Experimental Economics: Methods and Perspectives

Igor Asanov

GK-EIC
Max Planck Institute and Friedrich Schiller University, Jena

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Based on "Experimental Economics" (Davis and Holt,1992) "Handbook of Experimental Economics"(Roth, 1995), "Experimental Economics: Rethinking the Rules" (Bradsley et al., 2009), course on "Experimental Economics"(Kirchkamp, 2012), "Short- and Long-run Effects of External Interventions on Trust" (Asanov and Vannuccini, 2014).

Motivation: Methods in Economics

- **Theory:** Various types of tautology.
- **Empirical studies – Observational studies:** Various types of statistical analysis without intervention in the data generating process.
- **Experiment:** Purposeful intervention in the data generating process.

Motivation: Theory 1/2

A theory is a tautology.
Properties:

- Internal correctness
- Testable
- Simple

A theory allows to make models.
Like a good map, a good model provides a **simple**, and, hence, **inaccurate and imprecise** representation of the world.

Motivation: Theory 2/2

"**A good model** in economic theory, like a good fable, **identifies a number of themes and elucidates them**. **We perform thought exercises that are only loosely connected to reality** and that have been stripped of most of their real-life characteristics. However, in a good model, as in a good fable, **something significant remains**." Rubinstein (2006)

Theory makes a predictions – How to test them?

Motivation: Observational ("Empirical") Studies 1/2

Samuelson and Nordhaus, (1985) Principles of Economics:

" **Economists** . . . cannot perform the controlled experiments . . . because **they cannot easily control other important factors**. Like astronomers or meteorologists, they generally **must be content largely to observe**"

→ Economists use observational studies without possibility to control for all important factors.

Why do we want to have a control?

Motivation: Observational ("Empirical") Studies 2/2

Competing Theories: Theory of Storks (Traditional) vs. Theory of Sexual Reproduction (Promoted by Medical Society)

Empirical tests (Neyman, 1952; Höfera et al., 2004):

1. Significant correlation between number of storks and births number.
2. No correlation between deliveries in hospital buildings and the stork population.

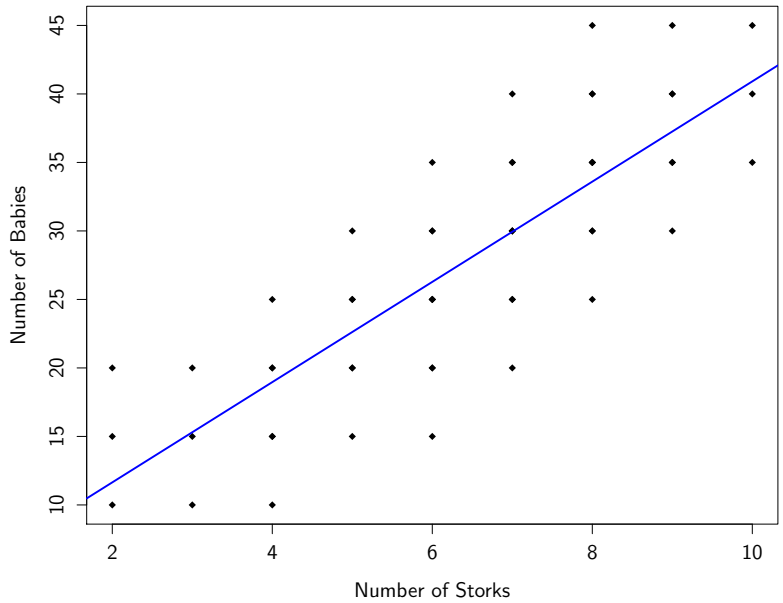


Figure: Relation between number of babies and storks (Neyman, 1952).

Motivation: Experiment 1/3

Laboratory Experiment:

- Controlled parameters
- Flexibel modelling
- Replication
- What-if experiments
- Many observations
- Long time-series

but

- Not field data

Field Experiment:

- Field data

but

- Uncontrolled parameters
- Expensive
- Long
- Few independent observations
- Ethical reasons

Motivation: Experiment 2/3

Let's suppose we want to test the hypotheis of **market equilibrium in case of perfect competition.**

- Can we do it in the field?
  → Perhaphs, not: Too many factors, no chance for intervention.
- Should we replicate the model in the lab that as much as close to reality (copy real world)?
  → No, too difficult to analyse, we have real life already e.g. we have RTS in Moscow, why to duplicate it?
- Shall we test a simple model with one asset and number of traders?
  → Perhaps, yes.

Motivation: Experiment 3/3

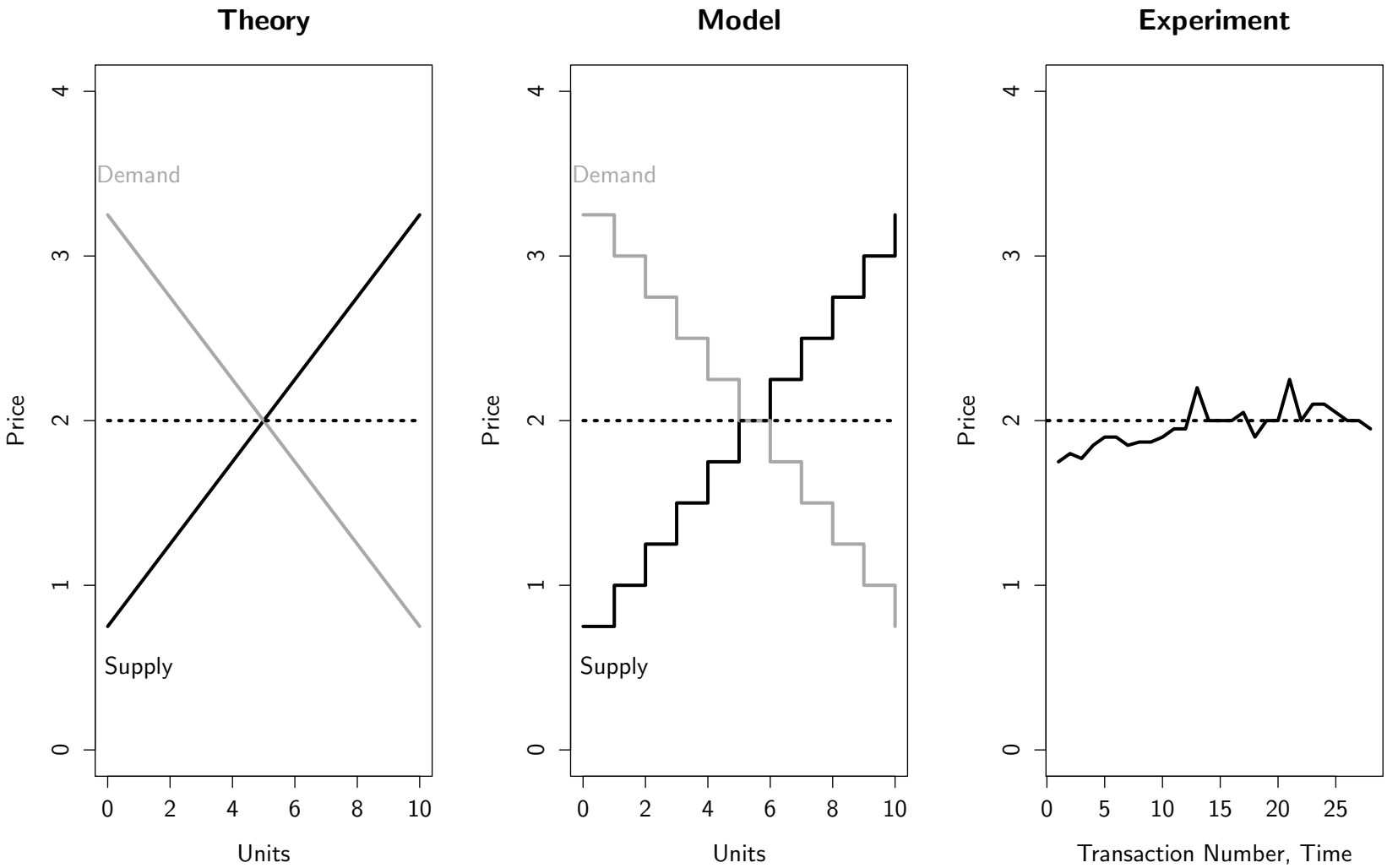


Figure: Market equilibrium with perfect competition (Smith, 1962)

First Experiments 1/3

Saint-Petersburg paradox, Bernoulli (1738)

A casino offers a lottery, L for a single player in which a fair coin is tossed at each stage. The pot starts at 2 dollars and is doubled every time a head appears. The first time a tail appears, the game ends and the player wins whatever is in the pot.

