# Design Invariance in the Classic Consumer Choice Problem

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# Design Invariance

- Recovered preferences (or heuristics) should be independent of the elicitation method.
- The experimental setting may affect choices:
  - Framing effects (Tversky and Kahneman (1981)).
  - The risk elicitation puzzle (e.g. Crosetto and Filippin (2016), Pedroni et al. (2017), Zhou and Hey (2018)).
  - Tables vs. formulas (Rubinstein (2006)).
  - Time preferences: textual budgets lines vs. MPLs (Chakraborty et al. (2017)).

# Choices from Linear Budget Sets

- Choice from a linear budget set is fundamental in Economics.
- Samuelson (1938), Afriat (1967) and Varian (1982) provide a formal non-parametric theory of revealed preferences in this context.
- Laboratory experiments where subjects are asked to make choices from multiple budget sets, provide relatively large individual level data sets natural for the application of the theory of revealed preferences.
- As opposed to most of this literature, this elicitation method is not based on binary comparisons.

# Experimental Designs

- ***The Textual methodology*** - Subjects are faced with a sentence that describes a budget set and are asked to plug in their preferred bundle.
- ***The Graphical methodology*** - Subjects are required to choose their preferred bundle from a visually presented budget set.
- These methodologies are used to investigate:
  - Preferences over goods (bundles of various food items).
  - Risk preferences (bundles of Arrow securities).
  - Other-regarding preferences (bundles of Dictator game outcomes).
  - Time preferences (bundles of payments at different dates).
- Other methodologies:
  - Discrete - Subjects are asked to choose among a small number of bundles on the same budget line.
  - Slider.

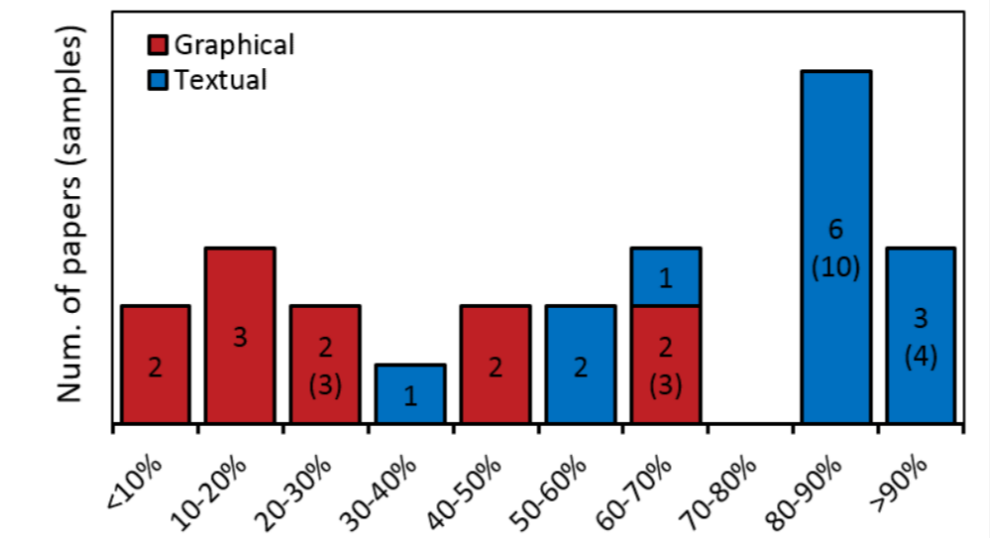
# Substantial Literature (86 Experiments)

