Deciding when 'Pay What You Want' Pricing is Profitable

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The Radiohead Story

- Radiohead posted their new album, *In Rainbows*, on their website.
- Visitors were encouraged to pay whatever price they wanted.
- This is not the same as offering the product for free or zero price.

Survey of Radiohead Customers, n=5,000

(Source: http://www.whatpricedidyouchoose.com/survey_results)

	Price, £	Frequency	Percent	Cumulative %
1	0	1,260	25.20%	25.20%
2	5	682	13.64%	38.84%
3	40*	667	13.34%	52.18%
4	1	308	6.16%	58.34%
5	10	242	4.84%	63.18%
6	3	192	3.84%	67.02%
7	2	179	3.58%	70.60%
8	0.01	169	3.38%	73.98%
9	4	156	3.12%	77.10%
10	8	92	1.84%	78.94%

*- these customers got a CD set in addition to the free download.

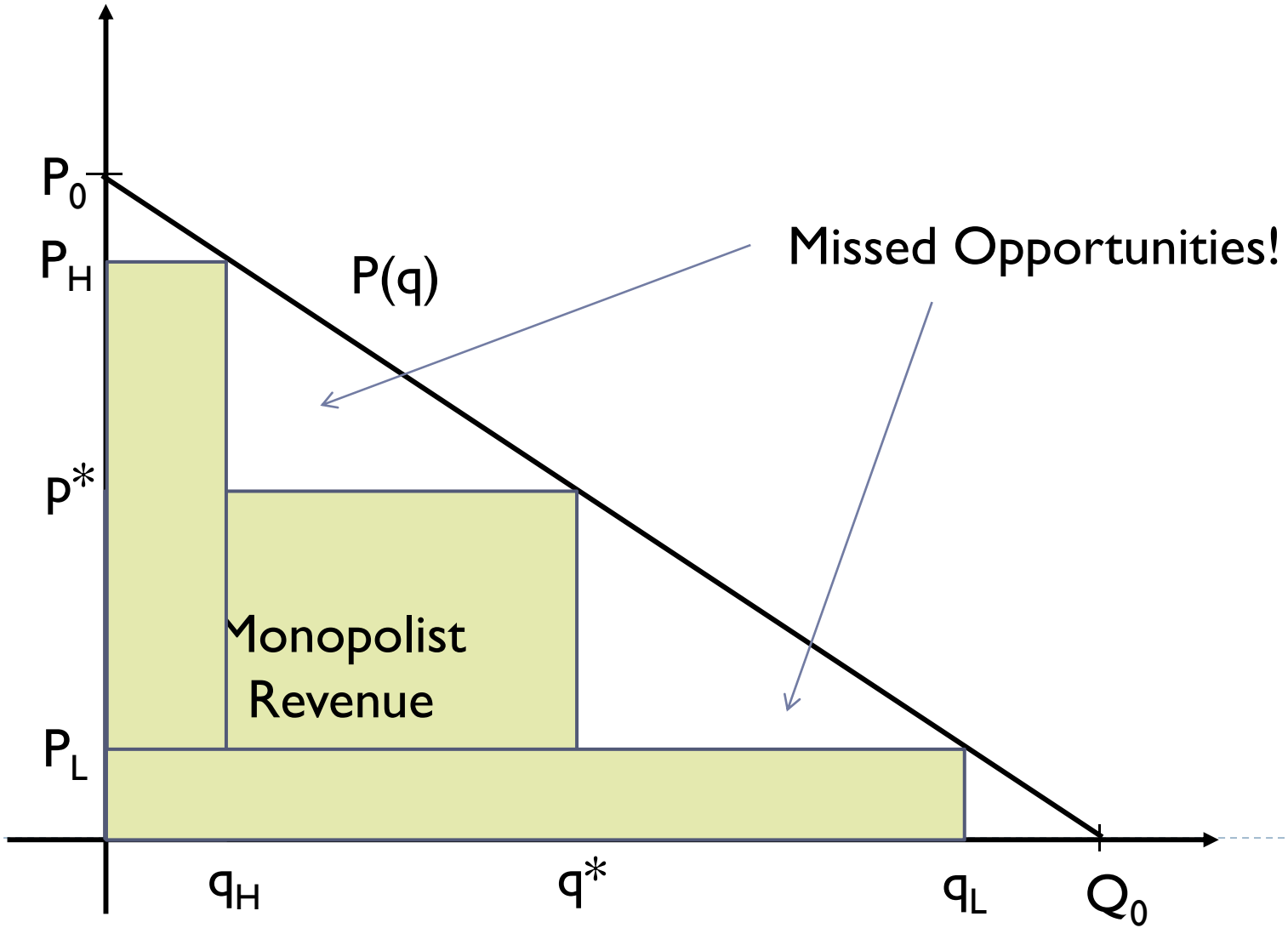
Related Examples to Voluntary Pricing

- Terra Bite (coffee shop in Kirkland, WA)
- WindowsSecrets.com
- Donations to not-for-profit organizations
- Tipping
- *Freakonomics* "Bagel guy"

