Online supplement to
Buying up the block:
An experimental investigation of capturing economic rents through sequential negotiations

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A Sequential cash purchase (SC-P) mechanism

This section provides a formal proof of Proposition 1.

Proof of Proposition 1. First note that rejecting a landowner counteroffer is a weakly dominant strategy if and only if the continuation payoff to the developer conditioned on that offer is non-positive and accepting the landowner counteroffer is a weakly dominant strategy whenever the continuation payoff for the developer is non-negative. Next note that making a final offer that the developer will reject is a weakly dominated strategy for the landowner. Since in the last negotiation, the developer’s continuation payoff equals $1 - o$, the developer’s unique best reply to any offer $o < 1$ is to accept the landowner’s offer. Thus, no landowner offer less than 1 can be played in a subgame perfect equilibrium as such an offer is dominated by an offer strictly between $o$ and 1. Accepting all landowner offers less than or equal to 1 is best response for the developer. Accepting a landowner offer greater than 1 is never a best reply for the developer. Thus, making an offer greater than 1 produces a zero payoff to the owner. Thus, in the final negotiation, in any subgame perfect equilibrium when the landowner makes a final offer, the landowner will demand 1 and the developer will accept the landowner’s offer.

Thus, the landowner’s payoff from rejecting the developer’s offer in the final negotiation equals 1 if dissipation does not occur and 0 if dissipation occurs. Since dissipation occurs

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with probability $\rho$ the landowner’s payoff from rejection in any subgame perfect equilibrium is $1 \times \rho = \rho$. Thus, in any subgame perfect equilibrium, the landowner will accept all developer offers $o_3 > \rho$ since acceptance generates a continuation payoff for the developer of $1 - \rho > 0$, making an offer $o_3 < \rho$, which triggers rejection always produces a lower payoff, 0, to the developer than making an offer which will be accepted and is less than 1. Thus, in all subgame perfect equilibria the developer will make an offer that will be accepted. An offer $o_3 < \rho$ produces a lower payoff to the developer than offers between $o_3$ and $\rho$ and thus will never be played in subgame perfect equilibria. Moreover, accepting all developer offers, $o_3 \geq \rho$ is a best reply for the landowner. Thus, in all subgame perfect equilibria, in the final negotiation, the developer will offer $\rho = 1/3$ and the landowner will accept the offer. Repeating the same argument for all of the earlier negotiations, proves the assertion that strategies presented in the proposition constitute the unique subgame perfect equilibrium strategies.

To show dominance solvability we proceed in like fashion. When responding to a final landowner offer in the last negotiation, rejecting any landowner counteroffer of $f_3 < 1$ is a strongly dominated strategy for the developer. Accepting any landowner offer of $f_3 > 1$ is a strongly dominated strategy for the developer. Thus, if it is common knowledge that the developer never plays strongly dominated strategies, the landowner expects a payoff of 0 from making a counteroffer, $e_3 > 1$. Thus making a final offer $f_3 < 1$ or $f_3 > 1$ is strongly dominated strategy for the landowner provided it is common knowledge that the developer is not playing dominated strategies because any such offer $0 \leq f_3 < 1$ is strongly dominated by some offer between $f_3$ and 1. Accepting a landowner offer of $f_3 = 1$ is not a weakly dominated strategy for the developer and given that this is the case the landowner proposing $f_3 = 1$ is not a weakly dominated strategy for the landowner. Thus, the only solution in undominated strategies to the subgame starting with the landowner’s final offer in the final negotiation, is for the landowner to offer $f_3 = 1$ and for the developer to accept this offer. Repeating this argument for each offer and counteroffer verifies that the strategies outlined in the Proposition are the unique solution to the game in undominated strategies.
B Tender and Conditional Offer (TC-O) mechanism

This section provides the formalization of the TC-O game, characterizes consistent best responses, proves Proposition 2, and identifies bounds on rationalizable initial developer tender offers (Lemma B.2).

B.1 Definitions and assumptions

Assumption B.1. We consider only equilibria in which the developer randomizes uniformly across all negotiation sequences in the continuation sequential which occurs if a landowner rejects the developer’s initial offer.

Definition B.1. A initial offer, \( \alpha_1 \) is permutation equivalent to initial offer \( \alpha_2 \) if \( (\alpha_2^1, \alpha_2^2, \alpha_2^3) = (\alpha_1^\sigma(1), \alpha_1^\sigma(2), \alpha_1^\sigma(3)) \), where \( \sigma \) is a permutation of \( \{1, 2, 3\} \), e.g., if \( \alpha_1 = (1/5, 1/3, 1/4) \) and \( \alpha_2 = (1/3, 1/4, 1/5) \) then \( \alpha_1 \) and \( \alpha_2 \) are permutation equivalent.

Definition B.2. An initial offer is a 3-tuple, represented by \( \alpha = (\alpha_1, \alpha_2, \alpha_3) \), where \( \alpha_i \) is the initial offer to the \( i \)th landowner. The set of feasible initial offers is represented by \( A \) is defined as \( A = \{ \alpha \in \mathbb{R}^3 : \alpha \geq 0 \text{ and } \alpha_1 + \alpha_2 + \alpha_3 \leq 1 \} \)

B.2 Formalization of the initial offer phase

The payoff to landowner \( i \) conditioned on initial offer \( \alpha \) and holdout set \( \mathcal{H} \) equals \( \alpha_i \) if the landowner accepts the initial offer and equals \( \Pi_L \left( \left\lfloor \mathcal{H} \cup \{i\} \right\rfloor, 1 - \sum_{\mathcal{H}^c \setminus \{i\}}(\alpha) \right) \) if the landowner rejects the offer. Thus, accepting the offer is a best reply for the landowner if \( \alpha_i \geq \Pi_L \left( \left\lfloor \mathcal{H} \cup \{i\} \right\rfloor, 1 - \sum_{\mathcal{H}^c \setminus \{i\}}(\alpha) \right) \) and rejecting the offer is a best reply for the landowner if \( \alpha_i \leq \Pi_L \left( \left\lfloor \mathcal{H} \cup \{i\} \right\rfloor, 1 - \sum_{\mathcal{H}^c \setminus \{i\}}(\alpha) \right) \).

B.3 Technical Lemmas

The following result shows that, for a given holdout set, landowners with smaller offers always have a higher propensity to hold out. This result is expected but not entirely obvious because a landowner receiving a small offer knows that, if other landholders accept the initial value,
her residual value in the continuation game will be smaller than the residual value available to other landowners should they reject the developer’s offer. However, this effect is never large enough to outweigh the direct effect of a smaller offer.

**Lemma B.1.** Let $\alpha$ be an initial offer and let $\mathcal{H}$ be a holdout set for $\alpha$. If $\alpha_i \geq \alpha_j$, then

1. if $i, j \not\in \mathcal{H}$, then accepting the offer is a best response for landowner $i$ whenever it is a best response for landowner $j$;
2. if $i, j \in \mathcal{H}$, holding out is a best response for landowner $j$ whenever it is a best response for landowner $j$.

**Proof.** Consider part (1). First suppose that $\#(\mathcal{H}) = 1$. In which case, the holdout landowner is $k \neq i, j$. The payoff to $j$ from accepting the offer is $\alpha_j$. If $j$ holds out there will be two holdouts $j$ and $k$, and one acceptor, $i$, and the payoff to $j$ from holding out is thus $\Pi_L(2, 1 - \alpha_i)$. Similarly the payoff to $i$ from accepting the offer is $\alpha_i$ and the payoff from rejecting is $\Pi_L(2, 1 - \alpha_j)$. Next note, by plugging into the definition of $\Pi_L$, one can verify that

$$\left(\alpha_i - \Pi_L(2, 1 - \alpha_j)\right) - \left(\alpha_j - \Pi_L(2, 1 - \alpha_i)\right) = \frac{13}{18} (\alpha_i - \alpha_j) \geq 0. \quad (B-1)$$

The second term in parentheses on the left hand side of equation (B-1) is nonnegative by the assumption that accepting the offer is a best response for $j$. Thus, the first term must also be non-negative, i.e., accepting the offer is a best response for $i$.

