

# Classical Competition and Equilibrium: An Agent-Based Analysis - Accompanying simulations

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```
In[*]:= [REDACTED]
Out[*]:= [REDACTED]
```

## Model Setup

### Time

Defining length of time for the simulation.

```
In[*]:= T = 5;
```

### Land and Production

Number of lands,  $\mathcal{L} = \{1, \dots, n\}$ , used in simulations.

```
In[*]:= lands = 10;
```

Each piece of land is characterized by a production function with labor as the sole input,  $Y_i = f_i(L_i)$ . For the current simulation,  $Y_i = \alpha_i L_i^\beta$ .

```
In[*]:= prodFn[alpha_, L_, beta_] := alpha L^beta
```

Initial values of  $\alpha_i$  and  $\beta$ .

```
In[ ]:= alphas = Table[50 + i / 2., {i, 1, lands}]
```

```
Out[ ]:= {50.5, 51., 51.5, 52., 52.5, 53., 53.5, 54., 54.5, 55.}
```

```
In[ ]:=  $\beta = 0.9;$ 
```

## Coalitions

```
In[ ]:= cHeader = {" $\rho_{t,i}^c$ ", " $C_{t,i}'$ ", " $\Omega_{t,i}^{c'}$ ", " $L_{t,i}$ ",
  " $Y_{t,i}$ ", " $\Omega_{t,i}^c$ ", " $r_{t,i}^c$ ", " $\tilde{\rho}_{t,i}^c$ ", " $L_{t,i}^*$ ", " $C_{t,i}$ ", " $C_{t,i}''$ ", " $\Omega_{t,i}''$ "};
```

```
In[ ]:= coalitions = Table[Table[
  {0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0}, {lands}], {T}];
```

## Capitalists

Setting number of capitalists.

```
In[ ]:= numCap = 100;
```

Defining set of capitalists endowed with wage-funds  $\Omega_t^c$  and a memory of the realized profit rate  $r_t^c$ , advertized rents  $\rho_i$ , possible profit rates, and realized rent paid.

```
In[ ]:= header = {" $\Omega_t^c$ ", " $r_t^c$ ", " $\rho_i$ ", " $r_{t,i}^c$ ", " $\rho_{t,i}^c$ ",
  " $L_{t,i}$ ", " $Y_{t,i}$ ", " $C_{t,i}$ ", " $\rho_i^c$ ", " $r_{t,i}^{c'}$ ", " $C_{t,i}''$ ", " $\tilde{r}_t$ ", " $\tilde{\rho}_t$ ", " $\tilde{C}_t$ "};
```

```
In[ ]:= Length[header]
```

```
Out[ ]:= 14
```

```
In[ ]:= capitalists = Table[Table[{0.0, 0.0, 0.0, 0.0, 0.0,
  0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0}, {numCap}], {T}];
```

Setting initial wage-funds for capitalists.

```

In[ ]:= Omega = 10 000;

dist = { $\Omega_1 \rightarrow 625.6815459244169`$ ,  $\Omega_2 \rightarrow 690.4644544319946`$ ,
         $\Omega_3 \rightarrow 761.2229182066735`$ ,  $\Omega_4 \rightarrow 838.4419533410318`$ ,  $\Omega_5 \rightarrow 922.6406793641686`$ ,
         $\Omega_6 \rightarrow 1014.3743543711822`$ ,  $\Omega_7 \rightarrow 1114.2365103705224`$ ,  $\Omega_8 \rightarrow 1222.8611927591608`$ ,
         $\Omega_9 \rightarrow 1340.9253079488242`$ ,  $\Omega_{10} \rightarrow 1469.1510832820288`$ };

fundShares = Normalize[Sort[RandomVariate[
    TruncatedDistribution[{dist[[1, 2]], 0.4 Omega}, EstimatedDistribution[
    dist[[All, 2]], ParetoDistribution[k,  $\alpha$ ]], numCap]], Total];

initialWageFunds = Omega fundShares

```

```

Out[ ]:=
{62.1598, 62.4752, 62.7551, 63.032, 63.342, 63.5534, 63.6476, 63.9643, 64.3853,
 64.7703, 65.1098, 65.1463, 66.3219, 66.4354, 67.4223, 67.5988, 67.8766,
 68.0884, 68.1592, 68.8025, 69.5923, 70.0362, 70.0407, 70.124, 70.9126, 70.9422,
 71.2716, 73.0239, 73.3024, 73.6682, 74.8155, 74.9836, 75.2397, 75.5331,
 75.8887, 76.2151, 76.2652, 76.3716, 76.5991, 76.7475, 76.8775, 77.0747,
 77.1005, 78.1301, 78.4219, 79.4401, 79.5714, 79.9436, 80.7444, 81.0932,
 81.6501, 82.5101, 83.5154, 84.3077, 85.5641, 85.7529, 85.8381, 86.1362,
 87.4571, 89.0958, 89.7341, 90.9702, 91.8361, 91.9041, 91.9108, 93.4947,
 94.2308, 95.8128, 96.5926, 98.7661, 101.42, 101.849, 102.152, 102.255, 102.526,
 103.776, 103.948, 110.573, 110.832, 111.084, 113.325, 116.701, 117.487,
 130.919, 142.085, 145.86, 150.895, 160.771, 171.025, 175.126, 177.093, 178.309,
 187.203, 190.372, 207.764, 212.93, 229.354, 231.288, 267.714, 291.272}

```

```

In[ ]:= Total[initialWageFunds]

```

```

Out[ ]:=
10 000.

```

```

In[ ]:= capitalists[[1, All, 1]] = initialWageFunds;

```

```

In[ ]:= Min[capitalists[[1, All, 1]]]

```

```

Out[ ]:=
62.1598

```

```

In[ ]:= Max[capitalists[[1, All, 1]]]

```

```

Out[ ]:=
291.272

```

Capitalists maximize profit rate subject to their wage-fund constraint.

```
In[ ]:= maxR[α_, β_, ρ_, ω_, Ω_] := (
  Clear[x];
  x = Maximize[{ $\frac{\alpha L^\beta - \rho - \omega L}{\omega L}$ , 0. ≤ L ≤  $\frac{\Omega}{\omega}$ }, L];
  If[x[[1]] ∈ Reals && (Quiet[NumberQ[x[[1]]]] == True) && (L /. x[[2]]) > 0.,
    x, x = {0., {L → 0.}}]
)
```

Unconstrained maximum profit rates.

```
In[ ]:= maxRm[α_, β_, ρ_, ω_, Ω_] := (
  Clear[x];
  x = Maximize[{ $\frac{\alpha L^\beta - \rho - \omega L}{\omega L}$ , L ≥ 0.}, L];
  If[x[[1]] ∈ Reals && (Quiet[NumberQ[x[[1]]]] == True) && (L /. x[[2]]) > 0.,
    x, x = {0., {L → 0.}}]
)
```

```
In[ ]:= maxR[alphas[[10]], β, 4, 1, capitalists[[1, 1, 1]]]
Out[ ]:= {50.2829, {L → 0.701989}}
```

```
In[ ]:= maxRm[alphas[[10]], β, 4, 1, capitalists[[1, 1, 1]]]
Out[ ]:= {50.2829, {L → 0.701989}}
```

## Workers

Workers are essentially passive and inelastically supply labor at the prevailing real wage  $\omega$ .

```
In[ ]:= laborSupply = 500;
```

```
In[ ]:= (* wage=N[Total[initialWageFunds]/laborSupply] *)
```

```
In[ ]:= Clear[wage];
wage = N[Total[initialWageFunds] / laborSupply]
(* wage=1; *)
```

```
Out[ ]:= 20.
```

## Rents

During each period  $t$  land-owners announce rents  $\rho_i$  at which they are willing to supply land.

```
In[*]:= rents = Table[Table[0.0, {lands}], {T}];
```

## Equilibrium

### Finding equilibrium labor allocation

Setting up Lagrange function to find optimal  $L_i$ .

```
In[*]:= ls = Table[L_i, {i, 1, lands}]
```

```
Out[*]=
{L_1, L_2, L_3, L_4, L_5, L_6, L_7, L_8, L_9, L_10}
```

```
In[*]:= obj = Table[alphas[[i]] L_i^beta, {i, 1, lands}]
```

```
Out[*]=
{50.5 L_1^0.9, 51. L_2^0.9, 51.5 L_3^0.9, 52. L_4^0.9,
52.5 L_5^0.9, 53. L_6^0.9, 53.5 L_7^0.9, 54. L_8^0.9, 54.5 L_9^0.9, 55. L_10^0.9}
```

```
In[*]:= cons = Sum[L_i, {i, 1, lands}] - laborSupply
```

```
Out[*]=
-500 + L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7 + L_8 + L_9 + L_10
```

```
In[*]:= -Total[obj]
```

```
Out[*]=
-50.5 L_1^0.9 - 51. L_2^0.9 - 51.5 L_3^0.9 - 52. L_4^0.9 -
52.5 L_5^0.9 - 53. L_6^0.9 - 53.5 L_7^0.9 - 54. L_8^0.9 - 54.5 L_9^0.9 - 55. L_10^0.9
```

```
In[*]:= L = -Total[obj] + lambda cons
```

```
Out[*]=
-50.5 L_1^0.9 - 51. L_2^0.9 - 51.5 L_3^0.9 - 52. L_4^0.9 - 52.5 L_5^0.9 - 53. L_6^0.9 - 53.5 L_7^0.9 -
54. L_8^0.9 - 54.5 L_9^0.9 - 55. L_10^0.9 + lambda (-500 + L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7 + L_8 + L_9 + L_10)
```

```
In[*]:= Table[D[L, L_i] == 0, {i, 1, lands}]
```

```
Out[*]=
{lambda - 45.45 / L_1^0.1 == 0, lambda - 45.9 / L_2^0.1 == 0, lambda - 46.35 / L_3^0.1 == 0, lambda - 46.8 / L_4^0.1 == 0, lambda - 47.25 / L_5^0.1 == 0,
lambda - 47.7 / L_6^0.1 == 0, lambda - 48.15 / L_7^0.1 == 0, lambda - 48.6 / L_8^0.1 == 0, lambda - 49.05 / L_9^0.1 == 0, lambda - 49.5 / L_10^0.1 == 0}
```

```
In[*]:= D[L, lambda] == 0
```

```
Out[*]=
-500 + L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7 + L_8 + L_9 + L_10 == 0
```

```
In[*]:= EQs = Append[Table[D[L, Li] == 0, {i, 1, lands}], D[L, λ] == 0]
Out[*]=
```

$$\left\{ \lambda - \frac{45.45}{L_1^{0.1}} = 0, \lambda - \frac{45.9}{L_2^{0.1}} = 0, \lambda - \frac{46.35}{L_3^{0.1}} = 0, \lambda - \frac{46.8}{L_4^{0.1}} = 0, \right.$$

$$\lambda - \frac{47.25}{L_5^{0.1}} = 0, \lambda - \frac{47.7}{L_6^{0.1}} = 0, \lambda - \frac{48.15}{L_7^{0.1}} = 0, \lambda - \frac{48.6}{L_8^{0.1}} = 0, \lambda - \frac{49.05}{L_9^{0.1}} = 0,$$

$$\left. \lambda - \frac{49.5}{L_{10}^{0.1}} = 0, -500 + L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7 + L_8 + L_9 + L_{10} = 0 \right\}$$

```
In[*]:= sols = Append[ls, λ]
Out[*]=
```

$$\{L_1, L_2, L_3, L_4, L_5, L_6, L_7, L_8, L_9, L_{10}, \lambda\}$$

Equilibrium solution:

```
In[*]:= lSols = Solve[EQs, sols][[1]]
Out[*]=
```

$$\{L_1 \rightarrow 31.2841, L_2 \rightarrow 34.5232, L_3 \rightarrow 38.0611, L_4 \rightarrow 41.9221, L_5 \rightarrow 46.132, L_6 \rightarrow 50.7187,$$

$$L_7 \rightarrow 55.7118, L_8 \rightarrow 61.1431, L_9 \rightarrow 67.0463, L_{10} \rightarrow 73.4576, \lambda \rightarrow 32.2108\}$$

```
In[*]:= Total[lSols[[1 ;; lands, 2]]]
Out[*]=
```

500.

## Equilibrium capital allocation

```
In[*]:= capAlloc = Flatten[Table[Solve[wage ==  $\frac{\Omega_i}{L_i}$ , Ωi], {i, 1, lands}]] /. lSols
Out[*]=
```

$$\{\Omega_1 \rightarrow 625.682, \Omega_2 \rightarrow 690.464, \Omega_3 \rightarrow 761.223, \Omega_4 \rightarrow 838.442, \Omega_5 \rightarrow 922.641,$$

$$\Omega_6 \rightarrow 1014.37, \Omega_7 \rightarrow 1114.24, \Omega_8 \rightarrow 1222.86, \Omega_9 \rightarrow 1340.93, \Omega_{10} \rightarrow 1469.15\}$$

```
In[*]:= Total[capAlloc[[All, 2]]]
Out[*]=
```

10 000.

## Checking profit rate

```
In[*]:= Table[ $\frac{D[\text{alphas}[[i]] L_i^\beta, L_i] L_i - \text{wage } L_i}{\text{wage } L_i} = r, \{i, 1, lands\}] /. lSols
Out[*]=$ 
```

$$\{0.61054 = r, 0.61054 = r, 0.61054 = r, 0.61054 = r, 0.61054 = r,$$

$$0.61054 = r, 0.61054 = r, 0.61054 = r, 0.61054 = r, 0.61054 = r\}$$

In[\*]:= rEQ =

$$\text{Solve}\left[\left(\text{Table}\left[\frac{D[\text{alphas}[[i]] L_i^\beta, L_i] L_i - \text{wage } L_i}{\text{wage } L_i} == r, \{i, 1, \text{lands}\}\right] /. \text{lsols}\right)[[1]], r][[1]]$$

Out[\*]=

{r → 0.61054}

## Rents at equilibrium profit rate

In[\*]:= profs = Table[r ==  $\frac{\text{alphas}[[i]] L_i^\beta - \rho_i - \text{wage } L_i}{\text{wage } L_i}$ , {i, 1, lands}]

Out[\*]=

$$\left\{ \begin{array}{l} r == \frac{0.05 (50.5 L_1^{0.9} - 20. L_1 - \rho_1)}{L_1}, r == \frac{0.05 (51. L_2^{0.9} - 20. L_2 - \rho_2)}{L_2}, \\ r == \frac{0.05 (51.5 L_3^{0.9} - 20. L_3 - \rho_3)}{L_3}, r == \frac{0.05 (52. L_4^{0.9} - 20. L_4 - \rho_4)}{L_4}, \\ r == \frac{0.05 (52.5 L_5^{0.9} - 20. L_5 - \rho_5)}{L_5}, r == \frac{0.05 (53. L_6^{0.9} - 20. L_6 - \rho_6)}{L_6}, \\ r == \frac{0.05 (53.5 L_7^{0.9} - 20. L_7 - \rho_7)}{L_7}, r == \frac{0.05 (54. L_8^{0.9} - 20. L_8 - \rho_8)}{L_8}, \\ r == \frac{0.05 (54.5 L_9^{0.9} - 20. L_9 - \rho_9)}{L_9}, r == \frac{0.05 (55. L_{10}^{0.9} - 20. L_{10} - \rho_{10})}{L_{10}} \end{array} \right\}$$

In[\*]:= profs /. lsols

Out[\*]=

{r == 0.00159826 (493.969 -  $\rho_1$ ), r == 0.0014483 (545.114 -  $\rho_2$ ),  
r == 0.00131368 (600.977 -  $\rho_3$ ), r == 0.00119269 (661.941 -  $\rho_4$ ),  
r == 0.00108385 (728.415 -  $\rho_5$ ), r == 0.000985829 (800.837 -  $\rho_6$ ),  
r == 0.000897476 (879.678 -  $\rho_7$ ), r == 0.000817754 (965.436 -  $\rho_8$ ),  
r == 0.000745754 (1058.65 -  $\rho_9$ ), r == 0.000680665 (1159.88 -  $\rho_{10}$ )}

In[\*]:= rhos = Table[ $\rho_i$ , {i, 1, lands}]

Out[\*]=

{ $\rho_1$ ,  $\rho_2$ ,  $\rho_3$ ,  $\rho_4$ ,  $\rho_5$ ,  $\rho_6$ ,  $\rho_7$ ,  $\rho_8$ ,  $\rho_9$ ,  $\rho_{10}$ }

In[\*]:= rhoSols = Solve[profs /. lsols /. rEQ, rhos][[1]]

Out[\*]=

{ $\rho_1$  → 111.965,  $\rho_2$  → 123.558,  $\rho_3$  → 136.22,  $\rho_4$  → 150.038,  $\rho_5$  → 165.106,  
 $\rho_6$  → 181.521,  $\rho_7$  → 199.391,  $\rho_8$  → 218.83,  $\rho_9$  → 239.957,  $\rho_{10}$  → 262.903}

Checking rents:

```
In[*]:= Table[alphas[[i]] L_i^beta - D[alphas[[i]] L_i^beta, L_i] L_i, {i, 1, lands}] /. lSols
Out[*]:=
{111.965, 123.558, 136.22, 150.038,
 165.106, 181.521, 199.391, 218.83, 239.957, 262.903}
```

Checking profit rates:

```
In[*]:= profs /. lSols /. rhoSols
Out[*]:=
{r == 0.61054, r == 0.61054, r == 0.61054, r == 0.61054, r == 0.61054,
 r == 0.61054, r == 0.61054, r == 0.61054, r == 0.61054, r == 0.61054}
```

## Land Auction

### Announcing Rents

Announcing rents.

```
In[*]:= rentsAnnounce[t_] := rents[[t]] =
  Table[RandomReal[{(1 - 0.1) rhoSols[[i, 2]], 1.1 rhoSols[[i, 2]]}], {i, 1, lands}]
Out[*]:=
{111.77, 120.913, 134.846, 151.462,
 172.165, 198.401, 189.826, 221.421, 223.055, 278.002}
```

Number of announcements per land-owner to go out to capitalists.

```
In[*]:= announcements = 10;
```

Determine number of samples from set of capitalists to communicate rents to.

```
In[*]:= rents[[1]]
Out[*]:=
{111.77, 120.913, 134.846, 151.462,
 172.165, 198.401, 189.826, 221.421, 223.055, 278.002}
```

Assigning advertized rents to capitalists.

```

In[*]:= communicateRents[t_] := (

  announceGroups = Table[RandomSample[Range[100], announcements], {lands}];

  For[j = 1, j ≤ lands, j++,
    For[i = 1, i ≤ Length[announceGroups[[j]], i++,
      capitalists[[t, announceGroups[[j, i], 3]] =
        Flatten[Append[{capitalists[[t, announceGroups[[j, i], 3]]}, rents[[t, j]]]
      ]
    ]];

  For[i = 1, i ≤ numCap, i++,
    If[Length[capitalists[[t, i, 3]]] > 0,
      capitalists[[t, i, 3]] = DeleteCases[capitalists[[t, i, 3]], 0.],
    ]
  ];

  For[i = 1, i ≤ numCap, i++,
    If[Length[capitalists[[t, i, 3]]] == 1,
      capitalists[[t, i, 3]] = capitalists[[t, i, 3]][[1],
    ]
  ]

)

```

```

In[*]:= communicateRents[1]

```

Form possible coalitions after rents are advertized.







160.771	0.	198.401	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
171.025	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
175.126	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
177.093	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
178.309	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
187.203	0.	134.846	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
190.372	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		111.77											
207.764	0.	172.165	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		221.421											
212.93	0.	151.462	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
229.354	0.	198.401	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
231.288	0.	278.002	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
267.714	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
291.272	0.	111.77	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

## Land selection

Calculating all potential profit rates given advertized rents.

```
In[*]:= potentialProfitRates[t_] := (
  For[i = 1, i ≤ numCap, i++,
    capitalists[[t, i, 4]] =
      If[Length[capitalists[[t, i, 3]]] < 1. && capitalists[[t, i, 3]] == 0., 0.,
        If[Length[capitalists[[t, i, 3]]] > 1.,
          Table[maxRm[
            alphas[[Table[Flatten[Position[rents[[t], capitalists[[t, i, 3, j]]][[1],
              {j, 1, Length[capitalists[[t, i, 3]]}]]][[j]], β, capitalists[[t, i, 3, j]],
            wage, coalitions[[t, Flatten[Position[coalitions[[t, All, 1]],
              capitalists[[t, i, 3, j]]][[1], 3]],
              {j, 1, Length[capitalists[[t, i, 3]]}][[All, 1]],
            maxRm[alphas[[Flatten[Position[rents[[t], capitalists[[t, i, 3]]][[1]],
              β, capitalists[[t, i, 3]], wage, coalitions[[t, Flatten[
                Position[coalitions[[t, All, 1], capitalists[[t, i, 3]]][[1], 3]]][[1]]
          ]
        ]
      ]
    ]
  )
```

```
In[*]:= potentialProfitRates[1]
```

```
In[*]:= capitalists[[1]] // TableForm
```

```
Out[*]//TableForm=
62.1598  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
62.4752  0.  151.462  0.608851  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
        278.002  0.600578
62.7551  0.  111.77  0.610852  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
        223.055  0.623664
```













66.3219	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
66.4354	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
67.4223	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.	0.
67.5988	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
67.8766	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.	0.
		172.165	0.603065							
68.0884	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.	0.
		221.421	0.608435							
68.1592	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.	0.
68.8025	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.	0.
69.5923	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70.0362	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.	0.
70.0407	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70.124	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70.9126	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70.9422	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.	0.
		221.421	0.608435							
71.2716	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.	0.
73.0239	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
73.3024	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.	0.
73.6682	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
74.8155	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.	0.
74.9836	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
75.2397	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
75.5331	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		134.846	0.612355							
75.8887	0.612355	198.401	0.594706	134.846	0.	0.	0.	0.	0.	0.
		278.002	0.600578							
76.2151	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
76.2652	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.	0.
76.3716	0.612355	111.77	0.610852	134.846	0.	0.	0.	0.	0.	0.
		134.846	0.612355							
76.5991	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.	0.
76.7475	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.	0.
76.8775	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.	0.
77.0747	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.	0.
		151.462	0.608851							
77.1005	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.1301	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.4219	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.	0.
79.4401	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.	0.
79.5714	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
79.9436	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
80.7444	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
81.0932	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.	0.
		134.846	0.612355							
81.6501	0.623664	151.462	0.608851	223.055	0.	0.	0.	0.	0.	0.
		189.826	0.619361							
		223.055	0.623664							
		151.462	0.608851							
82.5101	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.	0.
		221.421	0.608435							
83.5154	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
84.3077	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.	0.
85.5641	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.	0.



187.203	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.	0.
190.372	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
207.764	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.	0.
		172.165	0.603065							
		221.421	0.608435							
212.93	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.	0.
229.354	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.	0.
231.288	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.	0.
267.714	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
291.272	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.	0.

## Update Coalition Wage Funds

Updating coalition wage funds for lands that will be active in production.

```
In[ ]:= activeLands = Table[0.0, {T}];
```

```
In[ ]:= wageFundUpdate[t_] := (
  Clear[tallyUpdate];
  tallyUpdate = Drop[Sort[Tally[capitalists[[t, All, 5]]], 1];
  activeLands[[t]] = Table[Flatten[Position[rents[[t], tallyUpdate[[j, 1]]][[1],
    {j, 1, Length[tallyUpdate]}]];
  Table[
    coalitions[[t, j, 6]] = Total[
      capitalists[[t, Position[capitalists[[t, All, 5], rents[[t, j]]][[All, 1], 1]],
      {j, activeLands[[t]]}
    ];
  );
```

```
In[ ]:= wageFundUpdate[t]
```

**Part:** The expression t cannot be used as a part specification.

**Tally:** List expected at position 1 in Tally[<<1>>]. [i](#)

**Tally:** Tally called with 0 arguments; 1 or 2 arguments are expected. [i](#)

**Set:** The expression t cannot be used as a part specification.

**Part:** The expression t cannot be used as a part specification.

**Table:** Iterator {j, {0., 0., 0., 0., 0.}[t]} does not have appropriate bounds. [i](#)

**Table:** Iterator {j, {0., 0., 0., 0., 0.}[t]} does not have appropriate bounds. [i](#)

```
In[*]:= coalitions[[1]] // TableForm
```

```
Out[*]//TableForm=
```

111.77	10	1096.94	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
120.913	10	958.093	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
134.846	10	944.115	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
151.462	10	1046.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
172.165	10	986.339	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
198.401	10	1225.52	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
189.826	10	840.635	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
221.421	10	989.089	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
223.055	10	818.67	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
278.002	10	1098.78	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

## Secondary Land Auction After Initial Allocation of Capitalists

Communicate rents in second round to initially unallocated capitalists.

```

In[ ]:= communicateSecondRound[t_] := (
  Clear[unallocated];
  unallocated = Reverse[Flatten[Position[capitalists[t, All, 2], 0.]]];

  Clear[announceSecondGroups];
  announceSecondGroups = Table[RandomSample[unallocated,
    Min[{IntegerPart[ $\frac{\text{announcements}}{2.}$ ], Length[unallocated]}]], {lands}];

  For[j = 1, j ≤ lands, j++,
    For[i = 1, i ≤ Length[announceSecondGroups[[j]], i++,
      capitalists[t, announceSecondGroups[[j, i], 9]] = Flatten[
        Append[{capitalists[t, announceSecondGroups[[j, i], 9]], rents[t, j]]]
      ]
    ];

  For[i = 1, i ≤ numCap, i++,
    If[Length[capitalists[t, i, 9]] > 0,
      capitalists[t, i, 9] = DeleteCases[capitalists[t, i, 9], 0.],
    ]
  ];

  For[i = 1, i ≤ numCap, i++,
    If[Length[capitalists[t, i, 9]] == 1,
      capitalists[t, i, 9] = capitalists[t, i, 9][[1],
    ]
  ]
)

```

```

In[ ]:= communicateSecondRound[1]

```

```

In[ ]:= capitalists[[1]] // TableForm

```

```

Out[ ]//TableForm=

```

62.1598	0.	0.	0.	0.	0.	0.	0.	134.846	0.
								223.055	
62.4752	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
		278.002	0.600578						
62.7551	0.623664	111.77	0.610852	223.055	0.	0.	0.	0.	0.
		223.055	0.623664						
63.032	0.	0.	0.	0.	0.	0.	0.	134.846	0.
								111.77	
63.342	0.	0.	0.	0.	0.	0.	0.	120.913	0.
								223.055	

63.5534	0.623664	120.913 223.055	0.614417 0.623664	223.055	0.	0.	0.	0.	0.
63.6476	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
63.9643	0.610852	111.77 172.165	0.610852 0.603065	111.77	0.	0.	0.	0.	0.
64.3853	0.619361	111.77 172.165 189.826	0.610852 0.603065 0.619361	189.826	0.	0.	0.	0.	0.
64.7703	0.	0.	0.	0.	0.	0.	0.	198.401	0.
65.1098	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
65.1463	0.	0.	0.	0.	0.	0.	0.	0.	0.
66.3219	0.	0.	0.	0.	0.	0.	0.	278.002	0.
66.4354	0.	0.	0.	0.	0.	0.	0.	111.77	0.
67.4223	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
67.5988	0.	0.	0.	0.	0.	0.	0.	189.826	0.
67.8766	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
68.0884	0.619361	172.165 189.826 221.421	0.603065 0.619361 0.608435	189.826	0.	0.	0.	0.	0.
68.1592	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
68.8025	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
69.5923	0.	0.	0.	0.	0.	0.	0.	151.462 172.165	0.
70.0362	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
70.0407	0.	0.	0.	0.	0.	0.	0.	120.913 151.462 198.401 221.421	0.
70.124	0.	0.	0.	0.	0.	0.	0.	111.77 134.846	0.
70.9126	0.	0.	0.	0.	0.	0.	0.	120.913 172.165 189.826 223.055	0.
70.9422	0.612355	134.846 221.421	0.612355 0.608435	134.846	0.	0.	0.	0.	0.
71.2716	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
73.0239	0.	0.	0.	0.	0.	0.	0.	0.	0.
73.3024	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
73.6682	0.	0.	0.	0.	0.	0.	0.	172.165	0.
74.8155	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
74.9836	0.	0.	0.	0.	0.	0.	0.	198.401	0.
75.2397	0.	0.	0.	0.	0.	0.	0.	151.462 221.421	0.
75.5331	0.	0.	0.	0.	0.	0.	0.	111.77 223.055	0.
75.8887	0.612355	134.846 198.401 278.002	0.612355 0.594706 0.600578	134.846	0.	0.	0.	0.	0.
76.2151	0.	0.	0.	0.	0.	0.	0.	0.	0.
76.2652	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
76.3716	0.612355	111.77 134.846	0.610852 0.612355	134.846	0.	0.	0.	0.	0.
76.5991	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.
76.7475	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
76.8775	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.

77.0747	0.612355	134.846 151.462	0.612355 0.608851	134.846	0.	0.	0.	0.	0.
77.1005	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.1301	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.4219	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
79.4401	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
79.5714	0.	0.	0.	0.	0.	0.	0.	278.002	0.
79.9436	0.	0.	0.	0.	0.	0.	0.	120.913	0.
80.7444	0.	0.	0.	0.	0.	0.	0.	111.77 120.913 278.002	0.
81.0932	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
81.6501	0.623664	134.846 151.462 189.826 223.055	0.612355 0.608851 0.619361 0.623664	223.055	0.	0.	0.	0.	0.
82.5101	0.619361	151.462 189.826 221.421	0.608851 0.619361 0.608435	189.826	0.	0.	0.	0.	0.
83.5154	0.	0.	0.	0.	0.	0.	0.	151.462	0.
84.3077	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
85.5641	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
85.7529	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
85.8381	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
86.1362	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
87.4571	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
89.0958	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
89.7341	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
90.9702	0.614417	120.913 151.462 221.421 278.002	0.614417 0.608851 0.608435 0.600578	120.913	0.	0.	0.	0.	0.
91.8361	0.	0.	0.	0.	0.	0.	0.	172.165	0.
91.9041	0.	0.	0.	0.	0.	0.	0.	172.165 221.421	0.
91.9108	0.	0.	0.	0.	0.	0.	0.	0.	0.
93.4947	0.614417	111.77 120.913	0.610852 0.614417	120.913	0.	0.	0.	0.	0.
94.2308	0.	0.	0.	0.	0.	0.	0.	134.846 198.401	0.
95.8128	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
96.5926	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
98.7661	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.
101.42	0.	0.	0.	0.	0.	0.	0.	0.	0.
101.849	0.	0.	0.	0.	0.	0.	0.	198.401	0.
102.152	0.623664	120.913 198.401 189.826 221.421 223.055 278.002	0.614417 0.594706 0.619361 0.608435 0.623664 0.600578	223.055	0.	0.	0.	0.	0.
102.255	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
102.526	0.	0.	0.	0.	0.	0.	0.	134.846 221.421	0.
103.776	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
103.948	0.623664	223.055 278.002	0.623664 0.600578	223.055	0.	0.	0.	0.	0.

110.573	0.623664	198.401 223.055	0.594706 0.623664	223.055	0.	0.	0.	0.	0.
110.832	0.608851	151.462 198.401 278.002	0.608851 0.594706 0.600578	151.462	0.	0.	0.	0.	0.
111.084	0.608851	151.462 198.401	0.608851 0.594706	151.462	0.	0.	0.	0.	0.
113.325	0.619361	120.913 189.826	0.614417 0.619361	189.826	0.	0.	0.	0.	0.
116.701	0.	0.	0.	0.	0.	0.	0.	0.	0.
117.487	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
130.919	0.608851	151.462 221.421	0.608851 0.608435	151.462	0.	0.	0.	0.	0.
142.085	0.	0.	0.	0.	0.	0.	0.	221.421	0.
145.86	0.614417	120.913 134.846 198.401 278.002	0.614417 0.612355 0.594706 0.600578	120.913	0.	0.	0.	0.	0.
150.895	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
160.771	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
171.025	0.	0.	0.	0.	0.	0.	0.	151.462 189.826	0.
175.126	0.	0.	0.	0.	0.	0.	0.	278.002	0.
177.093	0.	0.	0.	0.	0.	0.	0.	223.055	0.
178.309	0.	0.	0.	0.	0.	0.	0.	189.826	0.
187.203	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
190.372	0.	0.	0.	0.	0.	0.	0.	189.826	0.
207.764	0.610852	111.77 172.165 221.421	0.610852 0.603065 0.608435	111.77	0.	0.	0.	0.	0.
212.93	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
229.354	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
231.288	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.
267.714	0.	0.	0.	0.	0.	0.	0.	278.002	0.
291.272	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.

Coalition formation in secondary land auction.

