Behavioral Industrial Organization*

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*Thanks to Hunt Allcott for providing concise slides on Grubb and Osborne (2015) that were the basis for slides 29–45.

What is Behavioral Industrial Organization?

- Standard IO: Profit maximizing firms and expected utility maximizing consumers with correct beliefs.
- Sometimes the simplification is a bad approximation.

- Behavioral IO: Enrich models with more realistic models of behavior for market participants.

Behavioral Industrial Organization

- Behavioral Consumers
  1. Non-Standard Preferences
  2. Failing to choose the best price due to
     1. Suboptimal Search
     2. Confusopoly: Confusion Comparing Prices
     3. Excessive Inertia
  3. Overconfidence & Systematic Misweighting
- Behavioral Managers and Firms
  - Firms are run by people, and people make mistakes. . .

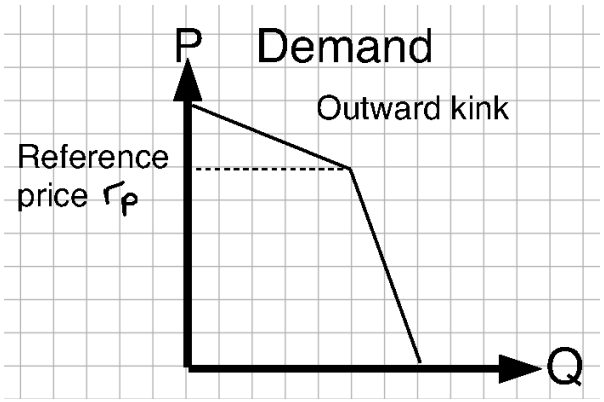
Behavioral Consumers: (1) Non-standard Preferences

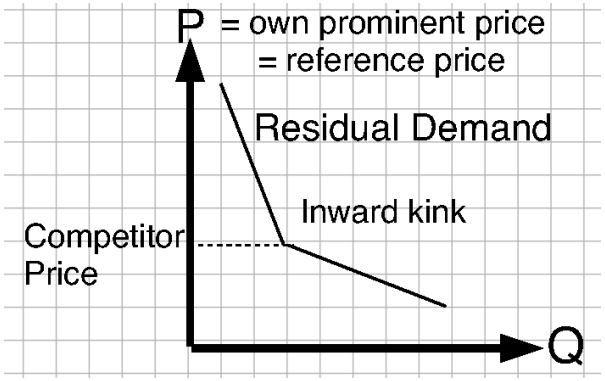
- How do profit maximizing firms respond to consumers that are
  - Loss averse? (Grubb, 2015c; Heidhues and Köszegi, 2018, 5.1)
  - Present biased and sophisticated? (Heidhues and Köszegi, 2018, 5.2))
  - Conspicuous consumers? (Heidhues and Köszegi, 2018, 5.3))
  - Fairness loving?
  - Status-seeking?
  - Ambiguity averse?

- Market response maybe be beneficial or exploitative.
  - Beneficial example: Offering commitment devices.
    - Seems rare in practice (Laibson, 2015).

Example: Selling to Loss Averse Consumers I

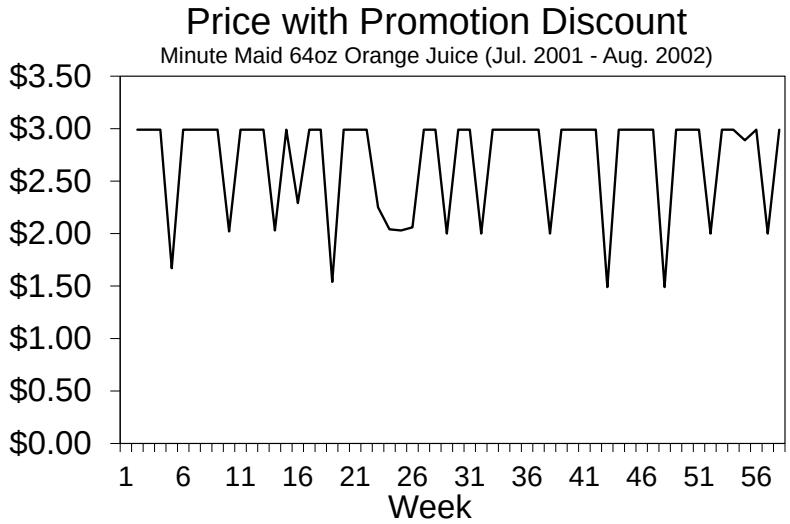
1. First-order risk aversion (Kőszegi and Rabin, 2007)
   - Consumers demand insurance for small risks
   - Firms charge flat rates (Herweg and Mierendorff, 2013)
2. Comparison Effect: Kinks in demand curves
   - Heidhues and Kőszegi (2014) & Spiegler (2012):
     - Fixed reference point $\rightarrow$ outward kink $\rightarrow$ rigid pricing
     - Price increases coded as losses—loom larger than price cuts
     - Focal prices & low pass-through
   - Zhou (2011):
     - Firm set reference point $\rightarrow$ inward kink $\rightarrow$ random pricing





Example: Selling to Loss Averse Consumers II

3. Stochastic pricing: Low prices create *attachment* (raising WTP) and high prices exploit
   - Interpretation: Hurts consumer by *lowering* utility of not buying
   - Regular prices and sales (Heidhues and Kőszegi, 2014)



   - Black Friday pricing (Rosato, 2016)

4. Managing expectations matters (Karle and Peitz, 2014, 2017)
   - Firms delay full disclosure to exploit attachment effect
   - Mandating early disclosure can lower prices & raise CS

Behavioral Consumers: (2) Failing to choose the best price

Consumers tend to (Grubb, 2015a):

1. Search too little
   - Example: U.S. Mortgage market (broker segment)
   - Woodward and Hall (2012): gain visiting 1 more broker $\approx \$1,000$
   - Conclusion: reject rational search
2. Miscompare prices or quality (confusion)
   - Example: U.K. electricity tariff choice. Wilson and Waddams Price (2010): 6–12% of those switching for a cheaper rate switch to a plan dominated by original tariff
3. Switch too little (excessive inertia)
   - Example: Choosing employer based health insurance plan
   - Handel (2013): average switching cost $\approx \$2,000$
   - Conclusion: additional sources of inertia such as inattention (Kiss, 2014), forgetting, or procrastination (Madeira, 2015).

Behavioral Consumers: (2) Failing to choose the best price

Lack of search & price confusion $\rightarrow$ *noisy* choices.

- Decision errors differ across consumers
- Firm perspective—like spurious product differentiation
- Creates market power $\rightarrow$ raises markups even with many sellers

Behavioral Consumers: (2) Failing to choose the best price

Lack of search & price confusion $\rightarrow$ *noisy* choices.

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Connection to Dimitry's talk on Thursday

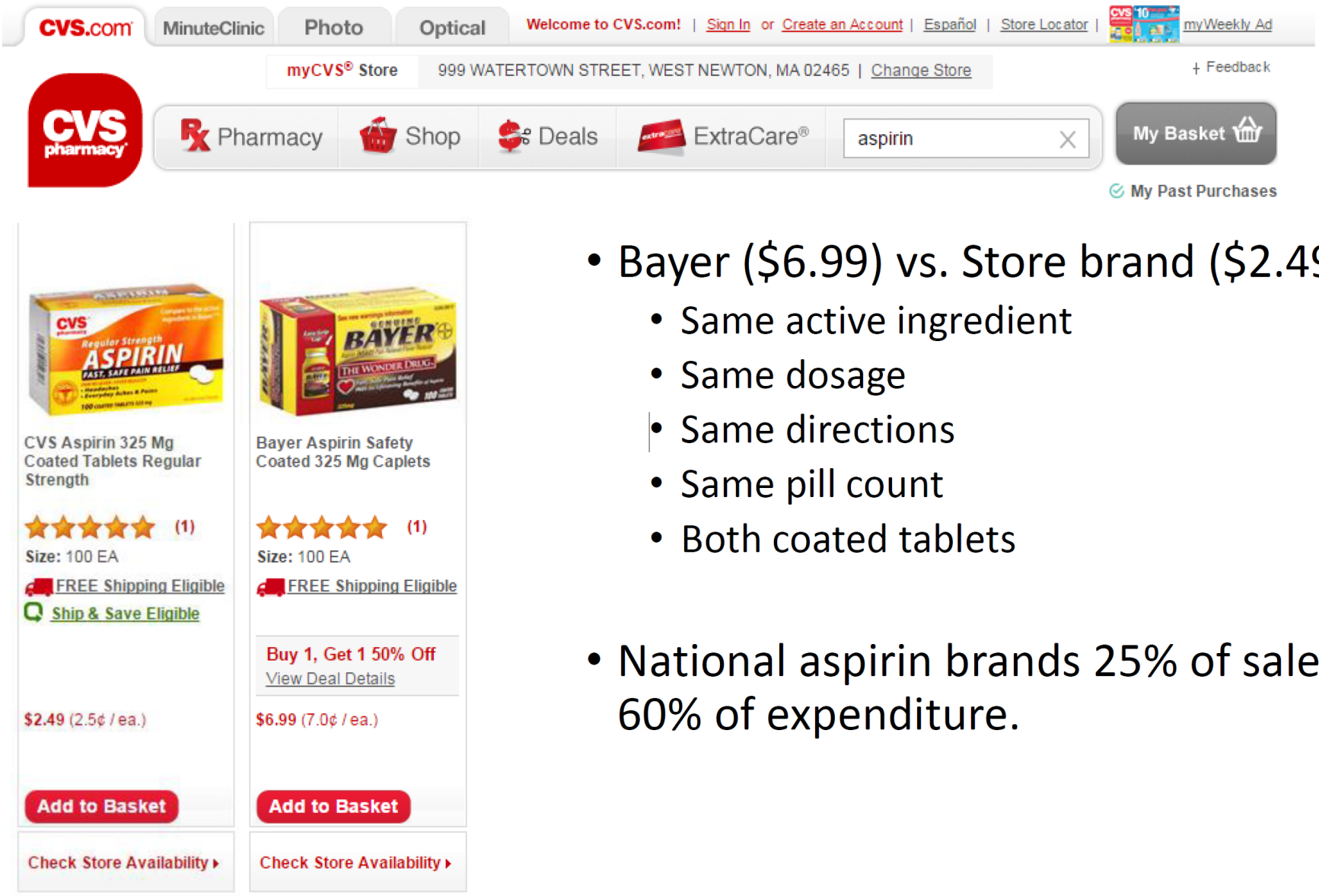
- With differentiated firms and/or outside option, noisy choices are also allocatively inefficient (but harder to identify mistakes)

Firms obfuscate to dampen search.