Now suppose that $\#(\mathcal{H}) = 0$. In this case, the payoff to from accepting to $i$ is $\alpha_i$ and the payoff from holding out is $\Pi_L(1, 1 - \alpha_j - \alpha_k)$. Similarly, the payoff to from accepting to $j$ is $\alpha_j$ and the payoff from holding out is $\Pi_L(1, 1 - \alpha_i - \alpha_k)$. In this case we see that,

$$\left(\alpha_i - \Pi_L(1, 1 - \alpha_j - \alpha_k)\right) - \left(\alpha_j - \Pi_L(2, 1 - \alpha_i - \alpha_k)\right) = \frac{2}{3} (\alpha_i - \alpha_j) \geq 0.$$

and the same argument as was applied to equation (B-1) again establishes the result. A symmetric argument establishes (2). \qed

In order to reduce the length of the subsequent expressions, define

$$\alpha^+ = \Pi_L[3, 1] = \alpha^+, \quad \alpha^o = \Pi_L[2, 1 - \alpha^+] = \frac{155}{729}, \quad \alpha^- = \Pi_L[1, 1 - \alpha^+ - \alpha^o] = \frac{403}{2187}, \quad \bar{a} = \frac{\alpha^+ + \alpha^o + \alpha^-}{3}. \quad (B-2)$$

A holdout set, $\mathcal{H}$ is consistent for initial offer $\alpha$ if for all $i \in \mathcal{H}$, holding out is a best reply and, for all $i \not\in \mathcal{H}$ accepting the initial offer is a best reply. Given Lemma B.1, for any given
initial offer up to a permutation of the indexes for the landowners, there are only four holdout sets are potentially consistent. We index these sets their number of elements. They are defined below:

\[ H_0 = \emptyset, \quad H_1 = \{ i : \alpha_i = \min(\alpha) \}, \quad H_2 = \{ i : \alpha_i \leq \operatorname{mid}(\alpha) \}, \quad \text{and} \quad H_3 = \{1, 2, 3\}. \]

Associated with each potentially consistent holdout set, \( H_i \) is a set of offers, \( \Gamma_i \) under which \( H_i \) is consistent.

\[
\Gamma_0 = \{ \alpha \in \Lambda : \min(\alpha) \geq \Pi_L (1, 1 - \operatorname{mid}(\alpha) - \min(\alpha)) \} = \{ \alpha \in \Lambda : \min(\alpha) \geq \frac{1}{3} (1 - \max(\alpha) - \operatorname{mid}(\alpha)) \},
\]

\[
\Gamma_1 = \{ \alpha \in \Lambda : \min(\alpha) \leq \Pi_L (1, 1 - \operatorname{mid}(\alpha) - \max(\alpha)) \} \text{ and } \operatorname{mid}(\alpha) \geq \Pi_L (2, 1 - \max(\alpha)) \} = \{ \alpha \in \Lambda : \min(\alpha) \geq \frac{5}{13} (1 - \max(\alpha)) \} \text{ and } \max(\alpha) + \operatorname{mid}(\alpha) + 3 \min(\alpha) \leq 1 \}.
\]

\[
\Gamma_2 = \{ \alpha \in \Lambda : \max(\alpha) \geq \alpha^+ \text{ and } \operatorname{mid}(\alpha) \leq \frac{5}{13} (1 - \max(\alpha)) \},
\]

\[
\Gamma_3 = \{ \alpha \in \Lambda : \max(\alpha) \leq \Pi_L (3, 1) \} = \{ \alpha \in \Lambda : \max(\alpha) \leq \alpha^+ \}. \]

These observations imply that a holdout set, \( H \) is consistent for \( \alpha \) if and only if there exist \( k \in \{0, 1, 2, 3\} \) such that \( \alpha \in \Gamma_k \) and \( H = H_k \).

The gamma sets are convex and collectively exhaustive of \( A \). However, when \( |j - k| > 1 \), the interiors of \( \Gamma_j \) and \( \Gamma_j \) may have nonempty intersections. For example \( \alpha = (0.26, 0.26, 0.26) \) is an element of the interior of both \( \Gamma_0 \) and \( \Gamma_3 \). Thus, there are two consistent holdout sets, \( H_0 \) and \( H_3 \), for \( \alpha = (0.26, 0.26, 0.26) \).

Now consider the developer, the developer payoff in the initial offer phase conditioned on holdout set \( H \) is given by the surplus, 1, less the sum of payments to acceptors in the initial offer and payments to holdout sets in the sequential continuation phase. Using equation (1) we see thus see that the developer payoff in the continuation phase, \( D \), is given by

\[
D(\alpha, H) = \left( \frac{2}{3} \right)^{\#(H)} \left( 1 - \Sigma H \right).
\]

Next note that over the gamma sets, \( \Gamma_i \), optimizing the developer’s profit is a simple linear programming problem. Over each of the gamma sets the developer’s payoff equals one minus

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the payments to the landowners, where payment to the acceptors determined by the initial offer and to the holdouts by the continuation game payoffs defined by equation (1). We represent these maximized developer payoffs by $\hat{D}_i$ where $i$ is the index representing the number of holdouts:

$\hat{D}_0 = \max\{1 - \alpha_1 - \alpha_2 - \alpha_3 : \alpha \in \Gamma_0\} = \frac{2}{3}$

$\hat{D}_1 = \max\{1 - \max(\alpha) - \operatorname{mid}(\alpha) - \Pi_L(1, 1 - \max(\alpha) - \operatorname{mid}(\alpha)) : \alpha \in \Gamma_1\} = \frac{269}{729}$

$\hat{D}_2 = \max\{1 - \max(\alpha) - 2\Pi_L(2, 1 - \max(\alpha)) : \alpha \in \Gamma_2\} = \frac{248}{729}$

$\hat{D}_3 = \max\{3\Pi_L(3, 1) : \alpha \in \Gamma_3\} = \frac{8}{27}$

Note that $\hat{D}_0 > \hat{D}_1 > \hat{D}_2 > \hat{D}_3$, so at the optimized initial offer the developer’s payoff is decreasing in the number of landowners who hold out.

A candidate landowner initial offer strategy and landowner accept/reject response is a Nash equilibrium if (a) the accept/reject response for the landowners such that, for each initial offer $\alpha$, there is a single consistent holdout set $H$ such that each landowner’s accept/reject decision is a best reply to $\alpha$ and $H$ and (b) given the landowners’ accept/reject response, the developer’s initial offer maximizes the developer’s payoff.

A rationalizable landowner accept/reject response is an accept/reject response for the landowners such that for each initial offer $\alpha$, each landowner’s accept/reject decision is a best reply to $\alpha$ for some consistent set $H$. Thus, a rationalizable response does not presume that landowners have the same model of how other landowners will respond to the developer offer only that each has a logically consistent model for all possible developer offers. A rationalizable solution is a rationalizable response by landowners and a developer initial offer strategy that maximizes the developer’s payoff subject to the landowner response. An offer is not rationalizable if, used against any rationalizable response, produces a lower developer payoff than the minimum developer payoff under any rationalizable response. Thus a rationalizable solution is one where the developer bases his offer on a model of landowner responses which posits that each landowner bases her responses on a self-consistent model of the behavior of the other landowners.