Brief Literature Review

- Hansmann 1980, 1981, 1987
- Cornelli 1997
- Kim, Natter and Spann, 2008
  - Three field experiments (buffet, cinema ticket, hot beverages) involving a switch to voluntary pricing.
  - Price paid goes down, but low free riding rates reported.
  - Behavior driven by fairness, satisfaction and price consciousness.

Conventional Pricing



The Model: Demand

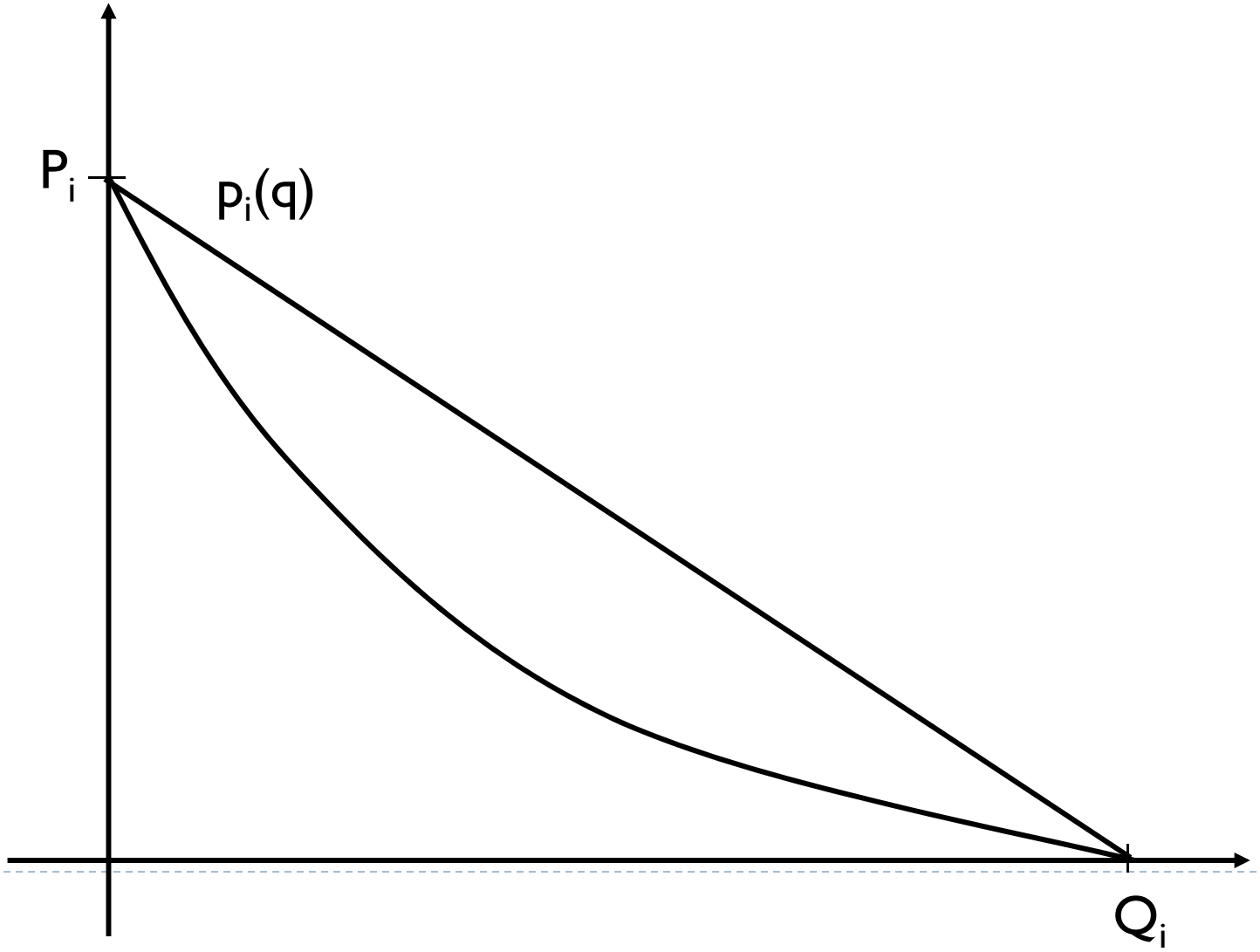
- $P_i > 0$ denotes the reservation price of a customer of type i.
- $Q_i > 0$ denotes the maximum number of units purchased by the group of customers of type i.
- K denotes the number of different types of potential customers.