Example: Drip pricing

- Lab: Drip pricing profitably dampens search (OFT, 2010)
- Field: Retailers hide price in S&H fees to defeat price comparison engine (Ellison and Ellison, 2009)
- Theory: Firm's raise own search costs in equilibrium (Wilson, 2010; Ellison and Wolitzky, 2012).

Confusopoly: Consumer confusion about quality



- Bayer ($6.99) vs. Store brand ($2.49)
  - Same active ingredient
  - Same dosage
  - Same directions
  - Same pill count
  - Both coated tablets
- National aspirin brands 25% of sales, 60% of expenditure.

Confusopoly: Consumer confusion about quality

Bronnenberg, Dubé, Gentzkow, and Shapiro (2015)

Aspirin Market	Brand name sales share
Typical Consumers	26%
Pharmacists	9%
Pharmacist couples	Data unavailable

Were all consumers pharmacists:

- Prices fall 37%
- Expenditure falls 15% ($435 million)

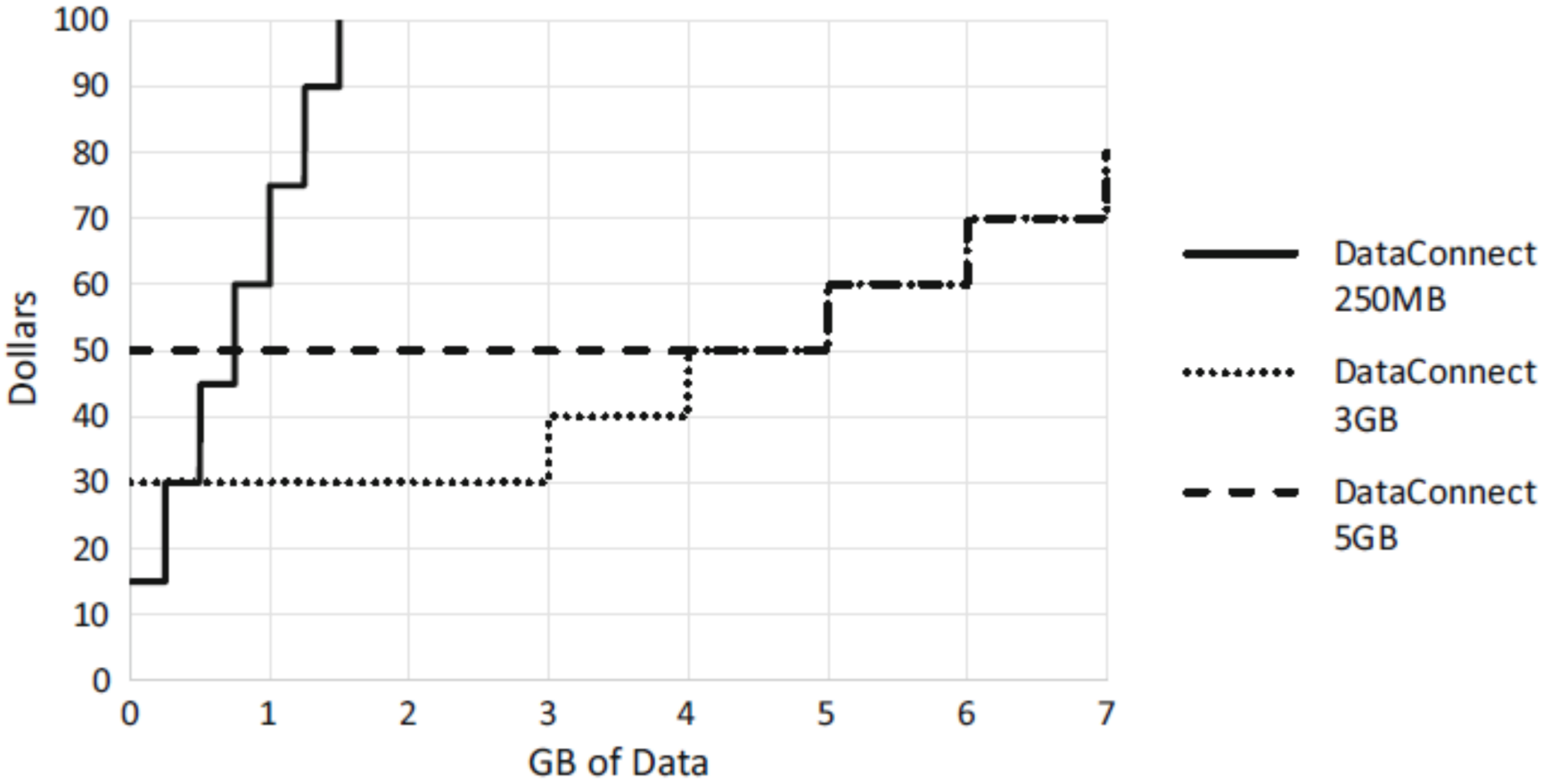
Which plan would you choose for Netflix on your iPad?

DataConnect Plans for:

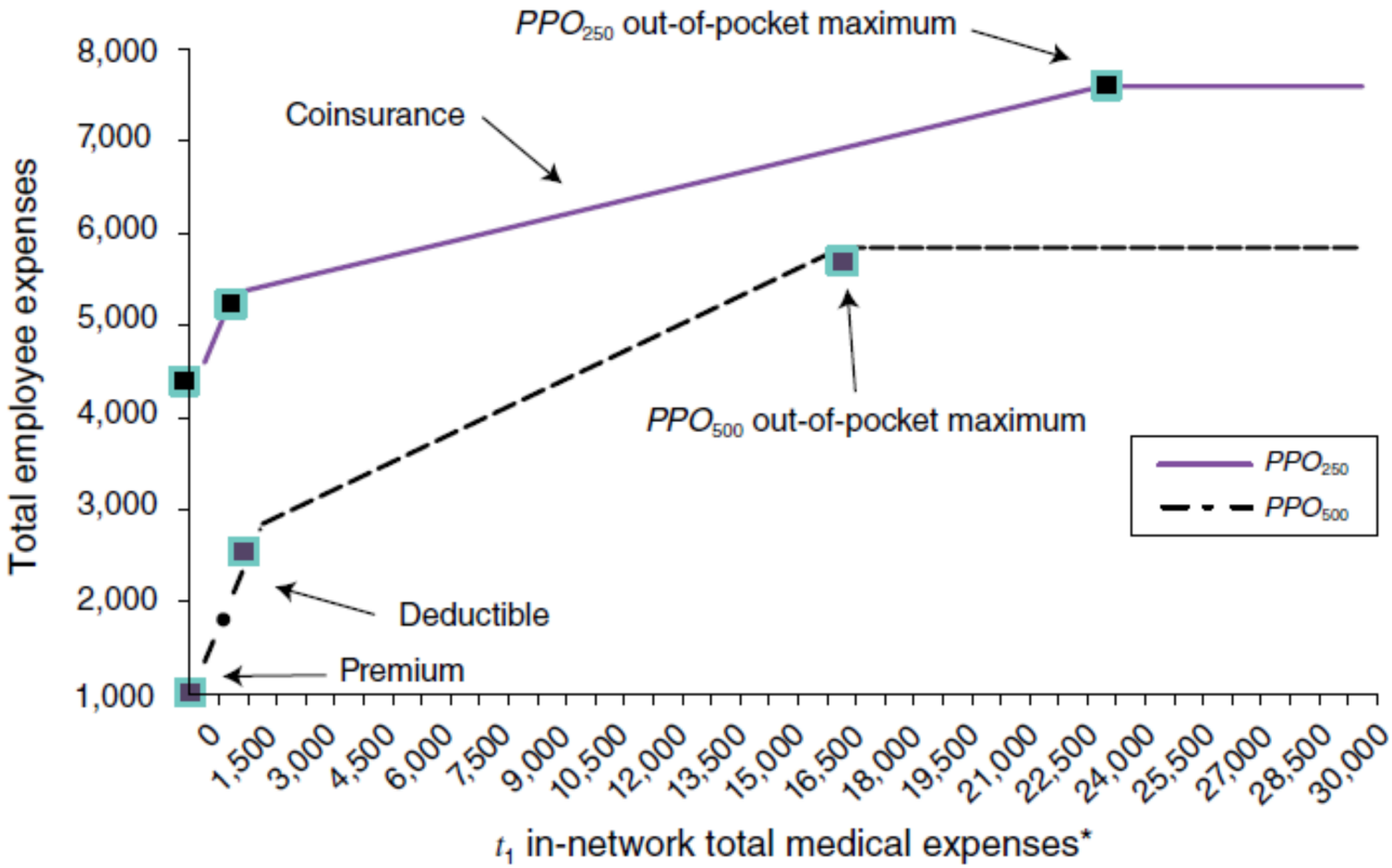
iPad, Tablets, Camera and Gaming Devices

Data	Plan Charges	AT&T Wi-Fi Access	Domestic Overage Fees	Canadian Data	International Data	
DataConnect 250MB	$14.99	✔	$14.99 per 250 MB	$0.015/KB	$0.0195/KB	Add View details
DataConnect 3GB	$30.00	✔	$10.00 per 1 GB	$0.015/KB	$0.0195/KB	Add View details
DataConnect 5GB	$50.00	✔	$10.00 per 1 GB	$0.015/KB	$0.0195/KB	Add View details

Which plan would you choose for Netflix on your iPad?