Proof of Proposition 2. First consider part (a). For any initial offer $\alpha = (\alpha_1, \alpha_2, \alpha_3)$ and any
landowner $i$ define

$$
\min^{-i}(\alpha) = \min\{\alpha_j : j \neq i\}, \quad \max^{-i}(\alpha) = \max\{\alpha_j : j \neq i\}, \quad \Sigma^{-i} = \sum_{j \neq i} \alpha_i.
$$

Define the function $a^{-i}: \mathcal{A} \to \mathbb{R}$ by

$$
a^{-i}_i(\alpha) = \begin{cases} 
\alpha^+ & \text{if } \max^{-i}(\alpha) < \alpha^+, \\
\Pi_L(2, 1 - \max^{-i}(\alpha)) & \text{if } \max^{-i}(\alpha) \geq \alpha^+ \text{ and } \min^{-i}(\alpha) \leq \frac{5}{18} (1 - \max^{-i}(\alpha)), \\
\Pi_L(1, 1 - \Sigma^{-i}(\alpha)) & \text{if } \max^{-i}(\alpha) \geq \alpha^+ \text{ and } \min^{-i}(\alpha) \geq \frac{5}{18} (1 - \max^{-i}(\alpha)).
\end{cases}
$$

Let,

$$
\alpha^*(\lambda) = \lambda \left(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}\right) + (1 - \lambda) (\bar{a}, \bar{a}, \bar{a}).
$$

Note that if initial offer $\alpha^*(\lambda)$ is accepted by all landowners the developer’s payoff will equal

$$
D^*(\lambda) = \lambda D^+ (1 - \lambda) D^-.
$$

Now for each $\lambda \in [0, 1]$ define a candidate landowner reservation demand given the initial developer offer by

$$
\mathbf{R}_i(\alpha) = \begin{cases} 
a^{-i}_i(\alpha) & \text{if } \alpha \neq \alpha^*(\lambda), \\
\alpha^*(\lambda) & \text{if } \alpha = \alpha^*(\lambda).
\end{cases}
$$

The candidate response for the landowners is to accept an initial offer $\alpha$ if and only if $\alpha_i \geq \mathbf{R}_i(\alpha)$. The candidate initial offer strategy for the developer is to offer $\alpha^*(\lambda)$. We will show that these candidate strategies satisfy the Nash equilibrium conditions.

First consider the developer. If the developer offers $\alpha^*(\lambda)$, under the candidate landowner strategy the developer’s offer will be accepted by all landowners and the developer’s payoff as noted above will equal $\lambda \frac{2}{3} + (1 - \lambda)(1 - \bar{a})$.

We will now show that if the developer makes any other offer, the developer’s payoff is at most $D^*(\lambda)$. Suppose that $\alpha \neq \alpha^*(\lambda)$. First, consider a developer offer that $\alpha$ such that $\max[\alpha] < \alpha^+$. In this case, under the landowner candidate response, the reservation demand $\mathbf{R}_i$ for all landowners is $\alpha^+$. Thus, the offer will be rejected by all landowners and the developer’s payoff will equal $1 - 3 \alpha^+ = 1 - 3 \Pi_L(3, 1) < D^*(\lambda)$.

Now consider a developer offer with $\max(\alpha) \geq \alpha^+$. Then, under the candidate best response for the landowners, at least one landowner will accept the offer, the landowner receiv-
ing the offer \( \max(\alpha) \). Assume without loss of generality that this landowner is landowner 1, \( \text{mid}(\alpha) \) is received by landowner 2 and \( \text{min}(\alpha) \) is received by landowner 3. Then, under the candidate response strategy, both landowners 2 and 3 will reject if
\[
\alpha_2 < \frac{5}{18} (1 - \alpha_1).
\]
In this case developer’s payoff will be no higher than \( \alpha_1 + \Pi_L(2, 1 - \alpha_1) \leq \alpha^+ + \Pi_L(2, 1 - \alpha^+) < D^*(\lambda) \). Next suppose that
\[
\alpha_2 \geq \frac{5}{18} (1 - \alpha_1),
\]
then landowners 1 and 2 will accept the developer’s offer. Landowner 3 will accept if and only if
\[
\alpha_3 \geq \frac{1}{3} (1 - \alpha_1 - \alpha_2).
\]
If landowner 3 rejects, landowner 3’s payoff will also equal \( \frac{1}{3} (1 - \alpha_1 - \alpha_2) \). Thus it is clearly weakly optimal for the developer to offer landowner 3 \( \frac{1}{3} (1 - \alpha_1 - \alpha_2) \). Thus, the payoff to the developer from all offers that are accepted by both landowner 2 and landowner 3 cannot exceed
\[
D_{\text{Deviate}} = \max_a \{ 1 - \alpha_1 + \alpha_2 + \alpha_3 : \alpha_1 \geq \alpha^+ \text{ and } \alpha_2 \geq \frac{5}{18} (1 - \alpha_1) \text{ and } \alpha_3 \geq \frac{1}{3} (1 - \alpha_1 - \alpha_2) \}.
\]
Solving this simple linear programming problem yields an optimal solution of \( \alpha = (\alpha^-, \alpha^o, \alpha^+) \) shows that \( D_{\text{Deviate}} = D^- \leq D^*(\lambda) \). Thus, given the candidate landowner strategies the developer’s strategy is a best response.

Now consider the landowners. First consider the case where \( \alpha \neq \alpha^*(\lambda) \). Again suppose without loss of generality that \( \max(\alpha) \) is received by landowner 1, \( \text{mid}(\alpha) \) is received by landowner 2 and \( \text{min}(\alpha) \) is received by landowner 3. If the initial developer offer satisfies,
\[
\alpha_1 < \alpha^+
\]
then the reservation demands of all landowners under the candidate response are \( \alpha^+ \). Thus, the candidate response calls for all landowners to reject the offer. But, when (B-12) is satisfied \( \alpha \in \Gamma_3 \) and thus the landowner’s candidate responses are a best responses. Now suppose (B-12) is not satisfied by initial offer \( \alpha \), i.e., that
\[
\alpha_1 \geq \alpha^+
\]
then landowner 1 will accept the offer because it at least equals landowner 1’s reservation.
demand, $\alpha^*$. For landowner 2, $\min^2 = \alpha_3$ and $\max^2 = \alpha_1$ and for landowner 3, $\min^2 = \alpha_3$ and $\max^2 = \alpha_1$. Because $\alpha_3 \leq \alpha_2$, if

$$\alpha_2 < \frac{5}{18} (1 - \alpha_1)$$

then (B-14) implies that

$$\alpha_3 < \frac{5}{18} (1 - \alpha_1).$$

(B-15)

Thus, the reservation demand for landowner 3 under the candidate response is $\Pi_L(2, 1 - \alpha_1) = \frac{5}{18} (1 - \alpha_1)$ and this reservation demand is less than the offer received by landowner 3. Thus, landowner 3 will reject the offer when (B-14) and (B-13) are satisfied. Under the candidate response, landowner 2’s reservation demand is also $\Pi_L(2, 1 - \alpha_1) = \frac{5}{18} (1 - \alpha_1)$, implying that when (B-14) and (B-13) are satisfied, landowner 2 will also reject. Thus, the candidate strategy calls for two holdouts, landowner 2 and 3. But, when (B-14) and (B-13) are satisfied, $\alpha \in \Gamma_2$ and thus two holdouts is a best response to the offer. When (B-13) and (B-15) is satisfied but (B-14) is not satisfied, i.e.,

$$\alpha_2 \geq \frac{5}{18} (1 - \alpha_1)$$

(B-16)

then the reservation demand of landowner 2 is still $\Pi_L(2, 1 - \alpha_1) = \frac{5}{18} (1 - \alpha_1)$ but the reservation demand of 3 is $\Pi_L(2, 1 - \alpha_1 - \alpha_2) = \frac{1}{3} (1 - \alpha_1 - \alpha_2)$. Thus, if

$$\alpha_3 < \frac{1}{3} (1 - \alpha_1 - \alpha_2)$$

(B-17)

and (B-13), (B-16) and (B-17) are satisfied, the candidate response calls for landowners 1 and 2 to accept and 3 to reject. But (B-13), (B-16) and (B-17) also imply that $\alpha \in \Gamma_1$ and thus, 1 and 2 accepting and 3 rejecting is a best response. A similar argument shows that if (B-13), (B-16) are satisfied but (B-17) is not satisfied, i.e.,

