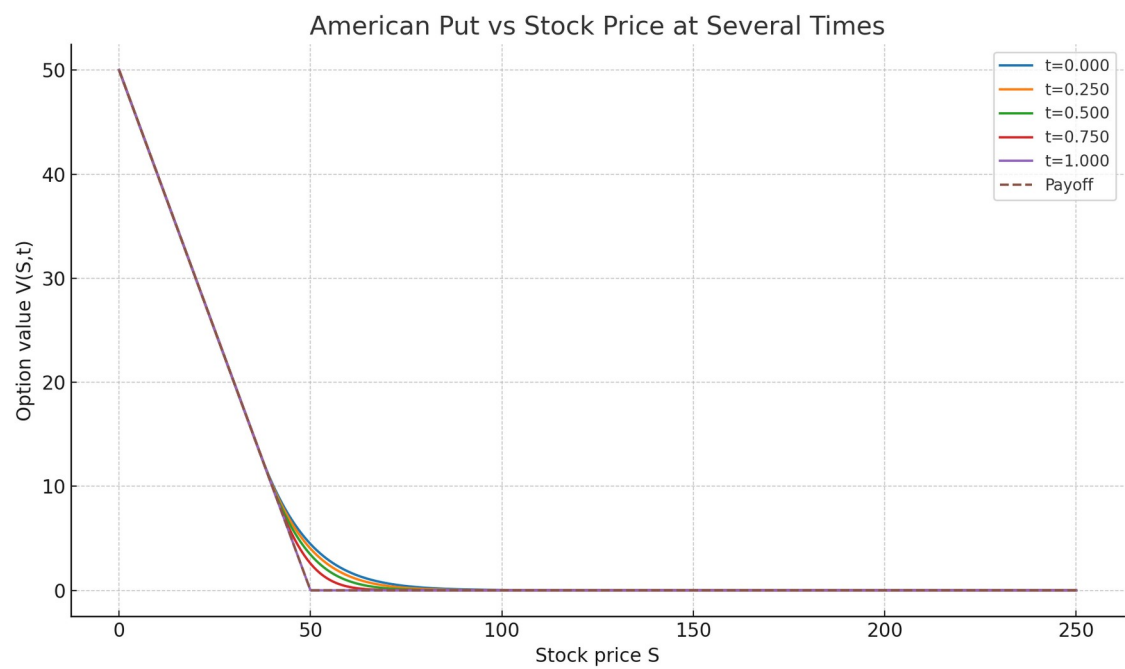Grid: Smax=250.0, M=300, N=800

We discretize the Black–Scholes PDE using the Crank–Nicolson scheme and solve the linear complementarity problem at each timestep using a Projected Successive Over-Relaxation (PSOR) solver (Cryer's method). The American constraint V(S,t) ≥ max(K−S,0) is enforced via projection in PSOR.
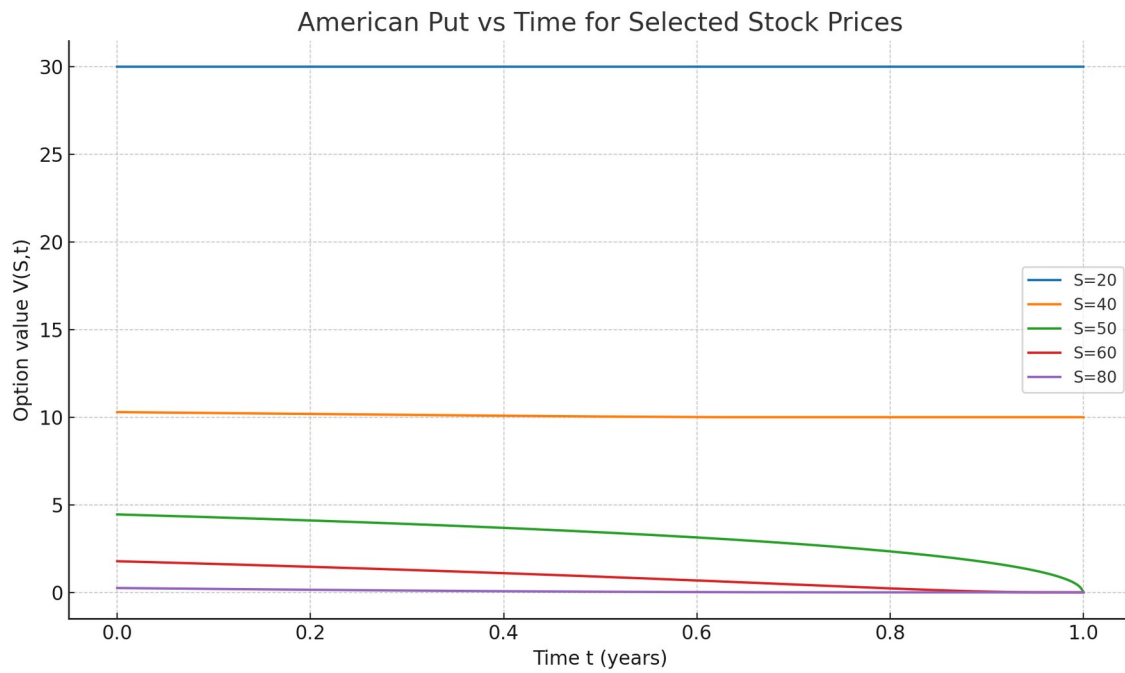
Results
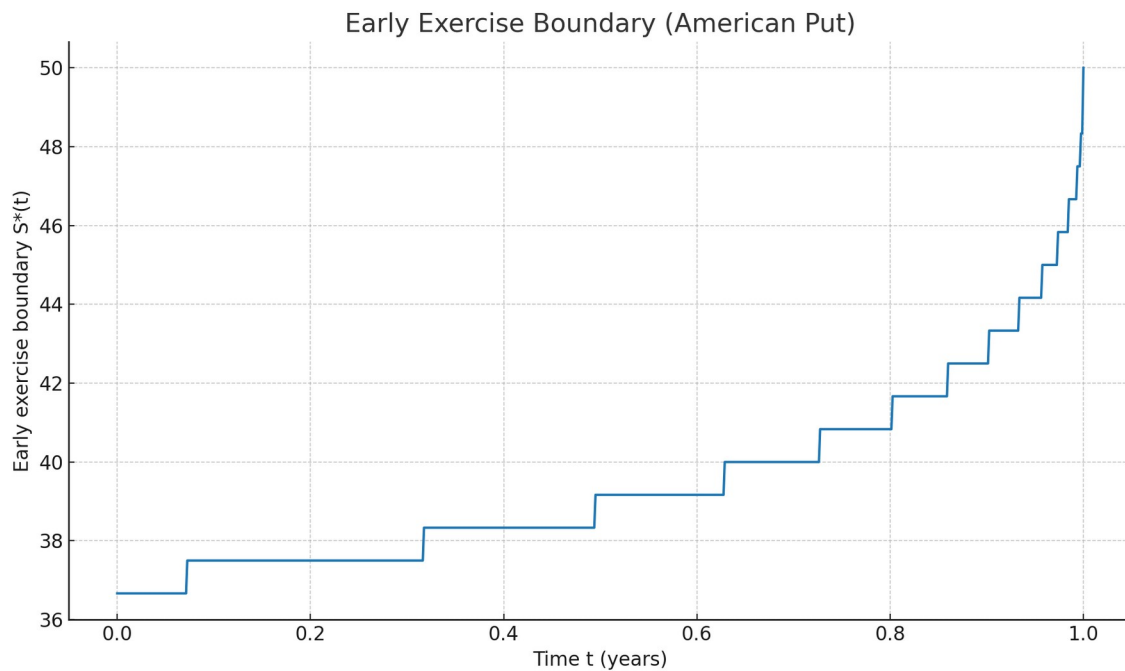
Computed American put price at S0 = 50.0 (t=0): 4.449554

Option value vs Stock Price (several times):

American Put vs Stock Price at Several Times

Option value vs Time (selected S):