7% new employees choose dominated plan (Handel 2014)



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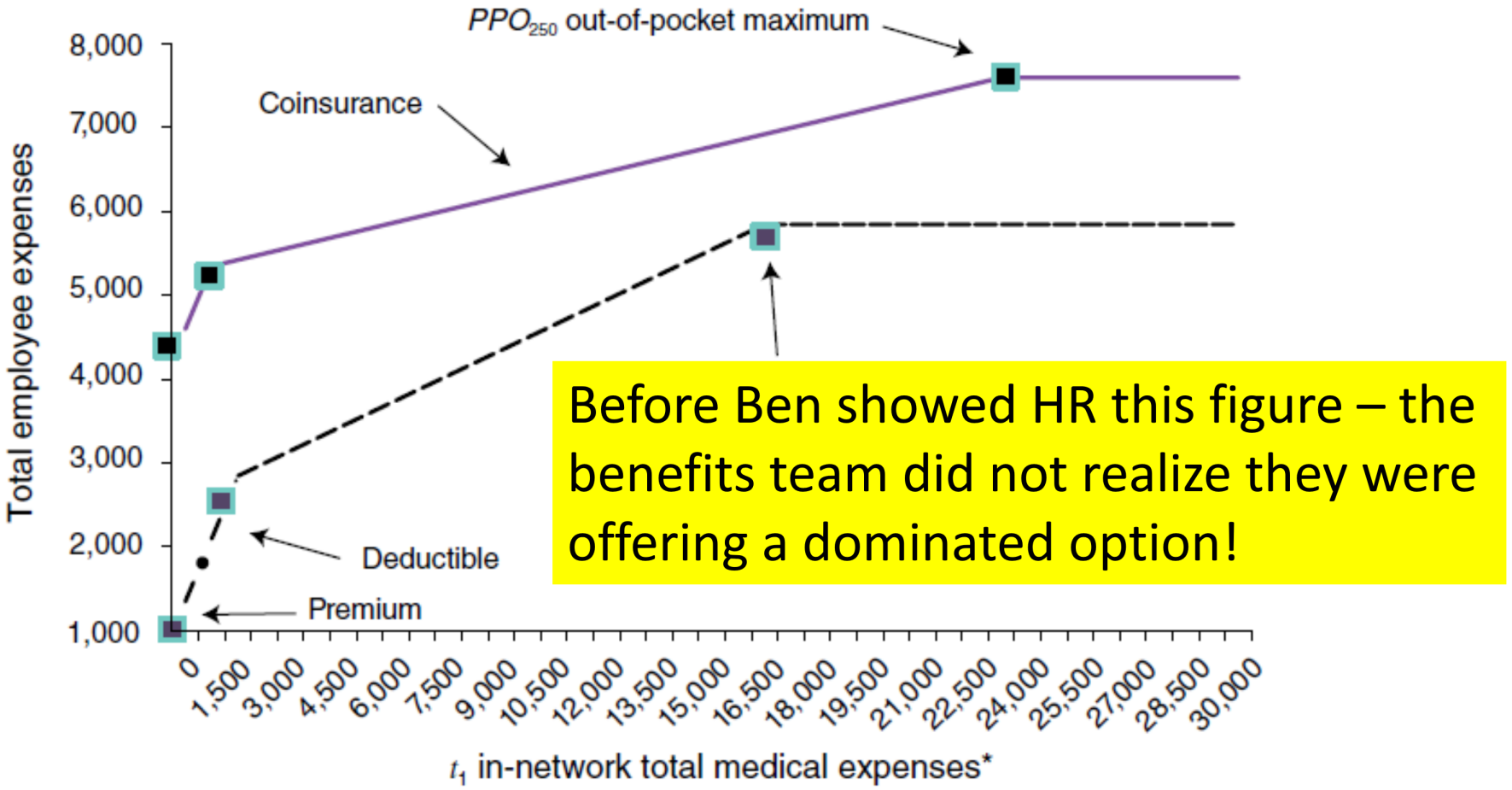


Before Ben showed HR this figure – the benefits team did not realize they were offering a dominated option!

Confusopoly: Price Obfuscation

Model

- Homogenous good Duopoly, unit demand
- Firms simultaneously choose a price and a price frame
  - Ex: Inclusive price ($9.99) vs. partitioned price ($1.99 plus $8 S&H)
- $\pi(x, y) = \Pr(\text{can compare prices across frames } x \text{ and } y)$
- Those who cannot compare prices choose randomly

Insights

- Firms obfuscate
- Firms may choose more complex frames and higher prices with
  - more competitors (Chioveanu and Zhou, 2013)
  - increased comparability of simple frames (Piccione and Spiegler, 2012)
- Firm response can undermine transparency policies

Behavioral Consumers: (3) Overconfidence and systematic misweighting

Consumers often misweight product attributes

- Example: underweight hidden fees

Themes

- Behavioral First Welfare Theorem:
  - Competition maximizes joint *perceived* surplus
- Firms exploit biases with complicated pricing features
- Exploitation (intensive margin) distortion
- Participation (extensive margin) distortion
- Cross-subsidies & Ripoff externalities
  - Firms can facilitate exploitation of the naïve by the sophisticated

Firms complicate contracts to exploit bias

Firms hide costs in hidden fees and add hurdles and traps to exploit overoptimism about navigating contract terms

- Consumers underweight hidden fees
  - Firms charge hidden fees 
- Overoptimism about remembering to act (prospective memory)
  Overoptimism about procrastination (self-control)
  - Firms set memory hurdles & procrastination traps
  - Free trials, teaser rates, and auto-renewal
  - Mail-in rebates
  - Bonus cash back (quarterly activation required)
- Overoptimism about attention
  - Firms set attention hurdles—price changes at thresholds
  - Overdraft fees, Credit card-over limit fees, Data overage charges, Fequent flyer awards

Firms distort contracts to exploit biased usage forecasts

- Overestimate usage $\rightarrow$ distort marginal price $\downarrow$ and quality $\uparrow$
- Underestimate usage $\rightarrow$ distort marginal price $\uparrow$ and quality $\downarrow$

Exploiting overprecision of demand forecasts

Grubb (2009): Overprecision: correctly forecast median data use Q but underestimate variance of data needs

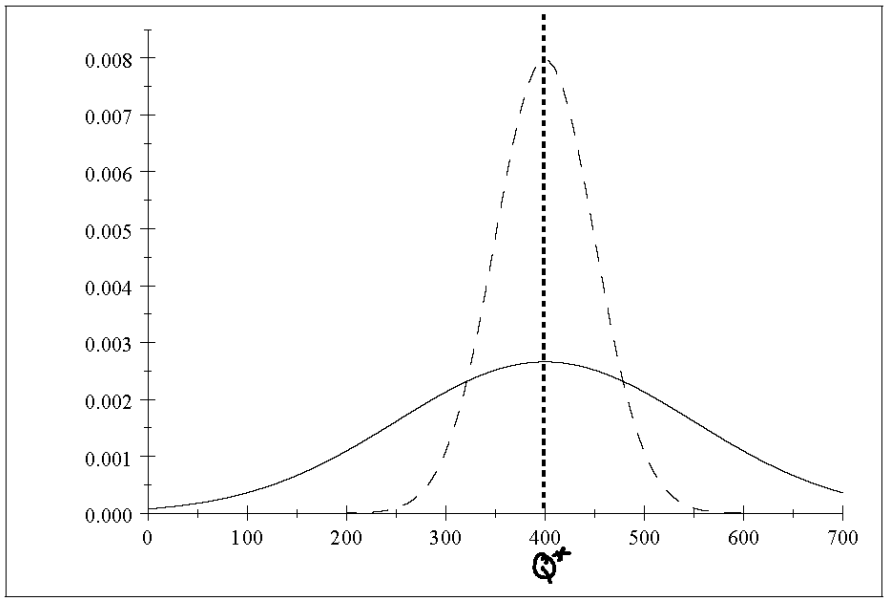
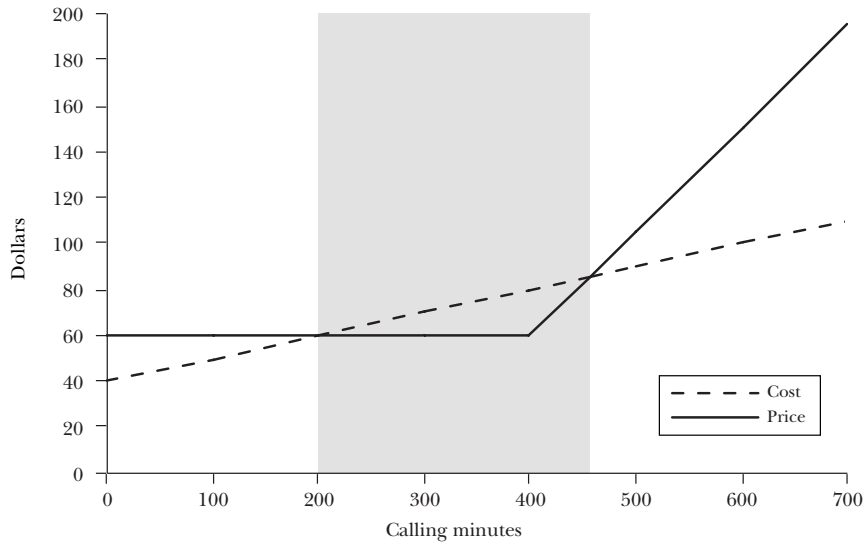


Figure 1
Three-Part Tariff Pricing



- Overestimate using qth MB for $q < Q$: Distort marginal price $\downarrow$
- Underestimate using qth MB for $q > Q$: Distort marginal price $\uparrow$
- $\rightarrow$ 3-part Tariff (data overages, data throttling, car lease, overdraft fees, credit card teaser rates,...)

