Exit Options and the dynamic of contributions to public *projects*

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I. Focus

III. Experiment

II. The Model

IV. Results

Risky joint ventures

We investigate the effect of exit options on the performance of public projects.

Focus on:

- risky public projects
- no monitoring of contribution possible ⇒ free-riding incentives.
- no direct forms of punishment possible ⇒ free-riding incentives.
- exit from the joint project is possible ⇒ good or bad?

Research questions

- How can we design *better* incentives for team work?
- Should we design *open* or *close* groups?
- Should we leave *outside options* open, and how attractive must they be?

Examples

Open source software: BSD vs. GPL (e.g. Gaudeul 2005)

Agriculture: collective farms *vs.* private plots (e.g. Lin 1990); enclosures, commons...

Team work: open *vs.* closed working groups (e.g. Keser and Montmarquette 2009)

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No exit

Baseline: no exit

- Two agents, i and j;
- decide on how much *effort* e_i, e_j to devote to a joint project;
- the project is successful with probability $\pi = f(e_i, e_j)$, f concave
- π is normalised as to never yield $\pi = 1$
- the project yields payoff v_k, $k = i, j$ if successful; 0 otherwise
- subjects maximise $P_k = f(e_i, e_j) \cdot v_k - e_k$, $k = i, j$

Features

- effort is non-observable by the other player (contributes to π)
- the model allows for symmetric as well as asymmetric players (if $v_i \neq v_j$)
- if symmetric, interior solution for both the Pareto-optimum and the Nash
- if asymmetric, corner solution for Nash

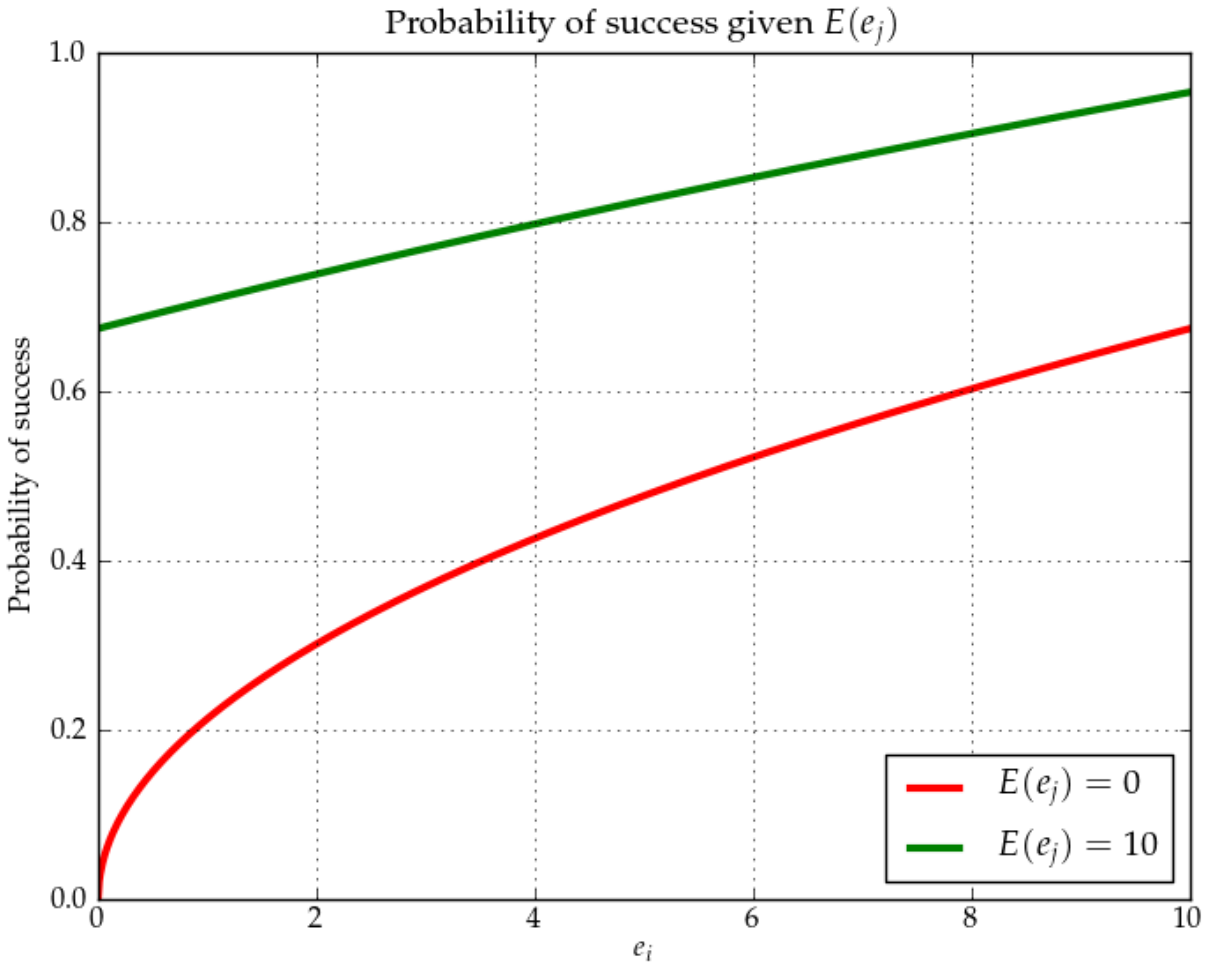
The Model: exit options, I

We assume $\pi = \frac{\sqrt{e_i + e_j}}{\sqrt{22}}$, $e_i, e_j \in (0, 10)$, $v_i = 24$, $v_j = 16$

