Merger Antitrust Review: Formulas and Other Reference Materials

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Note: if you need an equation out of this deck for the exam, just copy and paste into your Word document as an image.

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Contents

Typical structure of a formal merger analysis

- Step 1: The prima facie case
  - Relevant market
    - *Brown Shoe* "outer boundaries" and "practical indicia" tests for product markets
    - "Commercial realities" test for geographic market
    - Merger Guidelines hypothetical monopolist test
  - *PNB* presumption
    - Market participants and market shares
    - Application of the *PNB* presumption
  - Other evidence of anticompetitive effect
    - Unilateral effects
    - Coordinated effects
    - Elimination of a maverick

Upward pricing pressure
or other anticompetitive effects

- Step 2: Defendants' rebuttal
  - Challenges to the prima facie case (failure of proof on upward pressing pressure)[1]
  - Traditional defenses (offsetting downward pricing pressure)
    - Entry/expansion/repositioning
    - Efficiencies
    - Countervailing buyer power ("power buyers")
    - Failing company/division

Downward pricing pressure
or other procompetitive effects

- Step 3: Weighing of gross anti- and procompetitive effects

[1] Typically addressed in Step 1.

A judgment for the plaintiff requires a showing of
net anticompetitive effects (net consumer harm)

Elasticities

- Elasticity of demand—Some definitions
  - *Own-elasticity of demand*: The percentage change in the quantity demanded divided by the percentage change in the price of that *same* product.

$$\varepsilon = \frac{\dfrac{\Delta q_i}{q_i}}{\dfrac{\Delta p_i}{p_i}}$$

Percentage change q_i in the quantity of product *i* demanded

Percentage change p_i in the price of product *i*

    - Using a little algebra, this is equivalent to $\dfrac{\Delta q_i}{\Delta p_i}\dfrac{p_i}{q_i}$

Slope of the (residual) demand curve

    - Own-elasticities are negative, due to the downward-sloping nature of the demand curve
  - *Cross-elasticity of demand*: The percentage change in the quantity demanded for product *j* divided by the percentage change in the price of product *i*.

$$\varepsilon_{ij} = \frac{\dfrac{\Delta q_j}{q_j}}{\dfrac{\Delta p_i}{p_i}}$$

Percentage change q_j in the quantity of product *j* demanded

Percentage change p_i in the price of product *i*

    - Cross-elasticities are positive for substitutes and negative for complements

Elasticities

- Some conventions and definitions
    - By convention, economists speak of elasticities in terms of their absolute values
  - Own-elasticities
    - *Inelastic demand*: Own demand where the quantity demanded does not change significantly with changes in the product's price. *Not price sensitive*. $\left(|\varepsilon| < 1\right)$

This means take the "absolute value ((so, for example $|-0.5| = 0.5$), and so makes own-elasticities positive numbers.

$$|\varepsilon| = \frac{\%\text{change in quantity}}{\%\text{change in price}} < 1$$

Inelastic demand

- *Unit elasticity*: Where a 1% change in the product's price results in a 1% decrease in the quantity demanded $\left(|\varepsilon| = 1\right)$

$$|\varepsilon| = \frac{\%\text{change in quantity}}{\%\text{change in price}} = 1$$

Unit elasticity

- *Elastic demand*: Own demand where the quantity demanded drops rapidly with small changes in price. *Very price sensitive*$\left(|\varepsilon| > 1\right)$

$$|\varepsilon| = \frac{\%\text{change in quantity}}{\%\text{change in price}} > 1$$

Elastic demand

Estimating actual loss for a firm (Δq)

- The *Lerner condition* for profit-maximizing firms
  - *Proposition*: When a firm maximizes its profits, at the profit-maximum levels of price and output the firm's own elasticity ε is equal to $1/m$:

$$\varepsilon = \frac{1}{m},$$

NB: When you need a firm's own elasticity to calculate actual loss, this formula may help

where m is the *percentage gross margin*:

$$m = \frac{p - c}{p}$$

NB: The Lerner condition only applies to an individual profit-maximizing firm. Except in the case of a pure structural monopoly, it cannot be used to calculate aggregate demand elasticity.

Diversion ratios

- Definition (when Firm A raises in price and Firm B holds its price constant):

$$D_{A \to B} \equiv D_{AB} = \left.\frac{\Delta q_B}{\Delta q_A}\right|_{\text{for some } \Delta p_A}$$

Remember, "≡" means a definition

where Firm A increases prices by Δp_A and loses total sales of Δq_A, of which Δq_B go to Firm B

  - *Keep in mind*: The definition of diversion ratios is motivated by Firm A's price *increasing* and a corresponding loss of A's sales, some of which divert to Firm B

Diversion ratios

- Example
  - Firm A raises its price by 5% and loses 100 units (all other firms hold their price constant)
    - 40 units divert to Firm B
    - 25 units divert to Firm C
    - 35 units divert to other products

- Then:

$$D_{A \to B} = \frac{40}{100} = 0.40 \text{ or } 40\%$$

$$D_{A \to C} = \frac{25}{100} = 0.25 \text{ or } 25\%$$

Since $D_{A \to B} > D_{A \to C}$, B is generally regarded as a closer substitute to A than C

Diversion ratios

- Relative market share method of estimating diversion ratios
  - Very popular method
    - Used in court by economic experts when no other information on diversion ratios is available
  - Assumes that customers divert in proportion to the market shares of the competitor firms (after adjusting for any out-of-market diversion)
    - So that the largest competitors (by market share) get the highest diversions
  - When all diversion is to products within the candidate market:

$$D_{A\to B} = \frac{s_B}{1-s_A},$$

where s_A and s_B are the market shares of firms A and B, respectively

  - Example: Candidate market—
    - Firm A 40%
    - Firm B 30%
    - Firm C 24%
    - Firm D 6%

60% points to be allocated to three firms pro rata by their market shares

    - No diversion outside the candidate market

Then:

$$D_{A\to B} = \frac{0.30}{1-0.40} = 50.0\%$$

$$D_{A\to C} = \frac{0.24}{1-0.40} = 40.0\%$$

$$D_{A\to D} = \frac{0.06}{1-0.40} = 10.0\%$$

Adds to 100%, to account for 100% of the diverted sales

Diversion ratios

- Relative market share method of estimating diversion ratios
  - When there is some diversion to products outside the candidate market:

$$D_{A\to B} = \left(1 - \frac{\Delta q_{outside}}{\Delta q_A}\right)\frac{s_B}{1-s_A},$$

where $\frac{\Delta q_{outside}}{\Delta q_A}$ is the percentage of Firm A's lost sales that are diverted to firms outside

of the market

  - Example: Candidate market—
    - Firm A 50%
    - Firm B 25%
    - Firm C 15%
    - Firm D 10%
    - Outside diversion: 15%

Shares in the candidate market (= 100%)

→ 85% points to be allocated to the firms in the candidate market

Then:

$$D_{A\to B} = (1-0.15)\frac{0.25}{1-0.50} = 42.5\%$$

$$D_{A\to c} = (1-0.15)\frac{0.15}{1-0.50} = 25.5\%$$

$$D_{A\to D} = (1-0.15)\frac{0.10}{1-0.50} = 17.0\%$$

$$D_{A\to O} = 15\%$$

Total 85%
With outside diversion: 100%

Diversion ratios in *H&R Block*

- Warren-Boulton's derivation of diversion ratios in H&R Block/TaxACT
  - Used market shares to estimate diversion ratios
  - Recall
    - s_{HRB} = 15.6%
    - s_{TaxACT} = 12.8%
  - So

$$D_{HRB \to TaxACT} = \frac{12.8\%}{1 - 15.6\%} = 15.2\%$$

$$D_{TaxACT \to HRB} = \frac{15.6\%}{1 - 12.8\%} = 17.9\%$$

  - Interestingly, the court reported these diversion ratios as 14% and 12%
    - Warren-Boulton probably had some diversion to an outside option that was not given by the court
      - An outside option (assisted and manual) of 17% for HRB gives $D_{HRB \to TaxACT} = 14\%$
      - An outside option (assisted and manual) of 10% for TaxAct gives $D_{TaxACT \to HRB} = 12\%$

The Hypothetical Monopolist Test

The roadmap

1. The hypothetical monopolist test
2. Critical loss in homogeneous product markets
   - Use in markets support a single market price and hence do not exhibit differential prices or recapture
3. One-product SSNIP tests in differentiated products markets
   - Use in markets that are differentiated and so allow multiple prices and recapture
   - Also need data for one-product SSNIP recapture rates
4. Uniform SSNIP tests in differentiated products markets
   - Use in markets that are differentiated and so allow multiple prices and recapture
   - Also need data for uniform SSNIP recapture rates

In a differentiated product market, whether you use a one-product SSNIP or a uniform SSNIP depends on whether you have data on one-product SSNIP recapture rates or only uniform SSNIP recapture rates (say from switching data)

HMT: Example

- Example:
  - Say a hypothetical monopolist—
    - Faces an (inverse) demand: $p = 10 - \frac{1}{2} q$
    - Has no fixed costs and constant marginal costs of 4 per unit of production
    - Prevailing (premerger) price: $p_1 = 5$

Question: If the current market price is 5, would a SSNIP—usually taken to be 5%—be profitable?

  - We know how to do this:
    - Apply the incremental profitability test we examined in Unit 8 to determine if the gross loss in profits from the lost marginal sales are outweighed by the gross gain in profits from the higher profit margins earned on the retained inframarginal sales
    - Steps
      1. Set up the problem with what you know
      2. Figure out what you need
      3. Solve for the variables you need using the parameters given in the problem and the demand curve
      4. Solve for net incremental profits

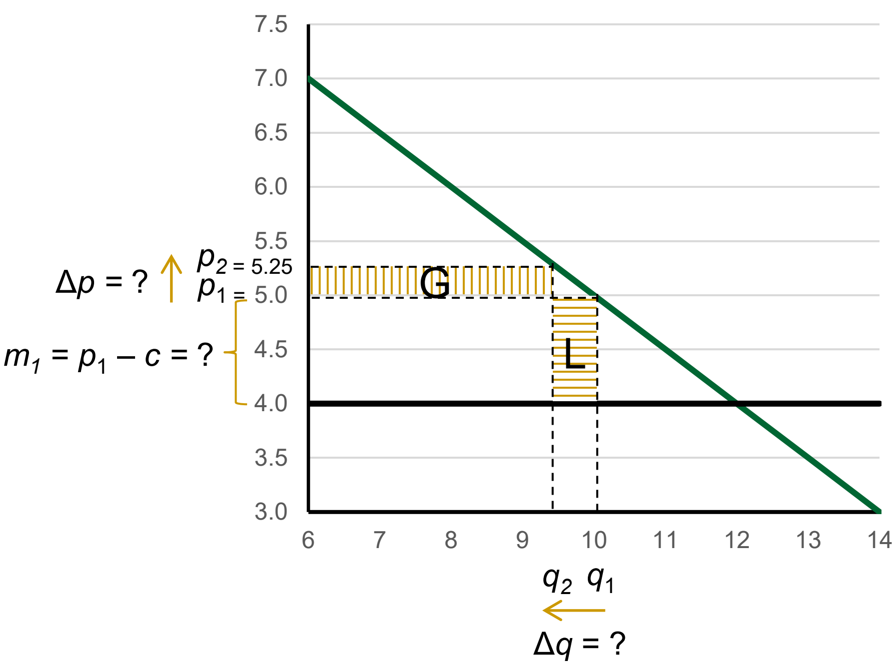
If incremental profits are positive, the hypothetical monopolist can profitably increase price by 5% and the product grouping satisfies the HMT

HMT: Example

- Step 1. Set up the problem with what you know:
  - (Inverse) demand: $p = 10 - \frac{1}{2} q$
  - Prevailing (premerger) price: $p_1 = 5$
  - SSNIP = 5%
  - Constant marginal cost $c = 4$

HMT: Example

- Step 1. Set up the problem:
  - (Inverse) demand: $p = 10 - \frac{1}{2}q$
  - Prevailing (premerger) price: $p_1 = 5$
  - SSNIP = 5%
  - Constant marginal cost $c = 4$



Step 2: Figure out what you need:

1. Need the gross gain on inframarginal sales that will be retained (Area G):

   Area G = price increase (Δp) times inframarginal sales (q_2)

   $= \Delta p q_2$

2. The gross loss on marginal sales that will be lost (Area L):

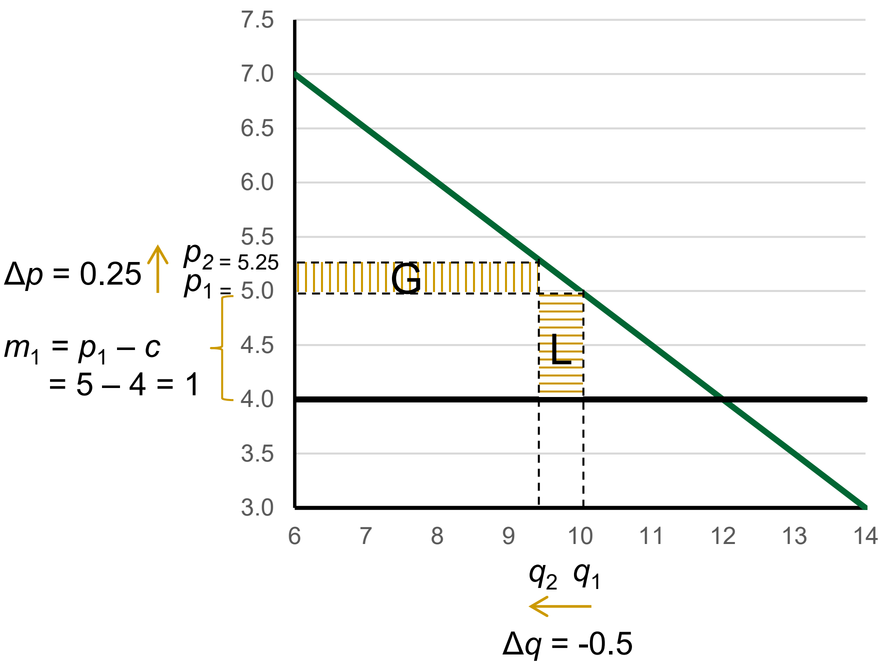
   Area L = gross margin on marginal sales (m_1) times (lost) marginal sales (Δq)

   $= m_1 \Delta q$

So need q_1, q_2, Δq, Δp, p_2, and m_1

HMT: Example

- Set up the problem:
  - (Inverse) demand: $p = 10 - ½ q$
  - Prevailing (premerger) price : $p_1 = 5$
  - SSNIP = 5%
  - Constant marginal cost $c = 4$



Step 3. Solve for the variables you need using the parameters given in the problem and the demand curve:

$q = 20 - 2p$ (from the inverse demand curve)

$q_1 = 10$ (when $p_1 = 5$)

$\Delta p = 0.25$ (applying 5% SSNIP to $p_1 = 5$)

$p_2 = 5.25$ (= $p_1 + \Delta p$)

$q_2 = 9.5$ (from demand curve with $p_2 = 5.25$)

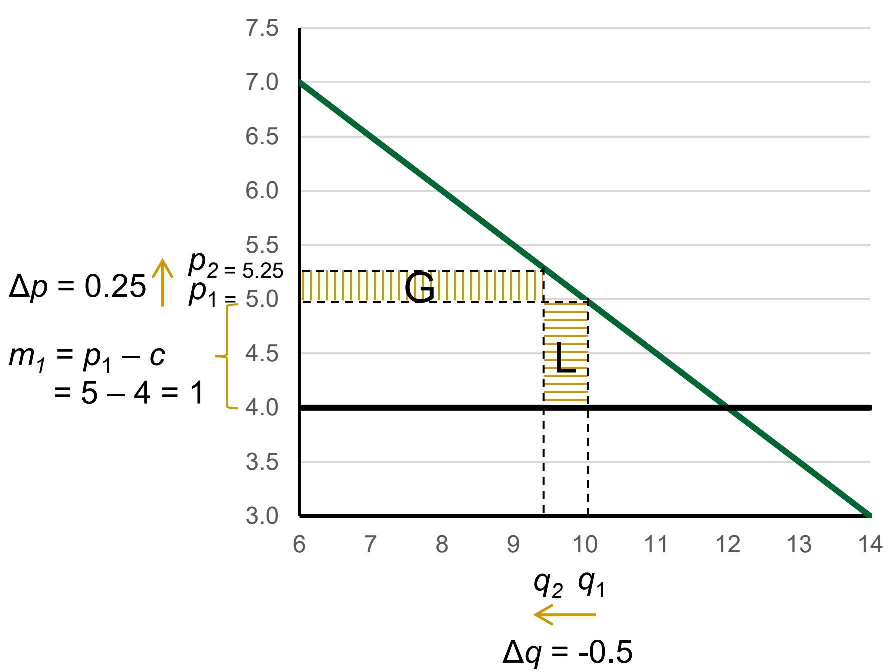
$\Delta q = q_2 - q_1 = 9.5 - 10 = -0.5$

$m_1 = p_1 - c = 5 - 4 = 1$

HMT: Example

- Set up the problem:
  - (Inverse) demand: $p = 10 - \frac{1}{2} q$
  - Starting point: $p_1 = 5$
  - SSNIP = 5%
  - Constant marginal cost $c = 4$

$q = 20 - 2p$ (from the inverse demand curve)
$q_1 = 10$ (when $p_1 = 5$)
$\Delta p = 0.25$ (applying 5% SSNIP to $p_1 = 5$)
$p_2 = 5.25$ (= $p_1 + \Delta p$)
$q_2 = 9.5$ (from demand curve with $p_2 = 5.25$)
$\Delta q = q_2 - q_1 = 9.5 - 10 = -0.5$
$m_1 = p_1 - c = 5 - 4 = 1$



Step 4. Solve for net incremental profits

Area G = $q_2 \Delta p$ = (9.5)(0.25) = 2.375
Area L = $m_1 \Delta q$ = (1)(-0.5) = -0.5

Incremental profits = Area G – Area L
= 2.375 – 0.5 = 1.875

Therefore, a price increase of 5 percent above the current level is profitable and the HMT is satisfied

HMT: Example 2

- Example—Uniform price increase on all products in the candidate market

> Consider blue cars (a homogeneous product) as a candidate market. Say blue cars are priced at $20,000 per car, cost $17,000 per car to produce, and sell 50,000 cars per year. If the price is increased by 5% on all blue cars, blue cars will only sell 45,000 cars per year. Are blue cars a relevant market under the hypothetical monopolist test for a 5% SSNIP?