```

In[ ]:= secondaryCoalitionFormation[t_] := (
  Clear[tallies];
  tallies = If[Length[Sort[Tally[Flatten[capitalists[[t, All, 9]]]]] > lands,
    Drop[Sort[Tally[Flatten[capitalists[[t, All, 9]]]], 1],
    Sort[Tally[Flatten[capitalists[[t, All, 9]]]]
  ];
  For[j = 1, j ≤ lands, j++,
    coalitions[[t, j, 11]] = If[MemberQ[tallies[[All, 1]], rents[[t, j]],
      tallies[[Position[tallies, rents[[t, j]][[1, 1]][[2]], 0.
    ];
    coalitions[[t, j, 12]] = coalitions[[t, j, 6]] + Total[
      capitalists[[t, Position[capitalists[[t, All, 9]], rents[[t, j]][[All, 1], 1]]];
  ]
)

```

```
In[ ]:= secondaryCoalitionFormation[1]
```

```
In[ ]:= coalitions[[1]] // TableForm
```

```
Out[ ]//TableForm=
```

111.77	10	1096.94	0.	0.	0.	0.	0.	0.	0.	5	356.179
120.913	10	958.093	0.	0.	0.	0.	0.	0.	0.	5	364.983
134.846	10	944.115	0.	0.	0.	0.	0.	0.	0.	5	392.072
151.462	10	1046.2	0.	0.	0.	0.	0.	0.	0.	5	469.413
172.165	10	986.339	0.	0.	0.	0.	0.	0.	0.	5	397.913
198.401	10	1225.52	0.	0.	0.	0.	0.	0.	0.	5	405.874
189.826	10	840.635	0.	0.	0.	0.	0.	0.	0.	5	678.217
221.421	10	989.089	0.	0.	0.	0.	0.	0.	0.	5	481.795
223.055	10	818.67	0.	0.	0.	0.	0.	0.	0.	5	449.04
278.002	10	1098.78	0.	0.	0.	0.	0.	0.	0.	5	669.477

Checking maximum profit rates in secondary land auction.

```
In[ ]:= secondaryPotentialProfitRates[t_] := (
  For[i = 1, i ≤ numCap, i++,
    capitalists[[t, i, 10]] =
      If[Length[capitalists[[t, i, 9]]] < 1. && capitalists[[t, i, 9]] == 0., 0.,
        If[Length[capitalists[[t, i, 9]]] > 1.,
          Table[maxRm[
            alphas[[Table[Flatten[Position[rents[[t], capitalists[[t, i, 9, j]]][[1],
              {j, 1, Length[capitalists[[t, i, 9]]}][[j]], β, capitalists[[t, i, 9, j]],
            wage, coalitions[[t, Flatten[Position[coalitions[[t, All, 1]],
              capitalists[[t, i, 9, j]]][[1], 12]],
            {j, 1, Length[capitalists[[t, i, 9]]}][[All, 1]],
            maxRm[alphas[[Flatten[Position[rents[[t], capitalists[[t, i, 9]]][[1]],
              β, capitalists[[t, i, 9], wage, coalitions[[t, Flatten[
                Position[coalitions[[t, All, 1], capitalists[[t, i, 9]]][[1], 12]]][[1]
            ]
          ]
        ]
      ]
    ]
  )
```

```
In[ ]:= secondaryPotentialProfitRates[1]
```

```
In[ ]:= capitalists[[1]] // TableForm
```

```
Out[ ]//TableForm=
```

62.1598	0.	0.	0.	0.	0.	0.	0.	134.846	0.
								223.055	0.
62.4752	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
		278.002	0.600578						
62.7551	0.623664	111.77	0.610852	223.055	0.	0.	0.	0.	0.
		223.055	0.623664						
63.032	0.	0.	0.	0.	0.	0.	0.	134.846	0.

63.342	0.	0.	0.	0.	0.	0.	0.	111.77	0.
								120.913	0.
								223.055	0.
63.5534	0.623664	120.913	0.614417	223.055	0.	0.	0.	0.	0.
		223.055	0.623664						
63.6476	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
63.9643	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
		172.165	0.603065						
64.3853	0.619361	111.77	0.610852	189.826	0.	0.	0.	0.	0.
		172.165	0.603065						
		189.826	0.619361						
64.7703	0.	0.	0.	0.	0.	0.	0.	198.401	0.
65.1098	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
65.1463	0.	0.	0.	0.	0.	0.	0.	0.	0.
66.3219	0.	0.	0.	0.	0.	0.	0.	278.002	0.
66.4354	0.	0.	0.	0.	0.	0.	0.	111.77	0.
67.4223	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
67.5988	0.	0.	0.	0.	0.	0.	0.	189.826	0.
67.8766	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
		172.165	0.603065						
68.0884	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
		221.421	0.608435						
68.1592	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
68.8025	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
69.5923	0.	0.	0.	0.	0.	0.	0.	151.462	0.
								172.165	0.
70.0362	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
								120.913	0.
70.0407	0.	0.	0.	0.	0.	0.	0.	151.462	0.
								198.401	0.
								221.421	0.
70.124	0.	0.	0.	0.	0.	0.	0.	111.77	0.
								134.846	0.
70.9126	0.	0.	0.	0.	0.	0.	0.	120.913	0.
								172.165	0.
								189.826	0.
								223.055	0.
70.9422	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
		221.421	0.608435						
71.2716	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
73.0239	0.	0.	0.	0.	0.	0.	0.	0.	0.
73.3024	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
73.6682	0.	0.	0.	0.	0.	0.	0.	172.165	0.
74.8155	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
74.9836	0.	0.	0.	0.	0.	0.	0.	198.401	0.
75.2397	0.	0.	0.	0.	0.	0.	0.	151.462	0.
								221.421	0.
75.5331	0.	0.	0.	0.	0.	0.	0.	111.77	0.
								223.055	0.
75.8887	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
		198.401	0.594706						
		278.002	0.600578						
76.2151	0.	0.	0.	0.	0.	0.	0.	0.	0.
76.2652	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
76.3716	0.612355	111.77	0.610852	134.846	0.	0.	0.	0.	0.
		134.846	0.612355						
76.5991	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.

76.7475	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
76.8775	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
77.0747	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
		151.462	0.608851						
77.1005	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.1301	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.4219	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
79.4401	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
79.5714	0.	0.	0.	0.	0.	0.	0.	278.002	0.
79.9436	0.	0.	0.	0.	0.	0.	0.	120.913	0.
								111.77	0.
80.7444	0.	0.	0.	0.	0.	0.	0.	120.913	0.
								278.002	0.
81.0932	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
		134.846	0.612355						
81.6501	0.623664	151.462	0.608851	223.055	0.	0.	0.	0.	0.
		189.826	0.619361						
		223.055	0.623664						
		151.462	0.608851						
82.5101	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
		221.421	0.608435						
83.5154	0.	0.	0.	0.	0.	0.	0.	151.462	0.
84.3077	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
85.5641	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
85.7529	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
85.8381	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
86.1362	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
87.4571	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
89.0958	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
89.7341	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
		120.913	0.614417						
90.9702	0.614417	151.462	0.608851	120.913	0.	0.	0.	0.	0.
		221.421	0.608435						
		278.002	0.600578						
91.8361	0.	0.	0.	0.	0.	0.	0.	172.165	0.
91.9041	0.	0.	0.	0.	0.	0.	0.	172.165	0.
								221.421	0.
91.9108	0.	0.	0.	0.	0.	0.	0.	0.	0.
93.4947	0.614417	111.77	0.610852	120.913	0.	0.	0.	0.	0.
		120.913	0.614417						
94.2308	0.	0.	0.	0.	0.	0.	0.	134.846	0.
								198.401	0.
95.8128	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
96.5926	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
98.7661	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.
101.42	0.	0.	0.	0.	0.	0.	0.	0.	0.
101.849	0.	0.	0.	0.	0.	0.	0.	198.401	0.
		120.913	0.614417						
		198.401	0.594706						
102.152	0.623664	189.826	0.619361	223.055	0.	0.	0.	0.	0.
		221.421	0.608435						
		223.055	0.623664						
		278.002	0.600578						
102.255	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
102.526	0.	0.	0.	0.	0.	0.	0.	134.846	0.
								221.421	0.

103.776	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
103.948	0.623664	223.055 278.002	0.623664 0.600578	223.055	0.	0.	0.	0.	0.
110.573	0.623664	198.401 223.055	0.594706 0.623664	223.055	0.	0.	0.	0.	0.
110.832	0.608851	151.462 198.401 278.002	0.608851 0.594706 0.600578	151.462	0.	0.	0.	0.	0.
111.084	0.608851	151.462 198.401	0.608851 0.594706	151.462	0.	0.	0.	0.	0.
113.325	0.619361	120.913 189.826	0.614417 0.619361	189.826	0.	0.	0.	0.	0.
116.701	0.	0.	0.	0.	0.	0.	0.	0.	0.
117.487	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
130.919	0.608851	151.462 221.421	0.608851 0.608435	151.462	0.	0.	0.	0.	0.
142.085	0.	0.	0.	0.	0.	0.	0.	221.421	0.
145.86	0.614417	120.913 134.846 198.401 278.002	0.614417 0.612355 0.594706 0.600578	120.913	0.	0.	0.	0.	0.
150.895	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
160.771	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
171.025	0.	0.	0.	0.	0.	0.	0.	151.462 189.826	0. 0.
175.126	0.	0.	0.	0.	0.	0.	0.	278.002	0.
177.093	0.	0.	0.	0.	0.	0.	0.	223.055	0.
178.309	0.	0.	0.	0.	0.	0.	0.	189.826	0.
187.203	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
190.372	0.	0.	0.	0.	0.	0.	0.	189.826	0.
207.764	0.610852	111.77 172.165 221.421	0.610852 0.603065 0.608435	111.77	0.	0.	0.	0.	0.
212.93	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
229.354	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
231.288	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.
267.714	0.	0.	0.	0.	0.	0.	0.	278.002	0.
291.272	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.

Finding max profit rates for secondary allocation of lands.

```

In[ ]:= checkSecondaryMaxR[t_] := (
  Clear[zeroProf];
  zeroProf = Flatten[Position[capitalists[[t, All, 2]], 0.]];

  For[i = 1, i ≤ Length[zeroProf], i++,
    capitalists[[t, zeroProf[[i]], 2] = If[Max[capitalists[[t, zeroProf[[i]], 10]] > 0.,
      Max[capitalists[[t, zeroProf[[i]], 10]], 0.]
  ];
)

```

```

In[ ]:= checkSecondaryMaxR[1]

```

```
In[*]:= capitalists[[1]] // TableForm
```

```
Out[*]//TableForm=
```

62.1598	0.623664	0.	0.	0.	0.	0.	0.	134.846	0.
								223.055	0.
62.4752	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
		278.002	0.600578						
62.7551	0.623664	111.77	0.610852	223.055	0.	0.	0.	0.	0.
		223.055	0.623664						
63.032	0.612355	0.	0.	0.	0.	0.	0.	134.846	0.
								111.77	0.
63.342	0.623664	0.	0.	0.	0.	0.	0.	120.913	0.
								223.055	0.
63.5534	0.623664	120.913	0.614417	223.055	0.	0.	0.	0.	0.
		223.055	0.623664						
63.6476	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
63.9643	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
		172.165	0.603065						
64.3853	0.619361	111.77	0.610852	189.826	0.	0.	0.	0.	0.
		172.165	0.603065						
		189.826	0.619361						
64.7703	0.594706	0.	0.	0.	0.	0.	0.	198.401	0.
65.1098	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
65.1463	0.	0.	0.	0.	0.	0.	0.	0.	0.
66.3219	0.600578	0.	0.	0.	0.	0.	0.	278.002	0.
66.4354	0.610852	0.	0.	0.	0.	0.	0.	111.77	0.
67.4223	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
67.5988	0.619361	0.	0.	0.	0.	0.	0.	189.826	0.
67.8766	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
		172.165	0.603065						
68.0884	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
		221.421	0.608435						
68.1592	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
68.8025	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
69.5923	0.608851	0.	0.	0.	0.	0.	0.	151.462	0.
								172.165	0.
70.0362	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
								120.913	0.
70.0407	0.614417	0.	0.	0.	0.	0.	0.	151.462	0.
								198.401	0.
								221.421	0.
70.124	0.612355	0.	0.	0.	0.	0.	0.	111.77	0.
								134.846	0.
70.9126	0.623664	0.	0.	0.	0.	0.	0.	120.913	0.
								172.165	0.
								189.826	0.
								223.055	0.
70.9422	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
		221.421	0.608435						
71.2716	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
73.0239	0.	0.	0.	0.	0.	0.	0.	0.	0.
73.3024	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
73.6682	0.603065	0.	0.	0.	0.	0.	0.	172.165	0.
74.8155	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
74.9836	0.594706	0.	0.	0.	0.	0.	0.	198.401	0.
75.2397	0.608851	0.	0.	0.	0.	0.	0.	151.462	0.
								221.421	0.



101.849	0.594706	0.	0.	0.	0.	0.	0.	198.401	0.
		120.913	0.614417						
		198.401	0.594706						
102.152	0.623664	189.826	0.619361	223.055	0.	0.	0.	0.	0.
		221.421	0.608435						
		223.055	0.623664						
		278.002	0.600578						
102.255	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
102.526	0.612355	0.	0.	0.	0.	0.	0.	134.846	0.
								221.421	0.
103.776	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
103.948	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
		278.002	0.600578						
110.573	0.623664	198.401	0.594706	223.055	0.	0.	0.	0.	0.
		223.055	0.623664						
		151.462	0.608851						
110.832	0.608851	198.401	0.594706	151.462	0.	0.	0.	0.	0.
		278.002	0.600578						
		151.462	0.608851						
111.084	0.608851	198.401	0.594706	151.462	0.	0.	0.	0.	0.
113.325	0.619361	120.913	0.614417	189.826	0.	0.	0.	0.	0.
		189.826	0.619361						
116.701	0.	0.	0.	0.	0.	0.	0.	0.	0.
117.487	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
130.919	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
		221.421	0.608435						
142.085	0.608435	0.	0.	0.	0.	0.	0.	221.421	0.
		120.913	0.614417						
145.86	0.614417	134.846	0.612355	120.913	0.	0.	0.	0.	0.
		198.401	0.594706						
		278.002	0.600578						
150.895	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
160.771	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
171.025	0.619361	0.	0.	0.	0.	0.	0.	151.462	0.
								189.826	0.
175.126	0.600578	0.	0.	0.	0.	0.	0.	278.002	0.
177.093	0.623664	0.	0.	0.	0.	0.	0.	223.055	0.
178.309	0.619361	0.	0.	0.	0.	0.	0.	189.826	0.
187.203	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
190.372	0.619361	0.	0.	0.	0.	0.	0.	189.826	0.
		111.77	0.610852						
207.764	0.610852	172.165	0.603065	111.77	0.	0.	0.	0.	0.
		221.421	0.608435						
212.93	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
229.354	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
231.288	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.
267.714	0.600578	0.	0.	0.	0.	0.	0.	278.002	0.
291.272	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.

Rents expected to be paid for secondary allocation.

```

In[*]:= rentPaidSecondary[t_] := (
  Clear[zeroRent];
  zeroRent = Flatten[Position[capitalists[[t, All, 5]], 0.]];

  For[i = 1, i ≤ Length[zeroRent], i++,
    If[Length[capitalists[[t, zeroRent[[i]], 10]]] > 1 &&
      Positive[Max[capitalists[[t, zeroRent[[i]], 10]]] == True,
      capitalists[[t, zeroRent[[i]], 5]] = capitalists[[t, zeroRent[[i]],
        9, Flatten[Position[capitalists[[t, zeroRent[[i]], 10]],
          capitalists[[t, zeroRent[[i]], 2]]][[1]]],
      If[Positive[capitalists[[t, zeroRent[[i]], 2]]] == True,
        capitalists[[t, zeroRent[[i]], 5]] = capitalists[[t, zeroRent[[i]], 9]],
        capitalists[[t, zeroRent[[i]], 5]] = 0.
      ]
    ]
  ]
)

```

```

In[*]:= rentPaidSecondary[1]

```

```

In[*]:= capitalists[[1]] // TableForm

```

```

Out[*]//TableForm=

```

62.1598	0.623664	0.	0.	223.055	0.	0.	0.	134.846	0.
								223.055	0.
62.4752	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
		278.002	0.600578						
62.7551	0.623664	111.77	0.610852	223.055	0.	0.	0.	0.	0.
		223.055	0.623664						
63.032	0.612355	0.	0.	134.846	0.	0.	0.	134.846	0.
								111.77	0.
63.342	0.623664	0.	0.	223.055	0.	0.	0.	120.913	0.
								223.055	0.
63.5534	0.623664	120.913	0.614417	223.055	0.	0.	0.	0.	0.
		223.055	0.623664						
63.6476	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
63.9643	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
		172.165	0.603065						
64.3853	0.619361	111.77	0.610852	189.826	0.	0.	0.	0.	0.
		172.165	0.603065						
		189.826	0.619361						
64.7703	0.594706	0.	0.	198.401	0.	0.	0.	198.401	0.
65.1098	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
65.1463	0.	0.	0.	0.	0.	0.	0.	0.	0.
66.3219	0.600578	0.	0.	278.002	0.	0.	0.	278.002	0.
66.4354	0.610852	0.	0.	111.77	0.	0.	0.	111.77	0.
67.4223	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
67.5988	0.619361	0.	0.	189.826	0.	0.	0.	189.826	0.
67.8766	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.

68.0884	0.619361	172.165 189.826 221.421	0.603065 0.619361 0.608435	189.826	0.	0.	0.	0.	0.
68.1592	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
68.8025	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
69.5923	0.608851	0.	0.	151.462	0.	0.	0.	151.462 172.165	0. 0.
70.0362	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
70.0407	0.614417	0.	0.	120.913	0.	0.	0.	120.913 151.462 198.401 221.421	0. 0. 0. 0.
70.124	0.612355	0.	0.	134.846	0.	0.	0.	111.77 134.846	0. 0.
70.9126	0.623664	0.	0.	223.055	0.	0.	0.	120.913 172.165 189.826 223.055	0. 0. 0. 0.
70.9422	0.612355	134.846 221.421	0.612355 0.608435	134.846	0.	0.	0.	0.	0.
71.2716	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
73.0239	0.	0.	0.	0.	0.	0.	0.	0.	0.
73.3024	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
73.6682	0.603065	0.	0.	172.165	0.	0.	0.	172.165	0.
74.8155	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
74.9836	0.594706	0.	0.	198.401	0.	0.	0.	198.401	0.
75.2397	0.608851	0.	0.	151.462	0.	0.	0.	151.462 221.421	0. 0.
75.5331	0.623664	0.	0.	223.055	0.	0.	0.	111.77 223.055	0. 0.
75.8887	0.612355	134.846 198.401 278.002	0.612355 0.594706 0.600578	134.846	0.	0.	0.	0.	0.
76.2151	0.	0.	0.	0.	0.	0.	0.	0.	0.
76.2652	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
76.3716	0.612355	111.77 134.846	0.610852 0.612355	134.846	0.	0.	0.	0.	0.
76.5991	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.
76.7475	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
76.8775	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
77.0747	0.612355	134.846 151.462	0.612355 0.608851	134.846	0.	0.	0.	0.	0.
77.1005	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.1301	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.4219	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
79.4401	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
79.5714	0.600578	0.	0.	278.002	0.	0.	0.	278.002	0.
79.9436	0.614417	0.	0.	120.913	0.	0.	0.	120.913	0.
80.7444	0.614417	0.	0.	120.913	0.	0.	0.	111.77 120.913 278.002	0. 0. 0.
81.0932	0.623664	223.055	0.623664	223.055	0.	0.	0.	0.	0.
81.6501	0.623664	134.846 151.462 189.826 223.055	0.612355 0.608851 0.619361 0.623664	223.055	0.	0.	0.	0.	0.

82.5101	0.619361	151.462 189.826 221.421	0.608851 0.619361 0.608435	189.826	0.	0.	0.	0.	0.
83.5154	0.608851	0.	0.	151.462	0.	0.	0.	151.462	0.
84.3077	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
85.5641	0.608435	221.421	0.608435	221.421	0.	0.	0.	0.	0.
85.7529	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.
85.8381	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
86.1362	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
87.4571	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.
89.0958	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
89.7341	0.619361	189.826	0.619361	189.826	0.	0.	0.	0.	0.
90.9702	0.614417	120.913 151.462 221.421 278.002	0.614417 0.608851 0.608435 0.600578	120.913	0.	0.	0.	0.	0.
91.8361	0.603065	0.	0.	172.165	0.	0.	0.	172.165	0.
91.9041	0.608435	0.	0.	221.421	0.	0.	0.	172.165 221.421	0. 0.
91.9108	0.	0.	0.	0.	0.	0.	0.	0.	0.
93.4947	0.614417	111.77 120.913	0.610852 0.614417	120.913	0.	0.	0.	0.	0.
94.2308	0.612355	0.	0.	134.846	0.	0.	0.	134.846 198.401	0. 0.
95.8128	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
96.5926	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.
98.7661	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.
101.42	0.	0.	0.	0.	0.	0.	0.	0.	0.
101.849	0.594706	0.	0.	198.401	0.	0.	0.	198.401	0.
102.152	0.623664	120.913 198.401 189.826 221.421 223.055 278.002	0.614417 0.594706 0.619361 0.608435 0.623664 0.600578	223.055	0.	0.	0.	0.	0.
102.255	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.
102.526	0.612355	0.	0.	134.846	0.	0.	0.	134.846 221.421	0. 0.
103.776	0.614417	120.913	0.614417	120.913	0.	0.	0.	0.	0.
103.948	0.623664	223.055 278.002	0.623664 0.600578	223.055	0.	0.	0.	0.	0.
110.573	0.623664	198.401 223.055	0.594706 0.623664	223.055	0.	0.	0.	0.	0.
110.832	0.608851	151.462 198.401 278.002	0.608851 0.594706 0.600578	151.462	0.	0.	0.	0.	0.
111.084	0.608851	151.462 198.401	0.608851 0.594706	151.462	0.	0.	0.	0.	0.
113.325	0.619361	120.913 189.826	0.614417 0.619361	189.826	0.	0.	0.	0.	0.
116.701	0.	0.	0.	0.	0.	0.	0.	0.	0.
117.487	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.
130.919	0.608851	151.462 221.421	0.608851 0.608435	151.462	0.	0.	0.	0.	0.
142.085	0.608435	0.	0.	221.421	0.	0.	0.	221.421	0.

		120.913	0.614417							
145.86	0.614417	134.846	0.612355	120.913	0.	0.	0.	0.	0.	0.
		198.401	0.594706							
		278.002	0.600578							
150.895	0.603065	172.165	0.603065	172.165	0.	0.	0.	0.	0.	0.
160.771	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.	0.
171.025	0.619361	0.	0.	189.826	0.	0.	0.	151.462	0.	0.
								189.826	0.	0.
175.126	0.600578	0.	0.	278.002	0.	0.	0.	278.002	0.	0.
177.093	0.623664	0.	0.	223.055	0.	0.	0.	223.055	0.	0.
178.309	0.619361	0.	0.	189.826	0.	0.	0.	189.826	0.	0.
187.203	0.612355	134.846	0.612355	134.846	0.	0.	0.	0.	0.	0.
190.372	0.619361	0.	0.	189.826	0.	0.	0.	189.826	0.	0.
		111.77	0.610852							
207.764	0.610852	172.165	0.603065	111.77	0.	0.	0.	0.	0.	0.
		221.421	0.608435							
212.93	0.608851	151.462	0.608851	151.462	0.	0.	0.	0.	0.	0.
229.354	0.594706	198.401	0.594706	198.401	0.	0.	0.	0.	0.	0.
231.288	0.600578	278.002	0.600578	278.002	0.	0.	0.	0.	0.	0.
267.714	0.600578	0.	0.	278.002	0.	0.	0.	278.002	0.	0.
291.272	0.610852	111.77	0.610852	111.77	0.	0.	0.	0.	0.	0.

Update wage funds for coalitions after secondary land auction procedure.

```
In[ ]:= secondaryWageFundUpdate[t_] := (
  Clear[tallyUpdate2];
  tallyUpdate2 = Drop[Sort[Tally[capitalists[t, All, 5]]], 1];
  activeLands[t] = Table[Flatten[Position[rents[t], tallyUpdate2[[j, 1]]][[1]],
    {j, 1, Length[tallyUpdate2]}];
  Table[
    coalitions[t, j, 6] = Total[
      capitalists[t, Position[capitalists[t, All, 5], rents[t, j]][[All, 1], 1]],
      {j, activeLands[t]}
    ];
  )
```

```
In[ ]:= secondaryWageFundUpdate[1]
```

```
In[ ]:= coalitions[[1]] // TableForm
```

```
Out[ ]//TableForm=
```

111.77	10	1096.94	0.	0.	866.369	0.	0.	0.	0.	5	356.179
120.913	10	958.093	0.	0.	909.79	0.	0.	0.	0.	5	364.983
134.846	10	944.115	0.	0.	1046.52	0.	0.	0.	0.	5	392.072
151.462	10	1046.2	0.	0.	942.34	0.	0.	0.	0.	5	469.413
172.165	10	986.339	0.	0.	747.641	0.	0.	0.	0.	5	397.913
198.401	10	1225.52	0.	0.	810.73	0.	0.	0.	0.	5	405.874
189.826	10	840.635	0.	0.	1264.14	0.	0.	0.	0.	5	678.217
221.421	10	989.089	0.	0.	469.733	0.	0.	0.	0.	5	481.795
223.055	10	818.67	0.	0.	1267.71	0.	0.	0.	0.	5	449.04
278.002	10	1098.78	0.	0.	995.386	0.	0.	0.	0.	5	669.477

## Production

### Labor hired

Determining labor hired by each coalition on each piece of land.

