Laboratory data supports the use of the Kalai (proportional) solution in bilateral bargaining over prices and quantities traded

Estimating bargaining solutions with laboratory data.

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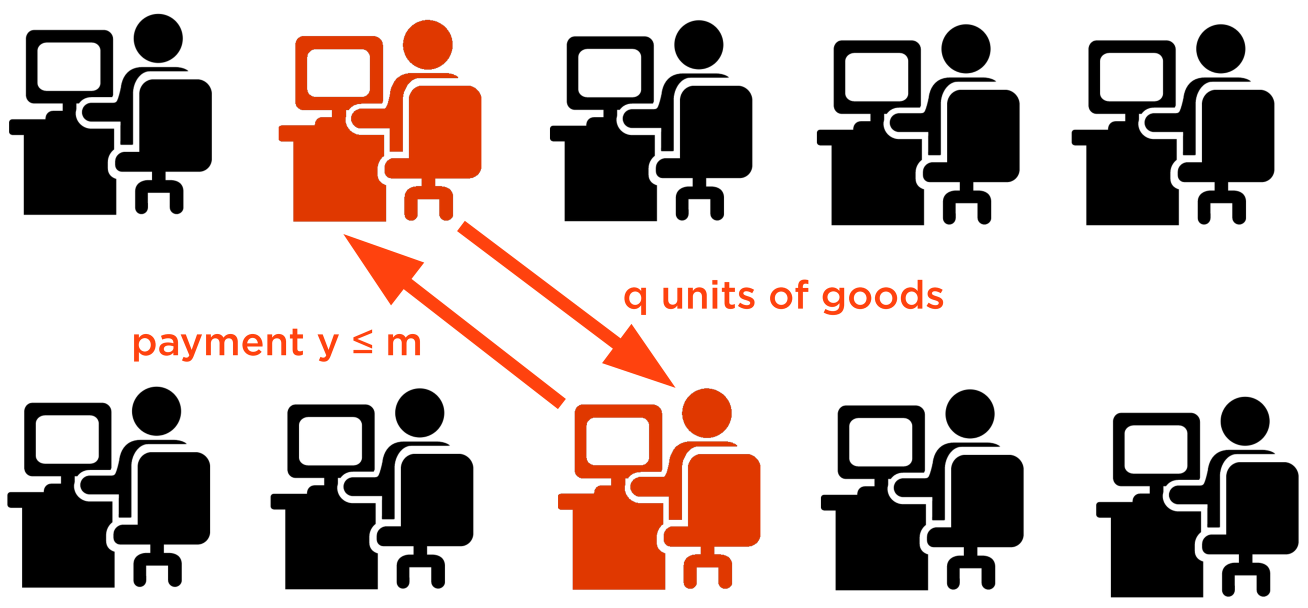
1 What we do and why

- **Generate laboratory data to study the process and outcomes of an unstructured bilateral negotiation** over how many units of goods to trade and at what price
  - ▶ Estimate bargaining weights
  - ▶ Compare outcomes to the 2 axiomatic solutions most commonly used in the literature: Nash (1950) and Kalai (1977)
- Preferences and payoffs used are typical of **workhorse models of monetary economies and over-the-counter asset trade**, e.g. Lagos and Wright (2005), where **the bargaining protocol and bargaining weights used have strong implications**:
  - ▶ theoretically, e.g., for the existence of monetary equilibria
  - ▶ quantitatively, e.g., to estimate the welfare cost of inflation

➡ Our results directly inform how to set up and calibrate those models

2 Experimental design

Producers. Payoff -c(q)+p



Consumers. Own m tokens per round. Payoff u(q)-p

Setting

- Experiment run at UC Irvine in the Experimental Social Sciences Lab
- 6 sessions as of September 2019

Each session

- 10 participants with **fixed roles**
  - ▶ 5 consumers
  - ▶ 5 producers
- Endowments and preferences: **see figure above**
- **30 rounds** of bargaining
- **Fixed treatment**
  - ▶ m ∈ {30, 60, 315}

Each round

- Bilateral bargaining
  - ▶ Random matching
- **Unstructured** bargaining
  - ▶ Both players can make any proposals (q,y) at any time as long as trade surpluses are positive and y ≤ m
  - ▶ Both players can accept any proposal made by the other player at any time
- 2-minute time limit. Disagreement payoff (0,0)

3 Identification strategy

- First-best trade size q* : u'(q*)=c'(q*)
- **m∈{30, 60}** ⇒ m > u(q*) ⇒ **"unconstrained"**
  - ▶ **Nash and Kalai predict the same outcome:** y=(1-θ)u(q*)+θc(q*)
  - ▶ Use offers close to this prediction to **estimate the consumer's bargaining power, θ,** using

