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A monetary measure of the strength and robustness of the attraction effect

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ABSTRACT

The Attraction Effect has been studied in conditions of indifference among options and measured at the aggregate level. We introduce a new within-subjects design based on induced preferences and psychometrics. Our method yields two individual-level measures: the traditional, *frequency* measure and a new, *monetary* indicator. The monetary indicator measures the robustness of the effect to decreases in the relative utility of the target with respect to the competitor. We find choice frequencies consistent with the literature. Our monetary measure shows that subjects still prefer the target up to the point where it is 8% more expensive than the competitor.

1. Introduction

The *Attraction* or *Asymmetric Dominance* effect (ADE) is a violation of a basic axiom of decision theory, whereby choice is Independent of Irrelevant Alternatives. The ADE was first documented by Huber et al. (1982). Consumers who are subject to the ADE are more likely to choose a *target* product rather than its *competitor* if the target is presented along with a *decoy* product that is clearly dominated by the target, than if it is presented against the competitor only.

The ADE has been widely replicated in consumer research (Huber and Puto, 1983; Simonson, 1989; Park and Kim, 2005; Malkoc et al., 2013), experimental economics (Herne, 1999; Sonsino, 2010; Kroll and Vogt, 2012), cognitive psychology (Trueblood et al., 2013), and even in biology, in studies of birds (Schuck-Paim et al., 2004) and bees (Shafir et al., 2002). The ADE "*may be one of the biggest exports from marketing research to other fields*" (Huber et al., 2014).

The robustness of the ADE has recently been put into question (Frederick et al., 2014; Yang and Lynn, 2014; Huber et al., 2014; Simonson, 2014). One clear limitation of the ADE literature is that it has studied only situations in which the decision maker is close to indifference between the alternatives proposed. In the words of Huber et al. (2014),

> [t]o the extent that a decision maker has clear preferences between the target and the competitor, the effect of adding an undesired decoy will be muted. [...] However, when prior preferences are weak, stemming either from unfamiliarity or indifference, [...] context will matter.

It is no surprise then that most of the literature relies on hypothetical choices,[1] meaning that money-oriented subjects are indifferent across options. Even the few incentivized experiments (Herne, 1999; Doyle et al., 1999; Lichters et al., 2015) study situations in which subjects should be indifferent between target and competitor.

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[1] Out of 52 studies listed in Lichters et al. (2015) only one uses an incentive-compatible design.

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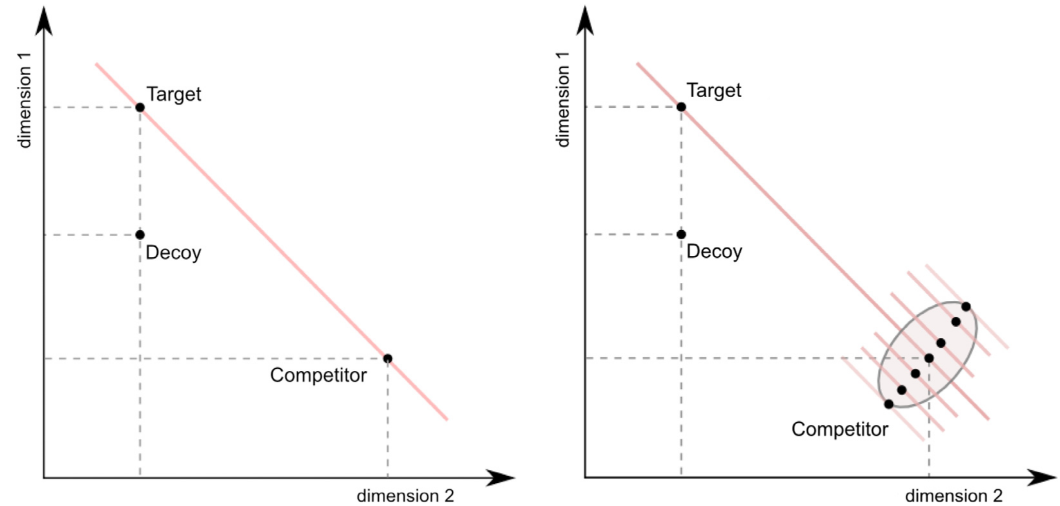


(a) Standard design: indifference.