```
In[*]:= optL[t_] := (
  For[j = 1, j ≤ lands, j++,
    If[coalitions[[t, j, 3]] > 0. && coalitions[[t, j, 1]] > 0.,
      coalitions[[t, j, 9]] =
        L /. maxRm[alphas[[Flatten[Position[rents[[t]], coalitions[[t, j, 1]]][[1]]],
          β, coalitions[[t, j, 1]], wage, coalitions[[t, j, 3]][[2]],
        coalitions[[t, j, 9]] = 0.
    ]
  ]
)
```

```
In[*]:= optL[1]
```

```
In[*]:= coalitions[[1]] // TableForm
```

```
Out[*]//TableForm=
```

111.77	10	1096.94	0.	0.	866.369	0.	0.	31.2235	0.	5	356.
120.913	10	958.093	0.	0.	909.79	0.	0.	33.703	0.	5	364.
134.846	10	944.115	0.	0.	1046.52	0.	0.	37.635	0.	5	392.
151.462	10	1046.2	0.	0.	942.34	0.	0.	42.3644	0.	5	469.
172.165	10	986.339	0.	0.	747.641	0.	0.	48.3289	0.	5	397.
198.401	10	1225.52	0.	0.	810.73	0.	0.	55.9856	0.	5	405.
189.826	10	840.635	0.	0.	1264.14	0.	0.	52.7504	0.	5	678.
221.421	10	989.089	0.	0.	469.733	0.	0.	61.9481	0.	5	481.
223.055	10	818.67	0.	0.	1267.71	0.	0.	61.8198	0.	5	449.
278.002	10	1098.78	0.	0.	995.386	0.	0.	78.1599	0.	5	669.

Labor hired by each coalition.

```

In[ ]:= coalitionLabor[t_] := (
  For[j = 1, j ≤ lands, j++,
    If[coalitions[[t, j, 6]] > 0.,
      coalitions[[t, j, 4]] =
        If[coalitions[[t, j, 9]] ==  $\frac{\text{coalitions}[[t, j, 6]]}{\text{wage}}$ , coalitions[[t, j, 9]],
          If[coalitions[[t, j, 9]] <  $\frac{\text{coalitions}[[t, j, 6]]}{\text{wage}}$ ,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{wage}}$ ,
            L /. maxR[alphas[[Flatten[Position[rents[[t]], coalitions[[t, j, 1]]][[1]]],
              β, coalitions[[t, j, 1], wage, coalitions[[t, j, 6]]][[2]]
            ]
          ],
      coalitions[[t, j, 4]] = 0.
    ]
  ]
)

```

```

In[ ]:= coalitionLabor[1]

```

```

In[ ]:= coalitions[[1]] // TableForm

```

```

Out[ ]//TableForm=

```

111.77	10	1096.94	43.3184	0.	866.369	0.	0.	31.2235	0.	5
120.913	10	958.093	45.4895	0.	909.79	0.	0.	33.703	0.	5
134.846	10	944.115	52.3259	0.	1046.52	0.	0.	37.635	0.	5
151.462	10	1046.2	47.117	0.	942.34	0.	0.	42.3644	0.	5
172.165	10	986.339	37.3821	0.	747.641	0.	0.	48.3289	0.	5
198.401	10	1225.52	40.5365	0.	810.73	0.	0.	55.9856	0.	5
189.826	10	840.635	63.2068	0.	1264.14	0.	0.	52.7504	0.	5
221.421	10	989.089	23.4866	0.	469.733	0.	0.	61.9481	0.	5
223.055	10	818.67	63.3855	0.	1267.71	0.	0.	61.8198	0.	5
278.002	10	1098.78	49.7693	0.	995.386	0.	0.	78.1599	0.	5

Mapping optimal labor hired by each coalition to capitalists once best land is selected.

```

In[ ]:= laborHired[t_] := (
  For[i = 1, i ≤ numCap, i++,
    If[(capitalists[[t, i, 2]] > 0.) && (coalitions[[t, Flatten[
      Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1], 6]] > 0.),
      capitalists[[t, i, 6]] =
        L /. maxR[alphas[[Flatten[Position[rents[[t]], capitalists[[t, i, 5]]][[1]]],
          β, capitalists[[t, i, 5]], wage, coalitions[[t, Flatten[
            Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1], 6]]][2],
            capitalists[[t, i, 6]] = 0.
        ]
      ]
    )
  )

```

```

In[ ]:= laborHired[1]

```

```

In[ ]:= capitalists[[1]] // TableForm

```

```

Out[ ]//TableForm=

```

62.1598	0.623664	0.	0.	223.055	61.8197	0.	0.	134.846 223.055
62.4752	0.608851	151.462 278.002	0.608851 0.600578	151.462	42.3644	0.	0.	0.
62.7551	0.623664	111.77 223.055	0.610852 0.623664	223.055	61.8197	0.	0.	0.
63.032	0.612355	0.	0.	134.846	37.635	0.	0.	134.846 111.77
63.342	0.623664	0.	0.	223.055	61.8197	0.	0.	120.913 223.055
63.5534	0.623664	120.913 223.055	0.614417 0.623664	223.055	61.8197	0.	0.	0.
63.6476	0.603065	172.165	0.603065	172.165	37.3821	0.	0.	0.
63.9643	0.610852	111.77 172.165	0.610852 0.603065	111.77	31.2235	0.	0.	0.
64.3853	0.619361	111.77 172.165 189.826	0.610852 0.603065 0.619361	189.826	52.7504	0.	0.	0.
64.7703	0.594706	0.	0.	198.401	40.5365	0.	0.	198.401
65.1098	0.612355	134.846	0.612355	134.846	37.635	0.	0.	0.
65.1463	0.	0.	0.	0.	0.	0.	0.	0.
66.3219	0.600578	0.	0.	278.002	49.7693	0.	0.	278.002
66.4354	0.610852	0.	0.	111.77	31.2235	0.	0.	111.77
67.4223	0.612355	134.846	0.612355	134.846	37.635	0.	0.	0.
67.5988	0.619361	0.	0.	189.826	52.7504	0.	0.	189.826
67.8766	0.623664	223.055	0.623664	223.055	61.8197	0.	0.	0.
68.0884	0.619361	172.165 189.826 221.421	0.603065 0.619361 0.608435	189.826	52.7504	0.	0.	0.
68.1592	0.603065	172.165	0.603065	172.165	37.3821	0.	0.	0.
68.8025	0.623664	223.055	0.623664	223.055	61.8197	0.	0.	0.
69.5923	0.608851	0.	0.	151.462	42.3644	0.	0.	151.462 172.165
70.0362	0.610852	111.77	0.610852	111.77	31.2235	0.	0.	0.

70.0407	0.614417	0.	0.	120.913	33.703	0.	0.	120.913 151.462 198.401 221.421
70.124	0.612355	0.	0.	134.846	37.635	0.	0.	111.77 134.846
70.9126	0.623664	0.	0.	223.055	61.8197	0.	0.	120.913 172.165 189.826 223.055
70.9422	0.612355	134.846 221.421	0.612355 0.608435	134.846	37.635	0.	0.	0.
71.2716	0.619361	189.826	0.619361	189.826	52.7504	0.	0.	0.
73.0239	0.	0.	0.	0.	0.	0.	0.	0.
73.3024	0.608435	221.421	0.608435	221.421	23.4866	0.	0.	0.
73.6682	0.603065	0.	0.	172.165	37.3821	0.	0.	172.165
74.8155	0.614417	120.913	0.614417	120.913	33.703	0.	0.	0.
74.9836	0.594706	0.	0.	198.401	40.5365	0.	0.	198.401
75.2397	0.608851	0.	0.	151.462	42.3644	0.	0.	151.462 221.421
75.5331	0.623664	0.	0.	223.055	61.8197	0.	0.	111.77 223.055
75.8887	0.612355	134.846 198.401 278.002	0.612355 0.594706 0.600578	134.846	37.635	0.	0.	0.
76.2151	0.	0.	0.	0.	0.	0.	0.	0.
76.2652	0.623664	223.055	0.623664	223.055	61.8197	0.	0.	0.
76.3716	0.612355	111.77 134.846	0.610852 0.612355	134.846	37.635	0.	0.	0.
76.5991	0.600578	278.002	0.600578	278.002	49.7693	0.	0.	0.
76.7475	0.594706	198.401	0.594706	198.401	40.5365	0.	0.	0.
76.8775	0.608435	221.421	0.608435	221.421	23.4866	0.	0.	0.
77.0747	0.612355	134.846 151.462	0.612355 0.608851	134.846	37.635	0.	0.	0.
77.1005	0.	0.	0.	0.	0.	0.	0.	0.
78.1301	0.	0.	0.	0.	0.	0.	0.	0.
78.4219	0.619361	189.826	0.619361	189.826	52.7504	0.	0.	0.
79.4401	0.610852	111.77	0.610852	111.77	31.2235	0.	0.	0.
79.5714	0.600578	0.	0.	278.002	49.7693	0.	0.	278.002
79.9436	0.614417	0.	0.	120.913	33.703	0.	0.	120.913
80.7444	0.614417	0.	0.	120.913	33.703	0.	0.	111.77 120.913 278.002
81.0932	0.623664	223.055	0.623664	223.055	61.8197	0.	0.	0.
81.6501	0.623664	134.846 151.462 189.826 223.055	0.612355 0.608851 0.619361 0.623664	223.055	61.8197	0.	0.	0.
82.5101	0.619361	151.462 189.826 221.421	0.608851 0.619361 0.608435	189.826	52.7504	0.	0.	0.
83.5154	0.608851	0.	0.	151.462	42.3644	0.	0.	151.462
84.3077	0.614417	120.913	0.614417	120.913	33.703	0.	0.	0.
85.5641	0.608435	221.421	0.608435	221.421	23.4866	0.	0.	0.
85.7529	0.608851	151.462	0.608851	151.462	42.3644	0.	0.	0.
85.8381	0.614417	120.913	0.614417	120.913	33.703	0.	0.	0.
86.1362	0.603065	172.165	0.603065	172.165	37.3821	0.	0.	0.

87.4571	0.610852	111.77	0.610852	111.77	31.2235	0.	0.	0.
89.0958	0.619361	189.826	0.619361	189.826	52.7504	0.	0.	0.
89.7341	0.619361	189.826	0.619361	189.826	52.7504	0.	0.	0.
90.9702	0.614417	120.913 151.462 221.421 278.002	0.614417 0.608851 0.608435 0.600578	120.913	33.703	0.	0.	0.
91.8361	0.603065	0.	0.	172.165	37.3821	0.	0.	172.165
91.9041	0.608435	0.	0.	221.421	23.4866	0.	0.	172.165 221.421
91.9108	0.	0.	0.	0.	0.	0.	0.	0.
93.4947	0.614417	111.77 120.913	0.610852 0.614417	120.913	33.703	0.	0.	0.
94.2308	0.612355	0.	0.	134.846	37.635	0.	0.	134.846 198.401
95.8128	0.603065	172.165	0.603065	172.165	37.3821	0.	0.	0.
96.5926	0.612355	134.846	0.612355	134.846	37.635	0.	0.	0.
98.7661	0.600578	278.002	0.600578	278.002	49.7693	0.	0.	0.
101.42	0.	0.	0.	0.	0.	0.	0.	0.
101.849	0.594706	0.	0.	198.401	40.5365	0.	0.	198.401
102.152	0.623664	120.913 198.401 189.826 221.421 223.055 278.002	0.614417 0.594706 0.619361 0.608435 0.623664 0.600578	223.055	61.8197	0.	0.	0.
102.255	0.594706	198.401	0.594706	198.401	40.5365	0.	0.	0.
102.526	0.612355	0.	0.	134.846	37.635	0.	0.	134.846 221.421
103.776	0.614417	120.913	0.614417	120.913	33.703	0.	0.	0.
103.948	0.623664	223.055 278.002	0.623664 0.600578	223.055	61.8197	0.	0.	0.
110.573	0.623664	198.401 223.055	0.594706 0.623664	223.055	61.8197	0.	0.	0.
110.832	0.608851	151.462 198.401 278.002	0.608851 0.594706 0.600578	151.462	42.3644	0.	0.	0.
111.084	0.608851	151.462 198.401	0.608851 0.594706	151.462	42.3644	0.	0.	0.
113.325	0.619361	120.913 189.826	0.614417 0.619361	189.826	52.7504	0.	0.	0.
116.701	0.	0.	0.	0.	0.	0.	0.	0.
117.487	0.603065	172.165	0.603065	172.165	37.3821	0.	0.	0.
130.919	0.608851	151.462 221.421	0.608851 0.608435	151.462	42.3644	0.	0.	0.
142.085	0.608435	0.	0.	221.421	23.4866	0.	0.	221.421
145.86	0.614417	120.913 134.846 198.401 278.002	0.614417 0.612355 0.594706 0.600578	120.913	33.703	0.	0.	0.
150.895	0.603065	172.165	0.603065	172.165	37.3821	0.	0.	0.
160.771	0.594706	198.401	0.594706	198.401	40.5365	0.	0.	0.
171.025	0.619361	0.	0.	189.826	52.7504	0.	0.	151.462 189.826
175.126	0.600578	0.	0.	278.002	49.7693	0.	0.	278.002
177.093	0.623664	0.	0.	223.055	61.8197	0.	0.	223.055
178.309	0.619361	0.	0.	189.826	52.7504	0.	0.	189.826

187.203	0.612355	134.846	0.612355	134.846	37.635	0.	0.	0.
190.372	0.619361	0.	0.	189.826	52.7504	0.	0.	189.826
207.764	0.610852	111.77	0.610852	111.77	31.2235	0.	0.	0.
		172.165	0.603065					
		221.421	0.608435					
212.93	0.608851	151.462	0.608851	151.462	42.3644	0.	0.	0.
229.354	0.594706	198.401	0.594706	198.401	40.5365	0.	0.	0.
231.288	0.600578	278.002	0.600578	278.002	49.7693	0.	0.	0.
267.714	0.600578	0.	0.	278.002	49.7693	0.	0.	278.002
291.272	0.610852	111.77	0.610852	111.77	31.2235	0.	0.	0.

## Output

Output produced by each coalition.

```
In[*]:= coalitionProduction[t_] := (
  For[j = 1, j ≤ lands, j++,
    If[coalitions[[t, j, 6]] > 0.,
      coalitions[[t, j, 5]] =
        prodFn[alphas[[Flatten[Position[rents[[t], coalitions[[t, j, 1]]][[1]]],
          coalitions[[t, j, 4]], β],
      coalitions[[t, j, 5]] = 0.
    ]
  ]
)
```

```
In[*]:= coalitionProduction[1]
```

```
In[*]:= coalitions[[1]] // TableForm
```

Out[\*]//TableForm=

111.77	10	1096.94	43.3184	1500.71	866.369	0.	0.	31.2235	0.
120.913	10	958.093	45.4895	1583.76	909.79	0.	0.	33.703	0.
134.846	10	944.115	52.3259	1814.06	1046.52	0.	0.	37.635	0.
151.462	10	1046.2	47.117	1666.72	942.34	0.	0.	42.3644	0.
172.165	10	986.339	37.3821	1366.33	747.641	0.	0.	48.3289	0.
198.401	10	1225.52	40.5365	1483.67	810.73	0.	0.	55.9856	0.
189.826	10	840.635	63.2068	2233.79	1264.14	0.	0.	52.7504	0.
221.421	10	989.089	23.4866	924.981	469.733	0.	0.	61.9481	0.
223.055	10	818.67	63.3855	2281.33	1267.71	0.	0.	61.8198	0.
278.002	10	1098.78	49.7693	1851.95	995.386	0.	0.	78.1599	0.

Output produced by each capitalist.

```
In[*]:= production[t_] := (
  For[i = 1, i ≤ numCap, i++,
    If[capitalists[[t, i, 2]] > 0.,
      capitalists[[t, i, 7]] =
        prodFn[alphas[[Flatten[Position[rents[[t], capitalists[[t, i, 5]]][[1]]],
          capitalists[[t, i, 6]], β],
        capitalists[[t, i, 7]] = 0.
    ]
  ]
)
```

```
In[*]:= production[1]
```

```
In[*]:= capitalists[[1]] // TableForm
```

Out[\*]//TableForm=

62.1598	0.623664	0.	0.	223.055	61.8197	2230.54	0.	134 223
62.4752	0.608851	151.462 278.002	0.608851 0.600578	151.462	42.3644	1514.62	0.	0.
62.7551	0.623664	111.77 223.055	0.610852 0.623664	223.055	61.8197	2230.54	0.	0.
63.032	0.612355	0.	0.	134.846	37.635	1348.46	0.	134
63.342	0.623664	0.	0.	223.055	61.8197	2230.54	0.	111 120 223
63.5534	0.623664	120.913 223.055	0.614417 0.623664	223.055	61.8197	2230.54	0.	0.
63.6476	0.603065	172.165	0.603065	172.165	37.3821	1366.33	0.	0.
63.9643	0.610852	111.77 172.165	0.610852 0.603065	111.77	31.2235	1117.7	0.	0.
64.3853	0.619361	111.77 172.165 189.826	0.610852 0.603065 0.619361	189.826	52.7504	1898.26	0.	0.
64.7703	0.594706	0.	0.	198.401	40.5365	1483.67	0.	198
65.1098	0.612355	134.846	0.612355	134.846	37.635	1348.46	0.	0.
65.1463	0.	0.	0.	0.	0.	0.	0.	0.
66.3219	0.600578	0.	0.	278.002	49.7693	1851.95	0.	278
66.4354	0.610852	0.	0.	111.77	31.2235	1117.7	0.	111
67.4223	0.612355	134.846	0.612355	134.846	37.635	1348.46	0.	0.
67.5988	0.619361	0.	0.	189.826	52.7504	1898.26	0.	189
67.8766	0.623664	223.055	0.623664	223.055	61.8197	2230.54	0.	0.
68.0884	0.619361	172.165 189.826 221.421	0.603065 0.619361 0.608435	189.826	52.7504	1898.26	0.	0.
68.1592	0.603065	172.165	0.603065	172.165	37.3821	1366.33	0.	0.
68.8025	0.623664	223.055	0.623664	223.055	61.8197	2230.54	0.	0.
69.5923	0.608851	0.	0.	151.462	42.3644	1514.62	0.	151 172
70.0362	0.610852	111.77	0.610852	111.77	31.2235	1117.7	0.	0.

70.0407	0.614417	0.	0.	120.913	33.703	1209.13	0.	1209.13
70.124	0.612355	0.	0.	134.846	37.635	1348.46	0.	1348.46
70.9126	0.623664	0.	0.	223.055	61.8197	2230.54	0.	2230.54
70.9422	0.612355	134.846	0.612355	134.846	37.635	1348.46	0.	0.
71.2716	0.619361	221.421	0.608435	189.826	52.7504	1898.26	0.	0.
73.0239	0.	189.826	0.619361	0.	0.	0.	0.	0.
73.3024	0.608435	0.	0.	221.421	23.4866	924.981	0.	0.
73.6682	0.603065	221.421	0.608435	172.165	37.3821	1366.33	0.	172.165
74.8155	0.614417	0.	0.	120.913	33.703	1209.13	0.	0.
74.9836	0.594706	120.913	0.614417	198.401	40.5365	1483.67	0.	198.401
75.2397	0.608851	0.	0.	151.462	42.3644	1514.62	0.	151.462
75.5331	0.623664	0.	0.	223.055	61.8197	2230.54	0.	2230.54
75.8887	0.612355	134.846	0.612355	134.846	37.635	1348.46	0.	0.
76.2151	0.	198.401	0.594706	0.	0.	0.	0.	0.
76.2652	0.623664	278.002	0.600578	223.055	61.8197	2230.54	0.	0.
76.3716	0.612355	0.	0.	111.77	37.635	1348.46	0.	0.
76.5991	0.600578	134.846	0.610852	278.002	49.7693	1851.95	0.	0.
76.7475	0.594706	0.	0.	198.401	40.5365	1483.67	0.	0.
76.8775	0.608435	221.421	0.608435	221.421	23.4866	924.981	0.	0.
77.0747	0.612355	134.846	0.612355	134.846	37.635	1348.46	0.	0.
77.1005	0.	151.462	0.608851	0.	0.	0.	0.	0.
78.1301	0.	0.	0.	0.	0.	0.	0.	0.
78.4219	0.619361	0.	0.	189.826	52.7504	1898.26	0.	0.
79.4401	0.610852	189.826	0.619361	111.77	31.2235	1117.7	0.	0.
79.5714	0.600578	0.	0.	278.002	49.7693	1851.95	0.	278.002
79.9436	0.614417	0.	0.	120.913	33.703	1209.13	0.	1209.13
80.7444	0.614417	0.	0.	120.913	33.703	1209.13	0.	1209.13
81.0932	0.623664	0.	0.	223.055	61.8197	2230.54	0.	0.
81.6501	0.623664	223.055	0.623664	223.055	61.8197	2230.54	0.	0.
82.5101	0.619361	134.846	0.612355	189.826	52.7504	1898.26	0.	0.
83.5154	0.608851	151.462	0.608851	151.462	42.3644	1514.62	0.	151.462
84.3077	0.614417	189.826	0.619361	120.913	33.703	1209.13	0.	0.
85.5641	0.608435	221.421	0.608435	221.421	23.4866	924.981	0.	0.
85.7529	0.608851	0.	0.	151.462	42.3644	1514.62	0.	0.
85.8381	0.614417	151.462	0.608851	120.913	33.703	1209.13	0.	0.
86.1362	0.603065	120.913	0.614417	172.165	37.3821	1366.33	0.	0.

87.4571	0.610852	111.77	0.610852	111.77	31.2235	1117.7	0.	0.
89.0958	0.619361	189.826	0.619361	189.826	52.7504	1898.26	0.	0.
89.7341	0.619361	189.826	0.619361	189.826	52.7504	1898.26	0.	0.
90.9702	0.614417	120.913 151.462 221.421 278.002	0.614417 0.608851 0.608435 0.600578	120.913	33.703	1209.13	0.	0.
91.8361	0.603065	0.	0.	172.165	37.3821	1366.33	0.	172
91.9041	0.608435	0.	0.	221.421	23.4866	924.981	0.	172 221
91.9108	0.	0.	0.	0.	0.	0.	0.	0.
93.4947	0.614417	111.77 120.913	0.610852 0.614417	120.913	33.703	1209.13	0.	0.
94.2308	0.612355	0.	0.	134.846	37.635	1348.46	0.	134 198
95.8128	0.603065	172.165	0.603065	172.165	37.3821	1366.33	0.	0.
96.5926	0.612355	134.846	0.612355	134.846	37.635	1348.46	0.	0.
98.7661	0.600578	278.002	0.600578	278.002	49.7693	1851.95	0.	0.
101.42	0.	0.	0.	0.	0.	0.	0.	0.
101.849	0.594706	0.	0.	198.401	40.5365	1483.67	0.	198
102.152	0.623664	120.913 198.401 189.826 221.421 223.055 278.002	0.614417 0.594706 0.619361 0.608435 0.623664 0.600578	223.055	61.8197	2230.54	0.	0.
102.255	0.594706	198.401	0.594706	198.401	40.5365	1483.67	0.	0.
102.526	0.612355	0.	0.	134.846	37.635	1348.46	0.	134 221
103.776	0.614417	120.913	0.614417	120.913	33.703	1209.13	0.	0.
103.948	0.623664	223.055 278.002	0.623664 0.600578	223.055	61.8197	2230.54	0.	0.
110.573	0.623664	198.401 223.055	0.594706 0.623664	223.055	61.8197	2230.54	0.	0.
110.832	0.608851	151.462 198.401 278.002	0.608851 0.594706 0.600578	151.462	42.3644	1514.62	0.	0.
111.084	0.608851	151.462 198.401	0.608851 0.594706	151.462	42.3644	1514.62	0.	0.
113.325	0.619361	120.913 189.826	0.614417 0.619361	189.826	52.7504	1898.26	0.	0.
116.701	0.	0.	0.	0.	0.	0.	0.	0.
117.487	0.603065	172.165	0.603065	172.165	37.3821	1366.33	0.	0.
130.919	0.608851	151.462 221.421	0.608851 0.608435	151.462	42.3644	1514.62	0.	0.
142.085	0.608435	0.	0.	221.421	23.4866	924.981	0.	221
145.86	0.614417	120.913 134.846 198.401 278.002	0.614417 0.612355 0.594706 0.600578	120.913	33.703	1209.13	0.	0.
150.895	0.603065	172.165	0.603065	172.165	37.3821	1366.33	0.	0.
160.771	0.594706	198.401	0.594706	198.401	40.5365	1483.67	0.	0.
171.025	0.619361	0.	0.	189.826	52.7504	1898.26	0.	151 189
175.126	0.600578	0.	0.	278.002	49.7693	1851.95	0.	278
177.093	0.623664	0.	0.	223.055	61.8197	2230.54	0.	221
178.309	0.619361	0.	0.	189.826	52.7504	1898.26	0.	189

187.203	0.612355	134.846	0.612355	134.846	37.635	1348.46	0.	0.
190.372	0.619361	0.	0.	189.826	52.7504	1898.26	0.	189.
		111.77	0.610852					
207.764	0.610852	172.165	0.603065	111.77	31.2235	1117.7	0.	0.
		221.421	0.608435					
212.93	0.608851	151.462	0.608851	151.462	42.3644	1514.62	0.	0.
229.354	0.594706	198.401	0.594706	198.401	40.5365	1483.67	0.	0.
231.288	0.600578	278.002	0.600578	278.002	49.7693	1851.95	0.	0.
267.714	0.600578	0.	0.	278.002	49.7693	1851.95	0.	278.
291.272	0.610852	111.77	0.610852	111.77	31.2235	1117.7	0.	0.

## Distribution and Updates at End of Period

### Tracking Coalition Membership

```

In[ ]:= coalMember[t_] := (
  For[i = 1, i ≤ numCap, i++,
    capitalists[[t, i, 8]] = If[
      capitalists[[t, i, 5]] > 0.,
      Flatten[Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1]],
      0.
    ];
  ];

  (* Clear[capSort];
  capSort=Sort[Tally[DeleteCases[capitalists[[t,All,8]],0.]]]; *)

  For[j = 1, j ≤ lands, j++,
    coalitions[[t, j, 10]] = Count[capitalists[[t, All, 8]], j]
  ]
)

```

```

In[ ]:= coalMember[1]

```

```

In[ ]:= capitalists[[1]] // TableForm;

```

## Realized Profit Rates and Rents Paid for Coalitions

```

In[*]:= realizedRents[t_] := (
  For[j = 1, j ≤ lands, j++,
    Clear[gamma];
    gamma =
      If[coalitions[[t, j, 4]] > 0., (coalitions[[t, j, 6]] / wage) / coalitions[[t, j, 9]],
        0.];

    coalitions[[t, j, 8]] = If[gamma ≥ 1, coalitions[[t, j, 1]],
      If[0.9 ≤ gamma < 1 &&
        coalitions[[t, j, 1]] < (coalitions[[t, j, 5]] - wage coalitions[[t, j, 4]]),
        coalitions[[t, j, 1]],
        If[0.75 ≤ gamma < 0.9 && (gamma coalitions[[t, j, 1]] <
          (coalitions[[t, j, 5]] - wage coalitions[[t, j, 4]]),
          gamma coalitions[[t, j, 1]],
          If[(2.5 gamma) < 0.75,
            Max[2.5 gamma coalitions[[t, j, 1]], Min[0.5 coalitions[[t, j, 1]],
              0.5 (coalitions[[t, j, 5]] - wage coalitions[[t, j, 4]])]],
            Min[0.5 coalitions[[t, j, 1]],
              0.5 (coalitions[[t, j, 5]] - wage coalitions[[t, j, 4]])]
          ]
        ]
      ]
    ];

  ]
)

```

```

In[*]:= realizedRents[1]

```

```

In[ ]:= realizedProfitRates[t_] := (
  For[j = 1, j ≤ lands, j++,
    coalitions[[t, j, 7]] = If[
      coalitions[[t, j, 4]] > 0.,
       $\frac{1}{\text{wage coalitions}[[t, j, 4]]}$ 
      (alphas[[Flatten[Position[rents[[t]], coalitions[[t, j, 1]]][[1]]]
        coalitions[[t, j, 4]]β - coalitions[[t, j, 8]] - wage coalitions[[t, j, 4]]),
      0.
    ];
  ]
)

```

```

In[ ]:= realizedProfitRates[1]

```

```

In[ ]:= coalitions[[1]] // TableForm

```

```

Out[ ]//TableForm=

```

111.77	10	1096.94	43.3184	1500.71	866.369	0.603175	111.77	31.2
120.913	10	958.093	45.4895	1583.76	909.79	0.607899	120.913	33.7
134.846	10	944.115	52.3259	1814.06	1046.52	0.604575	134.846	37.6
151.462	10	1046.2	47.117	1666.72	942.34	0.607976	151.462	42.3
172.165	10	986.339	37.3821	1366.33	747.641	0.649405	133.169	48.3
198.401	10	1225.52	40.5365	1483.67	810.73	0.707683	99.2007	55.9
189.826	10	840.635	63.2068	2233.79	1264.14	0.616881	189.826	52.7
221.421	10	989.089	23.4866	924.981	469.733	0.733475	110.711	61.9
223.055	10	818.67	63.3855	2281.33	1267.71	0.623614	223.055	61.8
278.002	10	1098.78	49.7693	1851.95	995.386	0.720884	139.001	78.1

## Updating Endowments

```

In[ ]:= endowmentUpdate[t_] := (
  For[
    i = 1, i ≤ numCap, i++,
    capitalists[[t + 1, i, 1]] = capitalists[[t, i, 1]]
  ]
  (* For[i=1, i ≤ numCap, i++,
  If[capitalists[[t, i, 7]] == 0,
    capitalists[[t + 1, i, 1]] = capitalists[[t, i, 1]],
    capitalists[[t + 1, i, 1]] = capitalists[[t, i, 1]] - wage (
       $\frac{\text{capitalists}[[t, i, 1]]}{\text{coalitions}[[t, \text{capitalists}[[t, i, 8], 6]]}$ 
      capitalists[[t, i, 6]] - coalitions[[t, capitalists[[t, i, 8], 1]]
      (If[(L/.maxR[alphas[[Flatten[Position[rents[[t], coalitions[[t, capitalists[
        t, i, 8], 1]]][[1]]], β, coalitions[[t, capitalists[[t, i, 8],
        1]], wage, coalitions[[t, capitalists[[t, i, 8], 3]]][[2]]]) == 0,
        0.,
        coalitions[[t, capitalists[[t, i, 8], 4]] /
        (L/.maxR[alphas[[Flatten[Position[rents[[t], coalitions[[t, capitalists[
          t, i, 8], 1]]][[1]]], β, coalitions[[t, capitalists[[t, i, 8],
          1]], wage, coalitions[[t, capitalists[[t, i, 8], 3]]][[2]]])
      ]  $\frac{\text{capitalists}[[t, i, 1]]}{\text{coalitions}[[t, \text{capitalists}[[t, i, 8], 6]]}$ ) + coalitions[[t, capitalists[[t, i, 8], 7]]
    )
    wage (
       $\frac{\text{capitalists}[[t, i, 1]]}{\text{coalitions}[[t, \text{capitalists}[[t, i, 8], 6]]}$ 
      capitalists[[t, i, 6]]
    )
  ]
  ] *)
)

```

## Individual Capitalist Updates

In[ ]:= **cHeader**

Out[ ]:=

$$\{\rho_{t,i}^c, C_{t,i}^c, \Omega_{t,i}^{c'}, L_{t,i}, Y_{t,i}, \Omega_{t,i}^c, r_{t,i}^c, \tilde{\rho}_{t,i}^c, L_{t,i}^*, C_{t,i}, C_{t,i}', \Omega_{t,i}'\}$$

In[ ]:= **header**

Out[ ]:=

$$\{\Omega_{t,i}^c, r_{t,i}^c, \rho_i, r_{t,i}^c, \rho_{t,i}^c, L_{t,i}, Y_{t,i}, C_{t,i}, \rho_i, r_{t,i}^{c'}, C_{t,i}', \tilde{r}_t, \tilde{\rho}_t, \tilde{C}_t\}$$

Updating realized profit rates for capitalists

```

In[*]:= capProfitRateUpdate[t_] := (
  For[i = 1, i ≤ numCap, i++,
    If[(capitalists[[t, i, 2]] > 0.) && (coalitions[[t, Flatten[
      Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1], 6]] > 0.),
      capitalists[[t, i, 12]] = coalitions[[t,
        Flatten[Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1], 7]],
        capitalists[[t, i, 12]] = 0.
    ]
  ]
)

```

```

In[*]:= capProfitRateUpdate[1]

```

```

In[*]:= capitalists[[1]] // TableForm;

```

Updating rents paid by capitalists (or realized for landowners).