Data		
Unit sales (q1)	50,000	From problem
Price (p1)	$20,000	From problem
Unit cost (c)	$17,000	From problem
$Margin ($m)	$3,000	Calculated
Retained sales (q2)	45,000	From problem
Lost (marginal) sales (Δq)	5,000	Calculated
%SSNIP	5%	From problem
$SSNIP	$1,000	Calculated

Incremental profit on inframarginal sales (area G)		
Inframarginal sales (q2)	45,000	
$SSNIP	$1,000	
Incremental gross profits	$45,000,000	q2 times $SSNIP
Incremental loss of profit on marginal sales (area L)		
Marginal sales (Δq)	-5,000	
$Margin ($m)	$3,000	
Incremental gross losses	-$15,000,000	$m times Δq
Incremental net profits	**$30,000,000**	Difference

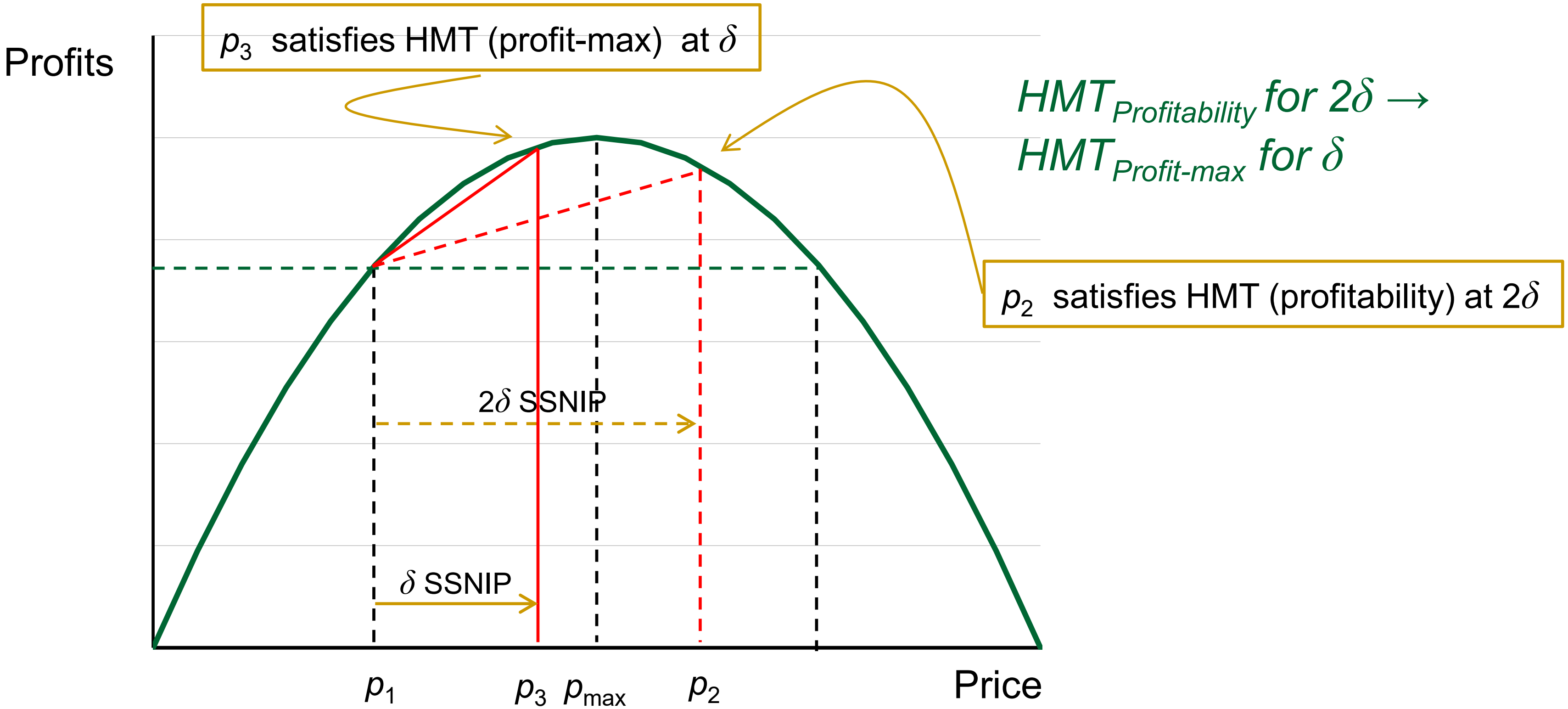
- Incremental net profits are positive, so blue cars are a relevant market under the hypothetical monopolist test
- This is a *"brute force" accounting* implementation of a uniform SSNIP test

HMT: Profitability v. profit maximization

1. Should the test be whether the SSNIP is profitable for the hypothetical monopolist (the *profitability* or *breakeven test*) or whether the hypothetical monopolist's profit-maximizing price is equal to or greater than the SSNIP (the *profit-maximization test*)?
   - The practice under the 1982 and 1992 Merger Guidelines in the agency and the courts was to use the profitability test
     - The profitability test is sometimes called the *breakeven test*
     - Moreover, notwithstanding that change in verb from "could" to "would" in the 1992 Merger Guidelines, the agencies did not change from a profitability test to a profit-maximization test either in their investigations or in their briefs in court
   - After the 2010 Merger Guidelines were released, the DOJ and FTC chief economists began to emphasize the profitability test as the proper one in economic analysis as well as the one prescribed by the language of the Guidelines
   - Practice in the courts
     - As the courts were adopting the hypothetical monopolist test in the 1980s and early 1990s, the 1982 and 1992 guidelines were in effect
     - As a result, the agencies urged the courts to adopt, and the courts did adopt in fact, the probability version of the hypothetical monopolist test
     - Today, the profitability test remains the judicial test in most courts

HMT: Profitability v. profit maximization

- Testing for profit-maximization
  - *Proposition*: Given the symmetry in the profit curve when demand is linear, a candidate market will satisfy the profit-maximization test for a SSNIP of δ if the candidate market satisfies the profitability test of 2δ



HMT: Profitability v. profit maximization

- Profitability v. profit-maximization: Does it matter?
  - *Not really*: The profit-maximization test will fail only if the prevailing market price is within 5 percent of the monopolist's profit-maximizing price
    - Empirically, this should occur only rarely
  - In any event, the profitability test appears to be used by most courts

In this course, the default is the profitability *version of the HMT although we will see the profit-maximization in some case studies*

HMT: Recap

- The question
  - Can a hypothetical monopolist of a group or products (a *candidate market*) profitably increase the price of those products by a small but significant nontransitory amount (a *SSNIP*)?
- The (profitability) test: If the incremental profits from the price increase are—
  - *Positive*: The price increase is profitable and the HMT is satisfied
  - *Negative*: The price increase is unprofitable and the HMT fails
- The accounting: Incremental profits
  - Incremental profits =
    - The gain from the increased margin (Δp) on the inframarginal sales (q_2)
    - *minus* the dollar loss of margin ($p_1 - c$) on the marginal sales (Δq)
  - $= [\Delta p \times q_2] - [(p_1 - c) \times \Delta q] = \Delta\pi$
- The data
  - The statement of the problem will give you p_1, q_1, c, the SSNIP, and some indication of how demand changes with an increase in price
  - Those variables will permit you to calculate Δp, q_2, Δq, and net incremental profits

HMT: Three implementations

- Critical loss in homogeneous (single-price) markets
- One-product SSNIP tests in differentiated markets
- Uniform SSNIP tests in differentiated markets

Critical Loss Analysis

Critical loss

- The *critical loss rule*:

  If actual loss is less than the critical loss,
  the candidate market satisfies the HMT

- The idea
  - When actual loss is less than critical loss, this means that for a given SSNIP the hypothetical monopolist is able—
    - to capture enough incremental profits on the margin increase on its inframarginal sales
    - to offset the incremental profit decrease on the loss of the marginal sales
- A caution
  - Actual loss and critical loss are functions of the magnitude of the SSNIP
  - A hypothetical monopolist that satisfies the HMT at a 5% SSNIP may fail the HMT for a different SSNIP (e.g., 10%)

Critical loss

- The basic idea
  - The critical loss for Δp will be the maximum quantity the hypothetical monopolist could loss Δq_{cl} and still make at least as much in profit as it did before the SSNIP was implemented:

Post-price <u>increase profits</u> = Pre-price <u>increase profits</u>

$$\underbrace{\underbrace{(p+\Delta p}_{p_2}-c)}_{m_2}\underbrace{(q-\Delta q_{cl})}_{q_2} = \underbrace{(p-c)}_{m_1}q$$

$\boxed{\text{Breakeven condition with constant marginal costs}}$

  - Rearranging this equality, we can also express this condition as an equality of the gross gain in profits on retained sales and the gross loss in profits from lost sales:

<u>Gain on retained sales</u> = <u>Loss of margin on lost sales</u>

$$\Delta p\left(q-\Delta q_{cl}\right) = \left(p-c\right)\Delta q_{cl}$$

Note: Critical loss is a function of the starting point *q* as well as *p, Δp,* and *c*

Critical loss

NB: By convention, Δq_{cl} is a *positive* number. *Always watch for the sign of Δq in any equation.*

- Summary of formulas[1]
  - *Absolute terms (brute force):*

$$\underbrace{\Delta p\left(q-\Delta q_{cl}\right)}_{\text{Gain on retained sales}} = \underbrace{\left(p-c\right)\Delta q_{cl}}_{\text{Loss of margin on lost sales}}$$

  - *Unit critical unit loss*:

$$\left(CL=\right)\Delta q_{cl} = \frac{q\Delta p}{\left(p+\Delta p\right)-c}$$

All variables are in units

  - *Percentage critical loss*:

$$\left(\%CL=\right)\frac{\Delta q_{cl}}{q} = \frac{\delta}{\delta+m}$$

All variables are in percentages

where δ is the percentage price increase: $\delta = \dfrac{\Delta p}{p}$

m is the percentage gross margin: $m = \dfrac{p-c}{p}$

[1] This is for the profitability implementation of the HMT and assumes constant marginal costs.

Critical loss

- Summary of formulas when the percentage margin *m* is the same for all products
  - *Critical elasticity*:

$$|\varepsilon_{cl}| \cong \frac{1}{\delta + m}$$

All variables are in decimals because of the "1" in the numerator (If you want to use percentages, use "100" in the numerator)

where ε is the own-elasticity of demand of the monopolist (i.e., the aggregate demand curve)

- Accordingly, when the actual own-elasticity of demand ε is less than the critical elasticity ε_{cl} (i.e., ε is more *in*elastic than ε_{cl} or equivalently $|\varepsilon| < |\varepsilon_{cl}|$), then for a small enough %SSNIP the price increase will be profitable:

$$|\varepsilon| < \frac{1}{\delta + m} \quad \text{means the HMT is satisfied}$$

Estimating actual loss (Δq)

- Estimating actual loss (Δq)
  - We can estimate the percentage critical loss if we know the aggregate own-elasticity of demand for the candidate market when:
    - Premerger, the firm are profit-maximizing (and so satisfy the Lerner Condition (ε =1/*m*)), and
    - All demand functions are linear in price in the vicinity of the premerger equilibrium point
  - Since

$$\varepsilon \equiv \frac{\frac{\Delta q}{q}}{\frac{\Delta p}{p}} = \frac{\%\Delta q}{\%\Delta p},$$

where ε is the residual own-elasticity of demand (e.g., of the hypothetical monopolist or of an individual firm)

  - Then (with a little algebra):
    - *Percentage actual loss (linear demand)*:

$$\%\Delta q = \delta\varepsilon$$

Percentage actual loss formula

    - *Unit actual loss* (linear demand):

$$\frac{\Delta q}{q} \approx \delta\varepsilon \Rightarrow \Delta q = q\delta\varepsilon.$$

Actual loss formula

Estimating actual loss (Δq)

- Example

> A firm sells 1000 gourmet pizzas in a differentiated market at $3.00 per pizza and a dollar margin of $1.50. How many customers would it lose if the firm were to increase its price by 5 percent?

  - Calculation:

Price (p)	$3.00	Data
Quantity (q)	1000	Data
$margin ($m)	$1.50	Data
%SSNIP	5%	Data
%margin (%m = $m/p)	50%	Calculated
Residual elasticity (ε = 1/%m)	2	Calculated
%Δq = %SSNIP times ε	10%	Calculated
Δq = q%Δq	100	Calculated

Critical loss: Example 0

Products A and B are being tested as a candidate market. Each has a price of $100, has an incremental cost of $60, and sells 1200 units. When the price for both products is increased by $5, each firm loses 100 units to outside the market. Do A and B constitute a relevant market under the 2010 Guidelines?

Brute force

Parameters			**"Brute force" profit calculations**		
Price	p	100	Gain = (Q+ΔQ)Δp		
Cost	c	60		Q + ΔQ	2200
Gross margin	m	40		Δp	5
Market output	Q	2400		Gain	11000
SSNIP	Δp	5	Loss = mΔQ		
Customer loss	ΔQ	-200		ΔQ	-200
				m	40
				Loss	-8000
			Net		3000

Brute force profit calculations confirmation: Since the gain exceeds the loss, a hypothetical monopolist of A and B could profitably raise price by 5% and so A and B are a relevant market under the HMT

Critical loss: Example 1

Products A and B are being tested as a candidate market. The market price for each unit of either product is $300, each type of product has a constant incremental cost of $160 per unit and aggregate sales of 1000 units. When the price for both products is increased by $15, each firm loses 100 units to products other than A and B. What is the critical loss for the candidate market of products A and B? Do A and B constitute a relevant market under the hypothetical monopolist test using critical loss analysis and SSNIP of 5%?

You are given the actual unit loss, so think the unit critical loss test

- Step 1: Summarize variables
  - $p = 300$ — $Q = 1000 + 1000 = 2000$
  - $c = 160$ — $\Delta Q = 100 + 100 = 200$
  - \$SSNIP = 15
- Step 2: Apply the *unit critical loss formula* to find unit critical loss

$$\Delta Q_{cl} = \frac{Q\Delta p}{(p+\Delta p)-c} = \frac{2000 * 15}{(300+15)-160} = 193.55$$

- Step 3: Compare actual loss to unit critical loss
  - Actual loss: $\Delta Q = 100 + 100 = 200$ units
  - Unit critical loss $\Delta Q_{cl} = 193.55$
- *Answer*: Since $\Delta Q > \Delta Q_{cl}$, Products A and B are technically NOT a relevant product market under the Merger Guidelines

Critical loss: Example 2

Premium cupcakes sell for \$1.50 apiece and cost \$0.90 to make. At this price, producers collectively sell 10,000 premium cupcakes. When the price for all premium cupcakes is increased by 5%, 15% of the customers switch to regular cupcakes. Do premium cupcakes constitute a relevant market under the 2010 Guidelines?

You are given the percentage loss, so think percentage critical loss

- Step 1: Summarize the variables
  - $p = 1.50$
  - $c = 0.90$
  - $m = \frac{1.50 - 0.90}{1.50} = 40\%$
  - %SSNIP = 5%
  - $Q = 10{,}000$
  - $\%\Delta Q = 15\%$
- Step 2: Calculate the percentage critical loss:

$$(\%CL =)\frac{\Delta q_{cl}}{q} = \frac{\delta}{\delta + m} = \frac{5\%}{5\% + 40\%} = 11.11\%$$

- Step 3: Compare percentage actual loss to percentage critical loss
  - Percentage actual loss = 15%
  - Percentage critical loss = 11.11%
- *Answer*: Since $\%\Delta Q > \%\ \Delta Q_{cl}$, premium cupcakes are NOT a relevant product market

Critical loss: Example 3

Premium ice cream sells at \$4.00/pint and has a constant marginal cost of \$2.25/pint. The own-elasticity of aggregate demand for premium ice cream is −1.9, with almost all diversion going to regular ice cream. Two premium ice cream manufacturers proposed to merge. Is premium ice cream a relevant product market under the hypothetical monopolist test under a 5% SSNIP, or should the market be expanded to include regular ice cream?

You are given an actual elasticity, so think critical elasticity

- Step 1: Summarize variables
  - $p = 4.00$ %SSNIP = 5%
  - $c = 2.25$ $\varepsilon = -1.9$
  - $\%m = \dfrac{4.00 - 2.25}{4.00} = 43.75\%$
- Step 2: Calculate the absolute value of the critical elasticity:

$$\left|\varepsilon_{cl}\right| = \frac{1}{\delta + m} = \frac{1}{0.05 + 0.4375} = 2.05$$

In calculating critical elasticity, be sure to convert the percentages into decimal numbers!

- Step 3: Compare the actual elasticity with the critical elasticity:
  - Actual elasticity (absolute value) = 1.9
  - Critical elasticity (absolute value) = 2.05
- *Answer*: Since $|\varepsilon| < |\varepsilon_{cl}|$, premium ice cream is a relevant market (inelastic enough)

Critical loss: Example 4

In *FTC v. Occidental Petroleum Corp*., No. 86-900, 1986 WL 952 (D.D.C. Apr. 29, 1986), the FTC challenged the pending acquisition by Occidental Petroleum, a major producer of polyvinyl chloride ("PVC"), of Tenneco's PVC business. Both companies produced PVC in plants in the United States. The parties agreed that the relevant product markets were suspension homopolymer PVC and dispersion PVC, and the PI proceeding focused largely on the relevant geographic market. The FTC alleged that the relevant geographic market was the United States for both types of products; the merging parties argued that the relevant geographic market was worldwide. In the Section 13(b) proceeding for a preliminary injunction, the evidence showed that if the price of all suspension homopolymer PVC produced in the United States was increased by 5%, U.S. customers would divert about 17% of their purchases to imports from foreign suppliers (who were ready to serve these customers). The evidence also showed that that if the price of all dispersion PVC produced in the United States was increased by 5%, U.S. customers would divert about 12% of their purchases to imports from foreign suppliers (again, who were ready to serve these customers). The evidence in the hearing also showed that the percentage gross margins for homopolymer PVC and dispersion PVC were 28% and 45%, respectively. Was the FTC correct that the relevant geographic market was the United States using the hypothetical monopolist test and a SSNIP of 5%?