| Method | Preferences | Article | Subjects | Trials | Max Slope | GARP Passing Rate | Av. CCEI | Types |
|---|---|---|---|---|---|---|---|---|
| Textual (32) | Other Regarding (17) | Andreoni and Vesterlund (2001) | 142 | 8 | 3 | 90.8% | 0.997 | Selfish 22.7%, Egalitarian 14.2%, MSW 6.2% |
| | | Andreoni and Miller (2002) | +34 | 11 | 4 | 85.3% | 1* | |
| | | Eckel and Grossman (2003) | 168 | 12 | 2 | N/A | N/A | N/A |
| | | Harrison and Johnson (2006) | 173 | 10 | 4 | N/A | N/A | N/A |
| | | Andreoni (2007) ($n=1$) | 120 | 5 | 4 | 96.7% | 0.996 | Selfish $>$ 9.16% |
| | | Dickinson (2009) | 152 | 11 | 4 | 83%-88% (WARP) | N/A | Selfish 9%-13%, Egalitarian 3%-14%, MSW 0%-4% |
| | | Visser and Roelofs (2011) | 106 | 4*5 | 3 | N/A | N/A | N/A |
| | | Dawes et al. (2012) | 20 | 5 | 3 | N/A | N/A | N/A |
| | | Jakiela (2013) | 144 | 10-12 | 3 | N/A | N/A | Selfish ⎓30% |
| | | Korenok et al. (2013) | 178 | 18 | 4 | 66% (MI) | 0.979 | Selfish ⎓28% |
| | | Porter and Adams (2015) | 190 | 11;22 | 4 | 88.4%-90.5%;26.8% | 0.917-0.945;0.835 | Selfish 3-45%, Egalitarian 20-35%, MSW 15-65%, Altruist 0-4% |
| | | Porter et al. (2019) | 369 | 11;33 | 4 | 79%-89%;18% | N/A | Selfish 1-10%, Egalitarian 0%, MSW 5-30%, Altruist 0-4% |
| | | Hong et al. (2015) | 144 | 20 | 10 | 56.9% | 75% $>$0.97 | Selfish 0%, Egalitarian 8.33%, MSW 0.9% |
| | | Engle-Warnick and Mishagina (2016), WP | 156 | 20 | 10 | 30.1% (WARP) | Approx. 0.929 | N/A |
| | | Davis et al. (2018) | 27 | 8 | 3 | 52% | 0.918 | Selfish 4%, Egalitarian 15% |
| | | Rigdon et al. (2018) | 189 | 8 | 3 | N/A | N/A | N/A |
| | | Chen et al. (2019) | 581 | 8(OR);6*4(Time) | 3(OR);2.22(Time) | 95.5%(OR) | N/A | Selfish 6%, Egalitarian 7%, MSW 11.4% (OR) |
| | Time (14) | Andreoni and Sprenger (2012a) | 97 | 45 | 2 | N/A | N/A | Corners 37% |
| | | Andreoni and Sprenger (2012b) | 80 | 84 | 1.43 | N/A | N/A | N/A |
| | | Cheung (2015) | 63 | 42 | 1.43 | N/A | N/A | N/A |
| | | Miao and Zhong (2015) | 111 | 56 | 1.43 | N/A | N/A | Corners 61%-72% or 10%-20% (without or with diversification) |
| | | Ashton (2015), WP | 143 | 5*11 | 2 | N/A | N/A | Corners 26% |
| | | Carvalho et al. (2016), Study 1 | 1060 | 12 | 1.03 | N/A | N/A | N/A |
| | | Kuhn et al. (2017) | 149 | 5*9 | 1.5 | N/A | N/A | Corners 36% |
| | | De Quidt et al. (2018) | 2805 | 1 | 1.2 | N/A | N/A | N/A |
| | | Franco and Mahadevan (2018), WP | 4*4 | 2 | 2 | N/A | N/A | N/A |
| | | Grijalva et al. (2018) | 62 | 9*4 | 60 | N/A | N/A | Corners 31% |
| | | Mudzingiri et al. (2018) | 85 | 1 | 1.25 | N/A | N/A | N/A |
| | | Rong et al. (2018) | 188 | 9 | 50 | N/A | N/A | Corners 60.1% |
| | | Rong et al. (2019) | 129 | 9*3 | 60 | N/A | N/A | N/A |
| | | Sun and Potters (2019) | 203 | 7*5;7*1 | 1.43 | N/A | N/A | Corners 38% |
| | Risk (1) | Drichoutis and Nayga Jr (2020) (Experiment 2) | 85 ; 80 | 60 | $3\frac{1}{3}$ | N/A | 0.867(0.814) ; 0.857(0.806) | N/A |
| Graphical (33) | Risk (18) | Choi et al. (2007a) ($p=\frac{1}{2}$) | 47 | 50 | unbounded | 27.7% | 0.934 | N/A |
| | | Hammond and Traub (2012), WP | 41 | 16-48 | unbounded | $<$ 48.7% | N/A | N/A |
| | | Ahn et al. (2014) | 154 | 50 | unbounded | 9.74% | 0.945 | N/A |
| | | Choi et al. (2014) | 1182 | 25 | unbounded | 22.8% | 0.881 (no socio-demographic subset above 0.925) | N/A |
| | | Chow (2014), WP | 92;88 | 20 | 7 | N/A | 0.74;0.90 | N/A |
| | | Cappelen et al. (2015), WP | 126;110;106 | 50 | unbounded | 23.8%;10%-25%,10.4% | 0.95;0.856;0.869 | N/A |
| | | Carvalho et al. (2016), Study 2 | 1119 | 25 | N/A | N/A | 0.85 | N/A |
| | | Castillo et al. (2017) | 202 | 50 | unbounded | 13% | 78%-83% $>$0.9 | N/A |
| | | Stango et al. (2017), WP | 1270 | 11 | unbounded | 47% | 0.95 | N/A |
| | | Halevy et al. (2018) | 203 | 22 | 4 | 44.8% | 0.979 | N/A |
| | | Shabat-Simon et al. (2018) | 46 | 50 | unbounded | N/A | N/A | N/A |
| | | Cettolin et al. (2020) | 100;104 | 50 | unbounded | $\approx$ 22%;N/A | 0.946;0.955 | N/A |
| | | Kurtz-David et al. (2019) | 33 | 108 | unbounded | 0% | 0.938 | N/A |
| | | Friedman et al. (2019), WP | 142 | 18 | 0.23-1.23 | N/A | N/A | N/A |
| | | Zame et al. (2020), WP | 276 | 50 | unbounded | N/A | 0.959 | 14.9% risk neutral, 3.3% infinite risk averse |
| | | González-Jiménez and Müller (2022), WP ($\pi=0.5$) | 128 ; 64 | 50 | unbounded | smaller than 51.6% ; 66% | 0.898 ; 0.927 | 31.2% ; 53% EUT |
| | | Cappelen et al. (2023) | 126 ; 216 | 50 | unbounded | N/A | 0.95 ; 0.86 | N/A |
| | | Drichoutis and Nayga Jr (2020) (Experiment 1) | 87 ; 91 | 60 | $3\frac{1}{3}$ | N/A | 0.939(0.917) ; 0.927(0.894) | N/A |
| | Other Regarding (10) | Fisman et al. (2007) (two person) | 76 | 50 | unbounded | 10.5% | 0.892 | Selfish 26.3%, Egalitarian 2.6%, MSW 2.6% |
| | | Becker et al. (2013), WP | 188 | 15 | 4.496 | 70.21%;63/83% | 94.15%;88/13% $>$0.9 | Selfish 16.5%;-, Egalitarian 0%;3.7%, MSW 0%;4.8% |
| | | Fisman et al. (2015a) GR treatment | 72 | 50 | unbounded | N/A | 0.944 | Selfish 31.9% |
| | | Fisman et al. (2015b) | 208;309;54;206 | 50 | unbounded | N/A | 0.95;0.86;0.882;0.857 | Selfish 31.7%;16.2%;?;? |
| | | Fisman et al. (2017) | 1002 | 50 | unbounded | N/A | 0.862 | Selfish 16.7%, Egalitarian 12.6%, MSW 18.3% |
| | | Müller (2019) | 116 | 50 | 10 | 0% | 0.96 | Selfish 23%;32% |
| | | Zame et al. (2020), WP | 276 | 50 | unbounded | N/A | 0.951 | Selfish 37.3%, Egalitarian 1.1%, MSW 1.1%, Other impartial 4.7% |
| | | Moreno et al. (2019), WP | 41 | 37 | 7 | 90.2% | N/A | Selfish 2.4%, Egalitarian 9.75%, MSW 2.4%, Altruist 2.4% |
| | | Nitsch et al. (2022) | 53;148;97 | 20*2;40*2;40*2 | 3 | N/A | 0.904,0.929;0.850,0.894;0.881,0.914 | N/A |
| | | Li et al. (2022) | 284;993;82;503 | 50 | unbounded | N/A | 0.96;0.86;?;? | Selfish 12%;12%,18%,24% (approx.) |
| | Social Risk (1) | Zame et al. (2020), WP | 276 | 50 | unbounded | N/A | 0.901 | MSW (corner) 10.9%, Egalitarian 3.3% |
| | Time (4) | Liu et al. (2014) | 185 | 5*2 | 1.025 | N/A | N/A | N/A |
| | | Balakrishnan et al. (2017), WP | 494 | 6*8;12*2 | 4 | 61.3% | N/A | Corners 11.9% |
| | | Imai and Camerer (2018), WP | 135 | 5*4 | ⎓1.1 | N/A | N/A | Corners ⎓50% |
| | | Dertwinkel-Kalt et al. (2018), WP | 93;92 | 36(6*2);32(2*2) | 1.8 | N/A | N/A | N/A |
| Discrete Textual (9) | Other Regarding (5) | Castillo and Cross (2008) | 107 | 4 Dictator + 4 Ultimatum | 3 | N/A | N/A | Selfish 49% |
| | | Dawes et al. (2011) | 234 | 5 | 3 | 94% (WARP) | N/A | Selfish 25.6% (55.4%), Egalitarian 0% (31.6%), MSW 1.3% (7.8%), Altruist 5.2% (5.2%) |
| | | Owens (2016) | N/A | 50 | 10 | N/A | N/A | |
| | | Schumacher et al. (2017) (games 1-3) | 581 | 3 | 2 | N/A | N/A | Selfish 35.1%, Egalitarian 8% |
| | | Nitsch et al. (2022) (Studies 1,2) | 53;148 | 20*2;40*2 | 3 | N/A | 0.858,0.867;0.738,0.759 | N/A |
| | Goods (2) | Banerjee and Murphy (2011) | 69 | 10 | 5 | 53.6% (WARP) | N/A | |
| | | Castillo and Freer (2023), WP (3 and 5 goods) | 63;64 | 30 | 6 | 33%;25% | 0.88;0.81 | |
| | Time (2) | Andreoni et al. (2015) | 86 | 6*4 | 2.22 | N/A | N/A | |
| | | Giné et al. (2018) | 2142 | 5*2 | 2 | N/A | N/A | |
| Discrete Visual (10) | Other Regarding (1) | Harbaugh and Krause (2000) | 40 | 11 | 4 | 55% | 0.87 | |
| | Goods (7) | Harbaugh et al. (2001) | 31 ; 42 ; 55 | 11 | 3 | 26% ; 62% ; 65% | 0.93 ; 0.96 ; 0.94 | N/A |
| | | Camille et al. (2011) | 9 (11) ; 22 (26) | 11 | 3 | 11% (27%) ; 68% (73%) | 0.9 (0.92) ; 0.95 (0.96) | 2 ; 4 corners only |
| | | Bruyneel et al. (2012), WP | 39 ; 31 ; 30 | 9 | 9 | 31% ; 48% ; 53% | 0.604 ; 0.737 ; 0.747 | |
| | | Burghart et al. (2013) | 101 | 11 | 3 | 58.4% | 0.967 | |
| | | Bruyneel et al. (2017), first stage | 42 ; 24 ; 34 | 9 | 9 | N/A | N/A | |
| | | Chung et al. (2017) | 38 | 11 | 3 | 57.9% | 0.98 | |
| | | Nitsch et al. (2021) | 144 | 3*11 | 5 | N/A | between 0.75 and 0.9 | N/A |
| | Risk (1) | Kim et al. (2018) | 2424 | 20 | ? | N/A | N/A | N/A |
| | Time (1) | Kim et al. (2018) | 2424 | 15 ; 15 | ? | N/A | N/A | N/A |
| Slider (2) | Other Regarding (1) | Nitsch et al. (2022) (Studies 1,2) | 53;148 | 20*2;40*2 | 3 | N/A | 0.891,0.935;0.834,0.874 | N/A |
| | Risk (1) | Halevy and Mayraz (2022) (two companies) | 112 | 10 | 4 | 78% | N/A | N/A |

# Contradicting Experimental Evidence (Giving)

| | *Trials* | *Price Ratios* | *No. of subjects* | *% of GARP satisfiers* | *Average Afriat index* |
|---|---|---|---|---|---|
| ***Fisman, Kariv and Markovits (AER 2007)**** | 50 | Unbounded | 76 | 10.5% | 0.108 |
| ***Andreoni and Miller (ECMT 2002)*** | 8<br>(8 or 11) | T=3<br>(T=4) | 142<br>(176) | 90.8%<br>(89.8%) | 0.003<br>(0.002) |

