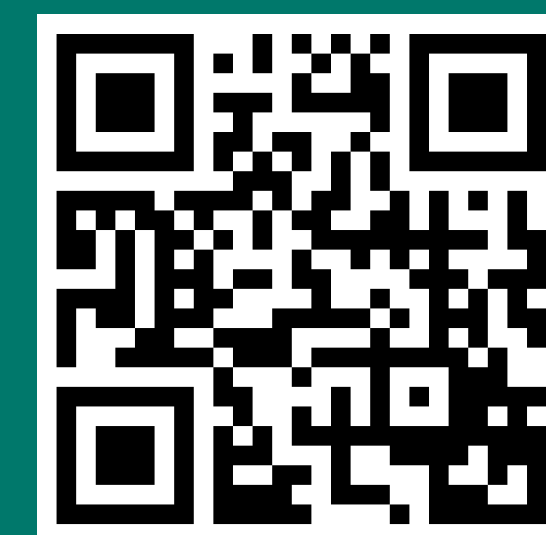# Partitioned Pricing and Consumer Welfare

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Abstract

In online commerce, obfuscation strategies by sellers are hypothesized to mislead consumers to their detriment and to the profit of sellers. One such obfuscation strategy is partitioned pricing in which the price is split into a base price and add-on fees. While empirical evidence suggests that partitioned pricing impacts consumer decisions through salience effects, its consumer welfare consequences are largely unexplored. Therefore, I provide a quantification of the welfare impact of the behavioral response to partitioned pricing. To do so, I derive a discrete choice model that jointly allows for differences in the reaction to marginal changes in add-on fees and the base price as well as a discontinuous effect of a zero fee. The model is based on a framework on limited attention and I estimate it using web scraped data of posted price transactions on eBay Germany. My results suggest under-reaction to marginal changes in the shipping fee, consistent with previous results in the literature. However, I also document a discontinuous positive effect of free shipping on consumer demand, which is novel to the literature. The combined impact of these effects on consumer welfare is less than six percent of consumer surplus. The welfare impact is attenuated because the maximum shipping fee on eBay is capped and the free shipping effect partly counteracts the under-reaction to shipping fees in expectation.

Partitioned Pricing

- Separation of price for good or service into multiple parts

- Example here: Product price and shipping fee on eBay

- Rational consumers should not be affected by partitioned pricing

- At least in auctions, partitioned pricing does seem to affect consumers (Morwitz et al., 1998; Hossain and Morgan, 2006; Brown et al., 2010; Einav et al., 2015)

- Welfare implications largely unexplored

This Paper

- Quantification of consumer welfare implications of partitioned pricing online

- Allow for discontinuity at zero fee in addition to differences in reaction to marginal changes in the fee and product price

- Focus on posted price transactions rather than auctions

Model

- DellaVigna (2009): Suppose consumer i gets value V_{ij} from product j. This value consists of a visible part v_{ij} and an opaque part c_{ij} (here: shipping fee).

$$V_{ij} = v_{ij} - c_{ij}$$

- If consumers perceive c_{ij} differently, *perceived* value/willingness-to-pay net of shipping is:

$$\hat{V}_{ij} = v_{ij} - (1-\theta)c_{ij} + \gamma_f f_{ij},$$

where $f_{ij} \equiv \mathbb{1}(c_{ij} = 0)$

- Perceived consumer surplus from buying product j at price p_{ij}

$$\hat{CS}_{ij} = \hat{V}_{ij} - p_{ij} = v_{ij} - (1-\theta)c_{ij} + \gamma_f f_{ij} - p_{ij}.$$

- Assuming utility linear in income, perceived utility at price p_{ij} is:

$$U(x_{ij}, tp_{ij}, c_{ij}, f_{ij}; \tilde{\gamma}, \tilde{\gamma}_f, \tilde{\beta}, \tilde{\theta}) = x'_{ij}\tilde{\gamma} + \tilde{\beta}tp_{ij} + \tilde{\theta}c_{ij} + \tilde{\gamma}_f f_{ij} + \epsilon_{ij}.$$

The parameters of interest are $\theta \equiv -\frac{\tilde{\theta}}{\tilde{\beta}}$ and $\gamma_f \equiv -\frac{\tilde{\gamma}_f}{\tilde{\beta}}$