```

In[*]:= capRentPaidUpdate[t_] := (
  For[i = 1, i ≤ numCap, i++,
    If[(capitalists[[t, i, 2]] > 0.) && (coalitions[[t, Flatten[
      Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1], 6]] > 0.),
      capitalists[[t, i, 13]] = coalitions[[t,
        Flatten[Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1], 8]],
        capitalists[[t, i, 13]] = 0.
    ]
  ]
)

```

```

In[*]:= capRentPaidUpdate[1]

```

```

In[*]:= capitalists[[1]] // TableForm;

```

Updating final coalitions capitalists participate in.

```

In[*]:= Flatten[Position[coalitions[[1, All, 1]], capitalists[[1, 1, 5]]][[1]]

```

```

Out[*]=

```

9

```

In[*]:= capCoalitionsUpdate[t_] := (
  For[i = 1, i ≤ numCap, i++,
    If[(capitalists[[t, i, 2]] > 0.) && (coalitions[[t, Flatten[
      Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1], 6]] > 0.),
      capitalists[[t, i, 14]] =
        Flatten[Position[coalitions[[t, All, 1]], capitalists[[t, i, 5]]][[1],
          capitalists[[t, i, 14]] = 0.
    ]
  ]
)

```

```
In[*]:= capCoalitionsUpdate[1]
```

```
In[*]:= capitalists[[1]] // TableForm;
```

---

## Rent Updates

Updating rents over time based on realized profit rates.

```

In[ ]:= rentUpdate[t_] := (
  For[j = 1, j ≤ lands, j++,
    Clear[psi, phi, kappa, zeroProf];

    psi =
      If[coalitions[[t, j, 4]] > 0.,  $\frac{\text{coalitions}[[t, j, 7]]}{\text{Mean}[\text{DeleteCases}[\text{coalitions}[[t, \text{All}, 7]], 0]]}$ , 0.];

    phi = If[coalitions[[t, j, 4]] > 0.,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{coalitions}[[t, j, 1]]}$ , 0.];

    kappa =
      If[coalitions[[t, j, 6]] > 0.,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{wage}}$  / coalitions[[t, j, 9]], 0.];

    zeroProf = alphas[[Flatten[Position[rents[[t]], coalitions[[t, j, 1]]][[1]]]
      coalitions[[t, j, 9]]β - wage coalitions[[t, j, 9]];

    eta = RandomReal[{0.08, 0.12}];

    (* RandomReal[{0.08,0.12}]; *)

    rents[[t + 1, j]] = If[kappa == 1, coalitions[[t, j, 1]],
      If[kappa > 1, (1 + eta) coalitions[[t, j, 1]],
         $\left(1 - \frac{\text{eta}}{3}\right)$  coalitions[[t, j, 1]]
      ]
    ];

  ]
)

```

```

In[ ]:= rentUpdate[1]

```

```
In[*]:= rents[[2]]
Out[*]:= {124.512, 135.291, 150.928, 167.04, 166.73, 192.253, 207.17, 214.194, 242.984, 268.71}
```

---

## Simulation Runs

### Initialization

Set parameters:  $T$ , lands  $\mathcal{L} = \{1, \dots, n\}$ ,  $\alpha = (\alpha_1, \dots, \alpha_n)$ ,  $\beta$ , and number of capitalists.

```
In[*]:= T = 300;
lands = 10;
β = 0.9;
numCap = 100;
```

```
In[*]:= alphas = Table[50 + i / 2., {i, 1, lands}]
```

```
Out[*]:= {50.5, 51., 51.5, 52., 52.5, 53., 53.5, 54., 54.5, 55.}
```

Initializing agent and coalition sets

```
In[*]:= coalitions = Table[Table[
    {0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0}, {lands}], {T}];
capitalists = Table[Table[{0.0, 0.0, 0.0, 0.0, 0.0,
    0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0}, {numCap}], {T}];
```

```
In[ ]:= (* initialWageFunds=Table[RandomInteger[{50,100}],{numCap}] *)
Omega = 10 000;
(*fundShares=Normalize[Table[RandomReal[{0,1}],{numCap}],Total]; *)
fundShares = Normalize[Sort[RandomVariate[
  TruncatedDistribution[{625.682, 0.4 Omega}, EstimatedDistribution[
    capAlloc[[All, 2]], ParetoDistribution[k,  $\alpha$ ]], numCap]], Total];
(*fundShares=Normalize[Table[i, {i,  $\frac{0.4}{numCap}$ , 0.4,  $\frac{0.4}{numCap}$ }], Total]; *)
initialWageFunds = Omega fundShares
```

```
Out[ ]:= {65.9732, 65.9999, 66.1417, 66.5713, 66.7918, 66.8861, 67.0654, 67.2479, 67.3331,
68.4097, 68.613, 68.7845, 68.7921, 69.3751, 69.5077, 70.104, 70.2172, 70.4382,
70.4614, 70.675, 70.8006, 70.8231, 71.7875, 71.8838, 71.9614, 72.1568, 72.1929,
72.5858, 72.975, 73.1554, 73.5819, 74.0157, 75.0122, 76.389, 77.889, 78.116,
78.6558, 80.0232, 80.8609, 81.5682, 81.5964, 81.7676, 82.3243, 82.5923,
82.8987, 83.1522, 83.6291, 83.7085, 84.5299, 84.7582, 85.1217, 86.0744,
86.0817, 87.2886, 87.9961, 89.1102, 90.4171, 90.551, 92.2178, 95.5925,
96.3343, 97.5745, 97.6521, 99.3778, 101.952, 103.969, 104.085, 104.277,
104.474, 104.905, 105.013, 105.307, 105.56, 108.346, 110.556, 112.896,
114.382, 114.429, 116.083, 116.288, 122.523, 124.729, 126.087, 127.403,
130.389, 133.033, 133.574, 137.282, 141.103, 147.877, 148.27, 148.287,
158.802, 166.363, 170.631, 192.139, 201.39, 240.123, 271.454, 271.851}
```

```
In[ ]:= Min[initialWageFunds]
```

```
Out[ ]:=
65.9732
```

```
In[ ]:= Max[initialWageFunds]
```

```
Out[ ]:=
271.851
```

Setting capitalist initial wage funds

```
In[ ]:= capitalists[[1, All, 1]] = initialWageFunds;
```

Labor supply and wage

```
In[ ]:= laborSupply = 500;
```

```
In[ ]:= Clear[wage];
wage = N[Total[initialWageFunds] / laborSupply]
(* wage=1; *)
```

```
Out[ ]:=
20.
```

Initializing rents over  $T$  and number of recipients of rental announcements.

```
In[*]:= rents = Table[Table[0.0, {lands}], {T}];
announcements = 20;
```

Set active lands across  $T$

```
In[*]:= activeLands = Table[0.0, {T}];
```

## Simulation Run

Initialize rent announcements for first time period.

```
In[*]:= rentsAnnounce[1]
```

```
Out[*]:= {120.978, 111.517, 143.124, 147.419,
163.391, 177.157, 192.484, 220.707, 228.113, 279.855}
```

Simulation sequence.

```
In[*]:= simulationRun[t_] := (
  communicateRents[t];
  coalitionFormation[t];
  potentialProfitRates[t];
  checkMaxR[t];
  rentPaid[t];
  wageFundUpdate[t];

  Clear[unassigned];
  unassigned = Count[capitalists[[t, All, 2]], 0.];
  If[unassigned > 0,
    communicateSecondRound[t],
  ];
  If[unassigned > 0,
    secondaryCoalitionFormation[t],
  ];
  If[unassigned > 0,
    secondaryPotentialProfitRates[t],
  ];
  If[unassigned > 0,
    checkSecondaryMaxR[t],
  ];
  If[unassigned > 0,
    rentPaidSecondary[t],
  ];
  If[unassigned > 0,
```

```

    secondaryWageFundUpdate[t],
  ];

  optL[t];
  coalitionLabor[t];
  laborHired[t];
  coalitionProduction[t];
  production[t];
  coalMember[t];
  realizedRents[t];
  realizedProfitRates[t];
  endowmentUpdate[t];
  capProfitRateUpdate[t];
  capRentPaidUpdate[t];
  capCoalitionsUpdate[t];
  rentUpdate[t];
  Print[Style["t=" <> ToString[t] <> ":", Underlined]];
  Print[TableForm[coalitions[[t]], TableHeadings -> {None, cHeader}]];
  Print[TableForm[capitalists[[t]], TableHeadings -> {None, header}]];
)

```

Running the simulation and exporting raw results.

```

In[*]:= Do[
  simulationRun[t],
  {t, 1, T}
Do[
  Export["./coalitions_t" <> ToString[t] <> ".csv", coalitions[[t]], "CSV"],
  {t, 1, T}
]
Do[
  Export["./capitalists_t" <> ToString[t] <> ".csv", capitalists[[t]], "CSV"],
  {t, 1, T}
]

```

t=1:

$\rho_{t,i}^C$	$C_{t,i}^C$	$\Omega_{t,i}^C$	$L_{t,i}$	$Y_{t,i}$	$\Omega_{t,i}^C$	$r_t^C$	$\tilde{\rho}_{t,i}^C$	$L_{t,i}^*$
120.978	20	1849.42	7.92426	325.353	158.485	0.609349	70.2946	34.0944
111.517	20	2151.12	107.556	3435.9	2151.12	0.545423	111.517	30.806
143.124	20	2039.05	11.0514	447.594	221.029	0.580127	98.3405	40.2106
147.419	20	2137.26	47.8724	1690.75	957.447	0.611924	147.419	41.1099
163.391	20	1915.92	29.5215	1104.8	590.431	0.732814	81.6953	45.6
177.157	20	1818.5	69.132	2398.76	1382.64	0.606784	177.157	49.3658
192.484	20	2064.56	47.916	1740.95	958.32	0.637017	172.163	53.5716
220.707	20	2252.44	40.7248	1517.98	814.496	0.728221	110.354	61.7262
228.113	20	1941.45	75.0117	2654.68	1500.23	0.617461	228.113	63.3794
279.855	20	1914.72	17.2882	715.05	345.763	0.623758	153.615	78.7387

$\Omega_t^C$	$r_t^C$	$\rho_i$	$r_{t,i}^C$	$\rho_t^C$	$L_{t,i}$	$Y_{t,i}$	$C_{t,i}$	$\rho_i^*$
		120.978	0.596745					
65.9732	0.613694	143.124	0.601717					
		147.419	0.613694	147.419	41.1099	1474.19	4	0.
		163.391	0.61241					
		163.391	0.61241					
65.9999	0.614901	177.157	0.614901	177.157	49.3658	1771.57	6	0.
		220.707	0.609012					
66.1417	0.614901	177.157	0.614901	177.157	49.3658	1771.57	6	0.
66.5713	0.613694	120.978	0.596745	147.419	41.1099	1474.19	4	0.
		147.419	0.613694					
66.7918	0.616862	192.484	0.616862	192.484	47.916	1740.95	7	0.
		163.391	0.61241					
66.8861	0.614901	177.157	0.614901	177.157	49.3658	1771.57	6	0.
		220.707	0.609012					
		279.855	0.599397					
67.0654	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
67.2479	0.616862	192.484	0.616862	192.484	47.916	1740.95	7	0.
		279.855	0.599397					
67.3331	0.616862	163.391	0.61241					
		192.484	0.616862	192.484	47.916	1740.95	7	0.
		220.707	0.609012					
68.4097	0.616862	120.978	0.596745	192.484	47.916	1740.95	7	0.
		192.484	0.616862					
68.613	0.616862	163.391	0.61241	192.484	47.916	1740.95	7	0.
		192.484	0.616862					
								120.978
								111.517
								143.124
								147.419
68.7845	0.628993	0.	0.	111.517	30.806	1115.17	2	163.391
								177.157
								220.707
								228.113
								279.855
68.7921	0.619624	228.113	0.619624	228.113	63.3794	2281.13	9	0.
69.3751	0.596745	120.978	0.596745	120.978	7.92426	325.353	1	0.
		163.391	0.61241					
69.5077	0.614901	177.157	0.614901	177.157	49.3658	1771.57	6	0.
		279.855	0.599397					
		111.517	0.628993					
70.104	0.628993	143.124	0.601717	111.517	30.806	1115.17	2	0.
		279.855	0.599397					
		120.978	0.596745					
70.2172	0.609012	143.124	0.601717	220.707	40.7248	1517.98	8	0.
		220.707	0.609012					
70.4382	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
		279.855	0.599397					
		111.517	0.628993					
70.4614	0.628993	163.391	0.61241	111.517	30.806	1115.17	2	0.
		228.113	0.619624					

70.675	0.619624	228.113 279.855	0.619624 0.599397	228.113	63.3794	2281.13	9	0. 120.978 111.517 143.124 147.419 163.391 177.157 192.484 220.707 228.113 279.855
70.8006	0.628993	0.	0.	111.517	30.806	1115.17	2	120.978 111.517 143.124 147.419 177.157 192.484 220.707 228.113 279.855
70.8231	0.628993	0.	0.	111.517	30.806	1115.17	2	120.978 111.517 143.124 147.419 177.157 192.484 220.707 228.113
71.7875	0.599397	279.855	0.599397	279.855	17.2882	715.05	10	0.
71.8838	0.628993	111.517 228.113	0.628993 0.619624	111.517	30.806	1115.17	2	0.
71.9614	0.619624	228.113	0.619624	228.113	63.3794	2281.13	9	0.
72.1568	0.628993	120.978 111.517 147.419 192.484 279.855	0.596745 0.628993 0.613694 0.616862 0.599397	111.517	30.806	1115.17	2	0.
72.1929	0.614901	120.978 163.391 177.157	0.596745 0.61241 0.614901	177.157	49.3658	1771.57	6	0.
72.5858	0.599397	279.855	0.599397	279.855	17.2882	715.05	10	0.
72.975	0.614901	147.419 177.157	0.613694 0.614901	177.157	49.3658	1771.57	6	0.
73.1554	0.619624	228.113	0.619624	228.113	63.3794	2281.13	9	0.
73.5819	0.61241	120.978 163.391	0.596745 0.61241	163.391	29.5215	1104.8	5	0.
74.0157	0.614901	120.978 177.157 279.855	0.596745 0.614901 0.599397	177.157	49.3658	1771.57	6	0.
75.0122	0.628993	0.	0.	111.517	30.806	1115.17	2	111.517 147.419 163.391 177.157 192.484 228.113 279.855
76.389	0.613694	147.419 220.707	0.613694 0.609012	147.419	41.1099	1474.19	4	0.
77.889	0.619624	147.419 192.484 228.113	0.613694 0.616862 0.619624	228.113	63.3794	2281.13	9	0.
78.116	0.616862	192.484	0.616862	192.484	47.916	1740.95	7	0.
78.6558	0.628993	111.517 192.484 220.707	0.628993 0.616862 0.609012	111.517	30.806	1115.17	2	0.
80.0232	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
80.8609	0.614901	177.157 279.855	0.614901 0.599397	177.157	49.3658	1771.57	6	0.
81.5682	0.619624	228.113 279.855	0.619624 0.599397	228.113	63.3794	2281.13	9	0.
81.5964	0.619624	220.707 228.113	0.609012 0.619624	228.113	63.3794	2281.13	9	0.
81.7676	0.614901	177.157 220.707	0.614901 0.609012	177.157	49.3658	1771.57	6	0.

82.3243	0.613694	147.419 220.707	0.613694 0.609012	147.419	41.1099	1474.19	4	0.
82.5923	0.616862	192.484 111.517	0.616862 0.628993	192.484	47.916	1740.95	7	0.
82.8987	0.628993	220.707 228.113 279.855	0.609012 0.619624 0.599397	111.517	30.806	1115.17	2	0.
83.1522	0.628993	0.	0.	111.517	30.806	1115.17	2	120.978 111.517 143.124 147.419 163.391 177.157 192.484 220.707 228.113 279.855
83.6291	0.619624	120.978 147.419 192.484 228.113	0.596745 0.613694 0.616862 0.619624	228.113	63.3794	2281.13	9	0.
83.7085	0.619624	143.124 163.391 228.113 279.855	0.601717 0.61241 0.619624 0.599397	228.113	63.3794	2281.13	9	0.
84.5299	0.614901	147.419 177.157	0.613694 0.614901	177.157	49.3658	1771.57	6	0.
84.7582	0.619624	177.157 228.113	0.614901 0.619624	228.113	63.3794	2281.13	9	0.
85.1217	0.614901	177.157	0.614901	177.157	49.3658	1771.57	6	0.
86.0744	0.628993	0.	0.	111.517	30.806	1115.17	2	120.978 111.517 143.124 147.419 163.391 177.157 192.484 220.707 228.113 279.855
86.0817	0.619624	143.124 163.391 228.113	0.601717 0.61241 0.619624	228.113	63.3794	2281.13	9	0.
87.2886	0.619624	120.978 177.157 228.113	0.596745 0.614901 0.619624	228.113	63.3794	2281.13	9	0.
87.9961	0.601717	120.978 143.124	0.596745 0.601717	143.124	11.0514	447.594	3	0.
89.1102	0.596745	120.978	0.596745	120.978	7.92426	325.353	1	0.
90.4171	0.609012	143.124 220.707	0.601717 0.609012	220.707	40.7248	1517.98	8	0.
90.551	0.619624	0.	0.	228.113	63.3794	2281.13	9	120.978 143.124 147.419 163.391 177.157 192.484 220.707 228.113 279.855
92.2178	0.614901	120.978 177.157	0.596745 0.614901	177.157	49.3658	1771.57	6	0.

								120.978
								111.517
								143.124
								147.419
95.5925	0.628993	0.	0.	111.517	30.806	1115.17	2	163.391
								192.484
								220.707
								228.113
								279.855
96.3343	0.61241	143.124	0.601717	163.391	29.5215	1104.8	5	0.
		163.391	0.61241					
97.5745	0.61241	143.124	0.601717	163.391	29.5215	1104.8	5	0.
		163.391	0.61241					
97.6521	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
		279.855	0.599397					
99.3778	0.614901	177.157	0.614901	177.157	49.3658	1771.57	6	0.
101.952	0.61241	163.391	0.61241	163.391	29.5215	1104.8	5	0.
		220.707	0.609012					
								120.978
								111.517
								143.124
								163.391
103.969	0.628993	0.	0.	111.517	30.806	1115.17	2	177.157
								192.484
								220.707
								279.855
104.085	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
		120.978	0.596745					
104.277	0.616862	192.484	0.616862	192.484	47.916	1740.95	7	0.
		220.707	0.609012					
104.474	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
		147.419	0.613694					
104.905	0.61241	120.978	0.596745	163.391	29.5215	1104.8	5	0.
		143.124	0.601717					
		163.391	0.61241					
		143.124	0.601717					
105.013	0.616862	147.419	0.613694	192.484	47.916	1740.95	7	0.
		177.157	0.614901					
		192.484	0.616862					
		143.124	0.601717					
105.307	0.613694	147.419	0.613694	147.419	41.1099	1474.19	4	0.
		220.707	0.609012					
		143.124	0.601717					
105.56	0.619624	192.484	0.616862	228.113	63.3794	2281.13	9	0.
		220.707	0.609012					
		228.113	0.619624					
		143.124	0.601717					
108.346	0.614901	147.419	0.613694	177.157	49.3658	1771.57	6	0.
		177.157	0.614901					
110.556	0.609012	220.707	0.609012	220.707	40.7248	1517.98	8	0.
112.896	0.619624	143.124	0.601717	228.113	63.3794	2281.13	9	0.
		228.113	0.619624					
		120.978	0.596745					
114.382	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
		143.124	0.601717					
		228.113	0.619624					
114.429	0.614901	177.157	0.614901	177.157	49.3658	1771.57	6	0.
116.083	0.61241	163.391	0.61241	163.391	29.5215	1104.8	5	0.
116.288	0.613694	147.419	0.613694	147.419	41.1099	1474.19	4	0.
122.523	0.616862	143.124	0.601717	192.484	47.916	1740.95	7	0.
		192.484	0.616862					

								120.978
								111.517
								143.124
								147.419
124.729	0.628993	0.	0.	111.517	30.806	1115.17	2	163.391
								177.157
								192.484
								220.707
								228.113
								279.855
126.087	0.613694	147.419	0.613694	147.419	41.1099	1474.19	4	0.
		120.978	0.596745					
127.403	0.616862	163.391	0.61241	192.484	47.916	1740.95	7	0.
		192.484	0.616862					
		111.517	0.628993					
130.389	0.628993	143.124	0.601717	111.517	30.806	1115.17	2	0.
		147.419	0.613694					
		163.391	0.61241					
133.033	0.601717	143.124	0.601717	143.124	11.0514	447.594	3	0.
		279.855	0.599397					
		120.978	0.596745					
133.574	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
		192.484	0.616862					
		279.855	0.599397					
137.282	0.628993	111.517	0.628993	111.517	30.806	1115.17	2	0.
								120.978
								111.517
								143.124
								147.419
141.103	0.628993	0.	0.	111.517	30.806	1115.17	2	163.391
								177.157
								192.484
								220.707
								228.113
								279.855
147.877	0.613694	147.419	0.613694	147.419	41.1099	1474.19	4	0.
		147.419	0.613694					
148.27	0.614901	177.157	0.614901	177.157	49.3658	1771.57	6	0.
		279.855	0.599397					
		111.517	0.628993					
148.287	0.628993	143.124	0.601717	111.517	30.806	1115.17	2	0.
		192.484	0.616862					
		111.517	0.628993					
158.802	0.628993	163.391	0.61241	111.517	30.806	1115.17	2	0.
		177.157	0.614901					
		111.517	0.628993					
166.363	0.628993	192.484	0.616862	111.517	30.806	1115.17	2	0.
		220.707	0.609012					
		279.855	0.599397					
170.631	0.613694	147.419	0.613694	147.419	41.1099	1474.19	4	0.
		220.707	0.609012					
		120.978	0.596745					
		111.517	0.628993					
192.139	0.628993	147.419	0.613694	111.517	30.806	1115.17	2	0.
		163.391	0.61241					
		228.113	0.619624					
201.39	0.599397	279.855	0.599397	279.855	17.2882	715.05	10	0.
		192.484	0.616862					
240.123	0.619624	228.113	0.619624	228.113	63.3794	2281.13	9	0.
271.454	0.609012	220.707	0.609012	220.707	40.7248	1517.98	8	0.
271.851	0.609012	220.707	0.609012	220.707	40.7248	1517.98	8	0.

t=2:

In[\*]:=

## Results

### Rents & Coalition Headcounts

In[\*]:= **cHeader**

Out[\*]=

$$\{\rho_{t,i}^C, C_{t,i}^C, \Omega_{t,i}^{C'}, L_{t,i}, Y_{t,i}, \Omega_{t,i}^C, r_{t,i}^C, \tilde{\rho}_{t,i}^C, L_{t,i}^*, C_{t,i}, C_{t,i}', \Omega_{t,i}'\}$$
In[\*]:= **coalitions[[1]] // TableForm**

Out[\*]//TableForm=

120.978	20	1849.42	7.92426	325.353	158.485	0.609349	70.2946	34.6
111.517	20	2151.12	107.556	3435.9	2151.12	0.545423	111.517	30.8
143.124	20	2039.05	11.0514	447.594	221.029	0.580127	98.3405	40.2
147.419	20	2137.26	47.8724	1690.75	957.447	0.611924	147.419	41.1
163.391	20	1915.92	29.5215	1104.8	590.431	0.732814	81.6953	45.6
177.157	20	1818.5	69.132	2398.76	1382.64	0.606784	177.157	49.3
192.484	20	2064.56	47.916	1740.95	958.32	0.637017	172.163	53.5
220.707	20	2252.44	40.7248	1517.98	814.496	0.728221	110.354	61.7
228.113	20	1941.45	75.0117	2654.68	1500.23	0.617461	228.113	63.3
279.855	20	1914.72	17.2882	715.05	345.763	0.623758	153.615	78.7

In[\*]:= **header**

Out[\*]=

$$\{\Omega_{t,i}^C, r_{t,i}^C, \rho_i, r_{t,i}^C, \rho_{t,i}^C, L_{t,i}, Y_{t,i}, C_{t,i}, \rho_i, r_{t,i}^{C'}, C_{t,i}', \tilde{r}_t, \tilde{\rho}_t, \tilde{C}_t\}$$

Coalition headcounts