*(*) only two-person treatment.*



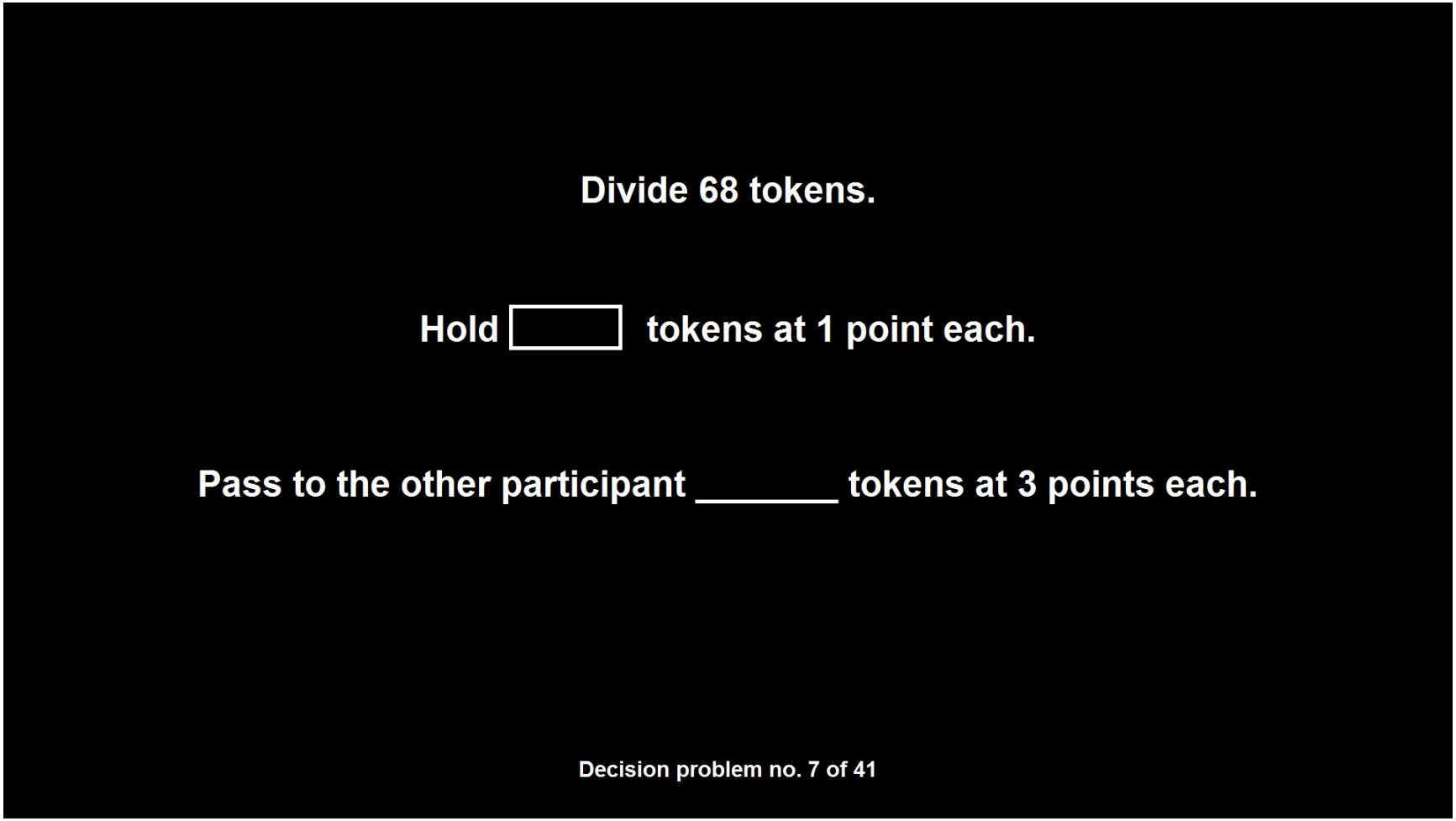
# General

- Two-by-two design.
- One dimension: The context - Dictator (MDG) vs. Risk (RISK).
- Second dimension: The format - Textual interface (Andreoni and Miller (2002)) vs. graphical interface (Fisman et al. (2007)).
- A between subjects design.

# MDG: The Setting

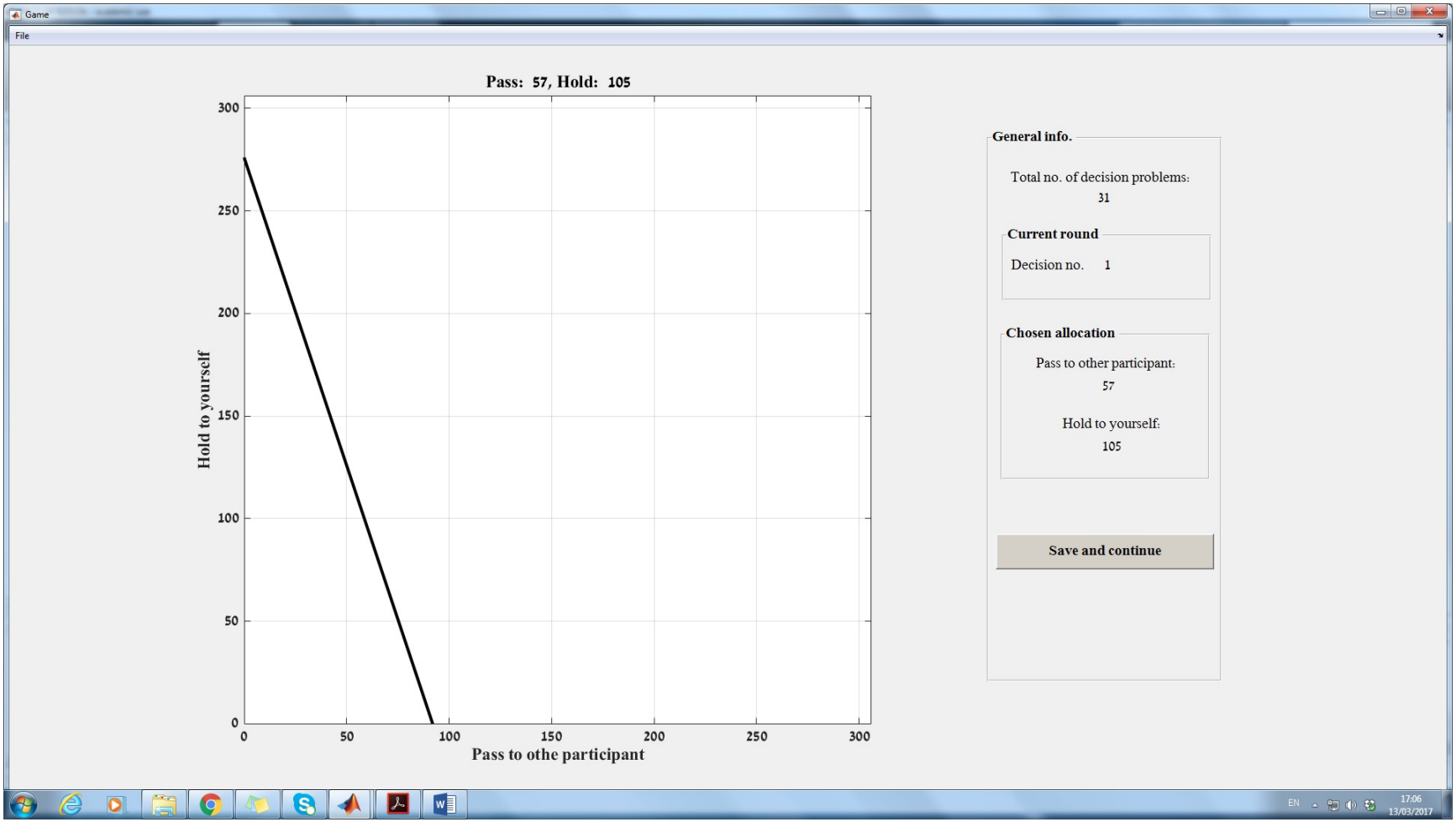
- Choices from linear budget sets in the context of other regarding preferences.
- In each decision problem the subject encounters a "modified" dictator game with an anonymous other subject.
- Each token that she allocates to herself is multiplied by $\alpha$ points while a token she allocates to the other is worth $\beta$ points.

