Self-Signaling and Pro-Social Behavior: a cause marketing mobile field experiment

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Pro-social behavior and incentives

- Rich literature at intersection of economics and psychology
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- long literature in cognitive social psychology disputes prediction
  - role of motivation crowding: Cognitive Evaluation Theory
  - extrinsic rewards replace intrinsic motivation
  - *intrinsically* motivated individual's behavior *crowded out* by *extrinsic* incentives (Deci 1971, Deci and Ryan 1975)
  - *hidden costs of rewards* or corruption effect (Lepper et al 1978)

- Many empirical examples where economic incentives crowd out pro-social behavior

  - E.g. Titmus (1970), Frey & Oberholtzer-Gee (1997), Gneezy and Rustichini (2000b), Barasch et al (2014), survey in Frey and Jegen (2001)

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- Evidence mixed (e.g. Mellström and Johannesson 2008, Lacetera, Macis and Slonim 2009, Landry et al 2010)

- Understanding the mixed evidence

- *Reputational* motivation such as a *social signal*
- In addition to intrinsic and extrinsic motivations

- Actions reveal information to peers
    - Theory: Bernheim (1994, 1997), Benabou and Tirole (2006)
    - Signal extraction problems

- Empirical evidence: Ariely et al (2009), Ashraf et al (2012)
    - prosocial behavior higher in public than private
    - monetary incentives work in private, but have neutral effect in public

- Self-perception as opposed to social image

- individidual as an outside observer learns about self through observed actions (Bem 1972)

- Bodner and Prelec (2002), Benabou and Tirole (2004, 2006)
  - The dual selves: one chooses, one observes/judges
  - observed action generates a signal about the "self"
  - rewards can dampen the signal

- Self-signaling and the crowding out effect of $ incentives
  - $ incentives dampen the self-signal, reducing pro-social behavior
- Large-scale Cause Marketing Mobile Field experiment
  - buy movie tickets bundled with charitable donation
  - Private signal (no public display of action)
  - Observe actual purchase behavior
- Conduct follow-up survey about motivation

- Model-free evidence
  - Positive and monotonic effects from "pure discounts"
  - for large donation levels, price discounts crowd out purchase
    - demand can slope upwards!
  - non-monotonicity cannot be explained by standard demand theories

- Rule out alternative explanations for crowding-out
  - mere incidence of payment
  - contextual inference

- Estimate a structural model of self-signaling (DellaVigna et al 2012)
- fits non-montonic moments of choice behavior in sample
- Qualitative insights: self-perception as altruistic (warm-glow) versus actual altruism
- measure potential non-fungibility of promotion money

- **Definition:** "*characterized by an offer from the firm to contribute a specified amount to a designated cause when customers engage in revenue-providing exchanges that satisfy organizational and individual objectives*" (Varadarajan and Menon 1988)

- $1.78 billion in the US in 2013 and growing

- conventional wisdom: WTP increases with donation sizes (Arora et al 2007, Haruvy et al 2009, Elfenbein and McManus 2010, Koschate-Fischer et al 2012)

  - "*Cause marketing works because people have an affinity for the cause or the cause's mission and want to support it.*" Paul Jones (Cause Marketing Consultant)

- our findings suggest warm-glow, not pure/impure altruism

- non-complementarity of discounts and donations vs integrated marketing

- Bodner and Prelec (2002), Benabou and Tirole (2006)

- Rational economic consumer who maximizes total expected utility
    - Preferences: consumption and diagnostic
    - Beliefs (about self)
    - Purchase decision

- Consumer uses own actions to update beliefs about self via Bayes rule

- *Game Theory* between the two selves

- Cause-marketing promotion scenario:

    - Consumer Action (purchase): $y \in \{0, 1\}$

    - Pro-Social product characteristic (donation): $a \geq 0$

    - Price:$p > 0$

- two corresponding components to utility:

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Utility

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1. Decision-maker self:
   consumption utility: $(V + \alpha p + \gamma a)$