(b) Our design: varying preference for competitor.

Fig. 1. Experimental design of ADE experiments: standard *vs.* our design.

The ADE literature shows that preferences are context-dependent: choices can be influenced by careful engineering of the choice set. However, this has only been shown in contexts of indifference—when *any* external cue might affect choice, and the effect matters the least. As (Frederick et al., 2014) puts it, "*the boundary conditions for the effect seem to be so restrictive that its practical validity should be questioned*".

Virtually all studies on asymmetric dominance rely on a *between-subjects* experimental design. Choices from a set with two options, target and competitor, which vary in two unrelated dimensions (e.g., quality and price) but *sit on the same indifference curve*, are compared with choices from the same set but with an added decoy, an option that is strictly dominated by the target in one dimension (Fig. 1, left). The ADE is measured as the difference in choice frequency of the target across those two sets.

In this paper we introduce an experimental method to explore the strength of the attraction effect when options differ in utility. We let the competitor sit not only on the same but also on higher or lower indifference curves compared to the target (Fig. 1, right). By varying *within subjects* the induced value of the target, our design allows us to evaluate the monetary cost of being subject to the ADE.

Compared with the traditional design, which offers only an aggregate frequency measure, our method provides an individual measure expressed in monetary terms. This is a step beyond proof-of-concept studies and towards real-world applicability.

2. Materials and methods

In the ADE literature, the options in a choice set usually vary along two not readily comparable dimensions: quality *vs* price or size *vs* location for apartments (see the list in Frederick et al., 2014, appendix A). In a recent paper (Trueblood et al., 2013) employ an unincentivized visual perception task in order to test if the ADE can be considered a fundamental trait of human perception. Subjects must repeatedly indicate the largest of three rectangles, target, competitor and decoy. Target and competitor have the same area, but different length/width ratios. The ADE results are replicated.

We implement a visual perception task similar to Trueblood et al. (2013), but crucially adding incentives. Subjects are asked to imagine to have to buy paint in order to cover a fixed, square area. They face three options: target, competitor and decoy. Subjects are not given unit prices (price/m^2 painted) but rather a price per bucket. Buckets differ in terms of the surface they can cover, which is shown to subjects.

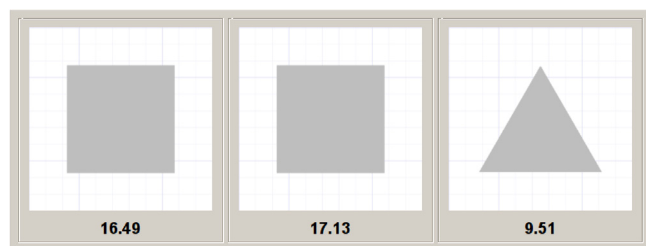


Fig. 2. A task. The decoy is the central square, identical but more expensive than the left one.

The task is conceptually simple but perceptually difficult. To find the best deal, subjects must compare prices and surface areas across options. Subjects are incentivized to minimize expenditure: they are given an endowment to buy a fixed amount of (fictitious) paint, and earn the money they have not spent. Subjects repeat the task several times, with different shapes, sizes and prices.

Our design replicates most features of the standard ADE task while at the same time introducing an objective standard to evaluate outcomes—unit prices. Relying on induced preferences allows us to manipulate the relative utility of the target with respect to the competitor.

2.1. Task details

Subjects faced 18 different choice tasks. Within and across tasks we varied the shape and size of the options, and the relative utility of the target with respect to the competitor.

Shapes could be circles, squares, or equilateral triangles (Krider et al., 2001).

Size normalizing the total area to be painted to 100 m^2, size took one of 12 possible values ranging from 10 m^2 to 43 m^2, in steps of 3 m^2, yielding small but still noticeable size differences.

Unit prices (price per m^2) were randomly drawn, half from $\sim N(0.5, 0.01)$, half from $\sim N(0.5, 0.05)$. No price was allowed to be so high as to result in a potential loss for the subject.

