A Statistical Physics Implementation of Coase's Theory of the Firm

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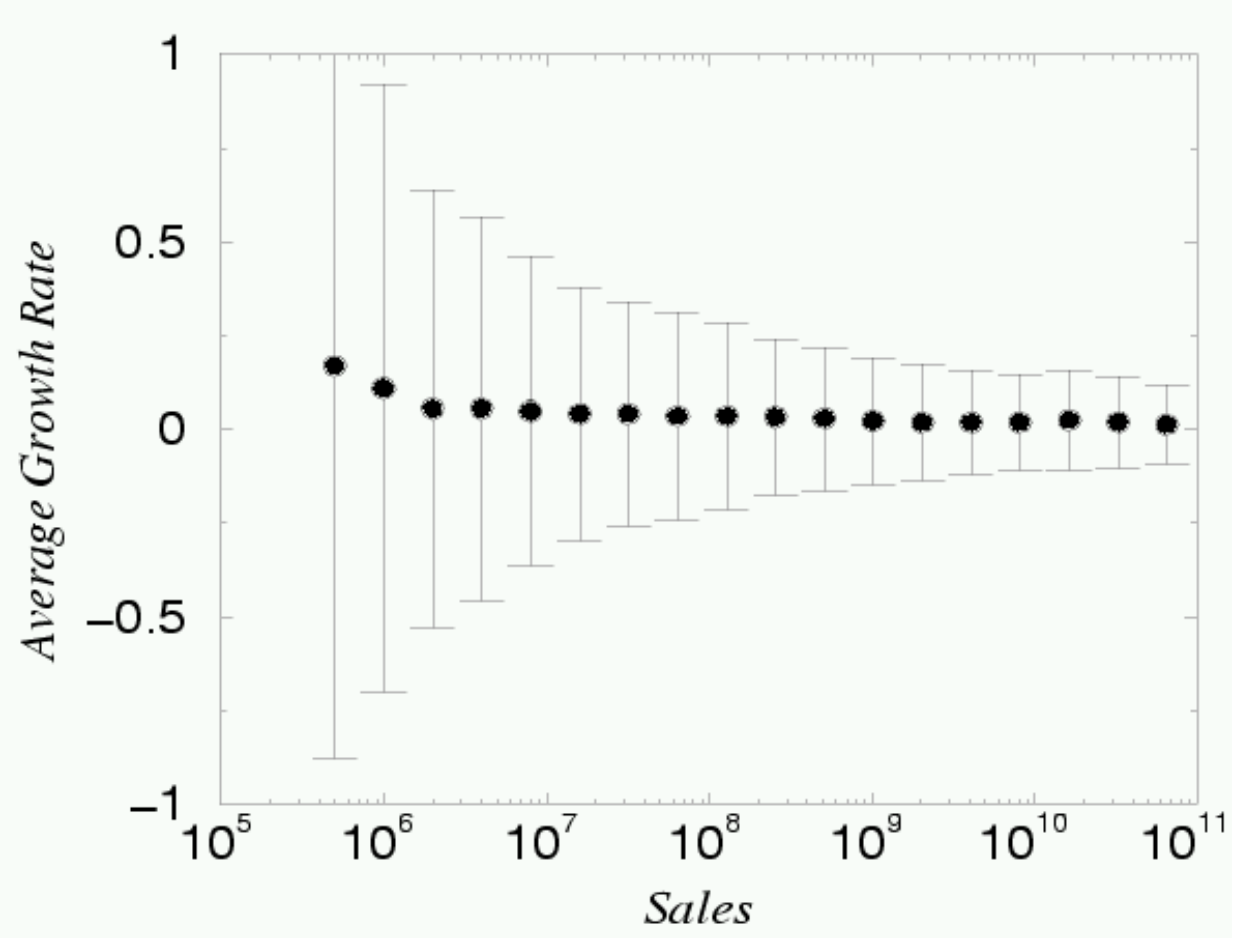
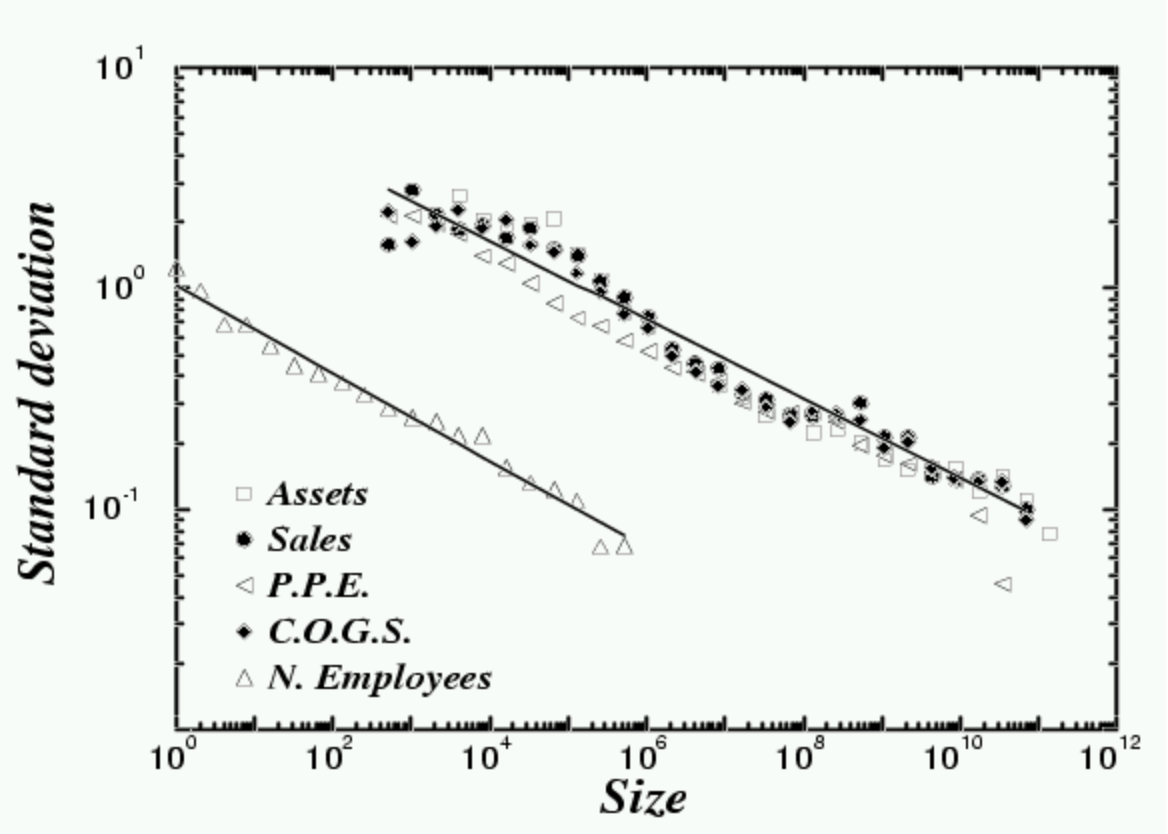
(joint with Sergey Buldyrev and H. Eugene Stanley)

