School of Business, Economics and Law
GÖTEBORG UNIVERSITY

Price Discrimination & Screening

Johan Stennek

TELIA

Abonnemang

Vad vill du med din mobil; surfa, messa eller prata? Vi har mobilabonnemanget som passar oavsett om du är storpratare, surfare eller kung på sms.

	Telia Mobil Prata på	Telia Mobil Till vänner	Telia Mobil Komplett	Telia Mobil Max 25	Telia Mobil Full koll
Sommarpris:	29 kr/mån året ut	29 kr/mån året ut	699 kr/mån	29 kr/mån året ut	49/189 kr/mån
Surf ingår:	Ja	Ja	Ja	Ja	Nej
Ordinarie pris:	49 kr/mån	49 kr/mån	699 kr/mån	49 kr/mån	49/189 kr/mån
Samtal till Telias mobilabonnemang:	0,29 kr	0 kr	0 kr	0 kr	0,69 kr
Samtal till övriga mobilabonemang:	0,29 kr	0,69 kr	0 kr	0,49 kr	0,69 kr
Samtal till fasta nätet:	0,29 kr	0,69 kr	0 kr	0,49 kr	0,69 kr
Öppningsavgift alla samtal:	0,79 kr	0,69 kr	0 kr	0,99 kr	0,99 kr
Sms:	0,29 kr	0,69 kr	0 kr	0 kr	0,69/0 kr
Mms:	1,99 kr	1,99 kr	0 kr	1,69 kr	1,99 kr

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Telia

- Summary

	Prata på	Komplett
Monthly fee	50	700
Per 2-minute call	1.40	0

- Features
  – Telia offers *menu* of pricing plans
  – Each plan has *two parts*: fixed fee + usage fees

Telia

- Why two types of complexity?
  - Why both monthly fee and usage price?
  - Why menu?

Recall monopolist's dilemma

- Monopolist's dilemma
  - To sell more, the monopolist must lower the price on infra-marginal units
- As a result
  - Consumers surplus (infra-marginal units)
  - Dead-weight loss (extra-marginal units)
- Is it possible to capture CS & DWL?

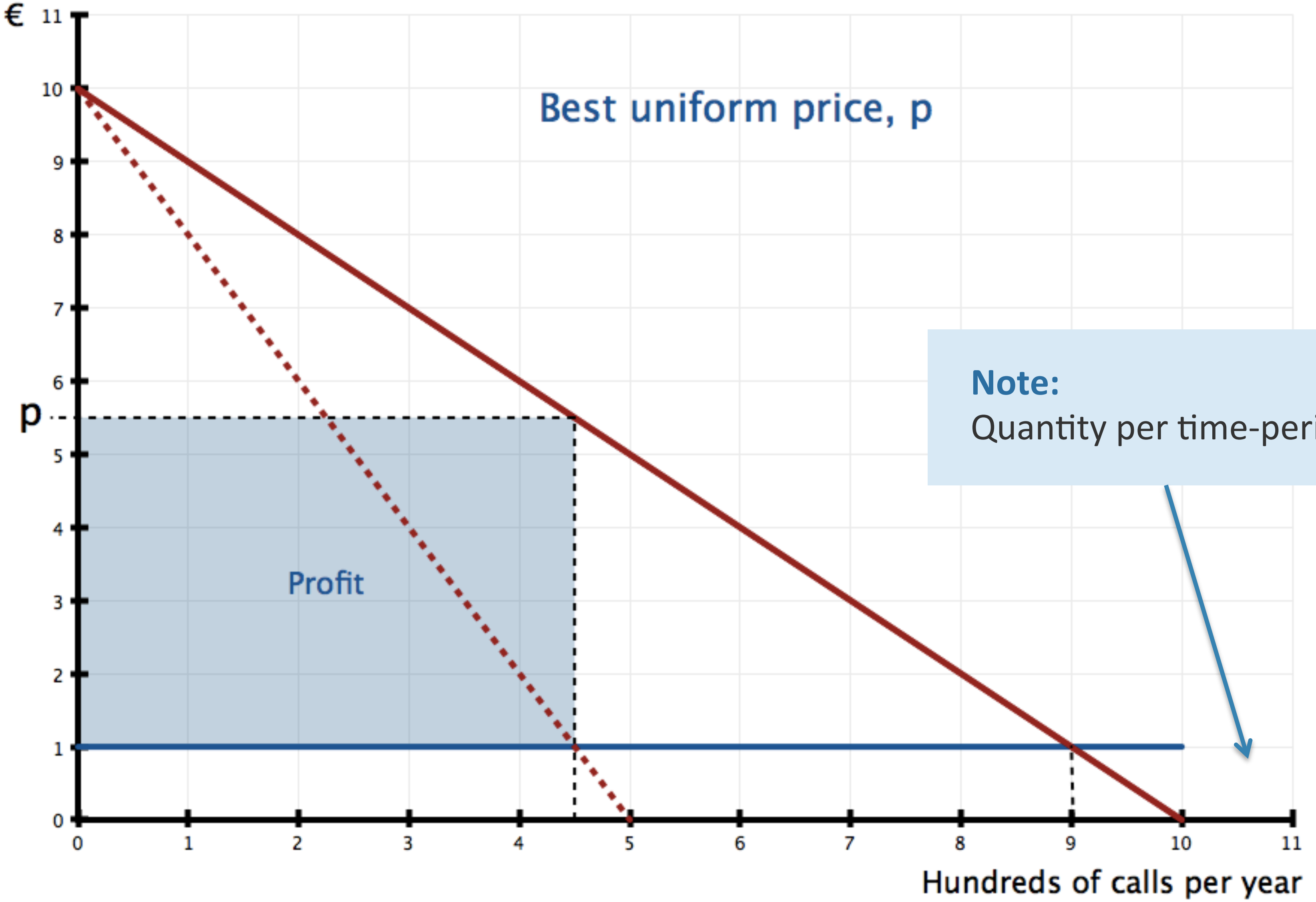
Two-Part Tariffs

(no menu)

Two-Part Tariffs

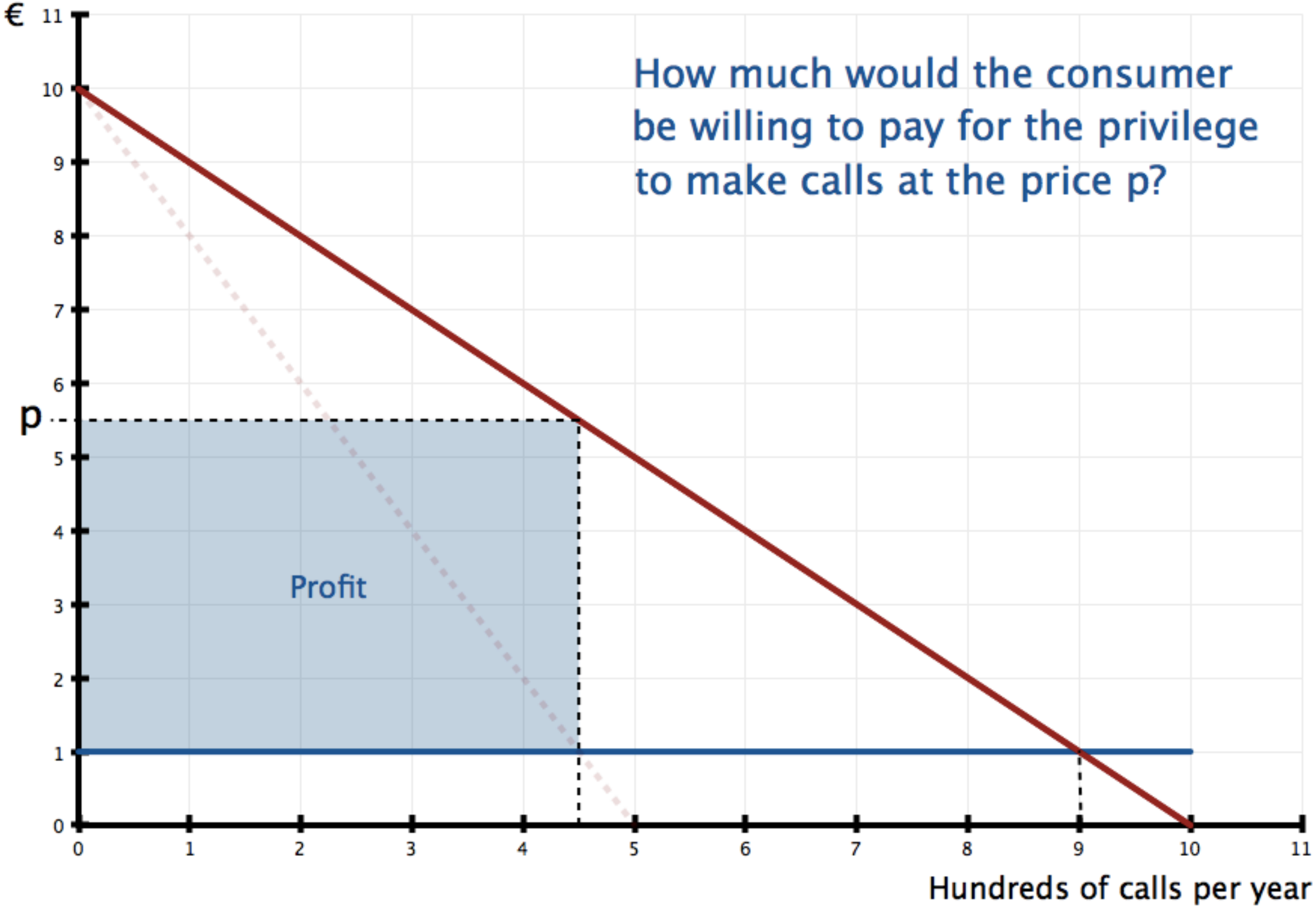
- Two-part tariff
  - p = price per unit
  - F = fixed fee
- Simplifications
  - All consumers identical
  - Constant marginal cost