The options were displayed as a gray shape centered on a white background representing the total area to be painted. The decoy

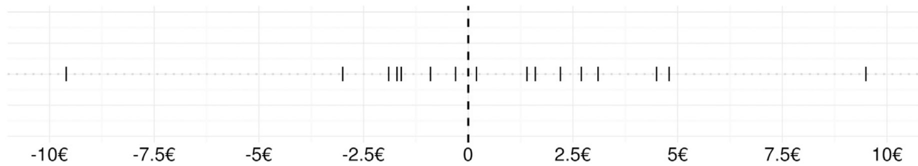


Fig. 3. Absolute profit premium of the target w.r.t. the competitor across tasks.

was introduced as an option with the same shape and size as the target but with a higher price (Fig. 2).

As a result of the random draw of unit prices, the utility premium of the target varied across tasks (Fig. 3), from a situation in which the competitor yielded 9.6 € more than the target (41% more) to an opposite situation in which it yielded 9.5€ less (−83%).

Subjects were exposed to the tasks[2] in random order, had up to two minutes per task and were forced to spend a minimum of 10 s on each.

Subjects received feedback after completing each task. Feedback included the total cost of the chosen option and the payoff but no information on unit prices or the cost of other options. At the end of the experiment, one randomly selected task was paid in cash.

2.2. Experimental details

202 student subjects took part in June 2011 to the experiment at the laboratory of the Max Planck Institute in Jena, Germany.[3] Payoffs averaged 11.44€ for an experiment lasting between 45 and 75 min.[4]

2.3. Measures

We analyze the data by means of psychometric measures, as recently done in economics by Lunn and Somerville (2015). A psychometric function (Wichmann and Hill, 2001; Klein, 2001) is a parametrically estimated sigmoid function that relates the subject response to an independently varying stimulus.[5] In our data, the response is the choice of the target, and the stimulus is its utility premium w.r.t. the competitor. For a rational, perfectly discriminating subject the function would cross the 50% probability of choosing the target at the point where the utility difference is zero, and would have a steep slope in that neighborhood (Fig. 4, left).

If a subject can only imprecisely discriminate among the options, the slope of the function in the neighborhood of the zero-difference point is lower. The flatter the slope, the lower the precision of the decision maker. If asymmetric dominance has an effect, then the function crosses the zero-difference point at a probability higher than 50% (Fig. 4, right).

The *vertical* distance on the zero-difference line between the estimated function and the 50% probability line is the traditional – *frequency* – measure of the ADE. At the individual level, this represents the likelihood of choosing the target when it gives the same utility as the competitor. At the aggregate level, this is the share of subjects choosing the target.

The *horizontal* distance on the 50%-probability line between the estimated function and the zero-difference line is our *monetary* ADE measure. It represents the money lost due to the attraction effect. A positive *monetary* measure means that the subject is leaving money on the table by choosing the asymmetrically dominant option.

Table 1
Mixed-effect logit results.

	Choice of target	
	(1: all choices)	(2: drop dominated)
Fixed effects parameters		
Constant	0.164***	0.308***
	(0.045)	(0.044)
π premium	0.020***	0.021***
	(0.002)	(0.002)
Random effects parameters		
Var(u_i)	0.380	0.339
Var(v_i)	0.004	0.002
Observations	3423	3423
Log likelihood	−2372.068	−2195.247

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

We estimate parameters in a mixed-effect logit model (1) in which the dependent variable is the choice of the target (1 if target, 0 if competitor *or* decoy). We allow both the constant and the slope of the function to vary across subjects indexed by *i*:

$$\ln\left[\frac{Pr(y_i = target)}{1 - Pr(y_i = target)}\right] = (\beta_0 + u_i) + (\gamma_0 + v_i) \times premium. \quad (1)$$

Premium is the % utility premium of the target, β_0 and γ_0 are fixed effects coefficients describing the average effect in the population, and u_i and v_i are the random effects. Given this structure, the *frequency* ADE measure is computed, at the individual level, at the point of zero utility premium:

$$\text{Frequency-ADE}_i = \frac{1}{1 + e^{-(\beta_0 + u_i)}} \quad (2)$$

while the *monetary* ADE measure is computed at the point where $Pr(y_i = target) = 50\%$, thus giving the ratio

$$\text{Monetary-ADE}_i = -\frac{\beta_0 + u_i}{\gamma_0 + v_i}. \quad (3)$$

The monetary measure depends on both the intercept and the slope of the estimated function: it can take different values for the same measured frequency-ADE, depending on the attitude of the subject towards dominance and his choice precision.