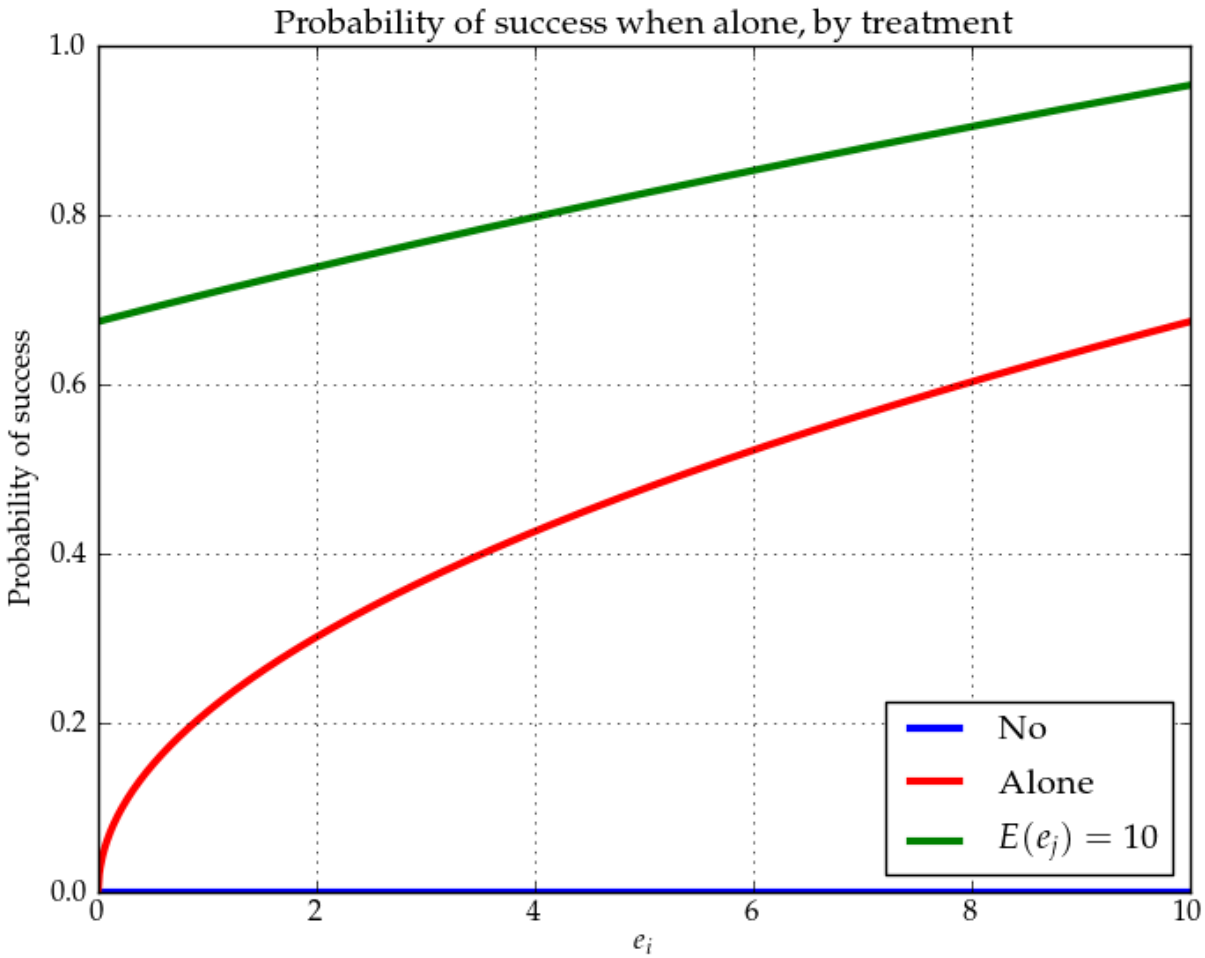
In this setting, we allow for different payoffs for the **exit option**

	π **if in**	π **of exiter** (j)	π **of stayer** (i)
NO exit	$\sqrt{e_i + e_j}$	-	-
Zero	$\sqrt{e_i + e_j}$	0	$\sqrt{e_i}$
Alone	$\sqrt{e_i + e_j}$	$\sqrt{e_j}$	$\sqrt{e_i}$
+3	$\sqrt{e_i + e_j}$	$\sqrt{e_j + 3}$	$\sqrt{e_i}$
+6	$\sqrt{e_i + e_j}$	$\sqrt{e_j + 6}$	$\sqrt{e_i}$