Two-part tariffs

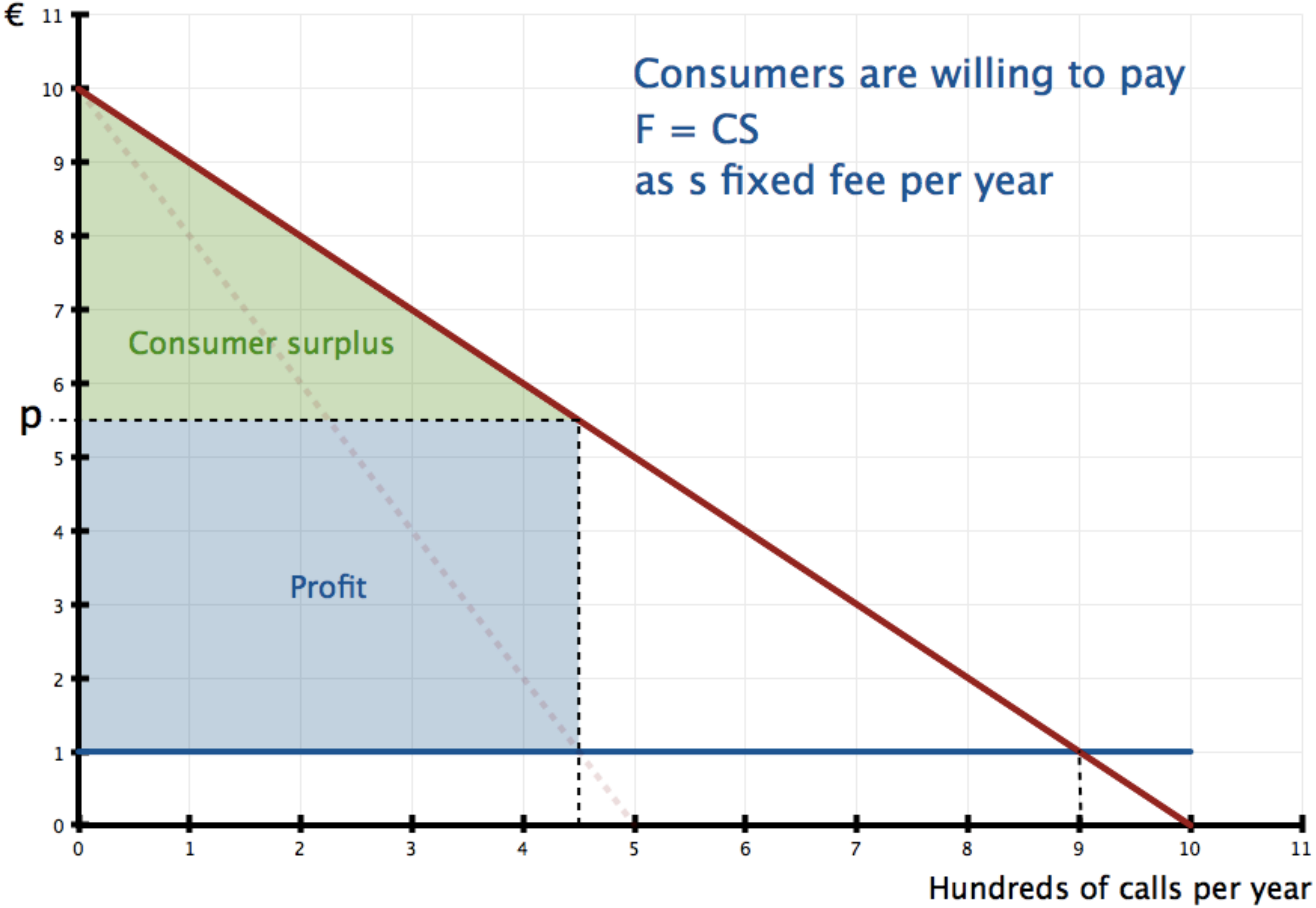


Note:
Quantity per time-period

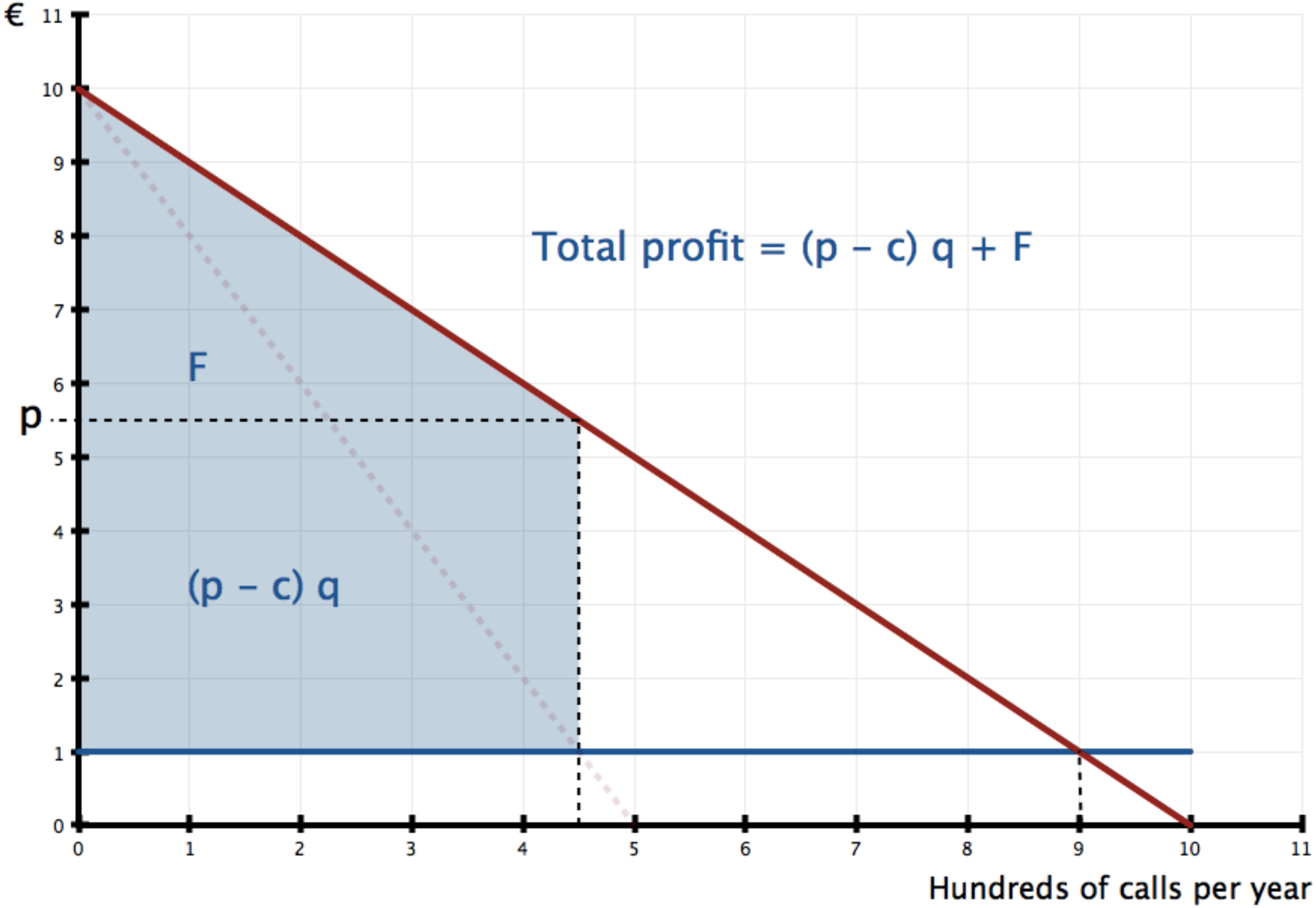
Two-part tariffs



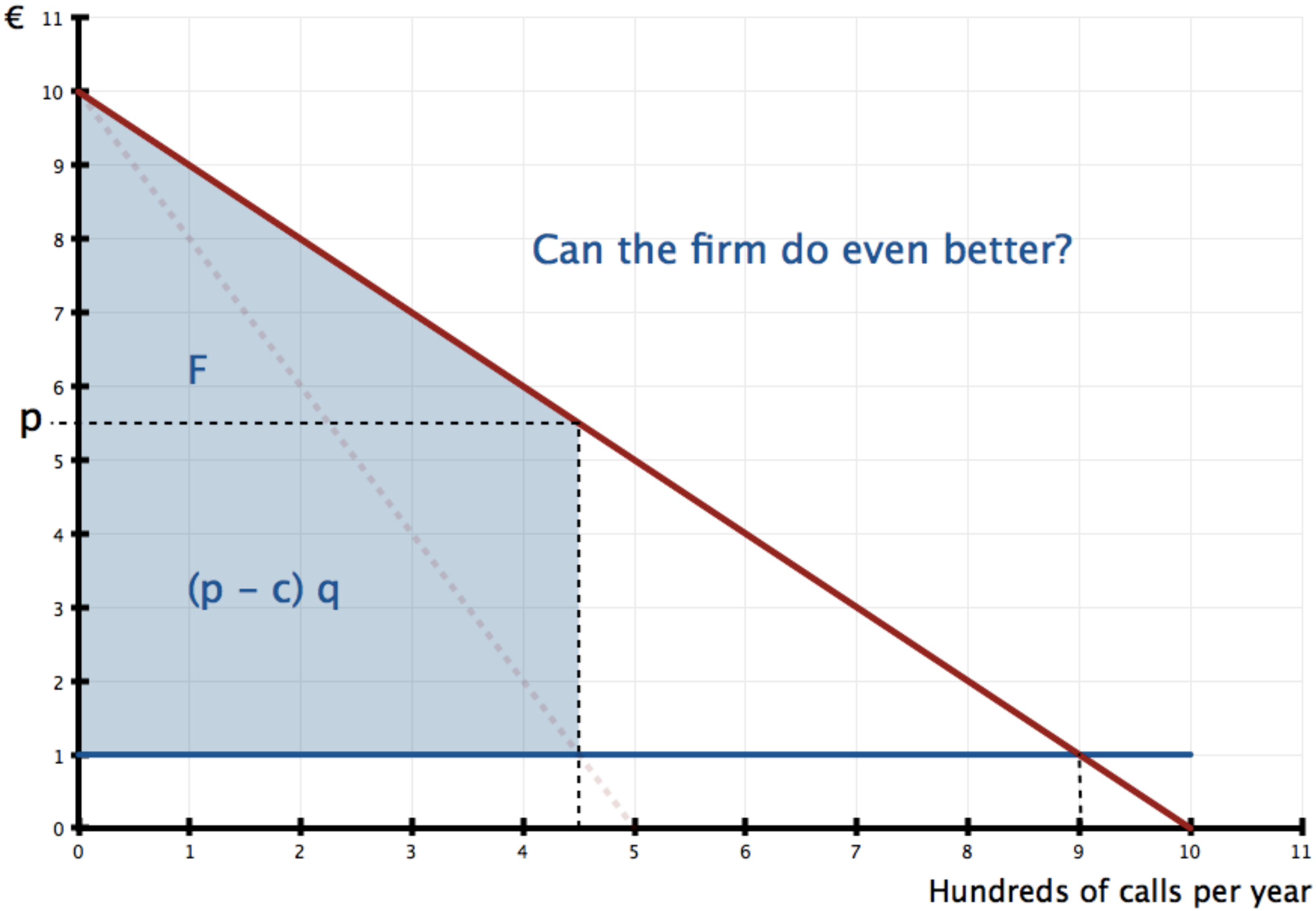
Two-part tariffs



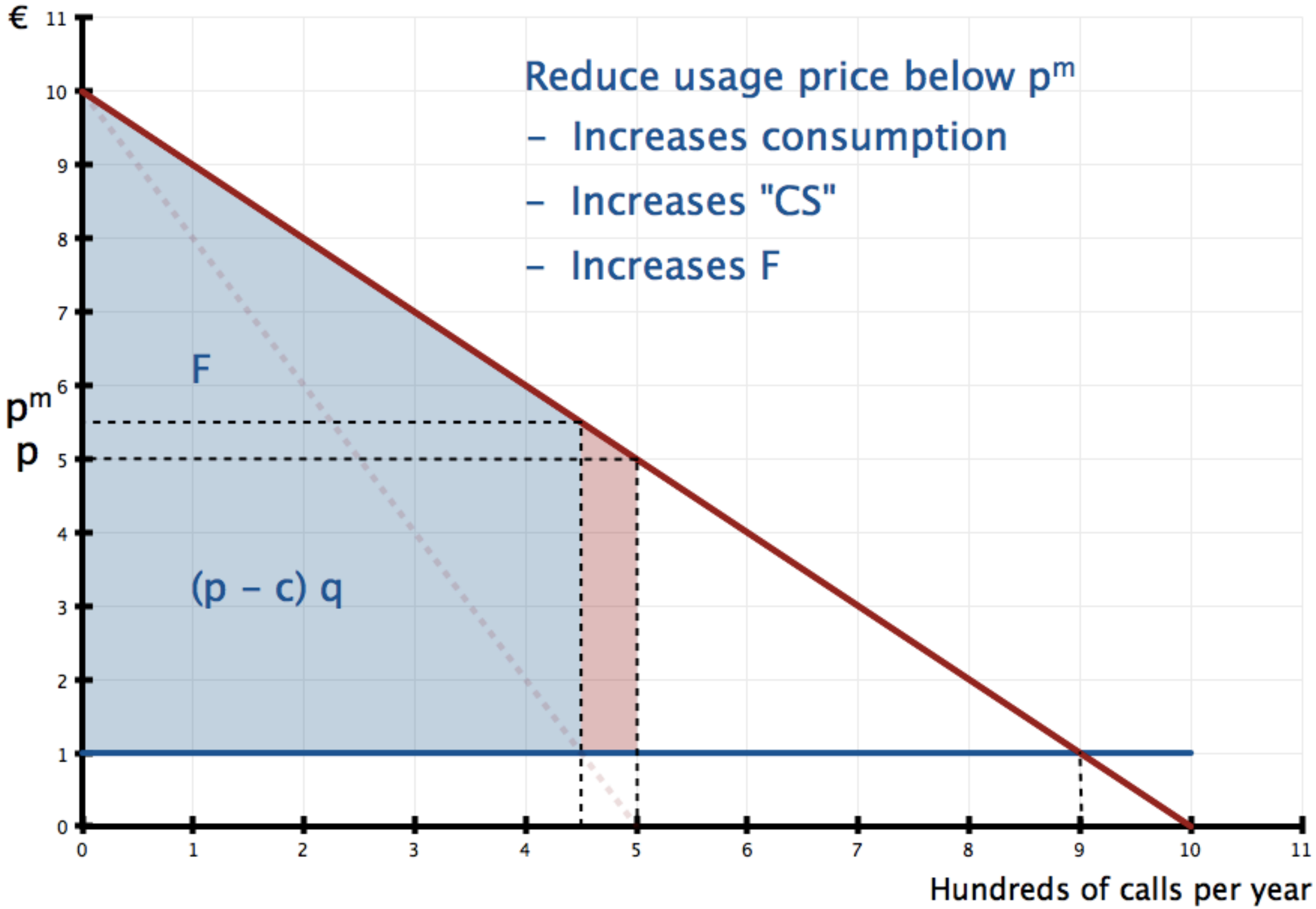
Two-part tariffs



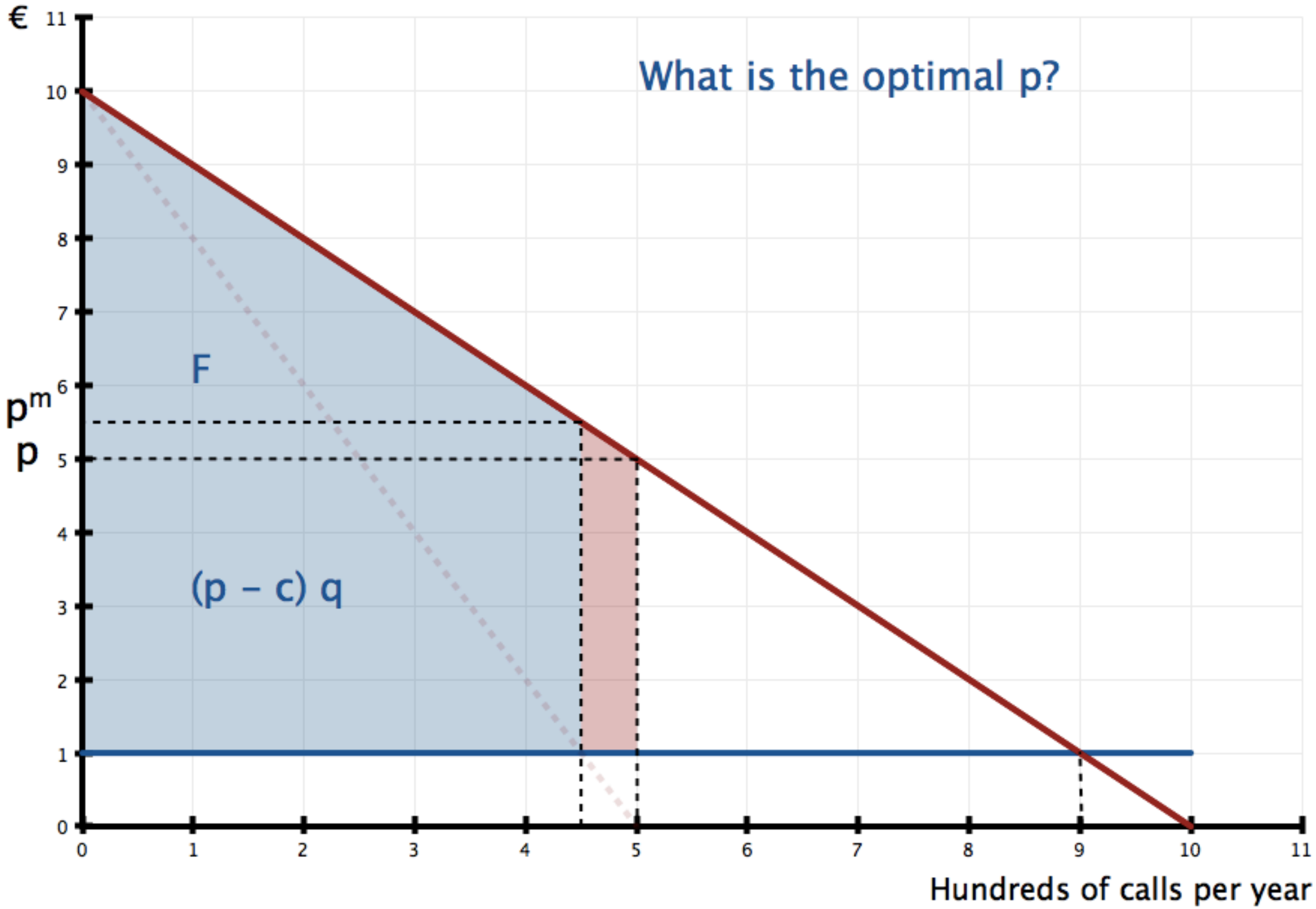
Two-part tariffs



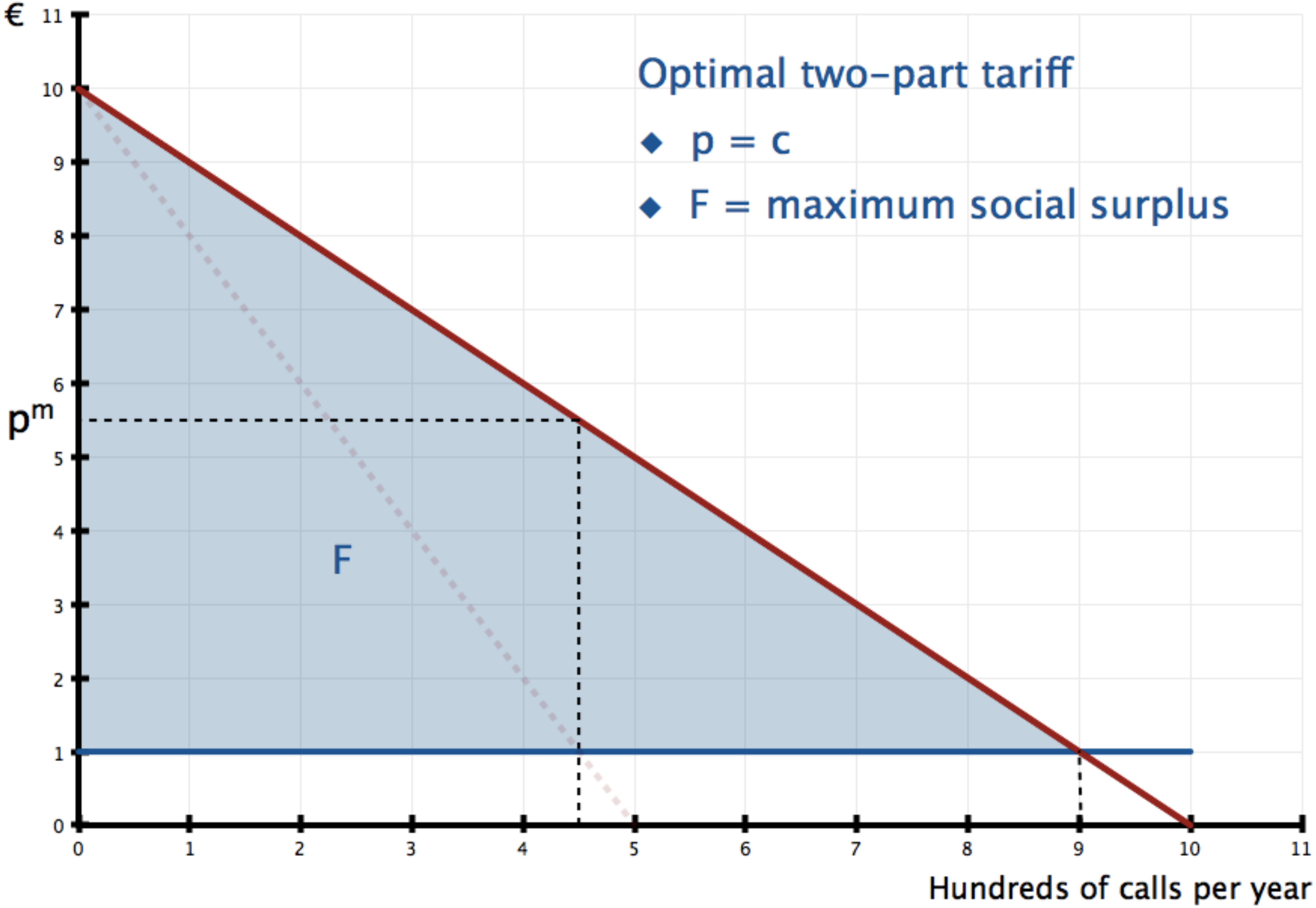
Two-part tariffs