3. Results

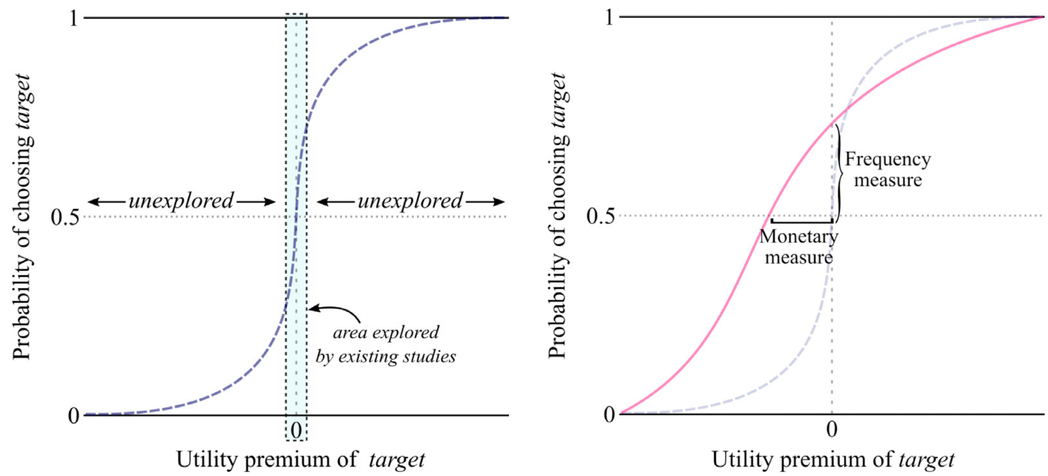
Over all 18 tasks, irrespective of utility premium, the target is chosen 56.7%, the competitor 37.4% and the decoy 5.8% of the time. As expected, these shares vary according to the premium. Table 1 reports the estimation results for the full dataset (1) and excluding choices of the *decoy* (2). The full model includes all choices but imposes a stronger requirement for ADE, since it still fixes the bar at 50%, rather than comparing with the choice share of the

[2] Visually represented in Online appendix C.

[3] Data presented in this paper are a subset of a wider investigation. For the analysis of the full dataset see Crosetto and Gaudeul (2011).

[4] Instructions are available in online appendix A.

[5] Psychometric functions are similar to Fechner errors, widely used in experimental economics. For an example see online appendix B.



(a) *Homo œconomicus* ($\beta_0 = 0,\ \gamma_0 = 4$).
(b) ADE ($\beta_0 = 1,\ \gamma_0 = 0.6$).

Fig. 4. Psychometric function and ADE measures.