The Model: exit options, II



The Model: exit options, II



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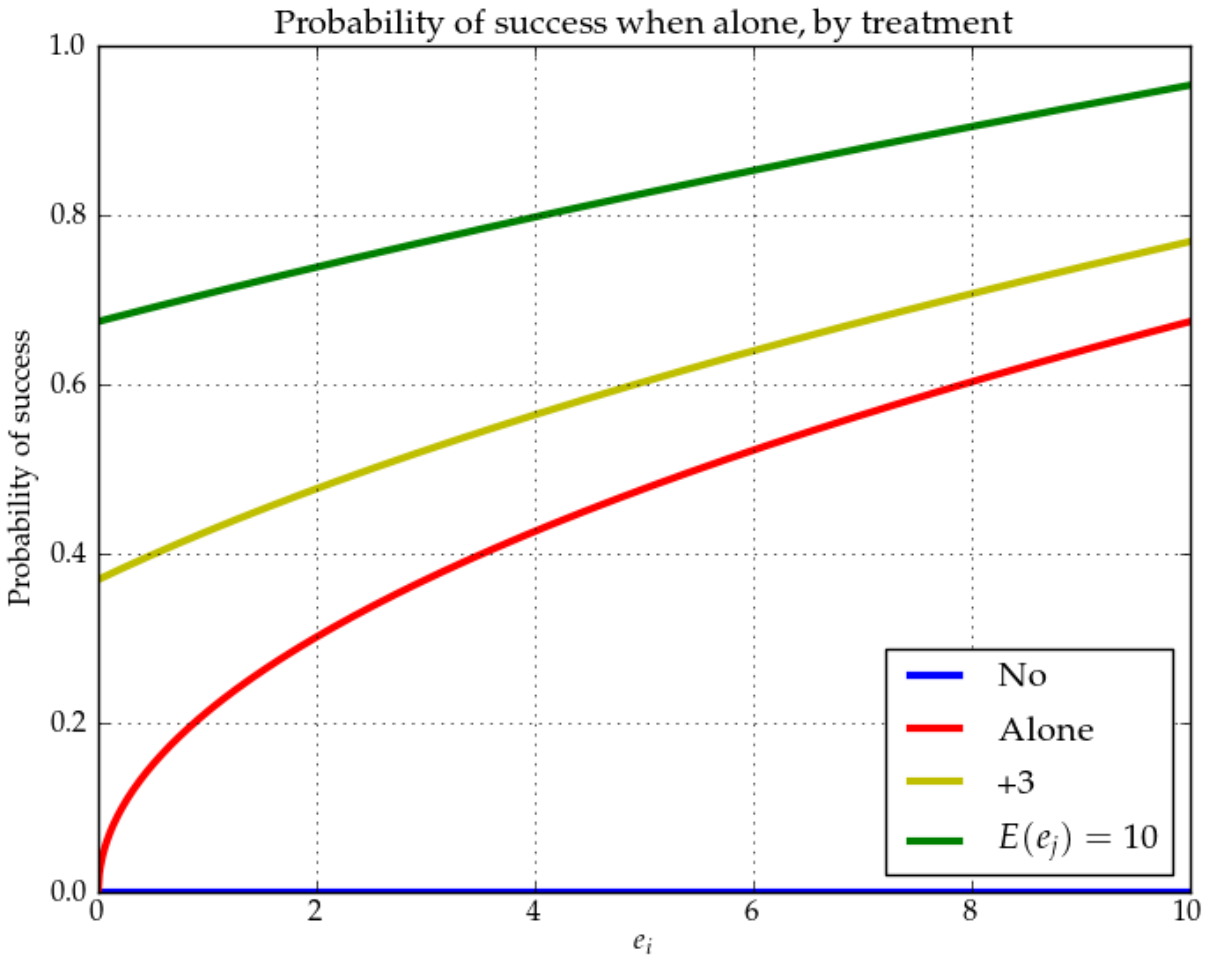
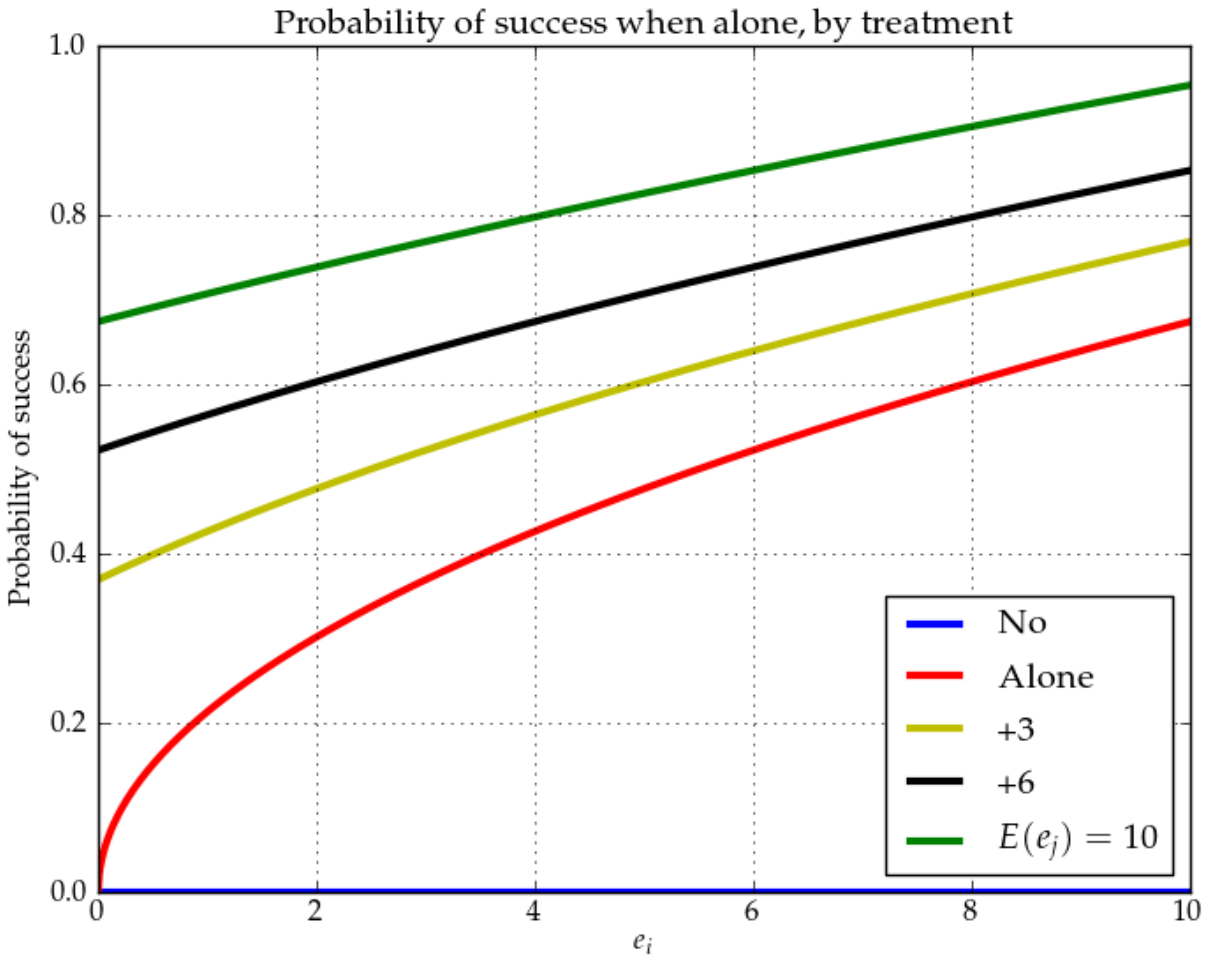
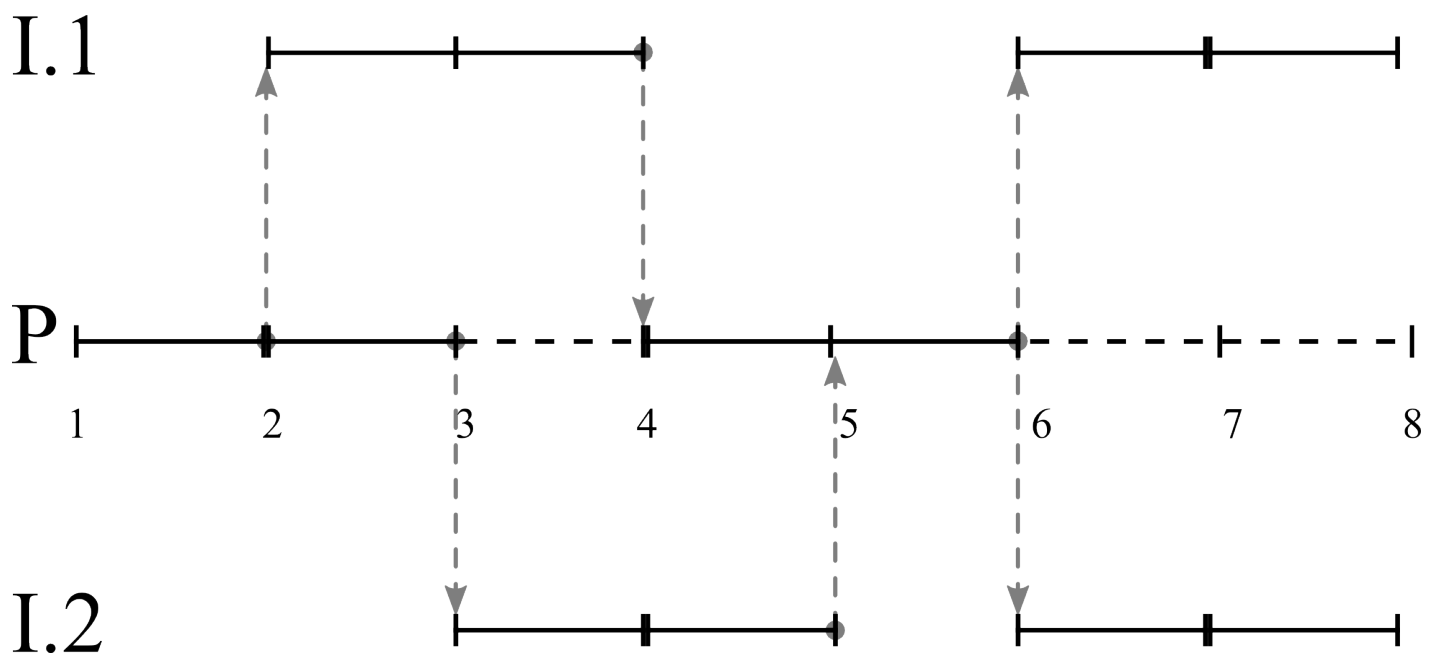


The Model: exit options, II



The Model: dynamic structure

Players can *exit* at anytime; re-entry is free, as is staying. One out $\neq$ both out.



Solution properties

- interior Pareto optimum
- if no exit, usual tragedy of the commons $\Rightarrow$ underprovision.
- high type should make effort, low type should not
- exit options Zero and Alone not credible threats
- exit options $+3$ and $+6$ credible threats $\Rightarrow$ more effort or more disruption?
- in general threat of exit by high type could force low type to exert effort

Solution

		Effort		Profit	
		High	**Low**	**High**	**Low**
		24	16	24	16
Pareto		9.09	9.09	18.18	18.18
NO exit		6.55	0	6.55	8.73
Zero	In	6.55	0	6.55	8.73
	Out	0	0	0	0
Alone	In	6.55	0	6.55	8.73
	Out	6.55	2.91	6.55	2.91
+3	In	6.55	0	6.55	8.73
	Out	3.55	0	9.55	5.91
+6	In	6.55	0	6.55	8.73
	Out	0.55	0	12.55	8.36

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Design

Design: main task

- Between subjects
- Repeated play, indefinite duration ($p = 0.9$) $\Rightarrow$ avoid endgame effects
- Subjects choose: ...public or private project (K and G), if eligible
- ...effort $e_i \in (0, 10)$ $\Rightarrow$ not restricted to integers
- Elicited beliefs: project and effort
- Feedback: own effort and success/failure (+ history) $\Rightarrow$ unobservability of e_j
- Whole game repeated 3 times, perfect strangers $\Rightarrow$ avoid contagion