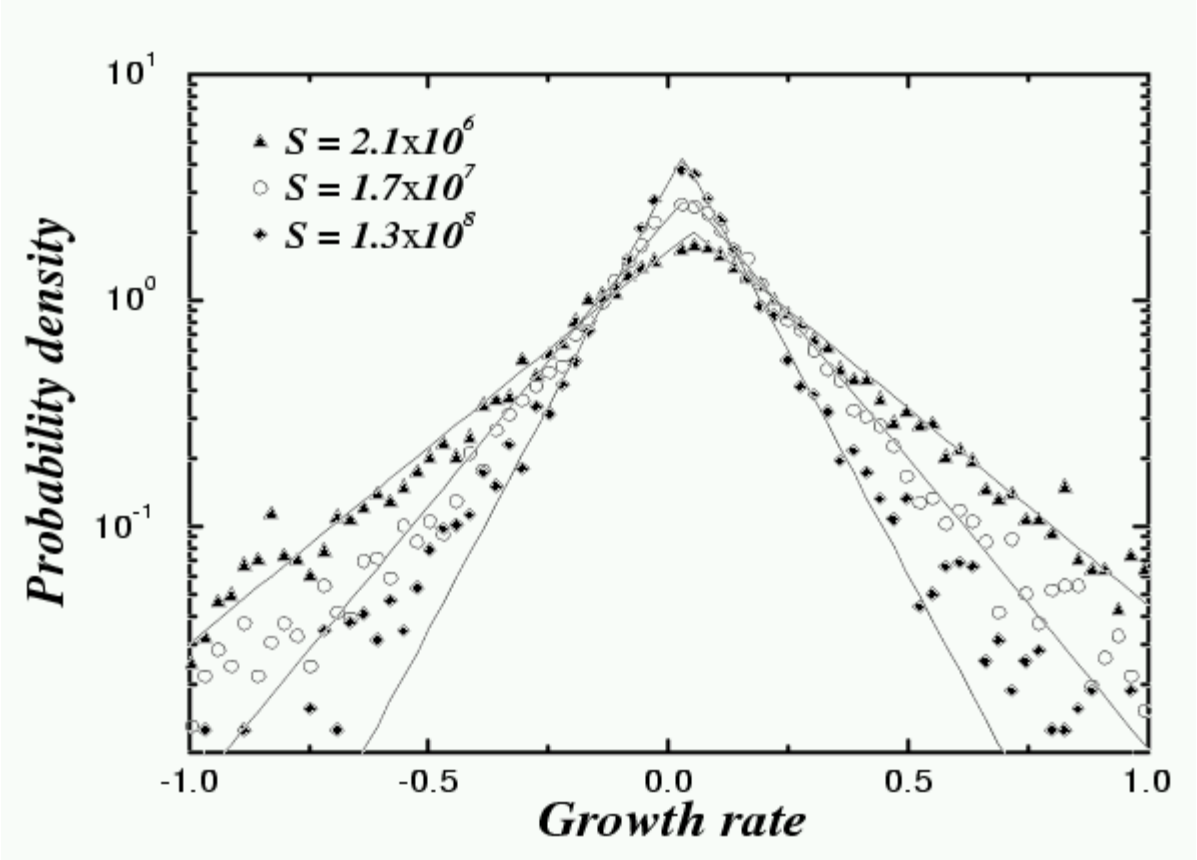
Firm size and mean growth rates



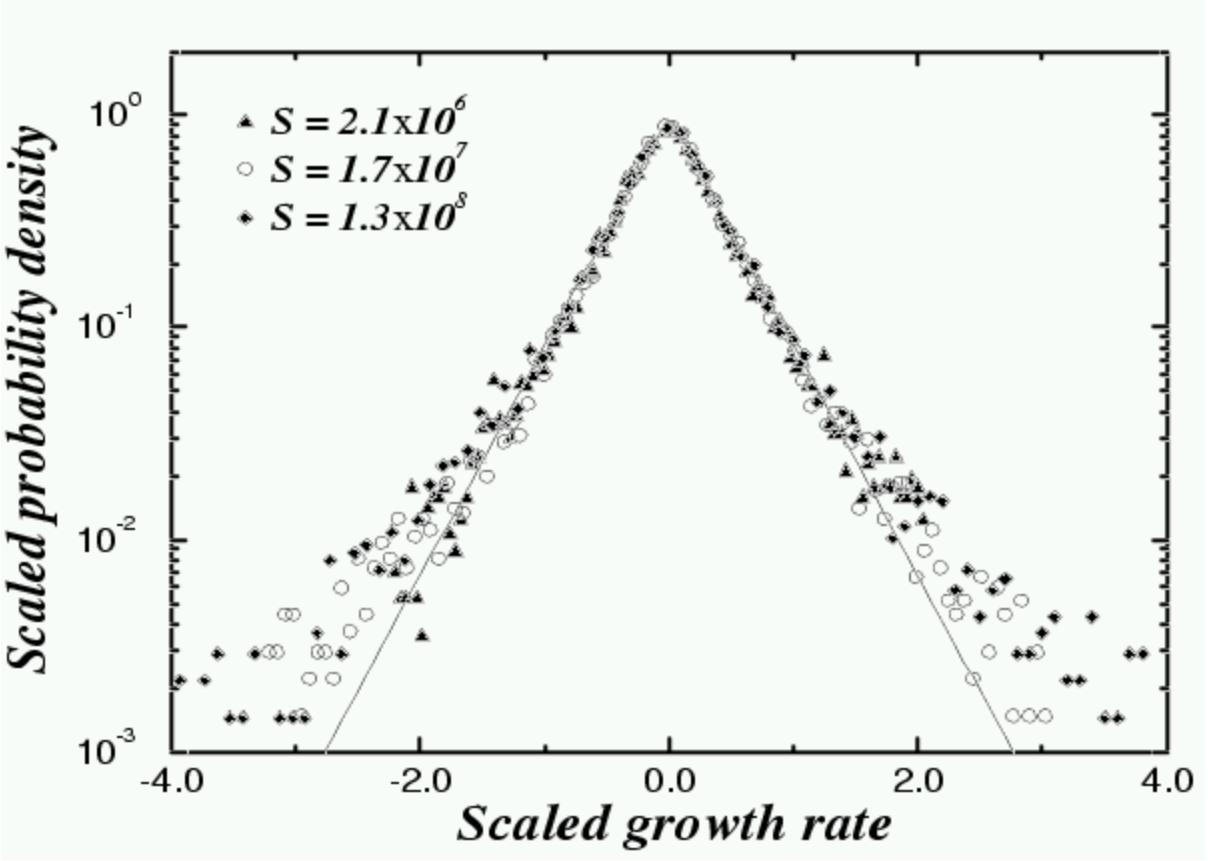
Firm size and standard deviation of growth



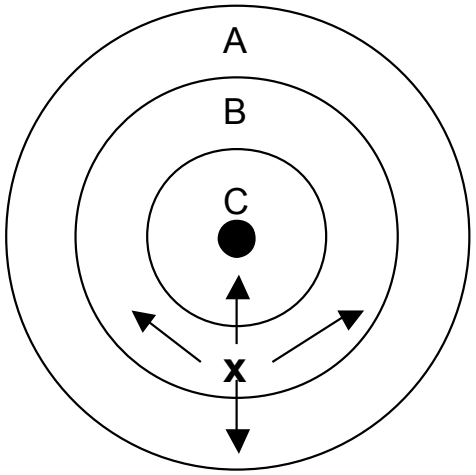
Distributions at different scales



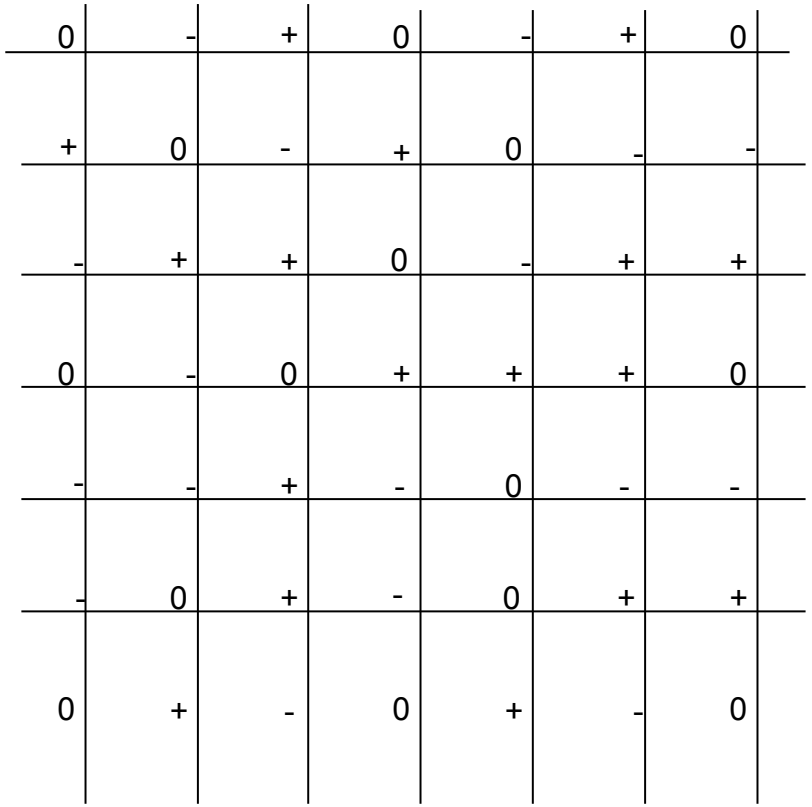
Data Collapse



Imagine an entrepreneur who starts controlling exchange transactions from x. Now as he extends his activities in the same product (B), the cost of organizing increases until at some point it becomes equal to that of a dissimilar product (A and C).