# MDG: Textual Interface




◂ Hebrew ◂ Original

# MDG: Graphical Interface

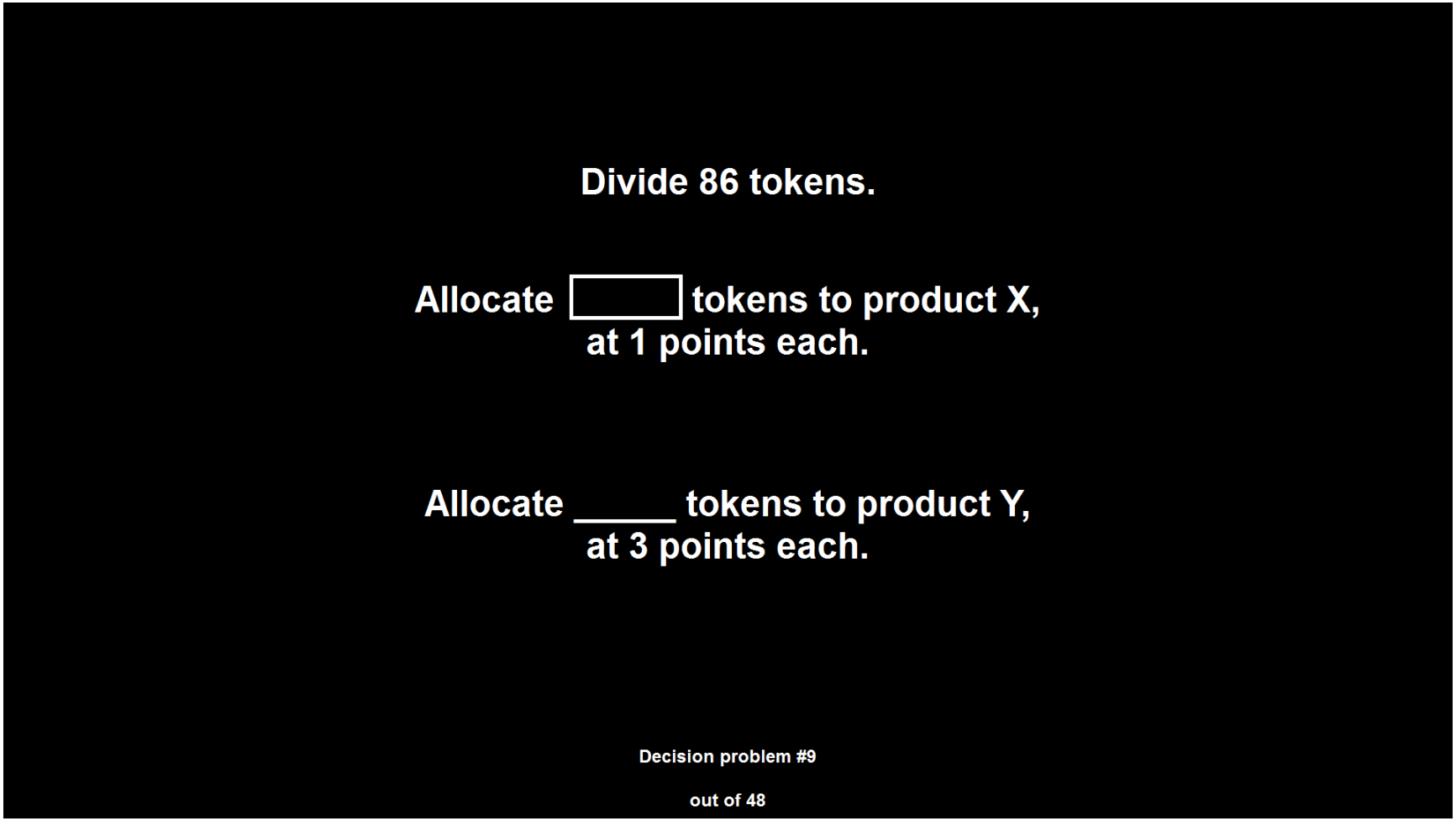



◂ Hebrew ◂ Original

# RISK: The Setting

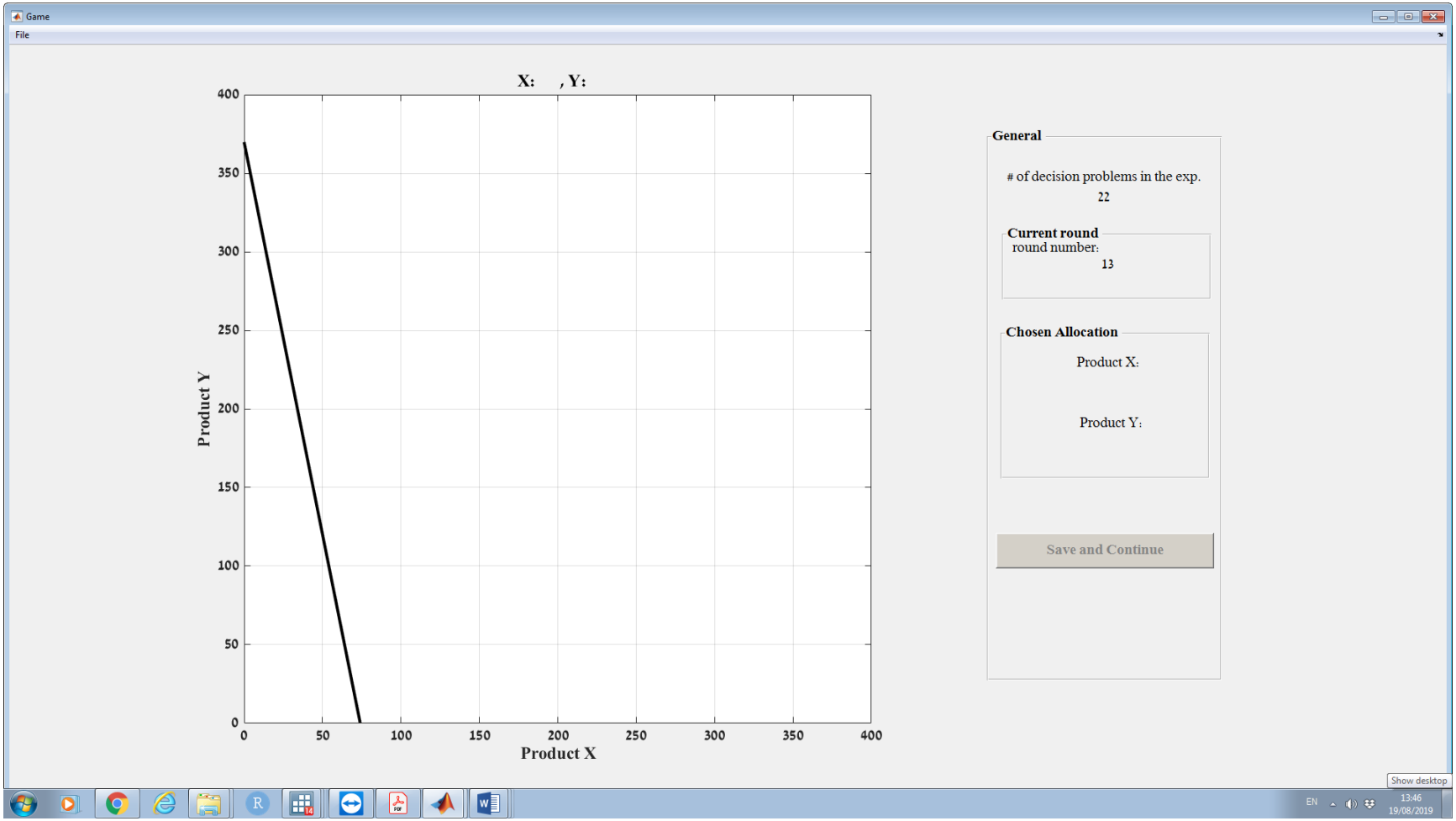
- Choices from linear budget sets in the context of risk preferences.
- Subjects were asked to choose the optimal portfolio of Arrow securities (two equally probable states) from linear budget sets with varying prices (following Choi et al. (2007b)).
- Each token that she allocates to X returns $\alpha$ points if X is the state of the world while a token she allocates to Y returns $\beta$ points if Y is the state of the world.

# RISK: Textual Interface




◂ Hebrew

# RISK: Graphical Interface



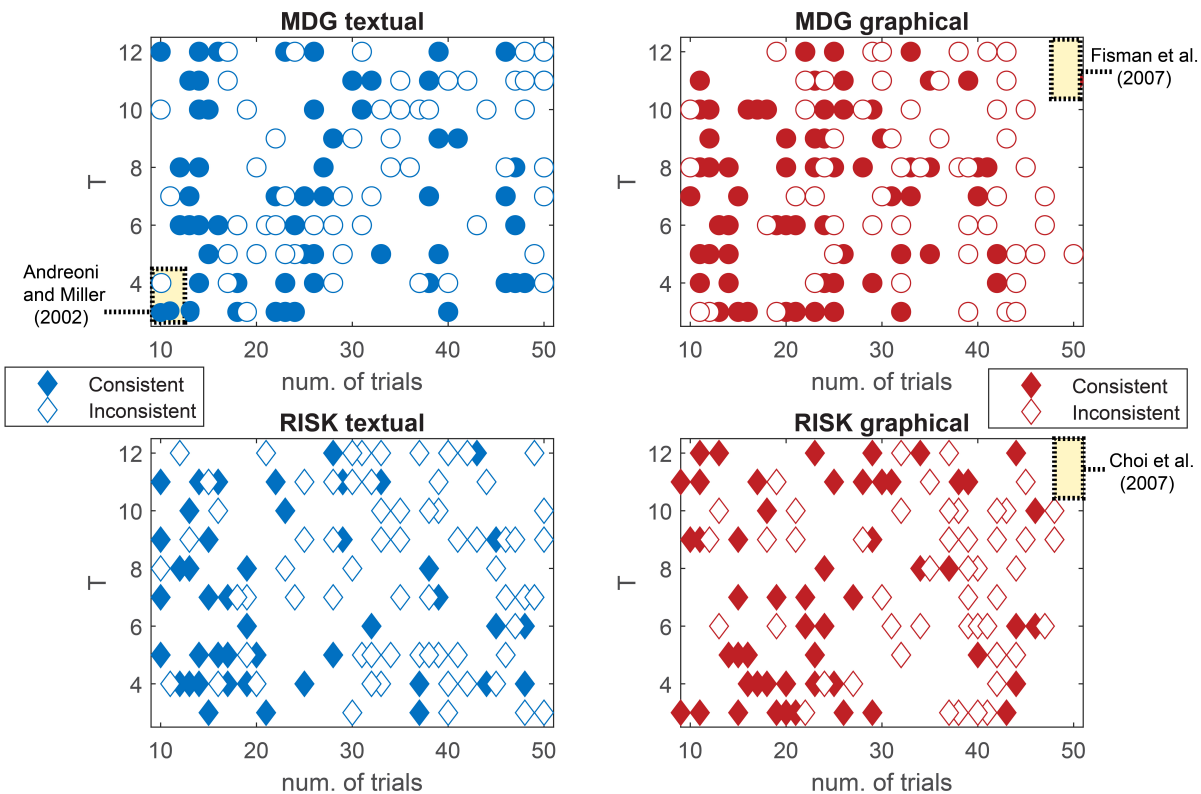

Hebrew

# Implementation

- At the beginning of the experiment each subject was randomly assigned with:
  - A number of repetitions (integer between 10 and 50).
  - An upper bound on the price ratio $T$ (integer between 3 and 12).
- In each trial the subject was randomly assigned with:
  - Price ratio (in $\{\frac{1}{T}, \frac{1}{T-1}, \ldots, 1, \ldots, T-1, T\}$).
  - Tokens endowment (integer between 40 and 100).
- Monotonicity was imposed.
- The subjects were undergrads from TAU and BGU (272 for the MDG and 245 for the RISK).
- The experiments took place in 2016-2017.