```
In[*]:= Table[{t, numCap - Total[coalitions[[t, All, 10]]]}, {t, 1, T}]
```

```
Out[*]=
```

```
{ {1, 0}, {2, 0}, {3, 0}, {4, 0}, {5, 0}, {6, 0}, {7, 0}, {8, 0}, {9, 0}, {10, 0},
  {11, 0}, {12, 0}, {13, 0}, {14, 0}, {15, 0}, {16, 0}, {17, 0}, {18, 0}, {19, 0},
  {20, 0}, {21, 0}, {22, 0}, {23, 0}, {24, 0}, {25, 0}, {26, 0}, {27, 0}, {28, 0},
  {29, 0}, {30, 0}, {31, 0}, {32, 0}, {33, 0}, {34, 0}, {35, 0}, {36, 0}, {37, 0},
  {38, 0}, {39, 0}, {40, 0}, {41, 0}, {42, 0}, {43, 0}, {44, 0}, {45, 0}, {46, 0},
  {47, 0}, {48, 0}, {49, 0}, {50, 0}, {51, 0}, {52, 0}, {53, 0}, {54, 0}, {55, 0},
  {56, 0}, {57, 0}, {58, 0}, {59, 0}, {60, 0}, {61, 0}, {62, 0}, {63, 0}, {64, 0},
  {65, 0}, {66, 0}, {67, 0}, {68, 0}, {69, 0}, {70, 0}, {71, 0}, {72, 0}, {73, 0},
  {74, 0}, {75, 0}, {76, 0}, {77, 0}, {78, 0}, {79, 0}, {80, 0}, {81, 0}, {82, 0},
  {83, 0}, {84, 0}, {85, 0}, {86, 0}, {87, 0}, {88, 0}, {89, 0}, {90, 0}, {91, 0},
  {92, 0}, {93, 0}, {94, 0}, {95, 0}, {96, 0}, {97, 0}, {98, 0}, {99, 0}, {100, 0},
  {101, 0}, {102, 0}, {103, 0}, {104, 0}, {105, 0}, {106, 0}, {107, 0}, {108, 0},
  {109, 0}, {110, 0}, {111, 0}, {112, 0}, {113, 0}, {114, 0}, {115, 0}, {116, 0},
  {117, 0}, {118, 0}, {119, 0}, {120, 0}, {121, 0}, {122, 0}, {123, 0}, {124, 0},
  {125, 0}, {126, 0}, {127, 0}, {128, 0}, {129, 0}, {130, 0}, {131, 0}, {132, 0},
  {133, 0}, {134, 0}, {135, 0}, {136, 0}, {137, 0}, {138, 0}, {139, 0}, {140, 0},
  {141, 0}, {142, 0}, {143, 0}, {144, 0}, {145, 0}, {146, 0}, {147, 0}, {148, 0},
  {149, 0}, {150, 0}, {151, 0}, {152, 0}, {153, 0}, {154, 0}, {155, 0}, {156, 0},
  {157, 0}, {158, 0}, {159, 0}, {160, 0}, {161, 0}, {162, 0}, {163, 0}, {164, 0},
  {165, 0}, {166, 0}, {167, 0}, {168, 0}, {169, 0}, {170, 0}, {171, 0}, {172, 0},
  {173, 0}, {174, 0}, {175, 0}, {176, 0}, {177, 0}, {178, 0}, {179, 0}, {180, 0},
  {181, 0}, {182, 0}, {183, 0}, {184, 0}, {185, 0}, {186, 0}, {187, 0}, {188, 0},
  {189, 0}, {190, 0}, {191, 0}, {192, 0}, {193, 0}, {194, 0}, {195, 0}, {196, 0},
  {197, 0}, {198, 0}, {199, 0}, {200, 0}, {201, 0}, {202, 0}, {203, 0}, {204, 0},
  {205, 0}, {206, 0}, {207, 0}, {208, 0}, {209, 0}, {210, 0}, {211, 0}, {212, 0},
  {213, 0}, {214, 0}, {215, 0}, {216, 0}, {217, 0}, {218, 0}, {219, 0}, {220, 0},
  {221, 0}, {222, 0}, {223, 0}, {224, 0}, {225, 0}, {226, 0}, {227, 0}, {228, 0},
  {229, 0}, {230, 0}, {231, 0}, {232, 0}, {233, 0}, {234, 0}, {235, 0}, {236, 0},
  {237, 0}, {238, 0}, {239, 0}, {240, 0}, {241, 0}, {242, 0}, {243, 0}, {244, 0},
  {245, 0}, {246, 0}, {247, 0}, {248, 0}, {249, 0}, {250, 0}, {251, 0}, {252, 0},
  {253, 0}, {254, 0}, {255, 0}, {256, 0}, {257, 0}, {258, 0}, {259, 0}, {260, 0},
  {261, 0}, {262, 0}, {263, 0}, {264, 0}, {265, 0}, {266, 0}, {267, 0}, {268, 0},
  {269, 0}, {270, 0}, {271, 0}, {272, 0}, {273, 0}, {274, 0}, {275, 0}, {276, 0},
  {277, 0}, {278, 0}, {279, 0}, {280, 0}, {281, 0}, {282, 0}, {283, 0}, {284, 0},
  {285, 0}, {286, 0}, {287, 0}, {288, 0}, {289, 0}, {290, 0}, {291, 0}, {292, 0},
  {293, 0}, {294, 0}, {295, 0}, {296, 0}, {297, 0}, {298, 0}, {299, 0}, {300, 0} }
```

```
In[*]:= Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 1, T}], {j, 1, lands}],
  Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 1, T}]]
```

Out[\*]=

```
{ { {1, 2}, {2, 3}, {3, 6}, {4, 6}, {5, 5}, {6, 15}, {7, 4}, {8, 9}, {9, 4}, {10, 3}, {11, 7}, {12, 13},
  {13, 6}, {14, 12}, {15, 0}, {16, 2}, {17, 8}, {18, 13}, {19, 3}, {20, 5}, {21, 12}, {22, 2},
  {23, 9}, {24, 1}, {25, 4}, {26, 7}, {27, 12}, {28, 2}, {29, 3}, {30, 9}, {31, 2}, {32, 4}, {33, 6},
  {34, 15}, {35, 3}, {36, 2}, {37, 3}, {38, 10}, {39, 0}, ... 222 ..., {262, 3}, {263, 2}, {264, 12},
  {265, 2}, {266, 6}, {267, 8}, {268, 8}, {269, 3}, {270, 2}, {271, 5}, {272, 14}, {273, 1}, {274, 6},
  {275, 10}, {276, 13}, {277, 1}, {278, 4}, {279, 6}, {280, 10}, {281, 2}, {282, 1}, {283, 9},
  {284, 6}, {285, 18}, {286, 3}, {287, 7}, {288, 7}, {289, 2}, {290, 5}, {291, 5}, {292, 14},
  {293, 5}, {294, 6}, {295, 10}, {296, 4}, {297, 2}, {298, 3}, {299, 7}, {300, 16} }, ... 10 ... }
```

Full expression not available (original memory size: 318.7 kB)

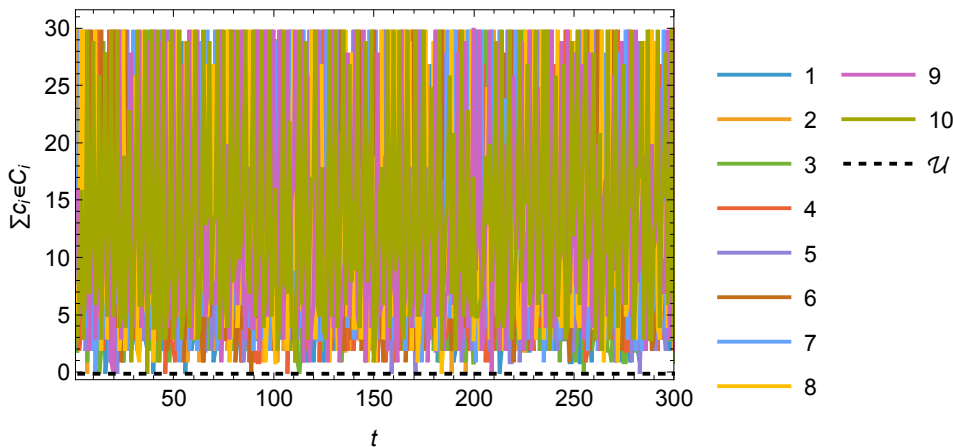


```

In[ ]:= coalitionHeadcount = ListLinePlot[
  Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 1, T}], {j, 1, lands}],
    Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 1, T}]],
  PlotRange -> {{1, T}, All}, Frame -> True, FrameLabel -> {"t", " $\sum_{C_i \in C_i}$ "},
  PlotStyle -> Append[Table[Automatic, {lands}], {Thick, Dashed, Black}],
  PlotLegends -> Append[Table[i, {i, 1, lands}], "u"], LabelStyle -> 12]
coalitionHeadcountGray = ListLinePlot[
  Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 1, T}], {j, 1, lands}],
    Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 1, T}]],
  PlotRange -> {{1, T}, All}, Frame -> True, FrameLabel -> {"t", " $\sum_{C_i \in C_i}$ "},
  PlotStyle -> Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends -> Append[Table[i, {i, 1, lands}], "u"], LabelStyle -> 12];
Export["./coalitionHeadcount.eps", coalitionHeadcount, "EPS"];
Export["./coalitionHeadcount.jpg", coalitionHeadcount, "JPEG"];
Export["./coalitionHeadcountGray.eps", coalitionHeadcountGray, "EPS"];
Export["./coalitionHeadcountGray.jpg", coalitionHeadcountGray, "JPEG"];

```

Out[ ]:=



## Rents

```
In[ ]:= rhoSols[All, 2]
```

Out[ ]:=

```
{111.965, 123.558, 136.22, 150.038,
 165.106, 181.521, 199.391, 218.83, 239.957, 262.903}
```

```
In[*]:= Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }, {t, 1, T}], {j, 1, lands}],
Table[{t, 1.}, {t, 1, T}]]
```

Out[\*]=

```
{{{1, 0.627826}, {2, 0.520807}, {3, 1.00227}, {4, 0.560696}, {5, 0.895791}, {6, 1.04419}, {7, 0.579647},
{8, 1.127}, {9, 0.619173}, {10, 0.601634}, {11, 1.01202}, {12, 1.12314}, ... 276 ..., {289, 0.789347},
{290, 1.11183}, {291, 0.642924}, {292, 1.23703}, {293, 0.689476}, {294, 1.06713}, {295, 1.29189},
{296, 0.707173}, {297, 0.68749}, {298, 0.664321}, {299, 1.28393}, {300, 1.23863}}, ... 10 ... }
```

Full expression not available (original memory size: 318.7 kB)



```
In[*]:= Table[{t, 1.}, {t, 1, T}]
```

```
Out[*]=
```

```
{ {1, 1.}, {2, 1.}, {3, 1.}, {4, 1.}, {5, 1.}, {6, 1.}, {7, 1.}, {8, 1.}, {9, 1.},
  {10, 1.}, {11, 1.}, {12, 1.}, {13, 1.}, {14, 1.}, {15, 1.}, {16, 1.}, {17, 1.},
  {18, 1.}, {19, 1.}, {20, 1.}, {21, 1.}, {22, 1.}, {23, 1.}, {24, 1.}, {25, 1.},
  {26, 1.}, {27, 1.}, {28, 1.}, {29, 1.}, {30, 1.}, {31, 1.}, {32, 1.}, {33, 1.},
  {34, 1.}, {35, 1.}, {36, 1.}, {37, 1.}, {38, 1.}, {39, 1.}, {40, 1.}, {41, 1.},
  {42, 1.}, {43, 1.}, {44, 1.}, {45, 1.}, {46, 1.}, {47, 1.}, {48, 1.}, {49, 1.},
  {50, 1.}, {51, 1.}, {52, 1.}, {53, 1.}, {54, 1.}, {55, 1.}, {56, 1.}, {57, 1.},
  {58, 1.}, {59, 1.}, {60, 1.}, {61, 1.}, {62, 1.}, {63, 1.}, {64, 1.}, {65, 1.},
  {66, 1.}, {67, 1.}, {68, 1.}, {69, 1.}, {70, 1.}, {71, 1.}, {72, 1.}, {73, 1.},
  {74, 1.}, {75, 1.}, {76, 1.}, {77, 1.}, {78, 1.}, {79, 1.}, {80, 1.}, {81, 1.},
  {82, 1.}, {83, 1.}, {84, 1.}, {85, 1.}, {86, 1.}, {87, 1.}, {88, 1.}, {89, 1.},
  {90, 1.}, {91, 1.}, {92, 1.}, {93, 1.}, {94, 1.}, {95, 1.}, {96, 1.}, {97, 1.},
  {98, 1.}, {99, 1.}, {100, 1.}, {101, 1.}, {102, 1.}, {103, 1.}, {104, 1.},
  {105, 1.}, {106, 1.}, {107, 1.}, {108, 1.}, {109, 1.}, {110, 1.}, {111, 1.},
  {112, 1.}, {113, 1.}, {114, 1.}, {115, 1.}, {116, 1.}, {117, 1.}, {118, 1.},
  {119, 1.}, {120, 1.}, {121, 1.}, {122, 1.}, {123, 1.}, {124, 1.}, {125, 1.},
  {126, 1.}, {127, 1.}, {128, 1.}, {129, 1.}, {130, 1.}, {131, 1.}, {132, 1.},
  {133, 1.}, {134, 1.}, {135, 1.}, {136, 1.}, {137, 1.}, {138, 1.}, {139, 1.},
  {140, 1.}, {141, 1.}, {142, 1.}, {143, 1.}, {144, 1.}, {145, 1.}, {146, 1.},
  {147, 1.}, {148, 1.}, {149, 1.}, {150, 1.}, {151, 1.}, {152, 1.}, {153, 1.},
  {154, 1.}, {155, 1.}, {156, 1.}, {157, 1.}, {158, 1.}, {159, 1.}, {160, 1.},
  {161, 1.}, {162, 1.}, {163, 1.}, {164, 1.}, {165, 1.}, {166, 1.}, {167, 1.},
  {168, 1.}, {169, 1.}, {170, 1.}, {171, 1.}, {172, 1.}, {173, 1.}, {174, 1.},
  {175, 1.}, {176, 1.}, {177, 1.}, {178, 1.}, {179, 1.}, {180, 1.}, {181, 1.},
  {182, 1.}, {183, 1.}, {184, 1.}, {185, 1.}, {186, 1.}, {187, 1.}, {188, 1.},
  {189, 1.}, {190, 1.}, {191, 1.}, {192, 1.}, {193, 1.}, {194, 1.}, {195, 1.},
  {196, 1.}, {197, 1.}, {198, 1.}, {199, 1.}, {200, 1.}, {201, 1.}, {202, 1.},
  {203, 1.}, {204, 1.}, {205, 1.}, {206, 1.}, {207, 1.}, {208, 1.}, {209, 1.},
  {210, 1.}, {211, 1.}, {212, 1.}, {213, 1.}, {214, 1.}, {215, 1.}, {216, 1.},
  {217, 1.}, {218, 1.}, {219, 1.}, {220, 1.}, {221, 1.}, {222, 1.}, {223, 1.},
  {224, 1.}, {225, 1.}, {226, 1.}, {227, 1.}, {228, 1.}, {229, 1.}, {230, 1.},
  {231, 1.}, {232, 1.}, {233, 1.}, {234, 1.}, {235, 1.}, {236, 1.}, {237, 1.},
  {238, 1.}, {239, 1.}, {240, 1.}, {241, 1.}, {242, 1.}, {243, 1.}, {244, 1.},
  {245, 1.}, {246, 1.}, {247, 1.}, {248, 1.}, {249, 1.}, {250, 1.}, {251, 1.},
  {252, 1.}, {253, 1.}, {254, 1.}, {255, 1.}, {256, 1.}, {257, 1.}, {258, 1.},
  {259, 1.}, {260, 1.}, {261, 1.}, {262, 1.}, {263, 1.}, {264, 1.}, {265, 1.},
  {266, 1.}, {267, 1.}, {268, 1.}, {269, 1.}, {270, 1.}, {271, 1.}, {272, 1.},
  {273, 1.}, {274, 1.}, {275, 1.}, {276, 1.}, {277, 1.}, {278, 1.}, {279, 1.},
  {280, 1.}, {281, 1.}, {282, 1.}, {283, 1.}, {284, 1.}, {285, 1.}, {286, 1.},
  {287, 1.}, {288, 1.}, {289, 1.}, {290, 1.}, {291, 1.}, {292, 1.}, {293, 1.},
  {294, 1.}, {295, 1.}, {296, 1.}, {297, 1.}, {298, 1.}, {299, 1.}, {300, 1.}}
```

```

In[*]:= (* Clear [avgRhoRAW];
avgRhoRAW=Table[Table[0.,{lands}],{T}];
For[t=1,t≤T,t++,
  Table[avgRhoRAW[[t,j]]=
    If[coalitions[[t,j,8]]==
      0.5 (coalitions[[t,j,5]]-wage coalitions[[t,j,4]]),
      coalitions[[t,j,8]],
      0.
    ],
  {j,1,lands}]
  (* avgRho[[t]]=TrimmedMean[Table[ $\frac{\text{coalitions}[[t,j,8]]}{\text{rhoSols}[[j,2]]}$  ,{j,1,lands}],{0.2,0}] *)
]; *)
(* avgRho=Table[Complement[ $\frac{\text{coalitions}[[t,All,8]]}{\text{rhoSols}[[All,2]]}$  ,  $\frac{\text{avgRhoRAW}[[t]]}{\text{rhoSols}[[All,2]]}$  ],{t,1,T}]; *)
avgRho = Table[ $\frac{\text{coalitions}[[t, All, 8]]}{\text{rhoSols}[[All, 2]]}$  , {t, 1, T}];

In[*]:= Table[DeleteCases[avgRho[[t]], 0.], {t, 1, T}];

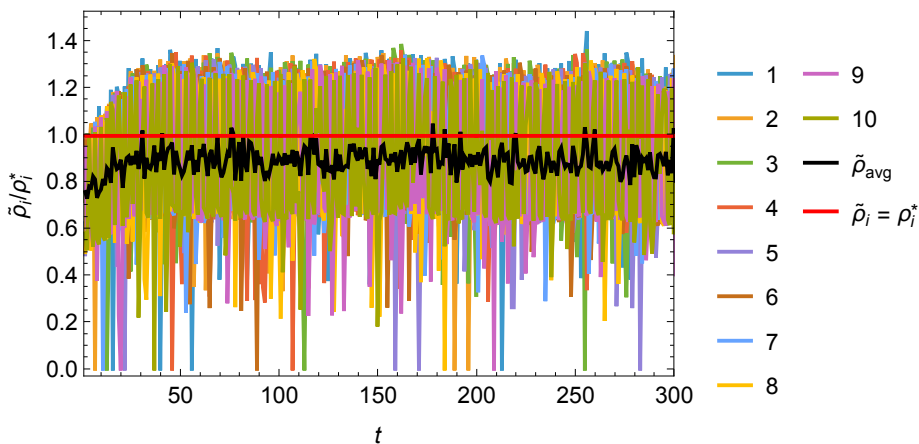
```

```

In[ ]:= rentsPlot = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }, {t, 1, T}], {j, 1, lands}],
    Table[{t, TrimmedMean[DeleteCases[avgRho[[t]], 0.], {0, 0}], {t, 1, T}],
    Table[{t, 1.}, {t, 1, T}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{1, T}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_{\text{avg}}$ ", " $\tilde{\rho}_i = \rho_i^*$ "],
  LabelStyle → 12]
rentsPlotGray = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }, {t, 1, T}], {j, 1, lands}],
  Table[{t, 1.}, {t, 1, T}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{1, T}, All},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_i = \rho_i^*$ ", LabelStyle → 12];
Export["./rentsPlot.eps", rentsPlot, "EPS"];
Export["./rentsPlot.jpg", rentsPlot, "JPEG"];
Export["./rentsPlotGray.eps", rentsPlotGray, "EPS"];
Export["./rentsPlotGray.jpg", rentsPlotGray, "JPEG"];

```

Out[ ]:=



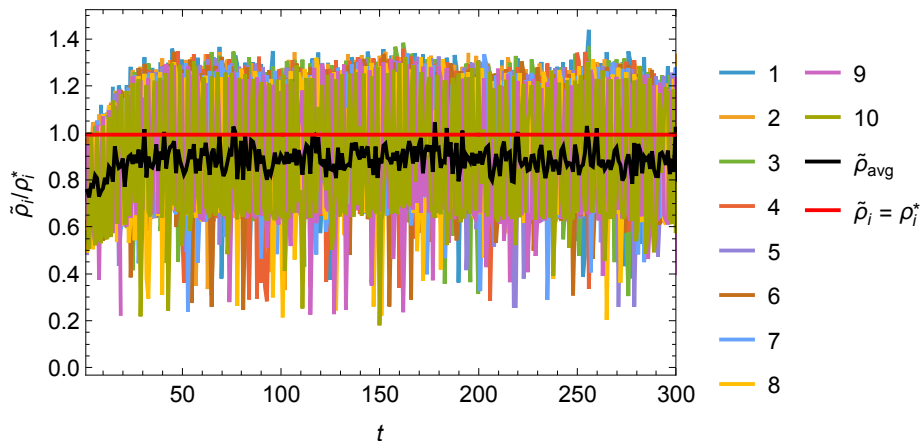
Zero rents removed.

```

In[ ]:= rentsPlot4 = ListLinePlot[
  Append[Append[Table[Table[{t, If[coalitions[[t, j, 8]] == 0., ,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ ]}],
    {t, 1, T}], {j, 1, lands}],
  Table[{t, TrimmedMean[DeleteCases[avgRho[[t]], 0.], {0, 0}], {t, 1, T}],
  Table[{t, 1.}, {t, 1, T}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{1, T}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_{\text{avg}}$ ", " $\tilde{\rho}_i = \rho_i^*$ "],
  LabelStyle → 12]
rentsPlotGray4 = ListLinePlot[
  Append[Table[Table[{t, If[coalitions[[t, j, 8]] == 0., ,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ ]}],
    {t, 1, T}], {j, 1, lands}], Table[{t, 1.}, {t, 1, T}],
  Frame → True, FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{1, T}, All},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_i = \rho_i^*$ ", LabelStyle → 12];
Export["./rentsPlot4.eps", rentsPlot4, "EPS"];
Export["./rentsPlot4.jpg", rentsPlot4, "JPEG"];
Export["./rentsPlotGray4.eps", rentsPlotGray4, "EPS"];
Export["./rentsPlotGray4.jpg", rentsPlotGray4, "JPEG"];

```

Out[ ]=



## Profit Rates

In[\*]:= **cHeader**

Out[\*]=

$\{\rho_{t,i}^C, C_{t,i}^C, \Omega_{t,i}^C, L_{t,i}, Y_{t,i}, \Omega_{t,i}^C, r_t^C, \tilde{\rho}_{t,i}^C, L_{t,i}^*, C_{t,i}, C_{t,i}', \Omega_{t,i}'\}$

In[\*]:= **r /. rEQ**

Out[\*]=

0.61054

In[\*]:= **rEQ**

Out[\*]=

{r → 0.61054}

In[\*]:= **Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]]}, {t, 1, T}]**

Out[\*]=

{ {1, 0.629288}, {2, 0.648982}, {3, 0.656231}, {4, 0.634941}, {5, 0.61299},  
 {6, 0.624932}, {7, 0.639905}, {8, 0.632473}, {9, 0.661764}, {10, 0.630804},  
 {11, 0.634116}, {12, 0.640576}, {13, 0.583986}, {14, 0.628638}, {15, 0.624467},  
 {16, 0.607156}, {17, 0.607751}, {18, 0.620706}, {19, 0.61795}, {20, 0.632132},  
 {21, 0.613048}, {22, 0.595208}, {23, 0.582078}, {24, 0.595677}, {25, 0.586661},  
 {26, 0.60763}, {27, 0.60618}, {28, 0.634454}, {29, 0.615488}, {30, 0.583407},  
 {31, 0.626611}, {32, 0.605821}, {33, 0.616782}, {34, 0.619316}, {35, 0.617279},  
 {36, 0.599781}, {37, 0.627049}, {38, 0.605921}, {39, 0.606428}, {40, 0.558963},  
 {41, 0.618249}, {42, 0.603627}, {43, 0.583715}, {44, 0.605541}, {45, 0.604881},  
 {46, 0.612381}, {47, 0.603427}, {48, 0.61443}, {49, 0.609366}, {50, 0.6253},  
 {51, 0.626257}, {52, 0.605156}, {53, 0.613002}, {54, 0.622833}, {55, 0.587545},  
 {56, 0.627399}, {57, 0.61077}, {58, 0.615875}, {59, 0.589996}, {60, 0.613211},  
 {61, 0.586546}, {62, 0.611367}, {63, 0.622102}, {64, 0.597732}, {65, 0.592501},  
 {66, 0.613053}, {67, 0.629574}, {68, 0.591466}, {69, 0.618789}, {70, 0.61476},  
 {71, 0.617924}, {72, 0.623145}, {73, 0.596118}, {74, 0.612736}, {75, 0.579748},  
 {76, 0.571561}, {77, 0.613265}, {78, 0.598497}, {79, 0.587486}, {80, 0.629914},  
 {81, 0.597181}, {82, 0.63043}, {83, 0.610551}, {84, 0.590479}, {85, 0.575807},  
 {86, 0.596788}, {87, 0.61892}, {88, 0.614468}, {89, 0.601926}, {90, 0.598157},  
 {91, 0.619679}, {92, 0.614353}, {93, 0.633661}, {94, 0.617989}, {95, 0.630475},  
 {96, 0.598464}, {97, 0.61274}, {98, 0.628669}, {99, 0.611072}, {100, 0.599613},  
 {101, 0.613573}, {102, 0.610128}, {103, 0.623484}, {104, 0.586004}, {105, 0.613019},  
 {106, 0.600013}, {107, 0.61241}, {108, 0.605239}, {109, 0.604681}, {110, 0.625224},  
 {111, 0.595693}, {112, 0.602714}, {113, 0.595582}, {114, 0.626272}, {115, 0.582442},  
 {116, 0.589854}, {117, 0.590932}, {118, 0.584132}, {119, 0.610439}, {120, 0.629157},  
 {121, 0.613719}, {122, 0.610178}, {123, 0.598064}, {124, 0.617242}, {125, 0.608846},  
 {126, 0.620816}, {127, 0.63637}, {128, 0.578993}, {129, 0.613997}, {130, 0.585259},  
 {131, 0.601349}, {132, 0.600377}, {133, 0.621376}, {134, 0.601397}, {135, 0.592182},  
 {136, 0.605015}, {137, 0.604265}, {138, 0.611173}, {139, 0.601936}, {140, 0.590262},  
 {141, 0.615368}, {142, 0.60001}, {143, 0.591965}, {144, 0.607628}, {145, 0.60187},

```
{146, 0.636576}, {147, 0.577158}, {148, 0.634234}, {149, 0.61751}, {150, 0.598849},
{151, 0.615448}, {152, 0.601284}, {153, 0.602168}, {154, 0.599683}, {155, 0.601978},
{156, 0.597346}, {157, 0.603019}, {158, 0.606531}, {159, 0.613812}, {160, 0.612517},
{161, 0.594251}, {162, 0.61645}, {163, 0.60683}, {164, 0.578673}, {165, 0.579306},
{166, 0.60652}, {167, 0.593041}, {168, 0.597475}, {169, 0.600609}, {170, 0.581376},
{171, 0.622854}, {172, 0.593521}, {173, 0.588705}, {174, 0.60716}, {175, 0.602978},
{176, 0.620376}, {177, 0.564981}, {178, 0.619971}, {179, 0.593901}, {180, 0.595653},
{181, 0.607015}, {182, 0.600175}, {183, 0.572512}, {184, 0.583795}, {185, 0.585596},
{186, 0.630576}, {187, 0.627007}, {188, 0.605465}, {189, 0.627639}, {190, 0.60676},
{191, 0.585506}, {192, 0.623287}, {193, 0.598611}, {194, 0.609587}, {195, 0.619026},
{196, 0.614845}, {197, 0.61424}, {198, 0.595362}, {199, 0.603945}, {200, 0.588913},
{201, 0.617406}, {202, 0.605854}, {203, 0.59907}, {204, 0.592426}, {205, 0.625508},
{206, 0.651214}, {207, 0.59081}, {208, 0.598928}, {209, 0.603666}, {210, 0.640742},
{211, 0.596365}, {212, 0.592668}, {213, 0.626733}, {214, 0.605938}, {215, 0.60677},
{216, 0.62217}, {217, 0.632352}, {218, 0.573222}, {219, 0.579811}, {220, 0.610743},
{221, 0.619336}, {222, 0.611676}, {223, 0.616937}, {224, 0.603745}, {225, 0.60748},
{226, 0.615071}, {227, 0.585298}, {228, 0.623546}, {229, 0.630872}, {230, 0.598175},
{231, 0.620683}, {232, 0.610755}, {233, 0.638092}, {234, 0.623572}, {235, 0.6016},
{236, 0.61388}, {237, 0.607365}, {238, 0.596768}, {239, 0.617566}, {240, 0.644954},
{241, 0.606198}, {242, 0.589117}, {243, 0.604368}, {244, 0.621789}, {245, 0.623018},
{246, 0.614776}, {247, 0.609256}, {248, 0.578304}, {249, 0.597116}, {250, 0.634406},
{251, 0.632663}, {252, 0.602203}, {253, 0.607606}, {254, 0.590544}, {255, 0.602611},
{256, 0.599902}, {257, 0.615649}, {258, 0.586222}, {259, 0.575119}, {260, 0.605284},
{261, 0.622135}, {262, 0.601491}, {263, 0.609681}, {264, 0.632366}, {265, 0.61757},
{266, 0.618811}, {267, 0.601071}, {268, 0.586418}, {269, 0.608688}, {270, 0.60332},
{271, 0.602617}, {272, 0.648254}, {273, 0.622198}, {274, 0.612783}, {275, 0.593999},
{276, 0.605077}, {277, 0.640761}, {278, 0.604732}, {279, 0.622254}, {280, 0.580284},
{281, 0.597403}, {282, 0.614582}, {283, 0.621404}, {284, 0.609514}, {285, 0.596292},
{286, 0.64284}, {287, 0.602158}, {288, 0.613545}, {289, 0.613765}, {290, 0.634007},
{291, 0.597472}, {292, 0.608608}, {293, 0.611595}, {294, 0.618707}, {295, 0.603707},
{296, 0.638072}, {297, 0.605847}, {298, 0.631342}, {299, 0.573143}, {300, 0.618694}
```