At the margin, the costs of organising within the firm will be equal either to the costs of organising in another firm or to the costs involved in leaving the transaction to be 'organised' by the price mechanism. Business men will be constantly experimenting, controlling more or less, and in this way, equilibrium will be maintained. This gives the position of equilibrium for static analysis. But it is clear that the dynamic factors are also of considerable importance, and an investigation of the effect changes have on the cost of organising within the firm and on marketing costs generally will enable one to explain why firms get larger and smaller. We thus have a theory of moving equilibrium.


0 - + 0 - + 0
+ 0 - + 0 - -
- + + 0 - + +
0 - 0 + + + 0
- - + - 0 - -
- 0 + - 0 + +
0 + - 0 + - 0

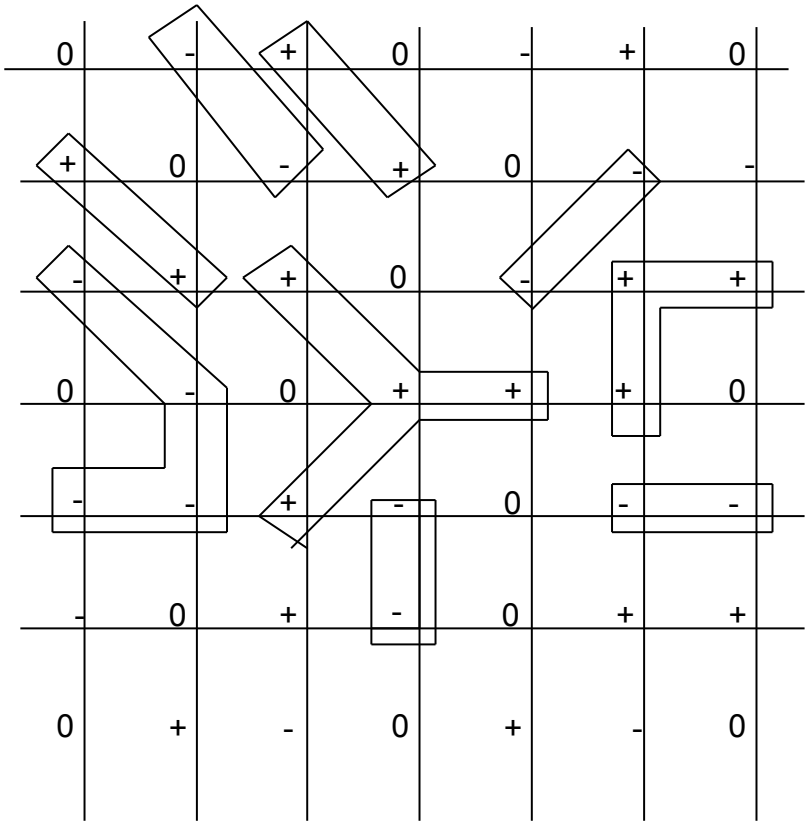
"Profit" function

- Captures synergies and organizational diseconomies of scale

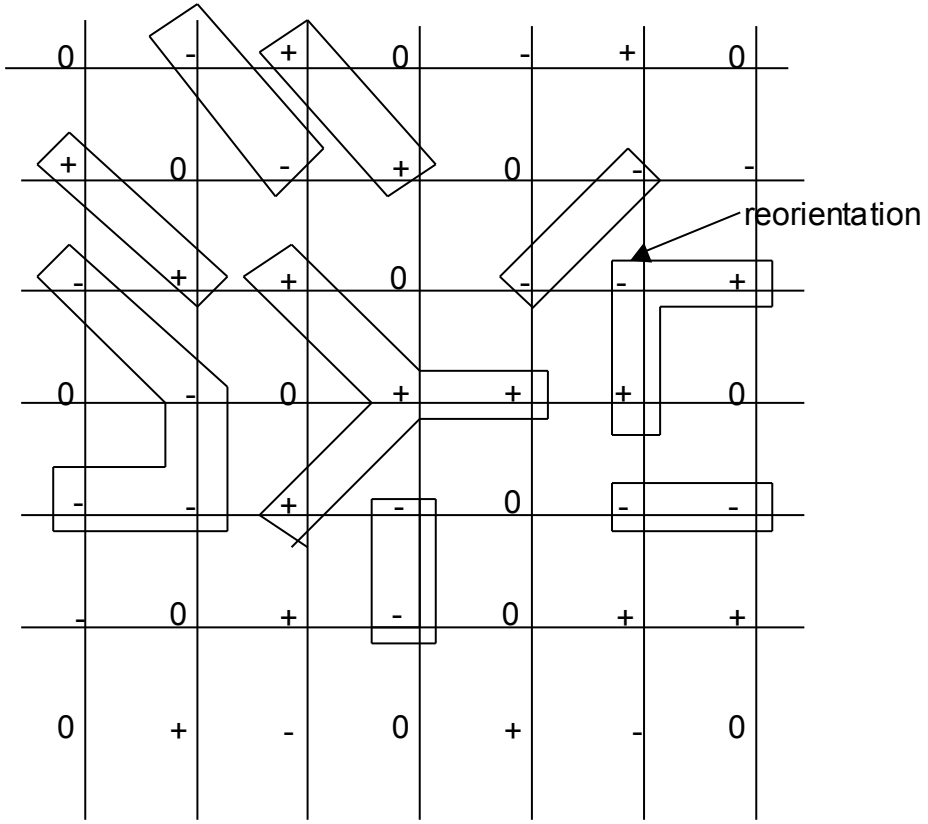
$$\pi_i = \left| P_i - N_i \right|^{\alpha} - k(P_i + N_i)^2 \qquad 1 < \alpha < 2$$