# Replication

| Context | Sample | Num. of trials | Price ratios ($T$)) | Num. od subjects | % GARP satisfiers) | Average CCEI |
|---|---|---|---|---|---|---|
| **MDG** | Andreoni and Miller (2002) | 8 (8 or 11) | $T=3$ ($T=4$) | 142 (176) | 90.8% (89.8%) | 0.003 (0.002) |
| | Textual interface | 10-29 | $T=3$ | 10 | 90% | 0 |
| | Fisman et al. (2007) (two person) | 50 | unbounded | 76 | 10.5% | 0.108 |
| | Graphical interface | 41-50 | $T>8$ | 8 | 12.5% | 0.067 |
| **RISK** | Choi et al. (2007a) ($p=\frac{1}{2}$) | 50 | unbounded | 47 | 25.5% | 0.066 |
| | Graphical interface | 41-50 | $T>8$ | 12 | 33.3% | 0.052 |



# Consistency

| Context | Interface | Consistent | | GARP violations | | CCEI | | Varian Index | | HMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | number | % | all | inconsistent | all | inconsistent | all | inconsistent | all | inconsistent |
| **MDG** | Textual | 75 | 55.6% | 24.7 | 55.6 | 0.047 | 0.106 | 0.013 | 0.029 | 0.044 | 0.098 |
| | Graphical | 79 | 57.7% | 6.7 | 15.8 | 0.027 | 0.063 | 0.006 | 0.014 | 0.029 | 0.068 |
| | **Total** | 154 | 56.6% | 15.6 | 36.1 | 0.037 | 0.085 | 0.009 | 0.021 | 0.036 | 0.083 |
| **RISK** | Textual | 52 | 41.6% | 12.2 | 20.9 | 0.034 | 0.059 | 0.008 | 0.013 | 0.042 | 0.072 |
| | Graphical | 62 | 51.7% | 14.1 | 29.1 | 0.032 | 0.066 | 0.007 | 0.015 | 0.033 | 0.068 |
| | **Total** | 114 | 46.5% | 13.1 | 24.6 | 0.033 | 0.062 | 0.007 | 0.014 | 0.038 | 0.070 |

## Result

*When the design controls for the number of repetitions and for the range of slopes, the effect of the interface on consistency vanishes and maybe even reverses.*

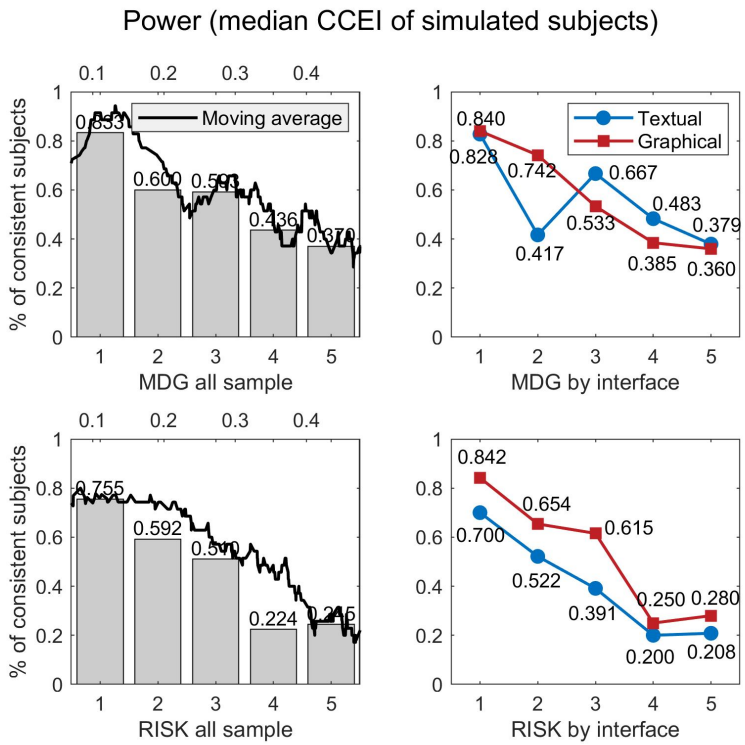
# Power: Definition

**Definition (Power)**

The probability that a DM who chooses randomly uniformly on the budget line will pass the revealed preference test of GARP.

- For each subject, we generated 2,500 simulated DMs.
- Each simulated DM encountered the same sequence of budget sets as the real subject and made random uniform choices.
- For many subjects most simulated DMs failed GARP.
- We opted to use the median CCEI across all simulated subjects as our measure for power.

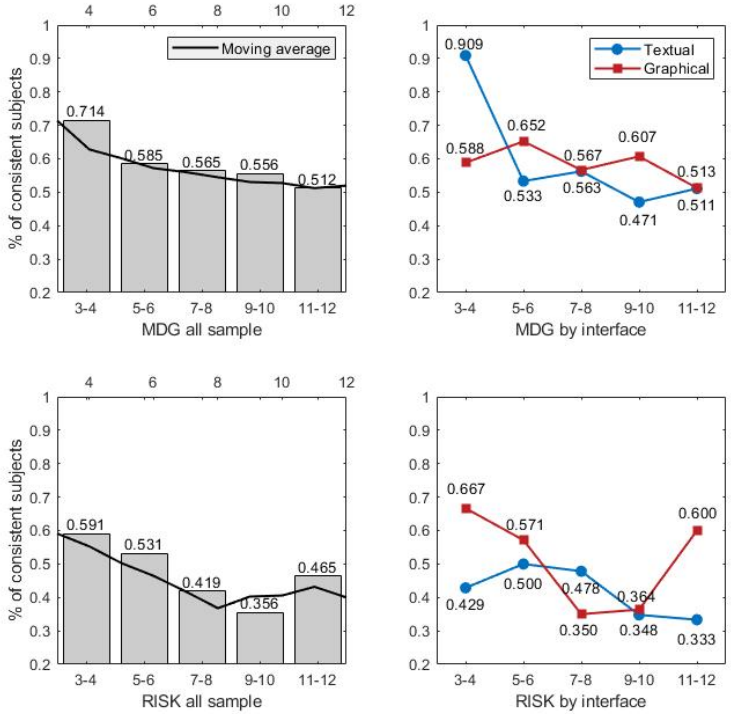
# Power: Result




## Result

*An increase in the power of the experiment leads to a decline in consistency rates, regardless of the interface and the context the subjects encounter.*

# The Range of Price Ratios



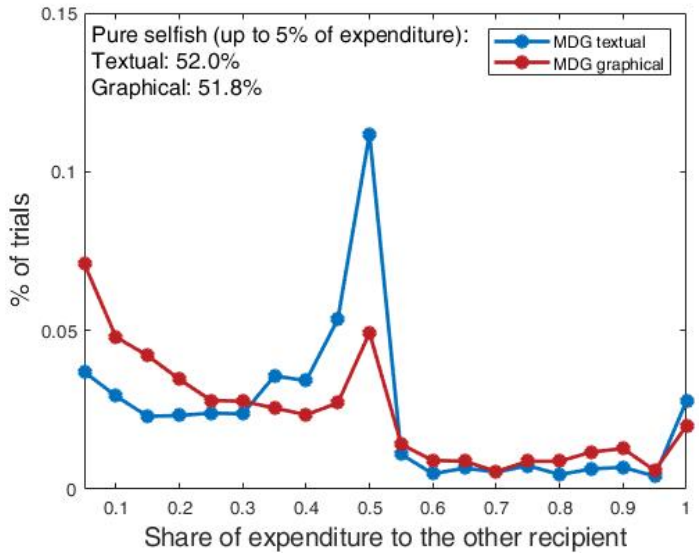

## Result

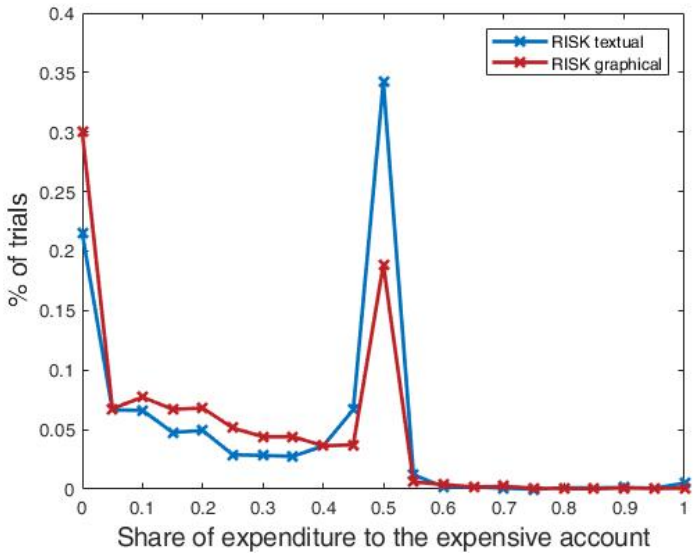
*An increase in the maximal slope assigned to the subject leads to heterogeneous effects across contexts and interfaces.*

# Does the Format Affect Behavior?

- If interfaces differ only in their “user friendliness” then we expect subjects to behave similarly over both interface (after accounting for mistakes).
- Consistency analysis is not adequate to answer this question since it cannot reveal changes in the distribution of behavior.
- Such analysis requires exploring actual choices rather than their internal consistency.