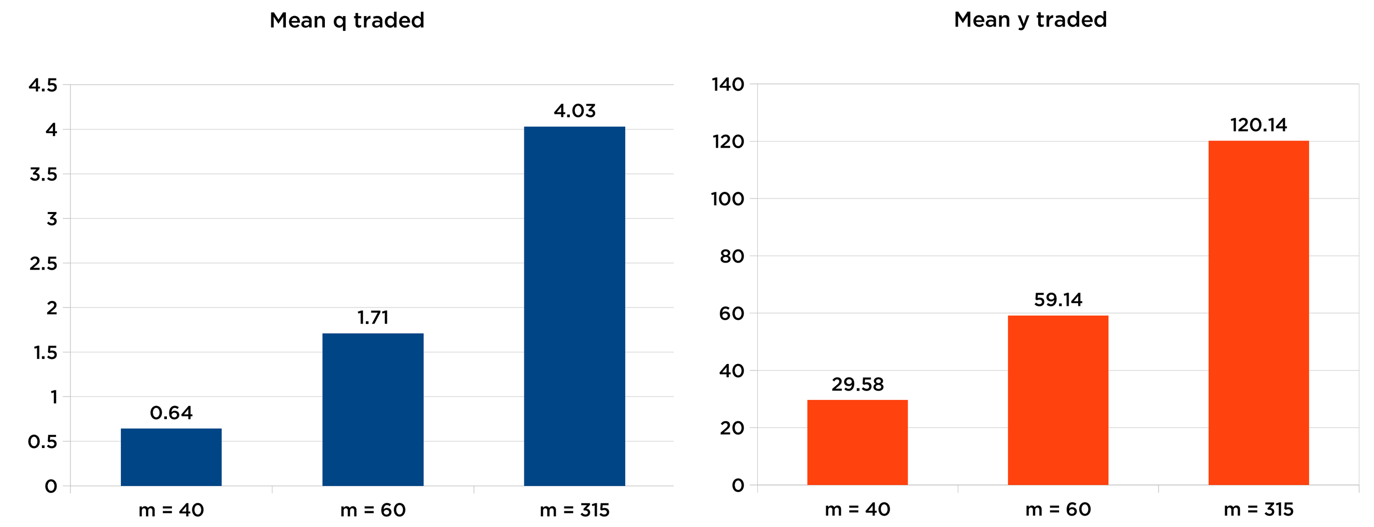
$$consumer's\ surplus = \theta \bullet total\ surplus + error \text{ (1)}$$

- **m = 315** ⇒ m < c(q*) ⇒ **"constrained"**
  - ▶ **Nash and Kalai predict different outcomes**
    - ▪ Kalai: equal split of surplus; individual surpluses ↑ in m
    - ▪ Nash: unequal split of surplus; consumer's surplus non-monotone
  - ▶ Use outcomes to **distinguish between Nash and Kalai**, e.g. test for monotonicity of consumer's surplus by estimating

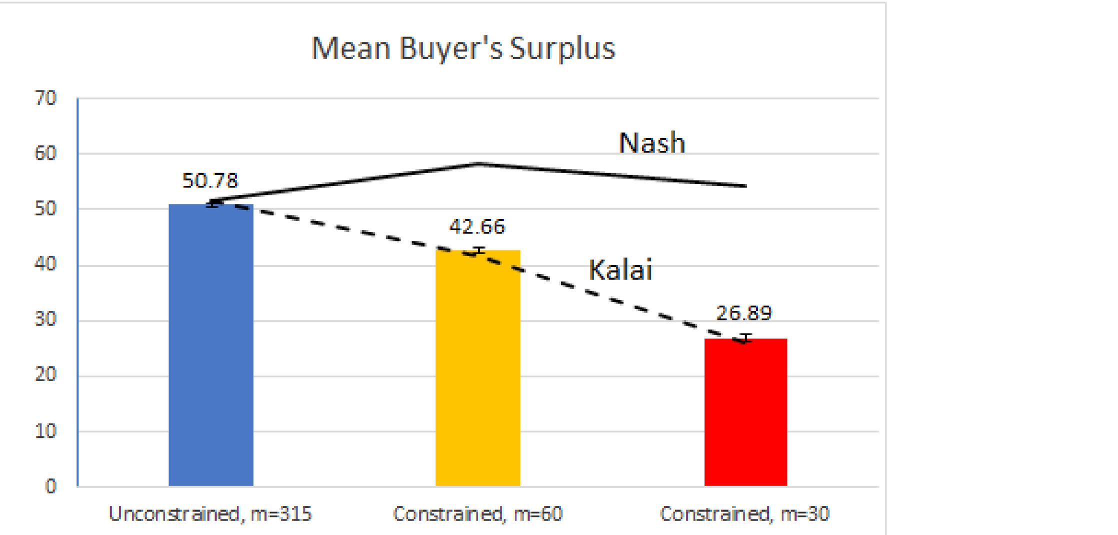
$$consumer's\ surplus = \beta_0 + \beta_1 \bullet (m{=}30) + \beta_2 \bullet (m{=}315) + error \text{ (2)}$$