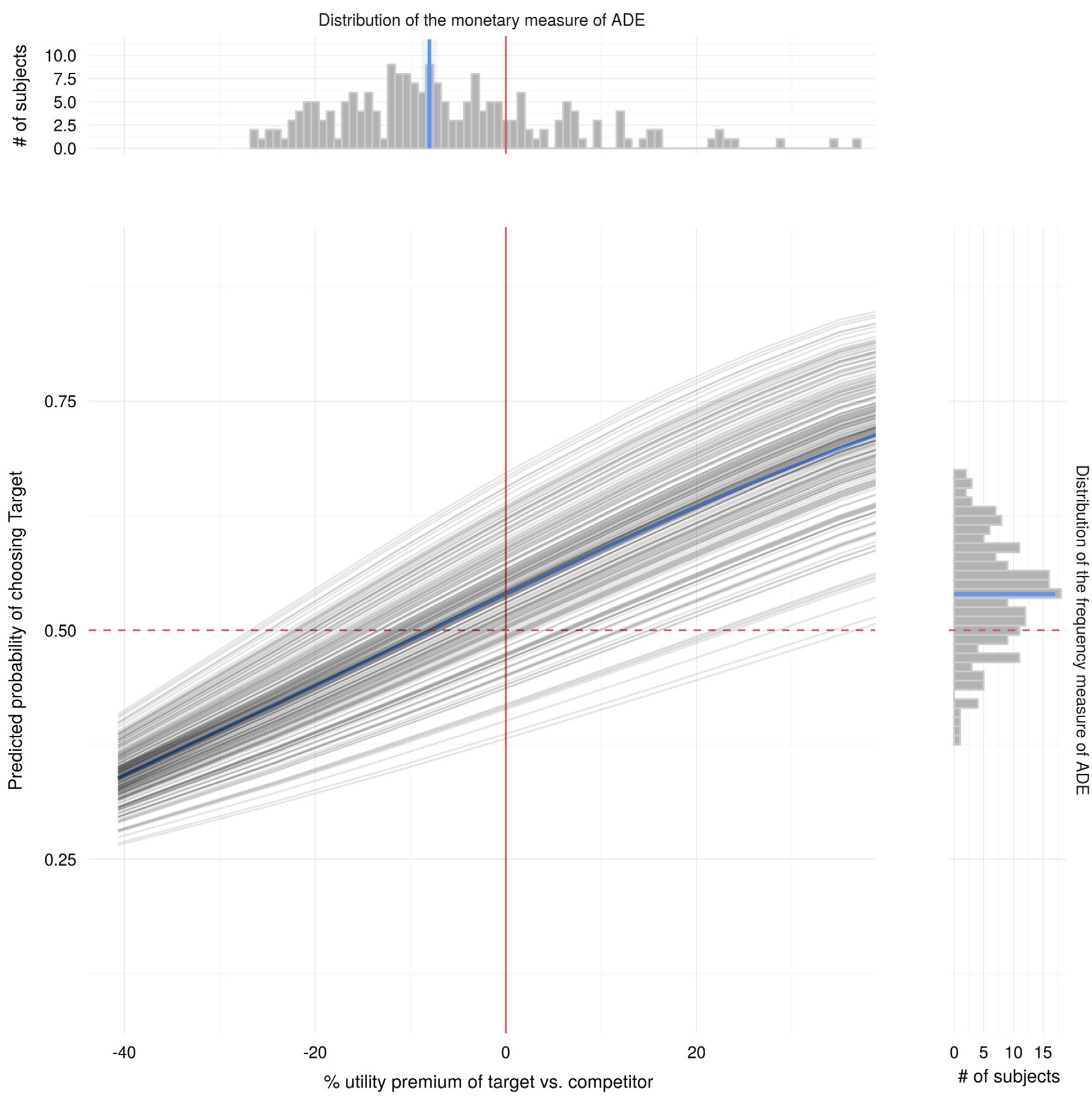


Fig. 5. Individual estimated psychometric functions and ADE measures—*all* data. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