Exploiting overoptimism about self control

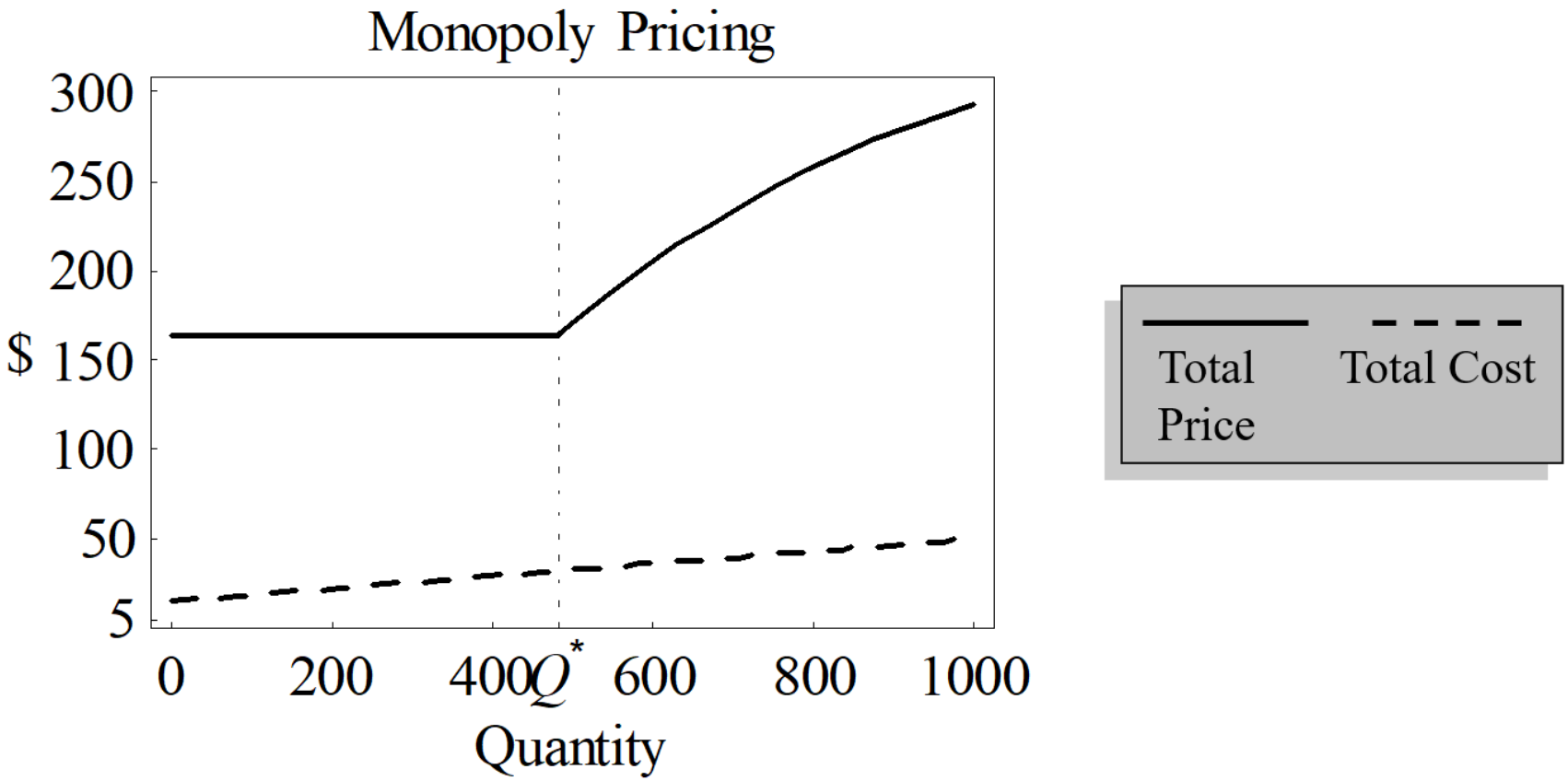
DellaVigna and Malmendier (2004)

- Investment goods: present costs, future benefits
  - Gym workout, language class
  - Overconfident $\rightarrow$ overestimate usage
  - High up-front fees, low usage fees, high quality

DellaVigna and Malmendier (2006) "Paying not to go to the gym"

- Members with \$70/mo flat-rate membership attend avg. 4.3/mo
- $\approx$ \$17 per visit
- Buying \$10 day passes would save \$600 during their membership.

Complex pricing is robust to competition



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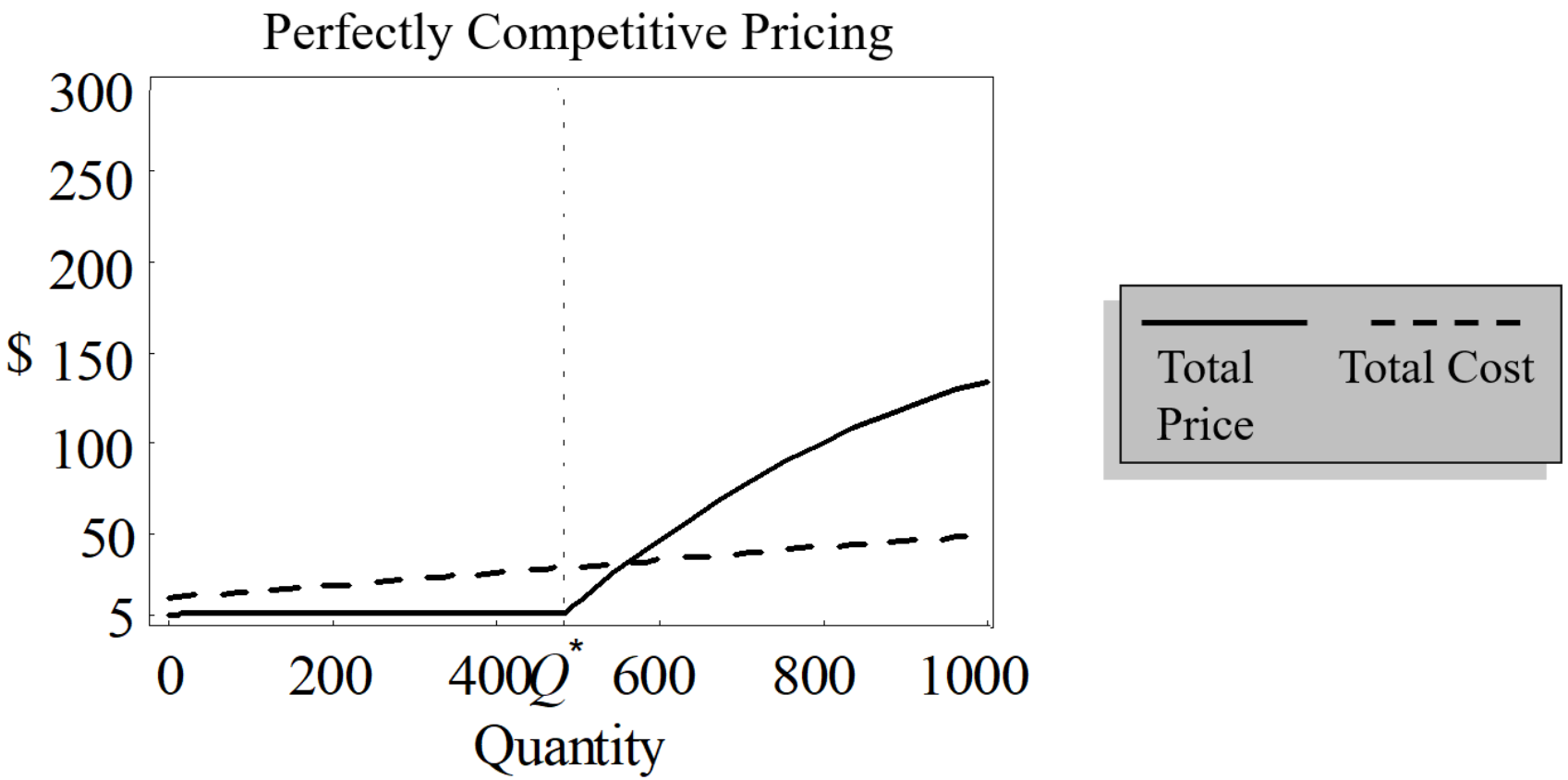


How does systematic misweighting affect welfare?

Ripoff Externalities

Suggested papers: Gabaix and Laibson (2006), Bubb and Kaufman (2013), and Armstrong (2015)

Model

- Bank cost c per account, monthly account fee p, hidden fee $a \leq \bar{a}$
- $(1-\alpha)$ Ninjas: Avoid fees
- α Naive: Pay a in fees, but don't realize (OC in ninja skills / unaware)
- $\pi = p + \alpha a - c$

Competitive Equilibrium: $a = \bar{a}$ and $\pi = 0 \rightarrow p = c - \alpha\bar{a}$

- Ninjas pay $p = c - \alpha\bar{a} < c$
- Naive pay $p + \bar{a} = c + (1-\alpha)\bar{a} > c$

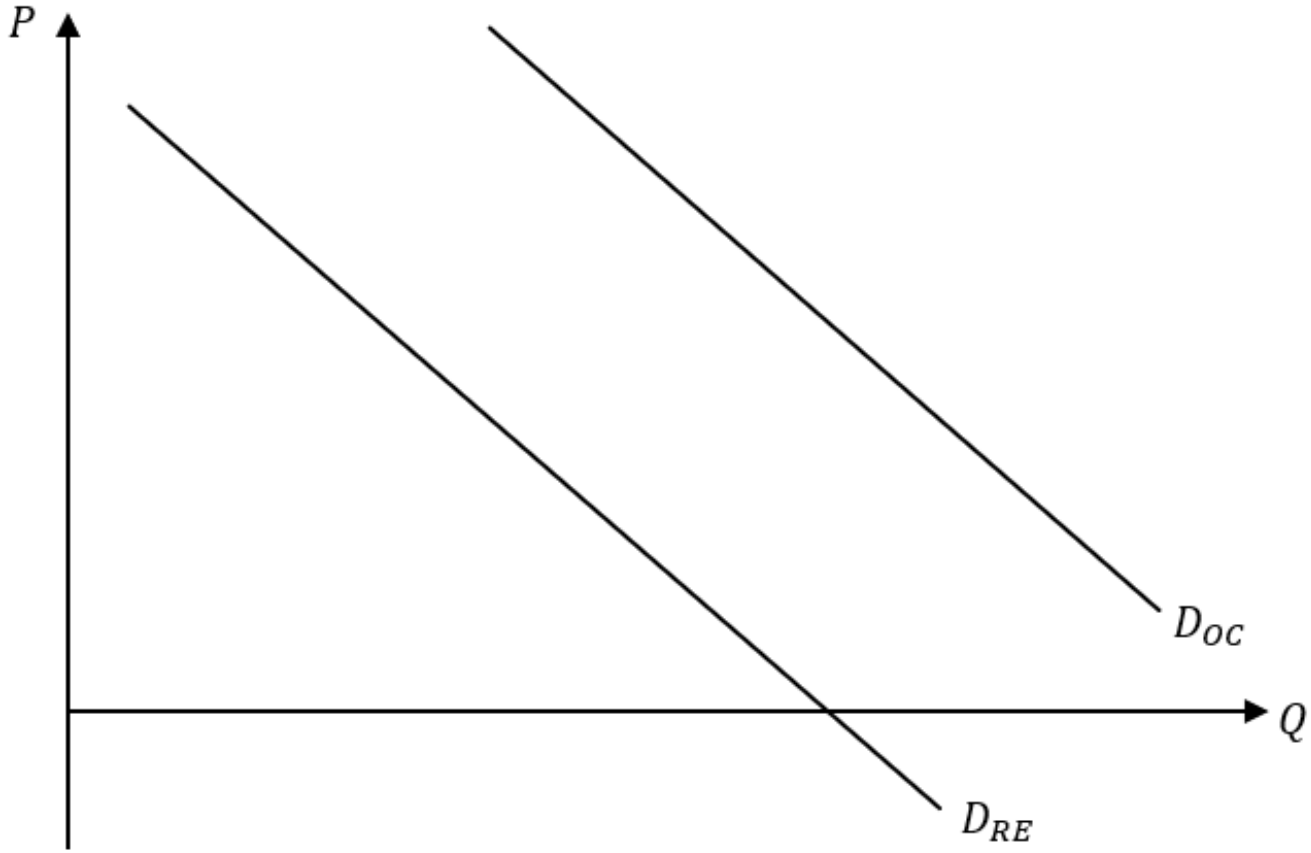
Insight

- Naive consumers cross-subsidize Ninjas
- Naive payment increases in # Ninjas $\rightarrow$ Ninja training camp can save some naifs, but those who do not attend are made worse off!