2. Judge self:
   diagnostic utility: $R(a, p, \lambda_\gamma, y) = \lambda_\gamma E(\gamma | a, p, y)$

- *taste* parameters: $\Theta = (V, \alpha, \gamma)$ and λ_γ

1. Decision-make self:
   consumption utility: $(V + \alpha p + \gamma a)$

2. Judge self:
   diagnostic utility: $R(a, p, \lambda_\gamma, y) = \lambda_\gamma E(\gamma | a, p, y)$

- **self-deception**: adjust actions to manipulate self-signal and raise diagnostic utility $R(a, p, \lambda_\gamma, y)$

- evidence of self-image motivation: Pessemier et al. (1977), Quattrone and Tversky (1984), Shafir and Tversky (1992), Gneezy et al (2012), Dhar and Wertenbroch (2012), Savary et al (2014)

Choice behavior

- Total indirect utility at time of choice:

$$U = \begin{cases} (V + \alpha p + \gamma a) + R\left(a, p, \lambda_\gamma, 1\right) & , y = 1 \\ \\ R\left(a, p, \lambda_\gamma, 0\right) & , y = 0 \end{cases}$$

Choice behavior

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$$U = \begin{cases} (V + \alpha p + \gamma a) + R\left(a, p, \lambda_\gamma, 1\right) & , y = 1 \\\\ R\left(a, p, \lambda_\gamma, 0\right) & , y = 0 \end{cases}$$

- purchase ticket if

$$V + \alpha p + \gamma a + \Delta\left(a, p, \lambda_\gamma\right) \;>\; 0$$

where

- $\Delta\left(a, p, \lambda_\gamma\right) = R\left(a, p, \lambda_\gamma, 1\right) - R\left(a, p, \lambda_\gamma, 0\right)$ is self-diagnostic benefit

  i.e. *the warm glow feeling*

- Diagnostic utility depends on consumer's posterior after making a choice

- Purchase decision generates a coarse (self) signal:

$$V + \alpha p + \gamma a + \Delta(a, p, \lambda_\gamma) \gtrless 0$$

- Consumer's posterior with rational Bayesian learning:

$$E(\gamma|y)$$
$$E(\alpha|y)$$

- to simplify the model, assume *Normal* prior self beliefs

$$\Theta \quad \sim \quad N\left(\bar{\Theta}, \Sigma_\Theta\right)$$

where

$$\bar{\Theta} = \left[\begin{array}{c} \bar{\gamma} \\ \bar{\alpha} \\ \bar{V} \end{array}\right]$$

$$\Sigma_\Theta = \left[\begin{array}{ccc} \sigma_\gamma^2 & 0 & 0 \\ 0 & \sigma_\alpha^2 & 0 \\ 0 & 0 & \sigma_V^2 \end{array}\right]$$

- If we let $V \sim N\left(\bar{V}, 1\right)$, we get *random coefficients* probit choice rule

$$
\begin{aligned}
&Pr\left(y = 1 | p, a\right) \\
=\ &\int \Phi\left(\bar{V} + \alpha p + \gamma a + \Delta\left(a, p, \lambda_\gamma\right) | 0, 1\right) \phi\left(\alpha, \gamma | \mu_{\alpha,\gamma}, \Sigma_{\alpha,\gamma}\right) d\alpha d\gamma
\end{aligned}
$$

- where $\Delta\left(a, p, \Lambda\right)$ depends on choice-specific (posterior) self-image

$$
E\left(\Theta | y\right) = F\left(\bar{\Theta}, \Sigma_\Theta, \lambda_\gamma, a, p\right)
$$