The Model: Demand

The indirect demand function for a customer of type i is $p_i : [0, Q_i] \longrightarrow [0, P_i]$ and satisfies:

- p_i is continuous
- p_i is concave
- p_i is monotone decreasing
- $p_i(0) = P_i$
- $p_i(Q_i) = 0$

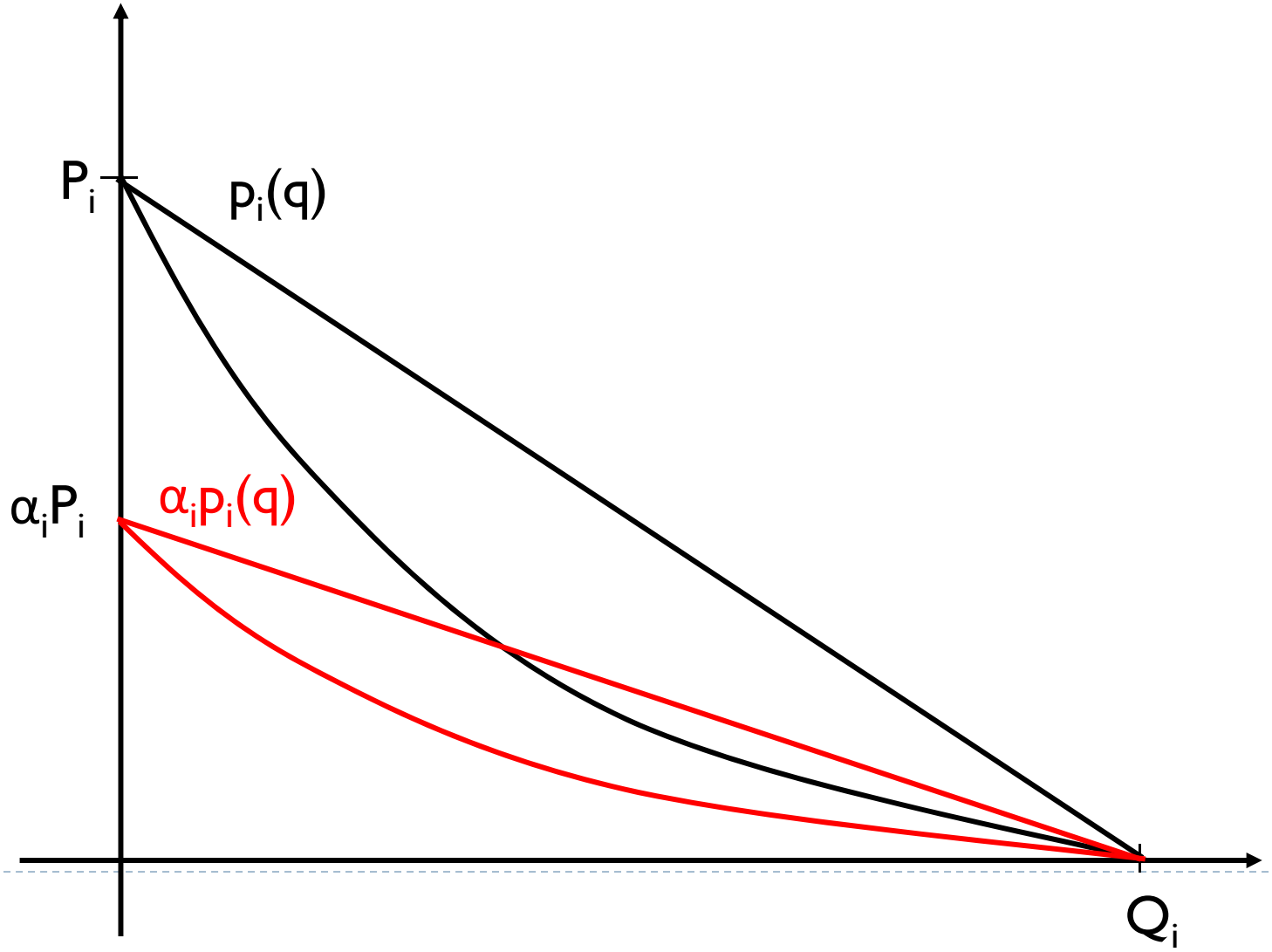
The Model: Demand



Propensity to Donate