Two-part tariffs



Two-part tariffs

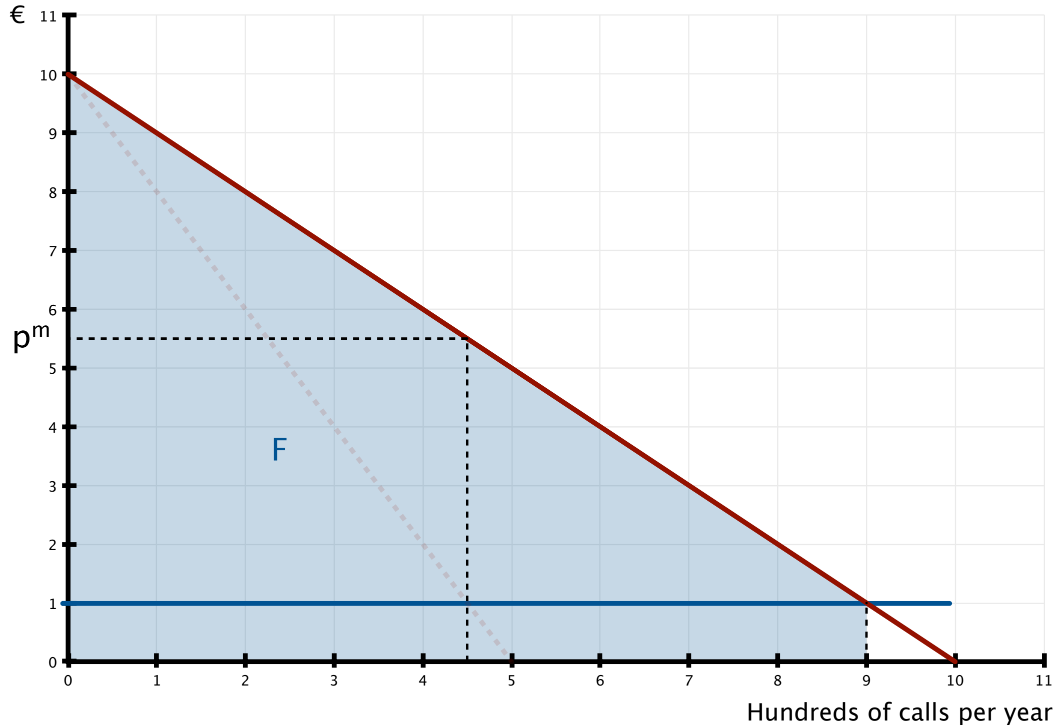


Two-Part Tariffs

- Conclusions
  - $p = c \Rightarrow$ Monopolist induces Pareto efficient Q (maximizes social surplus)
  - $F = CS \Rightarrow$ Monopolist takes the whole surplus

Two-Part Tariffs

- Alternative way to implement: Sell a "package"
  – Sell Q^* at F = Gross CS



Formal derivation
(not compulsory)