- Under Normal beliefs, the consumer's posterior for γ

$$E\left(\gamma|y=1\right) = \frac{\int \gamma\Phi\left(\bar{V}+\Delta(a,p,\lambda)+\gamma a+\alpha p\right)\phi(\alpha,\gamma|\mu_{\alpha,\gamma},\Sigma_{\alpha,\gamma})d\alpha d\gamma}{\int \Phi\left(\bar{V}+\Delta(a,p,\lambda)+\gamma a+\alpha p\right)\phi(\alpha,\gamma|\mu_{\alpha,\gamma},\Sigma_{\alpha,\gamma})d\alpha d\gamma}$$

$$E\left(\gamma|y=0\right) = \frac{\int \gamma\left[1-\Phi\left(\bar{V}+\Delta(a,p,\lambda)+\gamma a+\alpha p\right)\right]\phi(\alpha,\gamma|\mu_{\alpha,\gamma},\Sigma_{\alpha,\gamma})d\alpha d\gamma}{\int \left[1-\Phi\left(\bar{V}+\Delta(a,p,\lambda)+\gamma a+\alpha p\right)\right]\phi(\alpha,\gamma|\mu_{\alpha,\gamma},\Sigma_{\alpha,\gamma})d\alpha d\gamma}$$

- cases

  1. $a = 0$: just have standard binary probit (i.e. because $\Delta = 0$)

  2. $a > 0$: optimal choice is an equilibrium outcome

- Equilibrium consists of:

set of posterior self beliefs

$$\{E\left(\gamma|y=1\right), E\left(\gamma|y=0\right)\}$$

that satisfies the system

$$E\left(\Theta|y\right) = F\left(\bar{\Theta}, \Sigma_\Theta, \lambda_\gamma, a, p\right)$$

- computational challenges
  - numerical solution (no analytic solution)
  - potential multiplicity of equilibria

- changes in a or p affect:
  - consumption utility: $V + a\gamma + p\alpha$
  - diagnostic utility: $\lambda_\gamma E(\gamma|p, a)$

- crowding out arises if decline in $E(\gamma|p, a)$ is larger than increase in consumption utility

- *Contextual Inference* (Benabou and Tirole 2003)

- promotions generate a signal about product quality, not self

- crowding out due to large promotion budgets, not discounts

- does firm's "promotion effort level" moderate crowding?

- Two field experiments

- Study 1: Look at interaction between small discounts and donations

- Study 2: Look at interaction between large discounts and donations

- SMS promotional experiment in large Chinese city
  - population of 15 million subscribers living 2km from a theater and who purchased a ticket via phone in last 6 months

  - 10,500 subjects sampled

  - SMS offer for general admission voucher on any 2D movie betwen 1-15-2014 and 1-31-2014 (reg price of 75 RMB)

  - offer distributed on 1-15-2014 and expired at midnight 1-16-2014

- focus on small rewards (discounts) to test *mere incidence of payment* effect

- control condition:

"To buy a voucher for general admission to any of the 2D showings in January with your mobile phone, the purchase link below is valid until January 16..."

- pure discount condition:

"To buy a voucher for general admission to any of the 2D showings in January with your mobile phone at a [3, 6, 15, 30, and 36] RMB discount, the link below is valid until January 16..."

- pure donation condition:

"To buy a voucher for general admission to any of the 2D showings in January with your mobile phone, [wireless provider's name] will donate [3, 6, 15, 30, and 36] RMB per each sold ticket to poor aged people, the purchase link below is valid until January 16..."

- Combination condition:

"To buy a voucher for general admission to any of the 2D showings in January with your mobile phone at a [3, 6, 15, 30, and 36] RMB discount, [wireless provider's name] will donate [3, 6, 15, 30, and 36] RMB per each sold ticket to poor aged people, the purchase link below is valid until January 16..."