```
In[*]:= Mean[Table[{t, Mean[DeleteCases[coalitions[t, All, 7]], 0.]}, {t, 1, T}][[All, 2]]]
```

```
Out[*]=
```

```
0.608775
```

```
In[*]:= Append[Table[Table[{t,  $\frac{\text{coalitions}[t, j, 7]}{r /. rEQ}$ }, {t, 1, T}], {j, 1, lands}],
```

```
Table[{t, 1.}, {t, 1, T}]]];
```

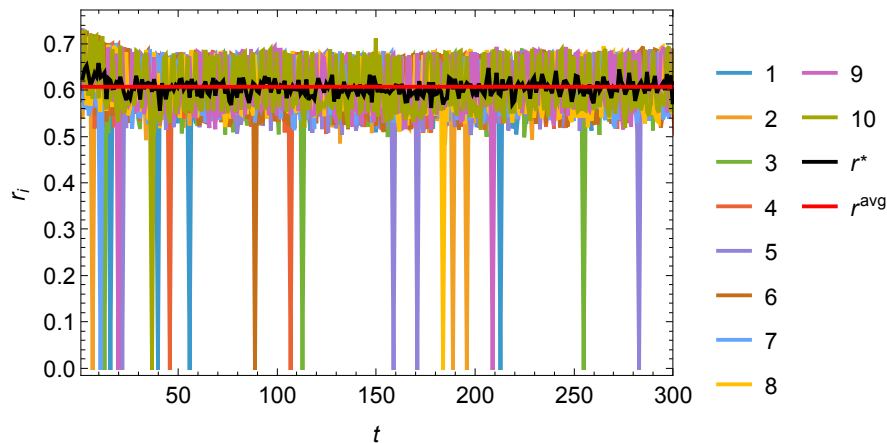
```
In[*]:= Append[Table[Table[{t, coalitions[t, j, 7]}, {t, 1, T}], {j, 1, lands}],
Table[{t, r /. rEQ}, {t, 1, T}]]];
```

```

In[ ]:= profitRatePlot = ListLinePlot[
  Append[Append[Table[Table[{t, coalitions[[t, j, 7]]}, {t, 1, T}], {j, 1, lands}],
    Table[{t, Mean[DeleteCases[coalitions[[t, All, 7], 0.]]}, {t, 1, T}]],
  Table[{t, r /. rEQ}, {t, 1, T}], Frame → True,
  FrameLabel → {"t", "ri"}, PlotRange → {{1, T}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"],
  LabelStyle → 12]
profitRatePlotGray =
  ListLinePlot[Append[Append[Table[Table[{t, coalitions[[t, j, 7]]}, {t, 1, T}],
    {j, 1, lands}], Table[{t, r /. rEQ}, {t, 1, T}]],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7], 0.]]}, {t, 1, T}]],
  Frame → True, FrameLabel → {"t", "ri"}, PlotRange → {{1, T}, All},
  PlotStyle → Append[Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin,
    GrayLevel[0.4]}, {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed,
    GrayLevel[0.75]}, {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  }, {Thick, Dashed, Black}], {Thick, Black}], PlotLegends →
  Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"], LabelStyle → 12];
Export["./profitRatePlot.eps", profitRatePlot, "EPS"];
Export["./profitRatePlot.jpg", profitRatePlot, "JPEG"];
Export["./profitRatePlotGray.eps", profitRatePlotGray, "EPS"];
Export["./profitRatePlotGray.jpg", profitRatePlotGray, "JPEG"];

```

Out[ ]:=



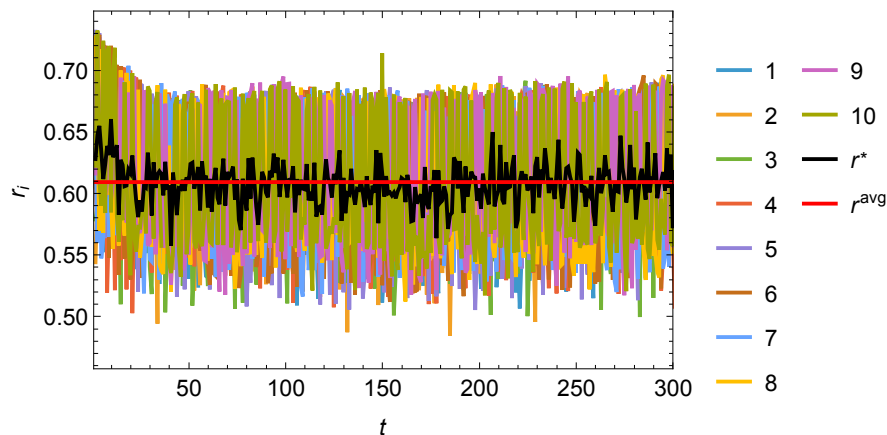
Zeros removed for profit rates.

```

In[ ]:= profitRatePlot4 = ListLinePlot[
  Append[Append[Table[Table[{t, If[coalitions[[t, j, 7]] == 0., , coalitions[[t, j, 7]]}],
    {t, 1, T}], {j, 1, lands}],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}, {t, 1, T}],
  Table[{t, r /. rEQ}, {t, 1, T}], Frame → True,
  FrameLabel → {"t", "ri"}, PlotRange → {{1, T}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"],
  LabelStyle → 12]
profitRatePlot4Gray = ListLinePlot[Append[
  Append[Table[Table[{t, If[coalitions[[t, j, 7]] == 0., , coalitions[[t, j, 7]]}],
    {t, 1, T}], {j, 1, lands}], Table[{t, r /. rEQ}, {t, 1, T}],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}, {t, 1, T}],
  Frame → True, FrameLabel → {"t", "ri"}, PlotRange → {{1, T}, All},
  PlotStyle → Append[Append[{{GrayLevel[0.8]}}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin,
    GrayLevel[0.4]}, {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed,
    GrayLevel[0.75]}, {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    ], {Thick, Dashed, Black}], {Thick, Black}], PlotLegends →
  Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"], LabelStyle → 12];
Export["./profitRatePlot4.eps", profitRatePlot4, "EPS"];
Export["./profitRatePlot4.jpg", profitRatePlot4, "JPEG"];
Export["./profitRatePlot4Gray.eps", profitRatePlot4Gray, "EPS"];
Export["./profitRatePlot4Gray.jpg", profitRatePlot4Gray, "JPEG"];

```

Out[ ]:=



## Employment

```
In[*]:= lSols
```

```
Out[*]=
```

```
{L1 → 31.2841, L2 → 34.5232, L3 → 38.0611, L4 → 41.9221, L5 → 46.132, L6 → 50.7187,  
L7 → 55.7118, L8 → 61.1431, L9 → 67.0463, L10 → 73.4576, λ → 32.2108}
```

```
In[*]:= lSols[[1 ;; lands, 2]]
```

```
Out[*]=
```

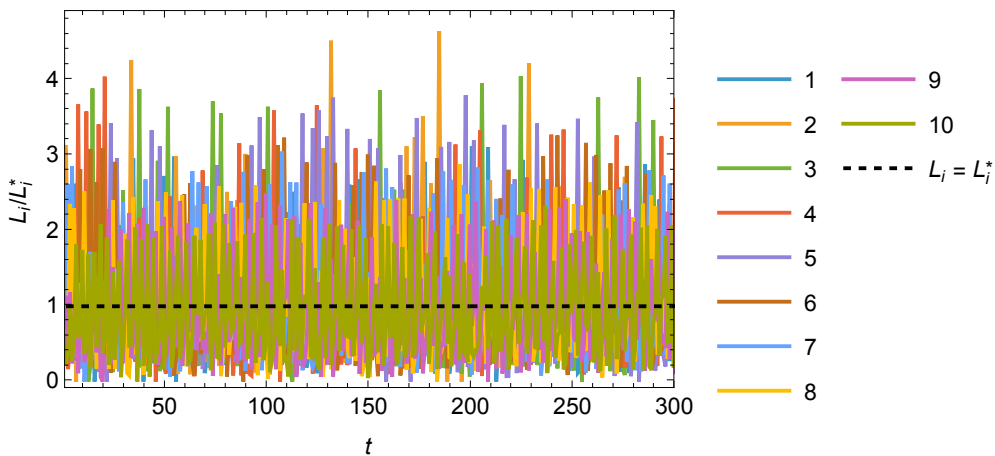
```
{31.2841, 34.5232, 38.0611, 41.9221,  
46.132, 50.7187, 55.7118, 61.1431, 67.0463, 73.4576}
```

```

In[ ]:= laborPlot = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 4]]}{\text{lSols}[[j, 2]]}$ }, {t, 1, T}], {j, 1, lands}],
  Table[{t, 1.}, {t, 1, T}], Frame → True,
  FrameLabel → {"t", " $L_i/L_i^*$ "}, PlotRange → {{1, T}, Automatic},
  PlotStyle → Append[Table[Automatic, {lands}], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $L_i = L_i^*$ "], LabelStyle → 12]
laborPlotGray = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 4]]}{\text{lSols}[[j, 2]]}$ }, {t, 1, T}], {j, 1, lands}],
  Table[{t, 1.}, {t, 1, T}], Frame → True,
  FrameLabel → {"t", " $L_i/L_i^*$ "}, PlotRange → {{1, T}, Automatic},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}},
    {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $L_i = L_i^*$ "], LabelStyle → 12];
Export["./laborPlot.eps", laborPlot, "EPS"];
Export["./laborPlot.jpg", laborPlot, "JPEG"];
Export["./laborPlotGray.eps", laborPlotGray, "EPS"];
Export["./laborPlotGray.jpg", laborPlotGray, "JPEG"];

```

Out[ ]:=



## Capital Allocation

In[ ]:= cHeader

Out[ ]:=

$$\{\rho_{t,i}^C, C_{t,i}, \Omega_{t,i}^C, L_{t,i}, Y_{t,i}, \Omega_{t,i}^C, r_t^C, \tilde{\rho}_{t,i}^C, L_{t,i}^*, C_{t,i}, C_{t,i}', \Omega_{t,i}'\}$$



$3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $0.0213393$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $0.103588$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $1.81899 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $0.00815682$ ,  $0.0855908$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $0.00815964$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $1.81899 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $0.0104474$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
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 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $0.00684097$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  
 $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$ ,  $3.63798 \times 10^{-16}$

```

In[ ]:= Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 1, T}], {j, 1, lands}], Table[
    {t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, All, 6]]}{\text{Omega}}$ }, {t, 1, T}], Table[{t, 1.}, {t, 1, T}]]

```

Out[ ]:=

```

{{1, 0.2533}, {2, 0.481881}, {3, 1.22711}, {4, 0.731065}, {5, 0.903668}, {6, 2.62674}, {7, 0.610409},
 {8, 1.45718}, {9, 0.491829}, {10, 0.394706}, {11, 1.02953}, {12, 1.73179}, {277, ...}, {290, 1.14771},
 {291, 0.650432}, {292, 2.41819}, {293, 0.946495}, {294, 1.10182}, {295, 1.38864}, {296, 0.79487},
 {297, 0.272881}, {298, 0.464407}, {299, 1.24742}, {300, 2.28238}, {10, ...}, {1, ...}}

```

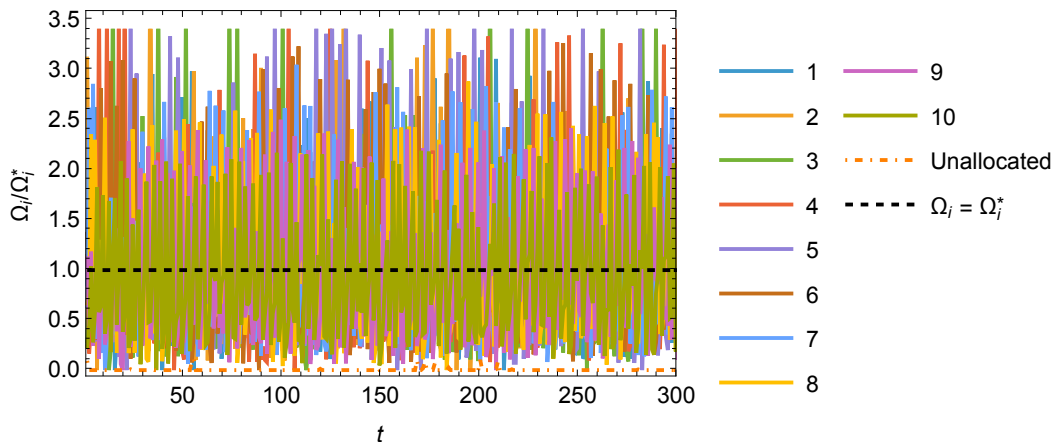
Full expression not available (original memory size: 347.7 kB) ⚙️

```

In[ ]:= capitalPlot = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 1, T}], {j, 1, lands}],
    Table[{t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, \text{All}, 6]]]}{\text{Omega}}$ }, {t, 1, T}]],
  Table[{t, 1.}, {t, 1, T}], Frame → True, FrameLabel → {"t", " $\Omega_i/\Omega_i^*$ "},
  PlotRange → {{1, T}, Automatic}, PlotStyle → Append[Append[
    Table[Automatic, {lands}], {Thick, DotDashed, Orange}], {Thick, Dashed, Black}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "Unallocated"], " $\Omega_i = \Omega_i^*$ "],
  LabelStyle → 12]
capitalPlotGray = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 1, T}], {j, 1, lands}],
    Table[{t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, \text{All}, 6]]]}{\text{Omega}}$ }, {t, 1, T}]],
  Table[{t, 1.}, {t, 1, T}], Frame → True, FrameLabel → {"t", " $\Omega_i/\Omega_i^*$ "},
  PlotRange → {{1, T}, Automatic}, PlotStyle →
  Append[Append[{{GrayLevel[0.8]}}, {Dashed, GrayLevel[0.7]}, {DotDashed,
    GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    ], {Thick, Black}], {Thick, Dashed, Black}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "Unallocated"], " $\Omega_i = \Omega_i^*$ "],
  LabelStyle → 12];
Export["./capitalPlot.eps", capitalPlot, "EPS"];
Export["./capitalPlot.jpg", capitalPlot, "JPEG"];
Export["./capitalPlotGray.eps", capitalPlotGray, "EPS"];
Export["./capitalPlotGray.jpg", capitalPlotGray, "JPEG"];

```

Out[ ]:=



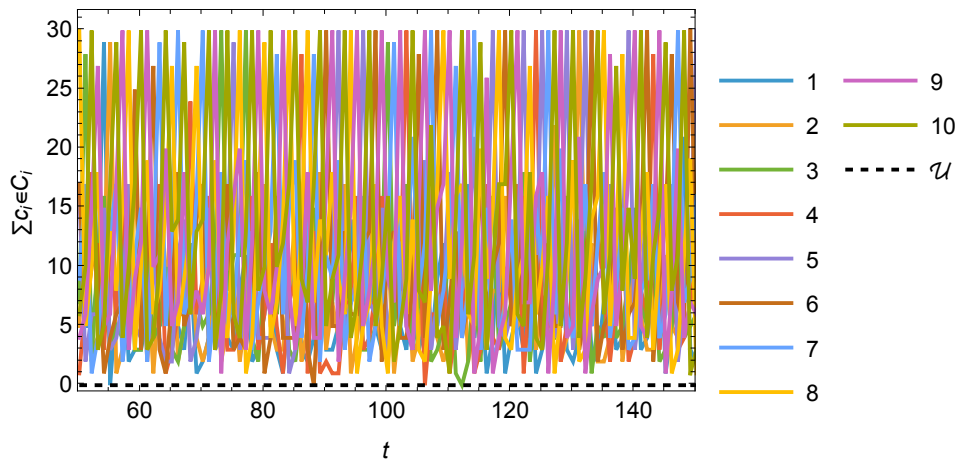
## Select time periods

```

In[*]:= coalitionHeadcount2 = ListLinePlot[
  Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 50, 150}], {j, 1, lands}],
    Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 50, 150}]],
  PlotRange -> {{50, 150}, All}, Frame -> True, FrameLabel -> {"t", " $\sum_{i \in C_i}$ "},
  PlotStyle -> Append[Table[Automatic, {lands}], {Thick, Dashed, Black}],
  PlotLegends -> Append[Table[i, {i, 1, lands}], "u"], LabelStyle -> 12]
coalitionHeadcount2Gray = ListLinePlot[
  Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 50, 150}], {j, 1, lands}],
    Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 50, 150}]],
  PlotRange -> {{50, 150}, All}, Frame -> True, FrameLabel -> {"t", " $\sum_{i \in C_i}$ "},
  PlotStyle -> Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends -> Append[Table[i, {i, 1, lands}], "u"], LabelStyle -> 12];
Export["./coalitionHeadcount2.eps", coalitionHeadcount2, "EPS"];
Export["./coalitionHeadcount2.jpg", coalitionHeadcount2, "JPEG"];
Export["./coalitionHeadcount2Gray.eps", coalitionHeadcount2Gray, "EPS"];
Export["./coalitionHeadcount2Gray.jpg", coalitionHeadcount2Gray, "JPEG"];

```

Out[\*]=

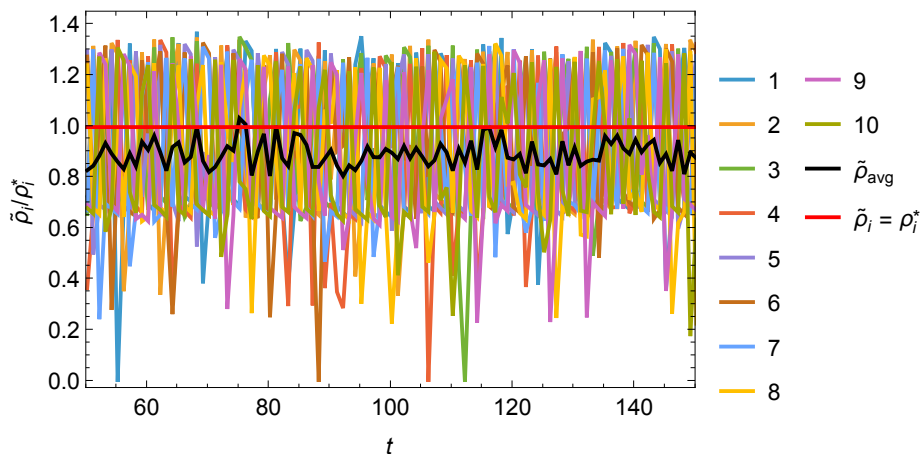


```

In[ ]:= rentsPlot2 = ListLinePlot[
  Append[Append[Table[Table[{{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }}, {t, 50, 150}], {j, 1, lands}],
    Table[{t, TrimmedMean[avgRho[[t]], {0., 0}]}, {t, 50, 150}]],
  Table[{t, 1.}, {t, 50, 150}]], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{50, 150}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_{\text{avg}}$ ", " $\tilde{\rho}_i = \rho_i^*$ "],
  LabelStyle → 12]
rentsPlot2Gray = ListLinePlot[
  Append[Table[Table[{{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }}, {t, 50, 150}], {j, 1, lands}],
    Table[{t, 1.}, {t, 50, 150}]], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{50, 150}, All},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_i = \rho_i^*$ ", LabelStyle → 12];
Export["./rentsPlot2.eps", rentsPlot2, "EPS"];
Export["./rentsPlot2.jpg", rentsPlot2, "JPEG"];
Export["./rentsPlot2Gray.eps", rentsPlot2Gray, "EPS"];
Export["./rentsPlot2Gray.jpg", rentsPlot2Gray, "JPEG"];

```

Out[ ]:=

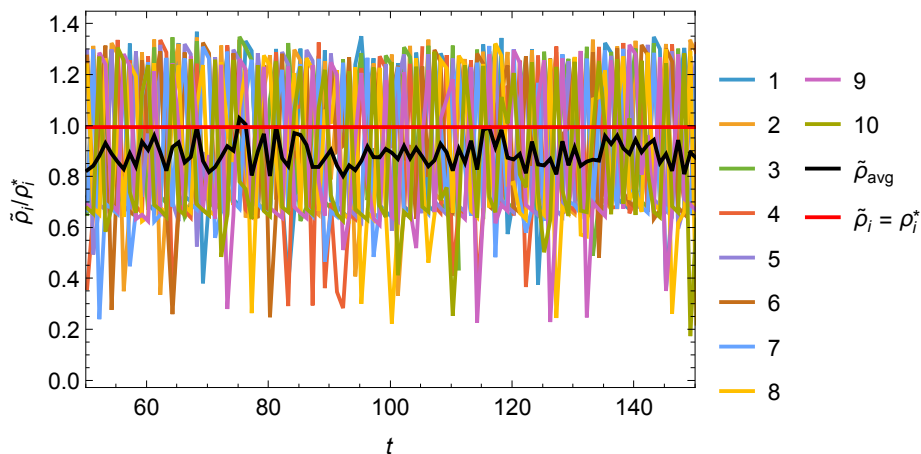


```

In[ ]:= rentsPlot22 = ListLinePlot[
  Append[Append[Table[Table[{t, If[coalitions[[t, j, 8]] == 0., ,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ ]}],
    {t, 50, 150}], {j, 1, lands}], Table[{t, TrimmedMean[avgRho[[t]], {0., 0}]}],
    {t, 50, 150}], Table[{t, 1.}, {t, 50, 150}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{50, 150}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_{\text{avg}}$ "], " $\tilde{\rho}_i = \rho_i^*$ "],
  LabelStyle → 12]
rentsPlot22Gray = ListLinePlot[
  Append[Table[Table[{t, If[coalitions[[t, j, 8]] == 0., ,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ ]}],
    {t, 50, 150}], {j, 1, lands}], Table[{t, 1.}, {t, 50, 150}],
  Frame → True, FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{50, 150}, All},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}],
    {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_i = \rho_i^*$ "], LabelStyle → 12];
Export["./rentsPlot22.eps", rentsPlot22, "EPS"];
Export["./rentsPlot22.jpg", rentsPlot22, "JPEG"];
Export["./rentsPlot22Gray.eps", rentsPlot22Gray, "EPS"];
Export["./rentsPlot22Gray.jpg", rentsPlot22Gray, "JPEG"];

```

Out[ ]:=

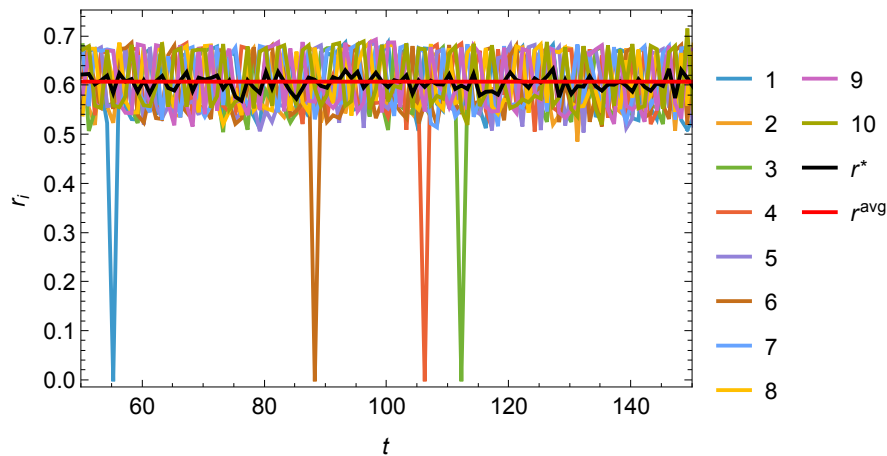


```

In[ ]:= profitRatePlot2 = ListLinePlot[
  Append[Append[Table[Table[{t, coalitions[[t, j, 7]]}, {t, 50, 150}], {j, 1, lands}],
    Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}], {t, 50, 150}]],
  Table[{t, r /. rEQ}, {t, 50, 150}]], Frame → True,
  FrameLabel → {"t", "ri"}, PlotRange → {{50, 150}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"],
  LabelStyle → 12]
profitRatePlot2Gray =
  ListLinePlot[Append[Append[Table[Table[{t, coalitions[[t, j, 7]]}, {t, 50, 150}],
    {j, 1, lands}], Table[{t, r /. rEQ}, {t, 50, 150}]],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}], {t, 50, 150}]],
  Frame → True, FrameLabel → {"t", "ri"}, PlotRange → {{50, 150}, All},
  PlotStyle → Append[Append[{{GrayLevel[0.8]}}, {Dashed, GrayLevel[0.7]}],
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin,
    GrayLevel[0.4]}, {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed,
    GrayLevel[0.75]}, {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    ], {Thick, Dashed, Black}], {Thick, Black}], PlotLegends →
  Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"], LabelStyle → 12];
Export["./profitRatePlot2.eps", profitRatePlot2, "EPS"];
Export["./profitRatePlot2.jpg", profitRatePlot2, "JPEG"];
Export["./profitRatePlot2Gray.eps", profitRatePlot2Gray, "EPS"];
Export["./profitRatePlot2Gray.jpg", profitRatePlot2Gray, "JPEG"];

```

Out[ ]:=

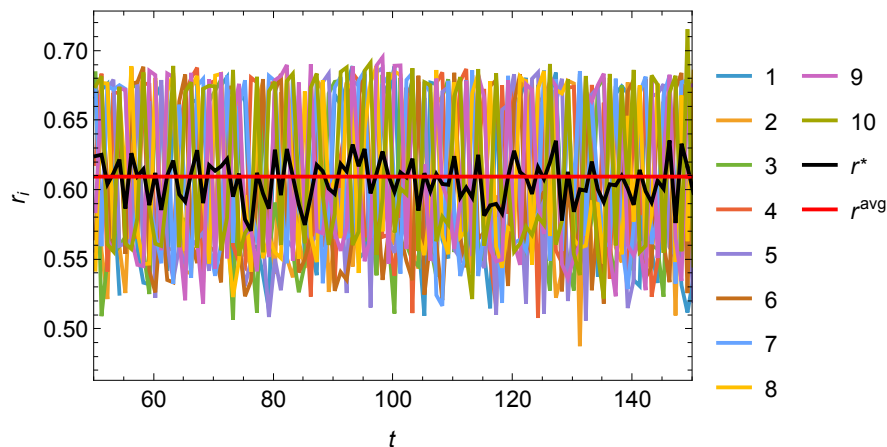


```

In[ ]:= profitRatePlot3 = ListLinePlot[
  Append[Append[Table[Table[{t, If[coalitions[[t, j, 7]] == 0., , coalitions[[t, j, 7]]}],
    {t, 50, 150}], {j, 1, lands}],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}, {t, 50, 150}],
  Table[{t, r /. rEQ}, {t, 50, 150}], Frame → True,
  FrameLabel → {"t", "ri"}, PlotRange → {{50, 150}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"],
  LabelStyle → 12]
profitRatePlot3Gray = ListLinePlot[Append[
  Append[Table[Table[{t, If[coalitions[[t, j, 7]] == 0., , coalitions[[t, j, 7]]}],
    {t, 50, 150}], {j, 1, lands}], Table[{t, r /. rEQ}, {t, 50, 150}],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}, {t, 50, 150}],
  Frame → True, FrameLabel → {"t", "ri"}, PlotRange → {{50, 150}, All},
  PlotStyle → Append[Append[{{GrayLevel[0.8]}}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin,
    GrayLevel[0.4]}, {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed,
    GrayLevel[0.75]}, {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    ], {Thick, Dashed, Black}], {Thick, Black}], PlotLegends →
  Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"], LabelStyle → 12];
Export["./profitRatePlot3.eps", profitRatePlot3, "EPS"];
Export["./profitRatePlot3.jpg", profitRatePlot3, "JPEG"];
Export["./profitRatePlot3Gray.eps", profitRatePlot3Gray, "EPS"];
Export["./profitRatePlot3Gray.jpg", profitRatePlot3Gray, "JPEG"];

```

Out[ ]:=

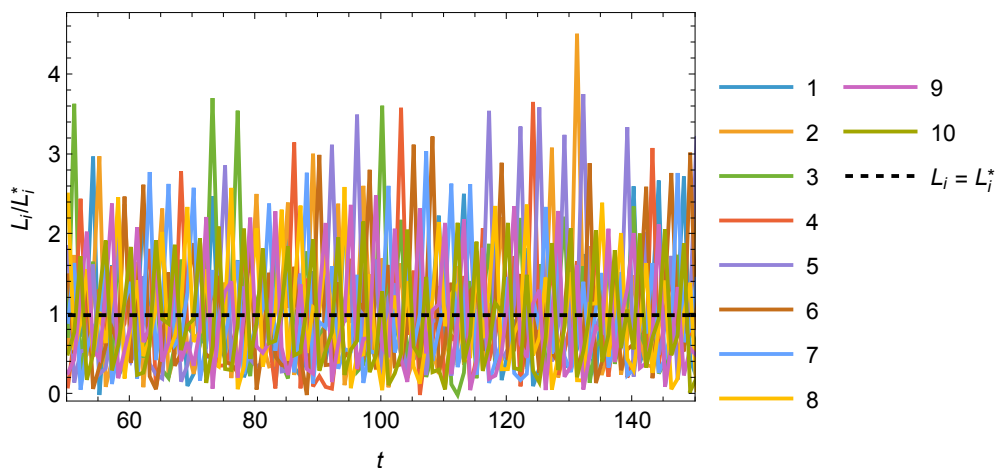