You are given the percentage loss, so think percentage critical loss

Critical loss: Example 4

- Use percentage critical loss method
  - Step 1: Summarize the variables

Suspension PVC	Dispersion PVC
%SSNIP = 5%	%SSNIP = 5%
%m =28%	%m = 45%
%ΔQ = 17%	%ΔQ = 12%

  - Step 2: Calculate the percentage critical loss:
  - $$\%\Delta q_{cl-suspension\ PVC} = \frac{\delta}{\delta + m} = \frac{5\%}{5\% + 28\%} = 15.15\%$$

$$\%\Delta q_{cl-dispersion\ PVC} = \frac{\delta}{\delta + m} = \frac{5\%}{5\% + 45\%} = 10.00\%$$

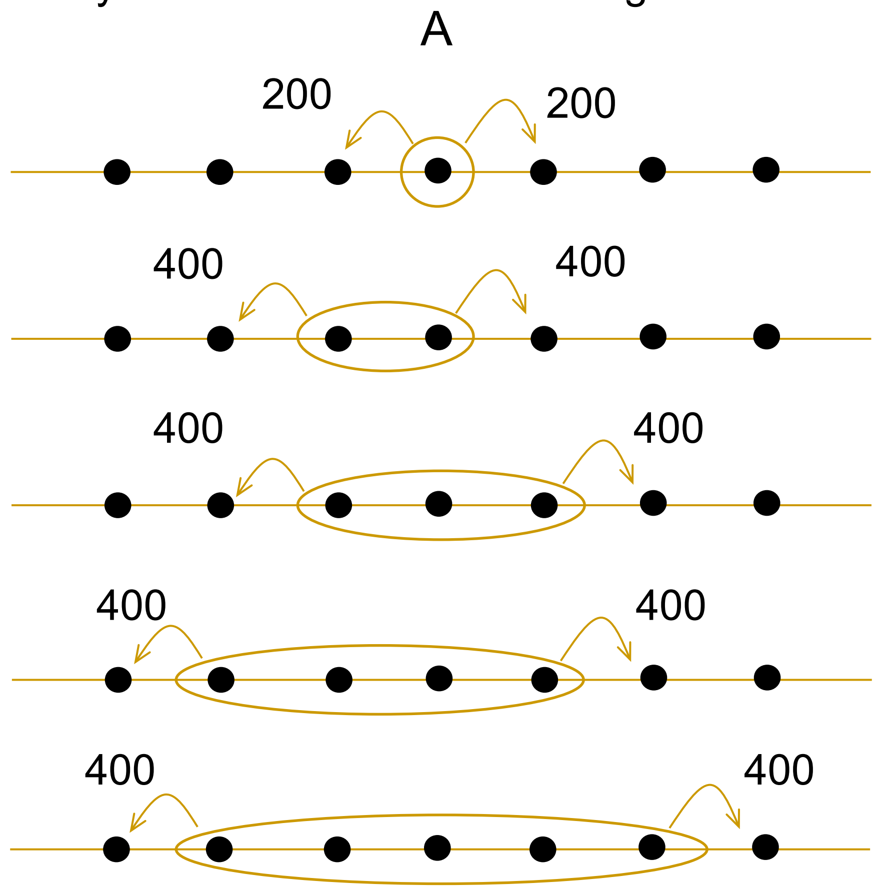
  - Step 3: Compare percentage actual loss to percentage critical loss:
    - Suspension PVC: 17% actual 15.15% percentage critical loss
    - Dispersion PVC: 12% actual 10.00% percentage critical loss
  - *Answer*: The percentage actual loss is greater than the percentage critical loss for both product types, so neither product type technically is its own relevant product market

Critical loss: Example 5

Assume that there is an identical gas station every mile on a straight road. Each gas stations charges $3.25 per gallon, has an incremental costs of $2.50, and sells 1000 gallons. When the price at a station is increased by 5% (holding the price at all other gas stations constant), the station loses customers who in the aggregate buy 400 gallons. No customer will travel more than one mile, however, to avoid a 5% price increase. For a given station A and assuming a SSNIP of 5%, what is the relevant market?

Critical loss: Example 5

- Example 4: Gas stations on a road
  - Step 0: Make sure you understand the switching behavior!



Critical loss: Example 5

Assume that there is an identical gas station every mile on a straight road. Each gas stations charges $3.25 per gallon, has an incremental costs of $2.50, and sells 1000 gallons. When the price at a station is increased by 5% (holding the price at all other gas stations constant), the station loses customers who in the aggregate buy 400 gallons. No customer will travel more than one mile, however, to avoid a 5% price increase. For a given station A and assuming a SSNIP of 5%, what is the relevant market?

This is complicated, so think brute force

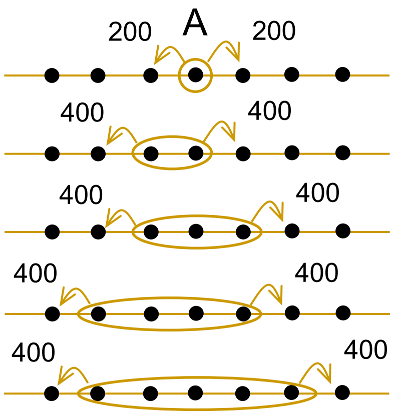
- Step 1: Summarize the variables
  - $p = 3.25$
  - $c = 2.50$
  - $\$m = 3.25 - 2.50 = 0.75$
  - Customers/station = 1000
  - Customer loss per station = 400

%SSNIP = 5%

$\$SSNIP = 0.05 * 3.25 = 0.1625$

- Step 2: Calculate net profit gain as the market expands

Stations in the market	Q	ΔQ	Gain	Loss	Net
1	1000	400	97.50	300.00	-202.50
2	2000	800	195.00	600.00	-405.00
3	3000	800	357.50	600.00	-242.50
4	4000	800	520.00	600.00	-80.00
5	5000	800	682.50	600.00	82.50



Five stations, with Station A in the middle, is the relevant geographic market

Critical loss: Differentiated margins

- Multiple margins in homogeneous product markets
  - In the percentage critical loss formulas in the earlier slides, the percentage margins of the various products in the candidate markets were all assumed to be equal
  - In many homogeneous candidate markets, however, the percentage margins will differ among firms
    - Production technologies may differ among firms resulting in different marginal costs and hence different margins even when all products are homogeneous and sell at the same price
  - Since the products are homogeneous, the market is single-priced and the hypothetical monopolist must increase the prices of all firms in the candidate market by a SSNIP

- There are three ways to handle homogeneous product markets with differentiated margins
  - Brute force accounting
  - Using diversion ratio-weighted average margins
  - Using sufficiency tests

Critical loss: Differentiated margins

- Setting up the problem
  - Without loss of generality, assume that there are three firms in the candidate homogeneous product market:

Firm	Sales (q_i)	Share (s_i)	%Margin (m_i)	Diversion (Δq_i)
1	500	0.5	0.4	60
2	300	0.3	0.6	30
3	200	0.2	0.2	10

    - The market price p is $10
    - The diversion Δq_i for firm i is the quantity that diverts outside the candidate market for a uniform 5% SSNIP (presumably there is no intramarket diversion with a uniform price increase)
    - Total division from the market for a uniform 5% SSNIP is $\sum_{i=1}^{3} \Delta q_i = 100$
  - HMT: Is a uniform 5% SSNIP profitable? YES
    - As in all cases, the answer depends on whether the gain to the monopolist on the increased margin on the inframarginal sales is greater than the loss of margin on the marginal sales

Brute force calculation

Gain on Inframarginal Sales				Loss on Marginal Sales			
Firm	$q_i - \Delta q_i$	$SSNIP	Gain	Δq_i	%Margin	$Margin	Loss
1	440	0.5	220	60	0.4	4	240
2	270	0.5	135	30	0.6	6	180
3	190	0.5	95	10	0.2	2	20
			450	100			440

Critical loss: Differentiated margins

- A simple sufficiency test
  - Let m_{Max} be the maximum margin of any product in the candidate market. Then if—

$$\frac{\delta}{\delta + m_{Max}} > \frac{\Delta q}{q} \ (= \%\text{actual loss}),$$

    a hypothetical monopolist can profitably increase prices by a uniform SSNIP
  - The idea is simple: This test essentially assumes the worst case—all unit losses by the hypothetical monopolist as a result of a unform SSNIP all come from the product with the highest margin and hence yields the maximum profit loss on the marginal sales
    - NB: This is a *sufficiency test*—the failure of the test does not necessarily mean that the candidate market is not a relevant market

Critical loss: Differentiated margins—Ex. 6

In a homogeneous product market, firms have different technologies and hence different marginal costs and percentage margins. The candidate market contains three firms with different margins given in the table below. For a 5% SSNIP, the hypothetical monopolist would lose 8% of its sales. Is the candidate market a relevant market?

Product	Share	Margin
A	0.5	0.4
B	0.3	0.7
C	0.2	0.3

- Solution
  - The problem gives the actual percentage loss, so use the percentage critical loss formula
  - Since the margins differ, use the diversion share-weighted percentage margin m_{Ave}
    - Also, since we do not know anything about the actual losses or diversion ratios for individual products, use market share (unit shares and revenue shares are the same) as a proxy:

$$m_{Ave} = s_1 m_1 + s_2 m_2 + s_3 m_3 = (0.5)(0.4) + (0.3)(0.7) + (0.2)(0.3) = 0.47$$

    - Solving for percentage critical loss:

$$\%CL = \frac{\delta}{\delta + m} = \frac{0.05}{0.05 + 0.47} = 9.6\%$$

Since the actual loss of 8% is less than the critical loss of 9.6%, the candidate market is a relevant market under a uniform SSNIP test

Critical loss: Summary

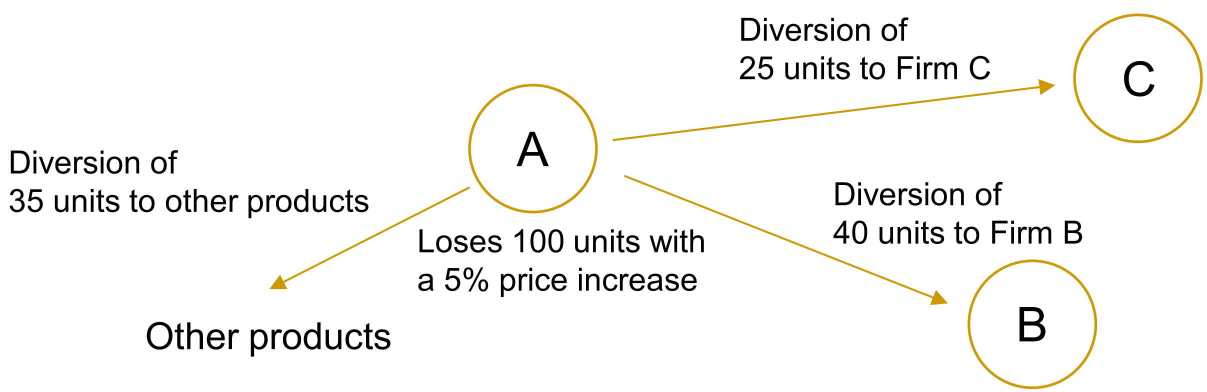
- Points to remember
  - In the standard models, the hypothetical monopolist increases price by reducing output, which creates a scarcity in the product. Inframarginal customers then bid up the price in order to clear the market.
  - While small reductions in output may increase profits, sufficiently large reductions will reduce profits below the prevailing level
  - The maximum output reduction at which the hypothetical monopolist just breaks even on profits is called the *critical loss*
    - The critical loss is the output reduction where the profits gained from the increase in margin in the inframarginal sales just equal the profits lost from the loss of the marginal sales
  - *Test*: If the actual loss of sales due to a SSNIP is less than the critical loss, the SSNIP will be profitable and the candidate market will satisfy the HMT
  - Implementations
    - "Brute force" accounting
      - Calculate the additional profit gain from the increase in margin on inframarginal sales ($SSNIP times inframarginal sales)
      - Calculate the profit loss from the lost marginal sales ($margin times marginal sales)
      - Compare: If the gains exceed the losses, then the product grouping is a relevant market
    - Use a critical loss formula
    - Use a sufficiency formula

When in doubt, use "brute force" accounting—
It is the most intuitive and will always work!

One-Product SSNIP Recapture Tests
(“Aggregate Diversion Analysis”)

Diversion ratios

- Example
  - Firm A raises its price by 5% and loses 100 units (all other firms hold their price constant):
    - 40 units divert to Firm B
    - 25 units divert to Firm C
    - 35 units divert to other products



  - Then:

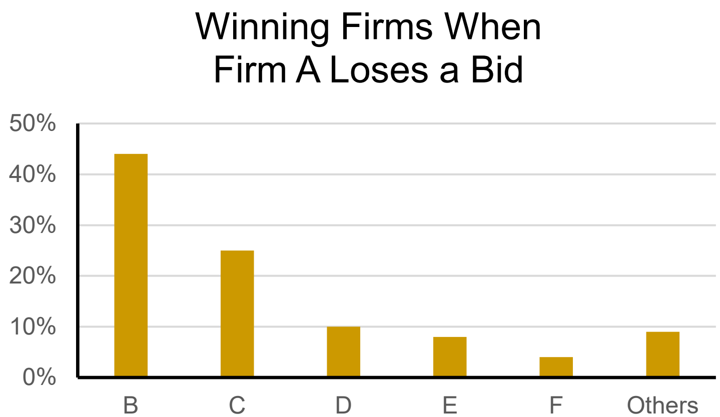
$$D_{A\to B} = \frac{40}{100} = 0.40 \text{ or } 40\%$$

$$D_{A\to C} = \frac{25}{100} = 0.25 \text{ or } 25\%$$

Since $D_{A\to B} > D_{A\to C}$, B is generally regarded as a closer substitute to A than C

Diversion ratios

- How are diversion ratios estimated? (Usually not very accurately)
  1. Data collected during the regular course of business (including win/loss data)



Firm	Loss Percentage
B	44%
C	25%
D	10%
E	8%
F	4%
Others	9%
	100%

  - The data is for losses on similar projects
    - That is, projects that are likely to be in the same relevant market
  - The loss percentages are taken as estimates of the diversion ratios
    - So the estimated D_{AB} is 44%
  - But may be inaccurate: For example—
    - Some bids may be evaluated on nonprice and well as price factors
      - This can result in the data overestimating either actual recapture or diversion outside of the candidate market, making the relevant market appear smaller or larger (respectively) than it actually is
    - Some firms may be engaged in strategic bidding (e.g., bidding to lose)

Diversion ratios

- How are diversion ratios estimated? (Usually not very accurately)

2. Indications in the company documents
3. Consumer surveys
   - But very sensitive to survey design and customer ability to accurately predict product choice in the presence of a price increase
   - Often given little weight in court, especially when there are better alternative methods of estimating diversion ratios (as was the case in *H&R Block*)
4. Switching shares as proxies
   - Where switching behavior is not limited to reactions to changes in relative price
   - Use only when better estimates are not available
   - *Example*: H&R Block/TaxACT (where the court accepted a diversion analysis based on IRS switching data only as corroborating other evidence)
5. Demand system estimation/econometrics
   - Econometric estimation of all own- and cross-elasticities of all interacting firms
   - Very demanding data requirements—Usually possible only in retail deals where point-of-purchase scanner data is available
6. Market shares as proxies: Relative market share method
   - Commonly used method when other data is not available
   - Assumes that customers divert in proportion to the market shares of the competitor firms (after adjusting for any out-of-market diversion)
     - So that the largest competitors (by market share) get the highest diversions

Diversion ratios

- Relative market share method: Application
  - When all diversion is to products within the candidate market:

$$D_{A\to B} = \frac{s_B}{s_B + s_C + \cdots + s_N} = \frac{s_B}{1 - s_A},$$

That is, $D_{A\to B}$ is the share of firm B divided by the sum of the shares of the firms other than A in the candidate market

where s_A and s_B are the market shares of firms A and B, respectively

  - *Example*: Candidate market—
    - Firm A 40%
    - Firm B 30%
    - Firm C 24%
    - Firm D 6%
    - No diversion outside the candidate market

$\left.\begin{array}{l}\text{Firm B } 30\% \\ \text{Firm C } 24\% \\ \text{Firm D } 6\%\end{array}\right\}$ 60% points to be allocated to three firms pro rata by their market shares

Then:

$$D_{A\to B} = \frac{0.30}{1-0.40} = 50.0\%$$

$$D_{A\to C} = \frac{0.24}{1-0.40} = 40.0\%$$

$$D_{A\to D} = \frac{0.06}{1-0.40} = 10.0\%$$

Adds to 100%, to account for 100% of the diverted sales

Diversion ratios

- Relative market share method: Application (con't)
  - When there is some diversion to products outside the candidate market:

$$D_{A\to B} = \left(1 - \frac{\Delta q_{outside}}{\Delta q_A}\right)\frac{s_B}{1-s_A},$$

where $\frac{\Delta q_{outside}}{\Delta q_A}$ is the percentage of Firm A's lost sales that are diverted to firms outside of the market

  - *Example*: Candidate market—
    - Firm A 50%
    - Firm B 25%
    - Firm C 15%
    - Firm D 10%

    $\}$ Shares in the candidate market (= 100%)

    - Outside diversion: 15%

    $\rightarrow$ 85% points to be allocated to the firms in the candidate market

The outside diversion is data (say, from empirical analysis) and not to be estimated