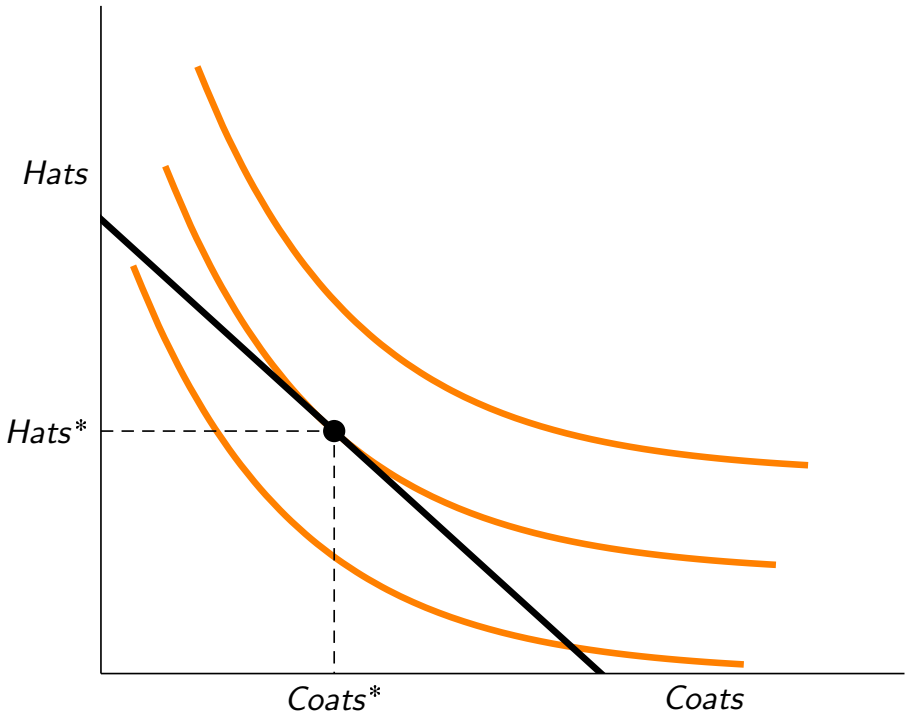
$$E(L) = \frac{1}{2} \cdot 2 + \frac{1}{4} \cdot 4 + \frac{1}{8} \cdot 8 + \frac{1}{16} \cdot 16 + \cdots = +\infty \qquad (1)$$

$\rightarrow$ Development of the expected utility theory – expected utility is monotonically decreasing with wealth, w e.g. $U(w) = \ln(w)$.

First Experiments 2/3

Estimation of Indifference Curves, Thurstone (1931)

Subjects make a large number of hypothetical choices between bundles of goods e.g. hats and coats.



First Experiments 1/3

Wallic and Friedman Critic (1942)

Subjects must state thier reactions to actual stimulus.

Rausseas and Hart Answer (1951)

An experiment where subjects actually receive the stimulus according to their choice e.g. breakfast type.

→ It is a standard to incentivize subjects: pay to subjects monetary reward according to their choice(s).

Further Development: Rise of Game Theory

Theory of Games and Economic Behavior, Neumann and Morgenstern (1944):

1. Refinement of expected utility theory
2. Theory of interactive behavior (Strategic Interaction)

Problems:

1. Allais Paradox (1953) and Ellsberg Paradox (1961)
2. Prisoner's Dilemma (1950).

Further Development: Allais Paradox

Choice between two gambles

(A) 100 millions for sure, $p = 1$.

(B) 500 millions with $p = 0.1$, 100 millions with $p = 0.89$, 0 with $p = 0.01$
Other gamble:

(C) 100 millions with $p = 0.11$, 0 millions with $p = 0.89$

(D) 500 millions with $p = 0.1$, 0 millions with $p = 0.9$

Theory: If $A > B$ then $C > D$.
Actual Choice: If $A > B$ then $C < D$.
$\rightarrow$ People are risk-averse.

Further Development: Ellsberg Paradox

Suppose you have an urn containing 30 red balls and 60 other balls that are either blue or orange. You don't know how many blue or how many orange balls there are, but that the total number of blue balls plus the total number of orange equals 60.

Choice between two alternatives

(A) You receive 100 if you draw a red ball.

(B) You receive 100 if you draw a blue ball.
Other gamble:

(C) You receive 100 if you draw a red or orange ball.

(D) You receive 100 if you draw a blue or orange ball.

Theory: If $A > B$ then $C > D$.
Actual Choice: If $A > B$ then $C < D$.
$\rightarrow$ People are ambiguity - averse.

Further Development: Prisoner's Dilemma

	Cooperate	Defect
Cooperate	3,3	1,4
Defect	4,1	2,2

Table: Prisoner's Dilemma

10 repeated prisoners dilemmas (Selten und Stoecker, 1986).
Results:

1. Participants start with mutual cooperation (at least 4 periods)
2. One player defects
3. Cooperation breaks down during the remaining periods

Why does it matter?

Public Good

Definition

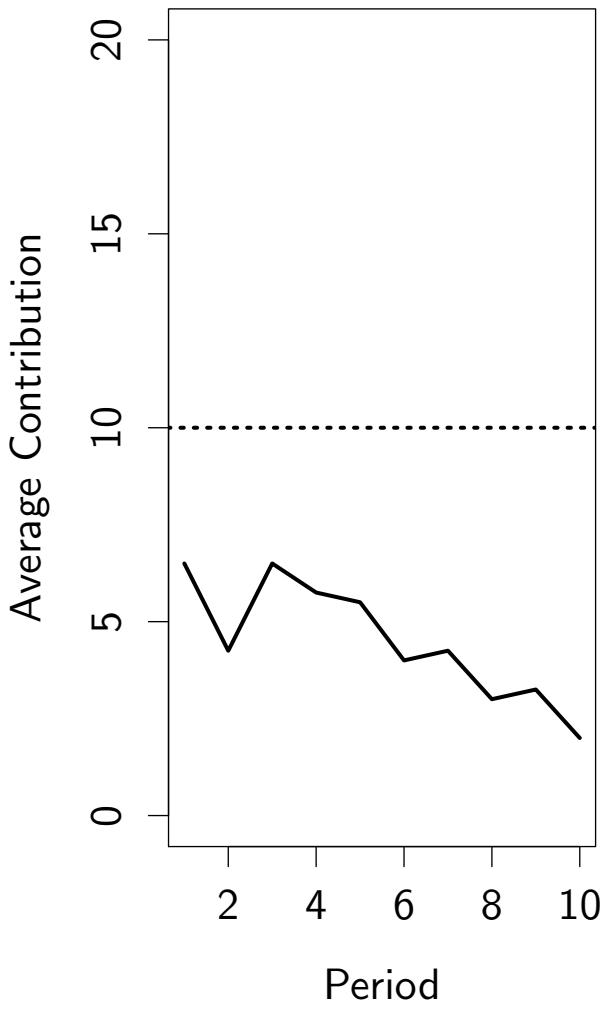
Public good – is a good that is both **non-excludable** and **non-rivalrous**.