```

In[ ]:= laborPlot2 = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 4]]}{\text{lSols}[[j, 2]]}$ }, {t, 50, 150}], {j, 1, lands}],
  Table[{t, 1.}, {t, 50, 150}], Frame → True,
  FrameLabel → {"t", " $L_i/L_i^*$ "}, PlotRange → {{50, 150}, Automatic},
  PlotStyle → Append[Table[Automatic, {lands}], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $L_i = L_i^*$ "], LabelStyle → 12]
laborPlot2Gray = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 4]]}{\text{lSols}[[j, 2]]}$ }, {t, 50, 150}], {j, 1, lands}],
  Table[{t, 1.}, {t, 50, 150}], Frame → True,
  FrameLabel → {"t", " $L_i/L_i^*$ "}, PlotRange → {{50, 150}, Automatic},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}},
    {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $L_i = L_i^*$ "], LabelStyle → 12];
Export["./laborPlot2.eps", laborPlot2, "EPS"];
Export["./laborPlot2.jpg", laborPlot2, "JPEG"];
Export["./laborPlot2Gray.eps", laborPlot2Gray, "EPS"];
Export["./laborPlot2Gray.jpg", laborPlot2Gray, "JPEG"];

```

Out[ ]:=

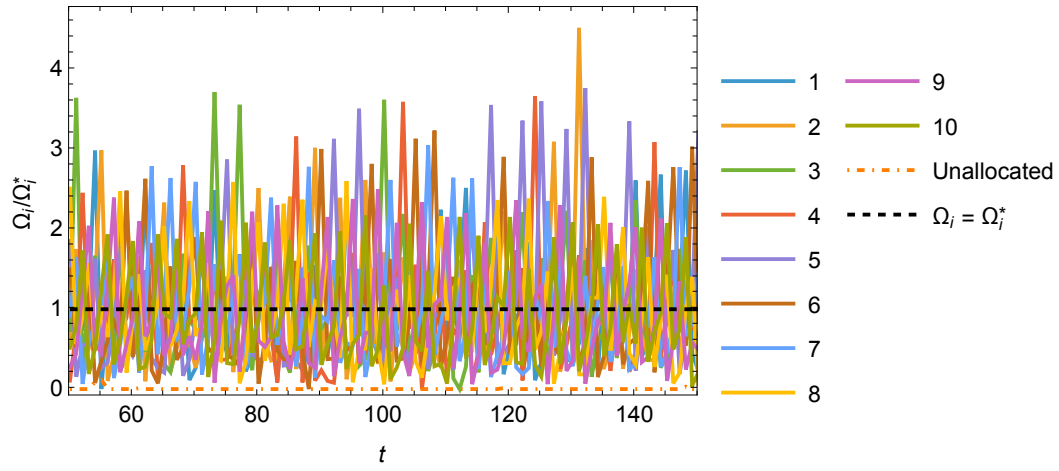


```

In[ ]:= capitalPlot2 = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 50, 150}], {j, 1, lands}],
    Table[{t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, \text{All}, 6]]]}{\text{Omega}}$ }, {t, 50, 150}]],
  Table[{t, 1.}, {t, 50, 150}], Frame → True, FrameLabel → {"t", " $\Omega_i/\Omega_i^*$ "},
  PlotRange → {{50, 150}, Automatic}, PlotStyle → Append[Append[
    Table[Automatic, {lands}], {Thick, DotDashed, Orange}], {Thick, Dashed, Black}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "Unallocated"], " $\Omega_i = \Omega_i^*$ "],
  LabelStyle → 12]
capitalPlot2Gray = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 50, 150}], {j, 1, lands}],
    Table[{t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, \text{All}, 6]]]}{\text{Omega}}$ }, {t, 50, 150}]],
  Table[{t, 1.}, {t, 50, 150}], Frame → True, FrameLabel → {"t", " $\Omega_i/\Omega_i^*$ "},
  PlotRange → {{50, 150}, Automatic}, PlotStyle →
  Append[Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]}, {DotDashed,
    GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    }, {Thick, Black}], {Thick, Dashed, Black}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "Unallocated"], " $\Omega_i = \Omega_i^*$ "],
  LabelStyle → 12];
Export["./capitalPlot2.eps", capitalPlot2, "EPS"];
Export["./capitalPlot2.jpg", capitalPlot2, "JPEG"];
Export["./capitalPlot2Gray.eps", capitalPlot2Gray, "EPS"];
Export["./capitalPlot2Gray.jpg", capitalPlot2Gray, "JPEG"];

```

Out[ ]=



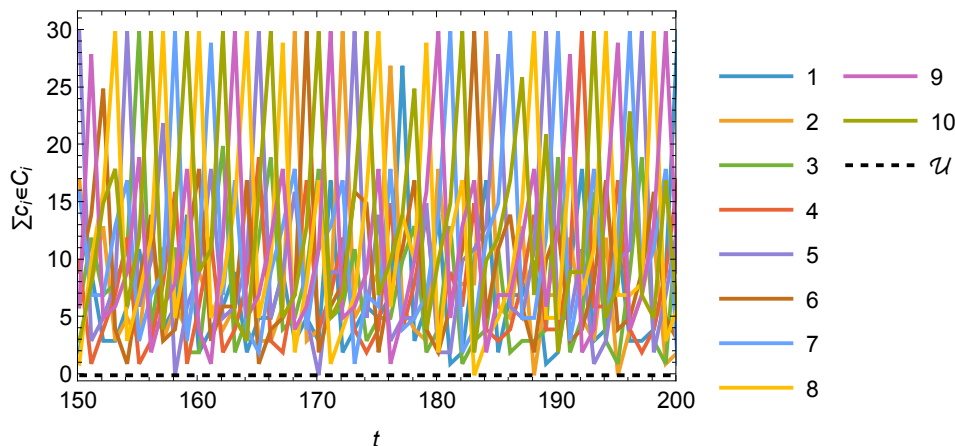
## Select time periods 2

```

In[ ]:= coalitionHeadcount2a = ListLinePlot[
  Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 150, 200}], {j, 1, lands}],
    Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 150, 200}]],
  PlotRange -> {{150, 200}, All}, Frame -> True, FrameLabel -> {"t", " $\sum_{C_i \in C_i}$ "},
  PlotStyle -> Append[Table[Automatic, {lands}], {Thick, Dashed, Black}],
  PlotLegends -> Append[Table[i, {i, 1, lands}], "u"], LabelStyle -> 12]
coalitionHeadcount2aGray = ListLinePlot[
  Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 150, 200}], {j, 1, lands}],
    Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 150, 200}]],
  PlotRange -> {{150, 200}, All}, Frame -> True, FrameLabel -> {"t", " $\sum_{C_i \in C_i}$ "},
  PlotStyle -> Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends -> Append[Table[i, {i, 1, lands}], "u"], LabelStyle -> 12];
Export["./coalitionHeadcount2a.eps", coalitionHeadcount2a, "EPS"];
Export["./coalitionHeadcount2a.jpg", coalitionHeadcount2a, "JPEG"];
Export["./coalitionHeadcount2aGray.eps", coalitionHeadcount2aGray, "EPS"];
Export["./coalitionHeadcount2aGray.jpg", coalitionHeadcount2aGray, "JPEG"];

```

Out[ ]:=

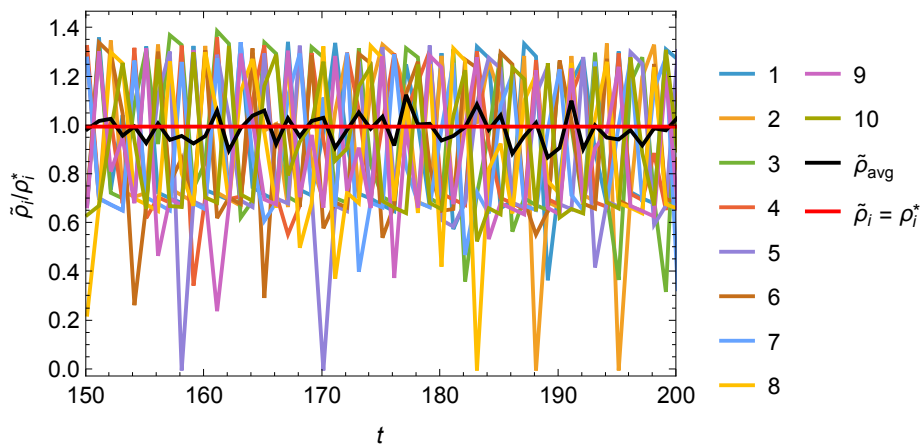


```

In[ ]:= rentsPlot2a = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }, {t, 150, 200}], {j, 1, lands}],
    Table[{t, TrimmedMean[avgRho[[t]], {0.2, 0}]}], {t, 150, 200}],
  Table[{t, 1.}, {t, 150, 200}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{150, 200}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_{\text{avg}}$ ", " $\tilde{\rho}_i = \rho_i^*$ "],
  LabelStyle → 12]
rentsPlot2aGray = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }, {t, 150, 200}], {j, 1, lands}],
  Table[{t, 1.}, {t, 150, 200}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{150, 200}, All},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_i = \rho_i^*$ "], LabelStyle → 12];
Export["./rentsPlot2a.eps", rentsPlot2a, "EPS"];
Export["./rentsPlot2a.jpg", rentsPlot2a, "JPEG"];
Export["./rentsPlot2aGray.eps", rentsPlot2aGray, "EPS"];
Export["./rentsPlot2aGray.jpg", rentsPlot2aGray, "JPEG"];

```

Out[ ]:=

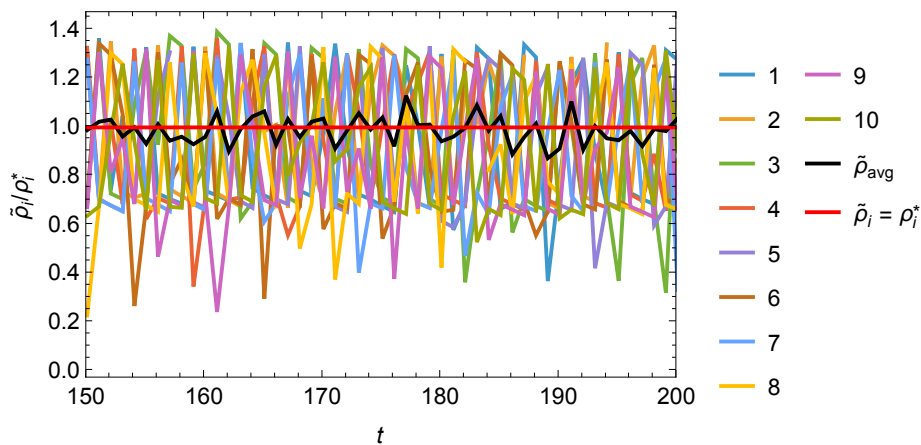


```

In[ ]:= rentsPlot22a = ListLinePlot[
  Append[Append[Table[Table[{t, If[coalitions[[t, j, 8]] == 0., ,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ ]}],
    {t, 150, 200}], {j, 1, lands}],
  Table[{t, TrimmedMean[avgRho[[t]], {0.2, 0}]}], {t, 150, 200}],
  Table[{t, 1.}, {t, 150, 200}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{150, 200}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_{\text{avg}}$ "], " $\tilde{\rho}_i = \rho_i^*$ "],
  LabelStyle → 12]
rentsPlot22aGray = ListLinePlot[
  Append[Table[Table[{t, If[coalitions[[t, j, 8]] == 0., ,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ ]}],
    {t, 150, 200}], {j, 1, lands}], Table[{t, 1.}, {t, 150, 200}],
  Frame → True, FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{150, 200}, All},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_i = \rho_i^*$ "], LabelStyle → 12];
Export["./rentsPlot22a.eps", rentsPlot22a, "EPS"];
Export["./rentsPlot22a.jpg", rentsPlot22a, "JPEG"];
Export["./rentsPlot22aGray.eps", rentsPlot22aGray, "EPS"];
Export["./rentsPlot22aGray.jpg", rentsPlot22aGray, "JPEG"];

```

Out[ ]:=

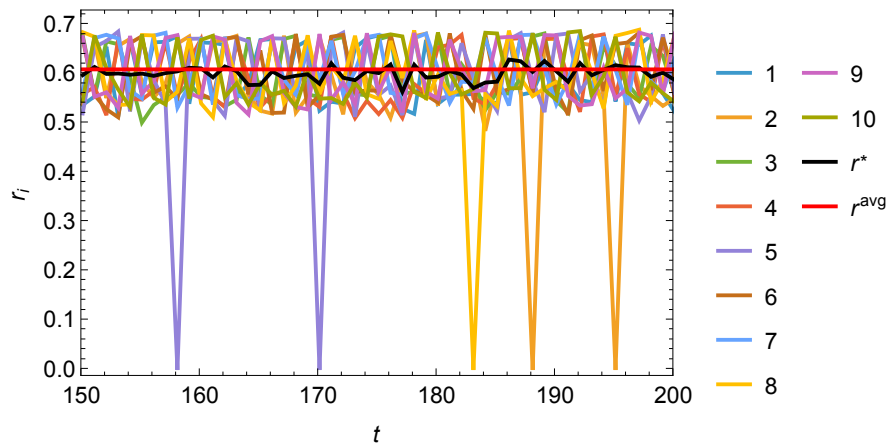


```

In[ ]:= profitRatePlot2a = ListLinePlot[
  Append[Append[Table[Table[{t, coalitions[[t, j, 7]]}, {t, 150, 200}], {j, 1, lands}],
    Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}], {t, 150, 200}]],
  Table[{t, r /. rEQ}, {t, 150, 200}]], Frame → True,
  FrameLabel → {"t", "ri"}, PlotRange → {{150, 200}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"],
  LabelStyle → 12]
profitRatePlot2aGray =
  ListLinePlot[Append[Append[Table[Table[{t, coalitions[[t, j, 7]]}, {t, 150, 200}],
    {j, 1, lands}], Table[{t, r /. rEQ}, {t, 150, 200}]],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}], {t, 150, 200}]],
  Frame → True, FrameLabel → {"t", "ri"}, PlotRange → {{150, 200}, All},
  PlotStyle → Append[Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin,
    GrayLevel[0.4]}, {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed,
    GrayLevel[0.75]}, {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    }, {Thick, Dashed, Black}], {Thick, Black}], PlotLegends →
  Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"], LabelStyle → 12];
Export["./profitRatePlot2a.eps", profitRatePlot2a, "EPS"];
Export["./profitRatePlot2a.jpg", profitRatePlot2a, "JPEG"];
Export["./profitRatePlot2aGray.eps", profitRatePlot2aGray, "EPS"];
Export["./profitRatePlot2aGray.jpg", profitRatePlot2aGray, "JPEG"];

```

Out[ ]:=

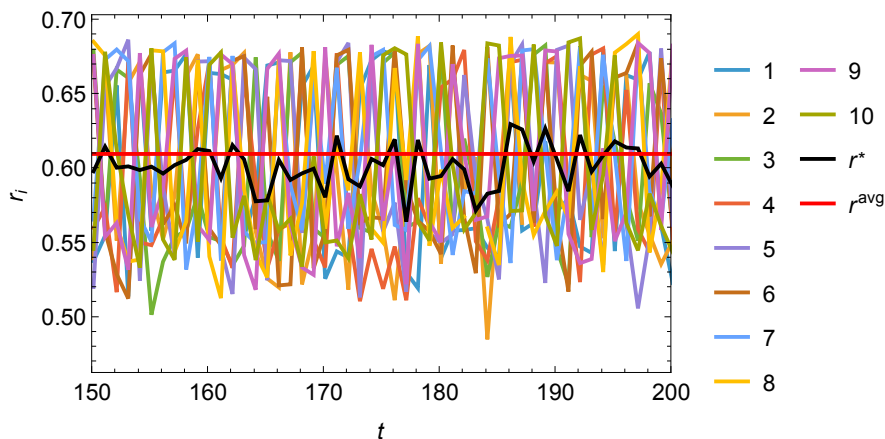


```

In[ ]:= profitRatePlot3a = ListLinePlot[
  Append[Append[Table[Table[{t, If[coalitions[[t, j, 7]] == 0., , coalitions[[t, j, 7]]}],
    {t, 150, 200}], {j, 1, lands}],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}, {t, 150, 200}],
  Table[{t, r /. rEQ}, {t, 150, 200}], Frame → True,
  FrameLabel → {"t", "ri"}, PlotRange → {{150, 200}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"],
  LabelStyle → 12]
profitRatePlot3aGray = ListLinePlot[Append[
  Append[Table[Table[{t, If[coalitions[[t, j, 7]] == 0., , coalitions[[t, j, 7]]}],
    {t, 150, 200}], {j, 1, lands}], Table[{t, r /. rEQ}, {t, 150, 200}],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}, {t, 150, 200}],
  Frame → True, FrameLabel → {"t", "ri"}, PlotRange → {{150, 200}, All},
  PlotStyle → Append[Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin,
    GrayLevel[0.4]}, {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed,
    GrayLevel[0.75]}, {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    }, {Thick, Dashed, Black}], {Thick, Black}], PlotLegends →
  Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"], LabelStyle → 12];
Export["./profitRatePlot3a.eps", profitRatePlot3a, "EPS"];
Export["./profitRatePlot3a.jpg", profitRatePlot3a, "JPEG"];
Export["./profitRatePlot3aGray.eps", profitRatePlot3aGray, "EPS"];
Export["./profitRatePlot3aGray.jpg", profitRatePlot3aGray, "JPEG"];

```

Out[ ]:=

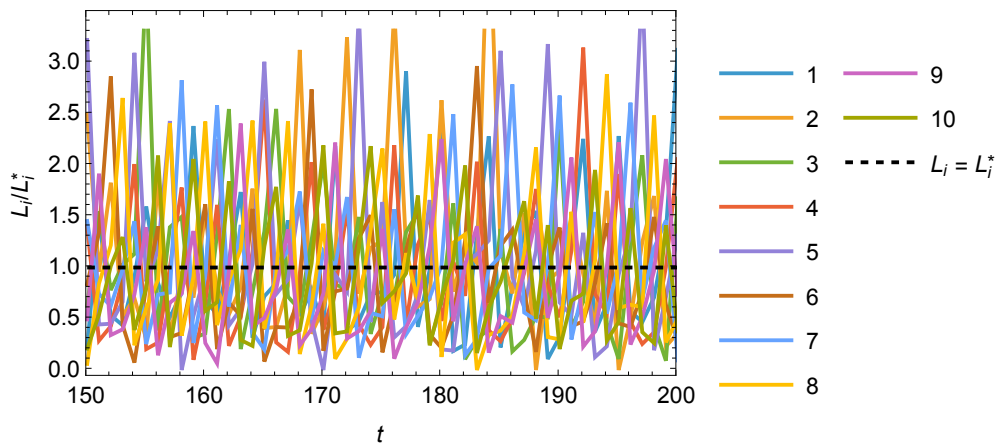


```

In[ ]:= laborPlot2a = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 4]]}{\text{Sols}[[j, 2]]}$ }, {t, 150, 200}], {j, 1, lands}],
  Table[{t, 1.}, {t, 150, 200}], Frame → True,
  FrameLabel → {"t", " $L_i/L_i^*$ "}, PlotRange → {{150, 200}, Automatic},
  PlotStyle → Append[Table[Automatic, {lands}], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $L_i = L_i^*$ "], LabelStyle → 12]
laborPlot2aGray = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 4]]}{\text{Sols}[[j, 2]]}$ }, {t, 150, 200}], {j, 1, lands}],
  Table[{t, 1.}, {t, 150, 200}], Frame → True,
  FrameLabel → {"t", " $L_i/L_i^*$ "}, PlotRange → {{150, 200}, Automatic},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}},
    {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $L_i = L_i^*$ "], LabelStyle → 12];
Export["./laborPlot2a.eps", laborPlot2a, "EPS"];
Export["./laborPlot2a.jpg", laborPlot2a, "JPEG"];
Export["./laborPlot2aGray.eps", laborPlot2aGray, "EPS"];
Export["./laborPlot2aGray.jpg", laborPlot2aGray, "JPEG"];

```

Out[ ]:=

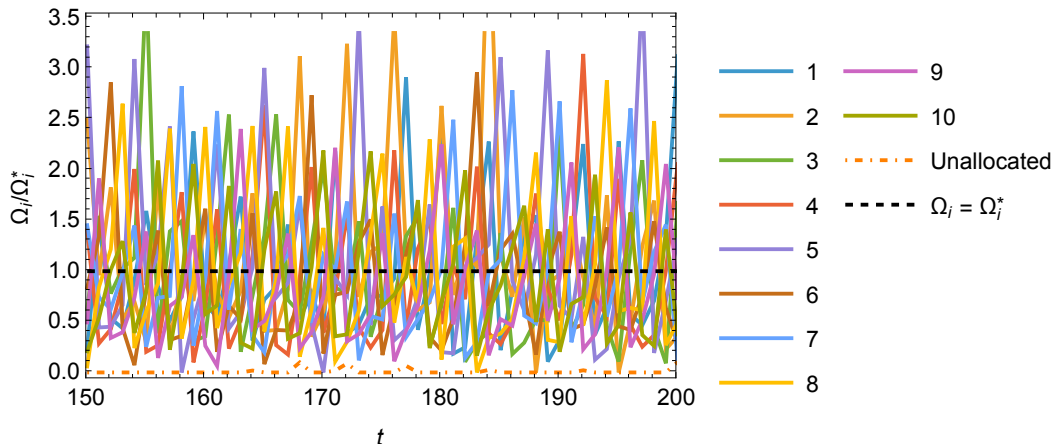


```

In[ ]:= capitalPlot2a = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 150, 200}], {j, 1, lands}],
    Table[{t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, \text{All}, 6]]]}{\text{Omega}}$ }, {t, 150, 200}]],
  Table[{t, 1.}, {t, 150, 200}], Frame → True, FrameLabel → {"t", " $\Omega_i/\Omega_i^*$ "},
  PlotRange → {{150, 200}, Automatic}, PlotStyle → Append[Append[
    Table[Automatic, {lands}], {Thick, DotDashed, Orange}], {Thick, Dashed, Black}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "Unallocated"], " $\Omega_i = \Omega_i^*$ "],
  LabelStyle → 12]
capitalPlot2aGray = ListLinePlot[Append[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 150, 200}], {j, 1, lands}],
    Table[{t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, \text{All}, 6]]]}{\text{Omega}}$ }, {t, 150, 200}]],
  Table[{t, 1.}, {t, 150, 200}], Frame → True, FrameLabel → {"t", " $\Omega_i/\Omega_i^*$ "},
  PlotRange → {{150, 200}, Automatic}, PlotStyle →
  Append[Append[{{GrayLevel[0.8]}}, {Dashed, GrayLevel[0.7]}, {DotDashed,
    GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  }, {Thick, Black}], {Thick, Dashed, Black}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "Unallocated"], " $\Omega_i = \Omega_i^*$ "],
  LabelStyle → 12];
Export["./capitalPlot2a.eps", capitalPlot2a, "EPS"];
Export["./capitalPlot2a.jpg", capitalPlot2a, "JPEG"];
Export["./capitalPlot2aGray.eps", capitalPlot2aGray, "EPS"];
Export["./capitalPlot2aGray.jpg", capitalPlot2aGray, "JPEG"];

```

Out[ ]:=



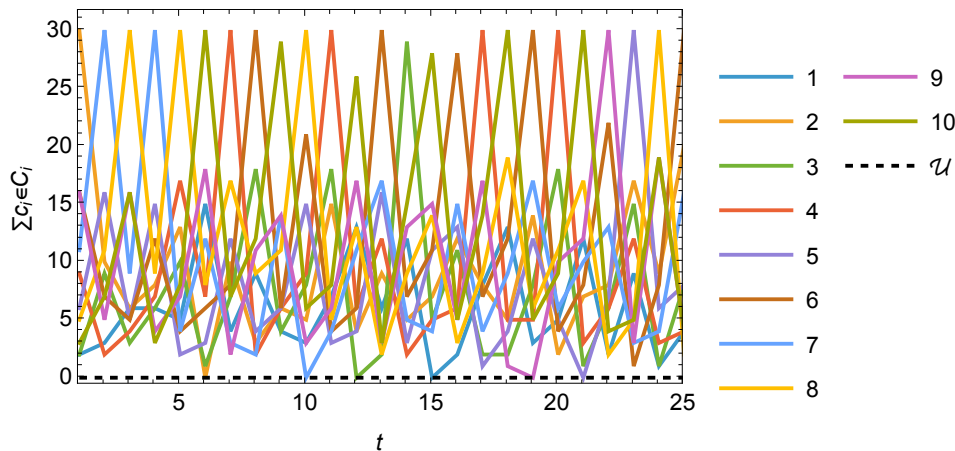
## Select time periods 3 - initialization

```

In[*]:= coalitionHeadcount2b = ListLinePlot[
  Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 1, 25}], {j, 1, lands}],
    Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 1, 25}]],
  PlotRange -> {{1, 25}, All}, Frame -> True, FrameLabel -> {"t", " $\sum_{c_i \in C_i}$ "},
  PlotStyle -> Append[Table[Automatic, {lands}], {Thick, Dashed, Black}],
  PlotLegends -> Append[Table[i, {i, 1, lands}], "u"], LabelStyle -> 12]
coalitionHeadcount2bGray = ListLinePlot[
  Append[Table[Table[{t, coalitions[[t, j, 10]]}, {t, 1, 25}], {j, 1, lands}],
    Table[{t, numCap - Total[coalitions[[t, All, 10]]}, {t, 1, 25}]],
  PlotRange -> {{1, 25}, All}, Frame -> True, FrameLabel -> {"t", " $\sum_{c_i \in C_i}$ "},
  PlotStyle -> Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends -> Append[Table[i, {i, 1, lands}], "u"], LabelStyle -> 12];
Export["./coalitionHeadcount2b.eps", coalitionHeadcount2b, "EPS"];
Export["./coalitionHeadcount2b.jpg", coalitionHeadcount2b, "JPEG"];
Export["./coalitionHeadcount2bGray.eps", coalitionHeadcount2bGray, "EPS"];
Export["./coalitionHeadcount2bGray.jpg", coalitionHeadcount2bGray, "JPEG"];

```

Out[\*]=

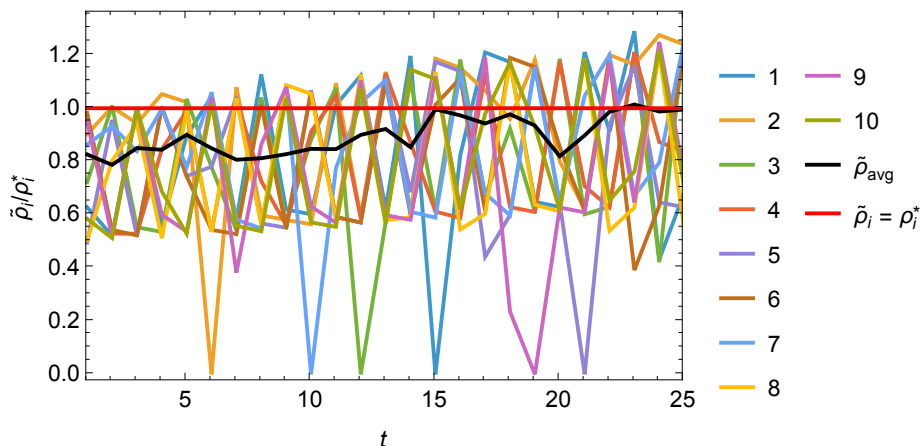