- ϵ_{ij} Standard Gumbel $\rightarrow$ conditional logit

Data

- Web scraped from eBay Germany from January to August 2019

- Reconstruction of choice sets: Match each transaction with closest scrapes. Example: Here, the choice set would consist of listings y and z. Because I cannot observe the exact time a listing started, I exclude cases such as a from the choice sets.
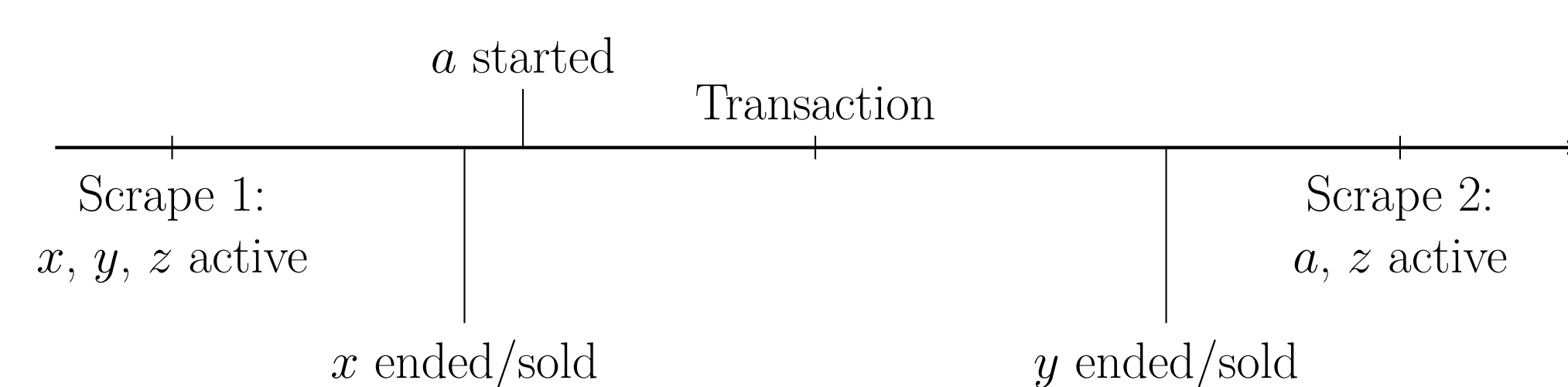
- Choice of products part of identification:

  - Balance between homogeneity (keep v_{ij} constant) and completeness of choice set
  - Propose product categories that likely fulfill these requirements: specific board games, specific video games, and specific smart phones
    * Idea: Analyze homogeneous goods $\rightarrow$ No unobserved heterogeneity in product quality. Leave relevant variation only on listing level, e.g. reputation of seller
  - Chose the most popular products in January 2019 for each category

Results

	Exit	Azul	Spiderman	FIFA 19	Pokemon	Duos
Inattention (θ)	1.065***	0.920**	0.177	0.039	0.390**	0.830***
	[0.335, 1.795]	[0.210, 1.630]	[-0.106, 0.460]	[-0.271, 0.349]	[0.045, 0.735]	[0.176, 1.484]
Free shipping effect (γ_f)	4.797***	1.789	2.264***	-2.649***	2.655***	8.250***
	[1.845, 7.749]	[-1.432, 5.010]	[1.067, 3.461]	[-3.845, -1.453]	[1.511, 3.799]	[4.188, 12.312]
No. individuals	53	108	933	1904	1236	740
No. unique choices	228	398	364	793	1040	617
No. individual-choice pairs	2202	9374	36176	87648	120193	49552

Notes: ***, **, and * indicate statistical significance at the one, five, and ten percent levels, respectively. The brackets show 95 percent confidence intervals. θ is calculated as $\theta = -\frac{\tilde{\theta}}{\tilde{\beta}}$. γ_f is calculated as $\gamma_f = -\frac{\tilde{\gamma}_f}{\tilde{\beta}}$. Standard errors for θ and γ_f are calculated using the Delta method.

- Under-reaction to marginal changes in shipping fee for most products ($\theta > 0$)

- Positive reaction to free shipping for most products ($\gamma_f > 0$)

Welfare Implications

- Follow framework for behavioral public economics by Bernheim and Rangel (2009), described in Bernheim and Taubinsky (2018):

  - Naturally occuring domain: Actual world (estimated parameters, denote utility as $\hat{U}_{ij}$)

  - Welfare-relevant domain: World without partitioned pricing ($\theta = \gamma_f = 0$, denote utility as U_{ij})

  - Calculate loss in expected consumer welfare from $\theta \neq 0$ and $\gamma_f \neq 0$

- Use approach described in Train (2015)

$$E(\hat{CS}_i) = \frac{1}{\beta}\left[ln\left(\sum_{j \in S_i} e^{\hat{W}_{ij}}\right) + \sum_{j \in S_i} P_{ij}d_{ij}\right],$$

where $\hat{W}_{ij}$ is the deterministic part of utility (including estimated reaction to partitioned pricing), P_{ij} are the choice probabilities based on $\hat{W}_{ij}$ and $d_{ij} = U_{ij} - \hat{U}_{ij} = -\tilde{\delta}_f f_{ij} - \tilde{\theta}c_{ij}$

	Exit	Pegasus	Spiderman	FIFA 19	Pokemon	Duos
$\frac{1}{N}\Sigma_i \Delta CS_i$	-0.5710	-0.1464	-0.0621	-0.1442	-0.0598	-0.1685
$\frac{1}{N}\Sigma_i(\Delta CS_i/CS_i)$	0.0533	0.0054	0.0024	0.0281	0.0022	0.0013

Notes: $\Delta CS_i = E(\hat{CS}_i) - E(CS_i)$ is the loss in consumer surplus of consumer i due to not using the welfare-relevant utility for decision-making. $\Delta CS_i/E(CS_i)$ is that loss relative to the level of consumer surplus under rational decision-making. Numbers shown here are means over all consumers $i \in 1, ..., N$.