Variable	Donation (RMB)					
		0	3	6	15	30	36
discount (RMB)	0	500	500	500	500	500	500
	3	500	500	500	500	500	
	6	500	500	500	500		
	15	500	500	500			
	30	500	500				
	36	500					

Model-free experimental results for Study 1

Variable	Donation (RMB)					
		0	**3**	**6**	**15**	**30**	**36**

		0	**3**	**6**	**15**	**30**	**36**
	0	0.000	0.004	0.006	0.010	0.040**	0.046**
	3	0.006	0.016*	0.018*	0.020**	0.044**	-
discount (RMB)	**6**	0.008	0.020**	0.022**	0.024**	-	-
	15	0.034**	0.032**	0.028**	-	-	-
	30	0.062**	0.040**	-	-	-	-
	36	0.066**	-	-	-	-	-

** Significant at 1 percent level

* Significant at 5 percent level

- ruling out **crowding out from small** rewards: no crowding out from any discounts (let alone from small discounts)

- SMS promotional experiment in large Chinese city
  - population of 15 million subscribers living 2km from a theater and who purchased a ticket via phone in last 6 months

  - 30,300 subjects sampled

  - SMS offer for admission voucher on any 3D showing of *X-Men: Days of Future Past* (5-22-2014 onwards) (reg price of 100 RMB)

  - offer distributed on 5-21-2014 and expired at midnight 5-22-2014

- larger rewards (i.e. discounts) to test for crowding out away from origin

- much larger sample for more power

- cases where same (or more) total promotion budget for combination (discount+donation) versus pure discount to rule out contextual inference

- control condition:

"To buy a voucher for general admission to any of X-Men: Days of Future Past's 3D showings, follow this link..."

- pure discount condition:

"To buy a voucher for general admission to any of X-Men: Days of Future Past's 3D showings at a [20, 35, 50, 60, 75] RMB discount, follow this link..."

- pure donation condition:

"To buy a voucher for general admission to any of X-Men: Days of Future Past's 3D showings, [wireless provider's name] will donate [5, 10, 15] RMB per each ticket sold to poor aged people, follow this link..."

- Combination condition:

"To buy a voucher for general admission to any of X-Men: Days of Future Past's 3D showings at a [20, 35, 50, 60] RMB discount, [wireless provider's name] will donate [5, 10, 15] RMB per each sold ticket to poor aged people, follow this link..."

Variable	Donation (RMB)			
		0	5	10	15
discount (RMB)	0	700	700	700	700
	20	700	1,000	1,000	1,000
	35	700	1,000	3,000	3,000
	50	700	1,000	3,000	3,000
	60	700	1,000	3,000	3,000
	75	700	-	-	-

- **Follow-up Survey** (5-23-2014)

- For 12 of 21 experimental cells, sub-sampled 40 subjects who purchased a ticket and 40 who did not

- questions regarding motivation (self-reported on 12-pt scale)

  - e.g. whether it was to make buyer feel good, whether it was to support charity, whether it was to see a movie etc.

Variable	Donation (RMB)			
		0	**5**	**10**	**15**

Variable		0	5	10	15
	0	0.0000	0.0043	0.0057	0.0114*
	20	0.0071	0.0170**	0.0200**	0.0240**
Discount (RMB)	**35**	0.0329**	0.0300**	0.0270**	0.0230**
	50	0.0557**	0.0420**	0.0180**	0.0160**
	60	0.0600**	0.0480**	0.0170**	0.0140**
	75	**0.0629****	-	-	-

** Significant at the 1 percent level

* Significant at the 5 percent level

- Crowding out from larger discounts (only at larger donation sizes)

Small rewards work, but *unintended consequences* of large rewards

Experimental Results, purchase_mean
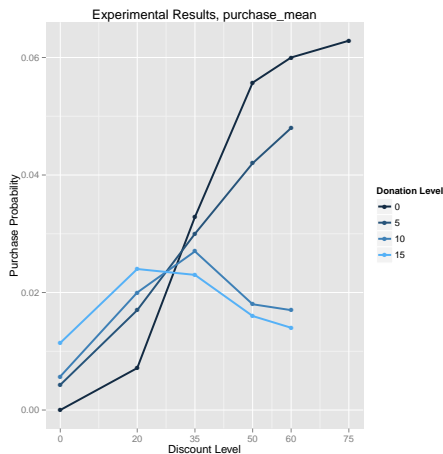
Non-montonicity at $a = 10$