Then:

$$D_{A\to B} = (1-0.15)\frac{0.25}{1-0.50} = 42.5\%$$

$$D_{A\to c} = (1-0.15)\frac{0.15}{1-0.50} = 25.5\%$$

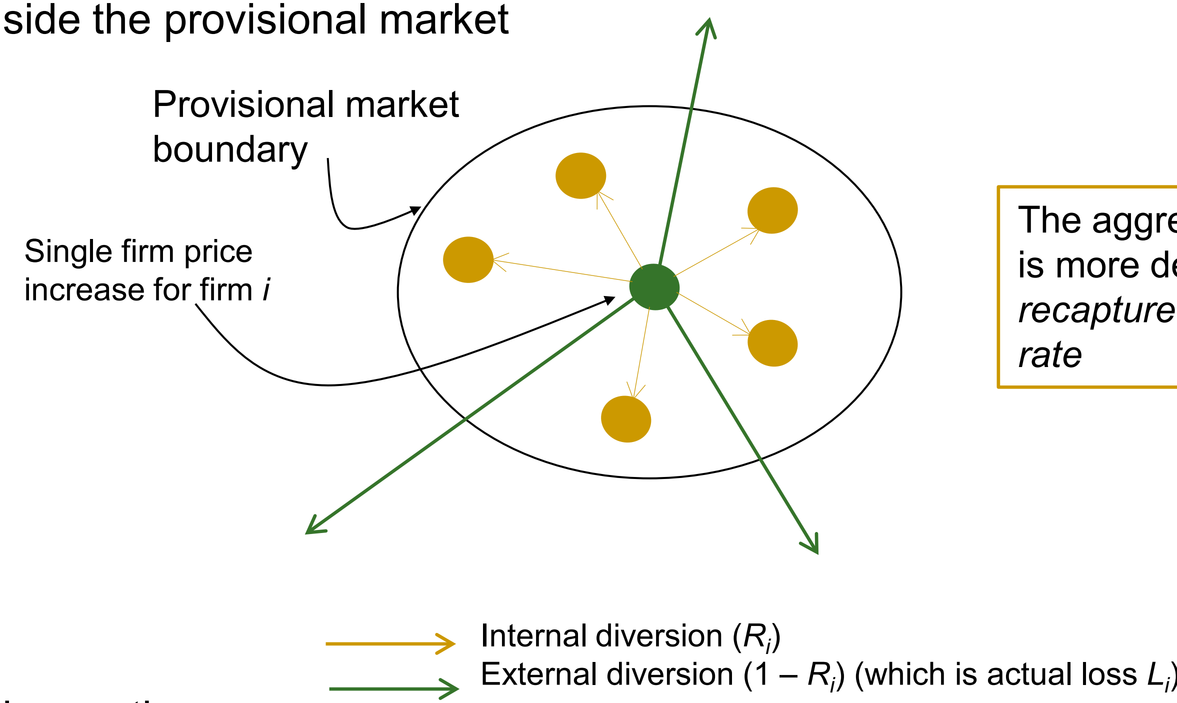
$$D_{A\to D} = (1-0.15)\frac{0.10}{1-0.50} = 17.0\%$$

$$D_{A\to O} = 15\%$$

Total 85% to firms B, C, and D
With outside diversion: 100%

One-product SSNIP recapture test

- Definition: Aggregate diversion ratio
  - The percentage R_i of total sales lost by a given product in the wake of a SSNIP applied only to product *i* that is captured by the aggregate of the other products inside the provisional market



The aggregate diversion ratio is more descriptively call the *recapture ratio* or the *recapture rate*

  - Observation
    - 100% of the total loss of sales by firm *i* is equal to the recapture percentage R_i that are diverted to firms in the candidate market plus the percentage loss of sales L_i to all firms outside the market (that is, R_i + L_i = 100% for all firms in the market)

The one-product SSNIP recapture test

- The idea
  - When the hypothetical monopolist increases the price of only one product in the candidate market, its lost sales divert both to—
    - Products outside of the market ("external diversion"), *and*
    - Other products inside the market ("internal diversion)
  - As always, the profitability of a one-product SSNIP will depend on whether the hypothetical monopolist profit gains from the price increase outweigh its losses
  - But in the case of a one-product SSNIP, the gains will be—
    - The increase in margin on the inframarginal sales of the product subject to the SSNIP
    - PLUS the profits earned by all other products in the candidate market on recaptured sales from internal diversion
  - *The test*: Assume that there are *n* products in the candidate market. A one-product SSNIP in the price of product 1 is profitable for the hypothetical monopolist if and only if:

$$\underbrace{\boxed{\text{Gains on the inframarginal sales of product 1}} + \boxed{\text{Loss of profits the lost marginal sales of product 1}}}_{\text{Net profits from the product subject to the SSNIP (these should always be negative!)}} < \boxed{\text{Profits on the lost product 1 sales recaptured by products } 2, \ldots, n}$$

The one-product SSNIP test

- The easy way to think about a one-product SSNIP test:
  - Let A be one of the merging firms. Looking only at A's accounting records:

Profit gains on inframarginal sales	+	Profit losses on marginal sales	=	Net loss

Because A was profit-maximizing as a standalone firm

  - Now look at the books of the other firms in the candidate market:

Profit gains on recaptured sales

These profits are earned at the original dollar margins because the SSNIP was imposed only on firm A

  - In considering the profitability of a price increase on A's product, the hypothetical monopolist considers the accounting results of all firms in the candidate market
  - Test: *Are the profits gains on the recaptured sales sufficient to offset firm A's standalone net loss?*
    - If so, then the candidate market is a relevant market under the HMT
    - If not, look at the profitability of a SSNIP on the other merging product

The one-product SSNIP test: Example 1

- "Brute force" method for single product price increase—Example 1
  - Example 1: (Differentiated) Gourmet pizzas
    - Assume that for a single product price increase of 5%, the hypothetical monopolist would retain 90 out of every 100 customers. Of the 10 lost customers, 7 would divert to another gourmet pizza and 3 would go to a standard pizza. Assume that the price of gourmet pizzas is $3.00 and that the dollar margin is $1.50 per pie for all producers.
    - *Query*: Under the single-product 5% SSNIP test, are gourmet pizzas a relevant product market?

Data	Out of every units sold:	100	Price	$3.00
			$Margin	$1.50
	Units retained	90	SSNIP (%)	5.00%
	Total units lost	10	SSNIP ($)	$0.15
	Units recaptured	7		
Analysis	Gain on inframarginal	$13.50	Units retained (90) times $SSNIP ($0.15)	
	Loss on marginal sales	-$15.00	Total units lost (10) times $margin ($1.50)	
	Gain on recapture	$10.50	Recaptured units (7) times $margin ($1.50)	
	Net gain	$9.00		

- Since the 5% price increase results in a net profit gain, gourmet pizzas are a relevant market

Relation to critical loss: When the dollar margins on the recapture sales are the same as the lost sales, those recaptured sales wash out the associated loss. Hence, you might think that you can look only at the sales not recaptured within the market (i.e., those that go to the "outside option") and do a critical loss analysis.

BUT this is not quite right. The inframarginal sales of Product 1 post-SSNIP earn an additional margin, but the recaptured sales earn the original margin. So you cannot use a critical loss test to test a one-product SSNIP.

The one-product SSNIP test: Example 2

- "Brute force" method for single product price increase—Example 2
  - We can use the brute force method for a single product price when *dollar margins* differ among products within the candidate market (here, $\$m_2 = 1.75$; $\$m_3 = 1.35$)
    - Of firm G1's 10 marginal customers, 4 divert to firm G2 and 3 divert to firm G3
    - A "brute force" accounting calculation is almost always the best way to analyze the profitability of a single-product SSNIP when dollar margins differ in the candidate market

Gourmet pizza--Single product price increase

(brute force method--different margins for candidate market of three firms)

Out of every 100 units sold by Firm G1 (the firm experiencing the price increase):

	For Firm G1:		**For Firm G2:**		**For Firm G3:**	
Data	Total units retained	90				
Data	Total unit lost	10	Total units recaptured	4	Total units recaptured	3
Data	G1 price	\$3.00				
Data	G1 margin	\$1.50	G2 \$margin	\$1.75	G2 \$margin	\$1.35
Data	SSNIP (%)	5.00%				
Data	SSNIP (\$)	\$0.15				
	Gain on retained units	\$13.50	Gain on recaptured units	\$7.00	Gain on recaptured units	\$4.05
	Loss on diverted units	-\$15.00				
	Total gross gain to HM	\$24.55	= \$13.50 + \$7.00 + \$4.05			
	Total gross loss to HM	-\$15.00				
	NET GAIN	**\$9.55**				

Since the net gain to the hypothetical monopolist is positive, the candidate market is a relevant market

One-product SSNIP recapture test formulas

- The test
  - *Proposition*: A candidate market is a relevant market under a one-product SSNIP recapture test for Product 1 if:

$$R_1 > R^1_{Critical} = \frac{\delta p_1}{\$m_{RAve}} \quad \left(= \frac{\$SSNIP_1}{\$m_{RAve}} \right).$$

That is, if this condition is satisfied, a hypothetical monopolist could profitably increase the price of Product 1 by δ

where $\$m_{RAve}$ is the recapture share-weighted average of the other products in the candidate market that are not subject to the SSNIP

  - *Observations*:
    1. NB: Any product in the candidate market can be Product 1
       - I assume that the SSNIP would apply to Product 1 to simplify the notation
    2. In a two-product candidate market, $\$m_{RAve}$ is simply the $\$m$ of the single recapturing product
       - That is, one product gets the SSNIP, the other product is the sole recapturing product
    3. Under the Merger Guidelines, as long a one product satisfies the one-product SSNIP recapture test, the candidate market satisfies the HMT
       - This is true even if all the other products in the candidate market fail the test

One-product SSNIP recapture test formulas

- Corollaries
  - There are several corollaries that can be derived for special cases (e.g., equal prices but different dollar margins, different prices but equal percentage margins)
    - There is no need to calculate recapture share-weighted averages or use any of these formulas in the exam and we will not address them in this deck
  - The only corollary that may be useful for the exam is for the symmetric case, where the prices *p* and percentage margins *m* of all products in the candidate market are the same:

$$R_1 > R^S_{Critical} = \frac{\delta}{m}.$$

  - Observations
    - The symmetric case rarely occurs in real life, but it is easy to apply and therefore attractive to use in exam hypotheticals
    - Products can be differentiated (i.e., support different prices) even when, in the current market equilibrium, the prices and margins of all products are coincidently identical (as was the situation in the ice cream homework problem)

Exam hint: *Except for the simplest case (symmetry), it is easier, more intuitive, and hence easiest to doublecheck if you use brute force accounting*

One-product SSNIP sufficiency test

- A sufficient recapture rate
  - Recapture share-weighted averages can be cumbersome to calculate in the general one-product SSNIP recapture formula for the critical aggregate recapture rate:

$$R^1_{Critical} = \frac{\delta p_1}{\$m_{RAve}} \quad \left(= \frac{\$SSNIP_1}{\$m_{RAve}} \right).$$

  - *Rule*: However, we can create a number $R^1_{Sufficient}$ that is at least as larger as $R^1_{Critical}$. Then if R^1_{Actual} is greater than $R^1_{Sufficient}$, it necessarily will be greater than $R^1_{Critical}$ and the HMT will be satisfied. That is:

If $R^1_{Actual} > R^1_{Sufficient} \left(\geq R^1_{Critical} \right)$, then the HMT is satisfied

  - *Method*. To create the sufficient recapture rate, simply use the smallest dollar margin of the recapturing products in the denominator:

$$R^1_{Sufficient} = \frac{\delta p_1}{\$m_{Min}} \quad \left(= \frac{\$SSNIP_1}{\$m_{Min}} \right),$$

If you fix the numerator, then the fraction with the smaller denominator will be the larger number (e.g., 10/5 > 10/10).

where $\$m_{Min}$ is the smallest dollar margin of the recapturing products

One-product SSNIP sufficiency test: Ex. 1

- Gourmet pizzas
  - Suppose the candidate market is the four firm that make gourmet pizzas. The four firms have the following prices and dollar margins:

	Price	Dollar margin	Diversion Rates (D_{1n})
Firm 1	\$3.00	\$1.60	—
Firm 2	\$4.00	\$2.50	60%
Firm 3	\$3.50	\$1.60	30%
Firm 4	\$2.80	\$1.50	10%

Suppose further that the actual aggregate recapture rate for Firm 1 is 80% for a 5% SSNIP. Do gourmet pizzas satisfy the HMT?

  - Use a one-product SSNIP sufficient test. The minimum dollar margin $\$m_{Min}$ is \$1.50. So

$$R^1_{Sufficient} = \frac{\$SSNIP_1}{\$m_{Min}} = \frac{\$3.00 \times 5\%}{\$1.50} = \frac{\$0.15}{\$1.50} = 10\%.$$

Since $R^1_{Actual} = 80\%$ is greater than $R^1_{Sufficient} = 10\%,$ the HMT is satisfied.

One-product SSNIP sufficiency test

- A sufficient but not necessary test
  - The idea
    - Whatever the diversion rates to individual products, as long as some recapturing products have dollar margins greater than the minimum dollar margin, the recapture-share weighted average of the dollar margins will be greater than the minimum dollar margin. Therefore, the sufficient recapture ratio is greater than the critical recapture ratio.
    - Because of the difference, it is possible that the actual recapture rate will fall below the sufficient recapture rate but above the critical recapture rate, thus failing the sufficiency test but satisfying the HMT. This shows that satisfaction of the sufficiency test is sufficient, but not necessary, to satisfy the HMT.
  - Example
    - In the previous example, the recapture-share weighted average of the recapturing product is:

$$\$m_{RAve} = (0.60)(2.50) + (0.30)(1.60) + (0.10)(1.50) = \$2.13.$$

    - The critical recapture rate is:

$$R^1_{Critical} = \frac{\$SSNIP_1}{\$m_{RAve}} = \frac{\$3.00 \times 5\%}{\$2.13} = \frac{\$0.15}{\$2.13} = 7\%.$$

    - So if the actual recapture rate was 9%, the candidate market would have failed the sufficiency test (which required at least 10%), but would have satisfied the one-product SSNIP recapture test using the correct recapture-weighted dollar margin.

One-product SSNIP necessary test

- A necessary but not sufficient test
  - The idea
    - We can create a necessary test that *every* market must pass in order to satisfy the HMT under a one-product SSNIP recapture implementation, even though passing the necessary test will not mean that that the candidate market satisfies the HMT
    - The test imposes a necessary but not sufficient condition on satisfying the HMT
  - A necessary aggregate recapture rate
    - We can create the necessary aggregate rate by doing just of opposite of what we did to create the sufficient aggregate recapture rate: Use the *maximum* dollar margin in the denominator in the critical recapture rate formula in place of the diversion weighted average:

$$R^1_{Necessary} = \frac{\delta p_1}{\$m_{Max}} \quad \left(= \frac{\$SSNIP_1}{\$m_{Max}} \right),$$

      where $\$m_{Max}$ is the largest dollar margin of the recapturing products
    - Using the largest dollar margin of the recapturing products in the denominator creates a recapture that is smaller than the critical recapture rare. If the actual recapture rate is smaller than the necessary recapture rate, the candidate market cannot satisfy the HMT

If $R^1_{Actual} < R^1_{Necessary} \left(\leq R^1_{Critical} \right)$, then the candidate market *cannot* satisfy the HMT

    - BUT if the actual recapture rate if greater than the necessary recapture rate, the candidate market still might be smaller than the critical recapture rate and so not satisfy the HMT.

One-product SSNIP recapture test

- A caution
  - In a well-known paper, Katz and Shapiro derived a different condition for a one-product SSNIP recapture test:

$$R_1 > \frac{\delta}{\cancel{\delta} + m_{RAve}},$$

    where the prevailing prices for all products are equal.[1]

This condition is INCORRECT for a one-product SSNIP test!

  - The problem is that the Katz-Shapiro proof assumed that the recaptured sales would be sold at the original price of the recapturing product *increased* by the SSNIP, but in a one-product SSNIP recapture test the recaptured sales would be sold at the original prices charged by the other firms in the market
    - I note this only because this incorrect condition is still in circulation
    - However, it is the correct test when all the products in the candidate market are increased by the same SSNIP

[1] *See* Michael Katz & Carl Shapiro, *Critical Loss: Let's Tell the Whole Story*, Antitrust, Spring 2003, at 53 & n.25.

Uniform SSNIPs and the Aggregate Diversion Ratio Test

Uniform SSNIP recapture test

- Extension to a uniform SSNIP
  - Some economists have attempted to create a recapture test for hypothetical monopolist imposing a *uniform* SSNIP in a differentiated candidate market
  - *Remember*: With recapture, the net profits of the hypothetical monopolist from a price increase in each product *i* taken individually comprise—
    - The net gain on the inframarginal sales of product *i* resulting from the price increase
    - MINUS the net loss on the sales of product *i* resulting from the price increase
    - PLUS all incremental profits earned by other firms in the candidate market from the capture of sales diverted from product *i*
  - When the hypothetical monopolist increases all prices in the candidate market by a SSNIP, its overall profit is the sum of the net profits from each of the individual products

Uniform SSNIP recapture test

- Extension to a uniform SSNIP
  - Observations:
    1. In a single-product SSNIP test, the price of only one product in the candidate market is increased and the diversion and recapture ratios are determined holding the prices of all other firms in the candidate market constant
    2. In a uniform SSNIP test, the price of all products in the candidate market are increased and the diversion and recapture ratios are determined using these higher prices for all products in the candidate market
    3. The diversion ratios are likely to be different in the two situations
       - With the one-product SSNIP, the diversion ratios are from the higher priced SSNIP product to the originally priced other products
       - With a uniform SSNIP, the diversion ratios are from one higher-priced SSNIP product to (now less attractive) other higher-priced SSNIP products

In general, we can expect the diversion ratios with a one-product SSNIP to be higher than the diversion ratios for a uniform SSNIP

    4. Whether you use a one-product SSNIP recapture test or a uniform SSNIP recapture test will depend on whether you have data on one-product SSNIP recapture rates or on uniform SSNIP recapture rates

Uniform SSNIP recapture test

- The aggregate diversion ratio test for a uniform SSNIP
  - *Proposition 1*. A hypothetical monopolist earns positive profits on product *i* from a uniform SSNIP in the candidate market if:

$$R_i^U > \frac{p_1\delta}{\$m_{RAve} + \$SSNIP_{RAve}} = \frac{\$SSNIP_i}{\$m_{RAve} + \$SSNIP_{RAve}} \equiv R_{Critical}^U$$

Call the right-hand side the *critical recapture rate* for a uniform SSNIP.