Controls

- Strategic Uncertainty and Risk Aversion (Heinemann *et al.*)
- Social Value Orientation (Murphy *et al.*)
- SOEP risk-related questionnaire

Pilot sessions run in Jena, February - March 2012, $N = 96$

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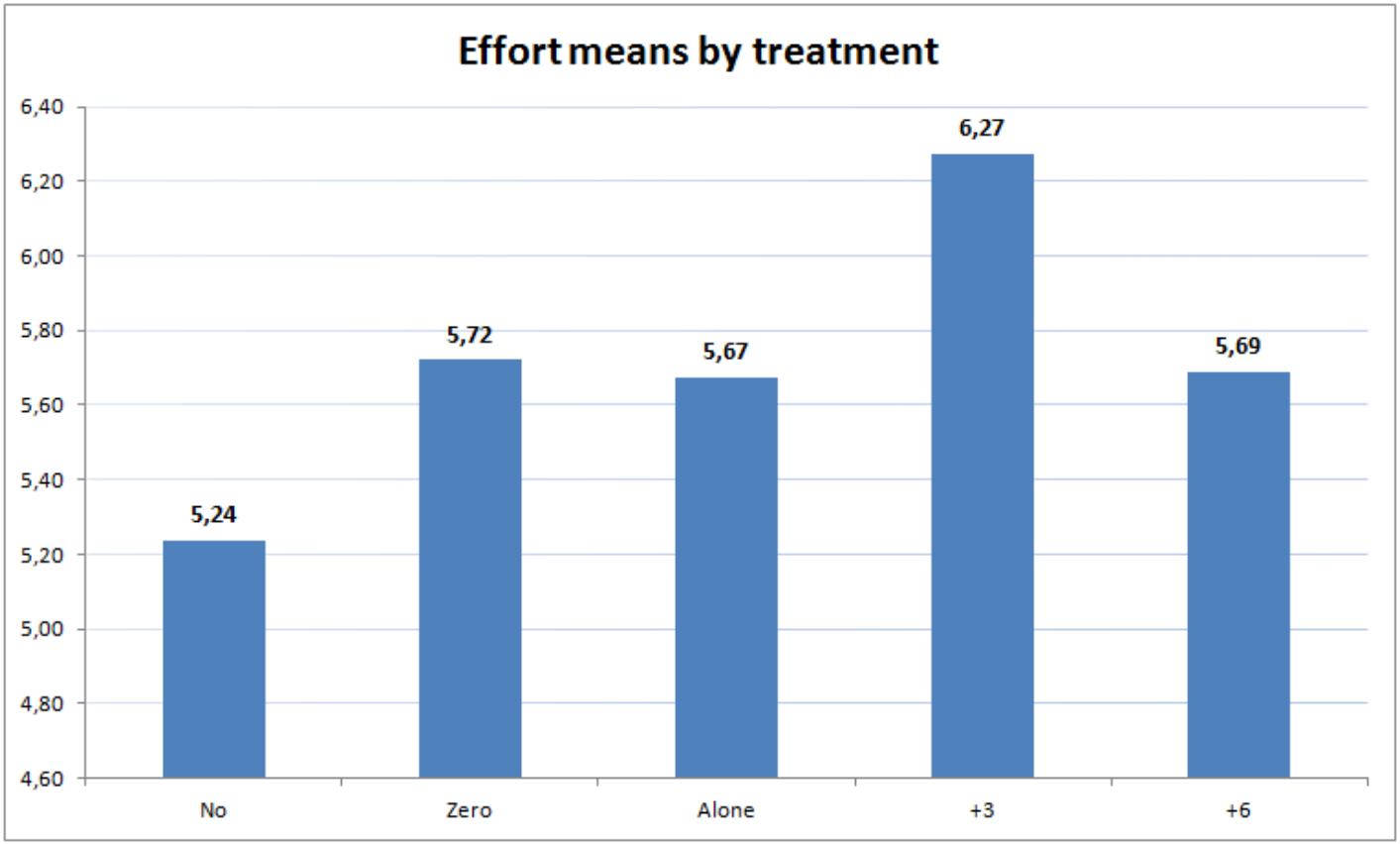
Effort



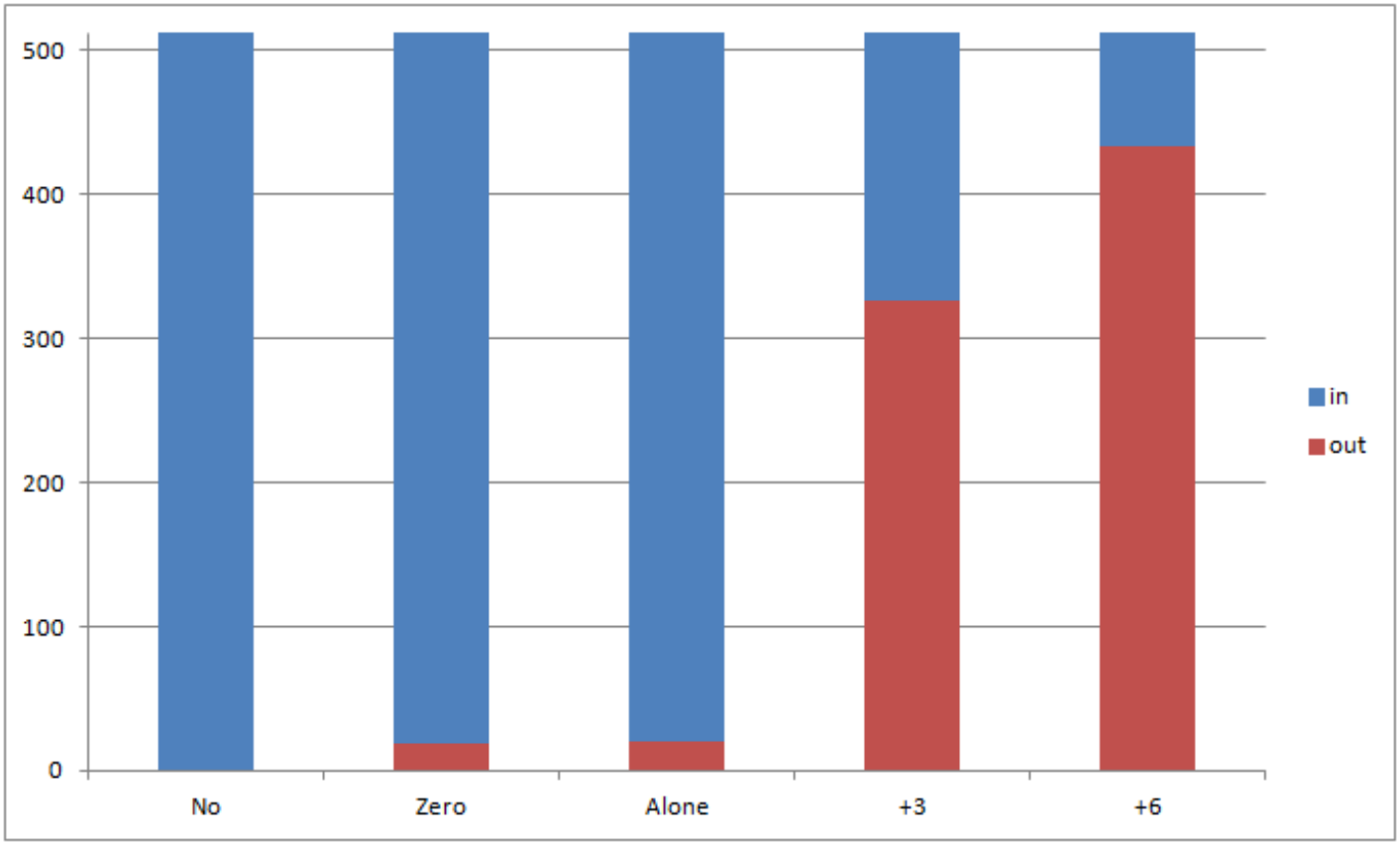
Effort increases with exit option, non monotonically

Effort, significance table

	NO	**0**	$\sqrt{e}$	$\sqrt{e+3}$	$\sqrt{e+6}$
NO	.	***	***	***	***
0		.	-	*	-
$\sqrt{e}$			.	**	-
$\sqrt{e+3}$				.	**
$\sqrt{e+6}$					.