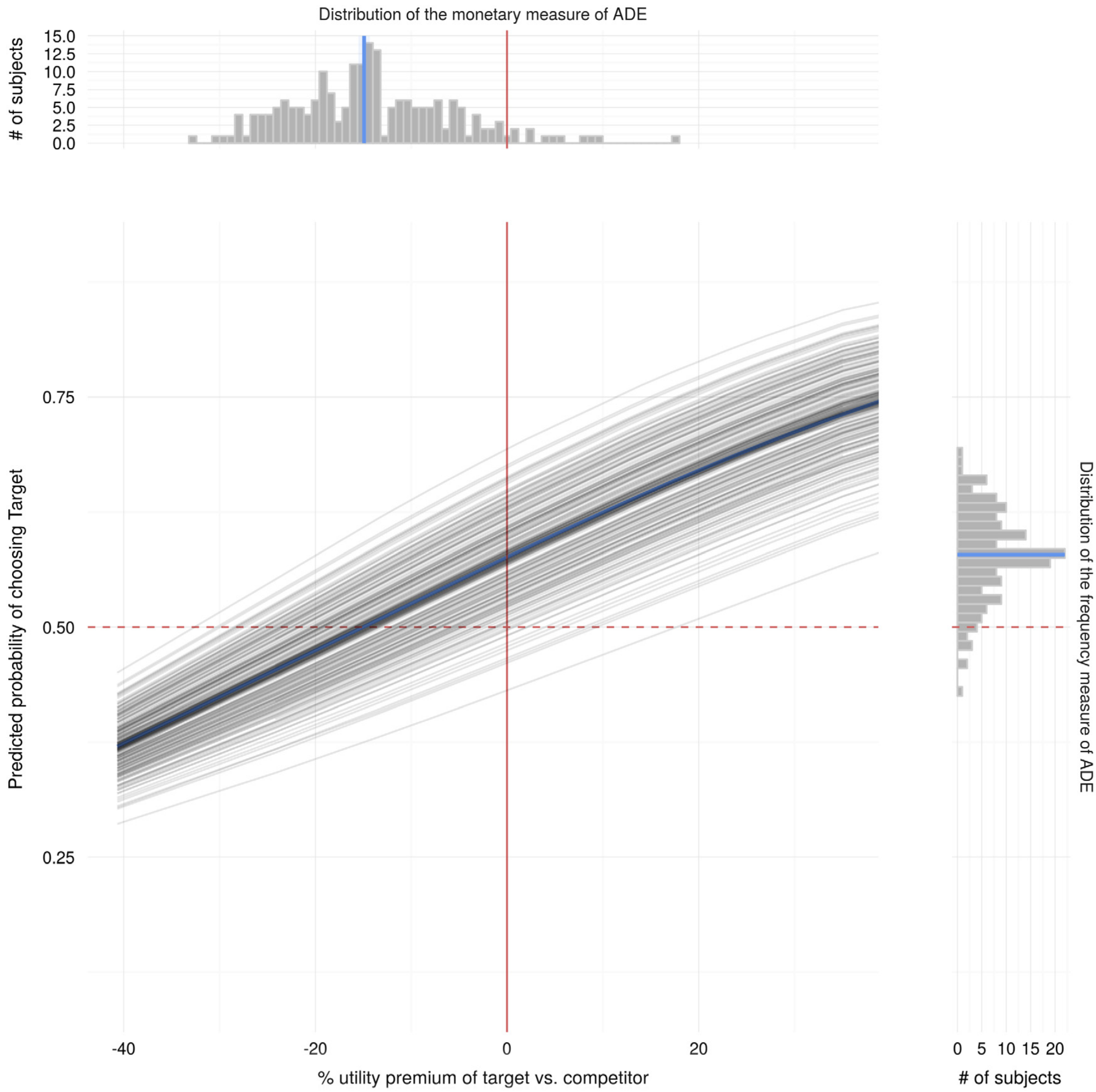


Fig. 6. Individual estimated psychometric functions and ADE measures—no *decoy*.

competitor. The restricted model correctly imposes 50%, but at the price of disregarding all dominated choices.[6]

Fig. 5 plots the estimated psychometric function (center), on average (blue line) and for each subject (gray lines), and the distributions of the monetary (top) and frequency (right) measures across individuals for model (1). The average frequency-ADE is 53.9% (different from 50%, t-test $p < 0.001$). This means that even when target and competitor yield equal payoffs, the target is chosen significantly more than half of the time. The average monetary-ADE is 8.02% (different from zero, t-test $p < 0.001$). The target is still chosen more than 50% of the time up to the point where it is 8.02% more expensive than the competitor. Subjects are incurring losses with respect to optimal behavior because of their preference for the asymmetrically dominant offer: subjects are losing on average 90 cents out of 11.4 Euro per choice. 76.2% of subjects are affected by the ADE.

When dropping choices of the *decoy*, results are stronger (Fig. 6). The frequency-ADE increases to 57.9% and the monetary-ADE to 14.9% (both significant $p < 0.001$), meaning that subjects are losing on average 1.7 out of 11.4 Euro per choice. 94% of subjects are affected by ADE.

4. Conclusion

We showed in this paper how to exploit induced preferences to measure the size of the attraction effect when moving away from the situations of indifference between target and competitor that are assumed in the existing literature. By employing psychometric measures in a within-subjects task, we estimated at the individual level a new monetary measure of the ADE.

A vast majority of participants are subject to an attraction effect and pay a price for it. The average subject is more likely to choose the target up to when it is 8% less profitable than the competitor (14.9% if we exclude decoy choices).

The value of the monetary-ADE depends on the nature of the stimuli used—here, comparing the size of shapes. Future research will show how this measure varies with different stimuli and how it generalizes to real market conditions.