How does systematic misweighting affect welfare?

- Usage on the intensive margin? (Exploitation distortions)
  - Marginal price distortions distort usage on the intensive margin
    - Hidden checked bag fees encourage competition for carry-on space
    - High overage rates discourage data use
  - Complicated contract terms lead to socially wasteful effort
    - Filling out mail-in rebates
    - Tracking account balances
- Purchase on extensive margin? (Participation distortion)
- Distribution of surplus between firms and consumers?

Competitive Case with Homogeneous Bias (Grubb, 2015b)

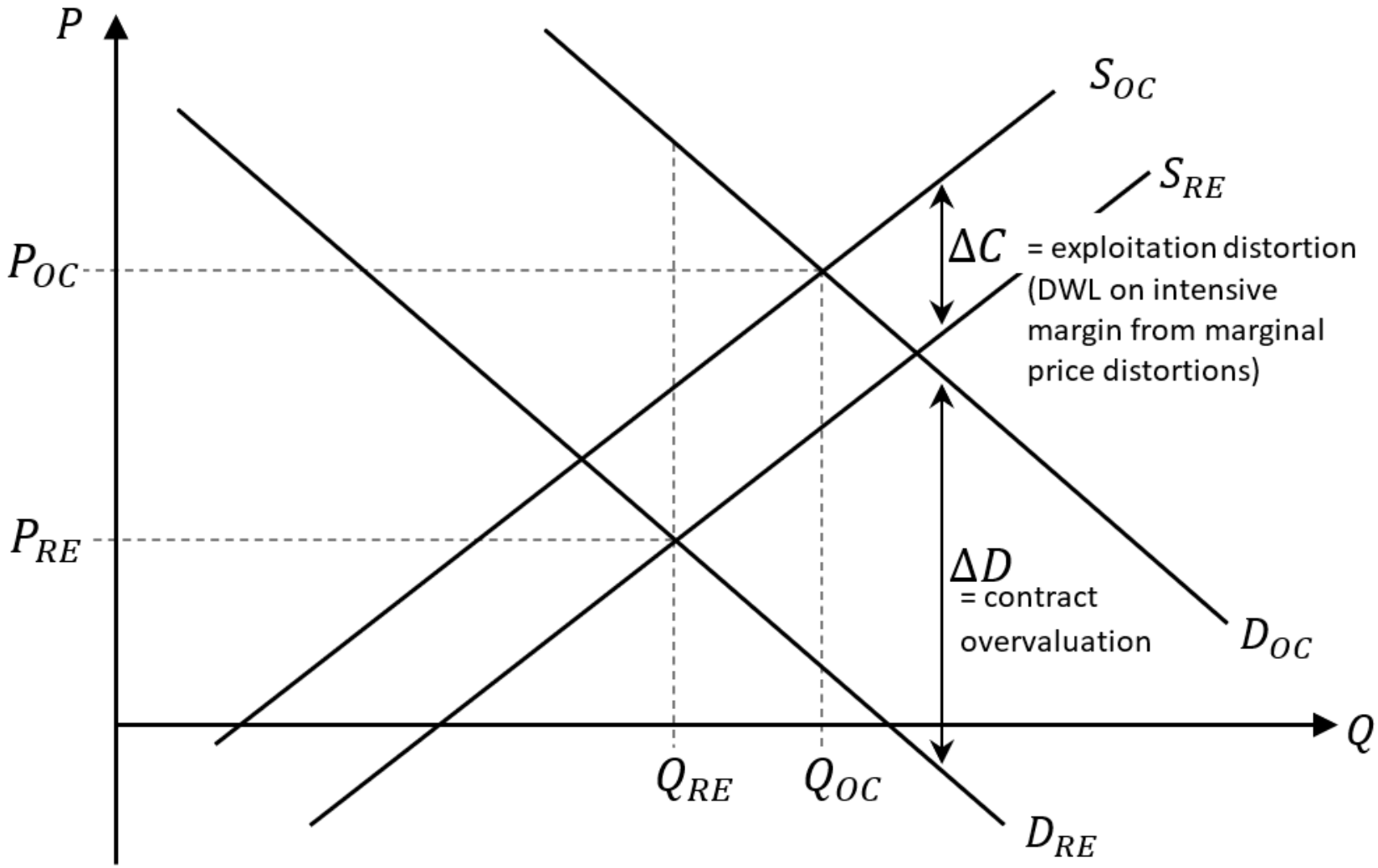


- RE = Rational Expectations (True welfare relevant preferences)
- OC = Overconfident (Biased demand)

Example

- MC data $= 0$
- RE: Wireless plan $=$ \$50/mo unlimited data.
  - "contract" $=$ p_{RE} $=$ unlimited data
  - "price" $= P_{RE} =$ \$50.
- OC: Wireless plan $=$ \$40/mo, 5 GB data, and \$1 per 100 MB overage
  Consumers pay \$10 overage & forgo \$5 value of curtailed data usage.
  - $P_{OC} =$ \$55 (not \$40!)
  - "contract" is
    - p_{OC} $=$ "5 GB data, \$1 per 100 MB overage, and \$15 cash back".
  - \$15 refund offsets:
    - \$10 in overage fees and \$5 value of forgone data usage
    - Makes contracts comparable (same U)
  - $\Delta C =$ \$15 refund $-$ \$10 overage $=$ \$5 $=$ Exploitation distortion

Competitive Case with Homogeneous Bias (Grubb, 2015b)



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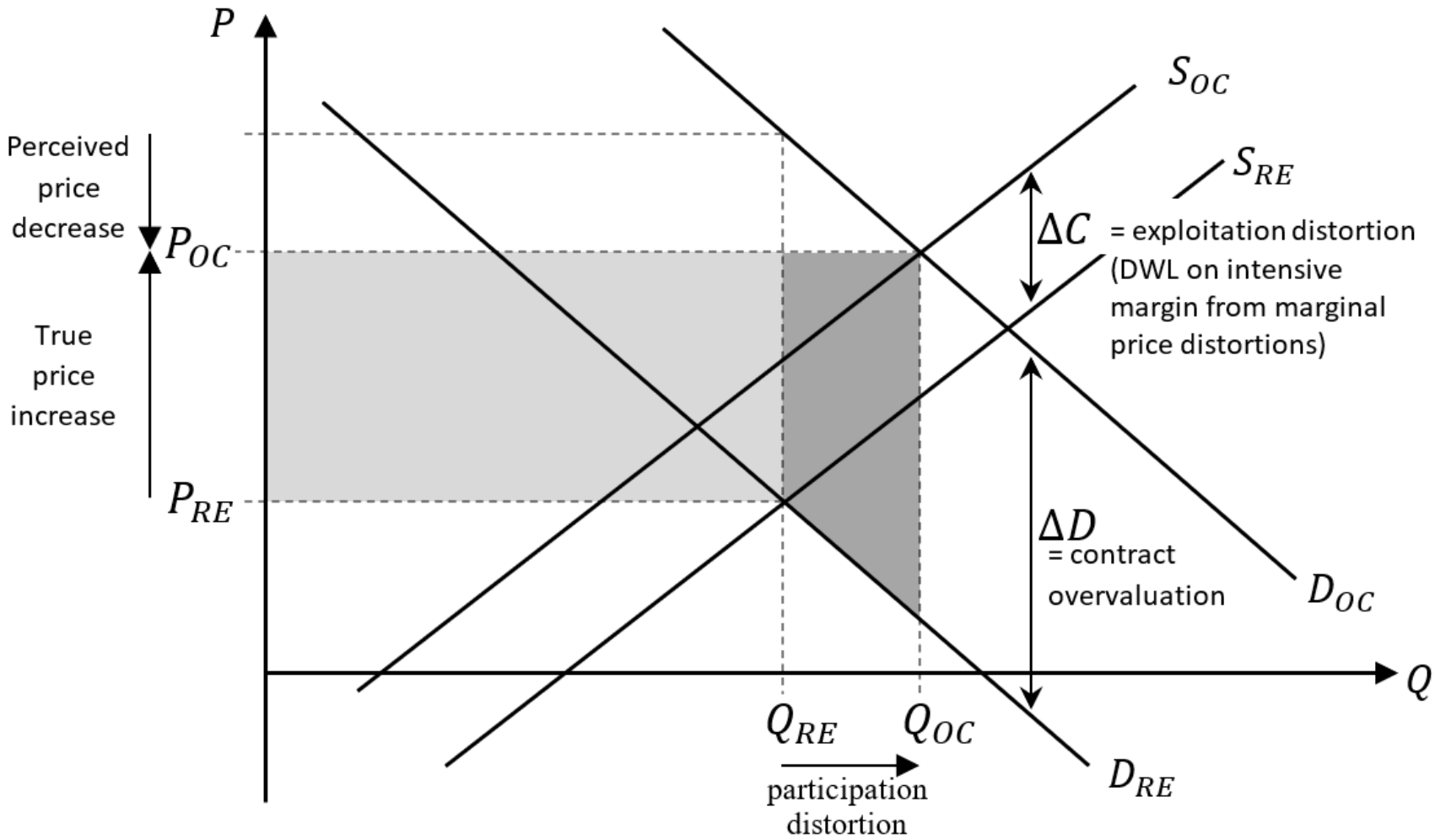


Price changes depend on pass-through

Given constant pass-through rate ρ:

- Overconfidence inflates true price (of utility U):

$$\Delta P = P_{OC} - P_{RE} = (1 - \rho)\,\Delta D + \rho \Delta C$$

- Overconfidence reduces perceived price:

$$\Delta P^* = \Delta P - \Delta D = -\rho\,(\Delta D - \Delta C)$$

- Expressions hold with firm market power
(even though the figure does not)

Grubb and Osborne (2015)