- k is small
- $\alpha > 1$ implies "synergies" among similarly oriented firms

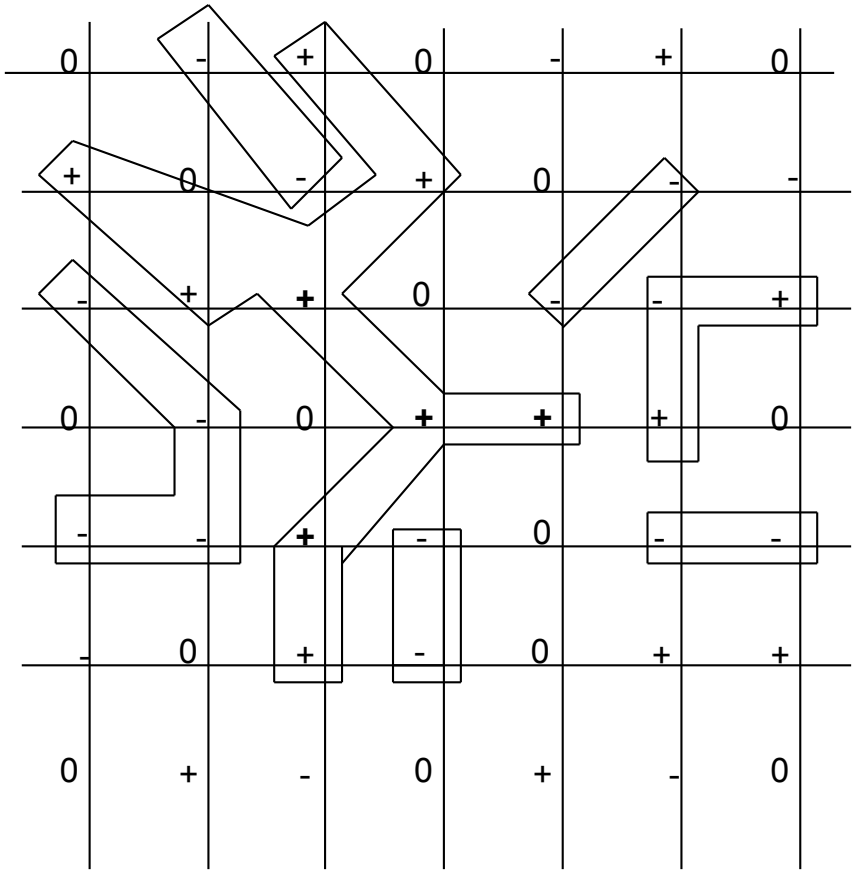
Possible first round move



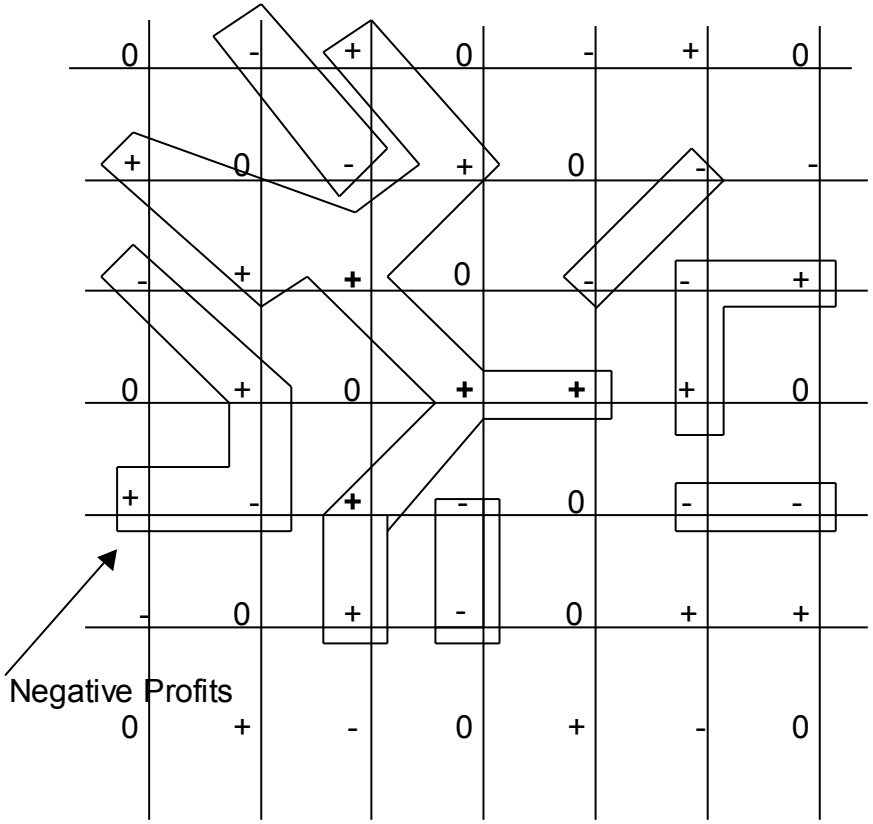
Reorientation



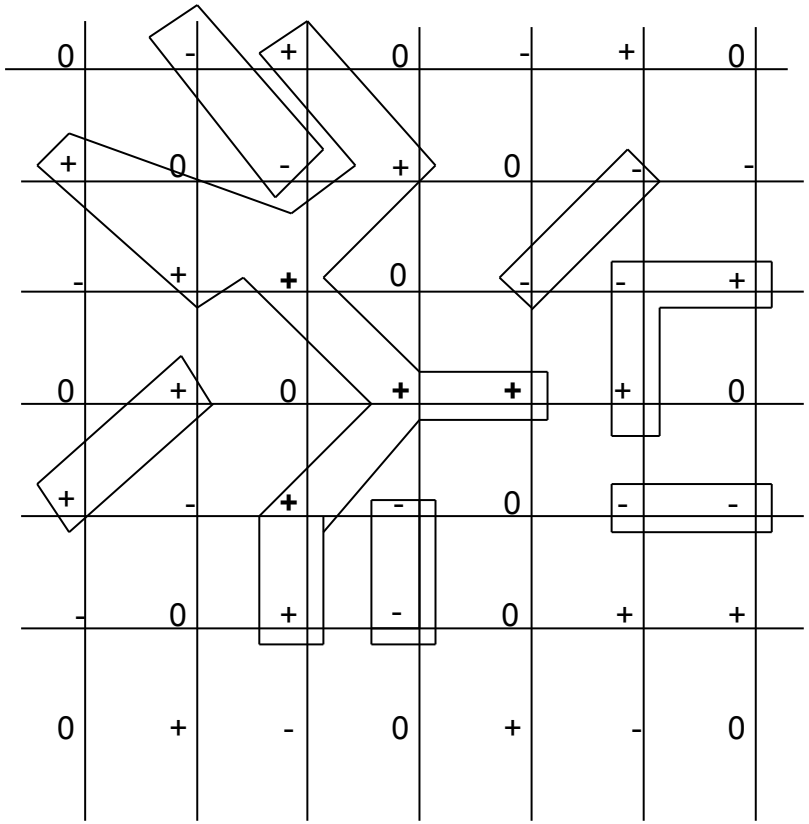
Next merger round (central firm only)