6 For both models the random effects are normally distributed: Shapiro–Wilk test p-value $= 0.681$ (1) and 0.948 (2).

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at http://dx.doi.org/10.1016/j.econlet.2016.09.031.

References

Crosetto, P., Gaudeul, A., 2011. Do consumers prefer offers that are easy to compare? An experimental investigation. Jena Economic Research Papers No. 2011-044, Friedrich-Schiller-University Jena, Oct.
Doyle, J.R., O'Connor, D.J., Reynolds, G.M., Bottomley, P.A., 1999. The robustness of the asymmetrically dominated effect: Buying frames, phantom alternatives, and in-store purchases. Psychol. Mark. 16, 225–243.
Frederick, S., Lee, L., Baskin, E., 2014. The limits of attraction. J. Mar. Res. 51, 487–507.
Herne, K., 1999. The effects of decoy gambles on individual choice. Exp. Econ. 2, 31–40.
Huber, J., Payne, J.W., Puto, C., 1982. Adding asymmetrically dominated alternatives: Violations of regularity and the similarity hypothesis. J. Consum. Res. 9, 90–98.
Huber, J., Payne, J.W., Puto, C.P., 2014. Let's Be honest about the attraction effect. J. Mar. Res. 51, 520–525.
Huber, J., Puto, C., 1983. Market boundaries and product choice: Illustrating attraction and substitution effects. J. Consum. Res. 10, 31–41.
Klein, S.A., 2001. Measuring, estimating, and understanding the psychometric function: A commentary. Percept. Psychophys. 63, 1421–1455.
Krider, R.E., Raghubir, P., Krishna, A., 2001. Pizzas: π or Square? Psychophysical biases in area comparisons. Mark. Sci. 20, 405–425.
Kroll, E.B., Vogt, B., 2012. The relevance of irrelevant alternatives. Econom. Lett. 115, 435–437.
Lichters, M., Bengart, P., Sarstedt, M., Vogt, B., 2015. What really matters in attraction effect research: when choices have economic consequences. Mark. Lett. 1–12.
Lichters, M., Sarstedt, M., Vogt, B., 2015. On the practical relevance of the attraction effect: A cautionary note and guidelines for context effect experiments. AMS Rev. 5, 1–19.
Lunn, P., Somerville, J.J., 2015. Surplus Identification with Non-Linear Returns. Papers No. WP522, Economic and Social Research Institute (ESRI).
Malkoc, S.A., Hedgcock, W., Hoeffler, S., 2013. Between a rock and a hard place: The failure of the attraction effect among unattractive alternatives. J. Consum. Psychol. 23, 317–329.
Park, J., Kim, J., 2005. The effects of decoys on preference shifts: The role of attractiveness and providing justification. J. Consum. Psychol. 15, 94–107.
Schuck-Paim, C., Pompilio, L., Kacelnik, A., 2004. State-dependent decisions cause apparent violations of rationality in animal choice. PLoS Biol. 2, 2305–2315.
Shafir, S., Waite, T.A., Smith, B.H., 2002. Context-dependent violations of rational choice in honeybees (Apis mellifera) and gray jays (Perisoreus canadensis). Behav. Ecol. Sociobiol. 51, 180–187.
Simonson, I., 1989. Choice based on reasons: The case of attraction and compromise effects. J. Consum. Res. 16, 158–174.
Simonson, I., 2014. Vices and virtues of misguided replications: The case of asymmetric dominance. J. Mar. Res. 51, 514–519.
Sonsino, D., 2010. The irrelevant-menu affect on valuation. Exp. Econ. 13, 309–333.
Trueblood, J.S., Brown, S.D., Heathcote, A., Busemeyer, J.R., 2013. Not just for consumers context effects are fundamental to decision making. Psychol. Sci. 24, 901–908.
Wichmann, F.A., Hill, N.J., 2001. The psychometric function: I. Fitting, sampling, and goodness of fit. Percept. Psychophys. 63, 1293–1313.
Yang, S., Lynn, M., 2014. More evidence challenging the robustness and usefulness of the attraction effect. J. Mar. Res. 51, 508–513.