Table: Mann-Whitney U pairwise tests, effort

Out or In?



Number of sustained joint projects goes down with treatment - but Zero = Alone

Decision to exit

Zero and Alone

- Very low exit, never both out
- Exit only as a reaction to either bad luck or perceived low effort of the partner

+3

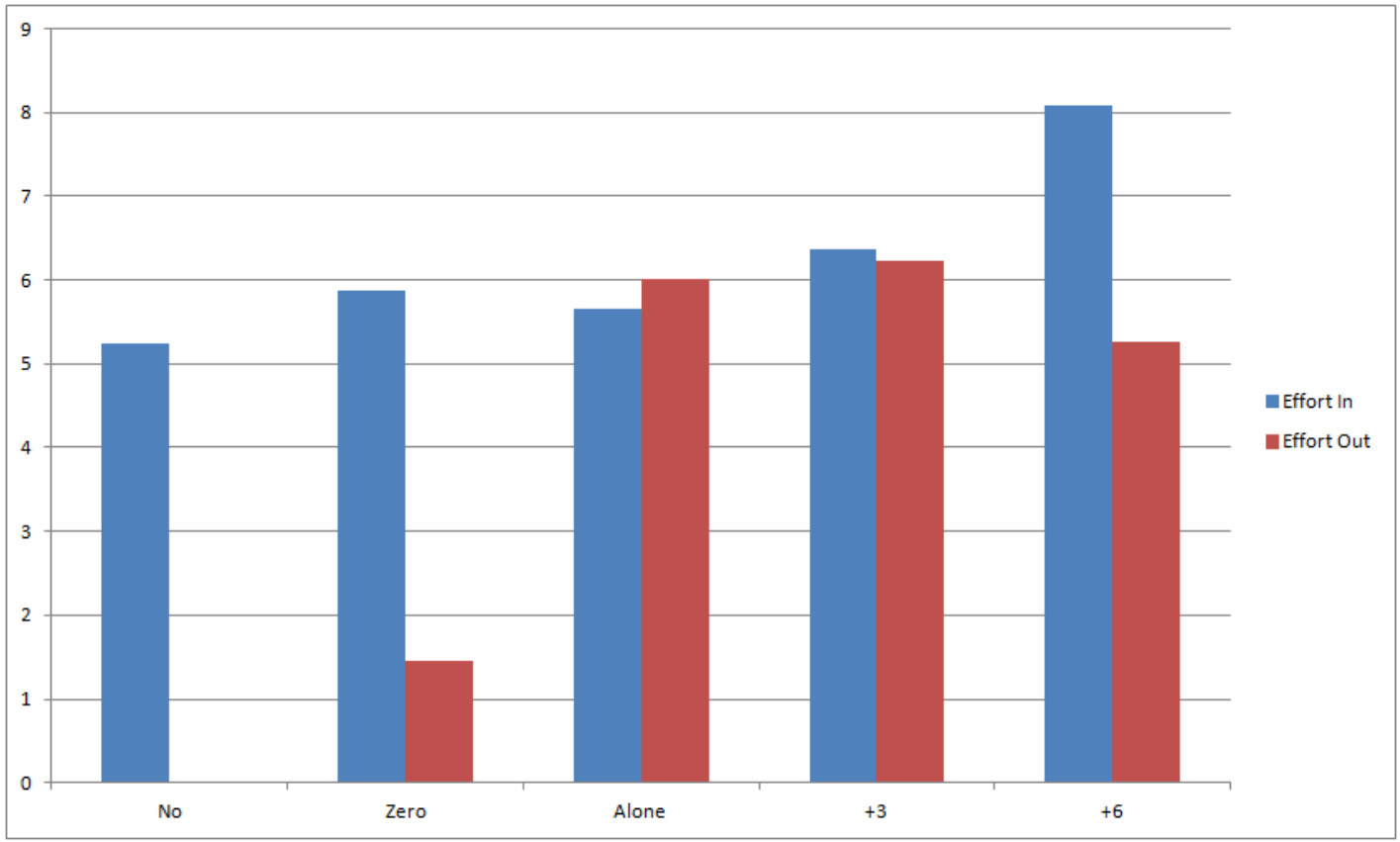
- High level of exit, low coordination
- Exit reflects both signaling and preference to be on one's own
- 25% exited in period 1
- Those who did not exit in period 1 showed a low level of exit

+6

- High level of exit
- Exit reflects mainly preference to be on one's own
- 90% exited in period 1
- No exit for the very few stayers, high effort