New term accounting for higher margins for recapturing products

  - *Corollary (symmetric products)*: If the products in the candidate market are symmetric (same prices *p* and percentage margins *m*), then a hypothetical monopolist earns positive profits on product *i* from a uniform SSNIP in the candidate market if:

$$R_i^U > \frac{p_i\delta}{\$m_{RAve} + \$SSNIP_{RAve}} = \frac{p\delta}{pm + p\delta} = \frac{\delta}{\delta + m}$$

The critical recapture rate in the symmetric case is the same as the percentage critical loss

- In the literature and some cases, the symmetric case is the variation most commonly discussed
  - True in some cases even when the prices and dollar margins of the products in the candidate market differ (presumably when the price differences within the candidate market are small relative to the price differences between product inside and outside the candidate market)

Uniform SSNIP recapture test

- A sufficiency test
  - *Proposition 2 (sufficiency)*: If:

$$R_i^U \geq R_{Critical}^U \qquad \text{for all firms } i \text{ in the candidate market}$$

$$R_j^U > R_{Critical}^U \qquad \text{for some firm } j \text{ in the candidate market}$$

  then the uniform SSNIP will be profitable for the hypothetical monopolist and the candidate market will be a relevant market

  - Proposition 2 simply says that if, in the wake of a uniform SSNIP, the hypothetical monopolist at least breaks even on every product in the candidate market and makes strictly positive profits on at least one product, the uniform SSNIP is profitable
  - Proposition 2 only states a *sufficient* condition
    - Failure to satisfy the test does not mean that the candidate market is not a relevant market
    - It is possible for a hypothetical monopolist to make positive profits from a uniform SSNIP even if it losses money in some products as long as it offsets those losses from positive profits in other products

This test is often misleadingly called the "aggregate diversion ratio test" in the literature and in cases (fails to distinguish the one-product SSNIP recapture test)

Uniform SSNIP recapture test

- Example: Aggregate diversion ratio test
  - Differentiated three-product candidate market
    - Parameters (symmetric products)
      - Each product has the same price of $100
      - Each product has a margin of 60%
      - Assume a uniform SSNIP of 5% across all products
    - Then use the symmetric version of the aggregate diversion ratio test:

$$R^U_{Critical} = \frac{\delta}{\delta + m} = \frac{0.05}{0.05 + 0.60} = 0.0769 \text{ or } 7.69\%$$

    - Suppose that the uniform SSNIP generates the following actual recapture rates:

			Recapture	
Product	q	Δq	Units	Rate (R^U_i)
A	1200	100	30	30.00%
B	900	75	12	16.00%
C	600	50	10	20.00%

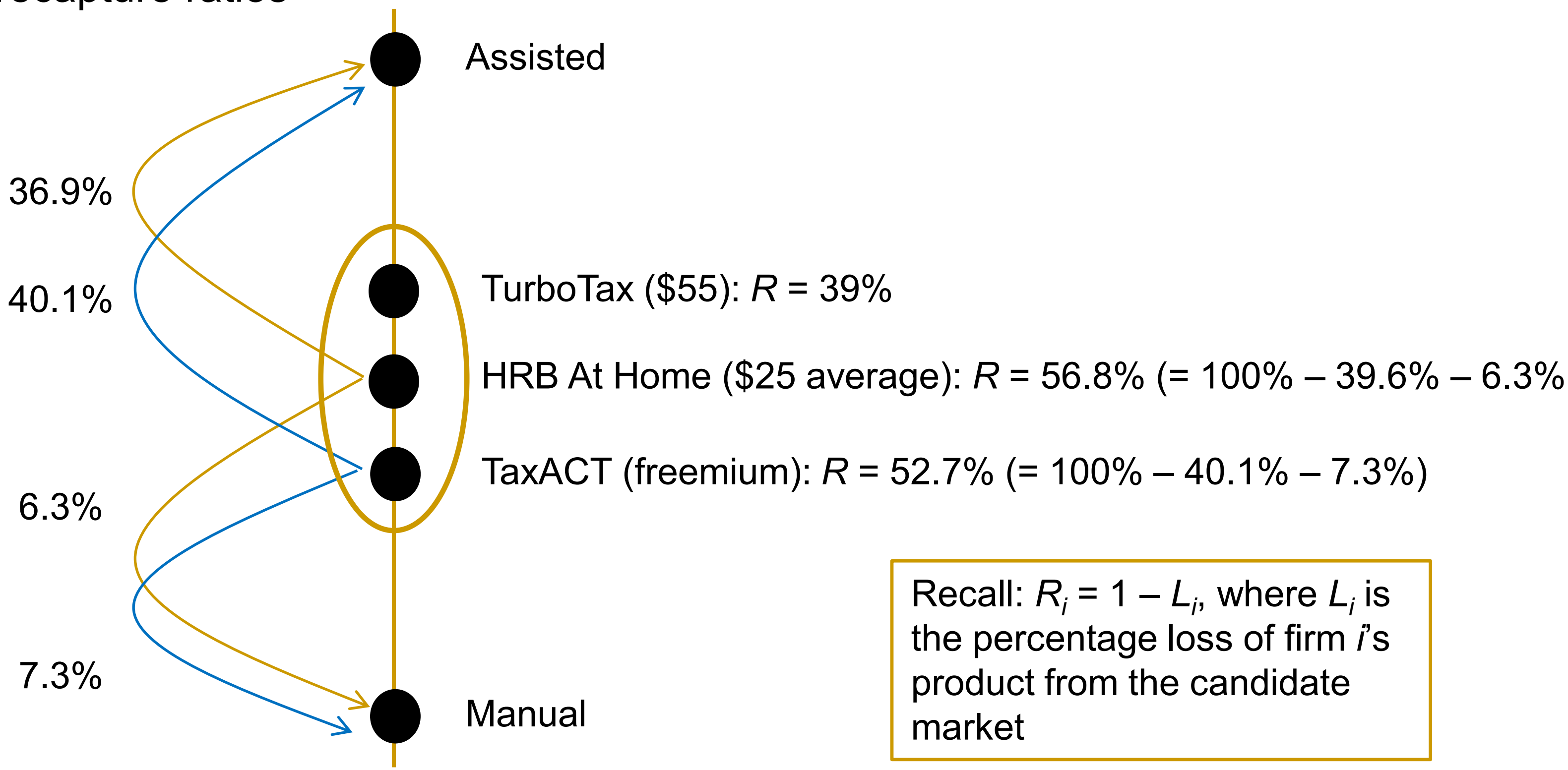
    - *Result*: Since the smallest R^U_i (16.00%) is greater than $R^U_{Critical}$ (7.69%), a hypothetical monopolist can profitably sustain a 5% uniform price and so the three products is a relevant market

Uniform SSNIP recapture test

- Some observations
  - It is important to remember that:
    - In a single-product SSNIP test, the price of only one product in the candidate market is increased and the diversion and recapture ratios are determined holding the prices of all other firms in the candidate market constant
    - In a uniform SSNIP test, the price of all products in the candidate market are increased and the diversion and recapture ratios are determined using these higher prices for all products in the candidate market

Uniform SSNIP recapture test

- Warren-Bolton analysis in H&R Block/TaxACT
  - Recall that Warren-Boulton relied on IRS switching data to estimate aggregate recapture ratios



Recall: $R_i = 1 - L_i$, where L_i is the percentage loss of firm *i*'s product from the candidate market

  - *Query*: Does the use of switching data indicated that the estimated R_i's are for a single-product SSNIP or a uniform SSNIP?

Uniform SSNIP recapture test

- Warren-Bolton analysis in H&R Block/TaxACT
  1. *Question*: Is DDIY a relevant market under a uniform SSNIP test?
  2. *Critical aggregate diversion ratio* ($R^U_{Critical}$)
     - Starting point: Start with DDIY products (HRB, TaxACT, and TurboTax)
     - SSNIP (δ): 10%
     - Gross margin (*m*): 50% on each product (Warren-Bouton assumption)
     - Then:

$$R^U_{Critical} = \frac{\delta}{\delta + m} = \frac{10\%}{10\% + 50\%} = 16.7\%$$

  3. *Actual loss*: Determine aggregate diversion ratios (recapture rates R^U_i) for each product
     - *Test*: If each $R^U_i \geq R^U_{Critical}$ for all products in the candidate market and $R^U_i > R^U_{Critical}$ for at least one product *i*, then product grouping is a market
     - Using IRS switching data as a proxy for *R*, Warren-Bolton found:
       - HRB: R_{HRB} = 57%
       - TaxACT: R_{TaxACT} = 53%
       - TurboTax: $R_{TurboTax}$ = 39%
  4. *Conclusion* (Warren-Boulton)
     - Since each $R^U_i > R^U_{Critical}$, a hypothetical monopolist of the DDIY product could profitably raise price by a uniform SSNIP and therefore DDIY was a relevant product market

Uniform SSNIP recapture test

- A "presumptive" test
  - Some commentators suggest that in a uniform SSNIP test, *the single-product SSNIP diversion and recapture rates* can be used in Proposition 2 to create a *presumption* that the condition is satisfied and the candidate market is a relevant market[1]
  - But the recapture ratios across products in the candidate market will at least as high and likely higher using a single-product SSNIP than a uniform SSNIP because of the prices of substitute products will be lower in the former situation. Therefore, we should expect:

$$R_i^S \geq R_i^U.$$

    - As one analyst noted:

> Unless the different products within a candidate antitrust market increase prices by different amounts, it is likely there will be little substitution among the products within the candidate market. Consequently, when there is a price increase across all products in the candidate market the value of the Aggregate Diversion Ratio is likely to be close to zero.[2]

    - Consequently, the presumptive test must be used with great care, if used at all

[1] Michael Katz & Carl Shapiro, *Critical Loss: Let's Tell the Whole Story*, Antitrust, Spring 2003, at 54 (footnote omitted).
[2] Barry Harris, *Recent Observations About Critical Loss Analysis* (undated), https://www.justice.gov/atr/recent-observations-about-critical-loss-analysis.

Implementations of the Hypothetical Monopolist Test: SUMMARY

Some symbols

$D_{1\to 2} = D_{12}$	The diversion ratio from product 1 to product 2
R_1	The actual recapture ratio for product 1 in a single-product SSNIP test
$R^1_{Critical}$	The critical recapture ratio for product 1 in a single-product SSNIP test
R^U_1	The actual recapture ratio for product 1 in a uniform SNIP test
$R^U_{Critical}$	The critical recapture ratio for product 1 in a uniform SNIP test

Summary

1. Prevailing (premerger) conditions
    - Competitive interactions established premerger equilibrium in prices and production quantities
    - Also establishes other competitive variable such as product attributes, but we do not have good models for this
2. Hypothetical monopolist test
    - Seeks to identify a product grouping (relevant market) that contains the product of one or both of the merging firms in which market power could be exercised
    - *Test*: Whether a hypothetical monopolist of the product grouping could profitably implement "small but significant nontransitory increase in price" (SSNIP) above the prevailing prices in one or more products in the grouping, including at least one of the products of the merging firms
    - The test is satisfied when the profits gained from the increase in margin in the inframarginal sales outweigh the profits lost from the loss of the marginal sales

Summary

3. Critical loss in homogeneous product markets
   - A homogeneous product market supports only one price
     - All producers sell an identical product and purchasers buy from the seller that offers the lowest price—this forces all sellers to sell at the same price
     - There is no recapture in this market of lost marginal sales
   - In the standard models, the hypothetical monopolist increases price by reducing output, which creates a scarcity in the product. Inframarginal customers then bid up the price in order to clear the market.
   - While small reductions in output may increase profits, sufficiently large reductions will reduce profits below the prevailing level
   - The output reduction beyond which any further reduction is unprofitable is called the *critical loss*
     - The critical loss is the output reduction where the profits gained from the increase in margin in the inframarginal sales just equal the profits lost from the loss of the marginal sales
   - *Test*: If the actual loss of sales due to a SSNIP is less than the critical loss, the SSNIP will be profitable and the candidate market will be a relevant market

Summary

4. One-product SSNIP tests in differentiated products markets
   - In differentiated products market, different products can have different prices and margins
   - The Merger Guidelines recognize as relevant markets products grouping where the hypothetical monopolist can profitably increase the price of one product, provided it is a product of one of the merging firms
   - The same basic critical loss analysis applies with one significant modification: When the product with the SSNIP loses marginal sales, some of those lost sales are "recaptured" by other products in the candidate market
   - The hypothetical monopolist earns profits on the recaptured sales that can be used to offset profit losses from lost marginal sales due to the SSNIP
     - The profit for each unit recaptured by any "other" product is the other product's original dollar margin (since the price of the recapturing product is not increased by the SSNIP)
   - The recapture rate on the lost marginal units that is just necessary for the hypothetical monopolist to break even with a SSNIP on one product is called the (one-product) *critical recapture rate*
     - The critical recapture rate is specific to the product on which the SSNIP is imposed, the diversion ratios from that product to other products in the market, and the dollar margins of all products
   - *Test*: For the product on which the SSNIP is imposed, if the actual recapture rate exceeds the critical recapture rate, the SSNIP will be profitable and the candidate market will be a relevant market

Summary

5. Uniform SSNIP tests in differentiated products markets
   - In some differentiated products markets, we may not have information on *one-product SSNIP recapture ratios*
     - A one-product SSNIP recapture ratio is the recapture ratio for the product with the SSNIP holding the prices of all other products in the candidate market constant
   - Instead, we may only have data on *uniform SSNIP recapture ratios*
     - A uniform SSNIP recapture ratio is the recapture ratio for a given product when all the products in the candidate market are subject to the SSNIP
     - Switching data usually provides information on uniform SSNIP recapture ratios, not one-product recapture ratios
   - *Rule*:
     - Use a one-product SSNIP recapture test when you have one-product SSNIP recapture ratios
     - Use a uniform SSNIP recapture test when you only have uniform SSNIP recapture ratio
       - Switching data is likely to be a better proxy for uniform SSNIP recapture ratios than for one-product SSNIP recapture ratios
   - *The test*:
     - The analysis and the test is the same for a uniform SSNIP recapture test as it is for the one-product SSNIP recapture test *except* that the margins of the recapturing products in the candidate market are increased by the SSNIP

The *PNB* Presumption

Calculating HHIs

- Math notes
  - *Calculating the HHI*: Assume n firms in the market, with firm i having a market share of s_i:

$$HHI = \sum_{i=1}^{n} s_i^2$$

  - *Calculating the delta*: Let a and b be the market shares of the merging companies:

Premerger contribution to the HHI:	$a^2 + b^2$
Postmerger contribution to the HHI:	$(a+b)^2 = a^2 + 2ab + b^2$
Difference (= HHI delta):	$2ab$

  - *Calculating the HHI contribution for "other" firms*: Say an unknown number of "other" firms collectively have a market share of x. If we assume that the number of "other" firms is k, then each firm contributes $(x/k)^2$ to the HHI. The total contribution to the HHI is then:

$$k\left(\frac{x}{k}\right)^2 = \frac{x^2}{k}$$

Calculating HHIs

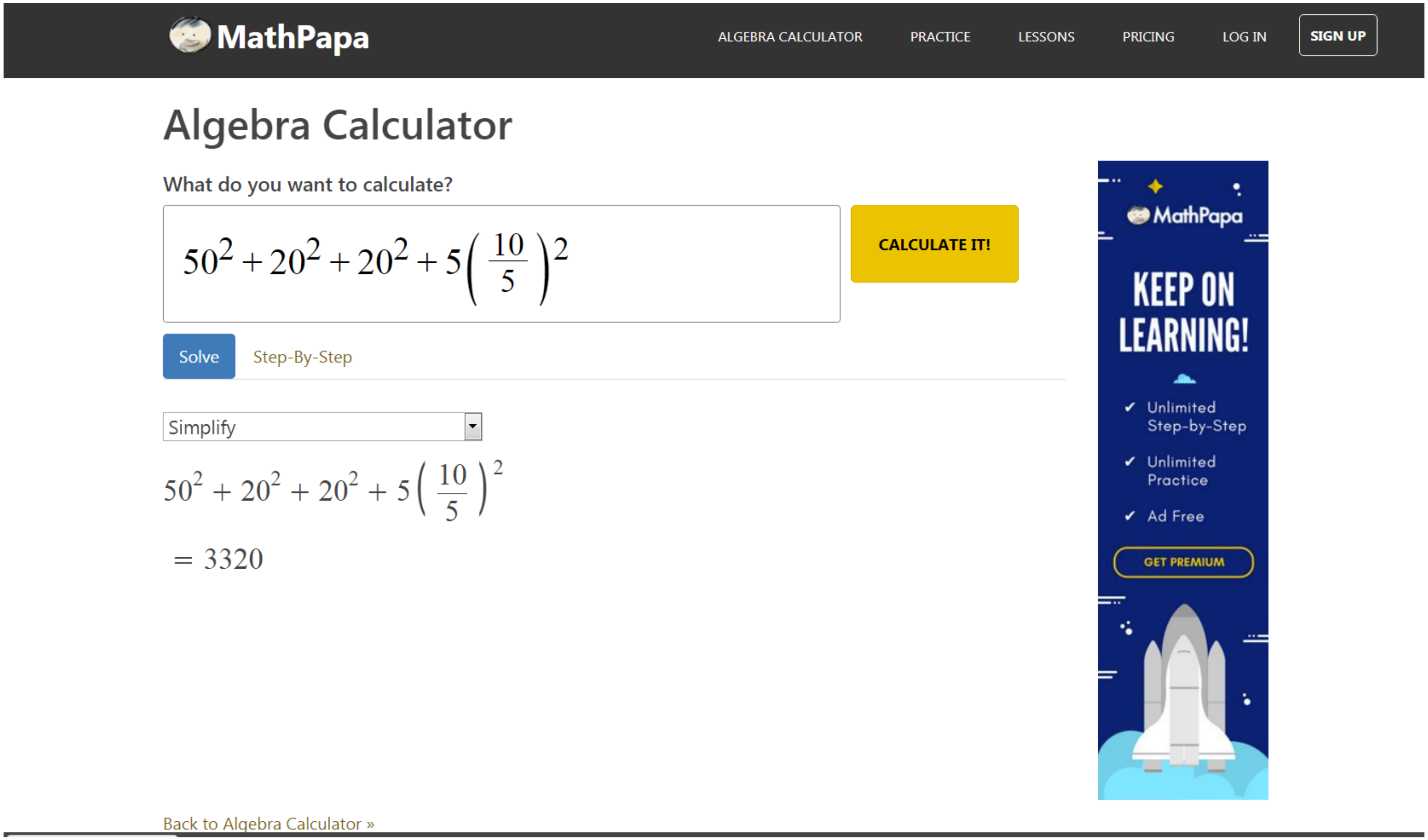
- *Application*: H&R Block/TaxACT

	Premerger Shares	HHI Contribution	
Intuit	62.2%	3869	The square of the firm's market share
HRB	15.6%	243	
TaxACT	12.8%	164	
Others (6)	9.4%	15	Residual share (9.4%) divided by 6 firms and added six times
	100.0%	4291	The sum of the squared shares of all of the firms in the market
Combined share	28.4%		
Premerger HHI		4291	
Delta		400	2 × HRB share × Intuit share
Postmerger HHI		4691	

"Violates" the 2010 Guidelines:
Postmerger HHI exceeds 2500 and delta exceeds 200

Note: The court appears to have assumed that six equal-sized firms are in the "other" category

Math Papa



https://www.mathpapa.com/algebra-calculator.html

The 2010 Merger Guidelines

- "HHI thresholds"[1]
  - Not really *PNB* thresholds, but courts tend to use them that way[1]

Postmerger HHI	ΔHHI	Guidelines
--	< 100	"unlikely to have adverse competitive consequences and ordinarily require no further analysis"
< 1500	--	"unlikely to have adverse competitive consequences and ordinarily require no further analysis"
Between 1500 and 2500	≥ 100	"potentially raise significant competitive concerns and often warrant scrutiny"
> 2500	100-200	"potentially raise significant competitive concerns and often warrant scrutiny"
	≥ 200	"will be presumed to be likely to enhance market power. The presumption may be rebutted by persuasive evidence showing that the merger is unlikely to enhance market power."

