DISCUSSION PAPERS IN ECONOMICS

Working Paper No. 00-01

Does Evolution Solve the Hold-up Problem?

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January 2000

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1 Introduction

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p b p l llr l p k r p p b f b r g p p g

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b f b r g p p g p b p l l g p r f p

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rr br lm br pg

l m l f bl r lm b p r b l m p r

m rb m grbp b r pg rpr b l m p r ll

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m p bl b m b ll l lm p br

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gg b p pp lb gb b r m l f rg ppggm b r l
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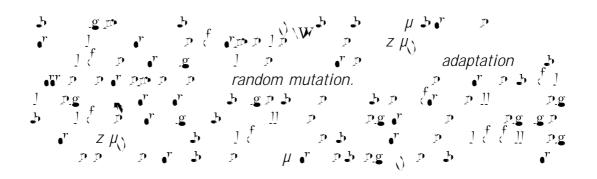
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pl f b b l _ r l m pg b r p p _ r g ppggm \mathbf{p}^{k} pg rpr 1 b llp

2 Investment and Bargaining

g gm ef p m r ll p m p b b m p gm
pl m l p m p p b lm m gm b p l b
pl p r ll r p b p l b r r p f l p r
l p f gm ef p

3 Evolution

Assumption 1 (i) The pie division is small: $V I_{i} > -$. (ii) The population is large: V I*\)



$$x^{L} = \{x \in D_{B} \mid I^{*} \setminus V \mid I^{*} \setminus -X \setminus \frac{N-I}{N} - I^{*} \geq V \mid I \setminus -I --\}:$$

$$X^{M} = X^{M} \{ x \in D_{B} \mid I^{*} \setminus V \mid I^{*} \setminus X - I^{*} > V \mid I \setminus Y - Y - I^{*} \}$$

Proposition 3 Let agents bargain according to the Nash demand game. The outcome % is locally stable if and only if % { I^* ; V I^* , - X; X, Y, where $X \le X^L$.

by by leading stable in and only in
$$m = \{1, \sqrt{1}, \sqrt{2}, \sqrt{$$

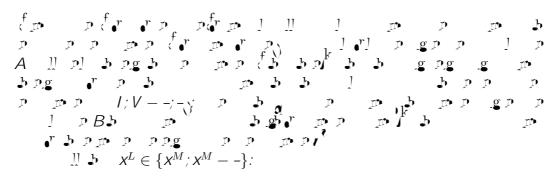
Theorem 1 An equilibrium μ is stochastically stable if and only if no other equilibrium has lower stochastic potential.

Appendix: Proofs

Lemma 1 Let $z_1 < z_2 ::: < z$ be demands in $D \mid_{\searrow}$ for some $l \in \Psi$. Assume that the set of demands following l for agents in the relevant population is $\{z_l\}_l$

Bb ppp bpg r g p x^f rp pb pr y^f br x^f r y^f pp y^f

Lemma 4 Let μ' (% μ') = { I':y':x'}) be an equilibrium. If $I \not \subseteq I'$ and $y-I \ge y'-I'$, then the population can get from μ' to an equilibrium μ with % μ) = { I:y:x'} through a sequence of single mutation transitions.



Lemma 5 The number of mutations required to get from an equilibrium with outcome $I^*; y; \chi_{\setminus}$ with $x \leq x^L$ to an equilibrium with outcome I; V = -; -; is $r : \chi_{\setminus I} = P\{r | r > N : -\frac{\hat{V} - \delta - \hat{I} + I^*}{V^* - V^*}\}$.

Lemma 6

(i) If μ is an equilibrium with outcome $I^*; y; x_{\gamma}$ and $x the easiest transition away from % <math>\mu_{\gamma}$ Supplies 1827 0.9482 2 2 2F7283m)-343 (with)-3832 (with)

Lemma 7 From an outcome $I^*; y; \chi_{i}$ the easiest transition in which investment is at all times e-cient, but which ends with different demands, is to an outcome $I^*; y'; x'$ where $x_i = x - -; x -; -; \text{ or } V^* - -$.

Lemma 8

- (i) Moving from x to x- takes $N \not = \frac{-\delta}{V^* \delta}$ mutations to pop A. (ii) Moving from x to x takes $N \not = \frac{V^* \delta}{V^* \delta}$ mutations to pop B. (iii) Moving from x to takes $N \xrightarrow{V^* \delta}$ mutations to pop B. (iv) Moving from x to $V^* -$ takes $N \xrightarrow{V^* \delta}$ mutations to pop A.

Lemma 9

(i) If $- < x < V^* - -$, then moving from x to x - - takes fewer mutations than moving from x to -, and moving from x to x - takes fewer mutations than moving from x to $V^* - -$.

(ii) If x_{i-} - then moving from x to

Lemma 11 Let surplus be divided by the ultimatum game. The component with the subgame perfect outcome, I^H ; $V^H - x^{\max} I^H$; $X^{\max} I^H$; is a subset of the unique locally stable set.

Lemma 12 Let surplus be divided by the ultimatum game. Agents in population A receive a payofi of at least $V^H - I^H - x^{\max} I^H$ in every equilibrium.

Lemma 13 Let surplus be divided by the 'ultimatum' game. If $V \mid_{\searrow} - I - x \ge V^H - I^H - x^{\max} \mid_{\searrow} I^H \mid_{\searrow}$ then there exists an equilibrium μ such that $\mu \in \Theta^L$ and $\#\mu_{\searrow} - I : V \mid_{\searrow} - x : \chi_{\searrow}$

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6 References

Markets and Hierarchies: Analysis and Antitrust Implications,

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