The Need for Information

The Fundamentals

Benevolent government trying to implement Pareto efficient policies

Population members have private information

- Personal preferences
- Effort choices
- Costs

This private information is relevant for determining socially optimal policy

Government needs to elicit citizens' private information

Citizens may have a strategic incentive to lie

Mechanism Design

Design incentive scheme (i.e., a game) that extracts as much information as possible in equilibrium

Also concerned about the costs of extracting that information

Focus on mechanisms that induce good behavior in **weakly dominant strategies**

> *A strategy is **weakly dominant** if it is a best response to any profile of strategies by other players.*

Outline

Outline

Private Values

Single asset to be allocated to one individual

- Spectrum
- Pollution rights
- Passage of a bill

Utilitarian Outcome: Prize goes to highest valuation player

Bidders have private information about valuations

- Person i's valuation is v_i

Just Ask

Ask people their valuations

Give to highest claimed valuation

Induces lying

First Price Auction

Bidders submit sealed bids

All bids are final

Highest bidder wins prize and pays bid

Losers pay nothing

Is telling the truth weakly dominant?

Suppose player i values prize $v_i > 0$

If bid v_i or higher, never have positive payoff

If bid less than v_i, payoffs sometimes positive (and never negative)

Bidding v_i not a best response to everyone else bidding their true valuation

Unless players' valuations drawn from exact same distribution, positive probability of inefficient allocation

The Second Price Auction

Bidders submit sealed bids (b_i)

Highest bidder wins prize and pays second-highest bidder's bid

Losers pay nothing

Bidding $b_i = v_i$ dominates any bid $b_i' < v_i$

Suppose highest other bid, B, with $b_i' < v_i < B$

- Lose if bid b_i' or v_i, so indifferent

Suppose $b_i' < B < v_i$

- If bid v_i payoff is $v_i - B > 0$
- If bid b_i' payoff is 0

Suppose $B < b_i' < v_i$

- Win and make payoff $v_i - B > 0$ under either bid, so indifferent

Outline

Common Values

Single asset to be auction, that we all value equally, v

We are uncertain about value of the asset

- Foreclosed home
- Toxic financial asset

Each person has some unbiased, private information about the likely value

Let's try such an auction

Is bidding your value weakly dominant?

If everyone is bidding their true belief, the winner's information must have been *the most* positive

Since everyone's information is unbiased, this means that the winner's bid was probably too high

The Winner's Curse

Outline

The Fundamental Problem

The government needs to regulate a firm

- Monopoly
- Externalities

The optimal regulation depends on information only the firm has

- Marginal cost of production
- Marginal cost of mitigating the externality

In order to regulate well, the government must first extract information from the firm, which may have incentives to lie

Implications

Lack of information limits the government's ability to regulate well

The best the government can do (i.e., the second best) involves the government behaving in ways that appear to favor a firm it legally shouldn't have to negotiate with

Sometimes the government can improve matters by hiring an expert agent

Concern about the agent being "captured" by industry leads to new shifts in optimal regulatory policy

Regulating a Monopolist

A graphical version of classic model

Monopolistic firm decides quantity of production

Can hold down production to raise prices and profits

This creates deadweight loss and so is not socially optimal

Regulator wants to require more production, but right level depends on firm's marginal costs, which are firm's private information

Outline

The Economy

Firm produces q widgets at constant marginal cost c

If price is p, then firm profits are

$$\pi(p, q, c) = q(p - c).$$

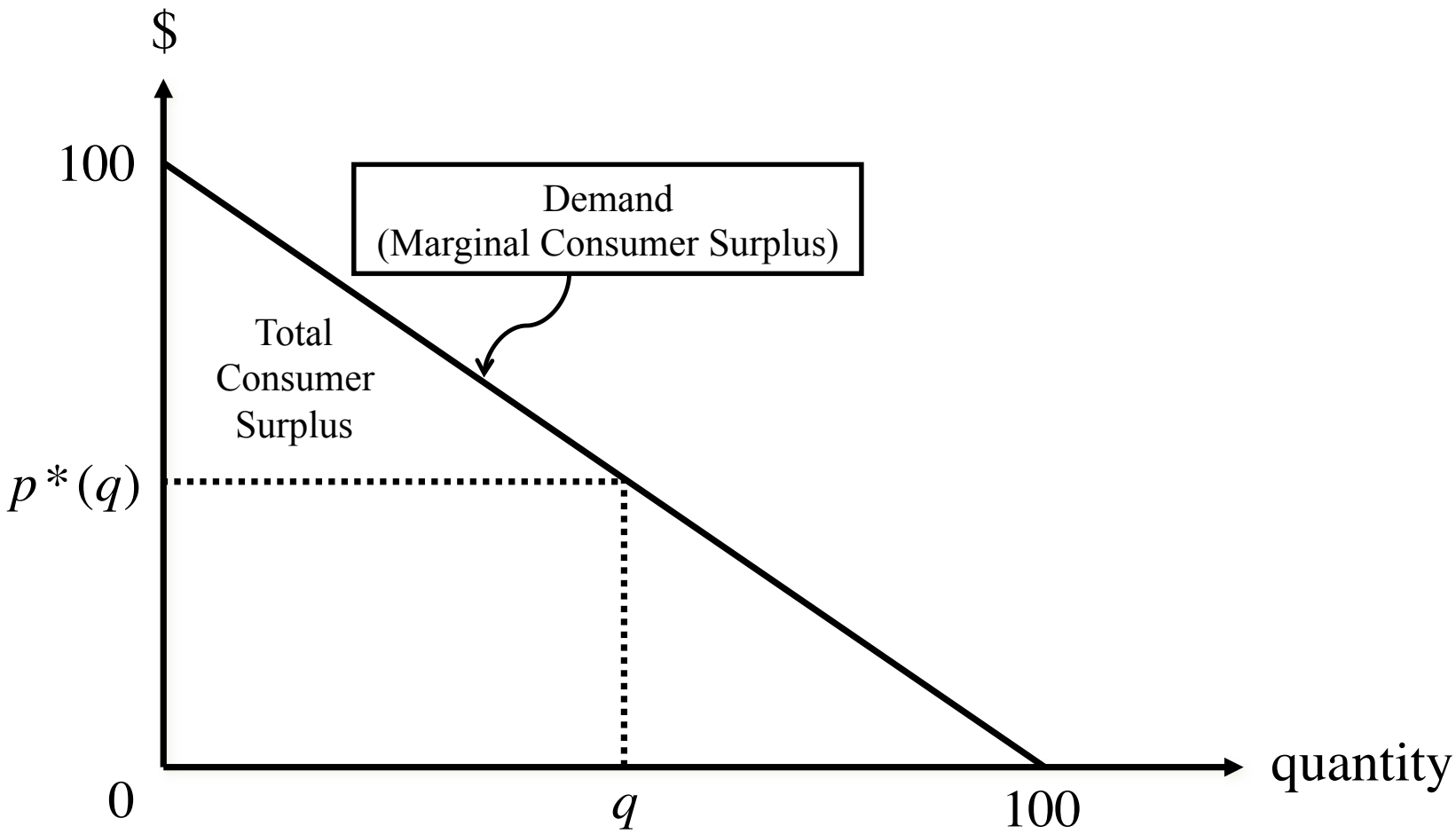
Demand is linear in price:

$$D(p) = 100 - p.$$

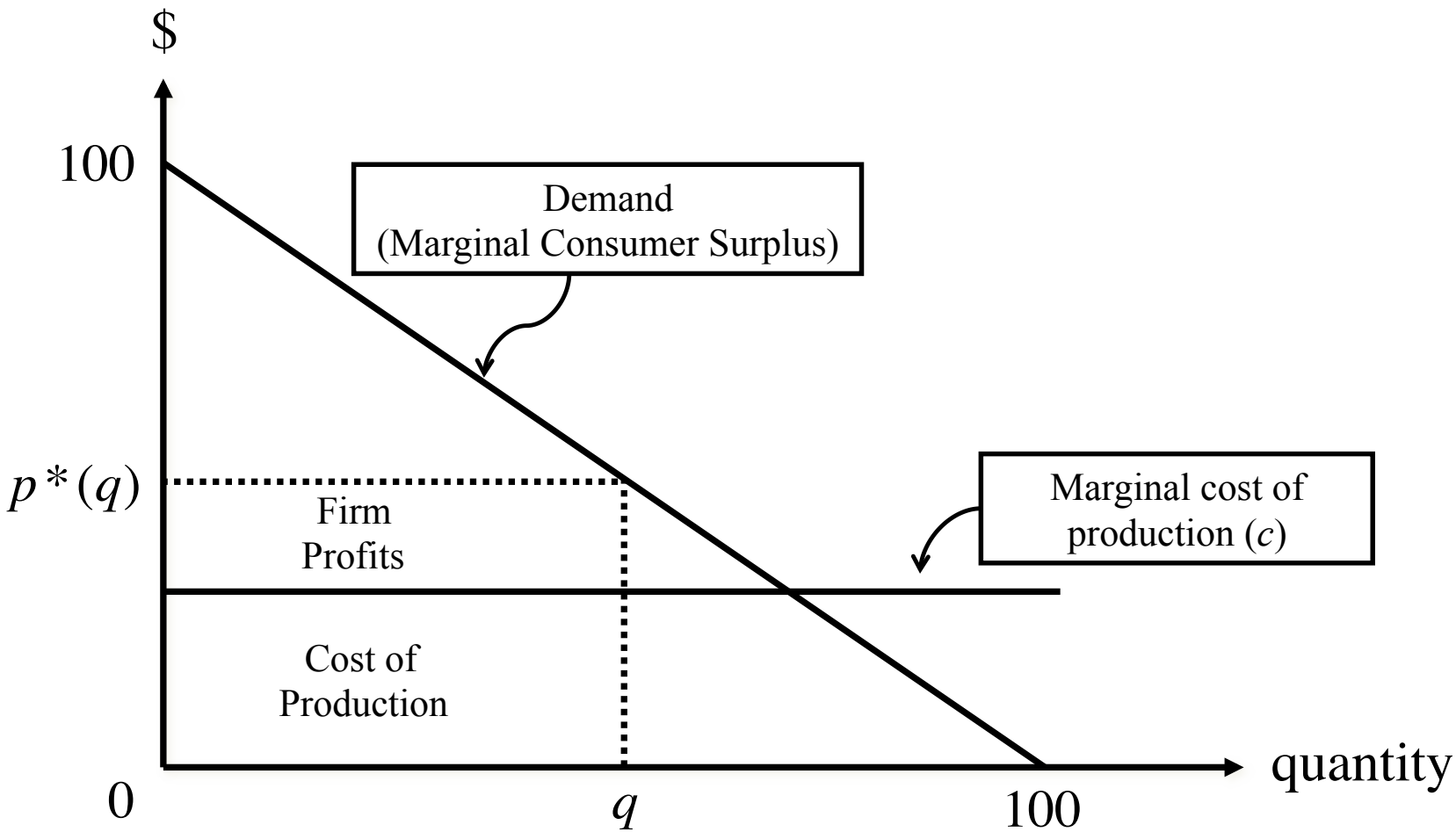
Equilibrium price, given production q is:

$$p^*(q) = 100 - q.$$

Consumer Surplus for Arbitrary q



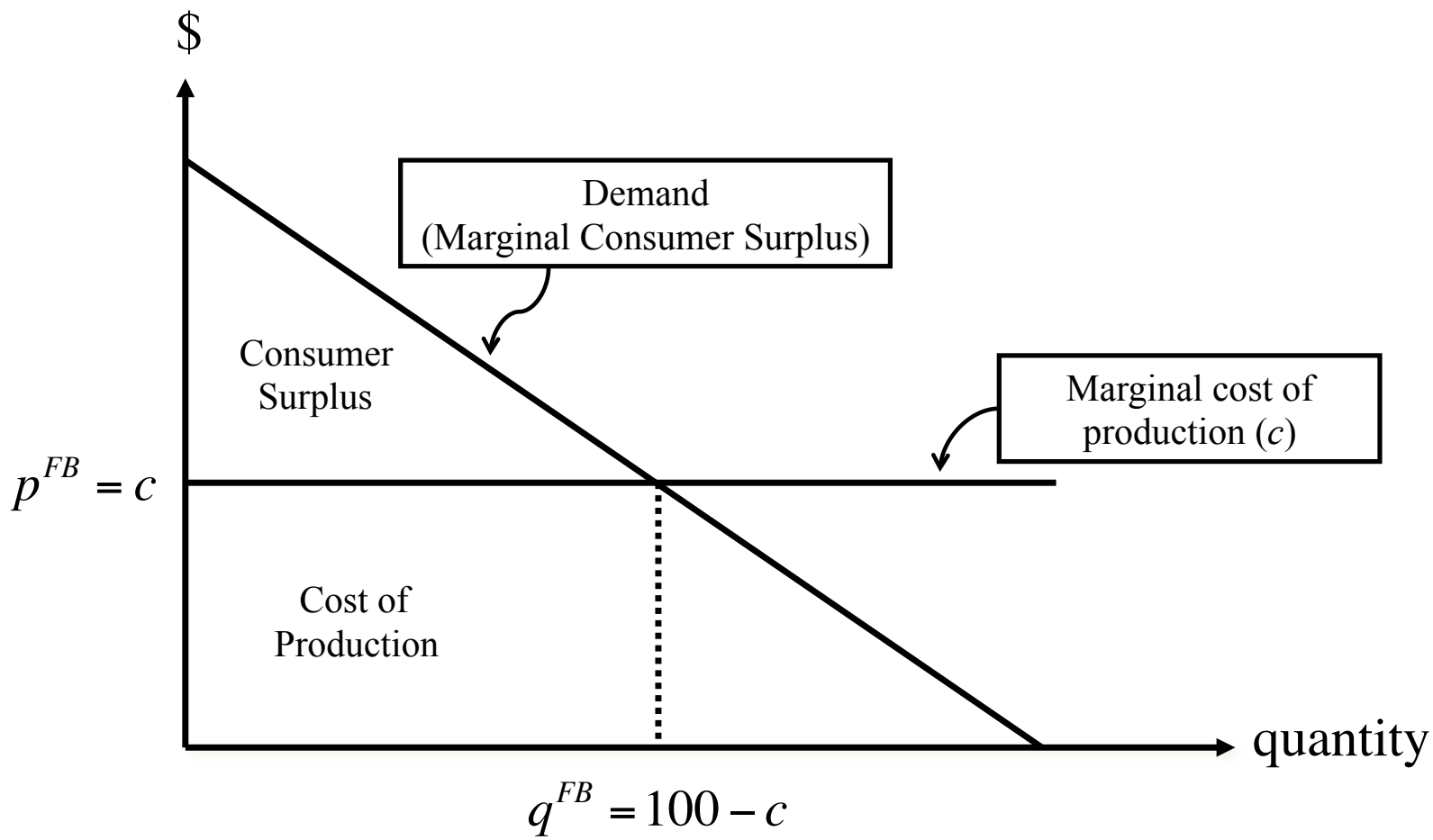
Firm Profits for Arbitrary q



Social Welfare

Utilitarian social welfare is consumer surplus plus firm profits

First Best: Price Equals Marginal Cost



Outline

The Monopolist's Problem

Monopolist maximizes profits:

$$\max_q q(p^*(q) - c).$$

Since $p^*(q) = 100 - q$, this is equivalent to solving

$$\max_q q(100 - q - c).$$

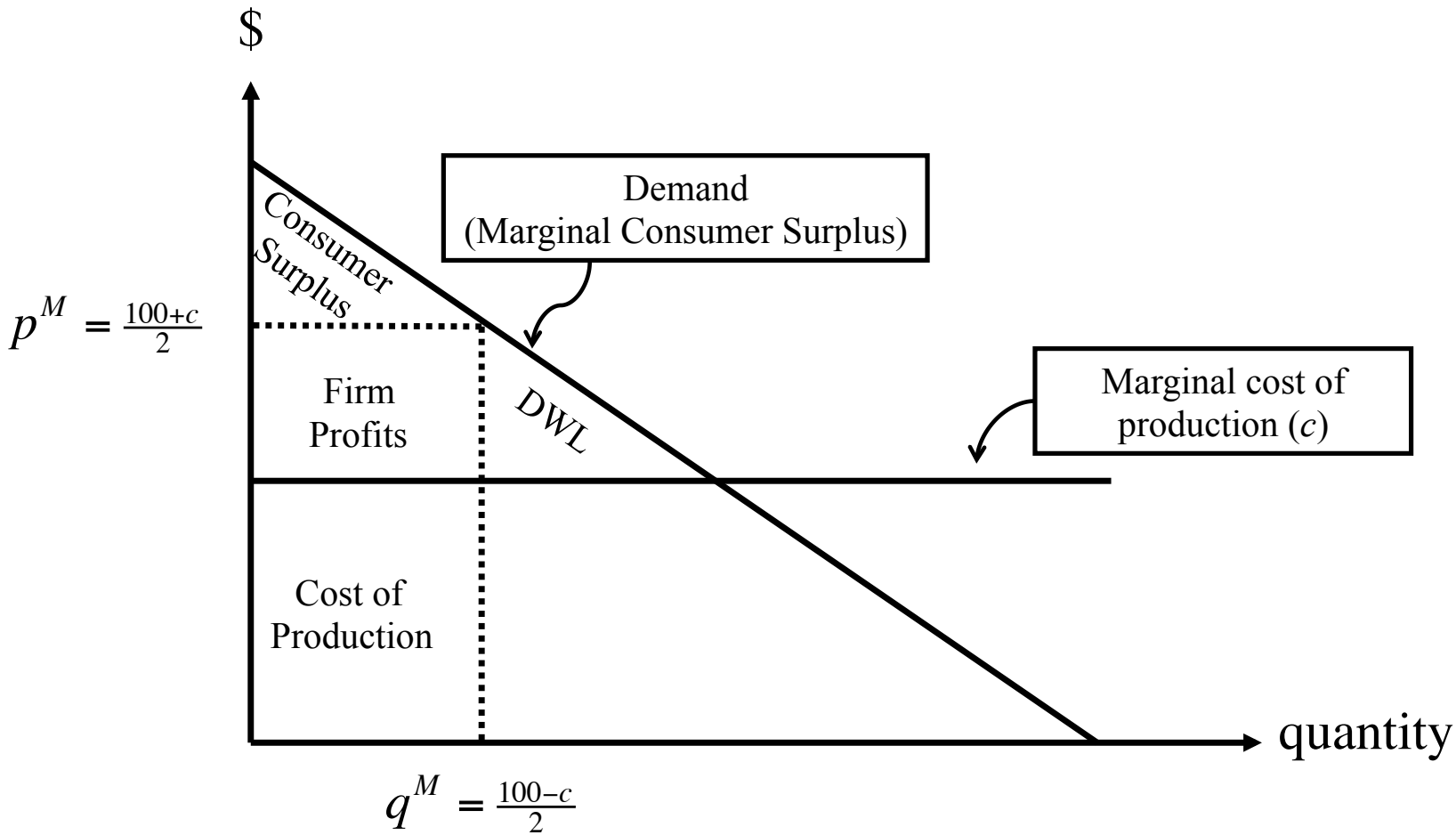
$$q^M(c) = \frac{100 - c}{2}.$$

Price under a monopolist is

$$p^M = p^*(q^M(c)) = 100 - \frac{100 - c}{2} = \frac{100 + c}{2}.$$

Social Welfare with Monopolist

Profits plus Consumer Surplus:



Outline

Utilitarian Optimum

The monopolist maximizes profits, not social welfare

Holds down production

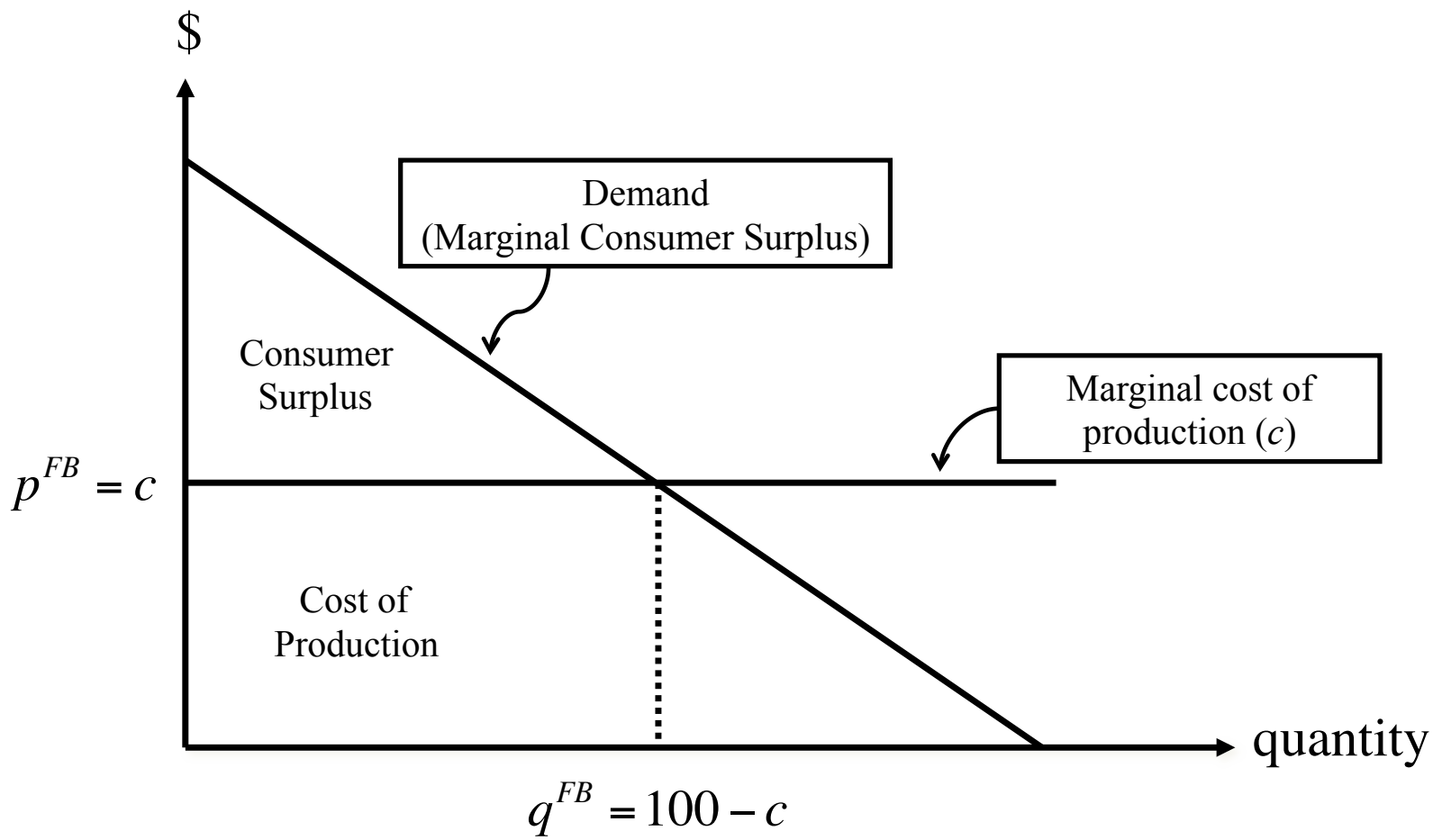
- Increases profits and reduces consumer surplus

The increase in profits is more than off-set by the reduction in consumer surplus

- Deadweight loss

So the utilitarian optimum involves higher production, less profits, and more consumer surplus