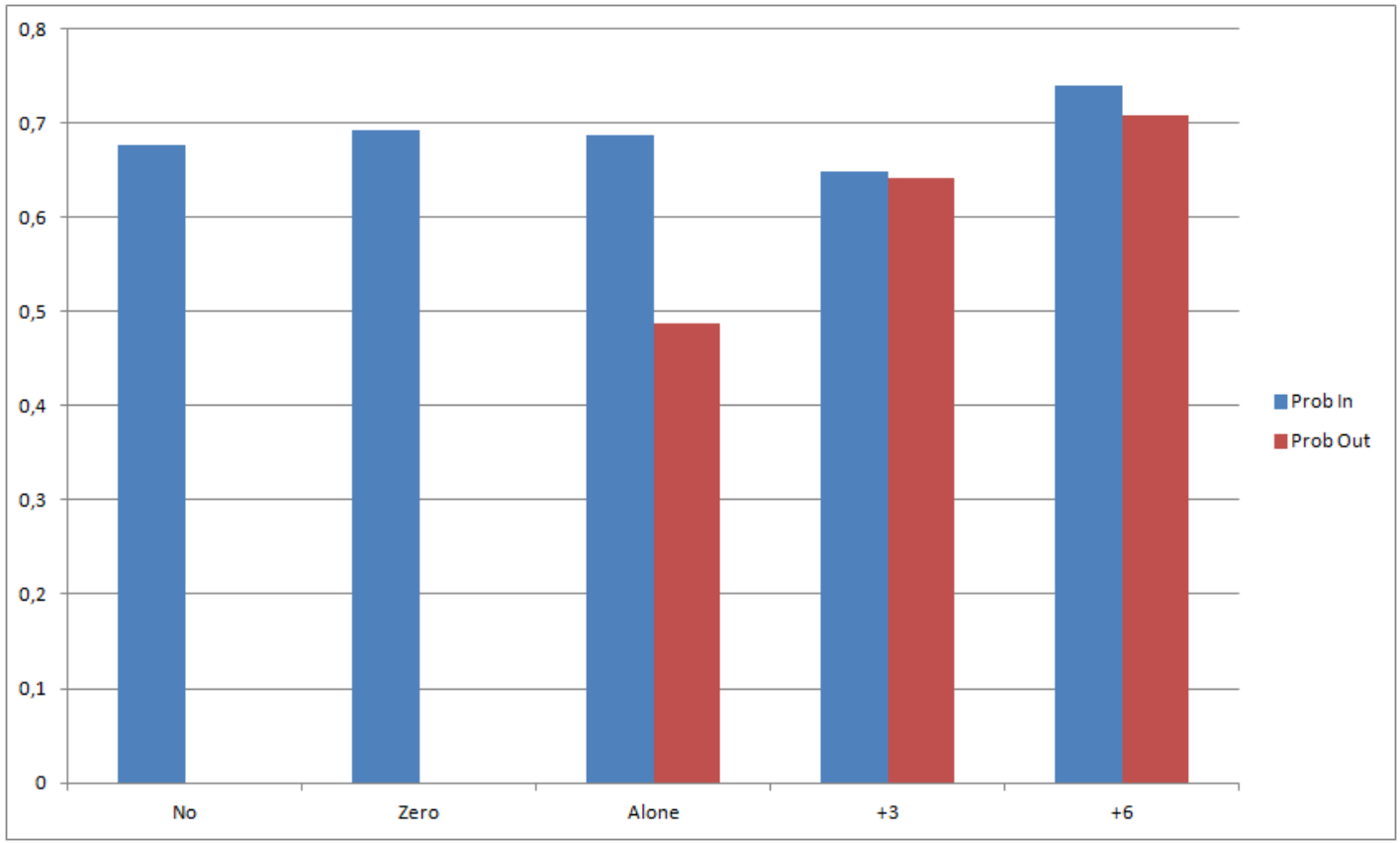
High type slightly more likely to exit in all treatments

Effort In *vs.* Out



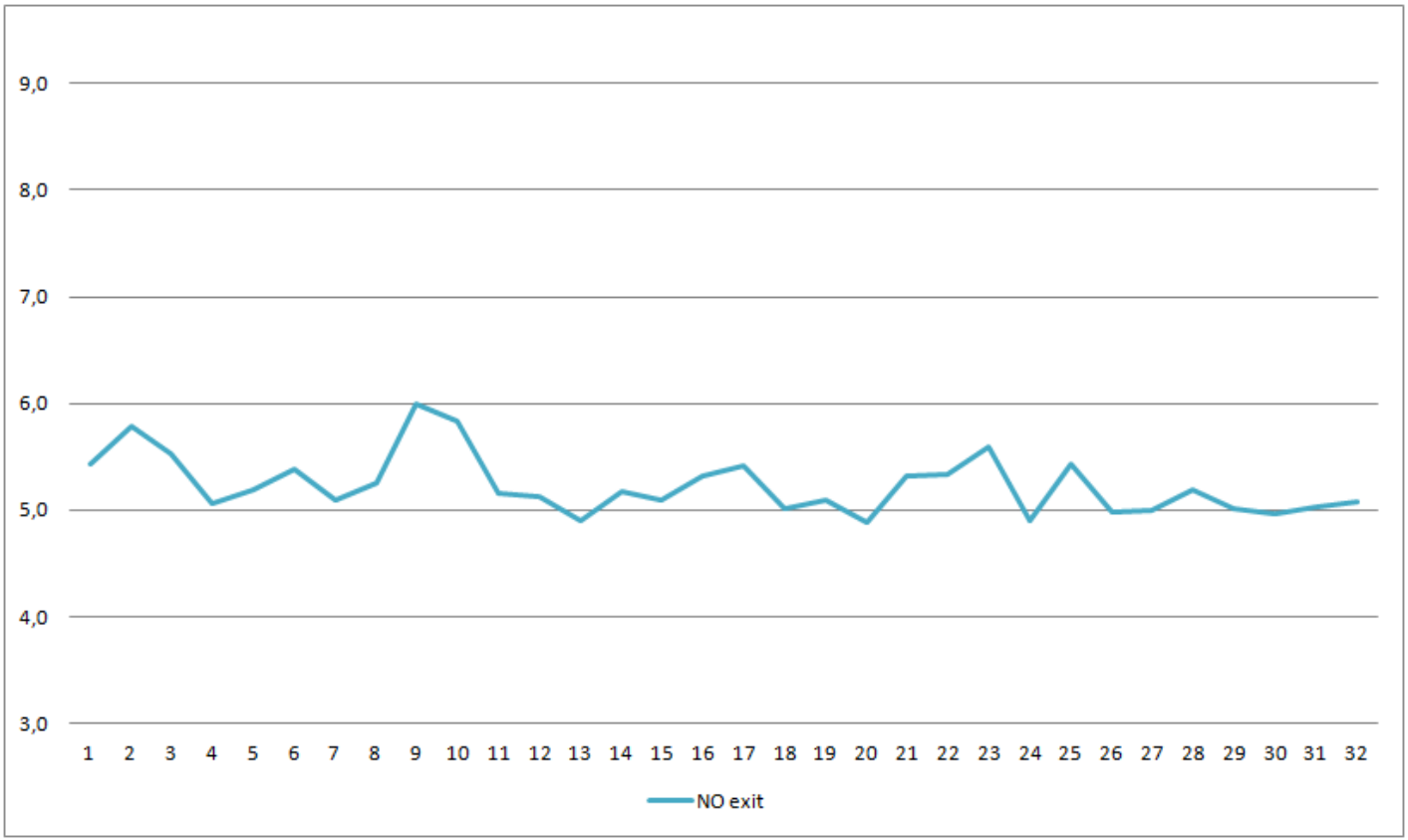
Positive effect on effort of exit option only in $+6$, few projects