Consider market with demand

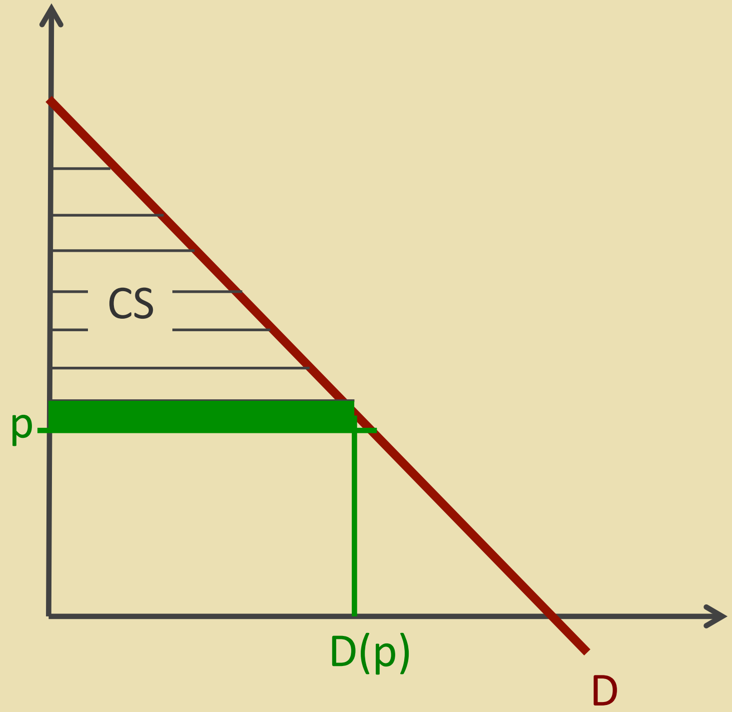
$$D(p)$$

Recall: Consumers' surplus (absent fixed fee)

$$CS(p) = \int_p^\infty D(z) \cdot dz$$

Recall: Derivative with respect to limit of integration

$$\frac{dCS(p)}{dp} = -D(p)$$



Note that a small increase in price removes a part of the “CS-area” which is given by the demand at that price dCS = - dp·D(p)