$Pr(y\|p = 80) < Pr(y\|p = 65)$, $p < 0.01$
$Pr(y\|p = 50) < Pr(y\|p = 65)$, $p < 0.01$

Small rewards work, but *unintended consequences* of large rewards

Experimental Results, purchase_mean
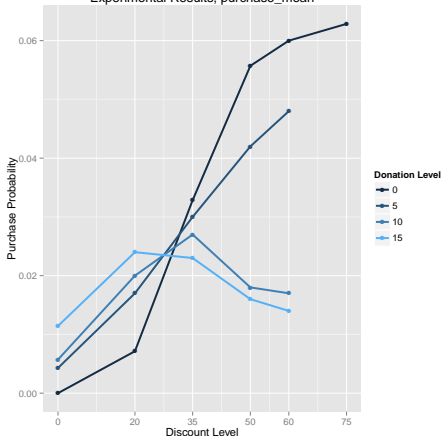
Mere Incidence of Payment?
$Pr(y|a = 5, p = 100) > Pr(y|a = 5, p = 80), \; p < 0.01$
$Pr(y|a = 10, p = 100) > Pr(y|a = 10, p = 80), \; p < 0.01$
$Pr(y|a = 15, p = 100) > Pr(y|a = 15, p = 80), \; p < 0.01$

Small rewards work, but *unintended consequences* of large rewards

Experimental Results, purchase_mean
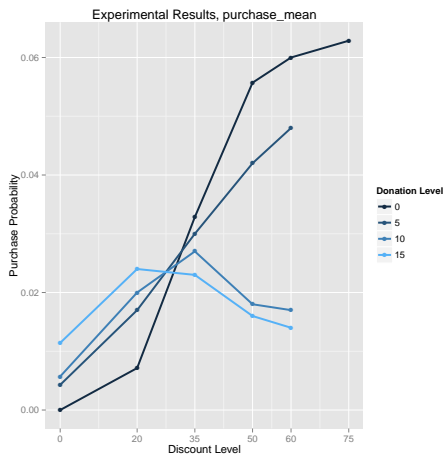
Contextual Inference?
$Pr\,(a = 0, p = 25) > Pr\,(a = 15, p = 50)$
↑budget from 35 to 60 RMB pp
$Pr(a = 0, p = 40) - Pr(a = 0, p = 65) > 0$
$Pr(a = 10, p = 50) - Pr(a = 0, p = 65) < 0$

Survey evidence

Please indicate the extent to which you agree with the following statement regarding why these consumers made the purchase in order to improve our business and customer service (12-point scale):

Those consumers wanted to feel good about themselves by donating to the charity.
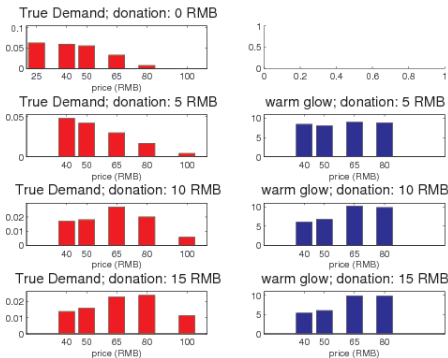
- crowding out of this self-reported motivation

Those consumers value the charity and wanted to support it.
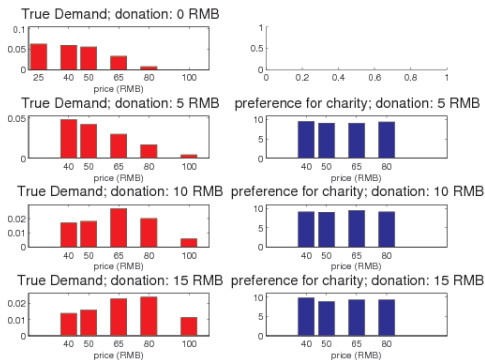
- Flat relationship between perception of charity and promotional conditions **(but high!)**