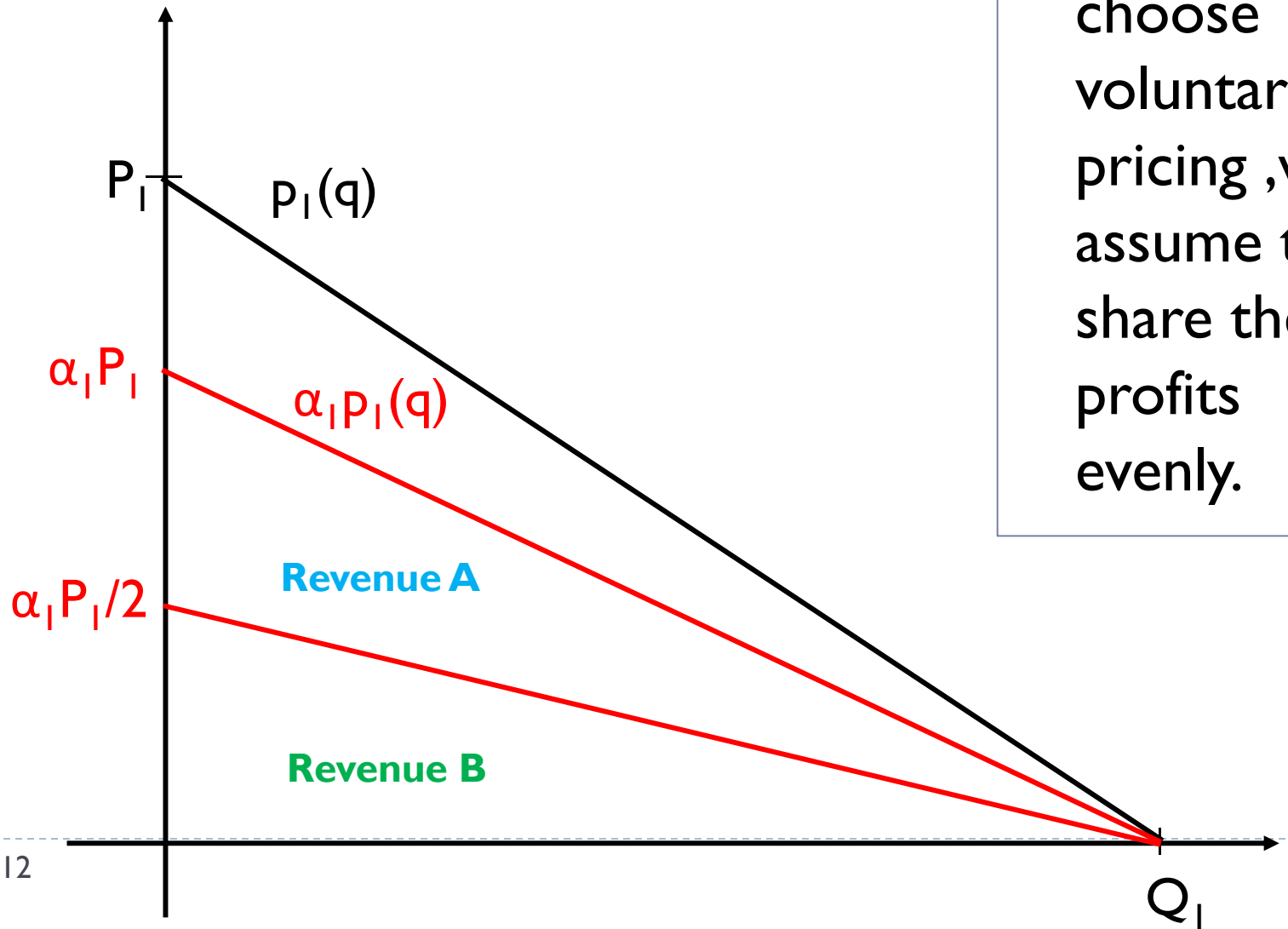
- Assume homogeneous customers.
- Let $0 \leq \alpha \leq 1$ denotes the propensity to donate of a typical customer.
- In other words, when customers are allowed to voluntarily determine the price, they will choose a fraction α of their willingness to pay.