[1] The "HHI" is a market concentration statistic. To calculate it, take the square of the market share of each firm in the relevant market and square it, and then add up all of the squared market shares. The "ΔHHI" is the difference between the HHI after the merger and the HHI before the merger.
[2] "The purpose of these thresholds is not to provide a rigid screen to separate competitively benign mergers from anticompetitive ones, although high levels of concentration do raise concerns. Rather, they provide one way to identify some mergers unlikely to raise competitive concerns and some others for which it is particularly important to examine whether other competitive factors confirm, reinforce, or counteract the potentially harmful effects of increased concentration." 2010 Merger Guidelines § 5.3.

HHIs in Successful DOJ/FTC Challenges

- The DOJ and FTC have not brought "close" cases in alleged markets

Agency	Complaint	Defendant	Combined share[1]	PreHHI	PostHHI	Delta	Deal Status
DOJ	2021	Bertelsmann	49	2220	3111	891	Preclosing
FTC	2020	Hackensack	≈50	1994	2835	841	Preclosing
FTC	2020	Peabody Energy	68	2707	4965	2258	Preclosing
FTC	2018	Wilhelmsen	84.7	3651	7214	3563	Preclosing
FTC	2017	Sanford Health	98.6[2]	5333	9726	4393	Preclosing
DOJ	2017	Energy Solutions	100	6040	10000	3960	Preclosing
DOJ	2016	Anthem	47	2463	3000	537	Preclosing
DOJ	2016	Aetna			>5000[3]		Preclosing
FTC	2016	Penn State Hershey	64	3402	5984	2582	Preclosing
FTC	2015	Advocate Heath	55	2094	3517	1423	Preclosing
FTC	2015	Staples	75[4]	3036	5836	2800	Preclosing
FTC	2015	Sysco	71[5]	3153	5519	1966	Preclosing

[1] When the complaint alleged multiple markets, the market with the most problematic highest HHIs is reported.
[2] Pediatricians market. The FTC alleged three other physician markets. The lowest problematic delta was in OB/GYN with a premerger HHI of 6211, a postmerger HHI of 7363, and a delta of 1152.
[3] The DOJ challenged Aetna's proposed acquisition of Humana in 17 geographic markets. The complaint did not provide HHI statistics for each market, although it noted that in 75% of the markets, the post-HHI would be greater than 5000.
[4] The FTC also challenged the transaction in 32 alleged relevant local geographic markets, with the smallest combined share being 51% and the largest being 100%.
[4] The complaint alleged multiple markets in food distribution. The numbers given are for national broadline distribution.

HHIs in Successful DOJ/FTC Challenges

- The DOJ and FTC have not brought "close" cases in alleged markets

Agency	Complaint	Defendant	Combined Share[1]	PreHHI	PostHHI	Delta	Deal Status
DOJ	2015	Electrolux		3350[2]	5100	1750	Preclosing
DOJ	2013	Bazaarvoice	68	2674	3915	1241	Consummated
FTC	2013	Saint Alphonsus	57	4612	6129	1607	Consummated
DOJ	2013	US Airways	100[3]	5258	10000	4752	Preclosing
DOJ	2013	ABInbev	100	5114	10000	4886	Preclosing
FTC	2011	OSF Healthcare	59	3422	5179	1767	Preclosing
FTC	2011	ProMedica	58	3313	4391	1078	Preclosing
DOJ	2011	H&R Block	28	4291	4691	400	Preclosing
FTC	2009	CCC	65	4900	5460	545	Preclosing
FTC	2008	Polypore	100	8367	10000	1633	Consummated
FTC	2007	Whole Foods	100[4]		10000		Preclosing
FTC	2004	Evanston	35	2355	2739	384	Consummated
DOJ	2003	UPM-Kemmene	20	2800	2990	190	Preclosing

[1] When the complaint alleged multiple markets, the market with the most problematic highest HHIs is reported.
[2] The complaint alleged three markets. The numbers given are for ranges. Cooktops and wall ovens were similar
[3] The complaint alleged 1043 markets.
[4] In some local geographic markets, this was a merger to monopoly in the FTC's alleged product market of premium, natural, and organic supermarkets.

HHIs in Successful DOJ/FTC Challenges

- The DOJ and FTC have not brought "close" cases in alleged markets

Agency	Complaint	Defendant	Combined Share[1]	PreHHI	PostHHI	Delta	Deal Status
FTC	2002	Libbey	79	5251	6241	990	Preclosing
FTC	2001	Chicago Bridge	73	3210	5845	2635	Consummated
FTC	2000	Heinz	33	4775	5285	510	Preclosing
FTC	2000	Swedish Match	60	3219	4733	1514	Preclosing
DOJ	2000	Franklin Electric	100	5200	10000	4800	Preclosing

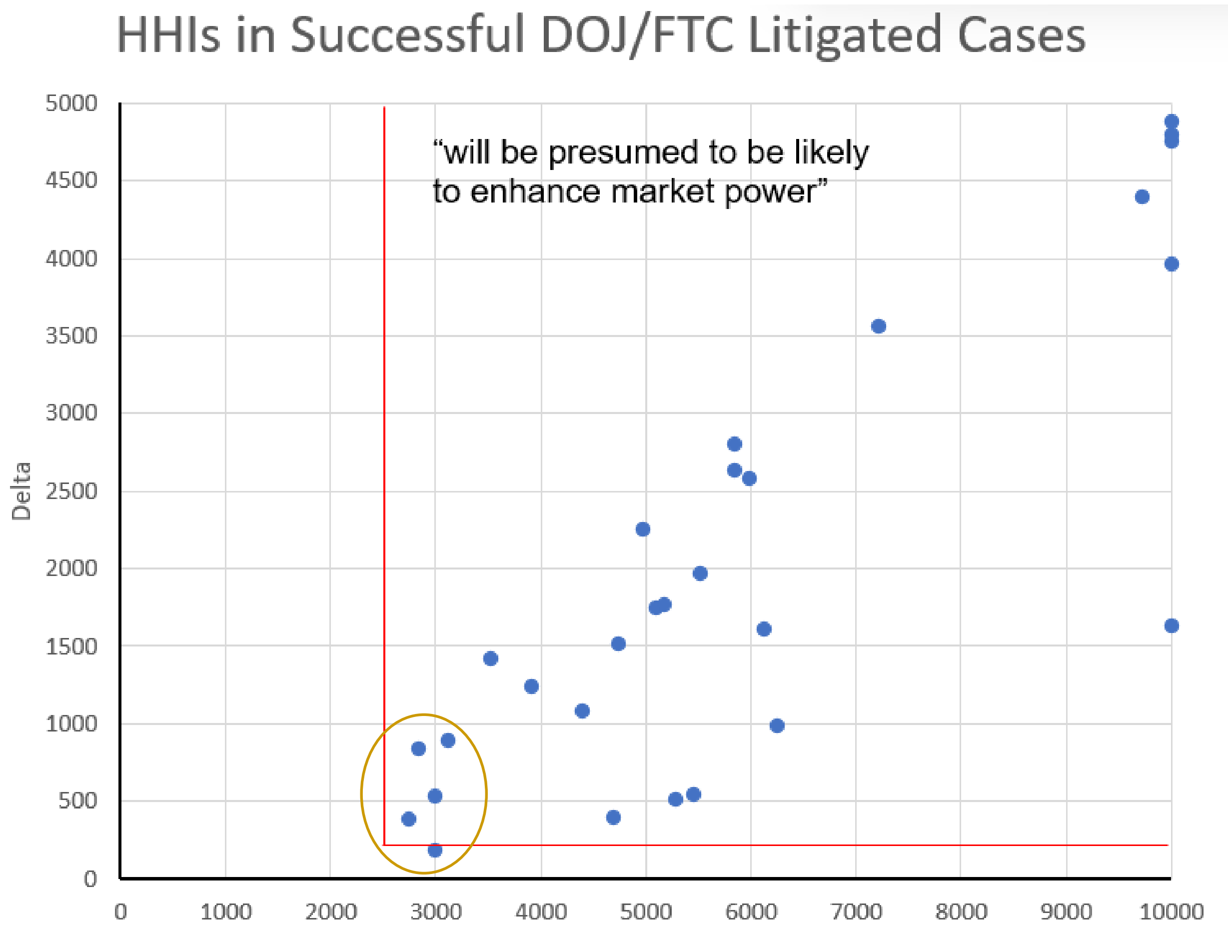
[1] When the complaint alleged multiple markets, the market with the most problematic highest HHIs is reported.

HHIs in Successful DOJ/FTC Challenges

- Lowest HHIs in successfully litigated DOJ and FTC cases

Agency	Complaint	Defendant	Combined share	PreHHI	PostHHI	Delta	Deal Status
FTC	2020	Hackensack	$\approx$50	1994	2835	841	Preclosing
DOJ	2016	Anthem	47	2463	3000	537	Preclosing
DOJ	2011	H&R Block	28	4291	4691	400	Preclosing
FTC	2004	Evanston	35	2355	2739	384	Consummated
DOJ	2003	UPM-Kemmene	20	2800	2990	190	Preclosing
FTC	2000	Heinz	33	4775	5285	510	Preclosing

HHIs in Successful DOJ/FTC Challenges



Unilateral Effects

Unilateral effects

- Definition
  - Unilateral effects is a theory of anticompetitive harm that goes to the elimination of significant "local" competition between the merging firms, so that the merged firm can raise prices *independently* of how other incumbent firms react

> A merger is likely to have unilateral anticompetitive effect if the acquiring firm will have the incentive to raise prices or reduce quality after the acquisition, independent of competitive responses from other firms.[1]

  - The idea
    - A cognizable anticompetitive effect results if the merging firm increases the price of one of its products as a result of the merger even if no other firm in the market increases its price
    - The concept of unilateral effects as a theory of merger anticompetitive harm was introduced in the 1992 DOJ/FTC Horizontal Merger Guidelines
    - The theory has been accepted as valid under Section 7 by the courts

The underlying economics is similar to that of the one-SSNIP recapture test: Is a price increase for merging product A profitable postmerger because of the recapture of some lost sales by merging product B?

[1] United States v. H&R Block, Inc., 833 F. Supp. 2d 36, 81 (D.D.C. 2011).

Differentiated products unilateral effects

- Relation to the one-product SSNIP test
  - The underlying economics of unilateral effect is similar to that of the one-SSNIP recapture test:

    Is a price increase for merging product A profitable postmerger because of the recapture of some lost sales by merging product B?

    As a matter of conventional, denote the combined firm's product subject to the price increase as "product A"

    - The profitability of a price increase in one of the merged firm's product is the incremental profits are profitable, taking into account—
      1. The gain in incremental profits from the increased price of product A's inframarginal sales
      2. The loss in margin from the loss of marginal customers of product A, *and*
      3. The gain in incremental profits from the recapture of lost marginal sales by product B
  - *A critical difference*: In unilateral effects, ANY (material) price increase is actionable
    - There is no "safe harbor" for anticompetitive price increases under Section 7
      - Under Section 7's terms, the only requirement is that the merger is reasonably likely to "substantially" lessen competition
    - Hence, unilateral effects does not employ a SSNIP to test the profitability of a price increase of one of the products of the merging firm
  - *Another difference*: In unilateral effects, the profit-maximization test is the right implementation in order to investigate substantiality
    - But the probability test is still probative of an anticompetitive price increase

Differentiated products unilateral effects

- The profit-maximizing economics
  - Premerger:

At the margin, B's marginal sales divert to A if A lowers its price

A's marginal revenue			=	Marginal cost
Gain in revenues on the higher margin on the inframarginal sales	+	Loss in revenues from the loss on the marginal unit	=	Reduction in the marginal cost of production

Holding B's price and booking all of B's losses to A

  - Postmerger:

A's marginal revenue			–	Loss on B's diverted sales	=	Marginal cost
Gain in revenues on the higher margin on the inframarginal sales	+	Loss in revenues from the loss on the marginal unit	–	$D_{BA}m_B$	=	Reduction in the marginal cost of production

  - Holding the price of B constant, the combined firm's marginal revenue equals A's marginal revenue minus the loss on B's diverted sales
  - Since *mr* = *mc* premerger, *mr* – loss on B's diverted sales < *mc* at A's premerger price and quantity
    - When combined firm's marginal revenue postmerger is less than its marginal cost, the combined firm must reduce quantity and increase price to maximize profits

Differentiated products unilateral effects

- *Example*: Firm A increases prices (and decrease production)
  - This is more the story in which we are interested

Initial conditions

	p	*c*	*$m*	*q*	Profits
Firm A	300	100	200	100	20000
Firm B	350	90	260	120	31200

Post-Price Increase

Firm A increases prices by:	30
Firm A marginal (lost) sales:	-15
Diversion: A to B	60%
Unit sales Firm A loses to Firm B:	9

	p	*c*	*$m*	*q*	Profits	Profit change
Firm A	330	100	230	85	19550	-450
Firm B	350	90	260	129	33540	2340

When A is independent, the price increase is unprofitable

When A and B merge, the price increase is jointly profitable

Differentiated products unilateral effects

- Example 2: Firm A *increases* production (and *decreases* price)
  - Say for firm A:
    - Inverse demand: $p = 300 - q$
    - Fixed costs: $f = 0$
    - Marginal costs: $mc = 20$
    - Marginal revenue: $mr = 300 - 2q$

FOC: $mr = mc$
$300 - 2q = 20$
So: $q^* = 140$
$p^* = 160$
$\$m_A = 140$

  - Say when firm A increases its production by 1 unit (and lowers its price by \$1), 0.3 units that firm B would have sold now divert to Firm A ($D_{AB} = |-0.3/+1| = 0.3$)
  - If firm B's margin is also 140 at its initial price level, then firm A's one-unit increase in production causes firm B to lose \$42 ($\Delta\pi_B = D_{AB} \times \$m_B$ = = (0.3)(140) = \$42).
    - That is, Firm A's conduct creates a *negative externality* for Firm B
  - When A and B are independent firms, firm A does not care about firm B's loss
  - But when firm A acquires firm B, firm A must take into account firm B's losses in firm A's marginal revenue:

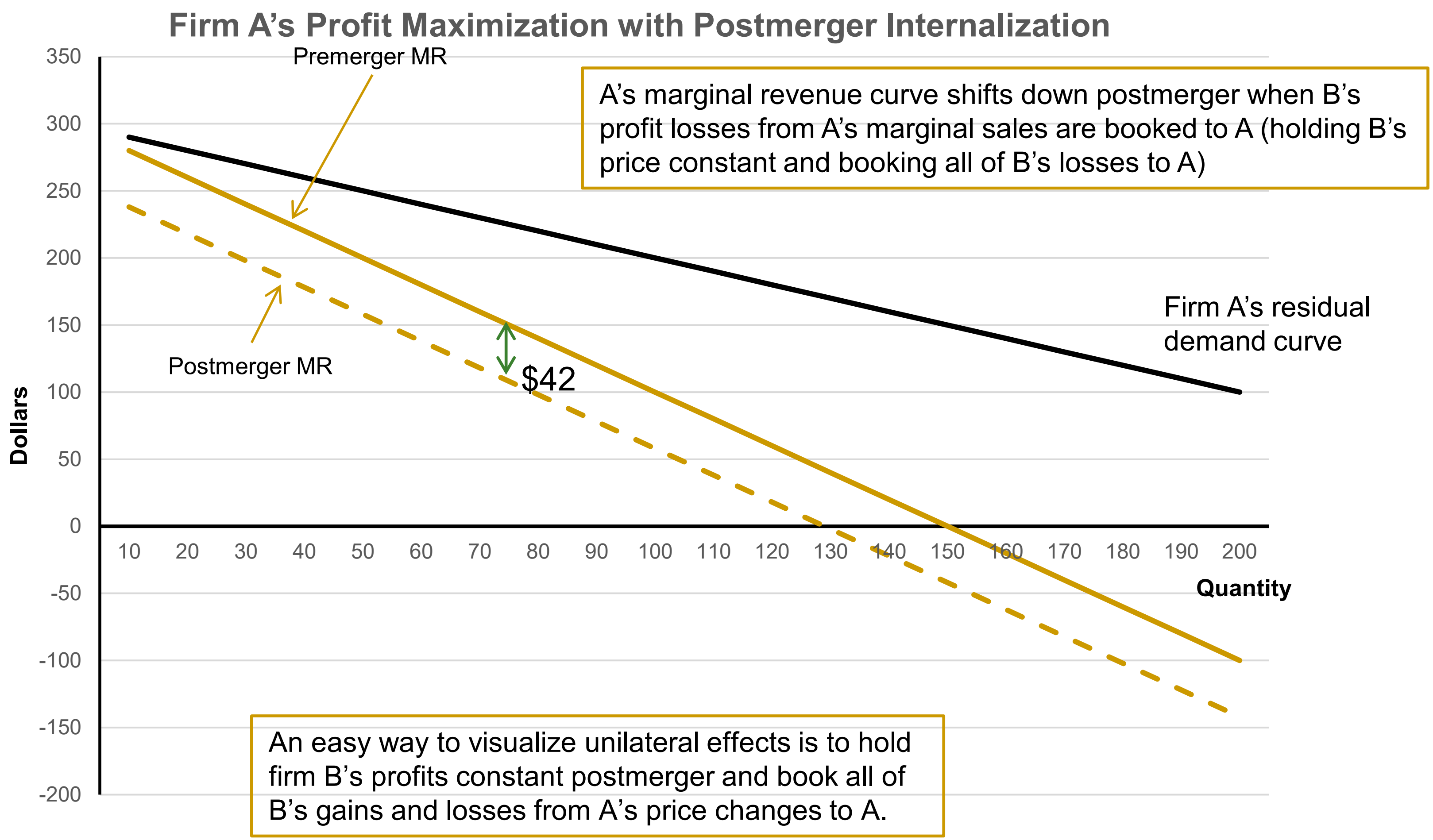
$$mr_A^{postmerger} = mr_A^{premerger} - D_{AB}\$m_B$$
$$= 300 - 2q - 42$$

