

# Representative Evidence on Experimenter Demand: Pre-analysis Plan

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## 1 Introduction

Experimenter demand effects pose an important challenge to understand and interpret results from laboratory and field experiments (Rosenthal, 1966; Zizzo, 2010). For example, experimenter demand effects are an important obstacle to interpreting effect sizes and they constitute a threat to the external validity of experiments. Experimenter demand effects also affect the optimal design of experiments; however, little or no empirical evidence exists that studies how design features affect the relevance of experimenter demand effects. Moreover, experimental economists have a very limited understanding of the relative importance of experimenter demand effects for different outcome measures or experimental paradigms.

In this experiment we manipulate subjects' beliefs about the intentions and desires of the experimenters. In particular, we are interested in the extent to which people's behavior in economic games is elastic to experimenter demand. Our estimates in turn provide us with a bound for the importance of experimenter demand effects for experimental economics. In our experiment, we manipulate our subjects' beliefs in two different standard preferences measures: a dictator game and an investment game.

Subjects are randomly assigned to one of three main treatment conditions: in the first one (in the case of the investment game), we induce "positive demand", by telling them that "we expect that participants who are shown these instructions will invest more in the project than

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they normally would” or by telling them that “you would do us a favor if you invest more in the project than you normally would”. In the second treatment condition, we induce “negative demand” by telling our participants that “we expect that participants who are shown these instructions will invest less in the project than they normally would” or by telling them that “you would do us a favor if you invest less in the project than you normally would”. In the third condition, we do not induce any demand. Similarly, we induce both positive, negative and no demand in the dictator game. Subjects are randomly assigned to play either of the two different games.

This document proceeds as follows: first, we outline the experimental design. Then in section 3, we describe the setting as well as the sample size. Subsequently, we describe the hypotheses. In section 5, we describe the analysis we would like to conduct. Finally, in section 6, we define all of our outcome variables of interest.

## 2 Experimental Design

At the start our respondents complete a few questions on demographics, e.g. about their age, household income, their region of residence as well as their gender. Then they complete a screener (Berinsky et al., 2014) that allows us to examine whether they are paying attention to our instructions. Then, our respondents are randomly assigned to play one of the two following games:<sup>1</sup>

### 2.1 Dictator Game

We let our respondents play a standard dictator game for real money<sup>2</sup>:

*In this task you will allocate \$1 in panel currency between yourself and another randomly chosen respondent who will be informed that another respondent had the chance to split money with him or her. You will simply decide how much of the \$1 you want to send to the other person. You will get to keep the rest of the money for yourself.*

We have five main treatment arms:

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<sup>1</sup>We record our participants’ response times to the games.

<sup>2</sup>In particular they receive the following instructions: We will now ask you to complete a task which involves real panel currency.

- **Positive Demand (Hypothesis Revelation):** Our subjects receive the following instructions: *We expect that participants who are shown these instructions will give more to the other participant than they normally would.*
- **Negative Demand (Hypothesis Revelation):** Our participants get the following instructions: *We expect that participants who are shown these instructions will give less to the other participant than they normally would.*
- **Positive Demand (Social Demand):** Our subjects receive the following instructions: *You will do us a favor if you give more to the other participant than you normally would.*
- **Positive Demand (Social Demand):** Our subjects receive the following instructions: *You will do us a favor if you give less to the other participant than you normally would.*
- **No Demand:** We do not induce any demand.

## 2.2 Investment Game

We let our respondents play an investment game (Gneezy and Potters, 1997) involving real money.<sup>3</sup>:

*You are endowed with \$1 panel currency and you can choose how much of the \$1 to keep or invest in a risky project. Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).*

- *If the project is successful, you will receive 3 times the amount you chose to invest.*
- *If the project is unsuccessful, you will receive nothing.*

We have five main treatment arms:

- **Positive Demand (Hypothesis Revelation):** Our subjects receive the following instructions: *We expect that participants who are shown these instructions will invest more in the project than they normally would.*
- **Negative Demand (Hypothesis Revelation):** Our participants receive the following instructions: *We expect that participants who are shown these instructions will invest less in the project than they normally would.*

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<sup>3</sup>In particular they receive the following instructions: We will now ask you to complete a task which involves real panel currency.