$$\alpha_3 \geq \frac{1}{3} (1 - \alpha_1 - \alpha_2)$$

(B-18)

then landowners 1, 2, and 3 will accept. The satisfaction of these conditions implies that $\alpha \in \Gamma_0$ and thus the landowner’s response is a best response. Since we have now exhausted the set of developer offers such that $\alpha \neq \alpha^*(\lambda)$ the proof that candidate replies are best replies will be complete once we verify the best response property for the landowner response to $\alpha^*(\lambda)$. When $\alpha = \alpha^*(\lambda), \alpha \in \Gamma_0$, thus $\mathcal{M}_0$ is a consistent holdout set and is the holdout set generated by the candidate landowner response. Thus, the candidate landowner response is a best reply.
Now consider (b). Note that in any subgame perfect equilibrium, landowner responses to the initial developer offer must be consistent best responses. From expression (B-7) we see that the highest developer payoff over all consistent best responses is \( D^+ = \frac{2}{5} \) and thus \( D^+ \) is an upper bound on developer payoffs in any subgame perfect Nash equilibrium. Next, note that if the developer offers \((\alpha^+, \alpha^o, \alpha^-) + (\frac{1}{3} \epsilon, \frac{1}{3} \epsilon, \frac{1}{3} \epsilon)\), where \( \epsilon > 0 \) but sufficiently small then \( \alpha \in \Gamma_0 \) and \( \alpha \not\in \Gamma_i, i = 1, 2, 3 \), i.e., under all consistent best responses all landowners accept the developer’s offer. Thus, the developers payoff from \( \alpha \) equals \( D^-(\epsilon) \) for all consistent landowner best responses. Since \( \epsilon \) can be made arbitrarily small, we see that \( D^- \) is the lower bound on all developer payoffs supported by a subgame perfect Nash equilibrium. \( \square \)

Lemma B.2.

1. Any developer initial offer so high that it satisfies
   \[
   \min [\max [\max (\alpha) - \alpha^+, 0], \max [\mid (\alpha) - \alpha^o, 0], \max [\min (\alpha) - \alpha^-, 0]] > 0 \quad (B-19)
   \]
   is not rationalizable.

2. Any developer initial offer so low that it satisfies
   \[
   \min (\alpha) < \frac{1}{3} (1 - \max (\alpha) - \mid (\alpha)) \text{ and } \mid (\alpha) < \frac{5}{18} (1 - \max (\alpha)) \quad (B-20)
   \]
   is not rationalizable.

Proof. First consider part (1). Let \( \alpha^o \) be an offer that fails to satisfy (B-19). Such an offer implies payments to landowners in excess of \( 1 - D^- \). As discussed in the Proof of Proposition 2 this offer given any consistent beleifs of landowners regarding the response to the offer by the other landowners, all landowners will accept the offer. Consider the alternative offer \( \alpha(\epsilon)(\alpha^+, \alpha^o, \alpha^-) + (\frac{1}{3} \epsilon, \frac{1}{3} \epsilon, \frac{1}{3} \epsilon), \epsilon, \epsilon > 0 \). For the same reasons as given above, given any consistent beliefs about of landowners regarding the response to the offer by the other landowners, all landowners will accept \( \alpha(\epsilon) \). For \( \epsilon \) positive but sufficiently small, \( D(\epsilon) < D^o \) and thus \( 1 - D(\epsilon) > 1 - D^o \). Thus, if it is common knowledge that all landowners play consistent best responses based on some consistent beliefs regarding the responses of other landowners, offering \( \alpha^o \) is never a rationalizable offer by the developer.

Finally, consider (2). If
   \[
   \min (\alpha) < \frac{1}{3} (1 - \max (\alpha) - \mid (\alpha)) \text{ and } \mid (\alpha) < \frac{5}{18} (1 - \max (\alpha)) \quad (B-21)
   \]
then $\alpha \notin \Gamma_0$ or $\Gamma_1$. From expression (B-7), we see that the highest possible developer payoff in this case is given by $\frac{248}{729}$ which is less than $D^-$. Since $D^-$ is a lower bound of developer payoffs assuming rationalizable landowner responses to the developer’s initial offer, such offers are not rationalizable. \qed
C More Results of the SC-P game

C.1 SC-P treatments with one or two landowners

This section provides some ancillary experimental results related to the SC-P treatments with one or two landowners. These results are included simply to provide the reader with a full accounting of all experiments performed and thus address the issues of reporting bias.

Table 1: Summary of Negotiation Success
This table presents the number of bilateral negotiations (N), successful ones (N Success), failed ones (N Failure), and percent of failed negotiations (% Failure). N1 and N2 represent the first and second negotiation, respectively.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>N Success</th>
<th>N Failure</th>
<th>% Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 landowner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>96</td>
<td>66</td>
<td>30</td>
<td>31%</td>
</tr>
<tr>
<td>ALL</td>
<td>96</td>
<td>66</td>
<td>30</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>2 landowners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>96</td>
<td>64</td>
<td>32</td>
<td>33%</td>
</tr>
<tr>
<td>N2</td>
<td>64</td>
<td>50</td>
<td>14</td>
<td>22%</td>
</tr>
<tr>
<td>ALL</td>
<td>96</td>
<td>50</td>
<td>46</td>
<td>48%</td>
</tr>
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</table>
Table 2: Payoffs
This table presents the means and standard deviations of the payoffs received by the developer and landowners in three negotiations in all games and all successful games. This table also presents the predicted payoffs in rational value-maximizing equilibrium and sunk-cost/even-split equilibrium.

<table>
<thead>
<tr>
<th></th>
<th>All Games</th>
<th>All Successful Games</th>
<th>Rational Equilibrium</th>
<th>Sunk-cost Equilibrium</th>
<th>Even-split Equilibrium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>StdDev</td>
<td>Mean</td>
<td>StdDev</td>
<td></td>
</tr>
<tr>
<td>1 landowner</td>
<td>0.370</td>
<td>0.261</td>
<td>0.538</td>
<td>0.087</td>
<td>0.667</td>
</tr>
<tr>
<td>Landowner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.318</td>
<td>0.227</td>
<td>0.462</td>
<td>0.087</td>
<td>0.333</td>
</tr>
<tr>
<td>2 landowners</td>
<td>0.114</td>
<td>0.244</td>
<td>0.289</td>
<td>0.192</td>
<td>0.444</td>
</tr>
<tr>
<td>Landowner 1</td>
<td>0.186</td>
<td>0.155</td>
<td>0.287</td>
<td>0.105</td>
<td>0.222</td>
</tr>
<tr>
<td>Landowner 2</td>
<td>0.179</td>
<td>0.183</td>
<td>0.344</td>
<td>0.085</td>
<td>0.333</td>
</tr>
</tbody>
</table>

Table 3: Initial Offers
This table presents the number (N) and average of initial offers made by the developer. Standard deviations are in parentheses. The table also presents comparison of the initial offers with predicted strategies in rational value-maximizing equilibrium and even-split equilibrium. For each equilibrium, the table includes the predicted offer (Strategy), the average of absolute errors between initial offers and predicted strategy (AbsErr) and its standard deviation in parentheses, and the percent of initial offers that are acceptable based on the equilibrium (NA). The table also presents the number and percent of initial offers that are between the predicted strategies of two equilibria.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Initial</th>
<th>Rational</th>
<th>Even-split</th>
<th>In Between</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Offer</td>
<td>Strategy</td>
<td>AbsErr</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 landowner</td>
<td></td>
<td>96</td>
<td>0.425</td>
<td>0.333</td>
<td>0.104</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.084)</td>
<td>(0.068)</td>
<td>(0.077)</td>
<td>(0.077)</td>
</tr>
<tr>
<td>2 landowners</td>
<td></td>
<td>96</td>
<td>0.425</td>
<td>0.104</td>
<td>88.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.084)</td>
<td>(0.068)</td>
<td>(0.077)</td>
<td>(0.077)</td>
</tr>
</tbody>
</table>

Buying up the block 29th September, 2016 C-2
Table 4: Acceptance Decision of Initial Offers

This table presents the number (N), average (Mean), and standard deviation (in parentheses) of initial offers that are accepted and rejected. The table also presents the percent of acceptable offers (NA) based on two equilibria, rational value-maximizing equilibrium and even-split equilibrium. In addition, it provides the percent of acceptable offers based on the equilibrium that are accepted (PA), and percent of rejectable offers based on the equilibrium that are rejected (PR).