The Model: Demand



(Voluntary, Voluntary)

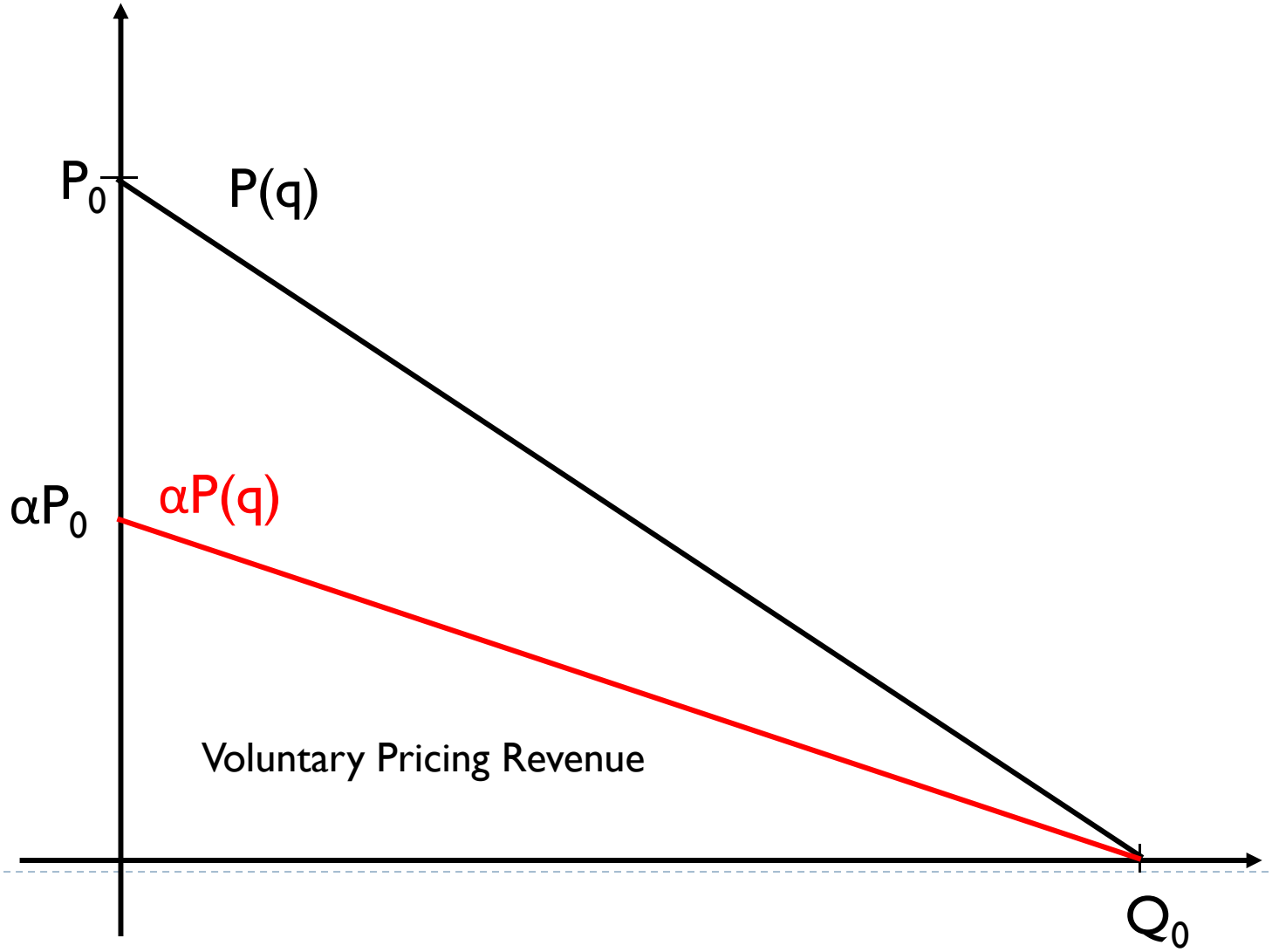
If both firms choose voluntary pricing ,we assume they share the profits evenly.



The Model: Supply

- Supply is given by a monopolist with zero marginal cost.
- The firm is interested in comparing the revenue generated by conventional pricing against voluntary pricing.
- Under conventional pricing, the seller sets a unique price in a poster offer market.

Propensity to Donate



First Results

Proposition 1 *Let $K = 1$ so that all agents are of the same type. If $\alpha \geq \frac{1}{2}$ then conventional monopoly pricing generates less than or equal revenue compared to voluntary pricing. Equality is only achieved when $P(q)$ is linear and $\alpha = \frac{1}{2}$.*

- If α is large enough, voluntary pricing outperforms conventional pricing.
- The monopolist chooses voluntary pricing not out of altruistic reasons, but seeking to maximize revenue.
- A convex demand curve strengthens the result.

Average Propensity to Donate

- Customers will differ with respect to propensities to donate.
- We would like to say that if the "average" propensity to donate α is big enough, then voluntary pricing still outperforms conventional pricing.

Proposition 2 *If* $\bar{\alpha} \geq \frac{1}{2}$ *then third degree price discrimination (and thus conventional pricing) generates less than or equal revenue compared to voluntary pricing. Equality is only achieved when* $P_i(q)$ *is linear for any* i *and* $\bar{\alpha} = \frac{1}{2}$.