Examples: Air, defense, knowledge, flood control systems, street lighting.

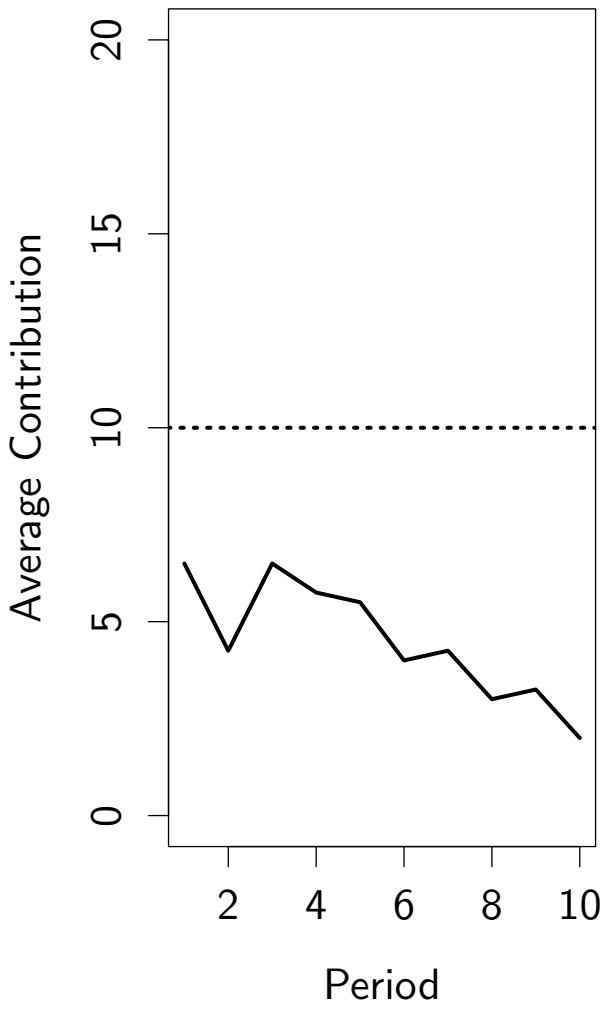
$$u_i = w_i - m_i + \frac{M}{n} \cdot \sum_{j=1}^{n} m, \tag{2}$$

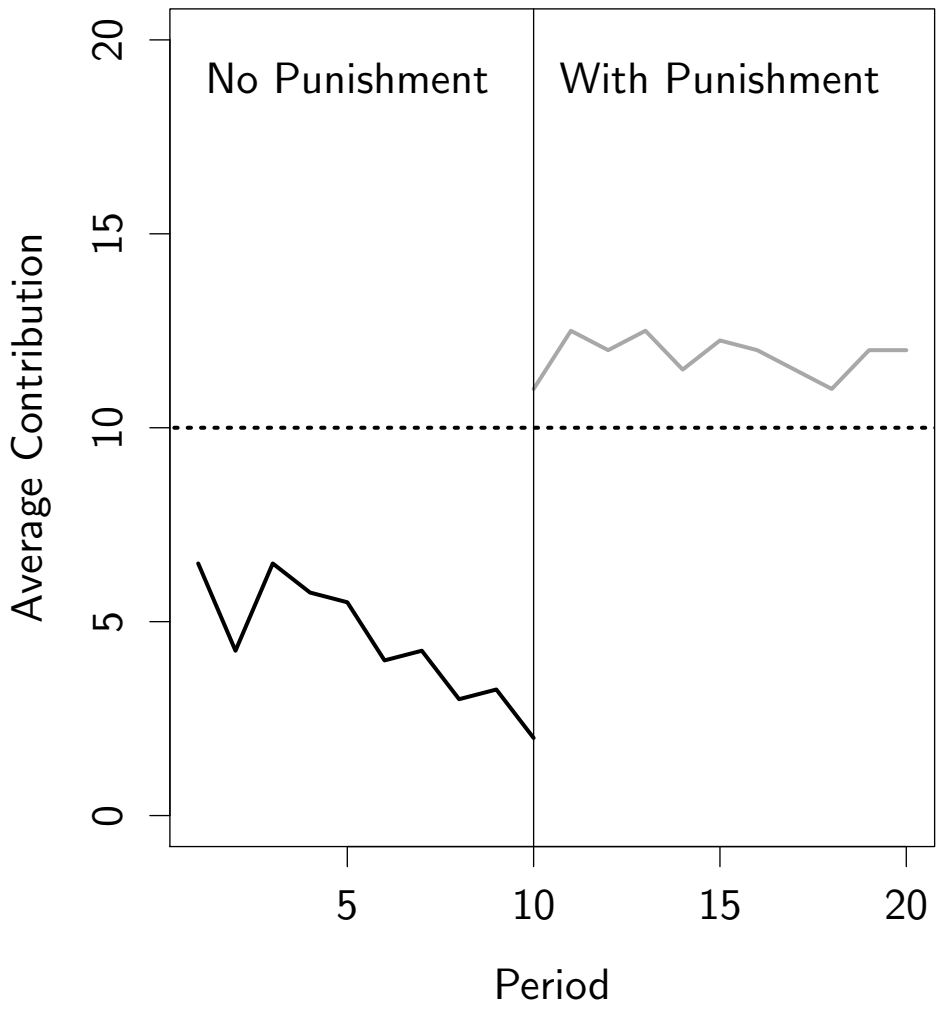
where u_i – utility, w_i – wealth and m_i – individual contribution of agent i; M - multiplier, n – number of individuals, $\frac{M}{n} > 1$.

Public Good Game (Fehr and Gächter, 2000)



Public Good Game (Fehr and Gächter, 2000)





Financial Markets: Beauty Contest Game 1/3

"It is not a case of choosing those [faces] that, to the best of one's judgment, are really the prettiest, nor even those that average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences **to anticipating what average opinion expects the average opinion to be.** And there are some, I believe, who practice the fourth, fifth and higher degrees."
Keynes(1936), General Theory of Employment Interest and Money

Financial Markets: Beauty Contest Game 2/3

- Each of you writes on a piece of paper down his or her name and one integer number between 2 and 200
- I collect all pieces of paper and determine the average number
- The player who is closest to 2/3 of the average wins a prize (in case of a tie the prize will be split)