A's marginal negative externality imposed on B

This shifts firm A's marginal revenue curve down and makes firm A's marginal revenue less than its marginal cost at premerger prices. *Firm A must decrease output and increase price to reequilibrate marginal revenue and marginal cost:* $q_{postmerger}$ = 119; $p_{postmerger}$ = 181

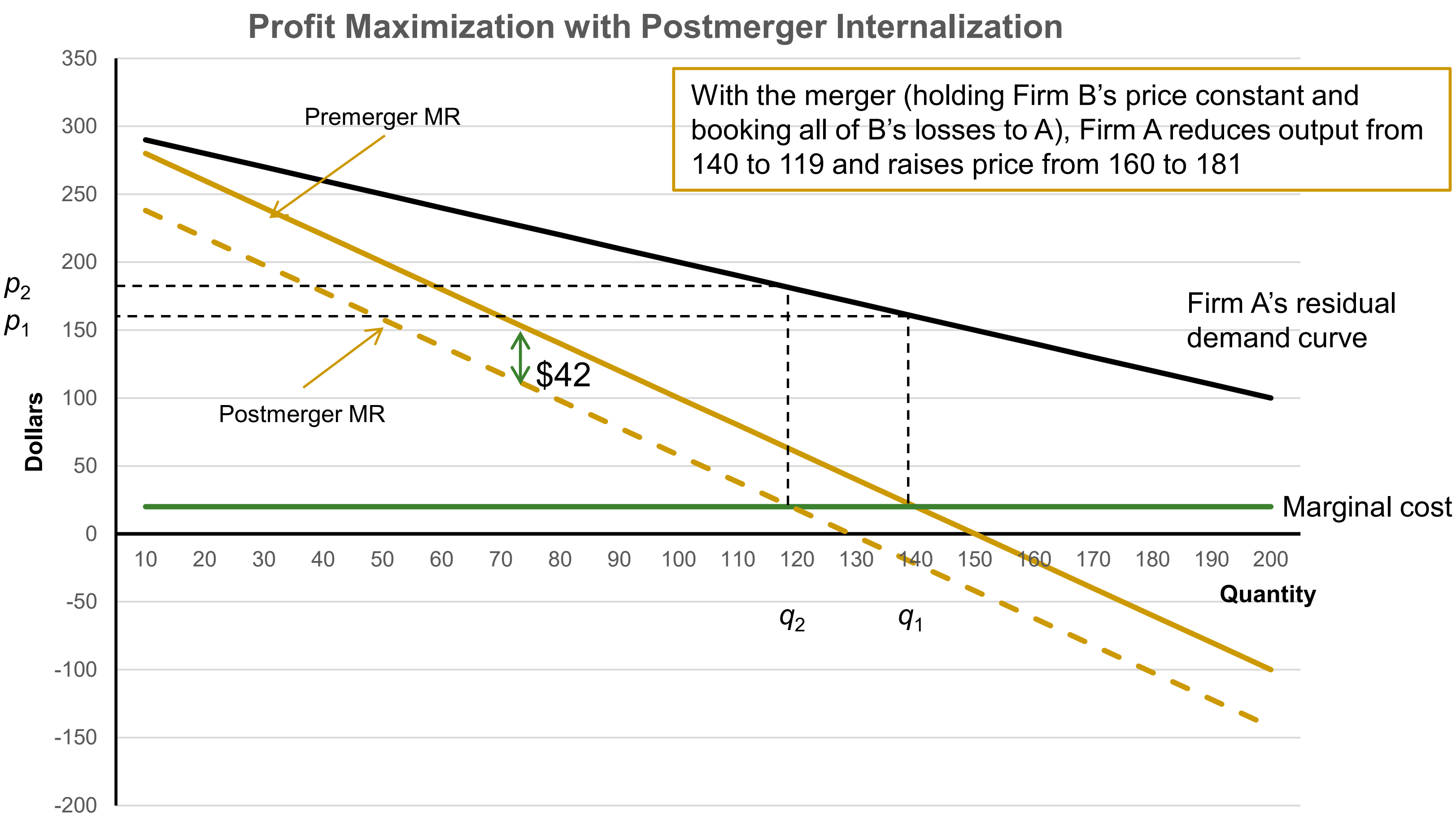
Differentiated products unilateral effects

- Example 2 (con't)



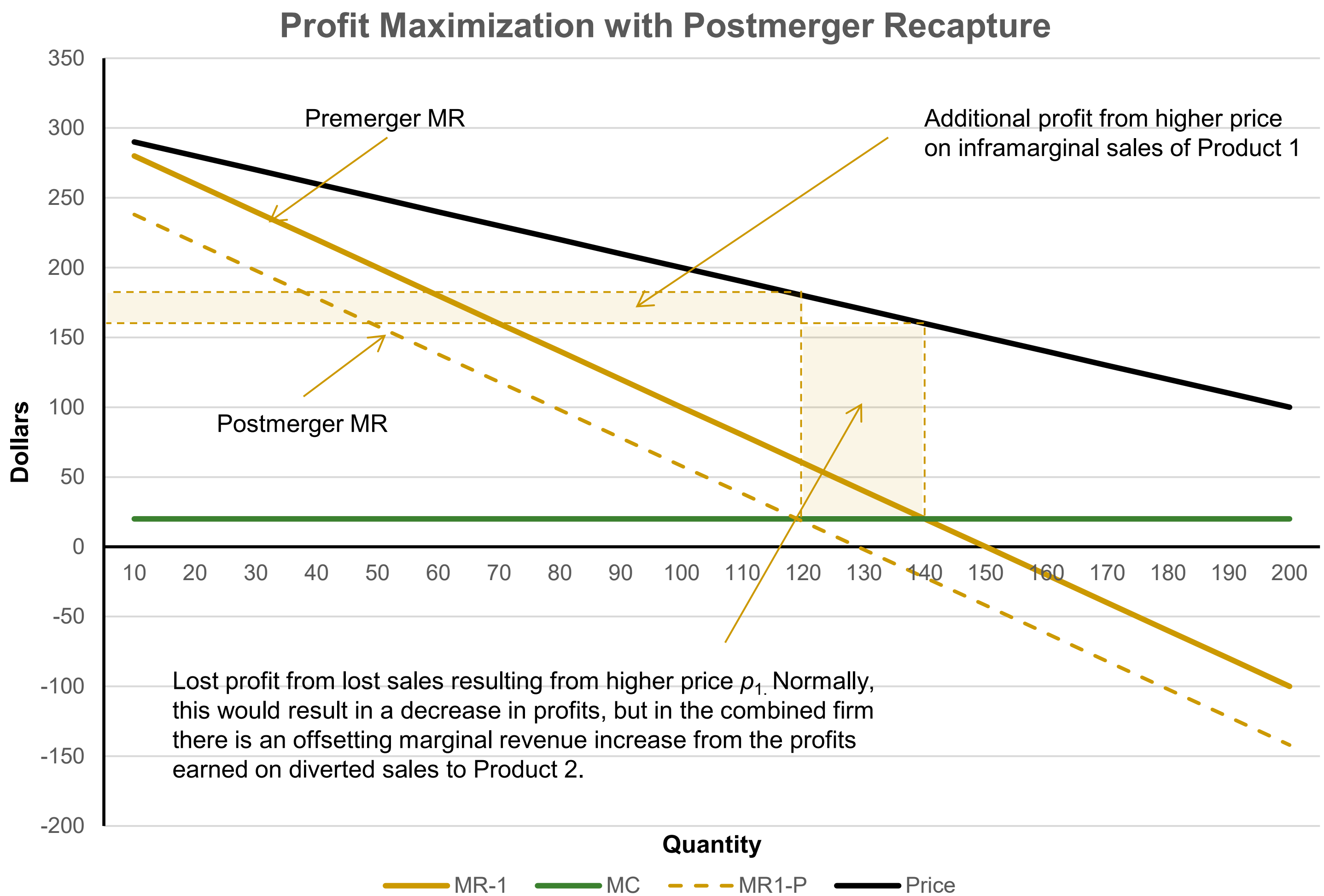
Differentiated products unilateral effects

- Example 2 (con't)



Differentiated products unilateral effects

- Example 2 (con't)



Offsetting marginal cost efficiencies

- *Query*: What marginal cost reduction would be necessary to offset a one-product unilateral effect when firms A and B merge?
  - Start with the first-order condition for firm A with no marginal cost efficiencies:

Where quantity is the control variable

$$mr_A^{postmerger} = mr_A^{premerger} - D_{AB}\$m_B = mc_A$$

Remember, here D_{AB} = | B's unit loss/ A's unit increase |

  - Say the marginal cost efficiencies reduce marginal costs by *e* percent. Then:

$$mr_A^{postmerger} = mr_A^{premerger} - D_{AB}\$m_B = (1-e)mc_A$$

    - Rearranging and cancelling equal terms:

$$\cancel{mr_A^{premerger}} - D_{AB}\$m_B = \cancel{mc_A} - e \times mc_A$$

Remember: $mr_A^{premerger} = mc_A$

  - So the following equation must be satisfied to restore the first order condition at original prices and output:

$$D_{AB}\$m_B = e \times mc_A$$

that is, the downward pricing pressure from the marginal cost reduction must offset the upward pricing pressure from diversion

Offsetting marginal cost efficiencies

- Interpretation
  - *Rule*:
    - If marginal cost efficiencies are the only source of downward pricing pressure in a merger, the merged firm can increase profitably increase the price of product A unless:

$$D_{AB}\$m_B \le e \times mc_A$$

where $D_{AB}\$m_B$ is the dollar subsidy per unit of A's total lost units paid to B and $e \times mc_A$ is the dollar marginal cost saving per unit of A produced

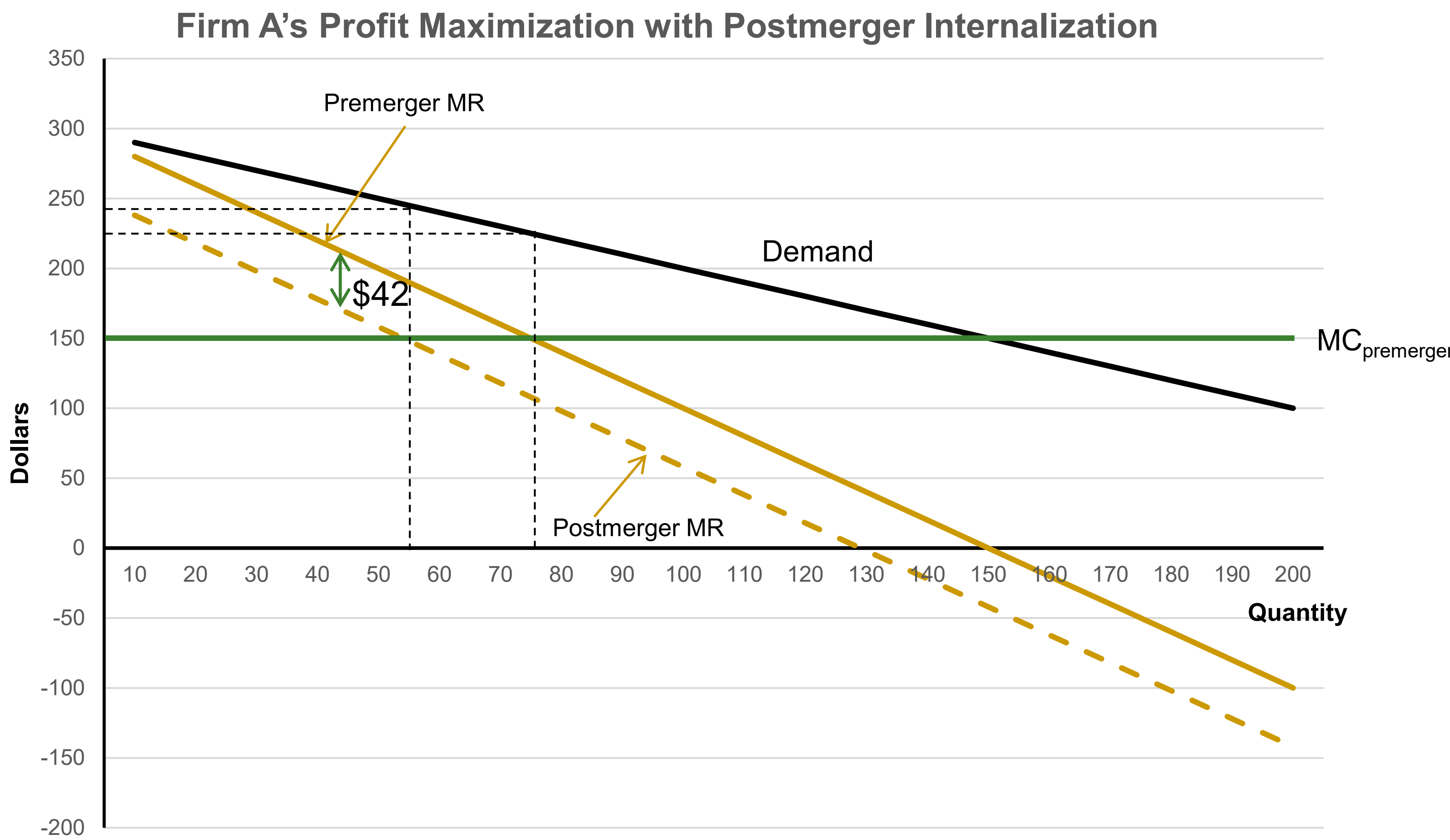
    - Multiplying both sides by Δq_A:

$$\Delta q_A D_{AB}\$m_B = \Delta q_B\$m_B \le \Delta q_A\left(e \times mc_A\right)$$

In order words, the total efficiency cost savings must be large enough to pay for the total subsidy to B

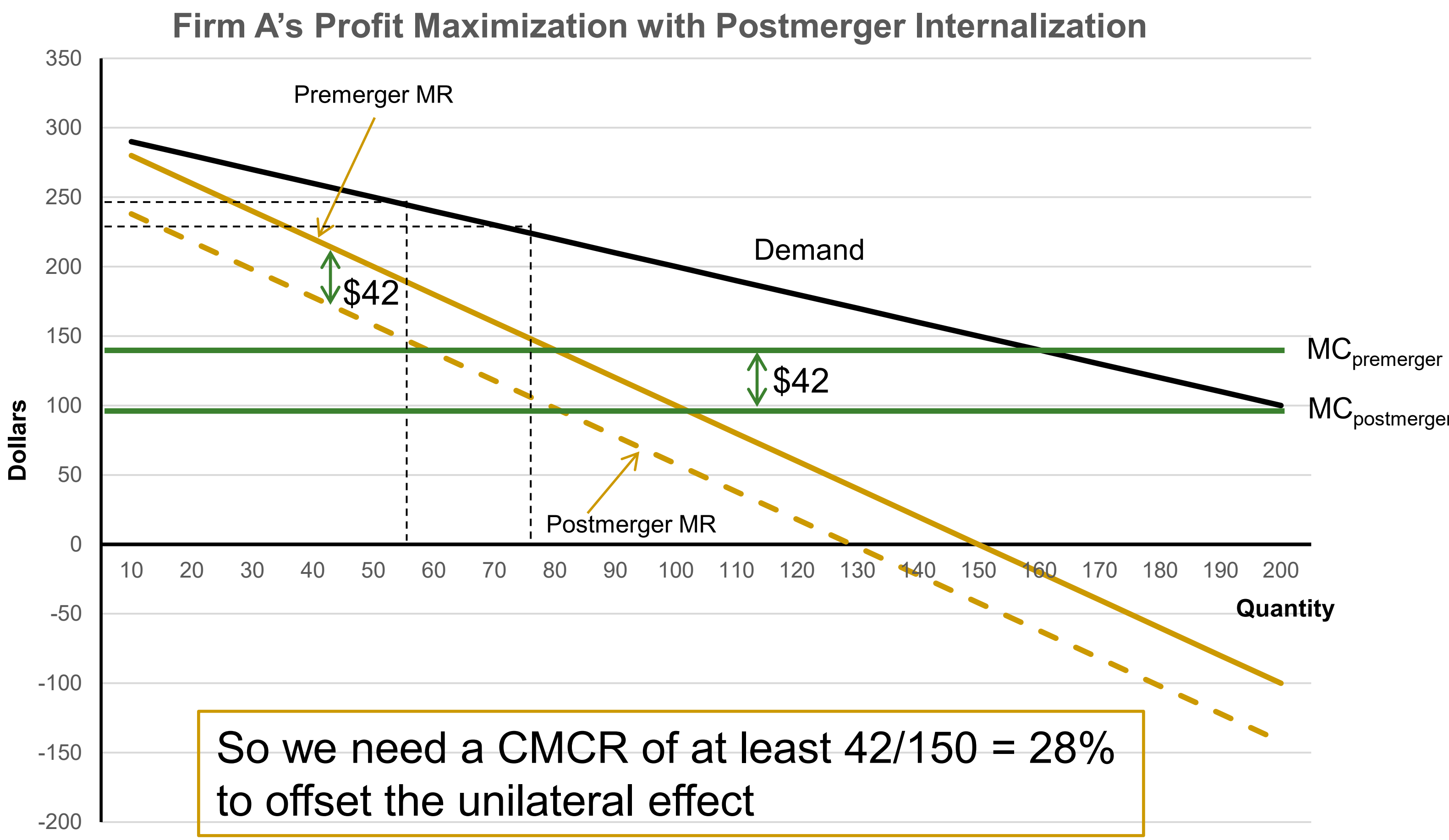
Offsetting marginal cost efficiencies

- Graphically: Postmerger without compensating marginal cost reduction



Offsetting marginal cost efficiencies

- Graphically: Postmerger with compensating marginal cost reduction



Offsetting marginal cost efficiencies

- Use in Kroger/Albertsons (2024)
  - Dr. Nicholas Hill, the FTC's economics expert at trial, used this relationship at trial to determine that, given the diversion ratios, dollar margins, and marginal costs, marginal costs must decrease by at least 5% to offset the upward pricing pressure from the unilateral effect in each of 1,472 local markets
    - Hill called this the "compensating marginal cost reduction" ("CMCR")

> CMCR analysis calculates a value that represents the reduction in marginal costs that would be necessary to offset the merged firm's incentives to raise prices. If the CMCR value is greater than the marginal cost reductions predicted to result from the acquisition, then the merged firm is likely to increase prices due to the acquisition.[1]

  - Hill observed that the total reductions in marginal costs that the merging parties estimate—regardless of whether such estimates are verified or merger-specific—are less than 1% of defendants' combined total operating cost
    - WDC: Operating costs are fixed costs plus variable costs. If measured against only variable costs, the marginal cost savings would be a somewhat greater percentage.
  - Hill concluded that the CMCR analysis "confirms that substantial competition will be eliminated and is conservative in using a 5% threshold to reach that conclusion."[2]

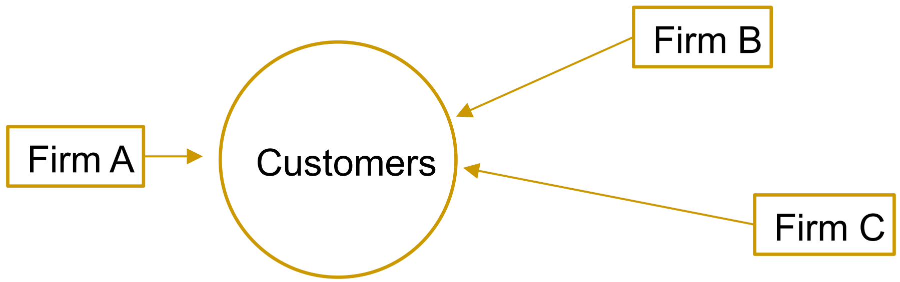
[1] Plaintiffs' Memorandum of Law in Support of Plaintiffs' Preliminary Injunction Motion 16 (filed July 26, 2024; redacted version July 30, 2024) ("CMCR analysis calculates a value that represents the reduction in marginal costs that would be necessary to offset the merged firm's incentives to raise prices.") (footnote omitted).
[2] *Id.* at 17 (footnote omitted).