First Best: Price Equals Marginal Cost



Outline

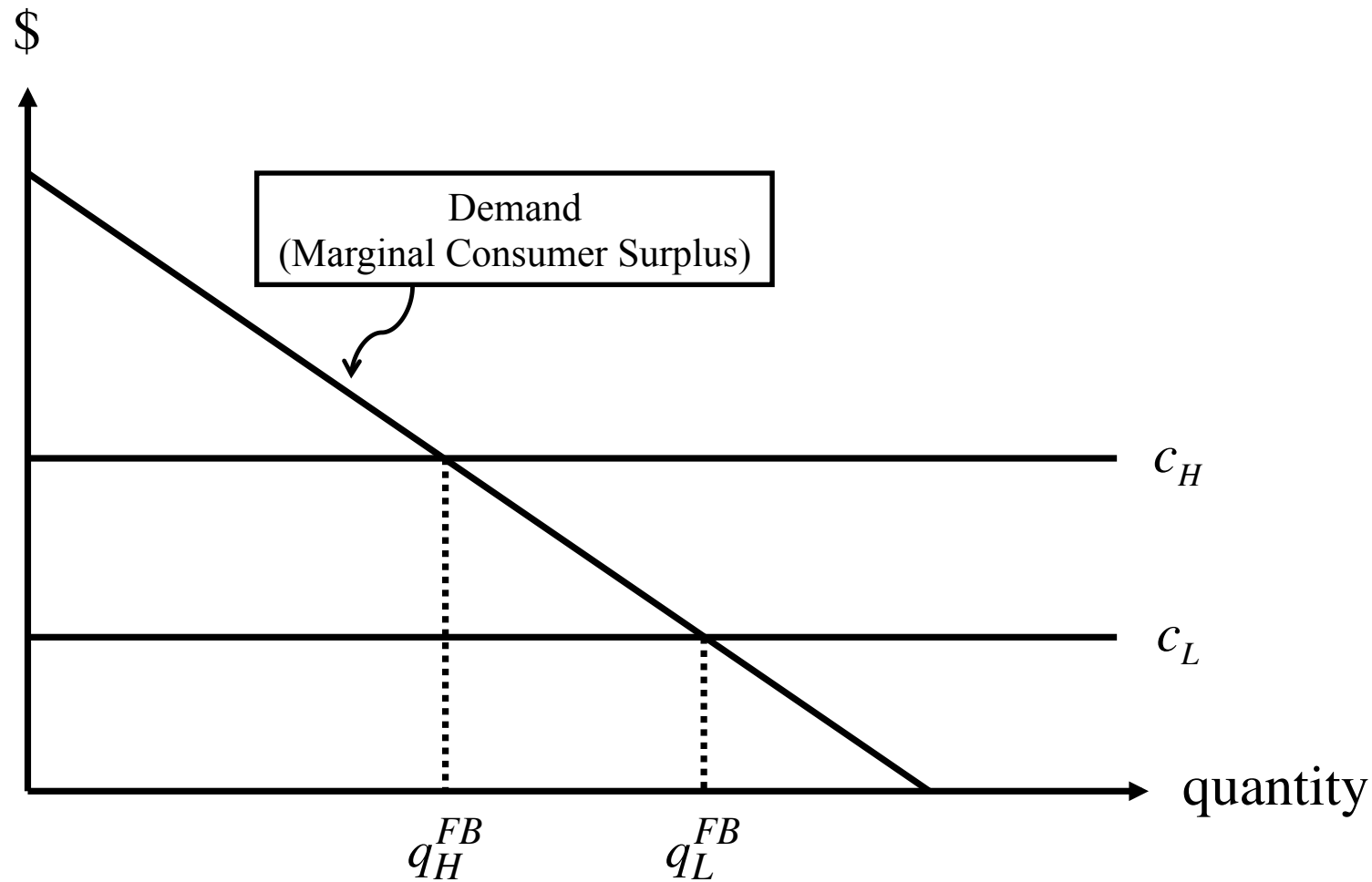
Unknown Marginal Costs

Government uncertain whether firm has high (c_H) or low (c_L) marginal costs

The probability marginal costs are low is $\lambda \in (0, 1)$

The government can regulate the firm, but cannot force the firm to operate at a loss

What the Government Would Like To Do



Attempting the First-Best Results in Manipulation

Ask firm its marginal costs, then implement first-best policy assuming the answer is truthful

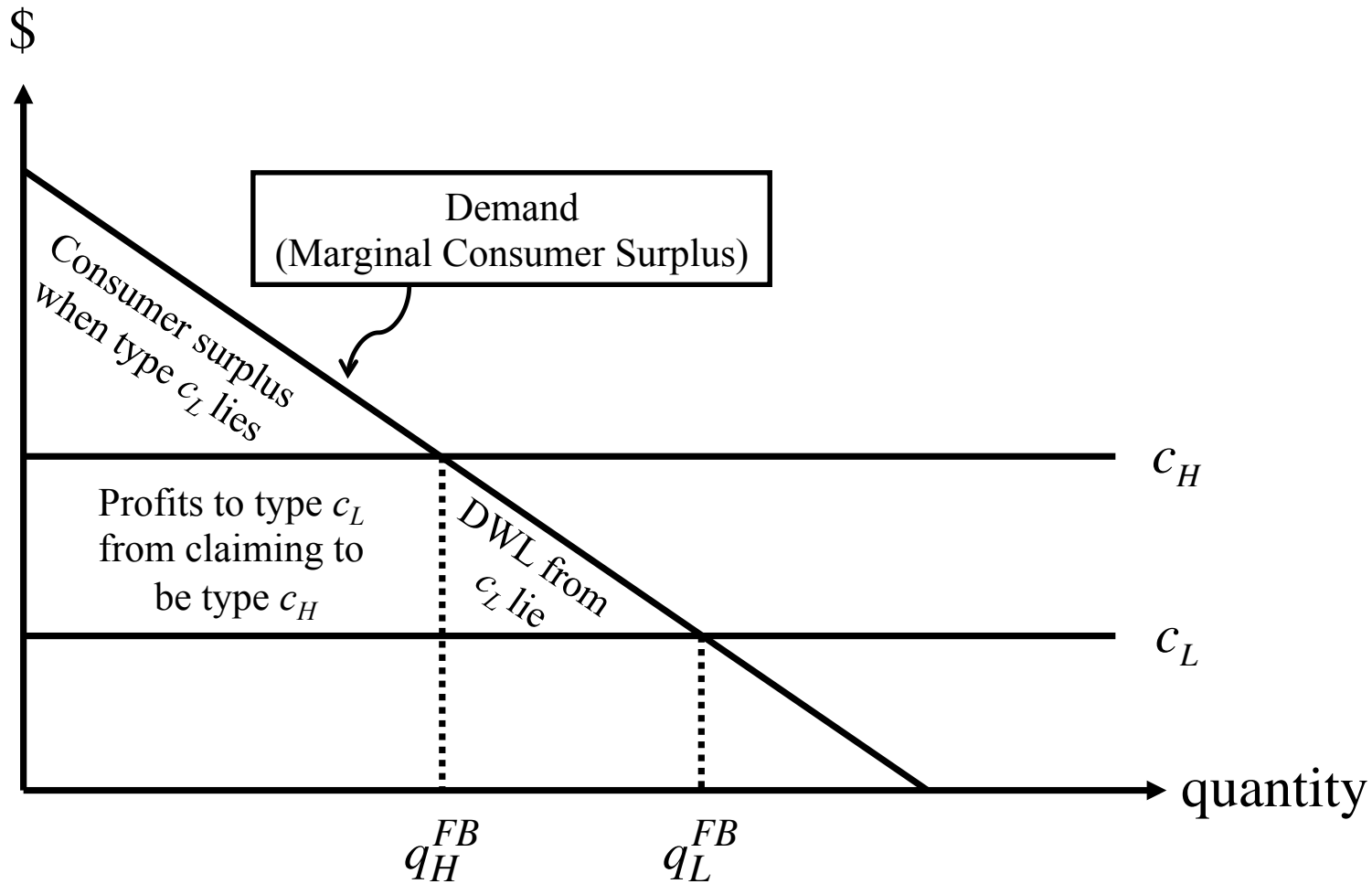
High marginal cost firm has no incentive to lie