Formal derivation
(not compulsory)

Profit as function of two-part tariff

$$\pi(p,F) = p \cdot D(p) + F - c \cdot D(p)$$

Recall that optimal fixed fee should be equal to consumers' surplus

$$F = \int_p^\infty D(z) \cdot dz$$

Rewrite profit as function of usage fee only

$$\pi(p) = p \cdot D(p) + \int_p^\infty D(z) \cdot dz - c \cdot D(p)$$

First-order condition for usage fee

$$\frac{d\pi(p)}{dp} = D(p) + p \cdot D_p(p) - D(p) - c \cdot D_p(p) = 0$$

Recall rules for taking derivatives with respect to limits of integration

Rearrange

$$\frac{d\pi(p)}{dp} = [p - c] \cdot D_p(p) = 0 \qquad \Rightarrow p = c$$

Two-Part Tariffs

- Q: Real-world examples of two-part tariffs?
  - Telecom
    - High monthly fee
    - Low price on calls
  - Amusement parks
    - High entry fee
    - Low price per ride
- Similar
  - Apple
    - Small profit on songs (iTunes)
    - High profit on iPods
  - Restaurants
    - Buffet: High entry fee & Eat as much as you want
    - A la carte: High usage fee

Two-Part Tariffs

- Q: What conditions must be fulfilled in order for the firm to use a two-part tariff?
  - No arbitrage

Two-Part Tariffs

- Q: What would happen if consumers are different?
  - Still want to set usage fee = marginal cost
  - Need different F for different consumers to extract full surplus (= 1st degree PD)
  - Needs information on individual demand
  - Need to be able to tell who is who

Menus

Menus

- Firm's problem
  - Different people have different WTP (= demand)
  - Firm cannot tell who is who

Menus

- Solution: Screening (Self-selection)
  - Design different "contracts" for different types
  - Let consumers choose
  - Will reveal who they are
- Restrictions
  - Must make sure people want to buy
  - Must make sure people have incentives to choose *their* contract

Example

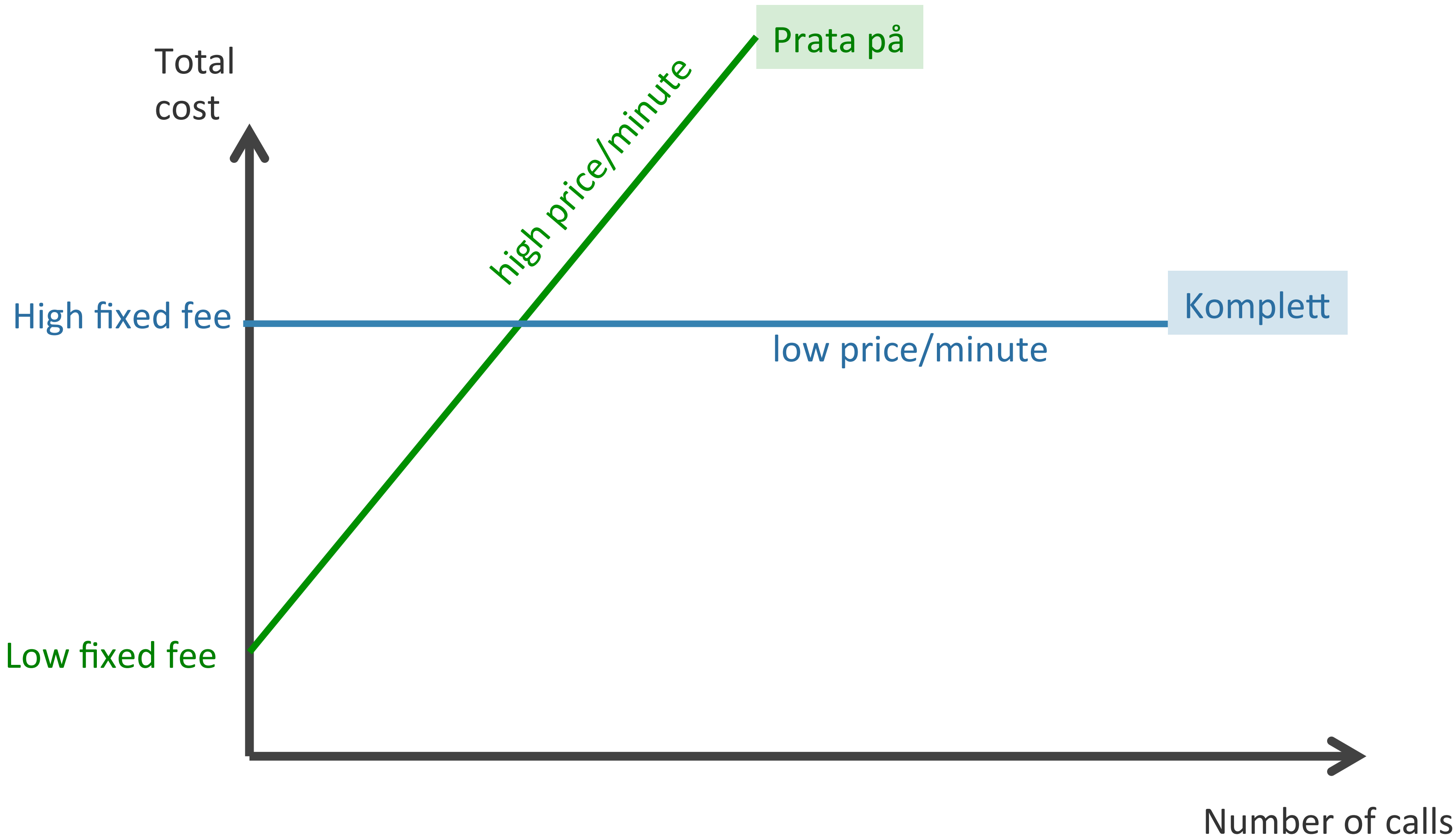
Telia

- Menu of two-part tariffs

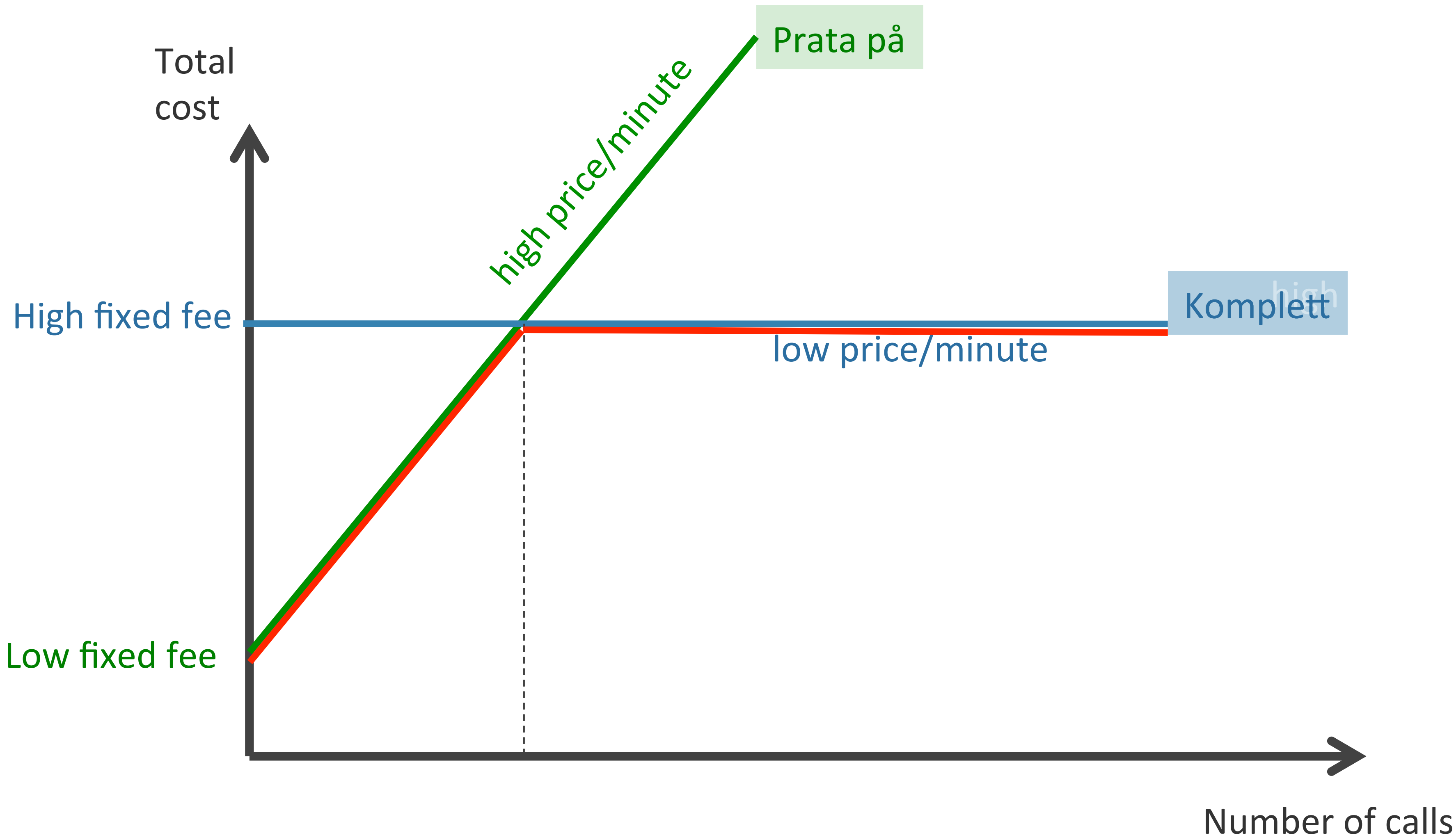
	Prata på	Komplett
Monthly fee	50	700
Per 2-minute call	1.40	0