Probability of success In *vs.* Out



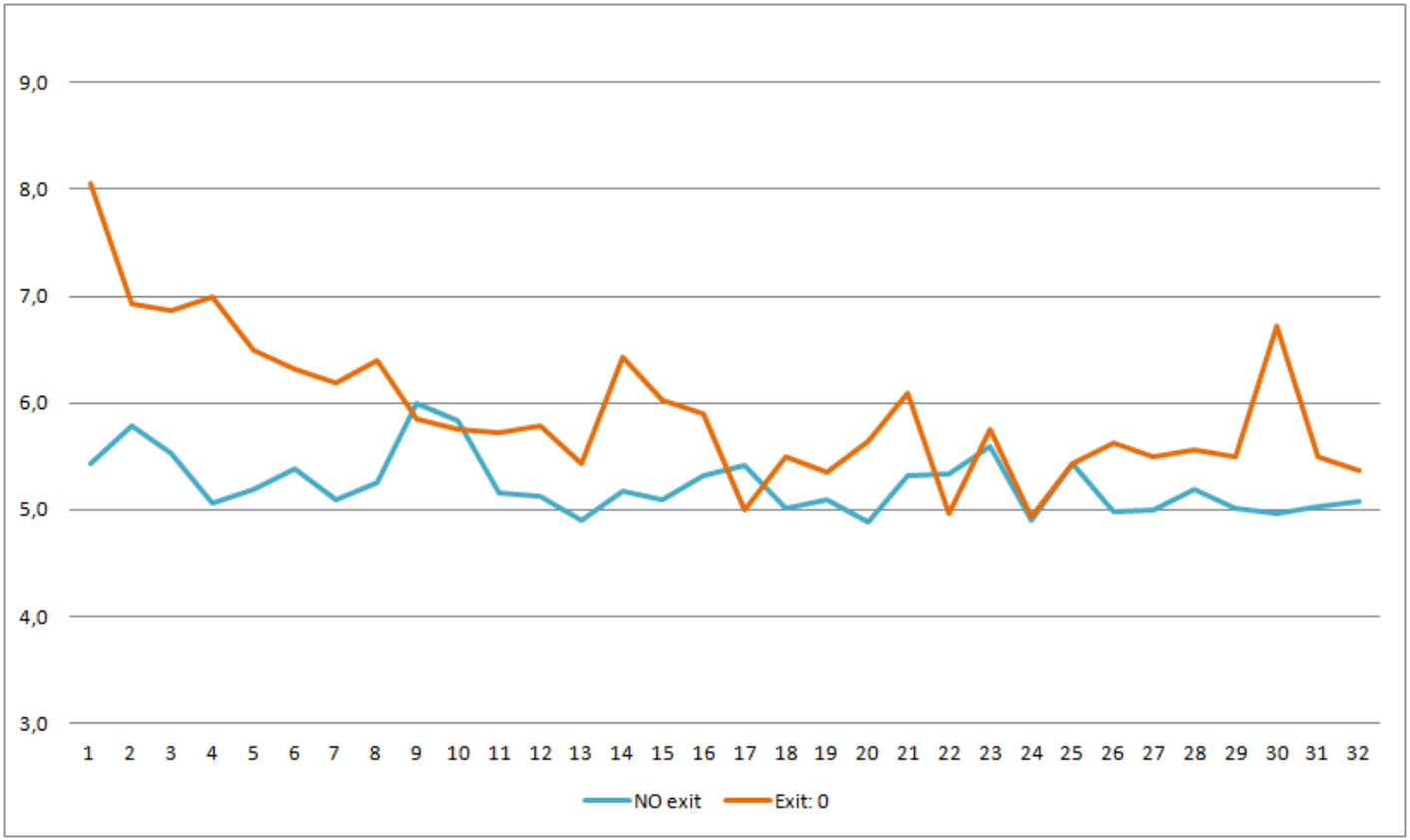
Exiting has a cost in terms of probability of success