Financial Markets: Beauty Contest Game 3/3

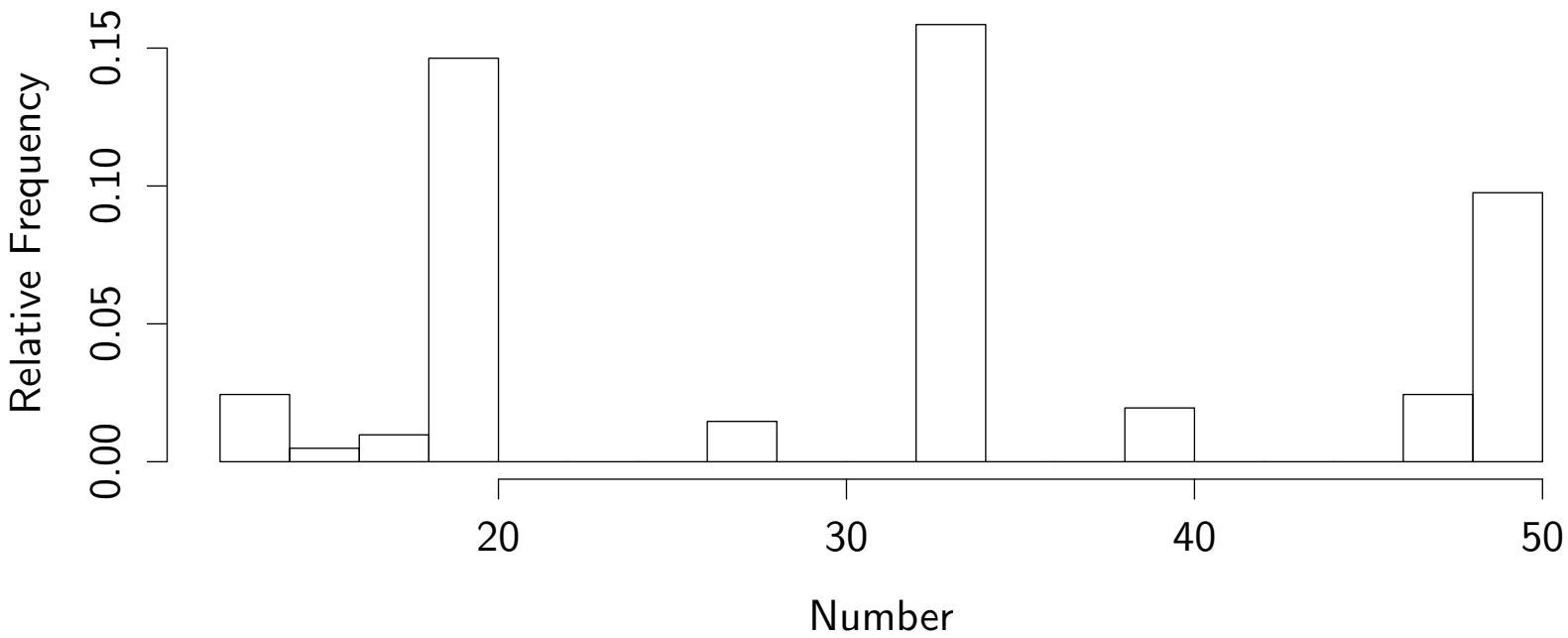


Figure: Distribution of Numbers, based on Nagel (1995)

Danish newspaper experiment (19000 people): Winning value $21.6 >> 0$.

Bargaining: Ultimatum Game 1/2

Situation: Monopolist offers a good at a fixed price.

Ultimatum Game (Guth, Schmidtberger, Schwarz, 1982)

- Proposer: proposes a division of a pie
- Responder: accepts or refuses.

In case of refusal, both players receive nothing.

Subgame perfect solution: Proposer keeps (almost) all pie.
Actual behavior:

- Offer $>$ 30%
- 20% of all offers are refused

Bargaining: Ultimatum Game 2/2

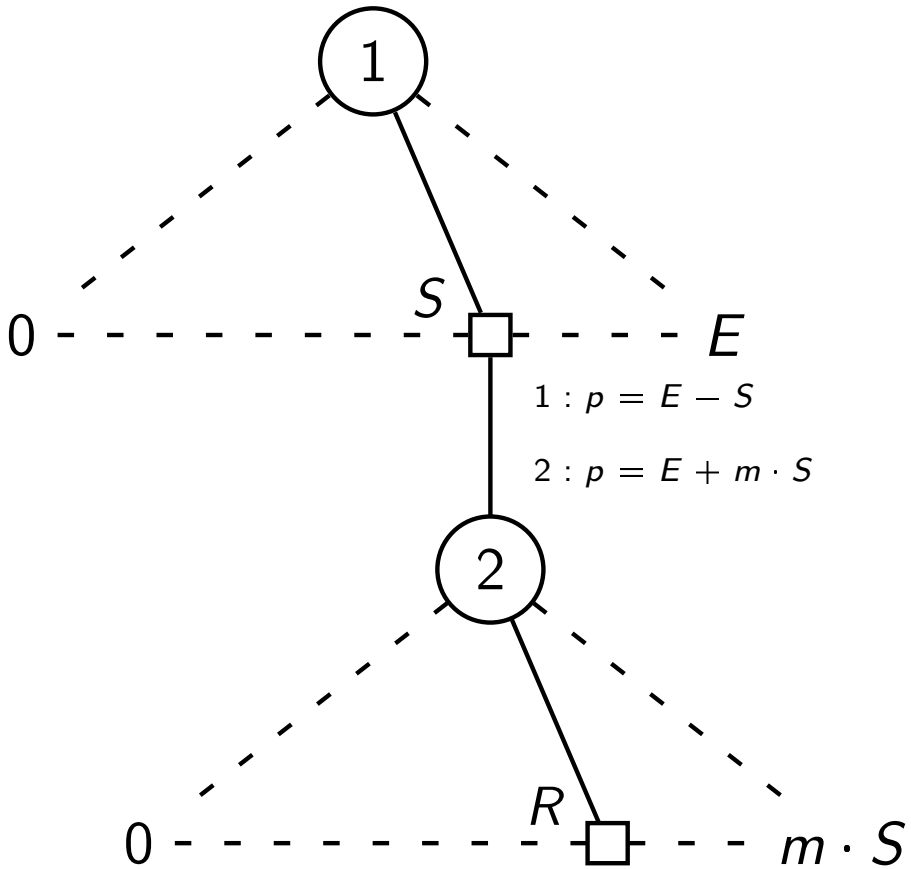
Possible Explanations:

1. Players do not understand the game, play a different (repeated) game with punishment.
2. $(\frac{1}{2}, \frac{1}{2})$ is just a focal point
3. Altruism of the proposer. Test:

Test of (1) and (2): Ultimatum game with training (Binmore, Shaked, Sutton, 1985).
Results: Partially corroborated.
Test of (3): Dictator Game (Forsythe, Horowitz, Savin, Sefton, 1994)
Result: Corroborated, but do not explain everything.

Incomplete Contracts: Investment (Trust) Game 1/2

Situation: (1) Principal-agent relations, (2) Investment decision.



1, 2- Players

E - Endowment

m - Multiplier

S - Sent

R - Resent

Incomplete Contracts: Investment (Trust) Game 2/2

Descriptive statistics by region.

Variable name	Obs.	Sum *N*	Mean	Std. dev.	Min	Max
Panel A: Sent fraction (trust)						
All regions	161	23,900	0.502	0.124	0.224	0.885
North America	46	4579	0.517	0.158	0.259	0.885
Europe	64	9030	0.537	0.121	0.224	0.783
Asia	23	3043	0.482	0.102	0.285	0.710
South America	13	4733	0.458	0.074	0.336	0.857
Africa	15	2515	0.456	0.133	0.300	0.750
Panel B: Proportion returned (trustworthiness)						
All regions	137	21,529	0.372	0.114	0.108	0.812
North America	41	4324	0.340	0.089	0.119	0.496
Europe	53	7596	0.382	0.094	0.108	0.542
Asia	15	2361	0.460	0.114	0.215	0.597
South America	13	4733	0.369	0.147	0.184	0.812
Africa	15	2515	0.319	0.106	0.180	0.514

Figure: Meta-study of the Trust game (Johnson and Mislin, 2011)

Results:

1. People send and send back
2. The behavior varies across countries with different economic characteristics (Bornhorst et al., 2009).
3. Significant correlation between investment propensity and trustful behavior (Willinger et al., 2003; Bohnet et al., 2010)

Motivation

Motivation: Academic Knowledge Commercialization

Academic spin-off: Google is a spin-off company of Stanford. This collaboration brought to the university as much as $337, 000, 000 (Stanford.com, 2012).
Aim: Foster academic knowledge commercialization.
SBTT — Small Business Technology Transfer (USA).
EXIST — Existenzgründungen aus der Wissenschaft (Germany).
Procedure:

- **Phase 1** — an academic institution receive a subsidy if invests certain amount in R&D project - potential spin-off firm.
- **Phase 2** — the spin-off firm receives a subsidy after successful completion of Phase 1.