- **Positive Demand (Social Demand):** Our subjects receive the following instructions:  
*You will do us a favor if you invest more in the project than you normally would.*
- **Negative Demand (Social Demand):** Our subjects receive the following instructions:  
*You will do us a favor if you invest less in the project than you normally would.*
- **No Demand:** We do not induce any demand.

### 2.3 Updated Beliefs

Thereafter our respondents complete a set of questions on their beliefs about the experimenters' intentions and their hypotheses. In particular, we ask the following two questions:

- What do you think is the result that the researchers of this study want to find?
  - They want to find that on average people invest a large share of the \$1.
  - They want to find that on average people invest a small share of the \$1.
- What do you think was the hypothesis of this research study?
  - The experimenters hypothesized that on average participants would invest a large share of the \$1 in the project.
  - The experimenters hypothesized that on average participants would invest a small share of the \$1 in the project.

### 2.4 Demographics

Finally, we ask participants to complete a questionnaire on other demographics variables in addition to the ones we ask them about at the start.

## 3 Setting, Sample Size and Power

We recruit a sample of 3,000 respondents that is representative of the US population along four dimensions: region, age, income and education. We recruit this sample with the help of online panels provided to us by "Research Now". This panel provider has been used in previous research, for example by Almås et al. (2016).

1200 respondents are in one of the two positive demand arms and 1200 respondents are in one of the two negative demand arms, while in total 600 participants are in the “no demand arm”. For our main test of interest, i.e. comparing the behavior of people in the positive and negative demand condition we have a power of .8 to detect standardized effect sizes of 0.114 at  $\alpha = 0.05$ . To test for heterogeneous treatment effects by the type of experimenter demand (“social demand” vs. “hypothesis revelation”) and gender we have a power of .8 to detect effect sizes of 0.161 at  $\alpha = 0.05$  respectively. Similarly, to test for heterogeneous responses to demand for the two different games, we can detect effect sizes of .161 with power .8 at  $\alpha = 0.05$ .

## 4 Main Hypotheses

**Hypothesis 1 (Positive Demand):** We hypothesize that individuals in the “positive demand conditions” will send more money to another respondent and will invest more in the investment game relative to participants in the control group.

**Hypothesis 2 (Negative Demand):** We hypothesize that individuals in the “negative demand conditions” will send less money to another respondent and will invest less in the investment game compared to participants in the control group.

**Hypothesis 3 (“Social Demand” vs. “Hypothesis Revelation”):** We hypothesize that individuals in the “social demand conditions” will change their behavior more strongly than people in the “hypothesis revelation demand conditions”.

## 5 Analysis

### 5.1 Baseline Balance

We will test for baseline balance for the following variables:

- gender
- age
- log income (income is the midpoint of the interval specified by the respondent)

- household size
- ethnicity (dummies for White, Black, Hispanic, and Asian)
- employment status (dummies for unemployed, part-time employed, and employed full-time)
- education (dummy for person with at least bachelor degree)
- political orientation (taking value one for Republicans and zero otherwise)

We will regress each of these variables on a treatment indicator to see if there are imbalances. We will account for multiple hypothesis testing by regressing the treatment indicator on all of the variables, and we will conduct a joint F-test, to see if the coefficients are jointly different from zero.

## 5.2 Main Specifications

### 5.2.1 Summary of main results

We present our main results by providing the means and standard deviations for each of our main games separately for each of the following conditions:

- Positive Demand: Hypothesis revelation
- Negative Demand: Hypothesis revelation
- Positive Demand: Social Demand
- Negative Demand: Social Demand
- No Demand

Thus in total, we present 10 means and standard deviations for our treatment arms of interest. We will also present these results graphically by the means of bar charts and by providing conventional 95 percent confidence intervals around the mean. We will also report the equivalent game-level regressions, with standard errors uncorrected for multiple comparisons. We next turn to our main specifications of interest.