# Focal Bundles

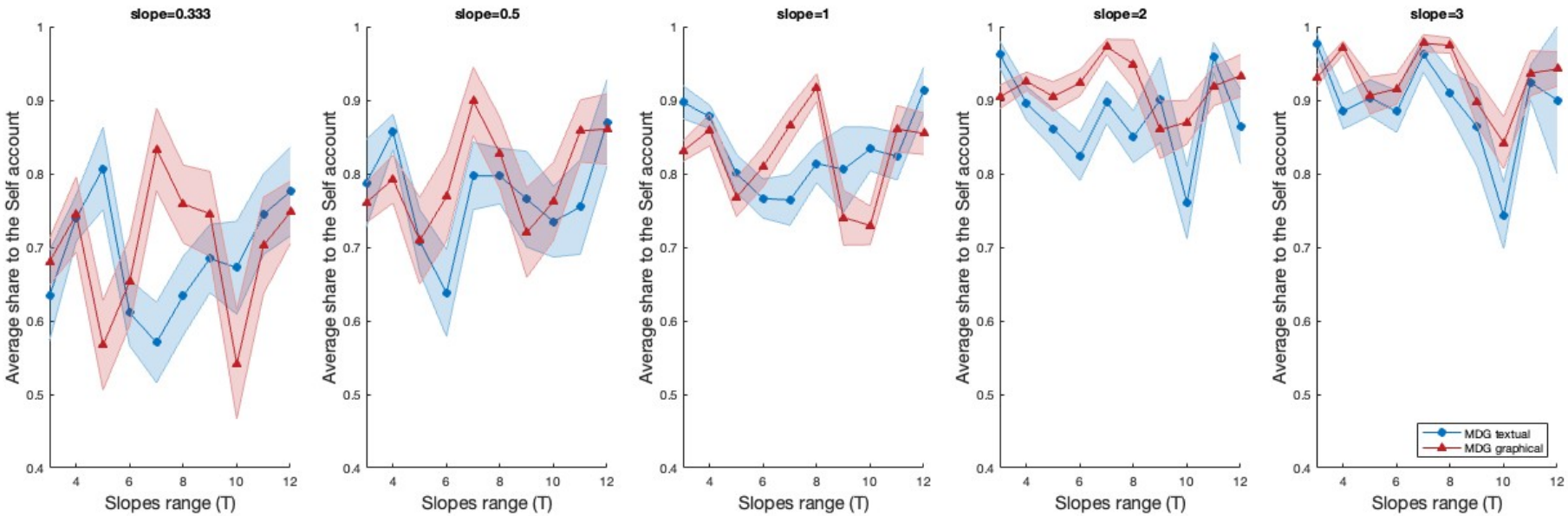


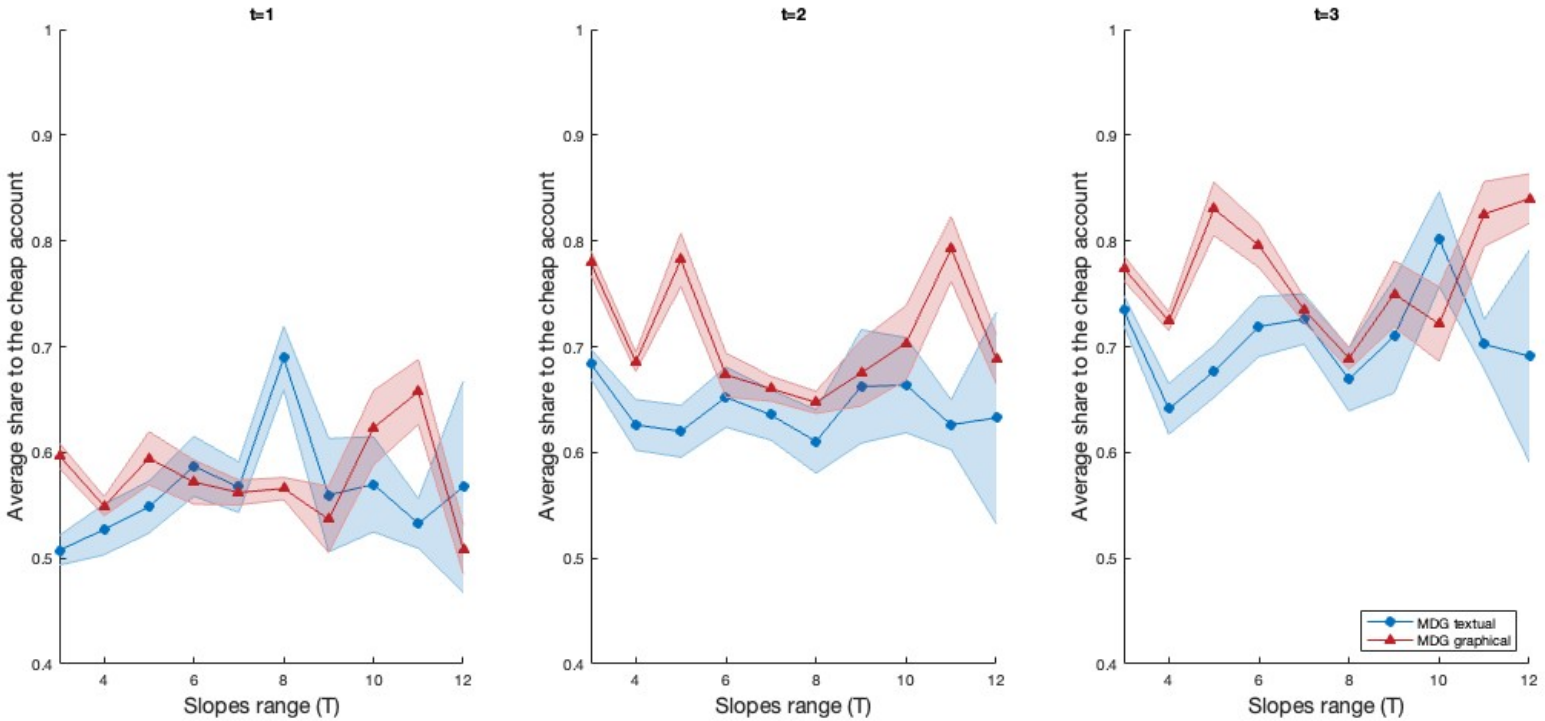

## Result

*Over all subjects, 50-50 bundles are chosen more in the textual interface. Corner bundles are chosen more in the graphical interface (at least in RISK).*

# The Range of Price Ratios: MDG



# The Range of Price Ratios: RISK




## Result

*Holding the question and the interface constant, the range of slopes affects, non-linearly, the DM's choices.*

# Parametric Recovery of Preferences: MDG

In MDG, preferences are usually recovered using the Constant Elasticity of Substitution (CES) utility function

$$u(x,y) = [\alpha \times x^{\rho} + (1-\alpha) \times y^{\rho}]^{\frac{1}{\rho}}$$

where $x$ is the monetary allocation for Self and $y$ is the monetary allocation for Other. $\alpha \in [0,1]$ is the relative weight on payoff to Self, and $1/(\rho - 1)$ is the elasticity of substitution between Self and Other ($\rho \in (-\infty, 1]$).

- Extreme Altruism: $\alpha = 0$.
- Extreme Selfishness: $\alpha = 1$.
- Egalitarianism: $\rho \to -\infty$.
- Maximal Social Welfare: $\alpha = 0.5$ and $\rho = 1$.
- Cobb-Douglas with Parameter $\alpha$: $\rho \to 0$.

# Results: MDG

| Type | Definition | Criteria | Methodology | MMI | NLLS |
|---|---|---|---|---|---|
| Selfish | $\alpha = 1$ | $\alpha > 0.9$ | Total | 37.1% | 56.2% |
| | | | Textual | 35.5% | 60.7% |
| | | | Graphical | 38.7% | 51.8% |
| Egalitarian | $\rho \to -\infty$ | $\rho < -1$ | Total | 10.7% | 18.0% |
| | | | Textual | 14.8% | 20.7% |
| | | | Graphical | 6.6% | 15.3% |
| Max Social Welfare | $\alpha = 0.5, \rho = 1$ | $0.25 < \alpha < 0.75$, $0.9 < \rho < 1.1$ | Total | 1.8% | 2.9% |
| | | | Textual | 2.2% | 3.0% |
| | | | Graphical | 1.5% | 3.0% |
| Altruist | $\alpha = 0$ | $\alpha < 0.2$ | Total | 0% | 0% |
| Unclassified | | | Total | 50.4% | 22.8% |

- MMI implies NLLS (except 4 selfish-graphical).
- We trust MMI more also due to Halevy et al. (2018).
- Half of the non-selfish subjects are unclassified even in the NLLS.

# Parametric Recovery of Preferences: RISK

In RISK, preferences are usually recovered using Gul's Disappointment Aversion utility function (Gul (1991))

$$u(x,y) = \gamma\omega(\max\{x,y\}) + (1-\gamma)\,\omega(\min\{x,y\})$$

where $x$ is the amount of Arrow securities type X and $y$ is the amount of Arrow securities type Y. $\gamma = \frac{1}{2+\beta}$ is the weight of the better outcome ($-1 < \beta < \infty$), and $\omega$ is a CRRA function with a relative risk aversion parameter $\rho$:

$$\omega(x) = \begin{cases} \frac{x^{1-\rho}}{1-\rho} & \rho \geq 0 \quad (\rho \neq 1) \\ ln(x) & \rho = 1 \end{cases}$$

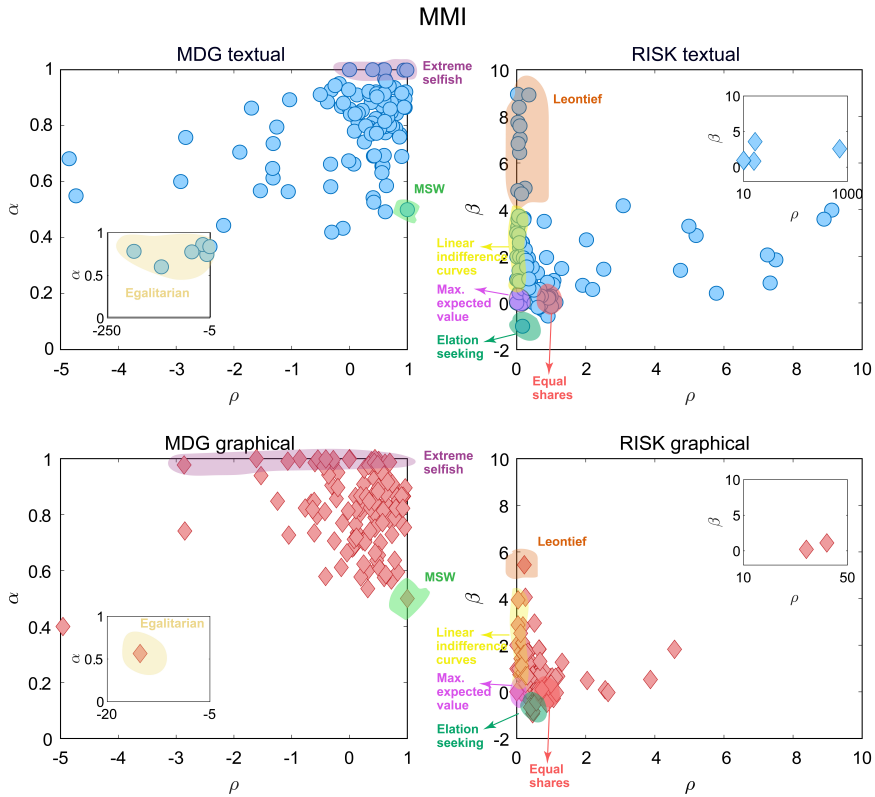
- Expected Value: (i) $\beta = -1$; (ii) $\beta \leq 0$ and $\rho = 0$.
- Cobb-Douglas with Equal Shares: $\beta = 0$ and $\rho = 1$.
- Safe Bundle: $\beta \to \infty$.
- Switch between safe and corner: $\beta \geq 0$ and $\rho = 0$.