Motivation: Literature Review

Extrinsic and intrinsic motivation (Titmuss, 1970; Andreoni, 1993; Deci et al., 1999; Fehr, 2000; Gneezy, 2011; Lazear et al. 2012)

Long-run effects of extrinsic incentives on intrinsic motivation (Bowles, 1998; Cornwell et al., 2006; Meier, 2007; Jackson, 2010, Bowles and Polania-Reyes, 2012).

Communication and conformity towards authority (Frey and Meier, 2004; Bicchieri and Xiao, 2009; Thoni and Gachter, 2012; Karakostas and Zizzo, 2012)

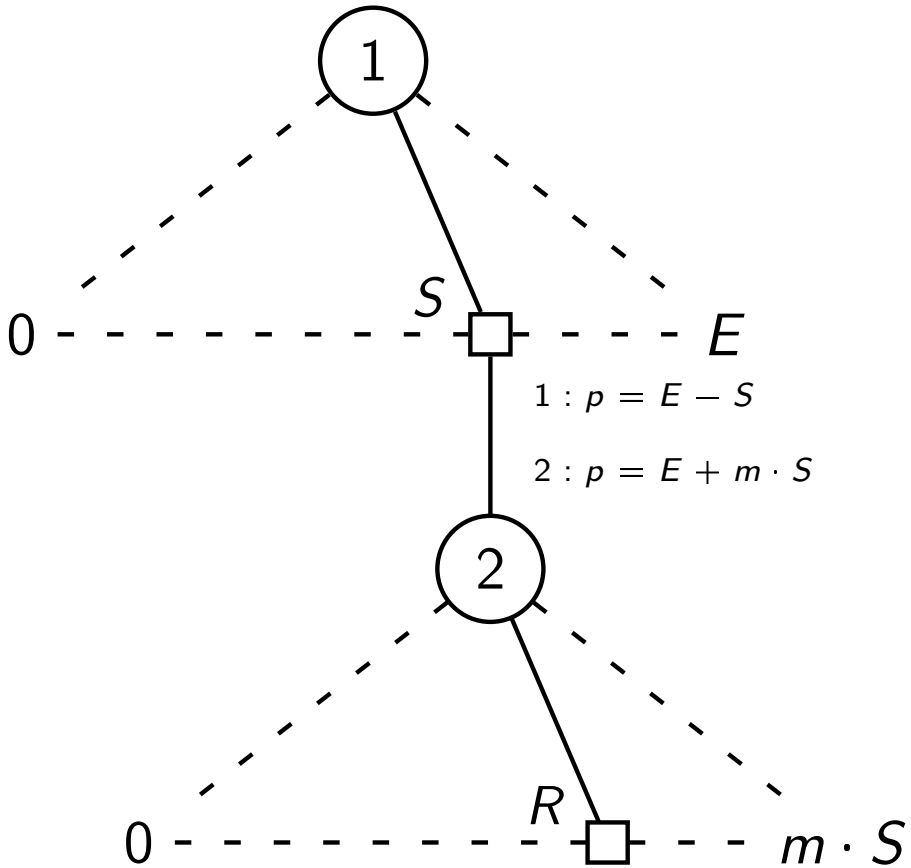
Motivation

Research question

Do external incentives have short- and/or long- run effects on investment activity?

- Is subsidy policy an efficient mean to foster investment activity in the short-run?
- Do non-monetary intervention such as suggestion increase investment activity during and after they are introduced?
- Does the subsidy policy have a negative impact on investment level after the policy termination?

The model: Investment Game



1, 2- Players

E - Endowment

m - Multiplier

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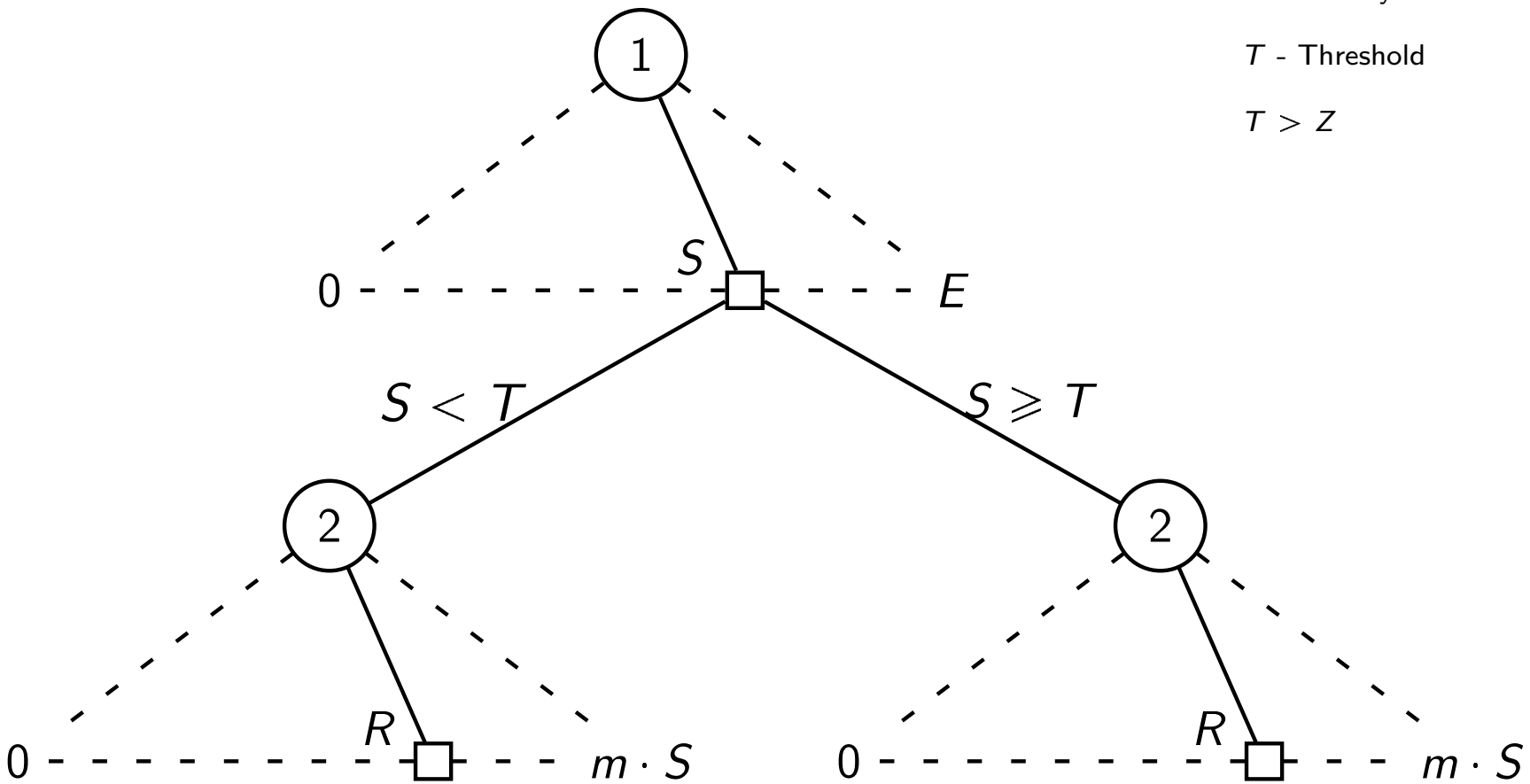
R - Resent

The model: Investment Game with Subsidies



Hypothesis 1/2: Short-run effects

Subsidy – High Threshold, $T > s_0$

H1: The amount sent is higher under external monetary incentives than without it if (1) threshold level is higher than the amount sent in case without the incentives and (2) the subsidy is larger than the crowding out effect.