### 5.2.2 Test 1: does demand affect choices?

First, we simply compare the behavior of people in the positive demand group and in the negative demand group with that of people in the control group. We z-score our outcome variables at the paradigm-incentive level, using the mean and s.d. for the no-demand group (Kling et al., 2007). For our main specification we pool together the z-scored outcomes for all three different games. We regress our z-scored outcome variable,  $ZY_i$ , on a treatment indicator,  $POS_i$ , which takes value one for people who receive the positive demand treatment, and value zero for all the other participants and on a dummy,  $NEG_i$  taking value one for people who receive the negative demand treatment, and value zero for all the other participants. Specifically, the equation that we estimate is:

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \varepsilon_i$$

We conduct three main tests:

- Do people increase their giving, their investment and their patience when exposed to positive demand?  $\beta_1 > 0$
- Do people decrease their giving, their investment and their patience when exposed to negative demand?  $\beta_2 < 0$
- Is the overall response to demand non-zero?  $\beta_1 - \beta_2 = 0$

We correct for multiple hypothesis testing in these three tests by using the “sharpened q-value approach” (Anderson, 2008; Benjamini et al., 2006). In particular, we will adjust our p-values for a false discovery rate of .05.

### 5.2.3 Test 2: Testing for differences in social demand and demand induced by hypothesis revelation

Next, we examine whether the effect of positive demand or negative demand depends on whether our respondents receive “social demand” or whether we induce demand by revealing our hypothesis to them. We create a dummy variable,  $Social_i$  which takes value 1 if our respondents receive “social demand” as defined above<sup>4</sup>. Specifically, the specification that we estimate is:

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \beta_3 POS_i \times Social_i + \beta_4 NEG_i \times Social_i + \varepsilon_i$$

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<sup>4</sup>“You will do us a favor if you...”

To test for differences in response to social demand and demand induced by hypothesis-revelation, we conduct the following test:

$$\beta_3 - \beta_4 \geq 0$$

which tests whether the size of the demand effect (difference in behavior under positive and negative demand) differs by the type of experimenter demand we induce (“social demand vs. demand induced through hypothesis revelation”).

#### 5.2.4 Test 3: Does demand differ between games?

Subsequently, we test whether experimenter demand varies by the type of game that our respondents play. In particular, we interact dummy variables for the different games with our “demand treatment indicators”. Specifically,  $RP_i$  takes value one for participants randomly assigned to play the investment game and zero otherwise. To identify differential effects across games we estimate the following equation:

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \beta_3 RP_i \times POS_i + \beta_4 RP_i \times NEG_i + \varepsilon_i$$

We examine whether the effects of demand differ between the dictator game and the investment game by conducting the following test.

$$H_0^{DR} : \beta_3 - \beta_4 = 0, H_1^{DR} : \beta_3 - \beta_4 \neq 0$$

#### 5.2.5 Test 4: does demand differ between men and women?

Subsequently, we test whether the elasticity of behavior to experimenter demand differs for men and women. To do so, we interact our demand indicators with a dummy,  $Male_i$ , taking value one for males. More precisely, we estimate the following equation:

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \beta_3 MALE_i \times POS_i + \beta_4 MALE_i \times NEG_i + \beta_5 MALE_i + \varepsilon_i$$



To test for gender differences in response to demand we conduct the following test:

$$\beta_3 - \beta_4 \geq 0$$

which tests whether the size of the demand effect (difference in behavior under positive and negative demand) differs by gender.