Proposition 2

Define ψ_i, segment i's market share as

$$\psi_i = \frac{\int_0^{Q_i} P_i(q)\, dq}{\sum_{j=1}^{K} \int_0^{Q_j} P_j(q)\, dq}$$

Define $\bar{\alpha}$, the weighted average propensity to donate as

$$\bar{\alpha} = \sum_{i=1}^{K} \psi_i \alpha_i$$

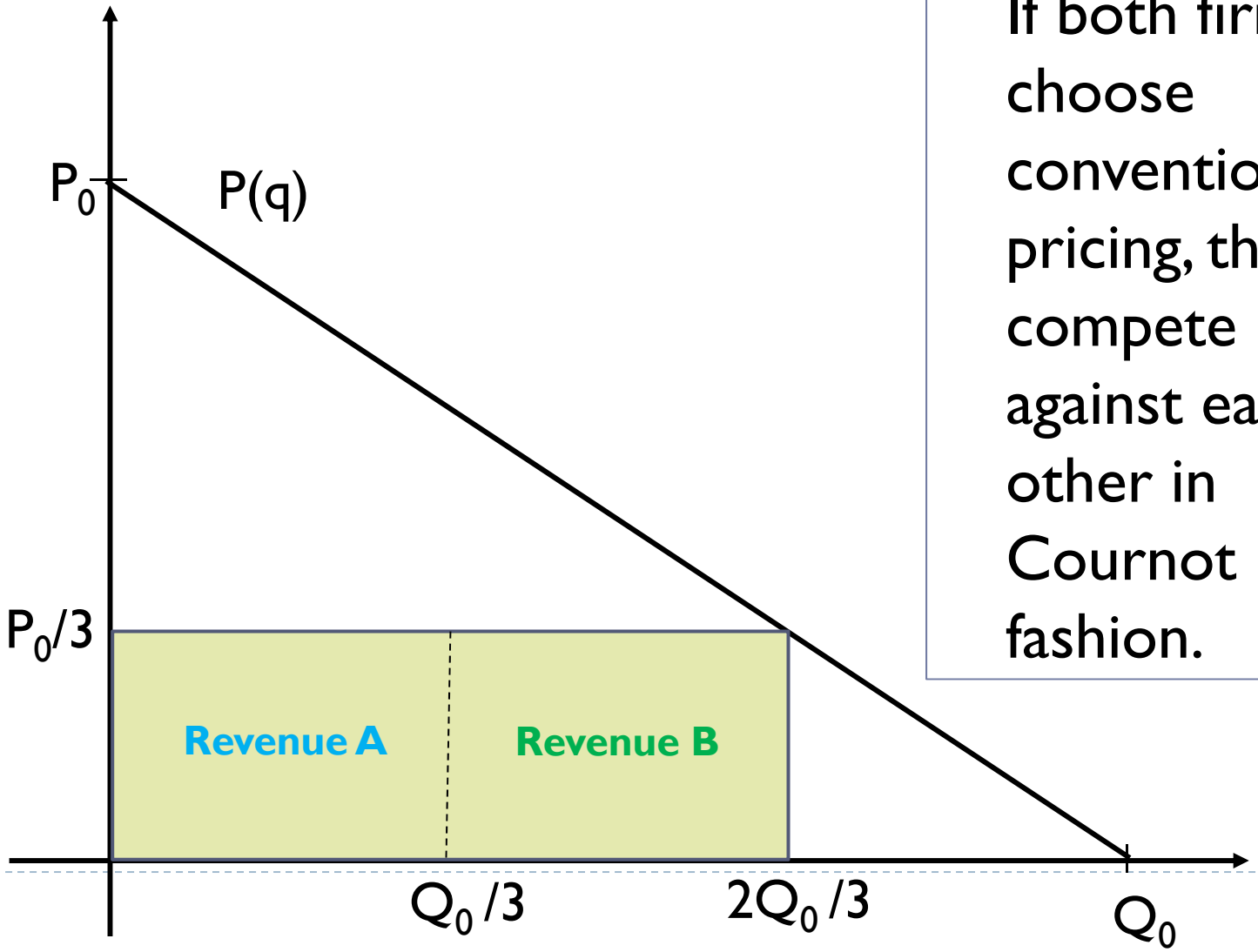
Duopoly

- Each firm decides to engage in either voluntary or conventional pricing.
- What are the payoffs to such game?
- Without loss of generality, assume $P_0Q_0 = 2$, so the potential revenue obtainable from this market is 1.