Auction unilateral effects

- Basic theory:
  - Lowest cost pays a price just below the bid by the second lowest cost firm
  - Anticompetitive unilateral effect when the two lowest cost firms merge unless the third-lowest cost firm is very close to the second lowest
  - If data on costs are not available, then can use historical bid prices as proxies for the cost relationships

Auction unilateral effects

- Example
  - Consider three firms that are the only firms that ship a homogeneous product to a customer-based relevant geographic market



	F.O.B	Shipping Cost	Delivered cost
A	100	7	107
B	100	12	112
C	100	15	115

  - Bertrand model predictions
    - Premerger, firm A wins the bids at a price just below firm B's delivered cost of $112
    - If A and B merge, then the combined company wins the bid at a price just below C's delivered cost of $115 → Merger increases prices to customers in the relevant market
    - If A and C merge, then the identity of the second lowest cost firm does not change and there is no postmerger price increase

Auction unilateral effects

- The antitrust practice
  - The agencies and the courts do not believe that this model predicts actual winning bid prices, but they do accept that the winning bid prices are positively correlated with the predictions

    > This means that if the lowest cost bidder acquires the second lowest cost bidder and the third lowest cost bidder is materially more distant, the agencies will accept a second price auction analysis as prima facie evidence of an anticompetitive price increase if A were to acquire B

  - Since the agencies and the court accept that delivered prices are correlated with delivered costs, the second price auction model may be applied to delivered prices if delivered costs are not available
    - That is, if one only observed the following delivered prices

	Delivered price
A	111
B	113
C	117

    - The agencies and the courts would accept a second price auction analysis as prima facie evidence of an anticompetitive price increase if A were to acquire B and C had a materially higher bid price than B

GUPPIs

- Gross Upward Pricing Pressure Index (GUPPI)
  - Definition:

$$GUPPI_1 = D_{12} \% m_2 \frac{p_2}{p_1}$$

    where $GUPPI_1$ is the GUPPI for product 1 in a merger with firm 2, D_{12} is the diversion ratio from product 1 to product 2, m_2 is the percentage margin of product 2, and p_1 and p_2 are the premerger prices of products 1 and 2, respectively
  - Some observations
    - GUPPIs measure the *upward pricing pressure* from a merger, reflecting the merged firm's profit-maximizing incentive to raise the price of one specified product while keeping the prices of its other products constant
    - GUPPIs are a *unilateral measure* of upward pricing pressure since they assume that firms inside and outside of the relevant market do not change their behavior in the wake of the merger (tha is, no accommodating conduct)
    - GUPPIs are a *gross measure* of upward pricing pressure since they ignore any incentives from the merger that might keep prices constant or reduce them, such as efficiencies, buyer power, or new entry or expansion by other firms
    - GUPPIs are an *ordinal measure* of upward pricing pressure, ranking mergers so that a larger GUPPI indicates a stronger incentive to raise prices, but without specifying the quantitative difference
      - For example, without more structure on the demand curves, a merger with a GUPPI of 10% does not mean that the merged firm has an incentive to increase its prices by twice the percentage of a merger with a GUPPI of 5%

GUPPIs

- GUPPIs: Relation to one-product SSNIP critical recapture ratios
  - Consider the critical recapture ratio for product 1 in a candidate market consisting of only the two merging firms:

$$R^1_{Critical} = \frac{\$SSNIP_1}{\$m_{RAve}} = \frac{\$SSNIP_1}{\$m_2} = \frac{\delta_1 p_1}{m_2 p_2},$$

    where $\$M_{RAve} = \$m_2$ since in a two-firm candidate market product 2 is the only recapturing product
  - Recall that $R^1_{Critical}$ is the aggregate recapture ratio necessary for the hypothetical monopolist to generate postmerger profits equal to premerger profits when the price of product 1 is increased by prices are increased by δ_1 percent
    - If $R_1 > R^1_{Critical}$, the hypothetical monopolist makes more than premerger profits
    - If $R_1 < R^1_{Critical}$, the hypothetical monopolist makes less than premerger profits

GUPPIs

- GUPPIs: Relation to one-product SSNIP critical recapture ratios (con't)
  - Now solve the critical recapture ratio equation for δ_1:

$$\delta_1 = R^1_{Critical} m_2 \frac{p_2}{p_1}$$

    which says that when the recapture ratio has a value equal to $R^1_{Critical}$, δ_1 is the percentage increase in product 1 necessary for the hypothetical monopolist to break even with premerger profits
  - Let's replace $R^1_{Critical}$ with the actual recapture rate R_1, which is equal to D_{12}, and reinterpret δ_1 :

$$\delta_1 = D_{12} m_2 \frac{p_2}{p_1}$$

  - Now δ_1 is the percentage price increase that will result in postmerger profits equal to premerger profits when the actual diversion rate is D_{12}

δ_1 is GUPPI$_1$

So the GUPPI is the percentage breakeven unilateral price increase for the merged firm

  - Without more structure on the merged firm's residual demand curve, this is all we can say

GUPPIs and merger simulation

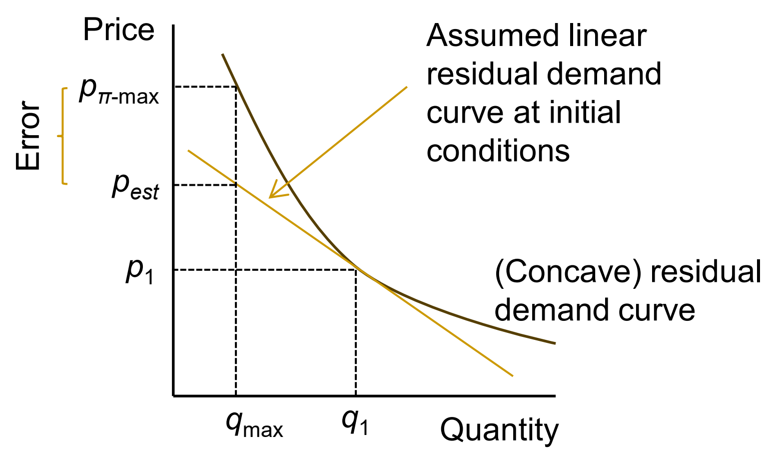
- GUPPIs when the merged firm's residual demand curve is linear in product 1
  - We know that when a firm's residual demand curve is linear and δ_1 is the breakeven percentage SSNIP, then $\delta_1/2$ is the firm's unilateral profit-maximizing SSNIP postmerger
  - *Key result 1*: If the merged firm has a residual demand curve that is linear in product 1, then:

$$\frac{GUPPI_1}{2} = \frac{D_{12}m_2}{2}\frac{p_2}{p_1}$$

    is the merged firm's unilateral percentage profit-maximizing price increase for product 1 holding product 2's price constant
  - *Important*:
    - While the GUPPI/2 gives the merged firm's unilateral percentage profit-maximizing price increase for product 1 holding product 2's price constant, if product 2's price is allowed to change, the merged firm's profit-maximizing strategy is to increase product 2's price and decrease product 1's price a little under the $GUPPI_1/2$ estimate
    - Although this strategy decreases the percentage price increase of product 1, it increases the merged firm's overall profits because of the additional gains due to product 2's price increase
    - Hence, the profit increase using $GUPPI_1/2$ percentage increase in product 1 while holding product 2' price constant gives a lower bound to the incremental dollar increase in the merged firm achieves postmerger from unilateral effects

GUPPIs and merger simulation

- Using GUPPI/2 to estimate a lower bound to the percentage price increase
  - The conditions under which the merged firm will have a residual demand curve that is linear in product 1 are restrictive
  - BUT conventional economics assume that residual demand curves are concave to the origin in a price-quantity graph
  - *Key result 2*: When a concave demand curve is estimated at the initial price-quality conditions, the *GUPPI*/2 estimate will *understate* the profit-maximizing percentage price increase



Bottom line: We can use the $GUPPI_1/2$ estimate to show that the profit-maximizing unilateral price increase for product 1 will be at least this large

Unilateral effects merger simulation

- Example
  - Say firms 1 and 2 are merging in a differentiated products market have the following properties:

	Price (p)	%Margin (m)	Margin ($m)	Recapture ratio (R)
Firm 1	$1.20	50.0%	$0.60	30.0%
Firm 2	$1.00	60.0%	$0.60	40.0%

  - Apply the break-even formula for a one-product price increase:

$$GUPPI_i = R_i m_j \frac{p_j}{p_i},$$

  - This yields:

Firm *i*	$GUPPI_i$	$GUPPI_i/2$
Firm 1	15.00%	7.50%
Firm 2	24.00%	12.00%

  - So the unilateral profit-maximizing price increase for products 1 and 2 would be 7.5% and 12.0% respectively
    - You can use this in analyzing the significance of unilateral effects

GUPPIs

- A different expression for GUPPIs
  - Sometimes you see GUPPI's defined the following way:

$$GUPPI_1 = \frac{\text{value of profits from sales diverted to product 2}}{\text{value of all sales lost by product 1}}$$

$$= \frac{\Delta q_2}{\Delta q_1} \frac{\left(p_2 - c_2\right)}{p_1}$$

$$\frac{\Delta q_2}{\Delta q_1} \frac{\left(p_2 - c_2\right)}{p_2} \frac{p_2}{p_1}$$

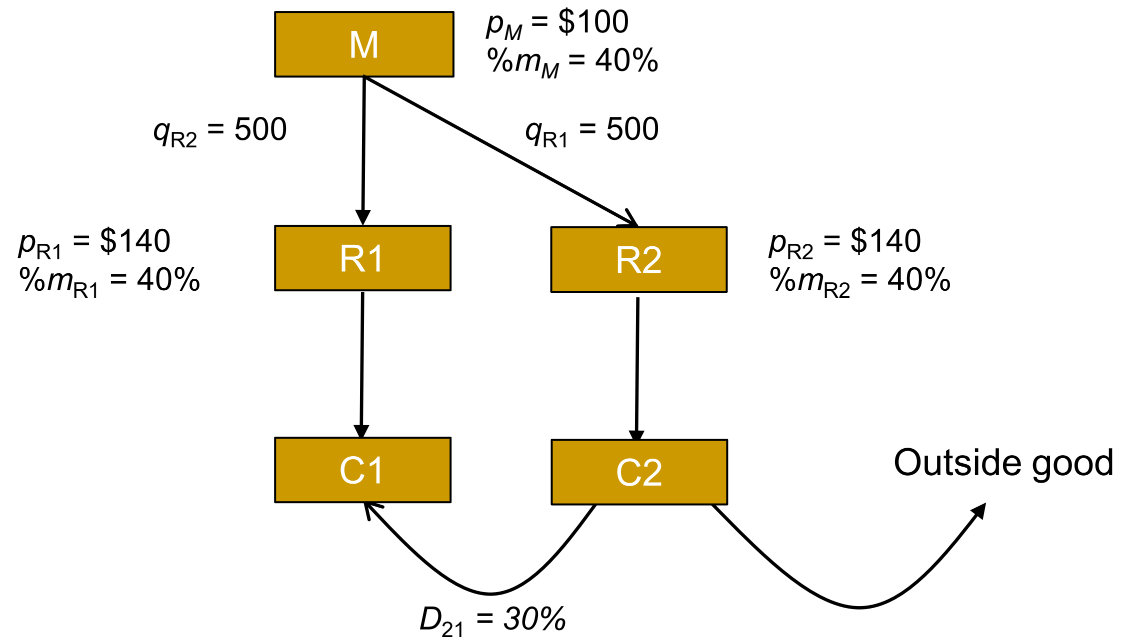
$$= D_{12} m_2 \frac{p_2}{p_1}$$

  - Although this definition seems a little strange and difficult to interpret, as you can see above it is the same as how we defined GUPPIs originally

Raising Rivals' Costs: The Vertical Arithmetic

RRC: The vertical arithmetic

- The setup
  - Find the incremental profit gain when M merges with D1 and increases D2's price by a $SSNIP2. M charges its distributors rack prices (no bargaining)



  - Net incremental profit gain for the merger firm =
    - M's incremental profit gain on the inframarginal sales to R2
    - Minus M's incremental profit loss on the R2 marginal sales
    - Plus the recapture profit gain to the merged firm from the diversion of R2's lost sales to R1

RRC: The vertical arithmetic

- The setup
  - Observations
    - The incremental profit formula is of the same form as the formula for incremental profits in recapture unilateral effects
    - The key difference is that the dollar margin is the recapture is the dollar margin of the merged firm ($\$m_{MF}$), not just the dollar margin of R1:

$$\$m_{MF} = \$m_M + \$m_{D1}$$

    - With an adjustment for the dollar margin, we can use the *GUPPI* formula for unilateral effects to create a *vGUPPI* for the vertical merger:

$$vGUPPI = D_{R2\to R1}\%m_{MF}\frac{p_{R1}}{p_M} = \frac{D_{R2\to R1}\$m_{MF}}{p_M},$$

In these problems, it is much easier to deal with $\$m_{MF}$ than $\%m_{MF}$

since $\$m_{MF} = \%m_{MF} * p_{R1}$

    - Proposition:

The profit-maximizing increase in the manufacturer's price to R2 is vGUPPI/2

RRC: The vertical arithmetic

- Example

> Premerger, Manufacturer M sells 500 widgets to each of retailers R1 and R2 at a price of $100 per widget for a gross margin of 50%. R1 and R2 each sell widgets to customers at $140 per widget for a gross margin of 40%. Although M's widgets are not differentiated, the retailers are differentiated by location, level of customer service, and overall product mix. If R2 increases its price, 60% of the sales it loses divert to R1 as customers comparison shop assuming no change in R1's price. There is no arbitrage, so M can price discriminate in the prices its charges R1 and R2. If M and R2 merge, will M increase the price to R2 and, if so, by how much?

- The merger of M and R1 is a vertical merger. The question asks whether M will engage in input RRC by increasing R2's price
  - The data

p_M	\$100	p_{D1}	\$140		
$\%m_M$	50%	$\%m_{D1}$	40%	D_{21}	60%
$\$m_M$	\$50	$\$m_{D1}$	\$56	$\$m_{MF}$	\$106

  - vGUPPI

$$vGUPPI = \frac{D_{R2\rightarrow R1}\$m_{MF}}{p_M} = \frac{(0.60)(106)}{100} = 63.6\%$$

  - Profit-maximizing price increase to R2: vGUPPI/2 = 31.8% or $31.80, for a new R2 price of $131.80

RRC: The vertical arithmetic

- Brute force calculation of incremental profits

Input RRC: M increases its price to R2 by (say) 20%

Price (p_M)	$100.00	Data
$\%m_M$	50.00%	Data
Elasticity	2	$1/\%m_M$ (Lerner condition)
$\%SSNIP_{R2}$	20.00%	Data
$\$SSNIP_{R2}$	$20.00	$\%SSNIP_{R2} * p_M$
q_{R2}	500	Data
$\%\Delta q_{R2}$	40.00%	$\%SSNIP_{R2}$ * elasticity (from elasticity definition)

By playing around with $\%SSNIP_{R2}$, you can find the profit-maximizing percentage price increase to R2

M's incremental inframarginal gain

$\$SSNIP_{R2}$	$20.00	From above
Inframarginal units	300	$q_{R2} - \Delta q_{R2}$
	$6,000.00	

M's incremental marginal loss

$\$m_M$	$50.00	$p_{R2} * \%m_M$
Marginal units (Δq_{R2})	200	$\%\Delta q_{R2} * q_{R2}$
	$10,000.00	

M's net incremental gain -$4,000.00

Should be negative if M is profit-maximizing premerger

R1 recapture

p_{R1}	$140.00	
$\%m_{R1}$	40.00%	
$\$m_{R1}$	$56.00	Holding R1 retail price constant
$\$m_M$	$50.00	
$\$m_{MF}$	$106.00	$\$m_M + \$m_{R1}$
D_{21}	60.00%	Actual diversion ratio
Recaptured	120.00	$R_{21} * \Delta q_{R2}$
Recap gain	$12,720.00	

TOTAL INCREMENTAL PROFITS	**$8,720.00**	
	$10,112.40	Maximum incremental profits Achieved at $\%SSNIP_2 = 31.80\%$