The consumer wanted to watch the movie and would have seen it regardless of the special offer.
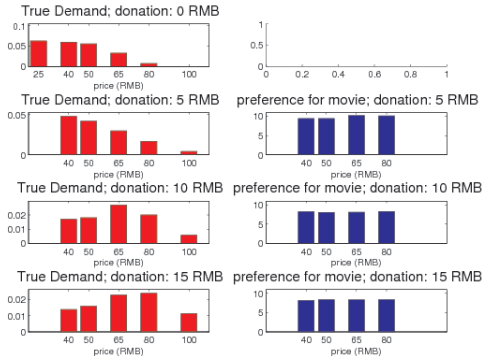
- Flat relationship between movie preference and price conditions
- suggestive of no contextual inference, but confounded with $E(V)$ for inframarginal consumers

Estimating the structural model

- assume rational expectations (everyone has same prior about self)

- need to address multiplicity of equilibria during estimation to solve coherency problem

- use constrained optimization (MPEC) as in Su and Judd (2012), Dube, Fox and Su (2012) and Su (2014)

$$\mathcal{L}\left(\Theta, \Lambda, \delta\right) = \sum_i y_t \log\left(Pr\left(y_t = 1 | p_t, a_t; \Theta, \Lambda, \delta_t\right)\right)$$

subject to constraints

$$\delta_t = F\left(\Theta, \Lambda, a_t, p_t\right), \ t = 1, .., T$$

- $(\Theta, \Lambda)^{MPEC}$ selects equilibrium with highest likelihood
- $(\Theta, \Lambda)^{MPEC}$ is an MLE when observationally equivalent consumers play same self-signaling equilibrium (Su 2014)
- Lagrangean smooth in equilibrium beliefs (vs nested fixed point approach)

- field experiment generates cross-sectional data

- normalizations
    - $\sigma_V = 1$ is pretty standard in choice literature
    - $\sigma_{\alpha,\gamma} = 0$ is practical due to limited experimental variation
- heterogeneity: σ_γ^2 and σ_α^2
    - cross-sectional semi-parametric identification of random coefficients (Bajari, Fox and Ryan 2010)

- diagnostic weight: λ_γ
    - non-montonicity in observed choice behavior

Structural Model Comparisons

	Probit	R.C. Probit	Self-Signaling on γ	Self-Signaling on γ and α
$\mathcal{L}$	-3254.0865	-3251.9625	**-3220.8172**	-3219.9328
BIC	6539.1297	6555.5195	**6503.5478**	6512.098

- self-signaling model fits the data better than simple homogeneous probit or random coefficients probit
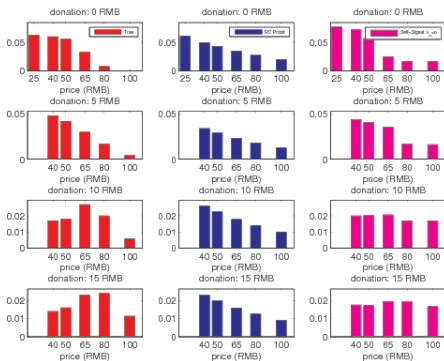- allowing for self-signaling on both price and donation dimensions has worse fit

	Self-Signaling on γ	Self-Signaling on γ ($\sigma_\alpha = 1$)
$\mathcal{L}$	**-3220.8172**	-3252.559
BIC	**6503.5478**	6577.3503

- self-signaling on movies leads to significantly inferior fit
- note need to set $\sigma_\alpha = 1$ and allow σ_V to vary freely

- self-signaling model captures non-monotonicity of price discounts in data
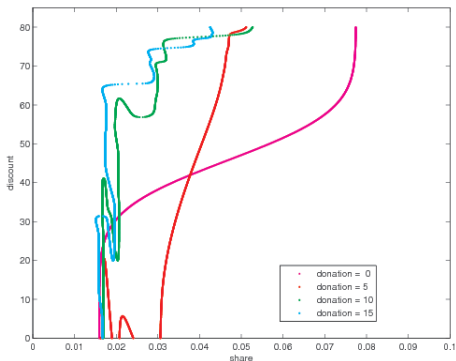
Structural Estimates