### 5.2.6 Test 5: does demand differ by attention?

Finally, we also test whether the elasticity of behavior to experimenter demand differs for attentive vs. inattentive subjects. To do so, we interact our demand indicators with a dummy,  $Attention_i$ , taking value one for all subjects correctly responding to the attention check. More precisely, we estimate the following equation:

$$\begin{aligned} ZY_i = & \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \beta_3 Attention_i \times POS_i + \beta_4 Attention_i \times NEG_i \\ & + \beta_5 Attention_i + \varepsilon_i \end{aligned}$$

To test differences in response to demand by attention we conduct the following test:

$$\beta_3 - \beta_4 \geq 0$$

which tests whether the size of the demand effect (difference in behavior under positive and negative demand) differs by attention.

### 5.2.7 Test 6: Beliefs about experimental hypotheses

To check whether the demand treatments affected people's beliefs about what the researchers want to find and hypothesized, we estimate the following equation:

$$Belief_i = \alpha_0 + \alpha_1 POS_i + \alpha_2 NEG_i + \varepsilon_i$$

As before, we conduct three main tests:

- Are people more likely to believe we wanted/hypothesized a “high” action when exposed to positive demand?  $\alpha_1 > 0$

- Are people more likely to believe we wanted/hypothesized a “low” action when exposed to positive demand?  $\alpha_2 < 0$
- Is there an overall effect of demand on beliefs?  $\alpha_1 - \alpha_2 = 0$

As above, we account for multiple hypothesis adjustment by adjusting the p-values for these six tests (three per beliefs question, two questions) for a false discovery rate of .05 (Anderson, 2008).

### 5.2.8 Do effect sizes differ across subject pools?

We ran the exact same experiment with a representative online panel as well as with participants from Amazon Mechanical Turk. In what follows we will outline how we will test for differences in treatment effects across subject pools. We pool our data from the mTurk experiments in which our respondents completed the tasks for real money together with our data from the experiment using the representative online panel pre-specified in this pre-analysis plan.

First, we pool all observations from the dictator<sup>5</sup> and investment game<sup>6</sup> together, then we estimate the baseline specification separately for the dictator and investment game. We include a dummy indicator taking value 1 for observations from mTurk,  $mTurk_i$  and interact this indicator with the demand treatment indicators. In particular, we estimate the following three specifications:

$$ZY_i = \gamma_0 + \gamma_1 POS_i + \gamma_2 NEG_i + \gamma_3 POS_i \times mTurk_i \\ + \gamma_4 NEG_i \times mTurk_i + \gamma_5 mTurk_i + \varepsilon_i$$

$$ZY_i^{DT} = \gamma_0^{DT} + \gamma_1^{DT} POS_i + \gamma_2^{DT} NEG_i + \gamma_3^{DT} POS_i \times mTurk_i \\ + \gamma_4^{DT} NEG_i \times mTurk_i + \gamma_5^{DT} mTurk_i + \varepsilon_i$$

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<sup>5</sup> $ZY_i^{DT}$  refers to the normalized outcomes from the dictator game. The superscript DT refers to the dictator game.

<sup>6</sup> $ZY_i^{RP}$  refers to the normalized outcomes from the investment game. The superscript RP refers to the investment game.

$$ZY_i^{RP} = \gamma_0^{RP} + \gamma_1^{RP} POS_i + \gamma_2^{RP} NEG_i + \gamma_3^{RP} POS_i \times mTurk_i \\ + \gamma_4^{RP} NEG_i \times mTurk_i + \gamma_5^{RP} mTurk_i + \varepsilon_i$$

We test the following three hypotheses:

- Is demand for mTurkers equal to demand for participants from the representative sample?

$$\gamma_3 - \gamma_4 \neq 0$$

- Is demand for mTurkers equal to demand for participants from the representative sample in the dictator game?

$$\gamma_3^{DT} - \gamma_4^{DT} \neq 0$$

- Is demand for mTurkers equal to demand for participants from the representative sample in the investment game?

$$\gamma_3^{RP} - \gamma_4^{RP} \neq 0$$

As above, we account for multiple hypothesis adjustment by adjusting the p-values for three tests for a false discovery rate of .05 (Anderson, 2008).