Two Firms

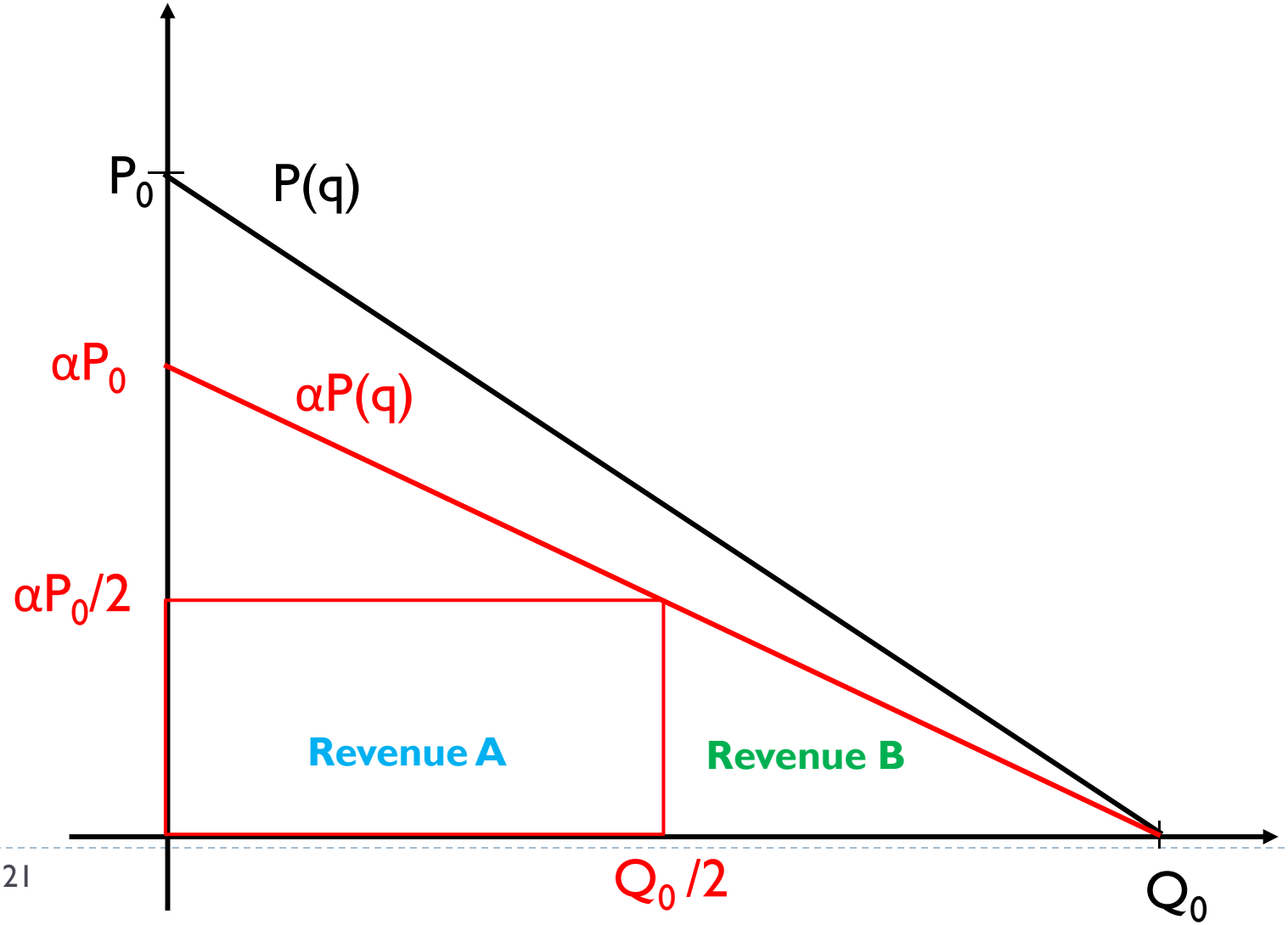
FIRM A \ FIRM B	Conventional Pricing	Voluntary Pricing
Conventional Pricing	(? , ?)	(? , ?)
Voluntary Pricing	(? , ?)	(? , ?)

(Conventional, Conventional)



If both firms choose conventional pricing, they compete against each other in Cournot fashion.