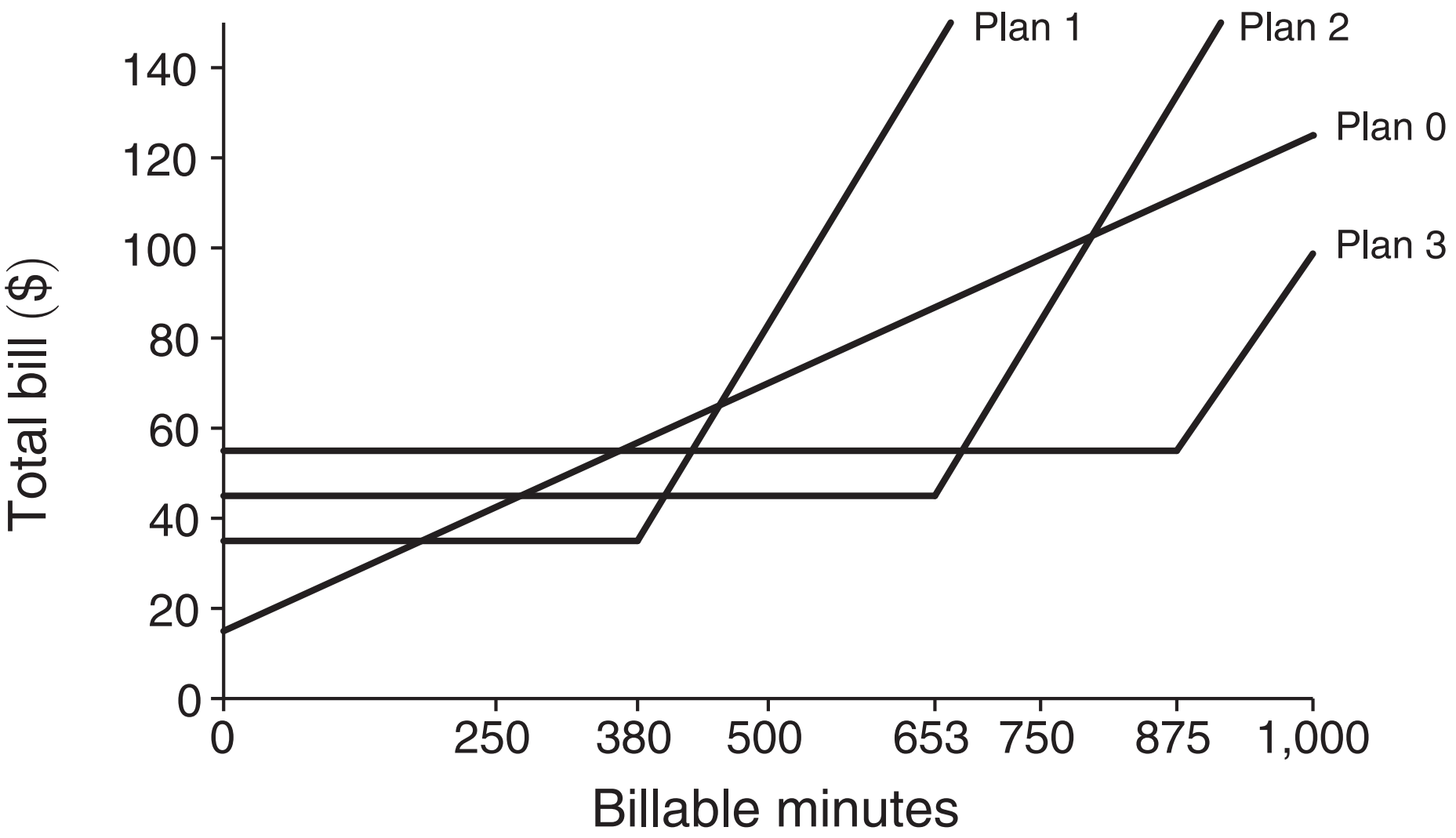
- Research question: what are the welfare effects of alerting cellular phone customers when they exceed usage allowances?
- Policy: cellular carriers agreed to provide alerts as of April 2013
- Key intuition:
  - Holding prices fixed, "unshrouding" prices benefits consumers
  - But firms offset this by increasing base good prices in equilibrium
- Approach:
  - Structural model of cellular phone usage, including estimates of bias
  - Counterfactuals with endogenous pricing

Data and Stylized Facts

Grubb and Osborne (2015): Data

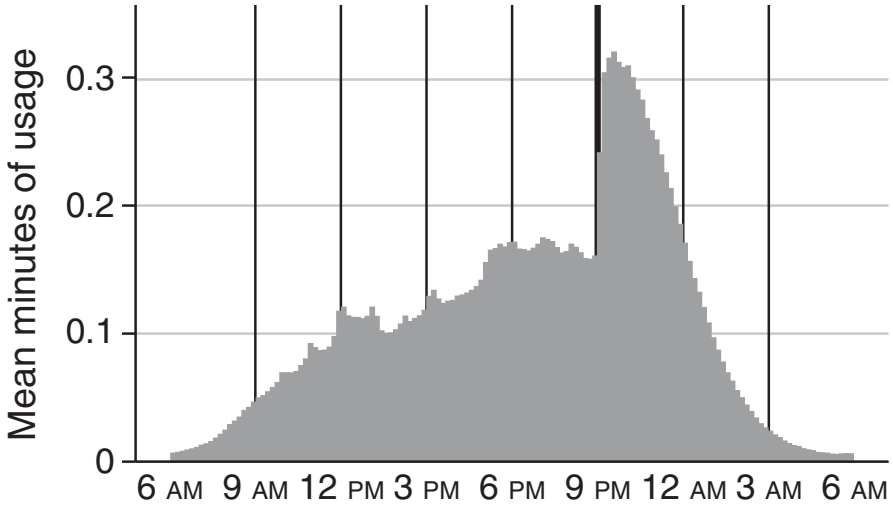
- Monthly billing record for students at a major university who were customers of a national cellular carrier
  - Limit to August 2002–July 2004, and subscribers who newly joined during that period
  - 1,261 subscribers
- Choice set: prices and characteristics of all plans available from any carrier

Available plans

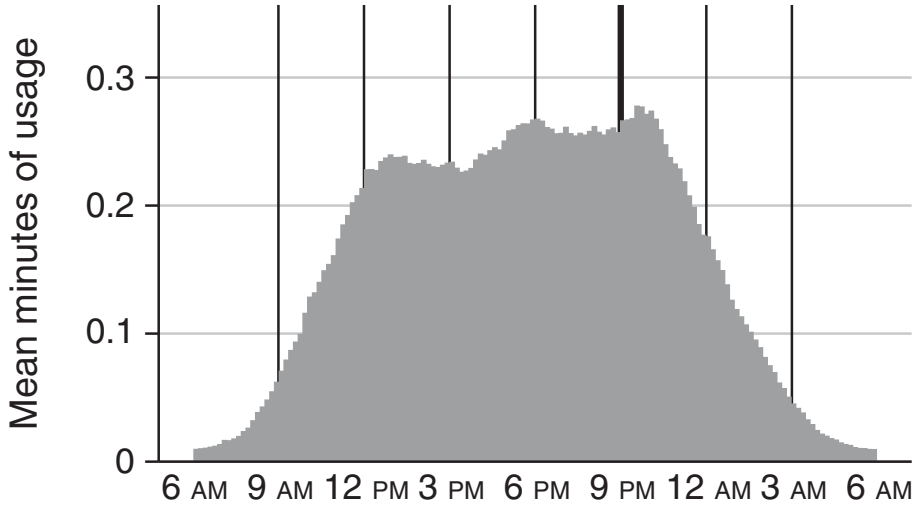


Fact 1: Consumers are price sensitive

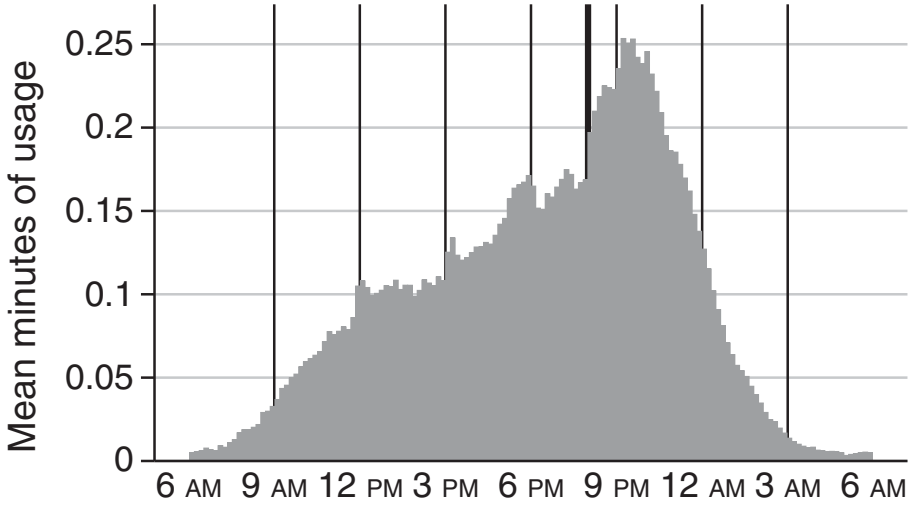
Panel A. Weekday (peak 6 AM–9 PM)



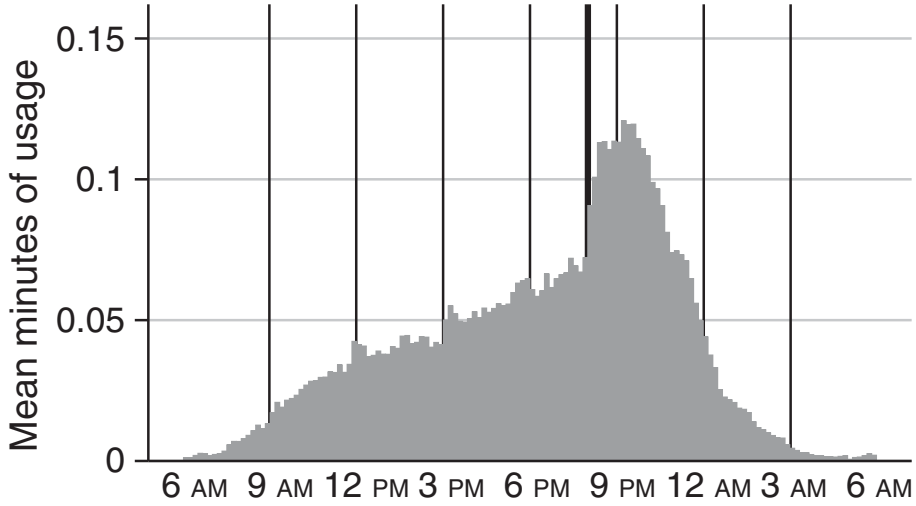
Panel B. Weekend (peak 6 AM–9 PM)