American Put vs Time for Selected Stock Prices

Legend:
- S=20
- S=40
- S=50
- S=60
- S=80

X-axis: Time t (years)
Y-axis: Option value V(S,t)

Early Exercise Boundary S(t):

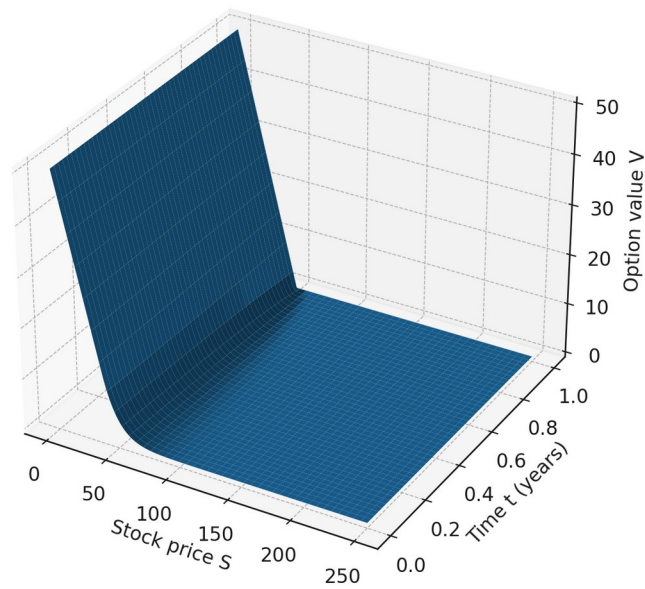**Early Exercise Boundary (American Put)**

X-axis: Time t (years)
Y-axis: Early exercise boundary S*(t)

Option Value Surface V(S,t):

American Put Value Surface V(S,t)

Conclusion

The early exercise boundary identifies stock prices where it becomes optimal to exercise prior to maturity. Numerical parameters (grid sizes M and N) affect accuracy and runtime; refine them if higher accuracy is required.