# Results: RISK

| Type | Definition | Criteria | Methodology | MMI | NLLS |
|---|---|---|---|---|---|
| Expected Value | $\beta = -1$ or $\beta \leq 0, \rho = 0$ | $\beta < -0.9$ or $\beta <= 0, \rho <= 0.2$ | Total | 9.8% | 18.0% |
| | | | Textual | 7.2% | 14.4% |
| | | | Graphical | 12.5% | 21.7% |
| Safe Bundle | $\beta \to \infty$ | $\beta > 5$ | Total | 3.7% | 8.2% |
| | | | Textual | 6.4% | 12.8% |
| | | | Graphical | 0.8% | 3.3% |
| Equal Shares of Endowment | $\beta = 0, \rho = 1$ | $-0.1 < \beta < 0.1$ $0.9 < \rho < 1.1$ | Total | 0.8% | 5.3% |
| | | | Textual | 1.6% | 4.0% |
| | | | Graphical | 0% | 6.7% |
| Switch | $\beta > 0, \rho = 0$ | $\beta > 0, \rho <= 0.2$ | Total | 20% | 19.2% |
| | | | Textual | 24.8% | 24% |
| | | | Graphical | 15% | 14.2% |
| Unclassified | | | Total | 65.7% | 49.3% |

- Two-thirds of the non-EV subjects are unclassified even in the NLLS.

# Summary




## Result

*The majority of subjects cannot be classified into standard behaviors by parametric elicitation of preferences across contexts and interfaces.*

# Understanding Behavior

- The most objective way: An algorithm partitions the subjects by their choices and the researcher studies each group's behavior ex-post [We did not do that. Maybe in the future].
- The next objective way: An algorithm classifies each subject to the best fitting predefined choice procedure [We are in the process of doing that (required a list of potential procedures)].
- The non-scientific way: RAs try to "understand" each subject's choice procedure [We have done that].

# Choice Procedures

- Informally, a procedure is:
  - A rule for partitioning the observations.
  - A function that assigns a “simple” decision rule to each element of the partition.
- We classified the subjects into a set of procedures.
- Partitions are implemented by cutoffs:
  - Either by price ratio, endowment or observation number.
  - We allow multiple cutoffs.
  - Two cases seem like individual random utility.
- Simple Decision rules:
  - MDG: Give to the other fix or percentage. [For RISK replace “other” with “expensive”].
  - Can work on: Tokens, points or money.
  - On top of that: Rounding (Breitmoser (2021)).
- We include almost all procedures in Halevy and Mayraz (2022) for the case of two firms.

# No Cutoff: MDG

| Name | Textual | Graphical |
|---|---|---|
| Extreme Selfish | 41 (30.4%) | 34 (24.8%) |
| Extreme Altruist | 0 (0%) | 0 (0%) |
| Egalitarian | 13 (9.6%) | 1 (0.7%) |
| Constant Ratio of Money | 0 (0%) | 2 (1.5%) |
| Constant Shares of Endowment | 6 (4.4%) | 6 (4.4%) |
| Around the Corner | 0 (0%) | 6 (4.4%) |
| Nearest Nice Number | 10 (7.4%) | 1 (0.7%) |
| Fixed | 1 (0.7%) | 5 (3.6%) |
| Total | 71 (52.6%) | 55 (40.1%) |

- In the textual interface more subjects employ simple decision rules.
- 51 subjects (37.7%) in the textual interface and 41 subjects (29.9%) in the graphical interface chose selfishly (using different procedures).
- In the textual interface more subjects implement the egalitarian procedure.

# No Cutoff: RISK

| Name | Textual | Graphical |
|---|---|---|
| Max Expected Value | 11 (8.8%) | 23 (19.2%) |
| Safe Bundle | 36 (28.8%) | 5 (4.2%) |
| Equal Shares of Endowment | 14 (11.2%) | 5 (4.2%) |
| Constant Shares of Endowment | 10 (8.0%) | 20 (16.7%) |
| Fixed Insurance | 7 (5.6%) | 13 (10.8%) |
| Constant Mix of Safe and Corner | 0 (0%) | 3 (2.5%) |
| Total | 78 (62.4%) | 69 (57.5%) |

- Slightly more subjects employ simple decision rules in the textual interface.
- It seems that the subjects faced with the textual interface exhibit more risk aversion than those faced with the graphical interface.

# More Complicated Procedures: MDG

- 41 subjects (30.4%) in the textual interface treatment implemented a procedure with one cutoff.
- 39 subjects (28.5%) in the graphical interface treatment implemented a procedure with one cutoff.
- 83% of the textual interface subjects implement one cutoff or less compared to 68.6% of the graphical interface subjects.

# More Complicated Procedures: RISK

- 35 subjects (28%) in the textual interface treatment implemented a procedure with one cutoff.
- 31 subjects (25.8%) in the graphical interface treatment implemented a procedure with one cutoff.
- 90.4% of the textual interface subjects implement one cutoff or less compared to 83.3% of the graphical interface subjects.
- Cautious conjecture: Subjects that use the graphical interface tend to use more complicated procedures.

# The Classification Algorithm

- For each dataset:
  - The algorithm assigns each procedure with a score (e.g. by its predictive performance, number of hits, revealed preference properties).
  - The algorithm "punishes" procedures for complexity (currently, by number of cutoffs).
  - The algorithm returns the best "simple" procedure.
- Currently, we are calibrating the algorithm - which combination of scoring rule and punishments works "best".

# Things we Learned on External Validity

- A mapping from the design within the lab to “real world” consumer choice problems is necessary but unclear.
- Each design induces different focal choices.
- The design and the variability of problems interact to produce different choices on similar problems.
- Cognitively easier interfaces induce subjects to use more complex choice procedures.

# Thanks


THANK
YOU
GRACIAS
ARIGATO
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EKHMET
MEHRBANI
GRAZIE
KOMAPSUMNIDA
JUSPAXAR
GOZAIMASHITA
EFCHARISTO
YAQHANYELAY
TINGKI
SPASSIBO
SNACHALHUYA
NUHUN
CHALTU
WABEEJA
MAITEKA
SPASIBO
DENKAUJA
NENACHALHYA
SIKOMO
MAAKE
PALDIES
MERASTAWHY
GAEJTHO
AGUYJE
FAKAAUE
TAVTAPUCH
MEDAWAGSE
BAIKA
MINMONCHAR
MAKETAJ

# Textual Methodology - Hebrew

back

חלק/י 60 אסימונים.

שמור/שמרי לעצמך ☐ אסימונים
בערך של 1 נקודות לאסימון.

העבר/העבירי למשתתף/ת השני/ה _____ אסימונים
בערך של 2 נקודות לאסימון.

בעית החלטה מספר 33
מתוך 34

# Textual Methodology - Hebrew

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# Textual Methodology - Original

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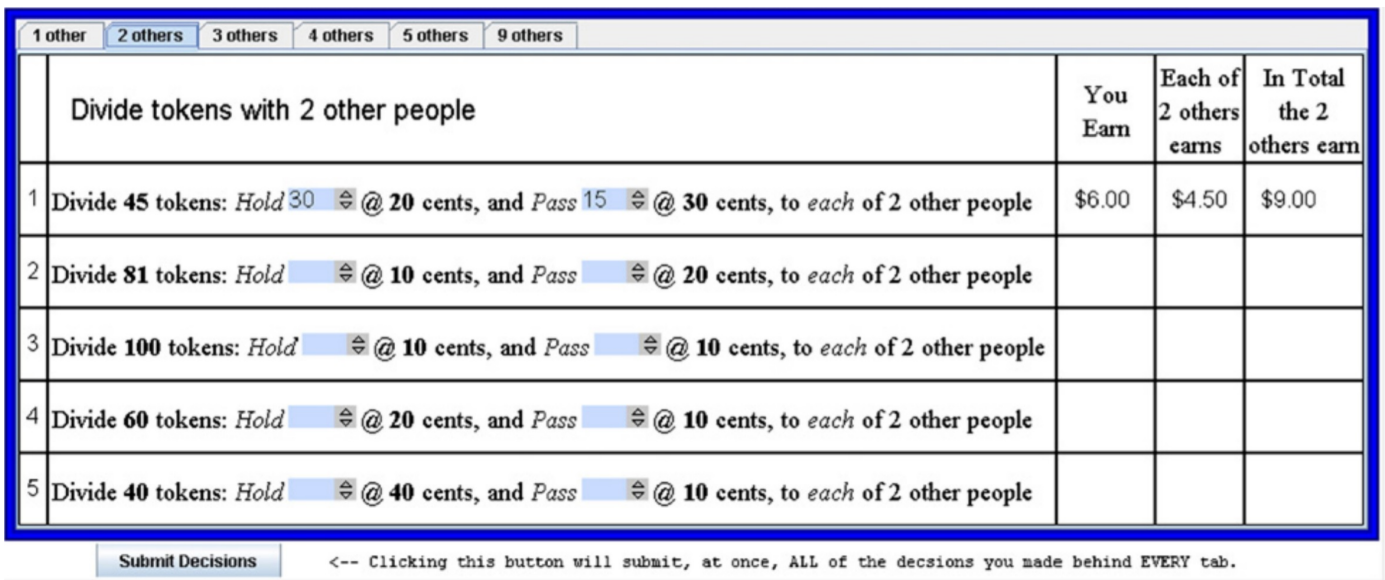