<table>
<thead>
<tr>
<th></th>
<th>Accepted</th>
<th>Rejected</th>
<th>Rational</th>
<th>Even-split</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>1 landowner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>63</td>
<td>0.451</td>
<td>33</td>
<td>0.376</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.073)</td>
<td></td>
<td>(0.083)</td>
</tr>
<tr>
<td>ALL</td>
<td>63</td>
<td>0.451</td>
<td>33</td>
<td>0.376</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.073)</td>
<td></td>
<td>(0.083)</td>
</tr>
<tr>
<td>2 landowners</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>59</td>
<td>0.278</td>
<td>37</td>
<td>0.202</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.059)</td>
<td></td>
<td>(0.101)</td>
</tr>
<tr>
<td>N2</td>
<td>42</td>
<td>0.356</td>
<td>22</td>
<td>0.322</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.059)</td>
<td></td>
<td>(0.050)</td>
</tr>
<tr>
<td>ALL</td>
<td>101</td>
<td>0.310</td>
<td>59</td>
<td>0.247</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.071)</td>
<td></td>
<td>(0.103)</td>
</tr>
</tbody>
</table>
Table 5: Analysis of Counteroffers by Landowners
This table presents the number (N), average (Mean), and standard deviation (in paratheses) of counteroffers made by landowners. The table also provides the average absolute errors of counteroffers from equilibrium strategies of rational value-maximizing equilibrium, sunk-cost equilibrium, and even-split equilibrium. The standard deviations of absolute errors are in paratheses. It also presents the percent of counteroffers that are weakly disadvantageous (Disadv. Offers), that is, counteroffers that are less than or equal to three times the initial offers.

<table>
<thead>
<tr>
<th>N</th>
<th>Counter Offer</th>
<th>AbsErr</th>
<th>Disadv. Offers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rational</td>
<td>Sunk-cost</td>
<td>Even-split</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>1 landowner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>9</td>
<td>0.759</td>
<td>0.241</td>
</tr>
<tr>
<td></td>
<td>(0.145)</td>
<td>(0.145)</td>
<td>(0.145)</td>
</tr>
<tr>
<td>ALL</td>
<td>9</td>
<td>0.759</td>
<td>0.241</td>
</tr>
<tr>
<td></td>
<td>(0.145)</td>
<td>(0.145)</td>
<td>(0.145)</td>
</tr>
<tr>
<td>2 landowners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>7</td>
<td>0.354</td>
<td>0.312</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.042)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>N2</td>
<td>7</td>
<td>0.677</td>
<td>0.323</td>
</tr>
<tr>
<td></td>
<td>(0.221)</td>
<td>(0.221)</td>
<td>(0.221)</td>
</tr>
<tr>
<td>ALL</td>
<td>14</td>
<td>0.516</td>
<td>0.318</td>
</tr>
<tr>
<td></td>
<td>(0.227)</td>
<td>(0.153)</td>
<td>(0.124)</td>
</tr>
</tbody>
</table>

Table 6: Acceptance Decision of the Developer
This table presents the number (N), average (Mean), and standard deviation (in paratheses) of counteroffers that are accepted and rejected. The table also presents the percent of acceptable counteroffers (NA) based on two equilibria, rational equilibrium and sunk-cost equilibrium. In addition, it provides the percent of acceptable offers based on the equilibrium that are accepted (PA), and percent of rejectable offers based on the equilibrium that are rejected (PR).

<table>
<thead>
<tr>
<th>Accepted</th>
<th>Rejected</th>
<th>Rational</th>
<th>Even-split</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>N</td>
</tr>
<tr>
<td>1 landowner</td>
<td></td>
<td></td>
<td>0.683</td>
</tr>
<tr>
<td>N1</td>
<td>3</td>
<td>0.683</td>
<td>0.797</td>
</tr>
<tr>
<td>ALL</td>
<td>3</td>
<td>0.683</td>
<td>0.797</td>
</tr>
<tr>
<td>2 landowners</td>
<td></td>
<td></td>
<td>0.536</td>
</tr>
<tr>
<td>N1</td>
<td>5</td>
<td>0.336</td>
<td>0.400</td>
</tr>
<tr>
<td>N2</td>
<td>4</td>
<td>0.513</td>
<td>0.897</td>
</tr>
<tr>
<td>ALL</td>
<td>9</td>
<td>0.414</td>
<td>0.698</td>
</tr>
</tbody>
</table>
C.2 Likelihood

We attempt to use maximum likelihood method to estimate the fraction of the rational players. At each stage of making offers and accepting/rejecting offers, we model the probability of offers and accepting/rejecting decision using a mixture of two probability distributions.

In particular, for any particular offer $o_d$ from the developer, the probability is specified as

$$
\text{Prob}(o_d) = \alpha \phi\left( \frac{o_d - 1}{\sigma} \right) + (1 - \alpha) \phi\left( \frac{o_d - 1}{\sigma} \right)
$$

where $\alpha$ is the fraction of the even-split players and $1 - \alpha$ is the fraction of rational players. $\phi(.)$ is the standard normal density function. From each type of players, we put the center of the normal distribution on the offer point where this type of players would play. That is, $o_e$ is the offer that an even-split developer would make, $1/(n+1)$ where $n$ is the number of landowners. $o_{dr}$ is the offer that a rational player would make, as specified by the discussion in the rational Nash solution of the game. $\sigma$ is the standard deviation of the normal distribution which we use to capture the variation.

For landowners, the probability of accepting an offer $o_d$ from the developer is specified as

$$
\text{Prob}(\text{Accept}|o_d) = \alpha \Phi\left( \frac{o_d - 1}{\sigma} \right) + (1 - \alpha) \Phi\left( \frac{o_d - 1}{\sigma} \right)
$$

where $\alpha$, $\sigma$, $o_{de}$ and $o_{dr}$ are defined the same. $\Phi(.)$ is the cumulative density function of the standard normal distribution.

When there is a round of counteroffer by the landowner, the probability of the landowner making an offer of $o_l$ is specified as

$$
\text{Prob}(o_l) = \alpha \phi\left( \frac{o_l - 1}{\sigma} \right) + (1 - \alpha) \phi\left( \frac{o_l - 1}{\sigma} \right)
$$

where $o_e$ is the offer that an even-split player would make, $1/(n+1)$ where $n$ is the number of landowners. $o_{lr}$ is the counteroffer that a rational landowner would make, as specified by the discussion of the rational Nash solution to the game. The probability of the developer accepting an offer $o_l$ from the landowner is specified as

$$
\text{Prob}(\text{Accept}|o_l) = \alpha \Phi\left( 1 - \frac{o_l}{\sigma} \right) + (1 - \alpha) \Phi\left( 1 - \frac{o_l}{\sigma} \right)
$$

Note that for developer, the offer $o_l$ is more likely to be accepted if it is low, hence the part in the cumulative probability function is reversed.

In the main paper, we present maximum likelihood estimates for the full sample. Here we present results for the restricted sample, where we exclude landowner counteroffers and developer’s response to these counteroffers. We also present maximum likelihood estimates of the first half and second half of the full sample. This way, we can check if there is any significant effect of learning among the players over time. Overall, the results are quite similiar.
in both halves of the data.