- Exercise: Sketch the two menus in diagram
  - X-axis: Number of calls
  - Y-axis: Total cost

Telia


Total
cost
Prata på
high price/minute
High fixed fee
Komplett
low price/minute
Low fixed fee
Number of calls

Telia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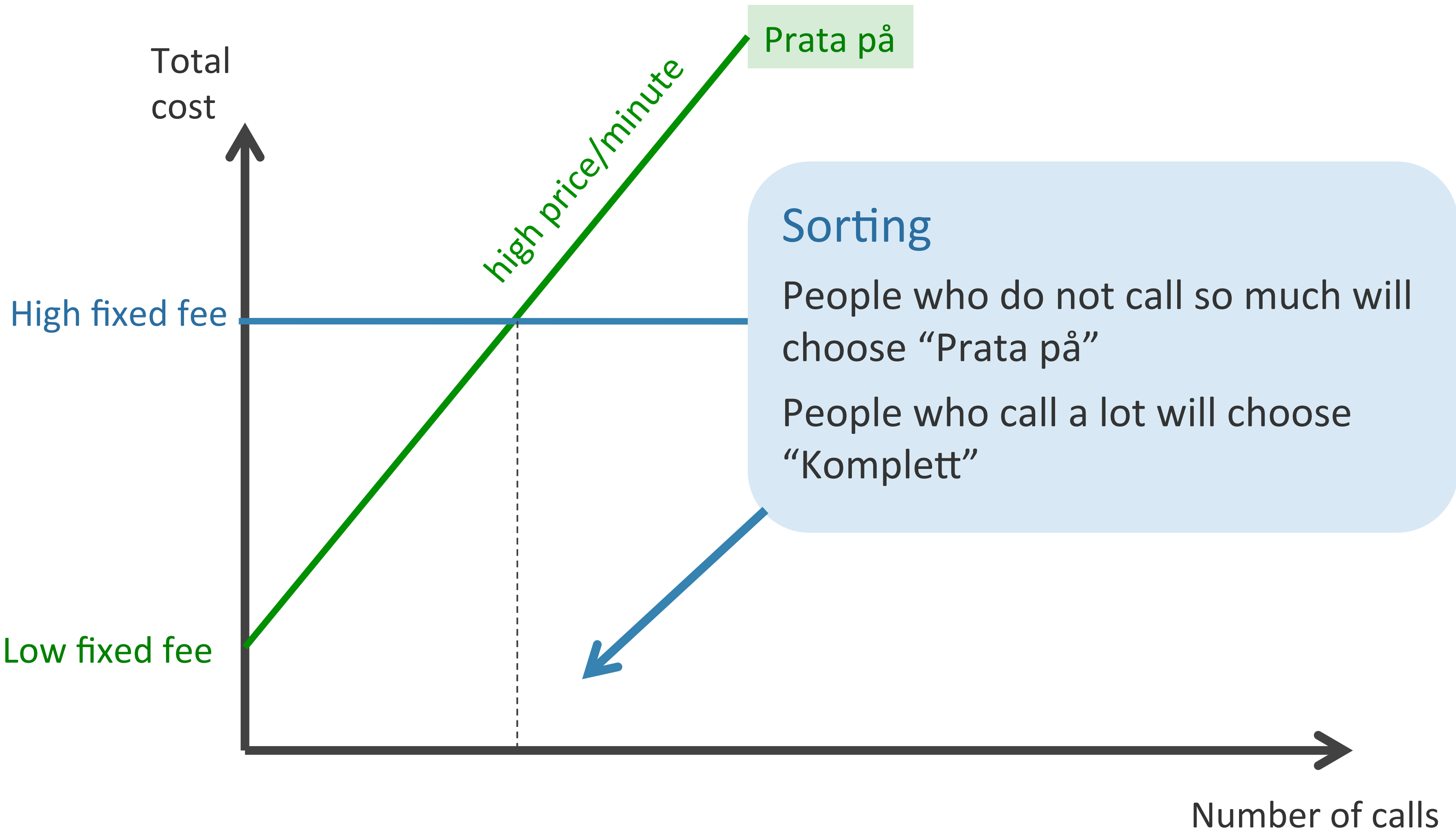
Telia


Prata på
high price/minute
Total
cost
High fixed fee
Low fixed fee
Number of calls
Sorting
People who do not call so much will choose “Prata på”
People who call a lot will choose “Komplett”

Telia

- Claim: Screening implies "price discrimination"
  - Average price depends on (i) pricing plan and (ii) number of calls

# Calls	Prata på	Komplett
1	51.40	700.00
400	1.52	1.75
700	1.47	1.00
1400	1.43	0.50

  - Different consumers will pay different average prices
    - quantity discount

Model

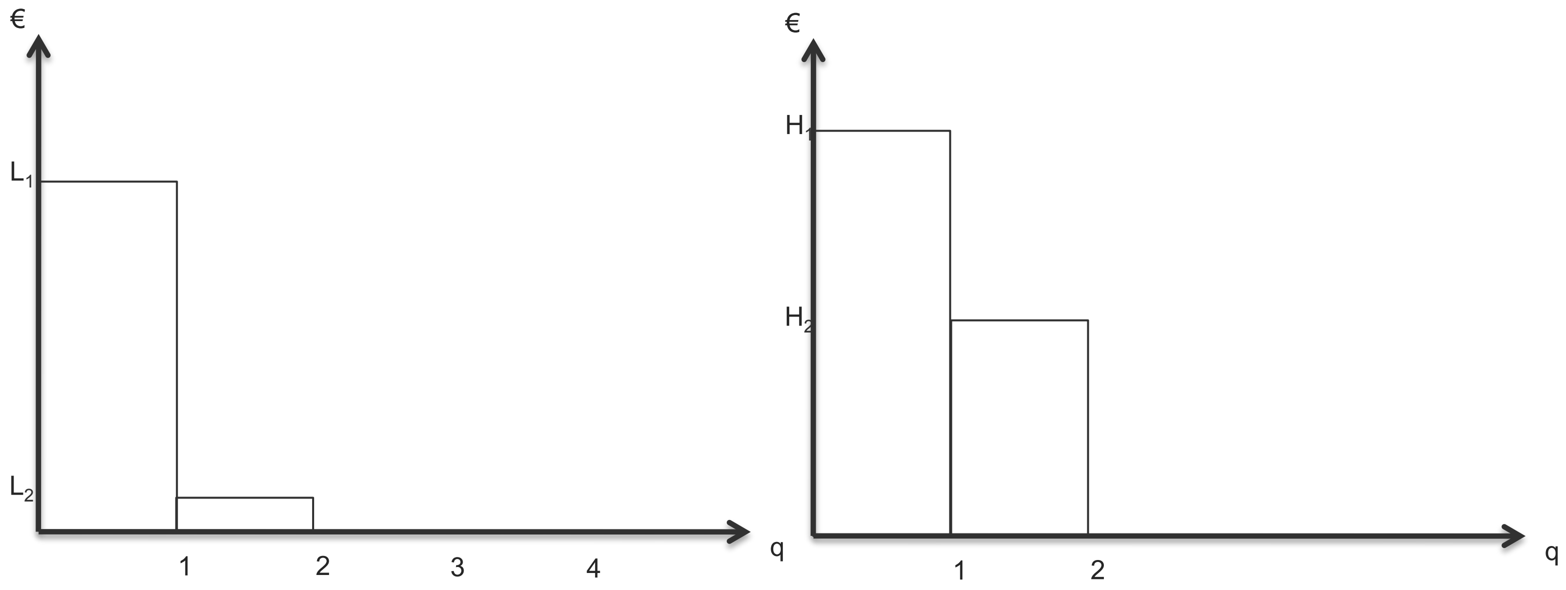
Set-up

- Demand
  - Two types of consumers, High and Low
- Technology
  - Constant marginal cost, c
- Concentration
  - Monopoly
- Timing
  - Firm sets price
  - Consumers buy or not
- Information
  - Incomplete: Monopolist doesn’t know each consumer’s type

Set-up

- Specific example
  - Equally many High and Low (1 each)
  - Maximum two units
  - Downward sloping demand: WTP first and second unit
    - $H_1 > H_2$
    - $L_1 > L_2$
  - High's demand (WTP) higher
    - $H_1 > L_1$
    - $H_2 > L_2$

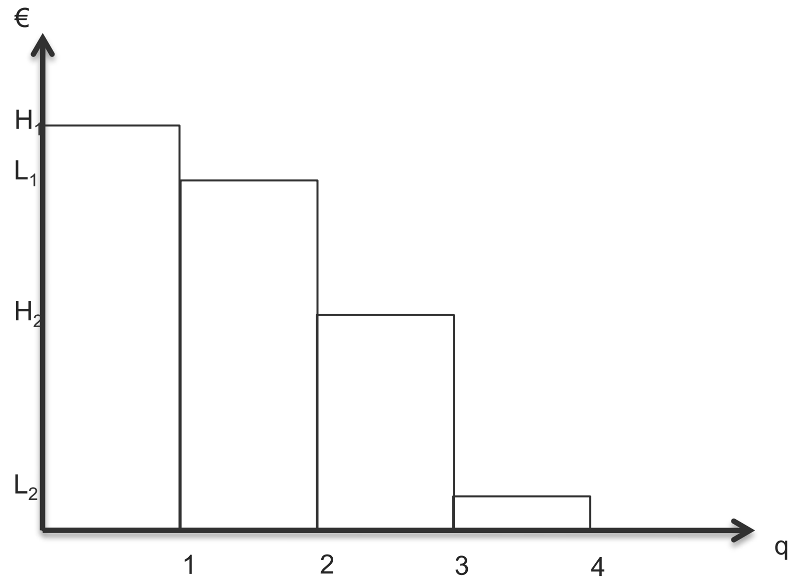
Set-up



Low High

Set-up

- Market demand
  - Assume also
    - $L_2 > c$
    - Also: $L_1 > H_2$



Uniform Pricing

Benchmark

Uniform Pricing

- Uniform pricing
  - Sell one package size: either 1 or 2 units
  - Same price for all
- Six options
  - One-unit packages at H_1, L_1, H_2 or L_2
  - Two-unit packages at $H_1 + H_2$ or $L_1 + L_2$