4 Results

1. On average, subjects behave optimally
   - ▶ unconstrained subjects achieve the first best, q=q*=4
   - ▶ constrained subjects trade all of the consumers' tokens
2. As m ↑, the agreed-upon q ↑



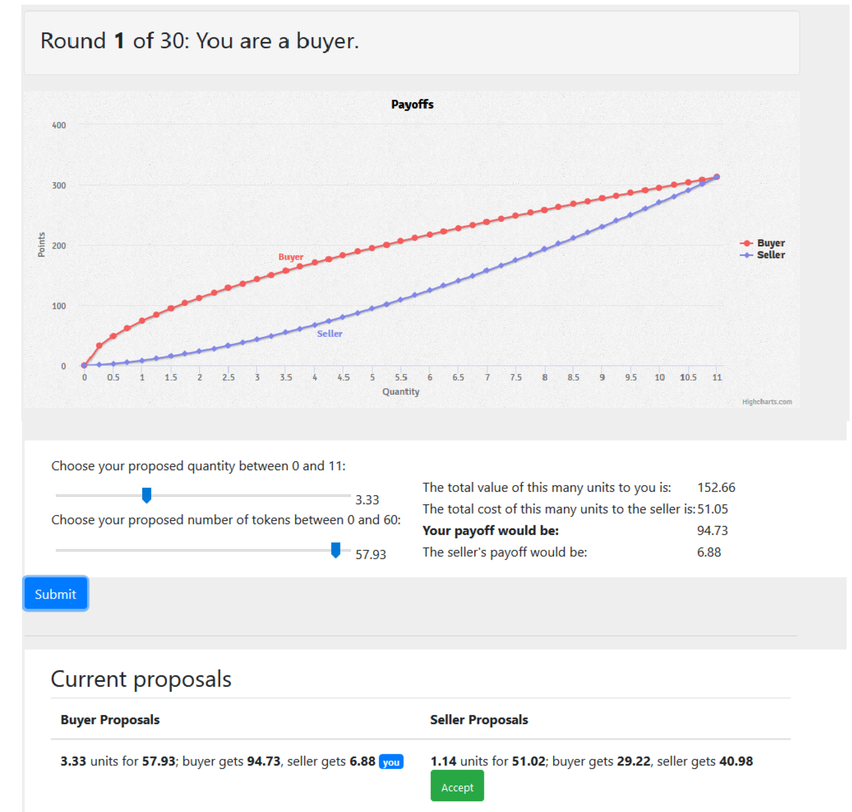
3. We estimate θ = 0.4960 (see appendix for more details)
4. Ratio of consumer's surplus to producer's surplus constant as m ↑, and individual surpluses all increase as m ↑ (see appendix for more details).



➡ Reject Nash bargaining in favor of Kalai (proportional) bargaining

Appendix

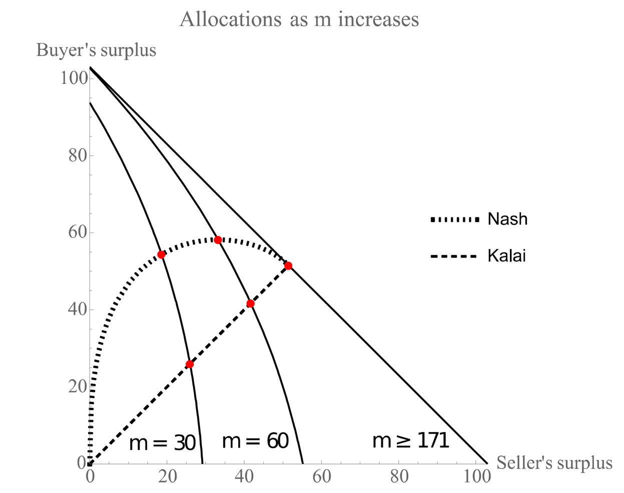
Decision screen



Descriptive statistics

- 4589 proposals
- 18.6% acceptance rate
- 95.5% agreement rate
- 5.1 proposals per round on average
- Consumers made
  - ▶ 50.3% of all proposals
  - ▶ 44% of all accepted proposals

Predicted outcomes when θ = 0.5



RE estimation of equation (1)

Samples: accepted offers when m ∈ {30,60}

(1) all (3) |q-4| < 0.1

(2) |q-4| < 0.5 (4) |q-4| < 0.05

	Buyer's surplus			
	(1)	(2)	(3)	(4)
Total surplus	0.4960	0.4991	0.4976	0.4979
	(0.0031)	(0.0025)	(0.0037)	(0.0038)
Observations	287	230	160	143

(standard errors in parentheses)

RE estimation of equation (2)

Samples: accepted offers

(1) all (2) |q-4| < 0.05 and 60-y < 0.5

	Buyer's surplus	
	(1)	(2)
m = 30	-16.4272	-17.5511
	(2.7015)	(2.2973)
m = 315	6.2254	6.8685
	(2.6833)	(2.2624)
Constant (m = 60)	44.5435	44.4585
	(1.9041)	(1.5978)
Observations	854	752

(standard errors in parentheses)