Extensions

- Random consideration sets (Goeree, 2008)

- Endogenous price with control function (Petrin and Train, 2010)

- Mixed Logit with normally distributed price sensitivity β_i

	Exit	Azul	Spiderman	FIFA 19	Pokemon	Duos
Random Consideration						
Inattention (θ)	1.225***	-0.126	0.111	-0.145	-0.240**	0.720**
	[0.436, 2.014]	[-1.003, 0.763]	[-0.045, 0.267]	[-0.472, 0.182]	[-0.475, -0.005]	[0.132, 1.308]
Free shipping effect (γ_f)	5.299***	-1.866	1.869***	-0.797	1.073**	6.697***
	[2.184, 8.415]	[-5.430, 1.697]	[1.547, 2.191]	[-1.899, 0.305]	[0.180, 1.967]	[3.353, 10.041]
Control Function						
Inattention (θ)	1.282***	0.890***	0.043	-0.015	-0.932**	1.681***
	[0.133, 3.325]	[0.135, 1.439]	[-0.228, 0.282]	[-0.228, 0.181]	[-1.936, -0.319]	[0.725, 3.087]
Free shipping effect (γ_f)	7.236***	1.689	1.305***	-2.500***	-13.487***	12.939***
	[0.176, 22.173]	[-1.960, 4.644]	[0.408, 2.297]	[-3.294, -1.572]	[-16.616, -11.234]	[7.237, 21.658]
Heterogeneous Price Sensitivity						
Inattention (θ)	0.993***	0.000	0.246***	0.383***	0.408***	0.643***
	[0.509, 1.477]	[-0.011, 0.011]	[0.134, 0.358]	[0.205, 0.561]	[0.217, 0.599]	[0.159, 1.127]
Free shipping effect (γ_f)	4.590***	-1.750***	2.222***	-0.178	2.665***	6.553***
	[2.604, 6.576]	[-2.682, -0.817]	[1.859, 2.586]	[-0.860, 0.503]	[1.885, 3.444]	[3.650, 9.455]
No. individuals	53	108	933	1904	1236	740
No. unique choices	228	398	364	793	1040	617
No. individual-choice pairs	2202	9374	36176	87648	120193	49552

Notes: ***, **, and * indicate statistical significance at the one, five, and ten percent levels, respectively. The brackets show 95 percent confidence intervals. θ is calculated as $\theta = -\frac{\tilde{\theta}}{\tilde{\beta}}$. γ_f is calculated as $\gamma_f = -\frac{\tilde{\gamma}_f}{\tilde{\beta}}$. Standard errors for θ and γ_f are calculated using the Delta method, except for in the control function approach. Standard errors for the control function approach are bootstrapped.

- Results robust for "Exit", "Spiderman", and "Duos"

- Results affected by some of the extensions for the remaining products

Discussion

- Only take consumer perspective here

- Calculated welfare losses would be potential benefit from removing partitioned pricing

- Potential costs are likely on the seller and/or platform side

- For evaluation of such a policy, the supply and platform sides need to be considered as well

References

Bernheim, B. D. and Rangel, A. (2009). Beyond Revealed Preference: Choice-Theoretic Foundations for Behavioral Welfare Economics. *The Quarterly Journal of Economics*, 124(1):51–104.

Bernheim, B. D. and Taubinsky, D. (2018). Behavioral Public Economics. *Handbook of Behavioral Economics*, 1:381–516.

Brown, J., Hossain, T., and Morgan, J. (2010). Shrouded Attributes and Information Suppression: Evidence from the Field. *The Quarterly Journal of Economics*, 125(2):859–876.

DellaVigna, S. (2009). Psychology and Economics: Evidence From the Field. *Journal of Economic Literature*, 47(2):315–372.

Einav, L., Kuchler, T., Levin, J., and Sundaresan, N. (2015). Assessing Sale Strategies in Online Markets Using Matched Listings. *American Economic Journal: Microeconomics*, 7(2):215–247.

Goeree, M. S. (2008). Limited Information and Advertising in the U.S. Personal Computer Industry. *Econometrica*, 76(5):1017–1074.

Hossain, T. and Morgan, J. (2006). ...Plus Shipping and Handling: Revenue (Non) Equivalence in Field Experiments on eBay. *Advances in Economic Analysis and Policy*, 6(2):1–27.

Morwitz, V. G., Greenleaf, E. A., and Johnson, E. J. (1998). Divide and Prosper: Consumers' Reactions to Partitioned Prices. *Journal of Marketing Research*, 35(4):453–463.

Petrin, A. and Train, K. (2010). A Control Function Approach to Endogeneity in Consumer Choice Models. *Journal of Marketing Research*, 47(1):3–13.

Train, K. (2015). Welfare calculations in discrete choice models when anticipated and experienced attributes differ: A guide with examples. *Journal of Choice Modelling*, 16:15–22.

For more

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