Uniform Pricing

- Under some conditions it is optimal with
  - One-unit packages
  - Price = H_2
- Q: Consumers' surplus? (recall $H_1>L_1>H_2>L_2>c$)
  - $U_{High} = (H_1+H_2) - 2H_2 = H_1 - H_2 > 0$
  - $U_{low} = L_1 - H_2 > 0$
- Q: Dead weight loss?
  - $L_2 > c$

Uniform Pricing

- Optimal uniform pricing
  - One-unit packages
  - Price = H_2
- Result
  - Consumer surplus > 0
  - Dead weight loss > 0

Menu

2nd degree price discrimination

Menu

Offer menu of two contracts, one for each type

- $c_L = (q_L, p_L)$
- $c_H = (q_H, p_H)$

Contracts must have different quantities. Otherwise everyone selects cheapest price

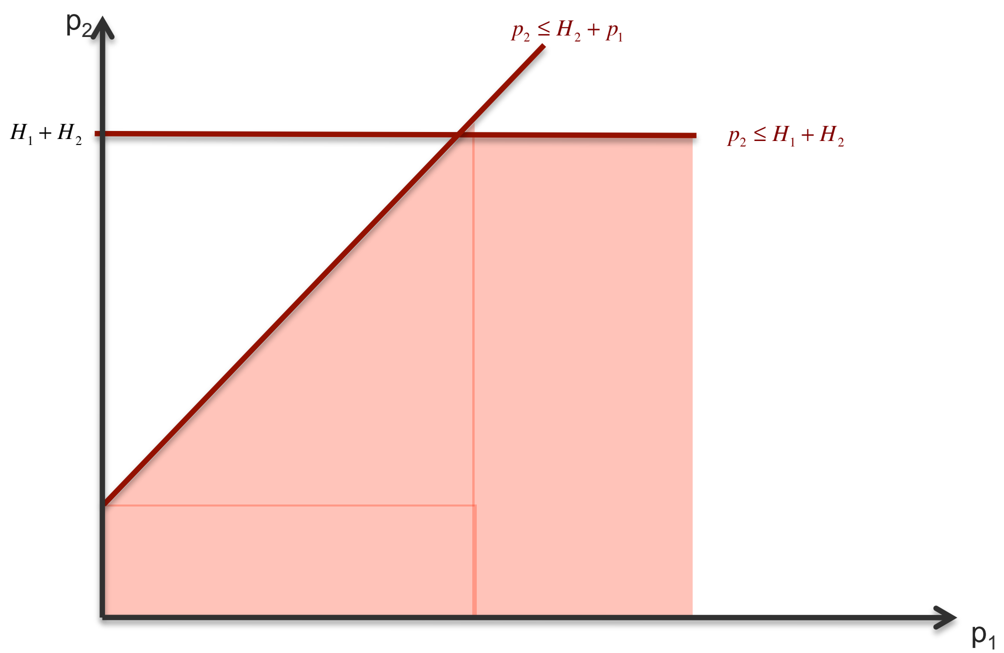
- Design different contract for e
  - $c_L = (1, p_1)$
  - $c_H = (2, p_2)$
- Let all consumers choose between
  - c_L, c_H or nothing
- Q: Can the firm extract larger share of WTP?

Menu

- Design optimal menu
  - p_2 = price of two-unit package (intended for High)
  - p_1 = price of one-unit package (intended for Low)

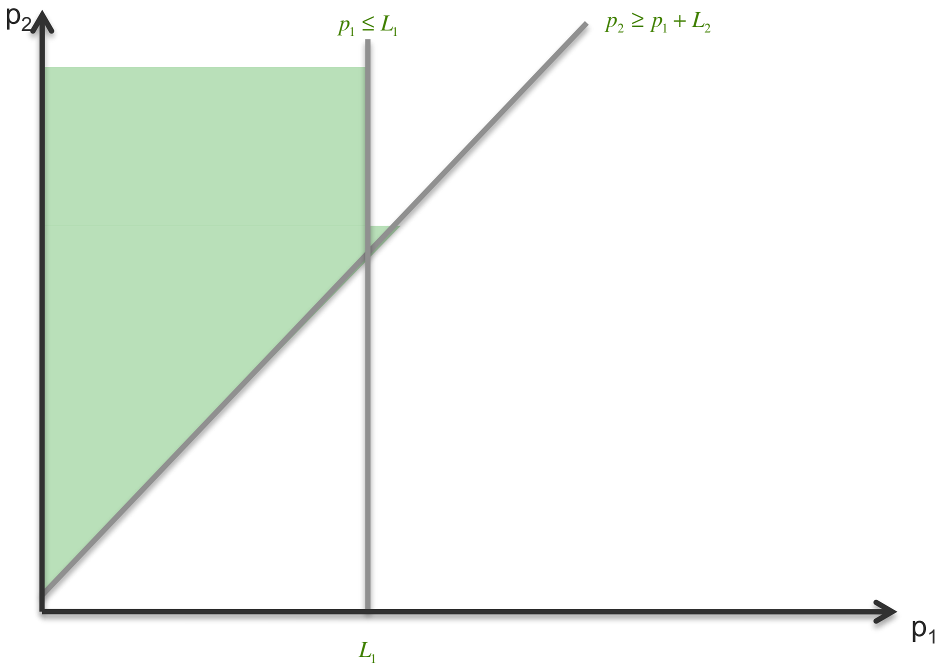
Menu

- Q: What is required for High to buy two units
  - IR: $H_1 + H_2 - p_2 \geq 0$ ⇔ $p_2 \leq H_1 + H_2$
  - IC: $H_1 + H_2 - p_2 \geq H_1 - p_1$ ⇔ $p_2 \leq H_2 + p_1$
- Q: Illustrate in diagram with p_1 on x-axis and p_2 on y



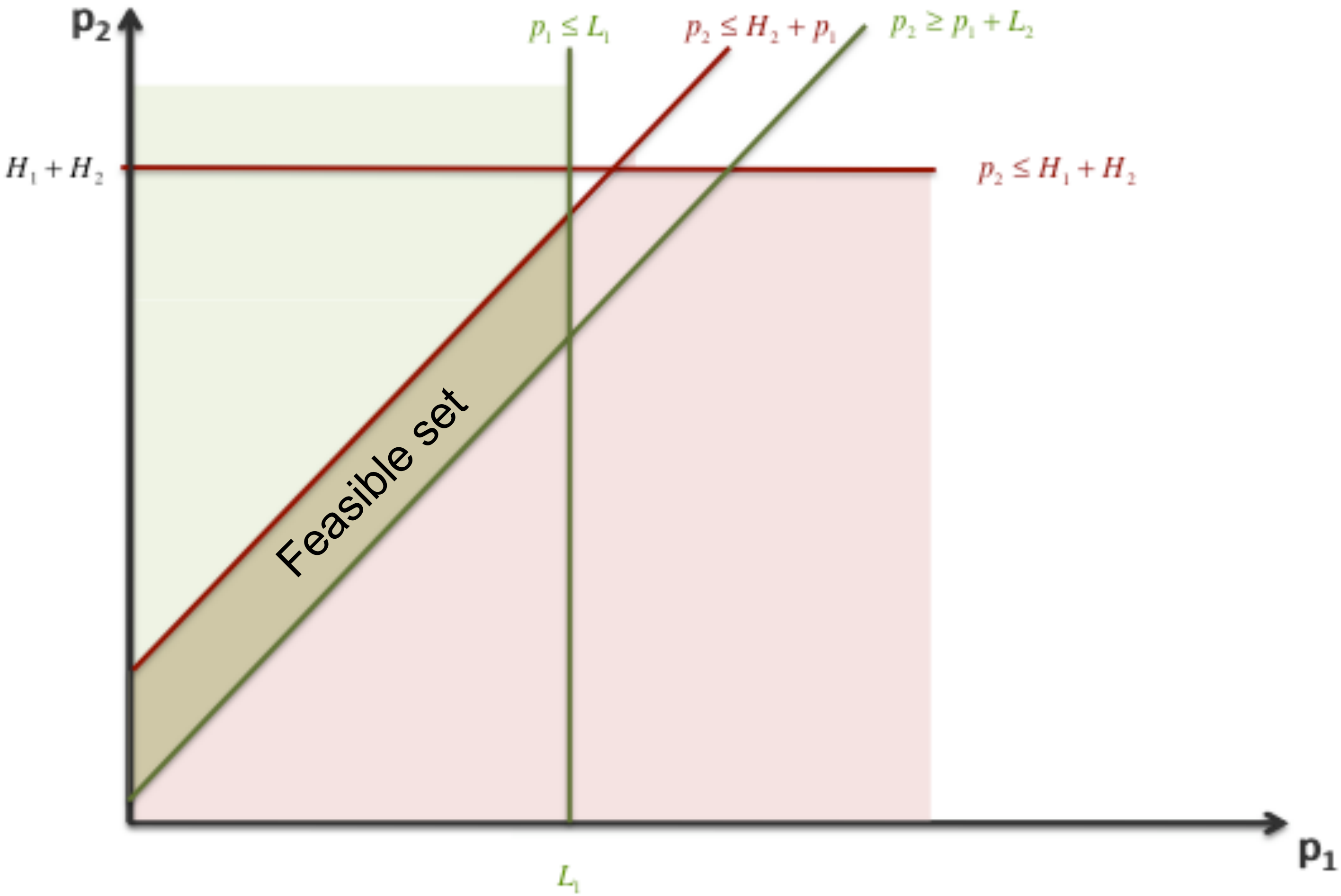
Menu

- Q: What is required for Low to buy one unit
  - IR: $L_1 - p_1 \geq 0$ ⇔ $p_1 \leq L_1$
  - IC: $L_1 + L_2 - p_2 \leq L_1 - p_1$ ⇔ $p_1 \leq - L_2 + p_2$
- Q: Illustrate in diagram with p_1 on x-axis and p_2 on y