```

In[ ]:= rentsPlot2b = ListLinePlot[
  Append[Append[Table[Table[{{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }}, {t, 1, 25}], {j, 1, lands}],
    Table[{t, TrimmedMean[avgRho[[t]], {0.2, 0}]}], {t, 1, 25}],
  Table[{t, 1.}, {t, 1, 25}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{1, 25}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_{\text{avg}}$ "], " $\tilde{\rho}_i = \rho_i^*$ "],
  LabelStyle → 12]
rentsPlot2bGray = ListLinePlot[
  Append[Table[Table[{{t,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ }}, {t, 1, 25}], {j, 1, lands}],
    Table[{t, 1.}, {t, 1, 25}], Frame → True,
  FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{1, 25}, All},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_i = \rho_i^*$ "], LabelStyle → 12];
Export["./rentsPlot2b.eps", rentsPlot2b, "EPS"];
Export["./rentsPlot2b.jpg", rentsPlot2b, "JPEG"];
Export["./rentsPlot2bGray.eps", rentsPlot2bGray, "EPS"];
Export["./rentsPlot2bGray.jpg", rentsPlot2bGray, "JPEG"];

```

Out[ ]:=

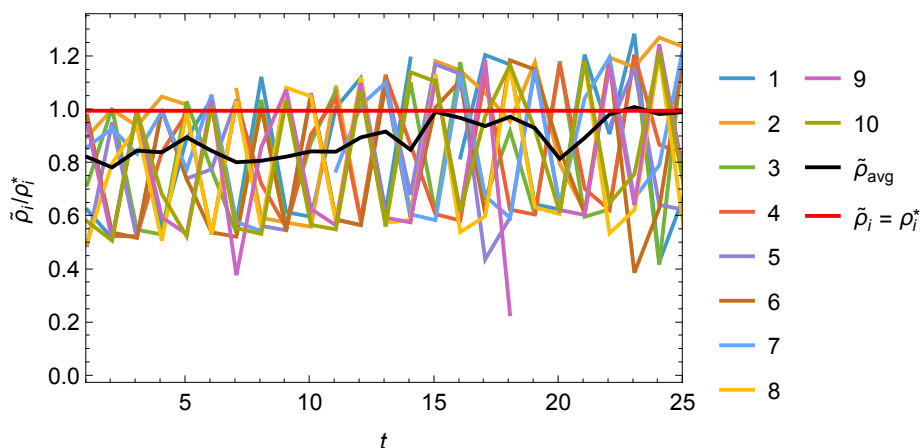


```

In[ ]:= rentsPlot22b = ListLinePlot[Append[Append[
  Table[Table[{t, If[coalitions[[t, j, 8]] == 0., ,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ ]], {t, 1, 25}],
    {j, 1, lands}], Table[{t, TrimmedMean[avgRho[[t]], {0.2, 0}]], {t, 1, 25}],
  Table[{t, 1.}, {t, 1, 25}], Frame → True, FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "},
  PlotRange → {{1, 25}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_{\text{avg}}$ "], " $\tilde{\rho}_i = \rho_i^*$ "],
  LabelStyle → 12]
rentsPlot22bGray = ListLinePlot[
  Append[Table[Table[{t, If[coalitions[[t, j, 8]] == 0., ,  $\frac{\text{coalitions}[[t, j, 8]]}{\text{rhoSols}[[j, 2]]}$ ]],
    {t, 1, 25}], {j, 1, lands}], Table[{t, 1.}, {t, 1, 25}],
  Frame → True, FrameLabel → {"t", " $\tilde{\rho}_i/\rho_i^*$ "}, PlotRange → {{1, 25}, All},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
  ], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $\tilde{\rho}_i = \rho_i^*$ "], LabelStyle → 12];
Export["./rentsPlot22b.eps", rentsPlot22b, "EPS"];
Export["./rentsPlot22b.jpg", rentsPlot22b, "JPEG"];
Export["./rentsPlot22bGray.eps", rentsPlot22bGray, "EPS"];
Export["./rentsPlot22bGray.jpg", rentsPlot22bGray, "JPEG"];

```

Out[ ]:=

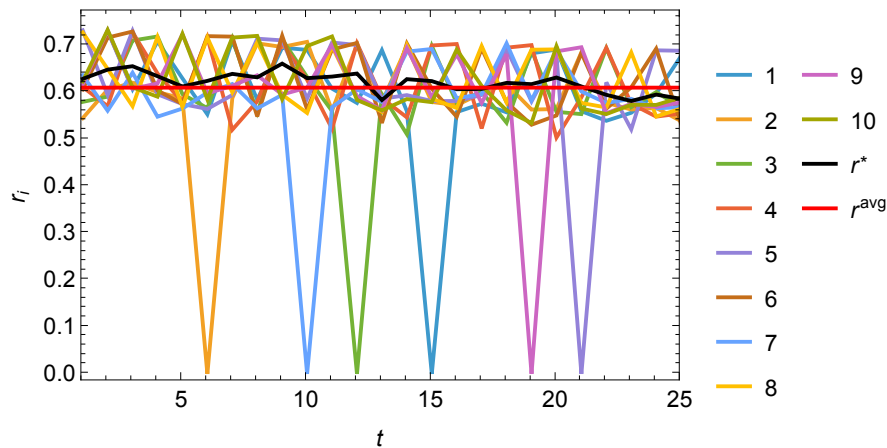


```

In[ ]:= profitRatePlot2b = ListLinePlot[
  Append[Append[Table[Table[{t, coalitions[[t, j, 7]]}, {t, 1, 25}], {j, 1, lands}],
    Table[{t, Mean[DeleteCases[coalitions[[t, All, 7], 0.]]}, {t, 1, 25}]],
  Table[{t, r /. rEQ}, {t, 1, 25}]], Frame → True,
  FrameLabel → {"t", "ri"}, PlotRange → {{1, 25}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"],
  LabelStyle → 12]
profitRatePlot2bGray =
  ListLinePlot[Append[Append[Table[Table[{t, coalitions[[t, j, 7]]}, {t, 1, 25}],
    {j, 1, lands}], Table[{t, r /. rEQ}, {t, 1, 25}]],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7], 0.]]}, {t, 1, 25}]],
  Frame → True, FrameLabel → {"t", "ri"}, PlotRange → {{1, 25}, All},
  PlotStyle → Append[Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin,
    GrayLevel[0.4]}, {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed,
    GrayLevel[0.75]}, {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    }, {Thick, Dashed, Black}], {Thick, Black}], PlotLegends →
  Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"], LabelStyle → 12];
Export["./profitRatePlot2b.eps", profitRatePlot2b, "EPS"];
Export["./profitRatePlot2b.jpg", profitRatePlot2b, "JPEG"];
Export["./profitRatePlot2bGray.eps", profitRatePlot2bGray, "EPS"];
Export["./profitRatePlot2bGray.jpg", profitRatePlot2bGray, "JPEG"];

```

Out[ ]:=

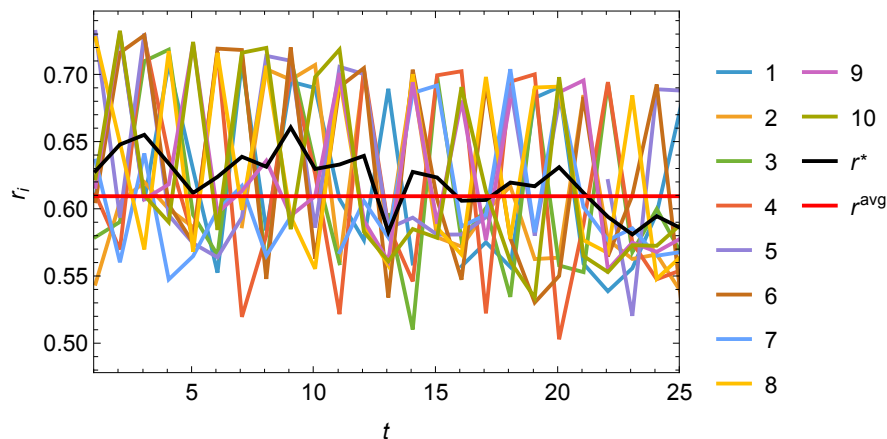


```

In[ ]:= profitRatePlot3b = ListLinePlot[
  Append[Append[Table[Table[{t, If[coalitions[[t, j, 7]] == 0., , coalitions[[t, j, 7]]}],
    {t, 1, 25}], {j, 1, lands}],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}, {t, 1, 25}],
  Table[{t, r /. rEQ}, {t, 1, 25}], Frame → True,
  FrameLabel → {"t", "ri"}, PlotRange → {{1, 25}, All}, PlotStyle →
  Append[Append[Table[Automatic, {lands}], {Thick, Black}], {Thick, Red}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"],
  LabelStyle → 12]
profitRatePlot3bGray = ListLinePlot[Append[
  Append[Table[Table[{t, If[coalitions[[t, j, 7]] == 0., , coalitions[[t, j, 7]]}],
    {t, 1, 25}], {j, 1, lands}], Table[{t, r /. rEQ}, {t, 1, 25}],
  Table[{t, Mean[DeleteCases[coalitions[[t, All, 7]], 0.]}, {t, 1, 25}],
  Frame → True, FrameLabel → {"t", "ri"}, PlotRange → {{1, 25}, All},
  PlotStyle → Append[Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin,
    GrayLevel[0.4]}, {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed,
    GrayLevel[0.75]}, {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    }, {Thick, Dashed, Black}], {Thick, Black}], PlotLegends →
  Append[Append[Table[i, {i, 1, lands}], "r*"], "ravg"], LabelStyle → 12];
Export["./profitRatePlot3b.eps", profitRatePlot3b, "EPS"];
Export["./profitRatePlot3b.jpg", profitRatePlot3b, "JPEG"];
Export["./profitRatePlot3bGray.eps", profitRatePlot3bGray, "EPS"];
Export["./profitRatePlot3bGray.jpg", profitRatePlot3bGray, "JPEG"];

```

Out[ ]:=

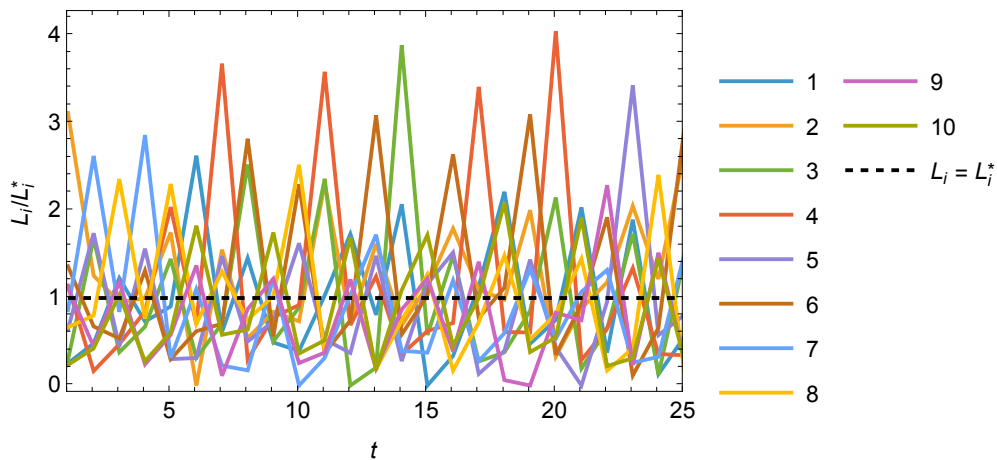


```

In[ ]:= laborPlot2b = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 4]]}{\text{lSols}[[j, 2]]}$ }, {t, 1, 25}], {j, 1, lands}],
  Table[{t, 1.}, {t, 1, 25}], Frame → True,
  FrameLabel → {"t", " $L_i/L_i^*$ "}, PlotRange → {{1, 25}, Automatic},
  PlotStyle → Append[Table[Automatic, {lands}], {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $L_i = L_i^*$ "], LabelStyle → 12]
laborPlot2bGray = ListLinePlot[
  Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 4]]}{\text{lSols}[[j, 2]]}$ }, {t, 1, 25}], {j, 1, lands}],
  Table[{t, 1.}, {t, 1, 25}], Frame → True,
  FrameLabel → {"t", " $L_i/L_i^*$ "}, PlotRange → {{1, 25}, Automatic},
  PlotStyle → Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]},
    {DotDashed, GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}},
    {Thick, Dashed, Black}],
  PlotLegends → Append[Table[i, {i, 1, lands}], " $L_i = L_i^*$ "], LabelStyle → 12];
Export["./laborPlot2b.eps", laborPlot2b, "EPS"];
Export["./laborPlot2b.jpg", laborPlot2b, "JPEG"];
Export["./laborPlot2bGray.eps", laborPlot2bGray, "EPS"];
Export["./laborPlot2bGray.jpg", laborPlot2bGray, "JPEG"];

```

Out[ ]:=

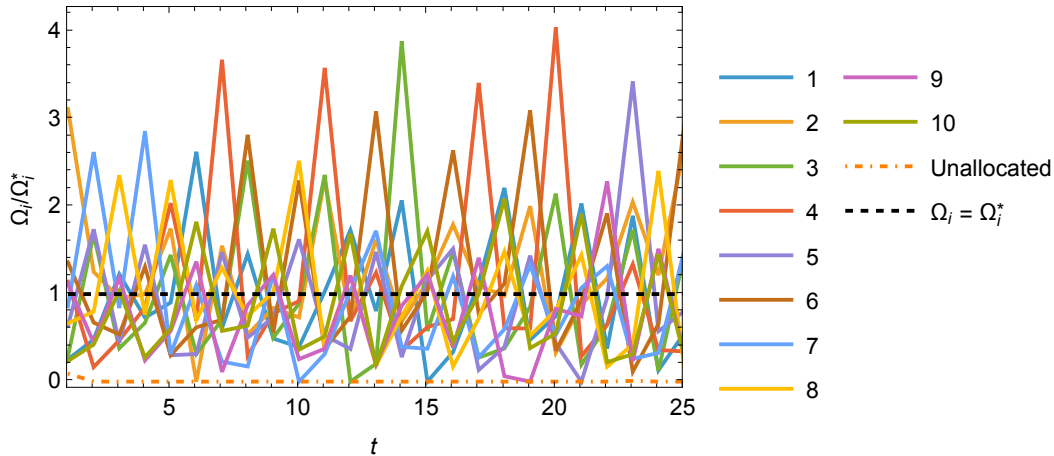


```

In[ ]:= capitalPlot2b = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 1, 25}], {j, 1, lands}],
    Table[{t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, \text{All}, 6]]]}{\text{Omega}}$ }, {t, 1, 25}]],
  Table[{t, 1.}, {t, 1, 25}], Frame → True, FrameLabel → {"t", " $\Omega_i/\Omega_i^*$ "},
  PlotRange → {{1, 25}, Automatic}, PlotStyle → Append[Append[
    Table[Automatic, {lands}], {Thick, DotDashed, Orange}], {Thick, Dashed, Black}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "Unallocated"], " $\Omega_i = \Omega_i^*$ "],
  LabelStyle → 12]
capitalPlot2bGray = ListLinePlot[
  Append[Append[Table[Table[{t,  $\frac{\text{coalitions}[[t, j, 6]]}{\text{capAlloc}[[j, 2]]}$ }, {t, 1, 25}], {j, 1, lands}],
    Table[{t,  $\frac{\text{Omega} - \text{Total}[\text{coalitions}[[t, \text{All}, 6]]]}{\text{Omega}}$ }, {t, 1, 25}]],
  Table[{t, 1.}, {t, 1, 25}], Frame → True, FrameLabel → {"t", " $\Omega_i/\Omega_i^*$ "},
  PlotRange → {{1, 25}, Automatic}, PlotStyle →
  Append[Append[{{GrayLevel[0.8]}, {Dashed, GrayLevel[0.7]}, {DotDashed,
    GrayLevel[0.6]}, {Dotted, GrayLevel[0.5]}, {Thin, GrayLevel[0.4]},
    {GrayLevel[0.55]}, {Dashed, GrayLevel[0.6]}, {DotDashed, GrayLevel[0.75]},
    {Dotted, GrayLevel[0.45]}, {Thin, GrayLevel[0.85]}
    }, {Thick, Orange, Black}], {Thick, Dashed, Black}],
  PlotLegends → Append[Append[Table[i, {i, 1, lands}], "Unallocated"], " $\Omega_i = \Omega_i^*$ "],
  LabelStyle → 12];
Export["./capitalPlot2b.eps", capitalPlot2b, "EPS"];
Export["./capitalPlot2b.jpg", capitalPlot2b, "JPEG"];
Export["./capitalPlot2bGray.eps", capitalPlot2bGray, "EPS"];
Export["./capitalPlot2bGray.jpg", capitalPlot2bGray, "JPEG"];

```

Out[ ]:=



## Histograms

Pooled histogram of rents on each parcel of land.

In[ ]:= **cHeader**

Out[ ]:=

$$\{\rho_{t,i}^C, C_{t,i}^C, \Omega_{t,i}^C, L_{t,i}, Y_{t,i}, \Omega_{t,i}^C, r_{t,i}^C, \tilde{p}_{t,i}^C, L_{t,i}^*, C_{t,i}, C_{t,i}^{\prime\prime}, \Omega_{t,i}^{\prime\prime}\}$$

```
In[ ]:= rentHist = Table[ $\frac{\text{DeleteCases}[\text{coalitions}[\text{All}, j, 8], 0.]}{\text{rhoSols}[[j, 2]]}$ , {j, 1, lands}];
```

In[ ]:= **rentMeans =**

```
Table[TrimmedMean[DeleteCases[coalitions[All, j, 8], 0.], {0., 0}], {j, 1, lands}]
(* rentMeans=Table[MovingAverage[ $\frac{\text{DeleteCases}[\text{coalitions}[\text{All}, j, 8], 0.]}{\text{rhoSols}[[j, 2]]}$ , 5], {j, 1, lands}]; *)
```

Out[ ]:=

```
{102.271, 115.289, 122.731, 132.558,
 146.453, 161.479, 176.197, 194.725, 209.675, 230.066}
```

```
In[ ]:= Table[Line[{{rentMeans[[j]], 0}, {rentMeans[[j]], 0.02}}, {j, 1, lands}]
```

Out[ ]:=

```
{Line[{{102.271, 0}, {102.271, 0.02}}, Line[{{115.289, 0}, {115.289, 0.02}}],
 Line[{{122.731, 0}, {122.731, 0.02}}], Line[{{132.558, 0}, {132.558, 0.02}}],
 Line[{{146.453, 0}, {146.453, 0.02}}], Line[{{161.479, 0}, {161.479, 0.02}}],
 Line[{{176.197, 0}, {176.197, 0.02}}], Line[{{194.725, 0}, {194.725, 0.02}}],
 Line[{{209.675, 0}, {209.675, 0.02}}], Line[{{230.066, 0}, {230.066, 0.02}}]}
```

```
In[ ]:= ChartLegends → Table[j, {j, 1, lands}]
```

Out[ ]:=

```
ChartLegends → {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
```

```
In[ ]:= Table[ $\frac{\text{rentMeans}[[j]]}{\text{rhoSols}[[j, 2]]}$ , {j, 1, lands}]
```

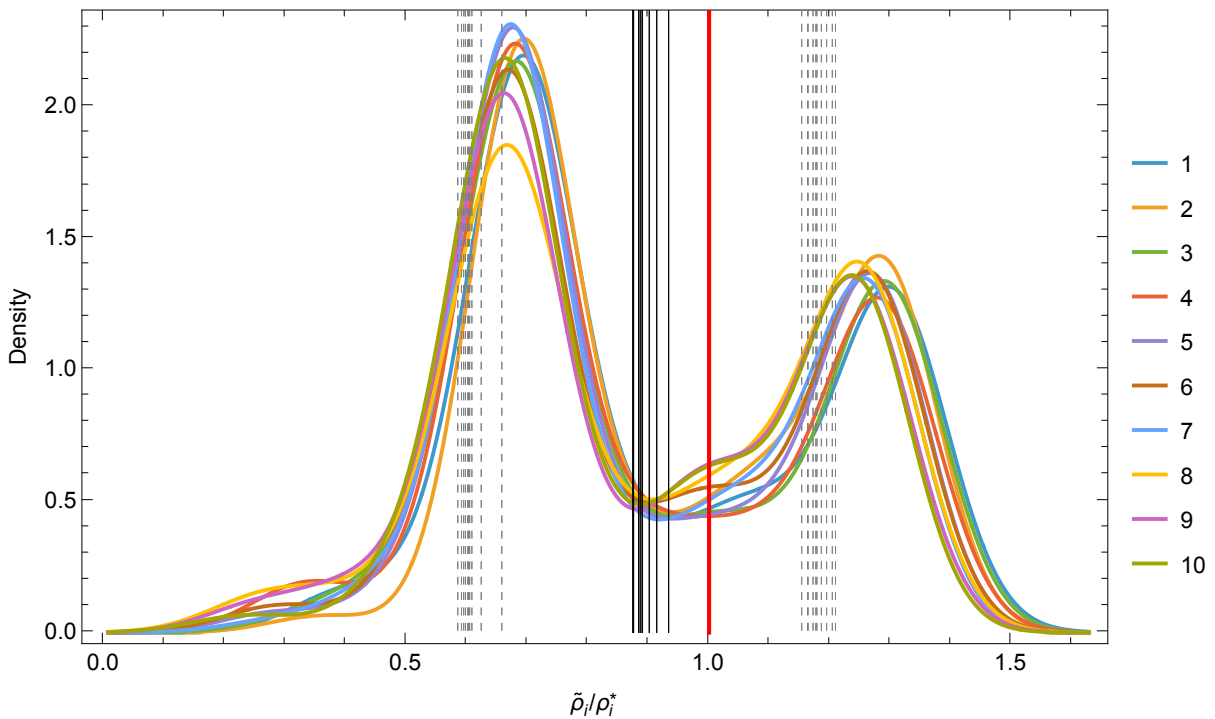
```
Out[ ]:=  
{0.913416, 0.933074, 0.900973, 0.883496,  
 0.887026, 0.889587, 0.883672, 0.889848, 0.873803, 0.875099}
```

```

In[*]:= histogramRent =
SmoothHistogram[rentHist, PlotRange → All, PlotLegends → Table[j, {j, 1, lands}],
Frame → True, FrameLabel → {" $\tilde{\rho}_i/\rho_i^*$ ", "Density"}, LabelStyle → 12, ImageSize → Large,
Epilog → {Table[Line[{{ $\frac{\text{rentMeans}[[j]]}{\text{rhoSols}[[j, 2]]}, 0$ }, { $\frac{\text{rentMeans}[[j]]}{\text{rhoSols}[[j, 2]]}, 145$ }}], {j, 1, lands}],
Thick, Red, Line[{{1, 0}, {1, 50}}], Thin, Dashed, Gray,
Table[Line[{{ $\frac{\text{rentMeans}[[j]]}{\text{rhoSols}[[j, 2]]} - \text{StandardDeviation}[\text{rentHist}[[j]]], 0$ },
{ $\frac{\text{rentMeans}[[j]]}{\text{rhoSols}[[j, 2]]} - \text{StandardDeviation}[\text{rentHist}[[j]]], 145$ }}], {j, 1, lands}],
Table[Line[{{ $\frac{\text{rentMeans}[[j]]}{\text{rhoSols}[[j, 2]]} + \text{StandardDeviation}[\text{rentHist}[[j]]], 0$ },
{ $\frac{\text{rentMeans}[[j]]}{\text{rhoSols}[[j, 2]]} + \text{StandardDeviation}[\text{rentHist}[[j]]], 145$ }}], {j, 1, lands}]]]
(* SmoothHistogram[rentHist,PlotRange→All,PlotLegends→Table[j,{j,1,lands}],
Epilog→{Table[Line[{{rentMeans[[j]],0},{rentMeans[[j]],145}}],{j,1,lands}],
Thick,Red,Line[{{1,0},{1,50}}]}]*)
Export["./histogramRent.eps", histogramRent, "EPS"];

```

Out[\*]=



Histogram for profit rates.

```

In[*]:= rEQ

```

Out[\*]=

```

{r → 0.61054}

```

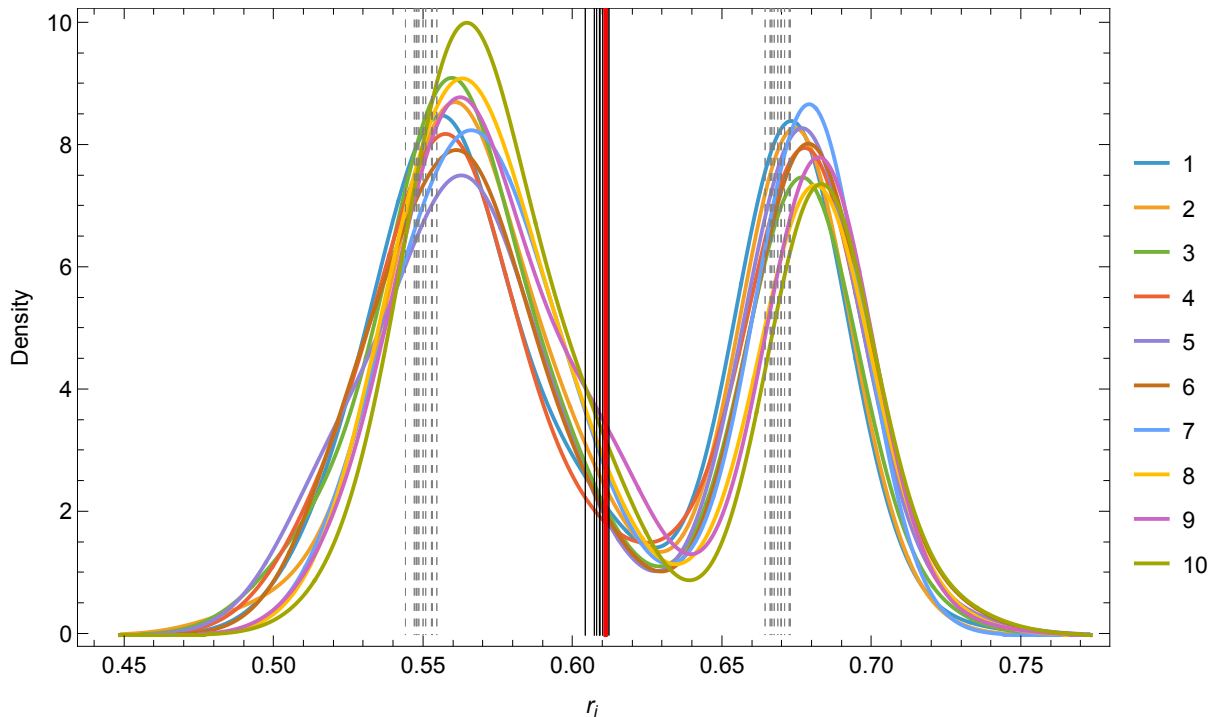
```

In[ ]:= profitHist = Table[DeleteCases[coalitions[All, j, 7], 0.], {j, 1, lands}];
In[ ]:= profitMeans = Table[Mean[DeleteCases[coalitions[All, j, 7], 0.]], {j, 1, lands}]
Out[ ]:=
{0.606779, 0.607543, 0.603751, 0.608482,
 0.609577, 0.610198, 0.611657, 0.608657, 0.61099, 0.610219}

In[ ]:= histogramProfit = SmoothHistogram[profitHist, PlotLegends -> Table[j, {j, 1, lands}],
  Frame -> True, FrameLabel -> {"ri", "Density"}, LabelStyle -> 12, ImageSize -> Large,
  Epilog -> {Table[Line[{{profitMeans[[j]], 0}, {profitMeans[[j]], 50}], {j, 1, lands}],
  Thick, Red, Line[{{r /. rEQ, 0}, {r /. rEQ, 50}], Thin, Dashed, Gray,
  Table[Line[{{profitMeans[[j]] - StandardDeviation[profitHist[[j]], 0},
    {profitMeans[[j]] - StandardDeviation[profitHist[[j]], 50}], {j, 1, lands}],
  Table[Line[{{profitMeans[[j]] + StandardDeviation[profitHist[[j]], 0},
    {profitMeans[[j]] + StandardDeviation[profitHist[[j]], 50}], {j, 1, lands}]]]
Export["./histogramProfit.eps", histogramProfit, "EPS"];

```

Out[ ]:=



```

In[ ]:= profitHist2 = Table[DeleteCases[coalitions[All, j, 7], 0.] /
  (r /. rEQ), {j, 1, lands}];
profitMeans2 = Table[Mean[DeleteCases[coalitions[All, j, 7], 0.] /
  (r /. rEQ)], {j, 1, lands}]

```

Out[ ]:=

```

{0.99384, 0.995091, 0.98888, 0.996629,
 0.998423, 0.999439, 1.00183, 0.996915, 1.00074, 0.999474}

```

```

In[ ]:= histogramProfitRel =
  SmoothHistogram[profitHist2, PlotLegends -> Table[j, {j, 1, lands}], Frame -> True,
  FrameLabel -> {" $r_i/r_i^*$ ", "Density"}, LabelStyle -> 12, ImageSize -> Large, Epilog ->
  {Table[Line[{{profitMeans2[[j]], 0}, {profitMeans2[[j]], 50}}, {j, 1, lands}],
  Thick, Red, Line[{{1, 0}, {1, 50}}], Thin, Dashed, Gray,
  Table[Line[{{profitMeans2[[j]] - StandardDeviation[profitHist2[[j]]], 0},
  {profitMeans2[[j]] - StandardDeviation[profitHist2[[j]]], 50}], {j, 1, lands}],
  Table[Line[{{profitMeans2[[j]] + StandardDeviation[profitHist2[[j]]], 0},
  {profitMeans2[[j]] + StandardDeviation[profitHist2[[j]]], 50}], {j, 1, lands}]]]
  Export["histogramProfitRel.eps", histogramProfitRel, "EPS"];

```

Out[ ]:=