(Conventional, Voluntary)



Two Firms

FIRM A \ FIRM B	Conventional Pricing	Voluntary Pricing
Conventional Pricing	(2/9 , 2/9)	(α/2 , α/4)
Voluntary Pricing	(α/4 , α/2)	(α/2 , α/2)

Equilibria with Two Firms

Proposition 3 *When two firms play the game described above:*

- $(Voluntary, Voluntary)$ *is always a Nash equilibrium and, if* $\alpha > \frac{8}{9}$ *then* $(Voluntary, Voluntary)$ *is the unique Nash equilibrium.*
- *If* $\alpha \leq \frac{8}{9}$ *then* $(Conventional, Conventional)$ *is also a Nash equilibrium.*
- *If* $\alpha > \frac{4}{9}$ *then* $(Voluntary, Voluntary)$ *is a Pareto-optimal outcome.*

Payoffs with n Firms

$n \setminus k$	0	1	2	$\cdots$	k
1	$\frac{1}{2}$, N.A.	N.A., α			
2	$\frac{2}{9}$, N.A.	$\frac{\alpha}{2}, \frac{\alpha}{4}$	N.A., $\frac{\alpha}{2}$		
3	$\frac{1}{8}$, N.A.	$\frac{2\alpha}{9}, \frac{\alpha}{9}$	$\frac{\alpha}{2}, \frac{\alpha}{8}$		
. . .	. . .	. . .	. . .	. . .	. . .
n	$\frac{2}{(n+1)^2}$, N.A.	$\frac{2\alpha}{n^2}, \frac{\alpha}{n^2}$	$\frac{2\alpha}{(n-1)^2}, \frac{\alpha}{2(n-1)^2}$	$\cdots$	$\frac{2\alpha}{(n-k+1)^2}, \frac{\alpha}{k(n-k+1)^2}$

n Firms

- Each of n firms decides to engage in either voluntary or conventional pricing.
- Each firm decides to engage in either voluntary or conventional pricing.
- What are the payoffs to such game?
- Let k be the number of firms that choose voluntary pricing.

Payoffs with n Firms

Proposition 4 *Assume n identical firms play the game described above and k of them choose voluntary pricing. If $k = 0$ then the payoff to each firm is*

$$\frac{2}{(n+1)^2}.$$

If $k > 0$ then the payoff to each of the $n - k$ firms pricing conventionally is

$$\frac{2\alpha}{(n-k+1)^2}$$

and the payoff to each of the k firms choosing voluntary pricing is

$$\frac{\alpha}{k(n-k+1)^2}.$$

Equilibria with n Firms

Proposition 5 *When n firms play the game described above:*

- *If* $n > 2$ *and* $\alpha \in [0, 1]$, $(Voluntary, \ldots, Voluntary)$ *is never a Nash equilibrium.*
- *If* $n > 2$ *and* $\alpha \in [0, 1]$, $(Conventional, \ldots, Conventional)$ *is always a Nash equilibrium.*
- *If* $\alpha > \frac{2n}{(n+1)^2}$ *then* $(Voluntary, \ldots, Voluntary)$ *is a Pareto-improvement over the conventional equilibrium.*

When will voluntary pricing work?

- Works well for digital products.
  - Marginal cost = 0
  - No supply constraints
  - Long tail demand
- Of course, if α is high.

When is alpha high?

- Share of budget
- Economic conditions
- Cultural norms

Advantages of Voluntary Pricing

- Firms
  - Discloses information.
  - If α is high enough, it generates more revenue.
  - Disposes of infrastructure costs (e.g., cash register at restaurant).
- Consumers
  - Increased economic efficiency.

Other Examples of Voluntary Pricing.

- Terra Bite (coffee shop in Kirkland, WA)
  - "When Terra Bite Lounge opened this year in downtown Kirkland with its voluntary-pay system, cynics predicted it wouldn't work — people won't pay more than they have to, they said. Terra Bite now gets about 200 customers per day, founder Ervin Peretz said, and freeloaders are few."
  - (http://seattletimes.nwsource.com/html/eastsidenews/2004099291_yearendeast30m.html)

Other Examples of Voluntary Pricing.

- WindowsSecrets.com (get content for free or choose a subscription amount)
  - "If they're at the point where they're going to give us any money at all, they really want us to succeed," Livingston said. "They want the newsletter to keep going. They want us to be able to pay for good writers who can dig up information for them."
  - (http://www.techflash.com/microsoft/Windows_Secrets_finds_formula_for_survival_Pay_what_you_want_40822717.html)

Brief Literature Review

- Kim, Ju-Young, Martin Natter and Martin Spann (2008), "Pay-What-You-Want – A New Participative Pricing Mechanism", *Journal of Marketing*.
  - Reports on three field experiments (buffet, cinema ticket, hot beverages) involving a switch to voluntary pricing.
  - Price paid goes down, but low free riding rates reported.
  - Behavior driven by fairness, satisfaction and price consciousness.

- Cornelli 1997, Journal of Economic Theory paper

Questions? Comments?