Subsidy – Low Threshold, $T < s_0$

H2: The amount sent is lower under external monetary incentives than without it if threshold level is higher than the amount sent in case without the incentives.

Suggestion – High Threshold, $T > s_0$

H3: The amount sent is higher under external non-monetary incentives than without them.

Hypothesis 2/2: Long-run effects

We assume that preferences are endogenous (Bowles, 1998).

Subsidy

H4: The amount sent is lower after experiencing external monetary incentives than without them.

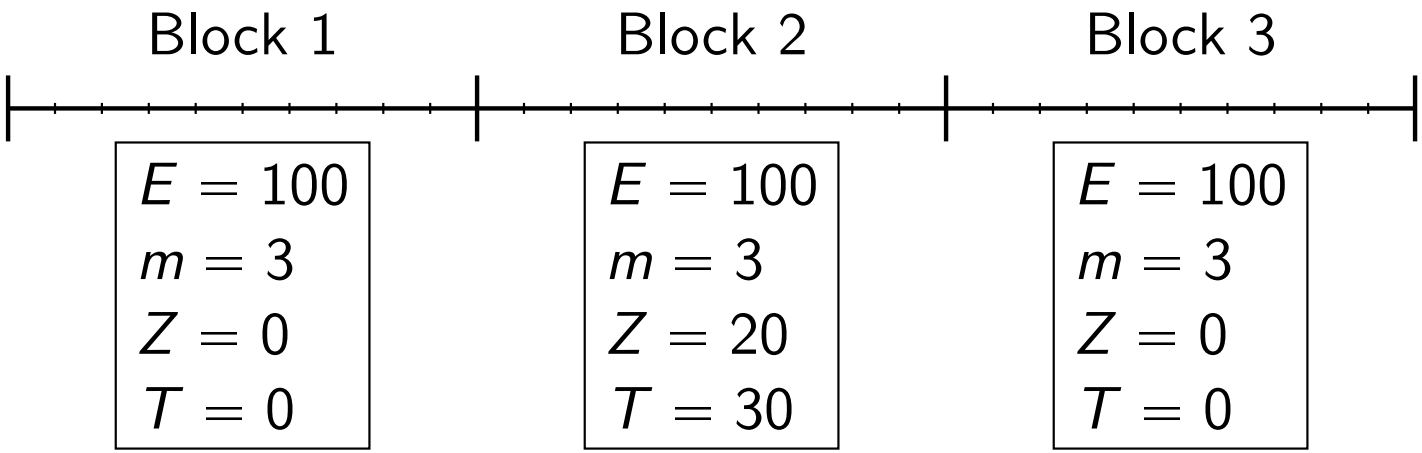
Suggestion

H5: The amount sent is higher after experiencing external non-monetary incentives.

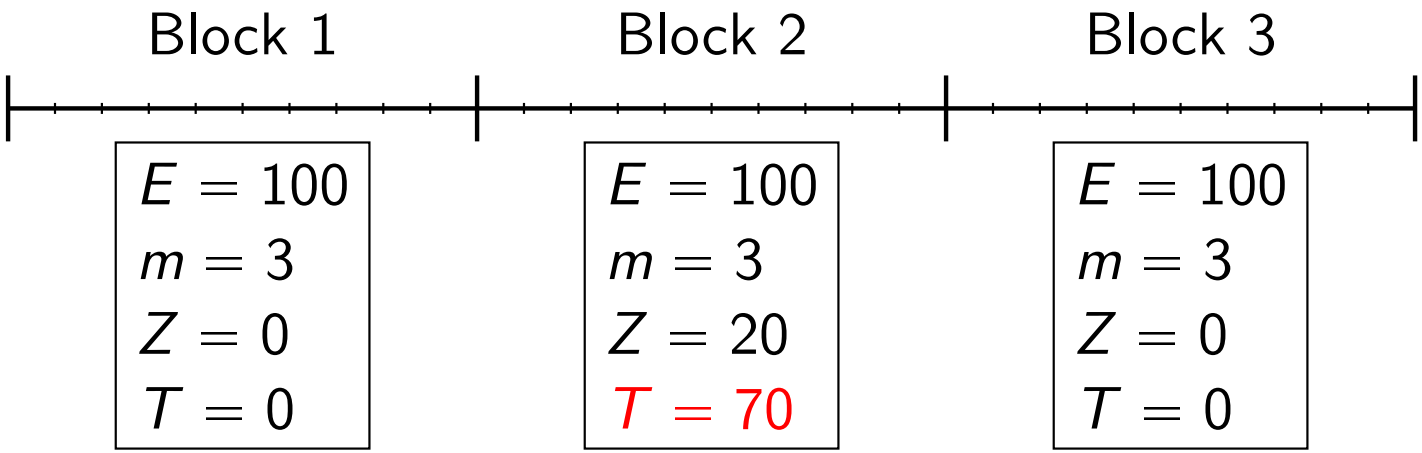
Experimental Design

- 4 treatments:
  - Subsidy with High Threshold Treatment (SUBHIGH)
  - Subsidy with Low Threshold Treatment (SUBLOW)
  - Suggestion Treatment (SUGGEST)
  - Control Treatment (CONTROL)
- 7 Sessions and **all four treatements in each session**.
- Between subject design
- 32 subjects in session
- Stranger matching
- 10 periods per each block (30 periods per one game)
- Payment per one random period