Menu

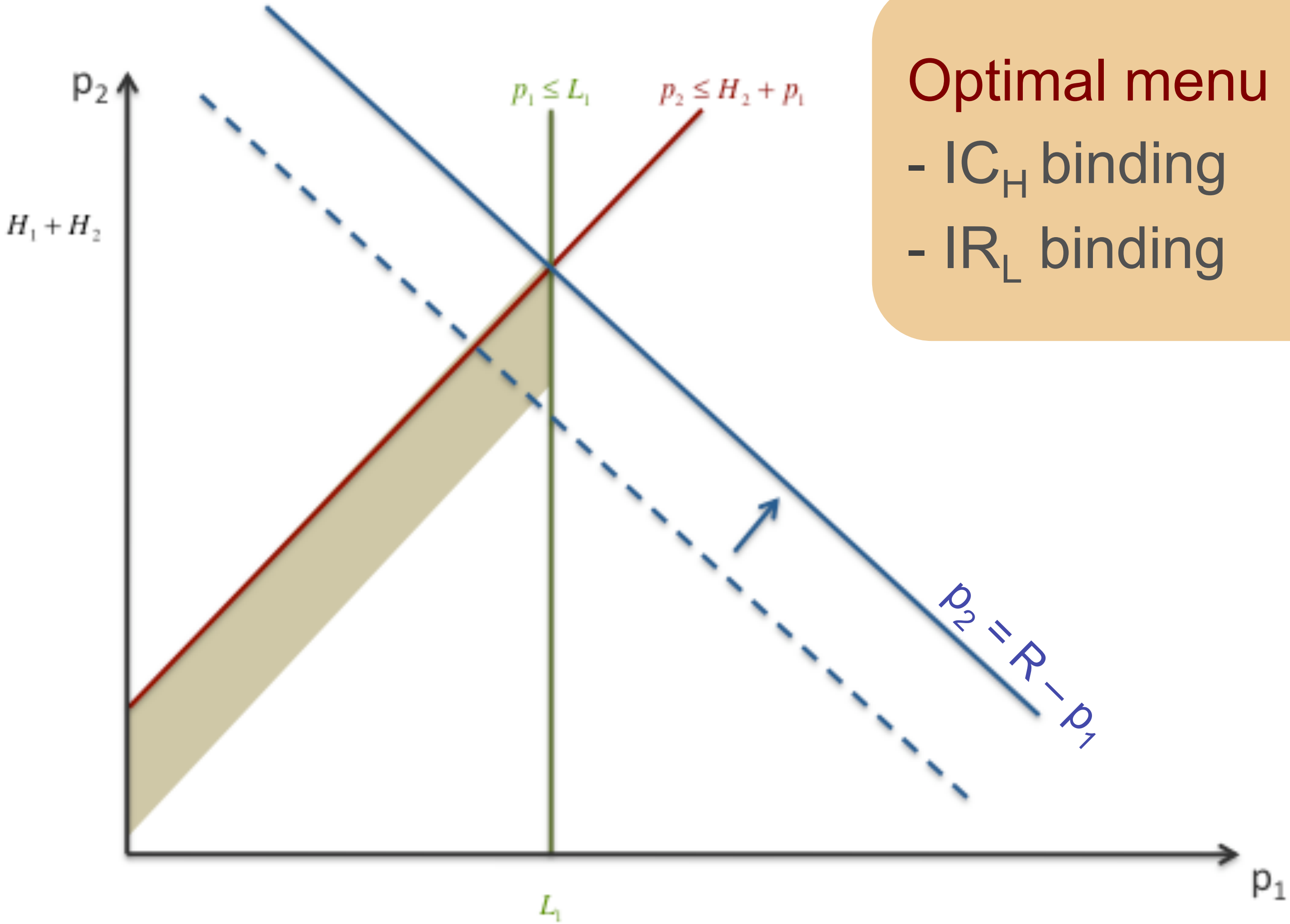
- Q: Feasible set (satisfy all 4 conditions)?



Menu

- Monopolist wishes to maximize profits
  = Revenues (given 3 units produced)
  - $R = p_1 + p_2$
  - Iso-R: $p_2 = R - p_1$

Menu



Optimal menu

- IC_H binding
- IR_L binding

Menu

- Optimal menu: p_1 and p_2, defined by
  - IR_L: $L_1 - p_1 = 0$
  - IC_H: $H_2 + p_1 = p_2$
- Hence
  - $p_1 = L_1$ (L's wtp for first unit)
  - $p_2 = L_1 + H_2$ (same price first unit + H's wtp for second)

Menu

- When is menu better than uniform pricing?
  - Best uniform: $\pi = 3H_2 - 3c$ [under certain conditions]
  - Best menu: $\pi = 2L_1 + H_2 - 3c$
- Condition
  - $2L_1 + H_2 > 3H_2 \Leftrightarrow L_1 > H_2$

Menu

- Quantity discount
  - Average price for Low: L_1
  - Average price for High: $(L_1+H_2)/2 < L_1$

Menu

- Welfare
  - Low
    - Consumes only one unit => DWL
    - No surplus
  - High
    - Consumes two units => Efficient
    - Some surplus: $(H_1+H_2) - (L_1+H_2) = H_1 - L_1 > 0$

Information rent

Menu

- But the best option is 1st degree price discrimination
  - Sell two units to Low for L_1+L_2
  - Sell two units to High for H_1+H_2
- Outcome
  - Efficient: All consume two units
  - Firm takes whole surplus
- What's wrong?
  - IR but not IC ($L_1+L_2 < H_1+H_2$)

Do this as exercise!

Menu of pricing plans

Menu of pricing plans

- Analysis
  - Menu of price/quantity contracts
- Telia
  - Menu of two-part tariffs
- Very similar logic
  - Can implement same outcome

Menu of pricing plans

- Menu of pricing plans

	Plan H	Plan L
Fixed fee	$L_1 + H_2 - 2c$	0
Usage fee	c	L_1

- Exercise 1
  - Show that this menu implements same outcome
- Steps
  - Show High consumes two units if he buys Plan H
  - Show High consumes one unit if he buys Plan L
  - Show High prefers Plan H over Plan L
  - Same three steps for Low
  - Compute profit

Menu of pricing plans

- Menu of pricing plans

	Plan H	Plan L
Fixed fee	$L_1 + H_2 - 2c$	0
Usage fee	c	L_1

- Exercise 2
  - Why is H's usage fee = c?
  - Why is H's fixed = $L_1 + H_2 - 2c$
  - Why is not L's plan: fixed = L_1 & usage = c?

Menu of pricing plans

- Menu of pricing plans

	Plan H	Plan L
Fixed fee	$L_1 + H_2 - 2c$	0
Usage fee	c	L_1

- Answers 2
  - Why is H's usage fee = c? *To induce efficient consumption*
  - Why is H's fixed = $L_1 + H_2 - 2c$ *To extract all surplus*
  - Why is not L's plan: fixed = L_1 & usage = c? *To deter H from buying L's plan*

Price Discrimination

- Definition: Price Discrimination
  - Same good sold at different prices to different consumers, in absence of any quality differences and any differences in cost serving them
- Types
  - 3rd degree: Different prices in different markets
  - 1st degree: Different prices to different individuals
  - 2nd degree: Offer consumers choice from menu of pricing plans

More examples of Screening

Menus

Third Class Railway Pass
in 184

Question

Why open carriages in 3rd class?

Menus

"It is not because of the few thousand francs which would have to be spent to put a roof over the third-class carriage or to upholster the third-class seats that some company or other has open carriages with wooden benches …

What the company is trying to do is prevent the passengers who can pay the second-class fare from traveling third class;

it hits the poor, not because it wants to hurt them, but to frighten the rich …

And it is again for the same reason that the companies, having proved almost cruel to the third-class passengers and mean to the second-class ones, become lavish in dealing with first-class customers. Having refused the poor what is necessary, they give the rich what is superfluous."

Jules Dupuit, ca 1860.

Adverse Selection and Screening

- Telecom
  - Menu of two-part tariffs
- Software
  - Disable features = quality discrimination (a.k.a. versioning)
- Insurance markets
  - Deductibles: Only those who know they have low risk take them, and get lower price on the risk they sell
- Credit markets
  - Entrepreneurs risking their own fortunes get better price