- If claim costs are low, forced to do more production for a lower price

Low marginal cost firm will lie

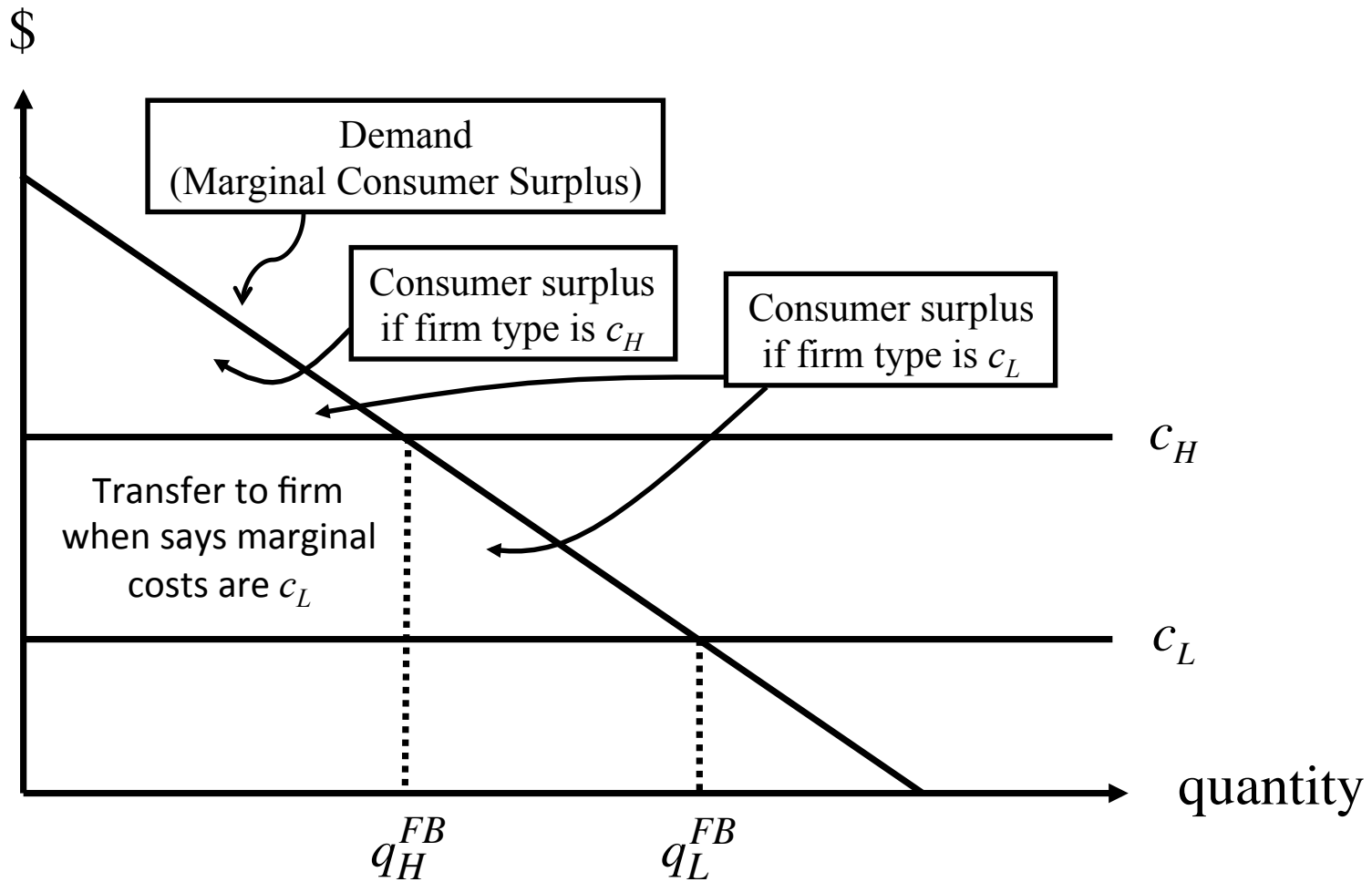
- Claim to have high costs, do less production for higher price
- Positive profits

Low Marginal Cost Firm's Incentive to Lie



Outline

Using Transfers to Induce Truth Telling



Distortionary Transfers

A one dollar transfer from the consumers to the firm costs the consumers $\tau > 1$

Government can transfer profits from firms to consumers without loss (i.e., 1 for 1)

- This is a simplification but it has an intuition
- Government can use revenue collected from firms as a substitute for revenue from more distortionary tools (e.g., income or sales taxes)
- Moving money from firms to consumers is less distortionary

Reducing Transfers

Achieving full truth telling by low marginal cost firm involved large, distortionary transfers

How can the government reduce distortionary transfers while still getting information?

Make lying less attractive by reducing profits from claiming to be high marginal cost