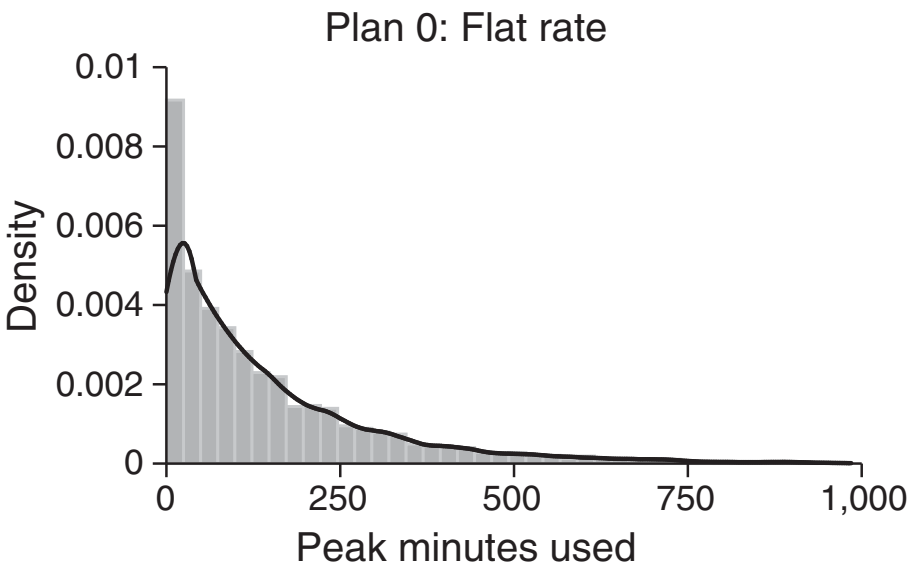
Panel C. Weekday (peak 7 AM–8 PM)

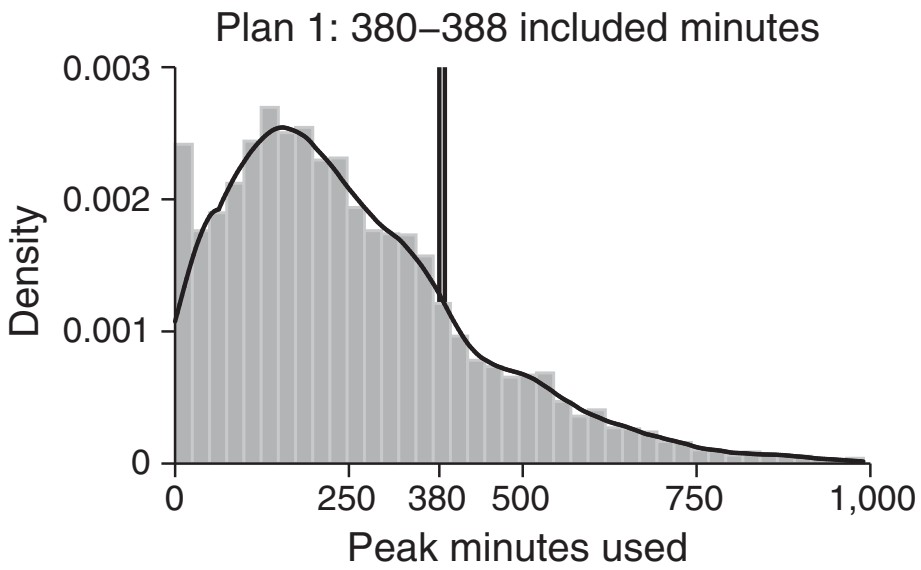


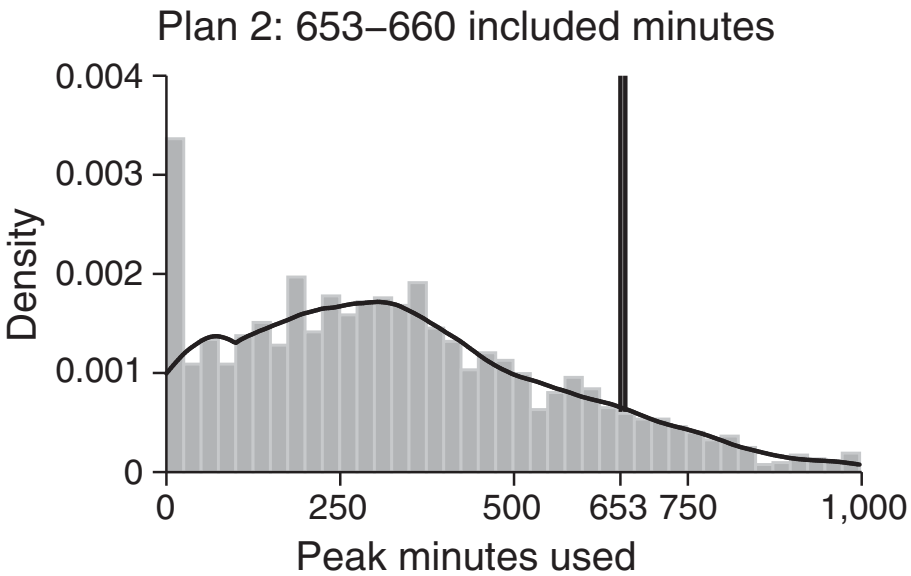
Panel D. Weekday outgoing landline (peak 7 AM–8 PM)

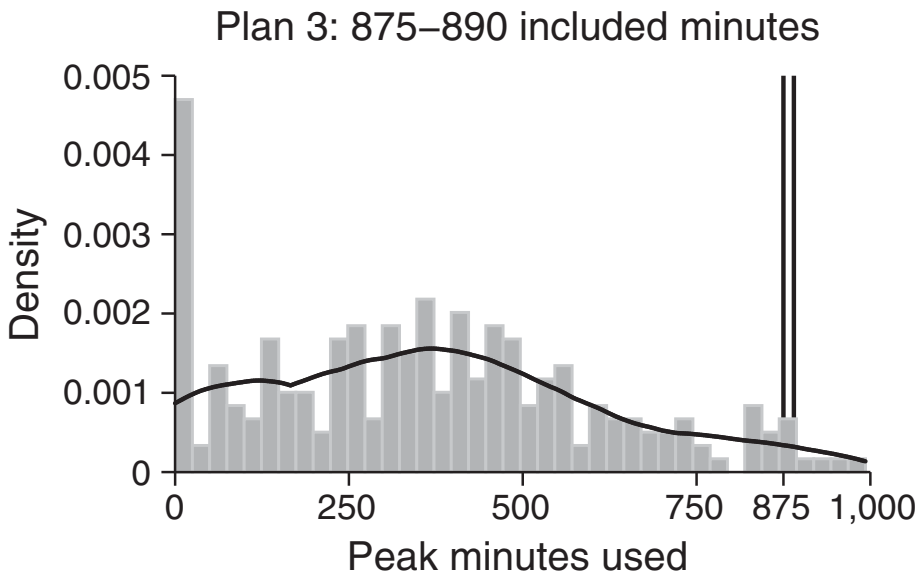


Fact 2: No bunching at included minute limits









Fact 3: Still wait for off-peak even when far below allowance

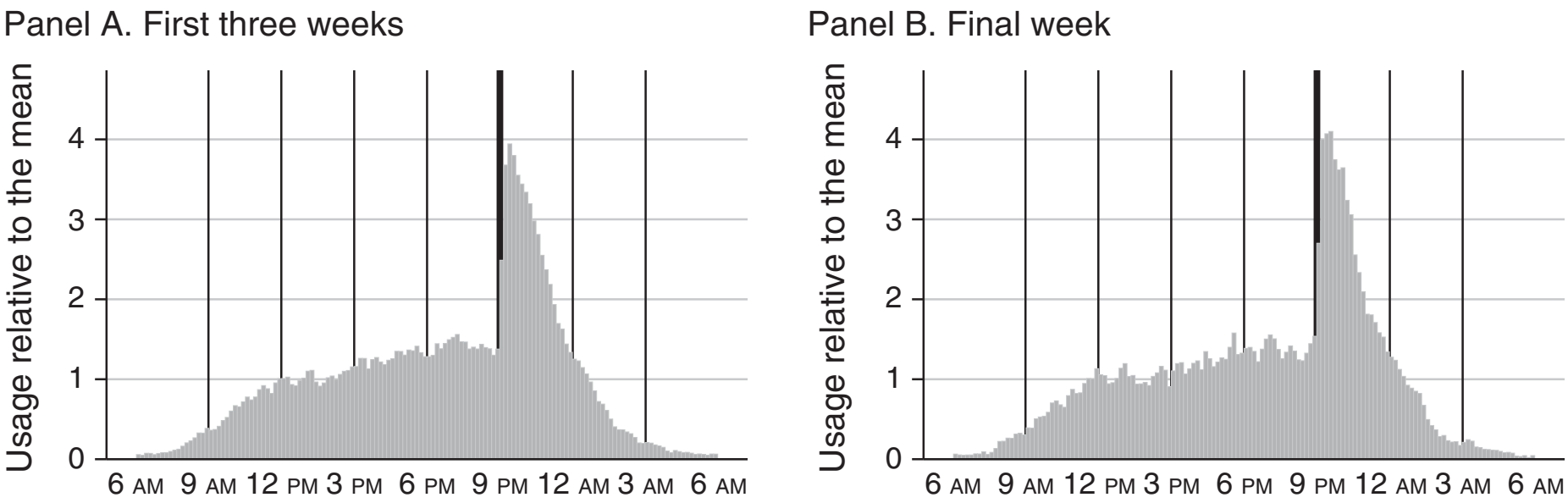


FIGURE 4. WEEKDAY USAGE PATTERNS IN MONTHS SUBSTANTIALLY BELOW ALLOWANCE

Fact 4: Average consumer could have saved money with a less convex or larger plan

TABLE 1—SAVINGS OPPORTUNITIES

Opportunity	(1)	(2)	(3)
Enrollment dates	10/02–8/03	9/03 onward	10/02–8/03
Enrollment change	plan 1–3 → plan 0	plan 1 → plan 2	plan 1 → plan 2
Affected customers	246 (34 percent)	437 (56 percent)	96 (14 percent)
Savings per affected bill	\$8.73	\$2.68	\$5.45

Notes: Savings opportunities indicate that consumers choose overly risky plans (overconfidence) predictably. Savings estimates are a lower bound because we cannot always distinguish in- and out-of-network calls.