1 other | 2 others | 3 others | 4 others | 5 others | 9 others

| | Divide tokens with 2 other people | You Earn | Each of 2 others earns | In Total the 2 others earn |
|---|---|---|---|---|
| 1 | Divide **45** tokens: *Hold* 30 @ **20** cents, and *Pass* 15 @ **30** cents, to *each* of 2 other people | $6.00 | $4.50 | $9.00 |
| 2 | Divide **81** tokens: *Hold* @ **10** cents, and *Pass* @ **20** cents, to *each* of 2 other people | | | |
| 3 | Divide **100** tokens: *Hold* @ **10** cents, and *Pass* @ **10** cents, to *each* of 2 other people | | | |
| 4 | Divide **60** tokens: *Hold* @ **20** cents, and *Pass* @ **10** cents, to *each* of 2 other people | | | |
| 5 | Divide **40** tokens: *Hold* @ **40** cents, and *Pass* @ **10** cents, to *each* of 2 other people | | | |

Submit Decisions <-- Clicking this button will submit, at once, ALL of the decsions you made behind EVERY tab.

# Graphical Methodology - Hebrew

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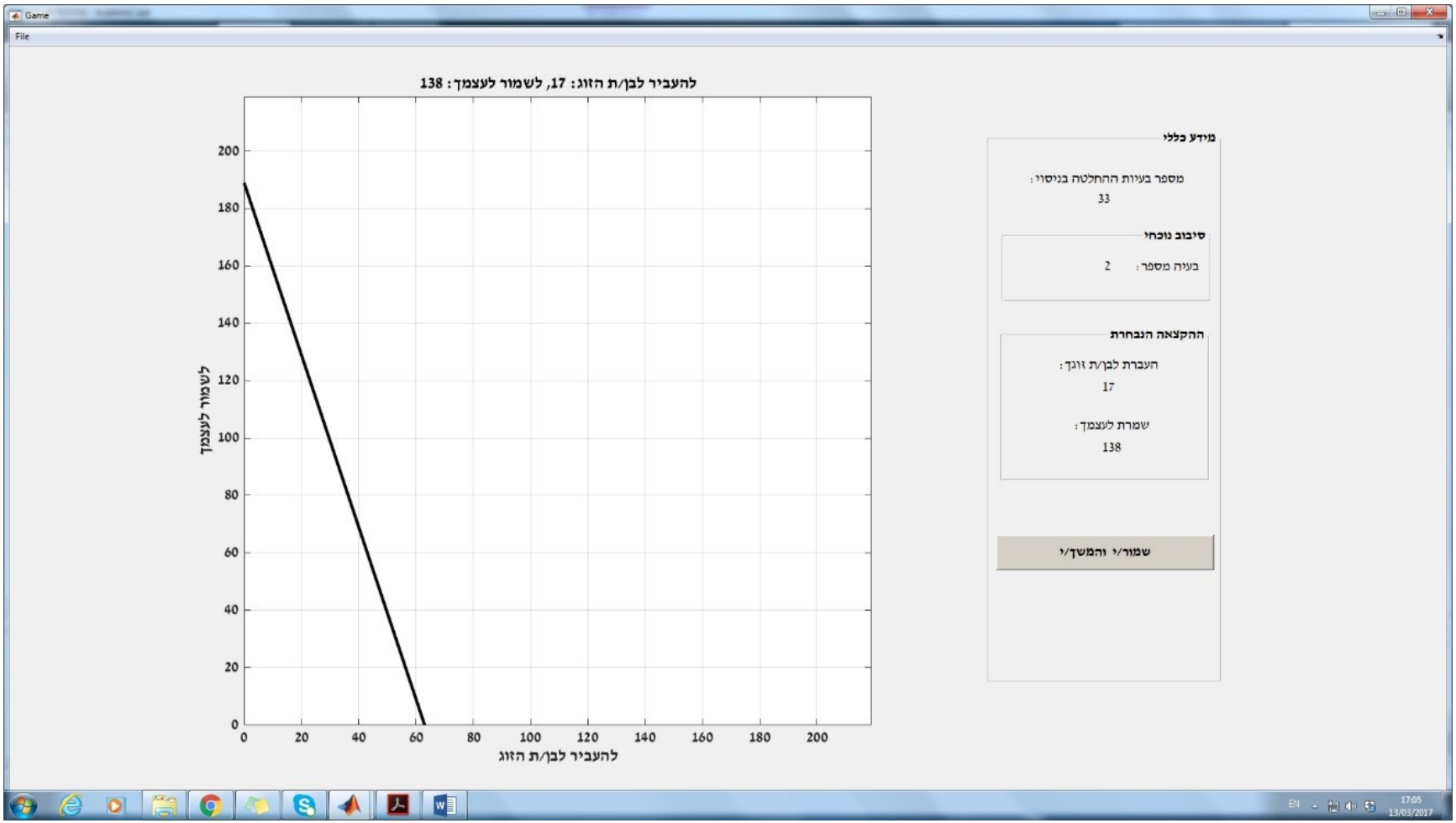

# Graphical Methodology - Hebrew

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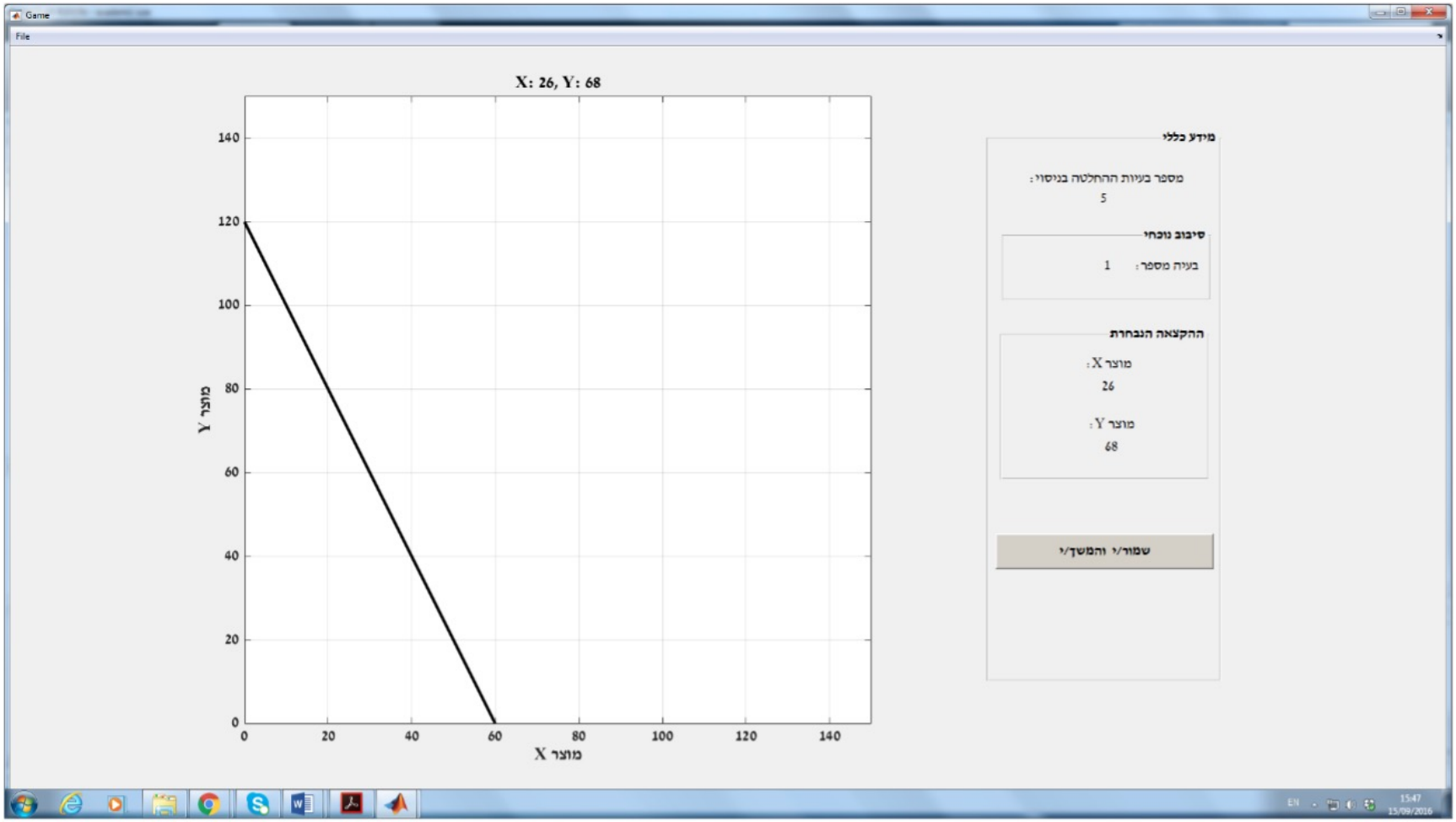

# Graphical Methodology - Original

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