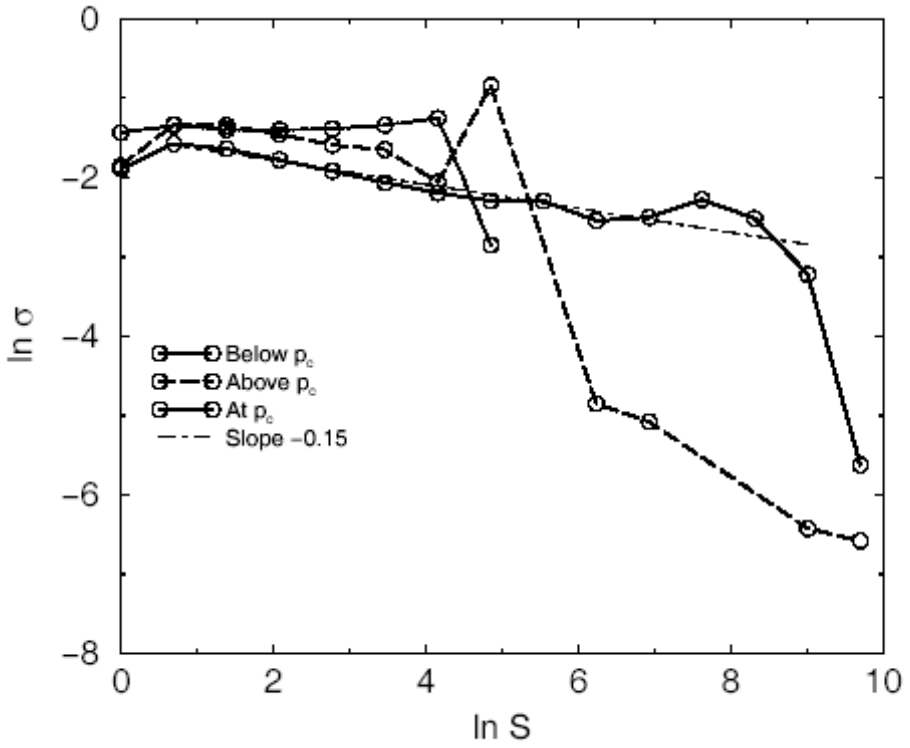


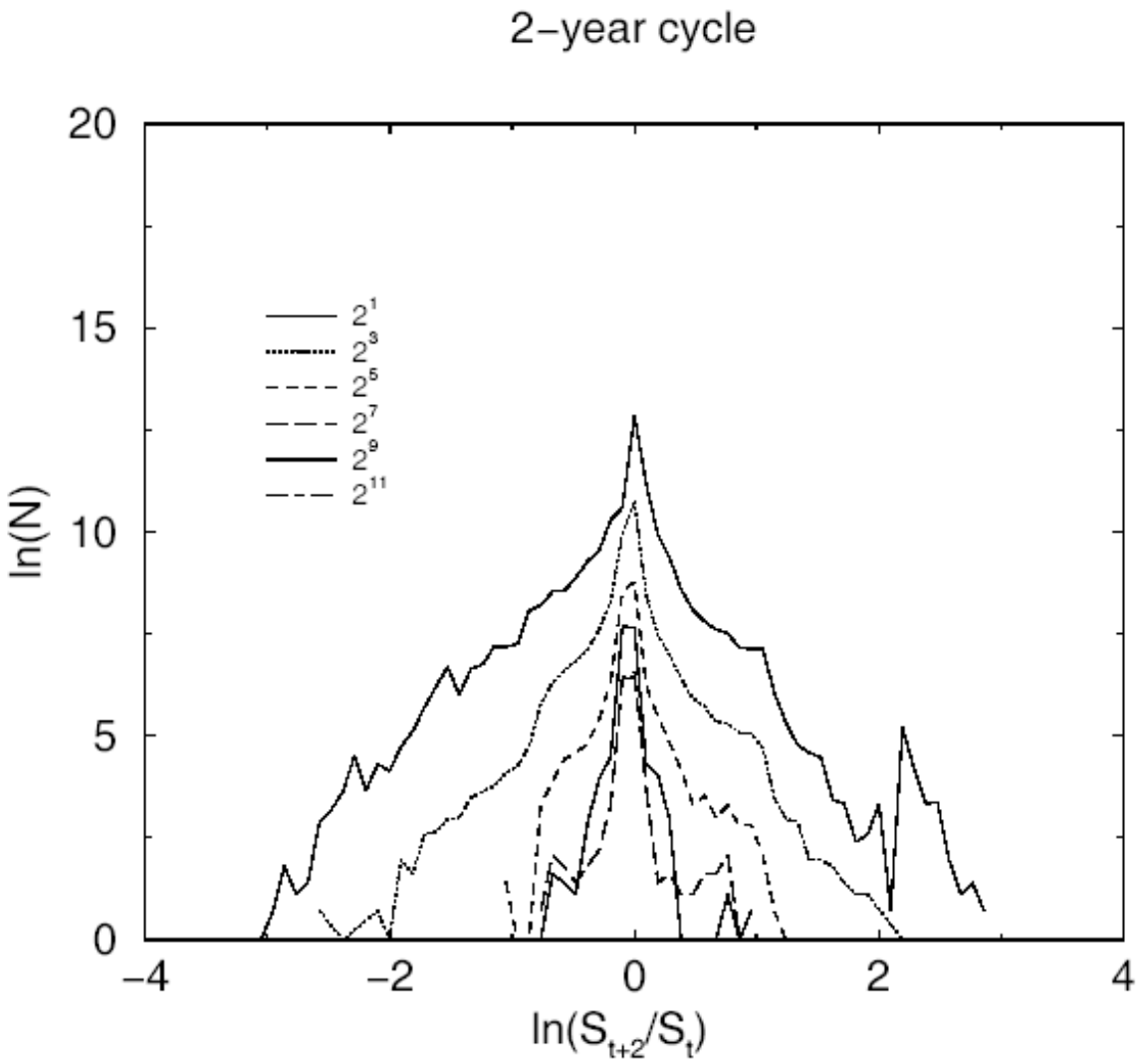
More reorientation

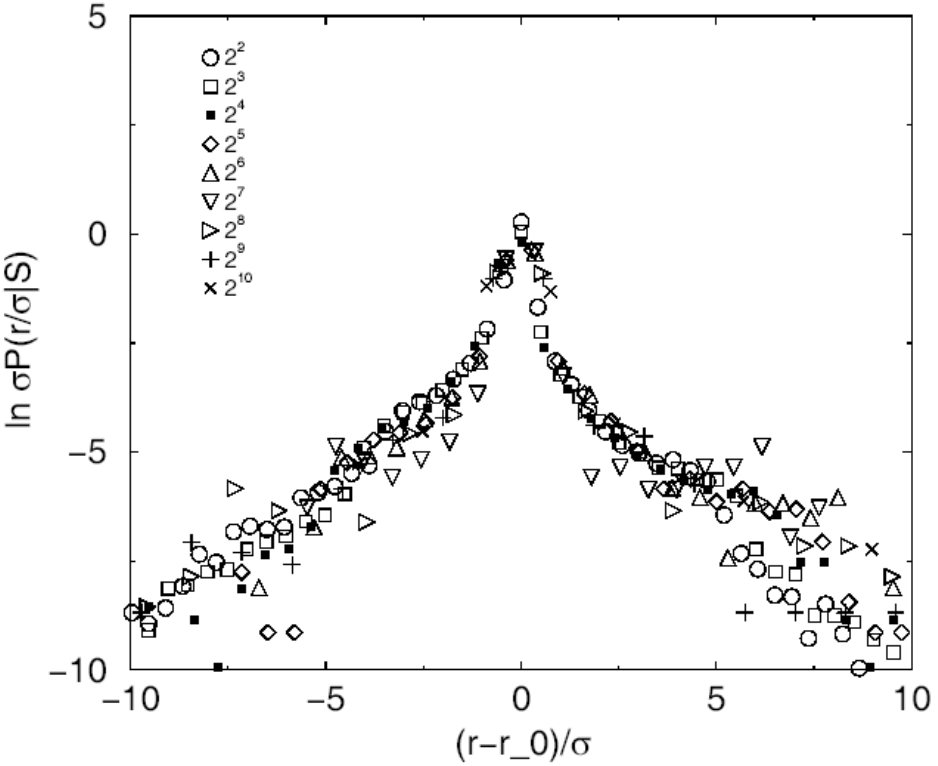


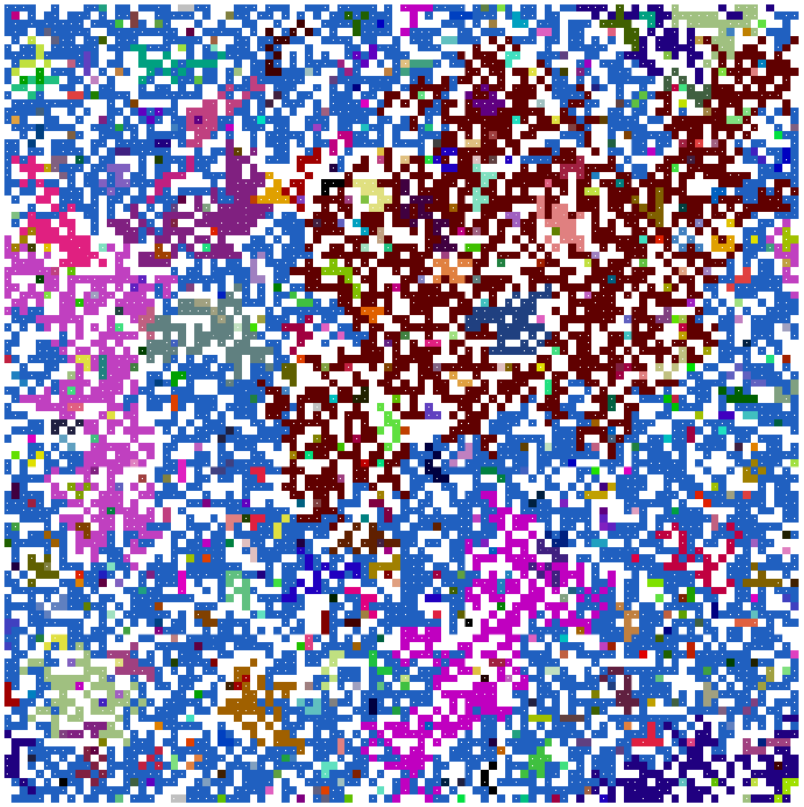
Breaking up

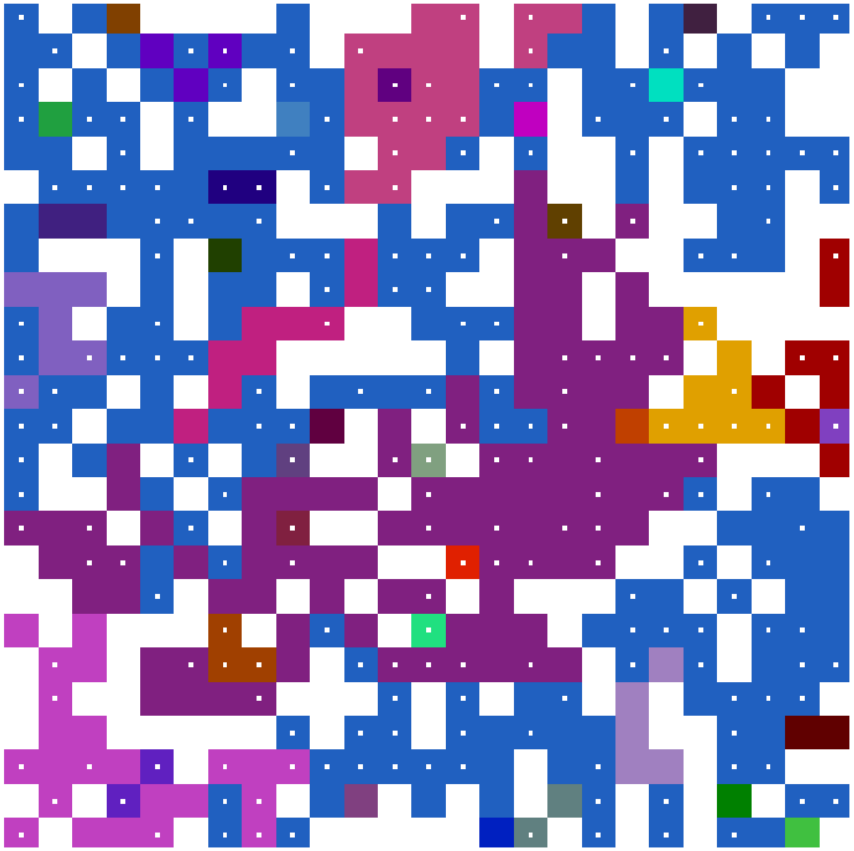



0
−2
−4
−6
−8
ln σ
0
2
4
6
8
10
ln S
Below p_c
Above p_c
At p_c
Slope −0.15


2−year cycle
20
15
10
5
0
ln(N)
−4
−2
0
2
4
ln(S_{t+2}/S_t)
2^1
2^3
2^5
2^7
2^9
2^11


5
0
−5
−10
−10
−5
0
5
10
ln σP(r/σ|S)
(r−r_0)/σ
2^2
2^3
2^4
2^5
2^6
2^7
2^8
2^9
2^10





Summary

- Stochastic dynamic model that captures essential features of Coase's article
- Reproduces empirical findings about growth dynamics with a model in which behavior is boundedly rational
- Implies that case-by-case analysis of what activities fit together in a single firm are doomed to "near failure"