Model

Model

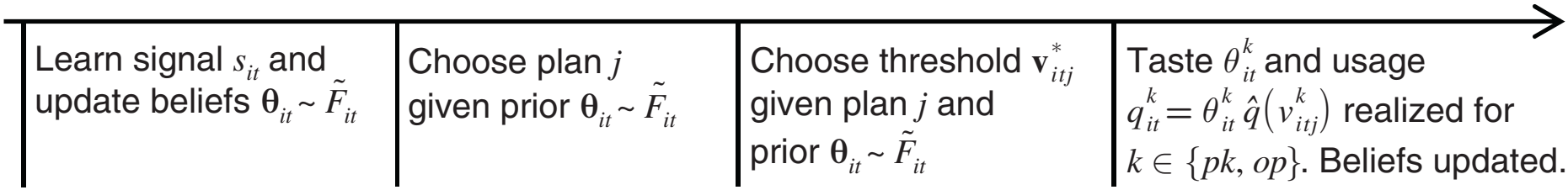


FIGURE 5. MODEL TIME LINE

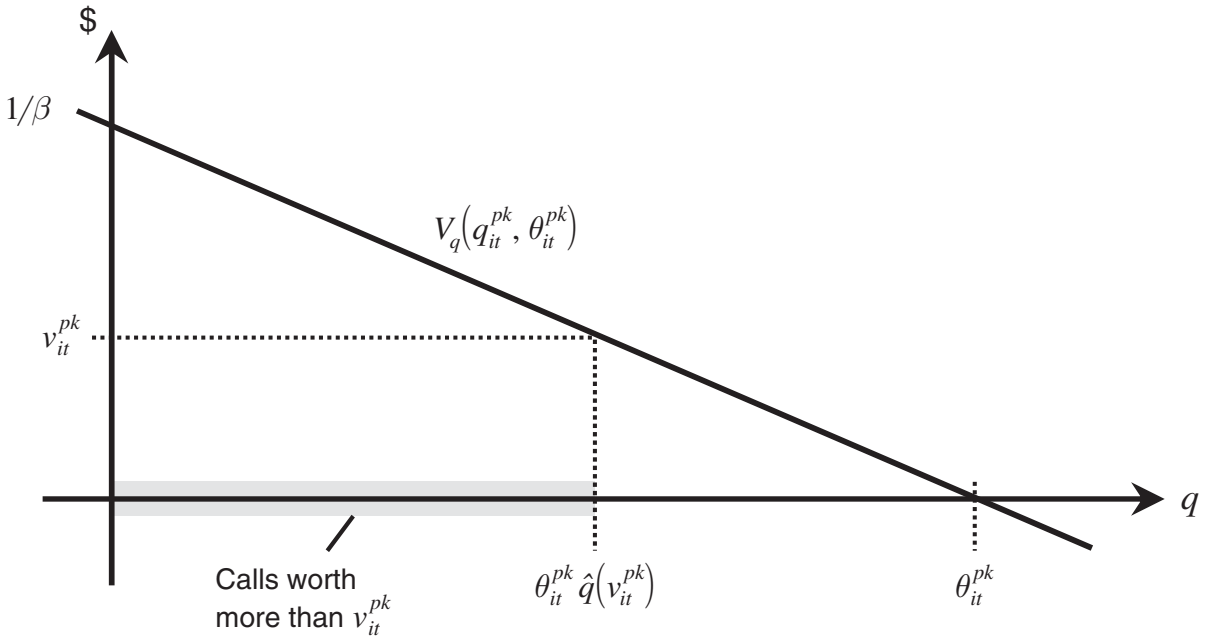


FIGURE 6. PEAK INVERSE DEMAND CURVE AND CALLING THRESHOLD

- Do not choose q
- Instead choose optimal threshold ν^*_{itj} and make calls of higher value

Bias

δ controls two kinds of overprecision:

- Peak consumption type μ_i^{pk}
- Monthly signals s_{it} and peak taste shocks ε_{it}^{pk}

- $\delta = 1$ if rational expectations, $\delta < 1$ if overprecision

Identification and Estimation

Identification and Estimation

Overview:

- Price sensitivity parameter β: assume call demand same from 9–0PM as 8–9PM, identify from Plan 0 ($0.11 on-peak, $0 off-peak)
  - Ignores storability of demand
- Beliefs about usage type and variance: initial plan choices
- Actual usage shock distribution: usage
- Estimate via Maximum Simulated Likelihood

Identification and Estimation

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Plan choice mistakes:

- Consumers chose overly risky plans
  - $\implies \hat{\delta} = 0.38$: consumers underestimate the variance of future calling demand by 62%
- Consumers chose overly "small" plans (too few included minutes)
  - $\implies \hat{b}_1 = -55$: consumers underestimate their average peak usage

Counterfactual Simulations

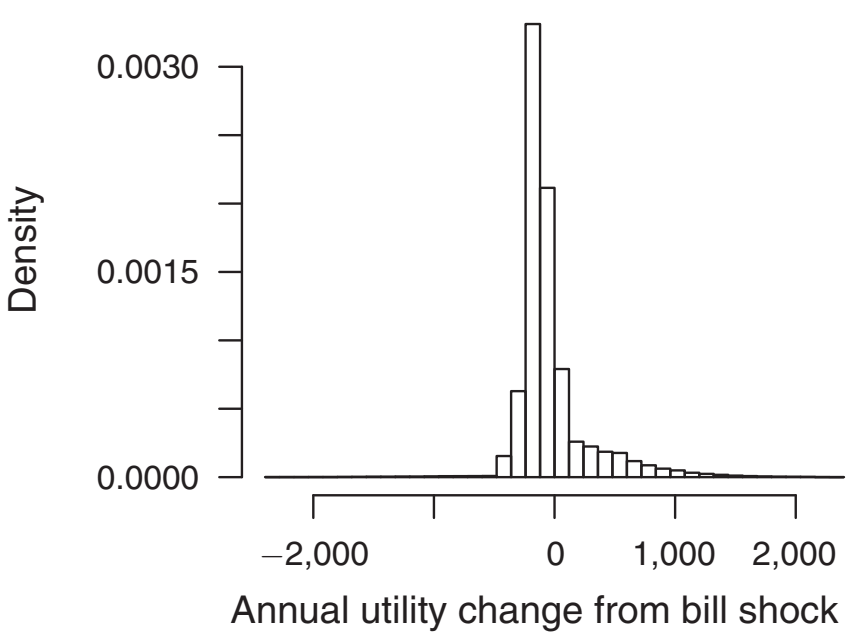
Counterfactual Simulations

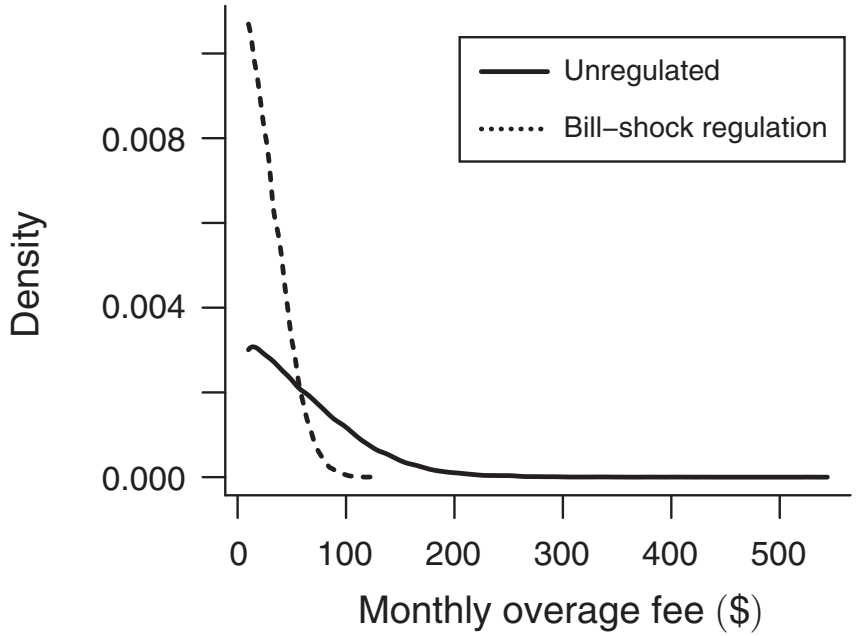
TABLE 5—EFFECT OF BILL-SHOCK REGULATION AND REMOVING BIASES WITH ENDOGENOUS PRICES

Biases:		Estimates	Estimates	Estimates	$\delta = 1$	No biases
Bill-shock regulation:		No	Yes (prices fixed)	Yes	No	No
		(1)	(2)	(3)	(4)	(5)
Plan 1	M	42.88	42.88	39.28	42.32	52.59
	Q	216	216	0	0	0
	p	0.50	0.50	0.17	0.13	0.07
	Share	39	43	26	42	37
Plan 2	M	48.64	48.64	50.66	70.63	69.41
	Q	383	383	80	∞	∞
	p	0.50	0.50	0.12	N/A	N/A
	Share	38	36	23	46	52
Plan 3	M	58.12	58.12	68.23		
	Q	623	623	540		
	p	0.50	0.50	0.12		
	Share	14	11	40		
Outside good share		10	10	12	11	11
Usage		240	199	239	262	288
Overage revenue		223	2	152	136	75
Annual profit		501	305	509	512	512
Annual consumer welfare		903	1,006	870	884	907
Annual total welfare		1,404	1,311	1,379	1,396	1,419
Δ annual profit			−196	7	11	11
Δ annual consumer welfare			103	−33	−19	4
Δ annual total welfare			−93	−26	−8	15

Notes: All welfare and profit numbers are expressed in dollars per customer per year. Because the counterfactuals in columns 4 and 5 produced two-part tariffs, bill-shock regulation has no additional effect. We simulate 10,000 consumers for 12 months.

Distributional consequences of bill-shock regulation





- Perhaps fairness benefits may outweigh the modeled average loss?

Grubb and Osborne (2015): Conclusions

- Assumptions and limitations:
  - Selected sample and early time period
  - Parametric model of learning, belief bias etc.
  - Binding, exogenous \$0.50/minute bound on overage rates
  - Myopic plan choice and static usage demand

- But the basic economics are clear:
  - Firms respond endogenously when consumers are debiased
  - Reduce exploitative overage fees, but offset through higher monthly charges and/or reduced minute allowances
  - Unintended consequences: substitution to outside option

Thank you!

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