Table 7: More Maximum Likelihood Estimates
This table presents the maximum likelihood estimates of landowner and developer offers and offer responses assuming the agents play random responses drawn from a mixture of offer/response distributions centered on two types of responses: rational Nash and even-split. The parameter $\alpha$ represents the estimated probability of drawing from the even-split distribution. The parameter $\sigma$ represents the variance of actions conditioned on type of response. Panel A restricts the sample by excluding landowner and developer counteroffers. Panel B presents estimates based on the first half of the full sample. Panel C presents estimates based on the second half of the full sample.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>0.739</td>
<td>0.043</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>0.275</td>
<td>0.010</td>
</tr>
<tr>
<td>Nobs</td>
<td>428</td>
<td></td>
</tr>
<tr>
<td>LogL</td>
<td>-339.7</td>
<td></td>
</tr>
</tbody>
</table>

Panel B. The First Half of the Full Sample

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>0.663</td>
<td>0.051</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>0.286</td>
<td>0.015</td>
</tr>
<tr>
<td>Nobs</td>
<td>238</td>
<td></td>
</tr>
<tr>
<td>LogL</td>
<td>-211.6</td>
<td></td>
</tr>
</tbody>
</table>

Panel C. The Second Half of the Full Sample

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>0.711</td>
<td>0.051</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>0.264</td>
<td>0.013</td>
</tr>
<tr>
<td>Nobs</td>
<td>233</td>
<td></td>
</tr>
<tr>
<td>LogL</td>
<td>-174.9</td>
<td></td>
</tr>
</tbody>
</table>
D Instructions and screen shots

This section provides the instructions for the experiment and screen shots of the information provided to subjects on their computer monitors.
D.1 Instructions for SC-P Games

1. General Instructions

You have been selected to participate in an experiment on economic decision making. The experiment consists of several rounds. At the end of each round your payoffs will be calculated. At the end of the experiment, the payoffs in each round will be added up. The sum of your round by round payoffs will determine your payoff from the experiment. Your payoff from the experiment could range from approximately $0-$50. The game may take up to 1 hour to complete. If you are still interested in participating in the game after reading the instruction sheet please sign the informed consent sheet.

2. The Game

In this experiment you can either be a developer who wants to develop a commercial property or you can be a land owner who has to sell a piece of land to the developer. Each game consists of one developer and one or two land owners. In each round you will be assigned a role of developer or landowner randomly. The value of the developed property to all agents is equal to Frank 100. However to develop this property the developer needs to purchase all plots of land. The value of each plot of land to the land owner is Fr. 0. The developer will be purchasing this land from each land owner separately one after another. To buy the land the developer will make an offer to any one landowner Fr. X. The land owner may accept or reject the offer. If he rejects the first offer from the developer then he/she can make a counteroffer to the developer which the developer may accept or reject. If the developer rejects the offer the game ends. Also, every time the land owner makes a counteroffer there is a 60% probability that the game ends. This is determined by the computer through a random number selection. If the land owner accepts the first bid of the developer, he/she sends the offer to another land owner and the same process repeats until the developer purchases the plots of land from all land owners.

Whenever a land owner accepts an offer or the developer accepts a counter offer (provided the game has not been ended by the computer) the payoff for that round to the land owner is the offer or the counteroffer. The payoff will be converted to $ by multiplying with a factor K. The developer’s payoff is

\[ \text{Developer’s Payoff} = (1 - \text{sum of all payoffs to the land owners}) \times K \]

Note: Developers payoff can be negative if he fails to buy land from all three land owners after buying land from one or two land owners. 2. Frank is a fictitious currency and will be converted to $ by using a conversion factor of K that will announced by the Instructor.
D.2 Flowchart of SC-P Game

Developer

Repeats to the other landowner

Landowner A/B
Offers: ‘X’

Accept/Reject

Landowner’s Payoff = ‘X’

Instr. Toss

1/3
2/3

Landowner
Counter Offer: ‘CX’

Developer

Game Ends
Developer’s Payoff = 0 – any payment made to L.O.

Landowner’s Payoff = ‘CX’

Accept/Reject

A
R

A
R

1/3
2/3
D.3 Offer/Counteroffer Log Sheet of SC-P Game

<table>
<thead>
<tr>
<th>Round No.</th>
<th>Offer</th>
<th>Accept or Reject by Landowner (A/R)</th>
<th>Game Ends? (Y/N)</th>
<th>Counter Offer</th>
<th>Accept or Reject by Developer (A/R)</th>
<th>Landowner No. 1</th>
<th>Sequence</th>
<th>Offer</th>
<th>Accept or Reject by Landowner (A/R)</th>
<th>Counter Offer</th>
<th>Accept or Reject by Developer (A/R)</th>
<th>Landowner No. 2</th>
<th>Sequence</th>
<th>Offer</th>
<th>Accept or Reject by Landowner (A/R)</th>
<th>Counter Offer</th>
<th>Accept or Reject by Developer (A/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
D.4 Screen Shots of SC-P Game

Screen 1: The first instruction sheet on each terminal for all participants.

Screen 2: Developer & landowners are chosen randomly and developer is given instructions on this screen.

---

1. General Instructions
   You have been selected to participate in an experiment on economic decision making. The experiment consists of several rounds. At the end of each round your payoffs will be calculated. At the end of the experiment, the payoffs in each round will be added up. The sum of your round by round payoffs will determine your payoff from the experiment. Your payoff from the experiment could range from approximately $0.60 to $9.00. If you are still interested in participating in this game after reading the instruction sheet please sign the informed consent sheet.

2. The Game
   In this experiment you can either be a developer who wants to develop a commercial property or you can be a land owner who has to sell a piece of land to the developer. Each game consists of one developer and three land owners. In each round you will be assigned a role of developer or landowner randomly. The value of the developed property to all agents is equal to Frank 100. However, to develop the property the developer needs to purchase all lots of land. The value of each lot of land to the land owner is Frank 9. The developer neither purchasing this land from each land owner separately nor after another.

   To buy the land the developer will make an offer to any one landowner. The land owner may accept or reject the offer. If he/she rejects the offer the developer then he/she can make a counteroffer to the developer which the developer may accept or reject. Every time before the land owner makes a counteroffe there is a fifty percent probability that the game ends. This is determined by the computer through a random number generation. After the round, the developer can choose to accept or reject the counteroffer. If the developer accepts the offer then the game ends. If the land owner accepts the first bid of the developer, he/she sends the offer to another land owner and the same process repeats until the developer purchases the plots of land from all land owners. Whenever a land owner accepts an offer or the developer accepts a counter offer, the game has not been ended by the computer the payoff for that round to the land owner is the offer or the counteroffer. The payoff will be converted to $ by multiplying with a factor k. (The developer's payoff is)

   If the developer gets all the three pieces of land, the Developer's Payoff = 100 - sum of all payoffs to the land owners
   If not, Developer's Payoff = - sum of all payoffs to the land owners

   Note:
   1. Developers' payoffs can be negative if he fails to buy land from all the three land owners after buying land from one or two land owners.
   2. Frank is a fictitious currency and will be converted to $ by using a conversion factor k that will be announced by the instructor.