Making Lying Less Attractive

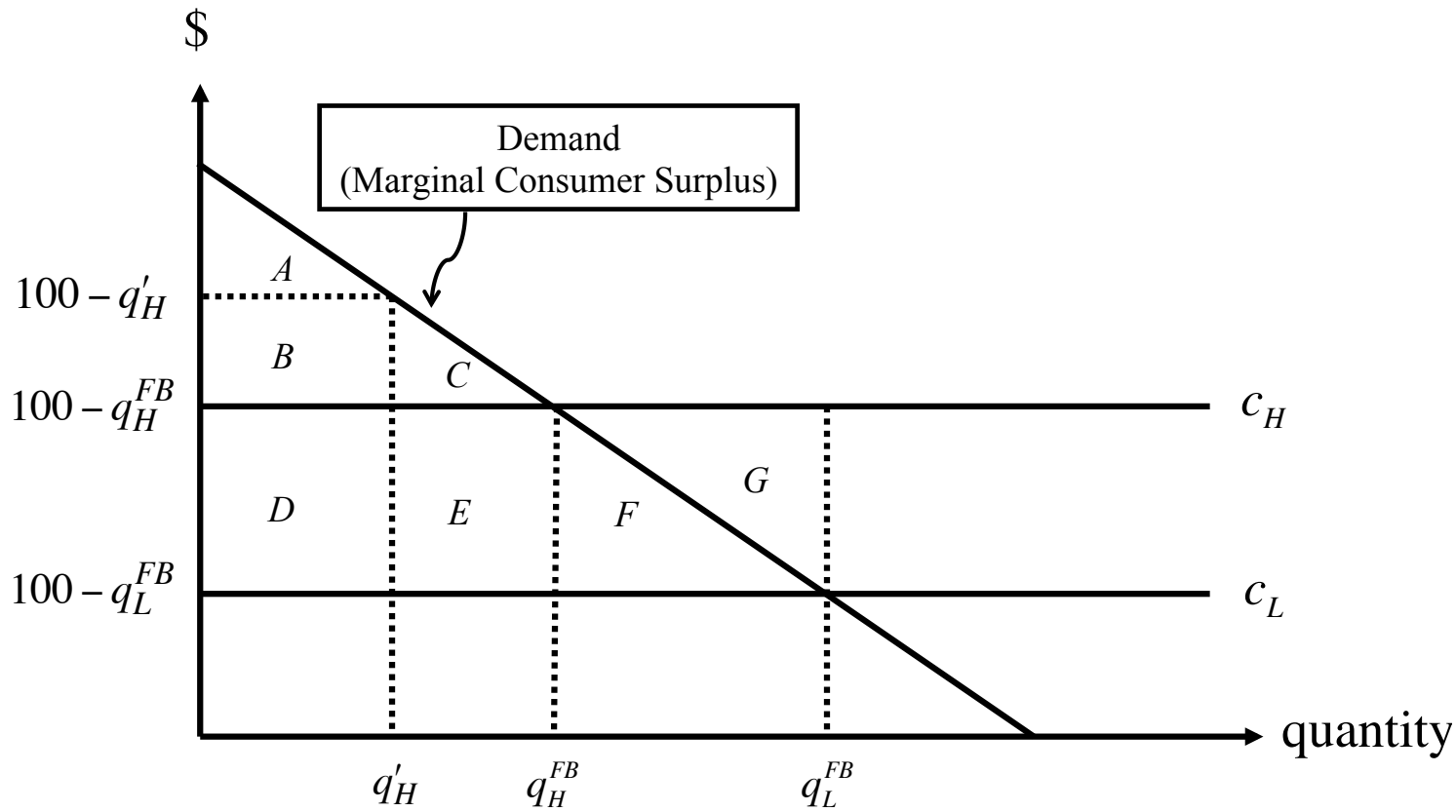
Reduce the amount produced by a firm claiming to have high marginal costs

- This leaves some profits even to a high marginal cost firm

Transfer the profits a high marginal cost firm would make to consumers

- This is non-distortionary

Leaves high marginal cost firm with exactly zero profits and reduces attractiveness of lying for a low marginal cost firm



If c_H: reduce to $q'_H < q_H$ and transfer B to consumers

If c_L: q_L^{FB} and transfer D

GOOD: Truth-telling by c_L transfering D instead of $D + E$

BAD: Deadweight loss of C when c_H

Some Notation

The first-best social welfare with full information, if c_L

$$\Delta_L = A + B + C + D + E + F.$$

The first-best social welfare with full information, if c_H

$$\Delta_H = A + B + C.$$

Social Welfare Under Policy q'_H and Transfers

For any given q'_H, the total social surplus if the firm has low marginal costs is

$$\Delta_L + D(1 - \tau).$$

If firm has high marginal costs

- Consumer surplus: $A + B$
- Firm profits: 0

If firm has high marginal costs, total social surplus is first-best social surplus minus deadweight loss:

$$\Delta_H - C$$

Social Welfare, continued

Probability firm has low marginal costs is λ

Expected social welfare under our policy is

$$U(q'_H) = \lambda(\Delta_L + D(1-\tau)) + (1-\lambda)(\Delta_H - C)$$

Note that we can calculate D and C as functions of q'_H and substitute (see the book)

$$D = q'_H(q_L^{FB} - q_H^{FB})$$

$$C = \frac{(q_H^{FB} - q'_H)^2}{2}$$

The Second Best

$$\max_{q'_H} U(q'_H)$$

$$q_H^{SB} = q_H^{FB} + \frac{\lambda}{1-\lambda}(1-\tau)(q_L^{FB} - q_H^{FB}).$$

Second-best production by high marginal cost firm is lower than first-best production

- Larger is τ, the lower is the second-best level of production by c_H
- Smaller is λ, the larger is the second-best level of production by c_H

The Costs of Informational Deficits

Deadweight loss due to underproduction by high marginal cost firms

Distortionary transfers by the government from consumers to low marginal cost firms

The Power of Information

The transfers to low marginal cost firm result in positive firm profits

Government has legal authority to regulate monopolies, but we nonetheless will observe negotiations with monopolistic firms over the terms of regulation

One might interpret this as failure to exercise authority or evidence of malfeasance

But it could actually be optimal policy given that the firm has information the government needs to exercise its regulatory authority effectively

Outline

Take Aways

Making Pareto-improving policy often requires information that the policy maker doesn't have.

When relevant information resides with interested parties, the policy maker must design incentives for those parties to reveal the information.

The challenge is that, revealing its information may sometimes lead to disadvantageous policy responses for a given party, giving that party an incentive to lie or fail to reveal information.

Informational asymmetries place an additional second-best constraint on how much good can be done through policy.