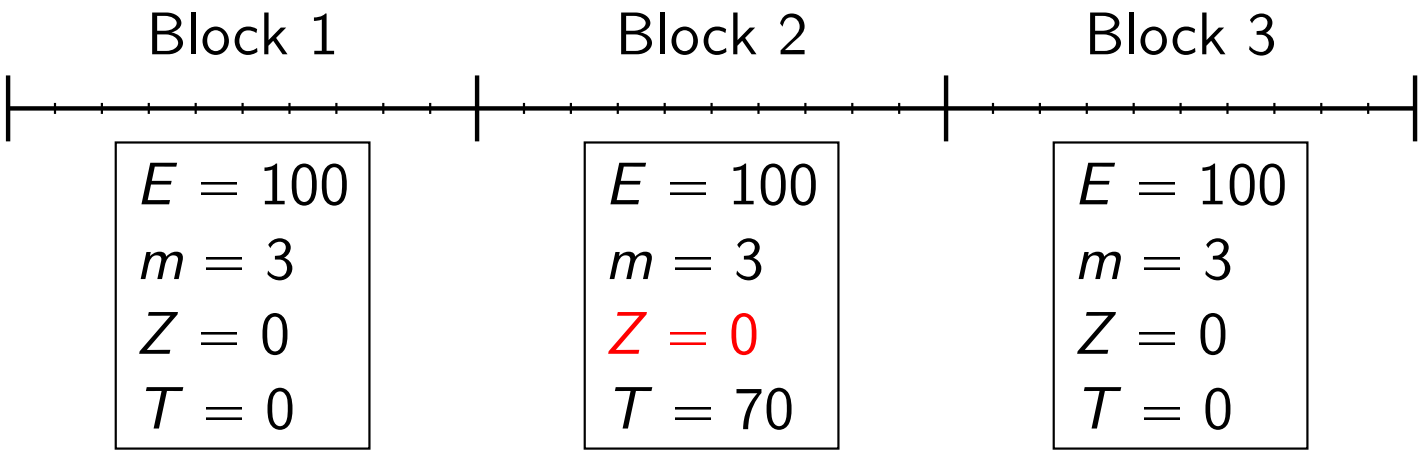
Experimental Design: SUBLOW Treatment



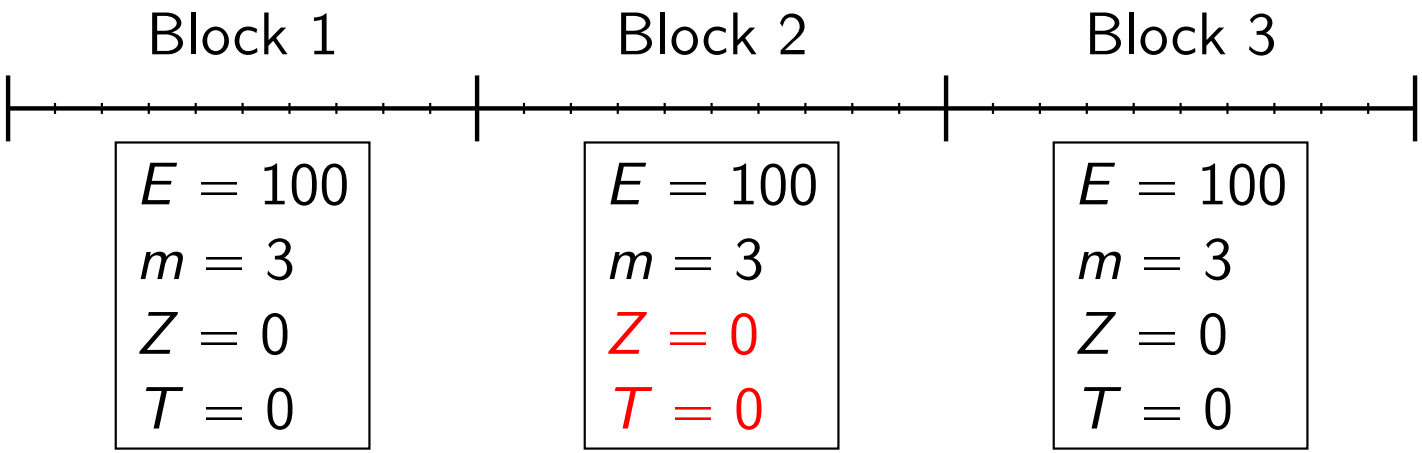
Experimental Design: SUBHIGH Treatment



Experimental Design: SUGGEST Treatment



Experimental Design: CONTROL Treatment



Results: Average amount send by treatment.

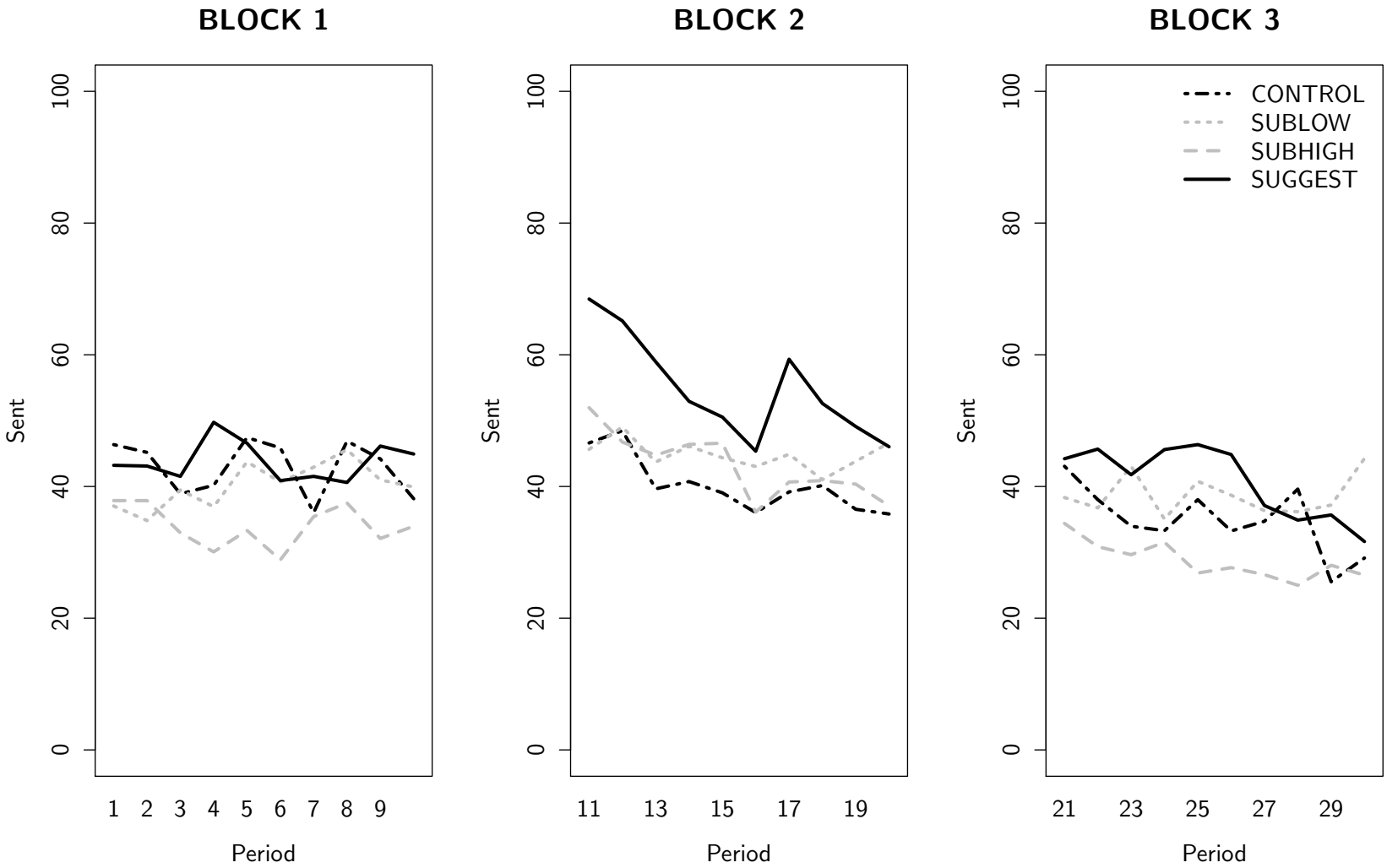


Figure:

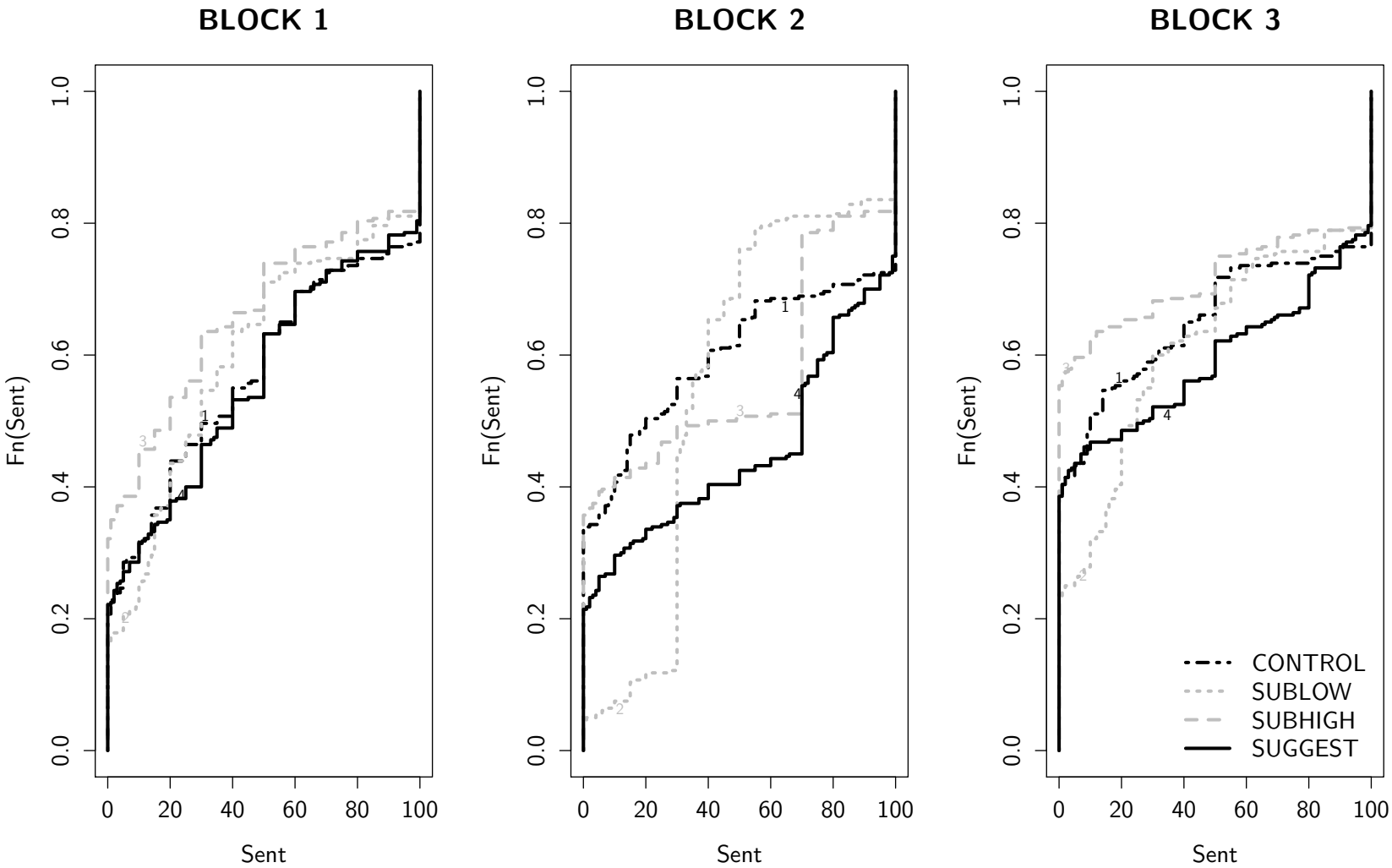
Results

Table: Determinants of Sending by five periods.

	Sent (s)					
	Periods					
	1-5	5-10	11-15	16-20	21-25	26-30
SUGGEST	1.2	0.6	16.3*	12.9	7.5	4.4
	(8.4)	(10.0)	(8.7)	(9.7)	(10.1)	(10.0)
SUBLOW	−5.2	−0.2	2.9	6.3	1.5	6.1
	(8.4)	(10.0)	(8.7)	(9.7)	(10.1)	(10.0)
SUBHIGH	−9.2	−8.7	4.4	1.5	−6.6	−5.7
	(8.4)	(10.0)	(8.7)	(9.7)	(10.1)	(10.0)
Constant	43.6***	42.2***	42.9***	37.5***	37.3***	32.5***
	(5.9)	(7.1)	(6.2)	(6.9)	(7.2)	(7.1)
Observations	560	560	560	560	560	560
Akaike Inf. Crit.	5,207.0	5,080.0	5,274.0	5,119.0	5,086.0	5,230.0
Bayesian Inf. Crit.	5,233.0	5,106.0	5,300.0	5,145.0	5,112.0	5,255.0

Note: *p<0.1; **p<0.05; ***p<0.01

Results: Cumulative distribution of amount sent by treatment.



Results

Table: Determinants $Pr(s \geqslant 70)$ by five periods.

	$Pr(s \geqslant 70)$					
	Periods					
	1-5	5-10	11-15	16-20	21-25	26-30
SUGGEST	0.8	−0.02	3.0***	5.4***	0.8	0.1
	(2.3)	(4.8)	(1.0)	(2.0)	(4.8)	(3.9)
SUBHIGH	−0.2	−0.6	2.1**	4.2**	−0.4	−0.4
	(2.5)	(5.2)	(1.0)	(2.0)	(5.3)	(4.2)
Constant	−6.0***	−8.4**	−1.9**	−5.3***	−8.6**	−7.7***
	(1.7)	(3.4)	(0.7)	(1.6)	(3.6)	(2.7)
Observations	420	420	420	420	420	420
Akaike Inf. Crit.	338.9	266.9	399.4	329.1	274.3	285.8
Bayesian Inf. Crit.	355.1	283.1	415.6	345.3	290.5	301.9

Note: *p<0.1; **p<0.05; ***p<0.01

Table: Determinants of $Pr(s = 70)$ by five periods

	$Pr(s = 70)$					
	Periods					
	1-5	5-10	11-15	16-20	21-25	26-30
SUGGEST	1.1	0.7	−1.7**	−1.7	−0.7	−32.3
	(1.2)	(1.2)	(0.7)	(2.4)	(1.2)	(5,671,734.0)
Constant	−4.9***	−4.9***	−1.6***	−5.3***	−4.2***	−4.2***
	(1.0)	(1.0)	(0.5)	(1.4)	(0.7)	(0.7)
Observations	280	280	280	280	280	280

Note: *p<0.1; **p<0.05; ***p<0.01

Table: Determinants of $Pr(s > 70)$ by five periods

	$Pr(s > 70)$					
	Periods					
	1-5	5-10	11-15	16-20	21-25	26-30
SUGGEST	0.7	0.4	3.4***	2.0	1.2	0.7
	(1.0)	(5.9)	(1.3)	(4.1)	(4.7)	(4.8)
Constant	−3.2***	−9.3**	−3.7***	−8.5**	−8.8**	−8.8**
	(0.8)	(4.3)	(0.9)	(3.3)	(3.7)	(3.7)
Observations	280	280	280	280	280	280

Note: *p<0.1; **p<0.05; ***p<0.01

Conlcusion

- We **experimentally test the different policies** to promote an investment activity.
- We find that the communication in form of **suggestion is effective** instrument to promote trustful behavior, whereas **the subsidy policy is not**.
- We propose to use a **field experiment** to test if communication policy fosters academic spin-off creation.

Thank you very much for your attention!

Web: www.igorasanov.com
E-mail: igor.asanov@uni-jena.de
VK: vk.com/economics

Table: Determinants of Net Payoff ($\pi_N = \pi - Z$) by five periods

	Dependent variable:					
	Net Payoff (π_N)					
	1-5	5-10	11-15	16-20	21-25	26-30
SUGGEST	1.2	0.6	16.3**	12.9*	7.5	4.4
	(6.7)	(6.9)	(8.1)	(7.7)	(8.3)	(8.2)
SUBHIGH	−5.2	−0.2	2.9	6.3	1.5	6.1
	(6.7)	(6.9)	(8.1)	(7.7)	(8.3)	(8.2)
SUBLOW	−9.2	−8.7	4.4	1.5	−6.6	−5.7
	(6.7)	(6.9)	(8.1)	(7.7)	(8.3)	(8.2)
Player (P)	−67.8***	−59.3***	−76.9***	−67.9***	−69.3***	−65.9**
	(4.7)	(4.9)	(5.8)	(5.4)	(5.9)	(5.8)
Constant	177.5***	171.9***	181.3***	171.5***	171.9***	165.4**
	(5.3)	(5.4)	(6.4)	(6.1)	(6.6)	(6.5)
Observations	1,120	1,120	1,120	1,120	1,120	1,120
Akaike Inf. Crit.	12,329.0	12,493.0	12,459.0	12,475.0	12,582.0	12,672.0
Bayesian Inf. Crit.	12,365.0	12,528.0	12,494.0	12,510.0	12,617.0	12,707.0

Note: *p<0.1; **p<0.05; ***p<0.