### 5.3 Dealing with Imbalances

If there are imbalances between the treatment group and the control group, we will also estimate the above equations with a set of controls. We will choose as controls all of the variables for which there are imbalances.

### 5.4 Differential Attrition

We will test whether attrition is related to the treatment by estimating the following equation:

$$A_i = \pi_0 + \pi_1 Treatment_i + \Pi^T X_i + \varepsilon_i$$

where  $A_i$  indicates if a participant did finish our experiment,  $Treatment_i$ , and where  $X_i$  is a vector of pre-determined characteristics. We will use the same set of pre-determined characteristics as for the baseline balance test.

If the coefficient  $\pi_1$  on the treatment indicator is significant at the 5 percent level, we will use Lee bounds for the statistical analysis. This will allow us to bound our estimates. If the coefficient  $\pi_1$  is not significant at the 5 percent level, we will conduct the statistical analysis without adjusting for attrition.

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## Experimental Instructions

### A Demographics

Which of these describes you most accurately? [Male, Female]

What is your age? [18 - 24, 25- 34, 35 - 44, 45 - 54, 55 - 64, 65 or older]

In which region do you currently reside? [Northeast (CT, ME, MA, NH, RI, VT, NJ, NY, PA), Midwest (IL, IN, MI, OH, WI, IA, KS, MN, MO, NE, ND, SD), South (DE, DC, FL, GA, MD, NC, SC, VA, WV, AL, KY, MS, TN, AR, LA, OK, TX), West (AZ, CO, ID, NM, MT, UT, NV, WY, AK, CA, HI, OR, WA)]

What was your family's household income in 2015? [Less than 15,000, *Between*15,000 and 25,000, *Between*25,000 and 50,000, *Between*50,000 and 75,000, *Between*75,000 and 100,000, *Between*100,000 and 150,000, *Between*150,000 and 200,000, *Morethan*200,000, Prefer not to say]

### B Screener

When a big news story breaks people often go online to get up-to-the-minute details on what is going on in the world. We want to know which websites people trust to get this information. We also want to know if people are paying attention to the question. To show that you've read this much, please ignore the question and select ABC News and The Drudge Report as your two answers.

When there is a big news story, which is the one news website would you visit first? (Please only choose one)

### C Instructions: Dictator Game

#### C.1 Control

We will now ask you to complete a task which involves real panel currency. In this task you will allocate \$1 in panel currency between yourself and another randomly chosen respondent who will

be informed that another respondent had the chance to split money with him or her.

You will simply decide how much of the \$1 you want to send to the other person. You will get to keep the rest of the money for yourself.

What amount would you like to give to the other respondent?

## **C.2 Positive Demand (Hypothesis Revelation)**

We will now ask you to complete a task which involves real panel currency. In this task you will allocate \$1 in panel currency between yourself and another randomly chosen respondent who will be informed that another respondent had the chance to split money with him or her.

You will simply decide how much of the \$1 you want to send to the other person. You will get to keep the rest of the money for yourself.

We expect that participants who are shown these instructions will give more to the other participant than they normally would.

What amount would you like to give to the other respondent?

## **C.3 Negative Demand (Hypothesis Revelation)**

We will now ask you to complete a task which involves real panel currency. In this task you will allocate \$1 in panel currency between yourself and another randomly chosen respondent who will be informed that another respondent had the chance to split money with him or her.

You will simply decide how much of the \$1 you want to send to the other person. You will get to keep the rest of the money for yourself.

We expect that participants who are shown these instructions will give less to the other participant than they normally would.

What amount would you like to give to the other respondent?

## C.4 Positive Demand (Social)

We will now ask you to complete a task which involves real panel currency. In this task you will allocate \$1 in panel currency between yourself and another randomly chosen respondent who will be informed that another respondent had the chance to split money with him or her.