---

Round: 1  Group: 1

You are the Developer

<table>
<thead>
<tr>
<th>Trade history:</th>
<th>You are the Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade with Landowner: N/A</td>
<td>In this round of game you are the developer.</td>
</tr>
<tr>
<td>Developer’s offer is: N/A</td>
<td>Now, choose any one of the following landowners to begin your trade.</td>
</tr>
<tr>
<td>Landowner’s decision is: N/A</td>
<td>Landowner A</td>
</tr>
<tr>
<td>The counter offer is: N/A</td>
<td>Landowner B</td>
</tr>
<tr>
<td>The developer’s decision is: N/A</td>
<td>Landowner C</td>
</tr>
<tr>
<td>Trade with Landowner: N/A</td>
<td></td>
</tr>
<tr>
<td>Developer’s offer is: N/A</td>
<td></td>
</tr>
<tr>
<td>Landowner’s decision is: N/A</td>
<td></td>
</tr>
<tr>
<td>The counter offer is N/A</td>
<td></td>
</tr>
<tr>
<td>The developer’s decision is: N/A</td>
<td></td>
</tr>
<tr>
<td>Trade with Landowner: N/A</td>
<td></td>
</tr>
<tr>
<td>Developer’s offer is: N/A</td>
<td></td>
</tr>
<tr>
<td>Landowner’s decision is: N/A</td>
<td></td>
</tr>
<tr>
<td>The counter offer is: N/A</td>
<td></td>
</tr>
<tr>
<td>The developer’s decision is: N/A</td>
<td></td>
</tr>
</tbody>
</table>

In this game the developer needs to purchase land from three landowners. The developer needs to negotiate with all the three land owners.

Step 1. The developer will first choose one landowner and attempt to purchase his/her land,

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.
1.2 If the landowner chooses to reject the offer, there will be 60% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.
1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

Step 2. The game ends.

The payoff to the Landowner is either the offer amount or the counter-offer amount.

The payoff to the Developer is the Fr. 100 - payment to Landowners. (Note: Developer can have a negative payoff if one or two landowners accept the offer and the other rejects it and the DEAL is not completed.)

Instructor will announce the conversion factor k to translate from Frank to $.
Screen 3.  Developer chooses the landowner and makes the first offer

In this game the developer needs to purchase land from three landowners. The developer needs to negotiate with all the three landowners.

Step 1. The developer will first choose one landowner and attempt to purchase his/her land.

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.

1.2 If the landowner chooses to reject the offer, there will be 80% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.

1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

Step 2. The game ends.

The payoff to the Landowner is the either the offer amount or the counter-offer amount.

The payoff to the Developer is the Fr. 100 - payment to Landowners. (Note: Developer can have a negative payoff if one or two landowner accepts the offer and the other rejects it and the DEAL is not completed.)

Instructor will announce the conversion factor k to translate from Frank to $.

Screen 4.  All landowners are instructed before developer makes the first offer

In this game the developer needs to purchase land from three landowners. The developer needs to negotiate with all the three landowners.

Step 1. The developer will first choose one landowner and attempt to purchase his/her land.

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.

1.2 If the landowner chooses to reject the offer, there will be 80% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.

1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

Step 2. The game ends.

The payoff to the Landowner is the either the offer amount or the counter-offer amount.

The payoff to the Developer is the Fr. 100 - payment to Landowners. (Note: Developer can have a negative payoff if one or two landowner accepts the offer and the other rejects it and the DEAL is not completed.)

Instructor will announce the conversion factor k to translate from Frank to $.
Once the developer chooses one landowner and makes an offer, the landowner chooses to accept or reject the offer.

In this game, the developer needs to purchase land from three landowners. The developer needs to negotiate with all three landowners.

**Step 1.** The developer will first choose one landowner and attempt to purchase his/her land.

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.

1.2 If the landowner chooses to reject the offer, there will be 66% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.

1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

**Step 2.** The game ends.

The payoff to the landowner is the offer amount or the counter-offer amount. The payoff to the Developer is the Fr. 100 - payment to Landowners. (Note: Developer can have a negative payoff if one or two landowner accepts the offer and the other rejects it and the DEAL is not completed.)

Instructor will announce the conversion factor $k$ to translate from Frank to $.

Developer is informed when the landowner accepted or rejected the offer.
Screen 7: If the first offer is accepted, developer chooses second landowner (if there is any to choose from or the game stops) and makes an offer.

In this game the developer needs to purchase land from three land owners. The developer needs to negotiate with all the three land owners.

Step 1. The developer will first choose one landowner and attempt to purchase his/her land,

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.

1.2 If the landowner chooses to reject the offer, there will be 66% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.

1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

Step 2. The game ends.

The payoff to the landowner is the either the offer amount or the counter-offer amount.

The payoff to the developer is the Fr. 100 - payment to Landowners. (Note: Developer can have a negative payoff if one or two landowner accepts the offer and the other rejects it and the deal is not completed.)

Instructor will announce the conversion factor k to translate from Frank to $.

Screen 8. Landowner chooses to accept or reject the offer from developer

In this game the developer needs to purchase land from three land owners. The developer needs to negotiate with all the three land owners.

Step 1. The developer will first choose one landowner and attempt to purchase his/her land,

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.

1.2 If the landowner chooses to reject the offer, there will be 66% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.

1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

Step 2. The game ends.

The payoff to the landowner is the either the offer amount or the counter-offer amount.

The payoff to the developer is the Fr. 100 - payment to Landowners. (Note: Developer can have a negative payoff if one or two landowner accepts the offer and the other rejects it and the deal is not completed.)

Instructor will announce the conversion factor k to translate from Frank to $.
Screen 9. If the landowner chooses to reject the offer, the landowner has 33.3% probability to make a counteroffer and 66.7% probability that the game ends.

<table>
<thead>
<tr>
<th>Round: 1 Group: 1</th>
<th>You are the Landowner C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trade history:</strong></td>
<td></td>
</tr>
<tr>
<td>Trade with Landowner: A</td>
<td>Developer's offer is: 33</td>
</tr>
<tr>
<td>Landowner's decision is: Accept</td>
<td>The counter offer is N/A</td>
</tr>
<tr>
<td>The developer's decision is: N/A</td>
<td></td>
</tr>
<tr>
<td>Trade with Landowner: C</td>
<td>Developer's offer is: 20</td>
</tr>
<tr>
<td>Landowner's decision is: Reject</td>
<td>The counter offer is N/A</td>
</tr>
<tr>
<td>The developer's decision is: N/A</td>
<td></td>
</tr>
<tr>
<td>Trade with Landowner: N/A</td>
<td>Developer's offer is: N/A</td>
</tr>
<tr>
<td>Landowner's decision is: N/A</td>
<td>The counter offer is N/A</td>
</tr>
<tr>
<td>The developer's decision is: N/A</td>
<td></td>
</tr>
</tbody>
</table>

In this game the developer needs to purchase land from three landowners. The developer needs to negotiate with all the three landowners.

**Step 1.** The developer will first choose one landowner and attempt to purchase his/her land.

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.

1.2 If the landowner chooses to reject the offer, there will be 66% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.

1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

**Step 2. The game ends.**

The payoff to the Landowner is the either the offer amount or the counter-offer amount. The payoff to the Developer is the Fr. 100 - payment to Landowners. (Note: Developer can have a negative payoff if one or two landowner accepts the offer and the other rejects it and the DEAL is not completed.)

Instructor will announce the conversion factor k to translate from Frank to $.

Screen 10: If the game does not end and landowner is able to make a counteroffer, the developer needs to accept or reject the counteroffer.

<table>
<thead>
<tr>
<th>Round: 1 Group: 1</th>
<th>You are the Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trade history:</strong></td>
<td></td>
</tr>
<tr>
<td>Trade with Landowner: A</td>
<td>Developer's offer is: 33</td>
</tr>
<tr>
<td>Landowner's decision is: Accept</td>
<td>The counter offer is N/A</td>
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<td>The developer's decision is: N/A</td>
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<tr>
<td>Trade with Landowner: C</td>
<td>Developer's offer is: 20</td>
</tr>
<tr>
<td>Landowner's decision is: Reject</td>
<td>The counter offer is N/A</td>
</tr>
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<td>The developer's decision is: N/A</td>
<td></td>
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<tr>
<td>Trade with Landowner: N/A</td>
<td>Developer's offer is: N/A</td>
</tr>
<tr>
<td>Landowner's decision is: N/A</td>
<td>The counter offer is N/A</td>
</tr>
<tr>
<td>The developer's decision is: N/A</td>
<td></td>
</tr>
</tbody>
</table>

In this game the developer needs to purchase land from three landowners. The developer needs to negotiate with all the three landowners.