	Self-Signaling	
	coefficient	st. error
Donation ($\bar{\gamma}$)	-3.3742	1.5967
Price, (α)	-2.497	1.1378
Intercept, ($\bar{V}$)	5.3693	1.7324
σ_γ	1.5743	0.674
σ_α	1.374	0.6454
λ_γ	15.1046	2.2182

- positive and precise self-diagnostic weight on donations, λ_γ (warm glow)
- considerably larger than main effect of donations, γ

- when $a > 0$, equilibrium path bends back on itself
- this creates multiplicity in equilibrium shares for given campaign
- regions with negative slope create "crowding out"

- At what point is $1 spent on a donation more "valuable" to the prospective consumer than $1 spent on a discount?

- We will now see that the relative effectiveness of a dollar discount versus a dollar donation is not constant
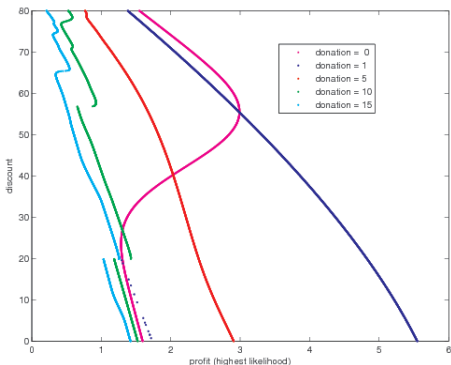
- select equilibrium with highest likelihood (use predicted choices)
- small donations can raise profits
- recall: jumps due to back-bending equilibrium path
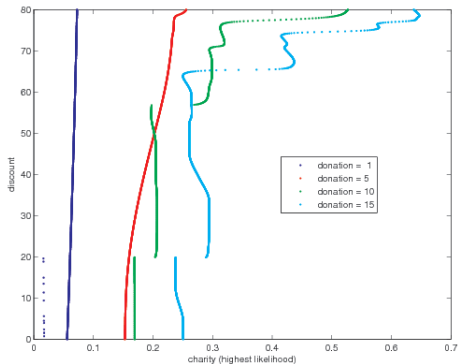
- select equilibrium with highest likelihood (use predicted choices)
- large donations and discounts effective for charitable campaign

- create campagin grid:$(a, p) = [0, 16] \times [20, 100]$ and select highest-likelihood equilibrium share

- Profit objective (no donation): $p^* = 44.4$ RMB, $E\left(\Pi\left(p^*\right)\right) = 3$ RMB pp

- Profit objective: $p^* = 100$ RMB, $a^* = 1$, $E\left(\Pi\left(p^*\right)\right) = 5.55$ RMB pp
  - i.e. <u>small</u> donation is effective!

- Charity objective: $p^* = 22.5$ RMB $a^* = 16$, $E\left(\Pi\left(p^*\right)\right) = 0.27$ RMB pp

Conclusions

- Image motivation can emerge in a private setting
- Extrinsic rewards (discounts) are less effective when self-image matters
- Rewards can crowd-out pro-social behavior through dampening of self-signal

- Crowding-out arises at larger, not smaller, discounts
  - this is not a *mere incidence of payment* effect

- No crowding out from pure discounts
  - this is not *contextual inference* effect (e.g. corporate motivation to promote low-quality movie)

- Structural analysis of preferences:
  - consumers not intrinsically motivated by donations, but motivated extrinsically by self-perception of valuing donation
  - non-fungibility of promotional money

- state-dependence in pro-social behavior
  - consumers accumulate a prosocial self-image capital stock (Benabou and Tirole 2011)
  - consumers impute (i.e. construct) their preferences from past actions (Ariely and Norton 2011)
- raising the cost of the signal today raises diagnostic value, increasing likelihood of future prosocial behavior (Gneezy et al 2012)