

# Bargaining with Deadline Extension

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## Abstract

Many real world negotiations have fixed deadlines. In reality however, a deadline of negotiation is often extended. In this paper, I examine how a probability of deadline extension will affect the equilibrium of bargaining, using a model of price negotiation.

I introduce one or more stochastic intermediate deadlines before a fixed deadline into a finite-horizon bargaining framework with incomplete information, based on *Fuch and Skrzypacz (2010)*, AER, “*Bargaining with Arrival of New Traders*”. In the model, a single seller intends to sell an asset to a single buyer with a private value of uniform distribution under intermediate deadlines that are stochastically realized with a probability  $\alpha$ . In other words, each stochastic intermediate deadline is extended with a probability  $1 - \alpha$ . Note that timing of the potential deadlines and  $\alpha$  are exogenous.

To begin with, the seller’s price, the buyer’s cutoff and the value functions of both players in discrete periods are derived by solving difference equations. I obtain two more interesting results, which can be applied to real world negotiations at the level of firms and governments, and to consumer shopping behavior.

One of the results is intuitive: When I consider a continuous limit of time, after the stochastic deadline passes, the price offered by the seller discontinuously drops. The offered price turns quite low after the stochastic deadline, because the buyer sharply decreases the cutoff value before the stochastic deadline, and the highest remaining value of the buyer is quite low. The seller’s price curve and the buyer’s cutoff curve are obtained by differential equations and the sizes of drops of the price and the cutoff can be given by closed form with parameters. This may be one reason why when a seller resells a good on eBay, the new price often is set lower. It would be exciting to find an appropriate real world example and confirm the discontinuity by an empirical approach.

The other result seems counterintuitive: When both players are equally and sufficiently patient, the expected profit of the seller is minimized, the expected surplus of the buyer and the total bargaining surplus are maximized with the same interior probability of deadline realization  $\alpha$ . In other words, the seller is worst-off and the buyer is best-off, and the bargaining is most socially-optimal when  $\alpha$  is somewhere between 0 and 1. The minimizer of the seller’s profit and the maximizer of the buyer’s surplus coincide only when homogeneous discount rates are assumed. I provide an explanation of the phenomenon, in which a difference of sensitivity with respect to deadline uncertainty between the seller and the buyer plays a key role.