**Step 1.** The developer will first choose one landowner and attempt to purchase his/her land.

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.

1.2 If the landowner chooses to reject the offer, there will be 66% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.

1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

**Step 2. The game ends.**

The payoff to the Landowner is the either the offer amount or the counter-offer amount. The payoff to the Developer is the Fr. 100 - payment to Landowners. (Note: Developer can have a negative payoff if one or two landowner accepts the offer and the other rejects it and the DEAL is not completed.)

Instructor will announce the conversion factor k to translate from Frank to $.
Screen 11. If developer accepts the counteroffer and all landowners are offered, the game is completed. Whenever game ends, the results are shown to all participants.

<table>
<thead>
<tr>
<th>Round: 1</th>
<th>Group: 1</th>
<th>You are the Landowner C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trade History:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade with Landowner: A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developer’s offer is: 33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landowner’s decision is: Accept</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The counter offer is: N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The developer’s decision is: N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade with Landowner: C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developer’s offer is: 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landowner’s decision is: Reject</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The counter offer is: 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The developer’s decision is: Accept</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade with Landowner: B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developer’s offer is: 33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landowner’s decision is: Accept</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The counter offer is: N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The developer’s decision is: N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Summary:**
- Developer receives: 4
- Landowner A receives: 33
- Landowner B receives: 77
- Landowner C receives: 50

In this game the developer needs to purchase land from three landowners. The developer needs to negotiate with all the three land owners.

**Step 1.** The developer will first choose one landowner and attempt to purchase his/her land.

1.1 If the landowner accepts the offer from the developer, a deal is complete. Go to Step 2.

1.2 If the landowner chooses to reject the offer, there will be 69% chance that the game will end. If the game continues, the landowner can choose to make a counter-offer to the developer.

1.3 If the game continues, and the developer accepts the counter-offer from the landowner, the deal is complete. Go to Step 2. If counter-offer is rejected, the game ends.

**Step 2.** The game ends.

The payoff to the Landowner is the either the offer amount or the counter-offer amount. The payoff to the Developer is the Fr. 100 / payment to Landowners. (Note: Developer can have a negative payoff if one or two landowner accepts the offer and the other rejects it and the DEAL is not completed.)

Instructor will announce the conversion factor k to translate from Frank to $.
D.5 Instruction of TC-O Game

1. General Instructions

You have been selected to participate in an experiment on economic decision making. The experiment consists of several rounds. At the end of each round your payoffs will be calculated. At the end of the experiment, the payoffs in each round will be added up. The sum of your round by round payoffs will determine your payoff from the experiment. Your payoff from the experiment could range from approximately $0-$50. The game may take up to 1 hour to complete. If you are still interested in participating in the game after reading the instruction sheet please sign the informed consent sheet.

1. The Game

In this experiment you can either be a developer who wants to develop a commercial property or you can be a landowner who has to sell a plot of land to the developer. Each game consists of one developer and two or three landowners. In each round, you will be assigned a role of developer or landowner randomly. The value of the developed property to the developer is equal to Frank (Fr.) 100. However to develop this property the developer needs to purchase all plots of land. The value of each plot of land to each landowner is Fr. 0. The landowner and developers will make offers. Offers specify an amount that the developer will pay a landowner in exchange for a landholder's land. Once an offer is accepted for a particular plot the contract received by the landowner who owns the plot is fixed and landowner takes no further action for the rest of the game. Offers are conditional, that is an accepted offers will only result in a payment from the developer if the developer is successful in fixing contracts for all plots of land. If the developer in not successful in fixing contracts for all plots, then the payoff to the developer and the payoffs to the landholders equal 0 Fr. If contracts are fixed with all three landowners, then the developer's payoff is 100 Fr less the contracted payments to the landowners and a landowner's payoff equal his/her contracted payment from the developer.

There are two offer phases---the initial phase and the final phase. In the initial phase, the developer makes simultaneous offers to all three landowner specifying how much the developer is willing to offer for each of their plots. The developer can, if he/she so chooses, make different offers for different plots. The contracts of landowners (if any) who accept the developer's offer are fixed. If any landowner(s) reject the developer's offer, these landowners,
who we will call **remaining landowners**, and the developer then have an opportunity to continue negotiations in the **final phase**.

In the final phase, the developer approaches remaining *individually*, making offers to them *one at a time*. If a landowner accepts the developer's offer in this final phase, the accepting landowners contract is fixed. If the landowner rejects a developer’s offer in the final phase, there is a 66.6% probability that the game ends. This is determined by the computer through a random number draw. If the game ends, all landowners and the developer receive a payoff of 0. If the game does not end, the landowner approached by the developer can make a counter offer. If the developer rejects the offer the game ends. If the game ends, all landowners and the developer receive a payoff of 0. If the developer accepts the landowner's offer in the final phase, the accepting landowners contract is fixed and, if there are any other remaining landowners, the developer chooses one of them and makes an offer. The same process repeats, i.e., the developer selects a landowner and makes an offer. If the selected landowner accepts, that landowner's contract is fixed. If the selected landowner rejects there is a 66% the game ends, if not, the selected landowner can make a counter offer which, if rejected by the developer, ends the game and, if accepted by the developer, fixes the landowner's contract.

Since there are only two or three landowners, the game will eventually end. If it ends with contracts fixed for all three landowners, the developer's payoff is 100 Fr. less the payments contracted to the landowners. Each landowner's payoff is his/her contracted payment from the developer. If the game ends without contracts fixed for all three landowners, the developer payoff and the payoff to all three landowners equals 0. To make the structure of the game more transparent, the following examples are provided. These are not intended to represent “smart” strategies for the developer and landowner. Rather they are intended to illustrate the mechanics of the game. In the examples, there are three landowners.

**Example 1**

**Initial phase:** The developer makes the same offer, 10 Fr, for to each landowner for his/her plot. Landowner 1 accepts and landowners 2 and 3 reject. Landowner 1's contract is fixed at 10 Fr. There are two remaining landowners, landowner 2 and landowner 3.

**Final phase:** In this case, since there are two remaining landowners, landowner 2 and landowner 3, the developer decides which one to approach. Suppose that the developer decides to approach landowner 3, offering 5 Fr.
Example 2:

**Initial phase:** The developer offers 5 Fr. to landowner 1, 10 Fr. to landowner 2 and 15 Fr. to landowner 3. Landowners 2 and 3 accept the developer's offer and landholder 1 rejects the offer. Landowners' 2 and 3 contracts are fixed and Landowner 1 is the remaining landowner.

**Final phase:** Since there is only one remaining landowner, landowner 1. The developer approaches landowner 1 and offers 10 Fr. Landowner 1 rejects the developer's offer. The computer draws a random number less than 0.66. So the game ends. All of the players receive a payoff of 0.

Example 3

**Initial Phase:** The developer offers each of the three landowners 30 Fr. for their plots. All three landowner accept.

**Final Phase:** Since all three landowners accepted the developer's offer in the initial phase, there is no final phase. The developer receives a payoff equal to the value of the land, 100 Fr., less the three contracted payments of 30 Fr. So the developers payoff equals 100 – 3x30 = 10 Fr. Each landowner's payoff equals 30 Fr.

**Note:** Frank is a fictitious currency and will be converted to $ by using a conversion factor of K that will announced by the Instructor.
D.6 Flowchart of TC-O Game

Developer first offers to all LO. If accepted by all LO then game ends. If rejected by any LO, Developer offers to them sequentially.

Repeats to the other landowner

Landowner
A/B

Accept
/ Reject
A
R

Instr. Toss
1/3
2/3

Landowner
Counter Offer: ‘CX’

Landowner’s Payoff = ‘X’

Game Ends
Developer’s Payoff = 0 – any payment made to L.O.

Landowner

Accept
/ Reject
A
R

Landowner’s Payoff = ‘CX’

Developer