Effort in time, by treatment



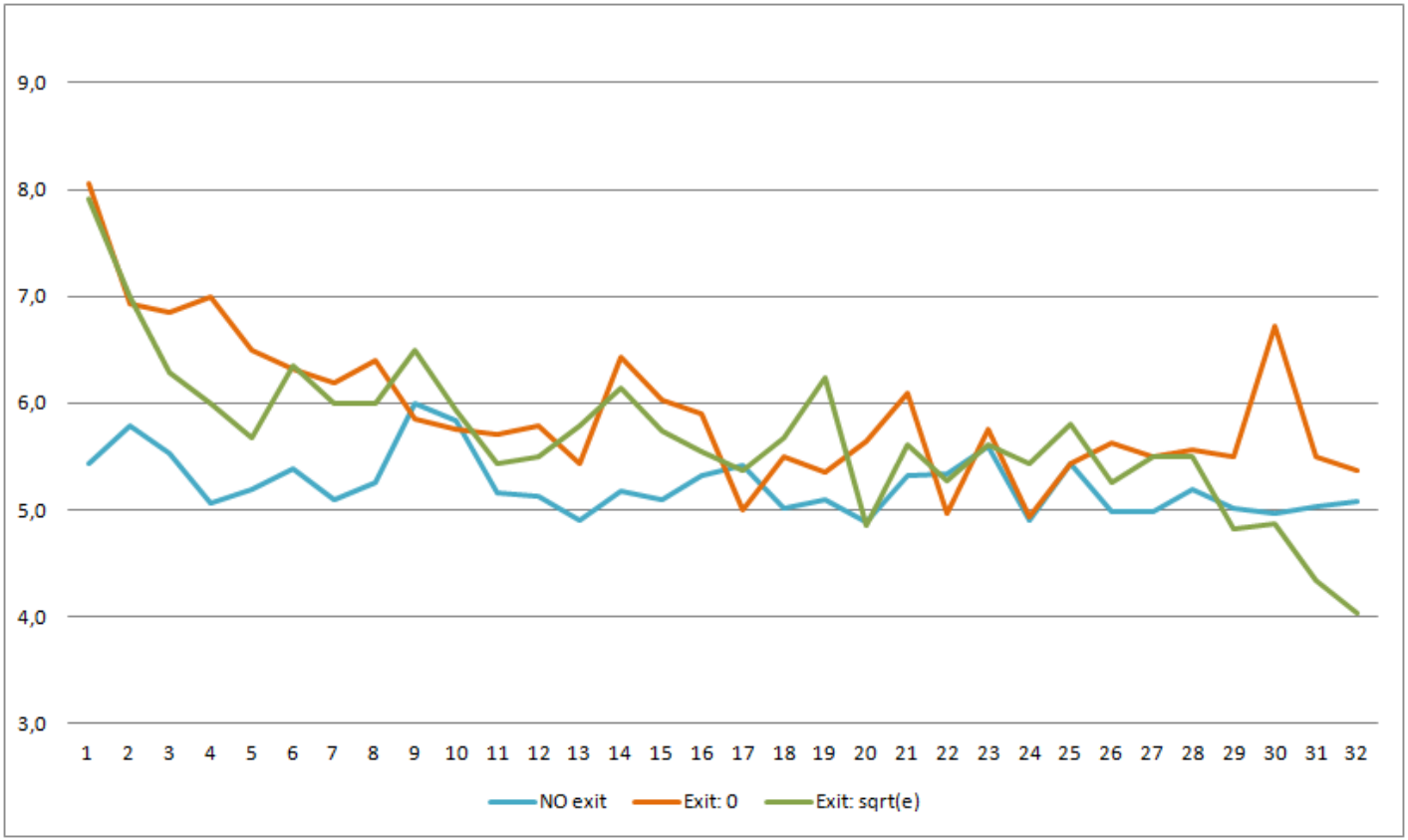
No exit: stability over time

Effort in time, by treatment



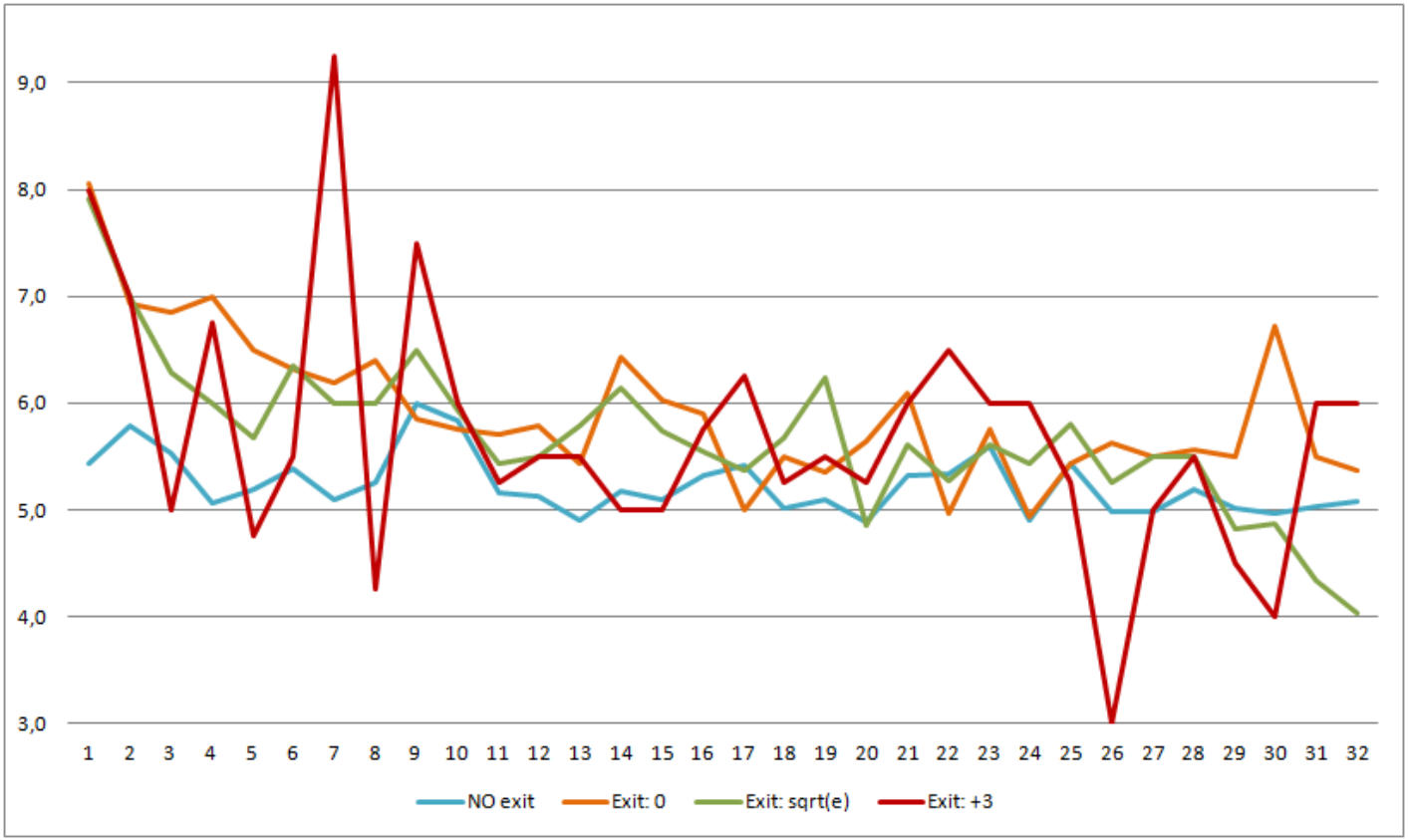
Zero: decrease over time (realising that the threat is empty?)

Effort in time, by treatment



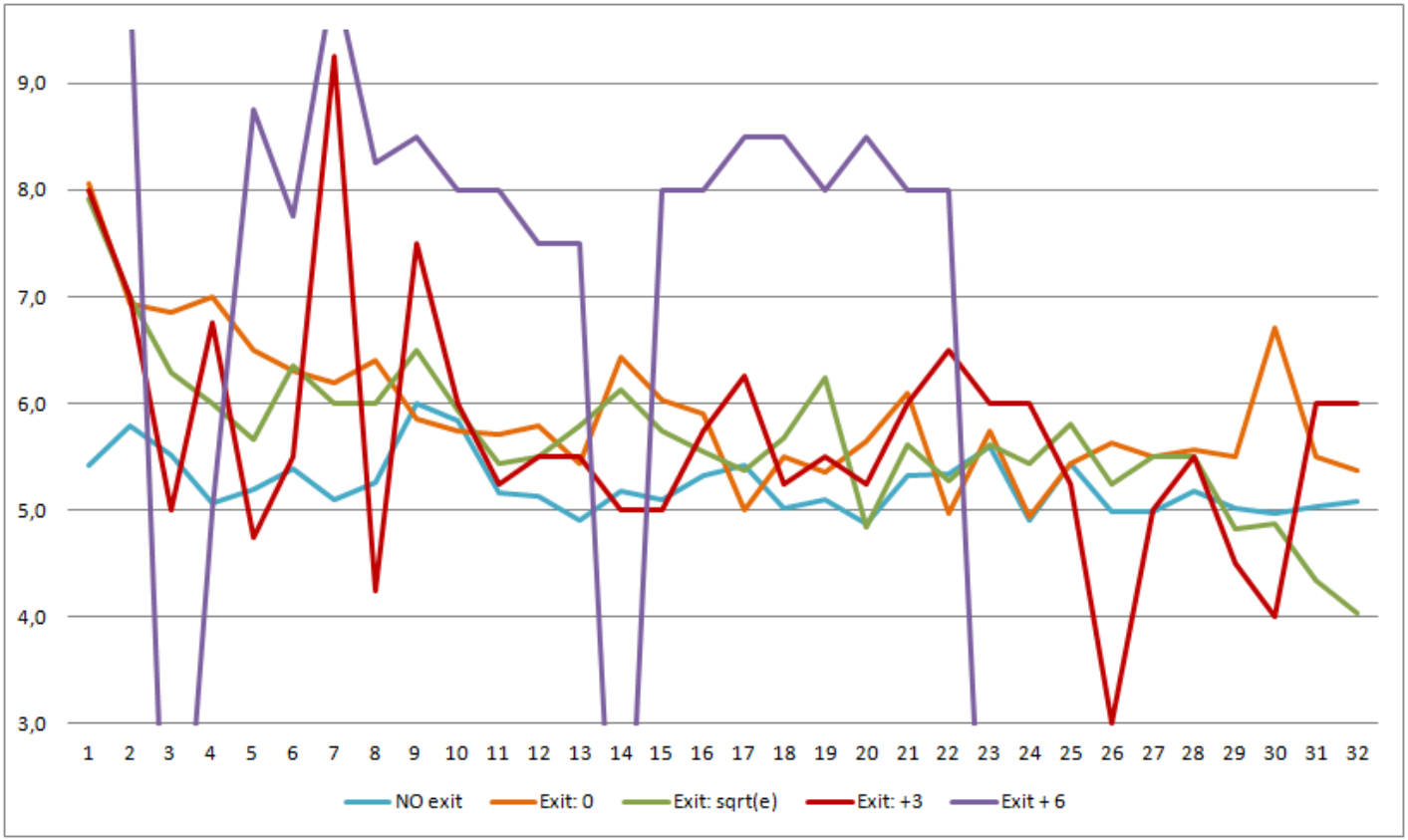
Alone: even further decrease)

Effort in time, by treatment



+3: **disagreement -volatility)**

Effort in time, by treatment



+6: **high effort for few stayers)**

Beliefs

Beliefs on effort

- Beliefs are highly correlated with effort
- Effort is on average slightly lower than beliefs (small-scale free-riding)
- Effort increases with beliefs, but less than proportionally

Beliefs on exit

- Beliefs on likelihood of exit converge to 0 in Zero and Alone (decrease in effort)
- ...are all over the place in +3
- ...and converge to 1 in +6
- In general, beliefs on exit tend to match behaviour well

Provisional results

1. Having an exit option increases overall effort
2. A good exit option dramatically increases breakdowns
3. ...but effort towards Pareto for the few stayers
4. Ambiguous exit option generates lots of coordination problems
5. Asymmetric nature of the game has small effect (big theoretical difference)

More data needed, symmetric version planned, stay tuned!

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Thanks!

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