You will simply decide how much of the \$1 you want to send to the other person. You will get to keep the rest of the money for yourself.

You will do us a favor if you give more to the other participant than you normally would.

What amount would you like to give to the other respondent?

## C.5 Negative Demand (Social)

We will now ask you to complete a task which involves real panel currency. In this task you will allocate \$1 in panel currency between yourself and another randomly chosen respondent who will be informed that another respondent had the chance to split money with him or her.

You will simply decide how much of the \$1 you want to send to the other person. You will get to keep the rest of the money for yourself.

You will do us a favor if you give less to the other participant than you normally would.

What amount would you like to give to the other respondent?

## C.6 Beliefs

What do you think is the result that the researchers of this study want to find?

- They want to find that on average people give a large share of the \$1 to the other person.
- They want to find that on average people give a small share of the \$1 to the other person.

What do you think was the hypothesis of this research study?

- The experimenters hypothesized that on average participants would send a large share of the \$1 to the other person.



- The experimenters hypothesized that on average participants would send a small share of the \$1 to the other person.

## D Instructions: Investment Game

### D.1 Control

We will now ask you to complete a task which involves real panel currency money.

You are endowed with \$1 in panel currency and you can choose how much of the \$1 to keep or invest in a risky project. Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- If the project is successful, you will receive 3 times the amount you chose to invest.
- If the project is unsuccessful, you will receive nothing.

What amount would you like to invest in the risky project?

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- If the project is successful, you will receive 3 times the amount you chose to invest.
- If the project is unsuccessful, you will receive nothing.

We expect that participants who are shown these instructions will invest more in the project than they normally would.

What amount would you like to invest in the risky project?

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You are endowed with \$1 in panel currency and you can choose how much of the \$1 to keep or invest in a risky project. Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- If the project is successful, you will receive 3 times the amount you chose to invest.
- If the project is unsuccessful, you will receive nothing.

We expect that participants who are shown these instructions will invest less in the project than they normally would.

What amount would you like to invest in the risky project?

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- If the project is successful, you will receive 3 times the amount you chose to invest.
- If the project is unsuccessful, you will receive nothing.

You will do us a favor if you invest more in the project than you normally would.

What amount would you like to invest in the risky project?

### D.5 Negative Demand (Social)

We will now ask you to complete a task which involves real panel currency money.

You are endowed with \$1 in panel currency and you can choose how much of the \$1 to keep or invest in a risky project.

Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- If the project is successful, you will receive 3 times the amount you chose to invest.
- If the project is unsuccessful, you will receive nothing.

You will do us a favor if you invest less in the project than you normally would.

What amount would you like to invest in the risky project?

## D.6 Beliefs

What do you think is the result that the researchers of this study want to find?

- They want to find that on average people invest a large share of the \$1.
- They want to find that on average people invest a small share of the \$1.

What do you think was the hypothesis of this research study?

- The experimenters hypothesized that on average participants would invest a large share of the \$1 in the project.
- The experimenters hypothesized that on average participants would invest a small share of the \$1 in the project.

Which of these options do you think is correct?

- Option A: The choice I made in the game was for real money.
- Option B: The choice I made in the game was for not for real money. It was just for imaginary money.

## E Other Demographics

The main part of the survey is now over. We will now just ask you some general questions about yourself.

What is the highest level of education you have completed? [12th grade or less; Graduated high school or equivalent; Some college, no degree; Associate degree; Bachelor's degree; Post-graduate degree]

What is your religion? [Christianity, Judaism, Islam, Hinduism, None, Other]

What is your ethnicity? [White, Black, Hispanic, Asian, Other]

What category would best describe your political orientation? [Democrat; Republican; Other]

Which of these describes your current situation most accurately? [Employed full-time, Employed part-time, Unemployed and looking for a job, Unemployed but not looking for a job, Retired, Other]

In which state do you currently live?