# ANTITRUST ECONOMICS 2013

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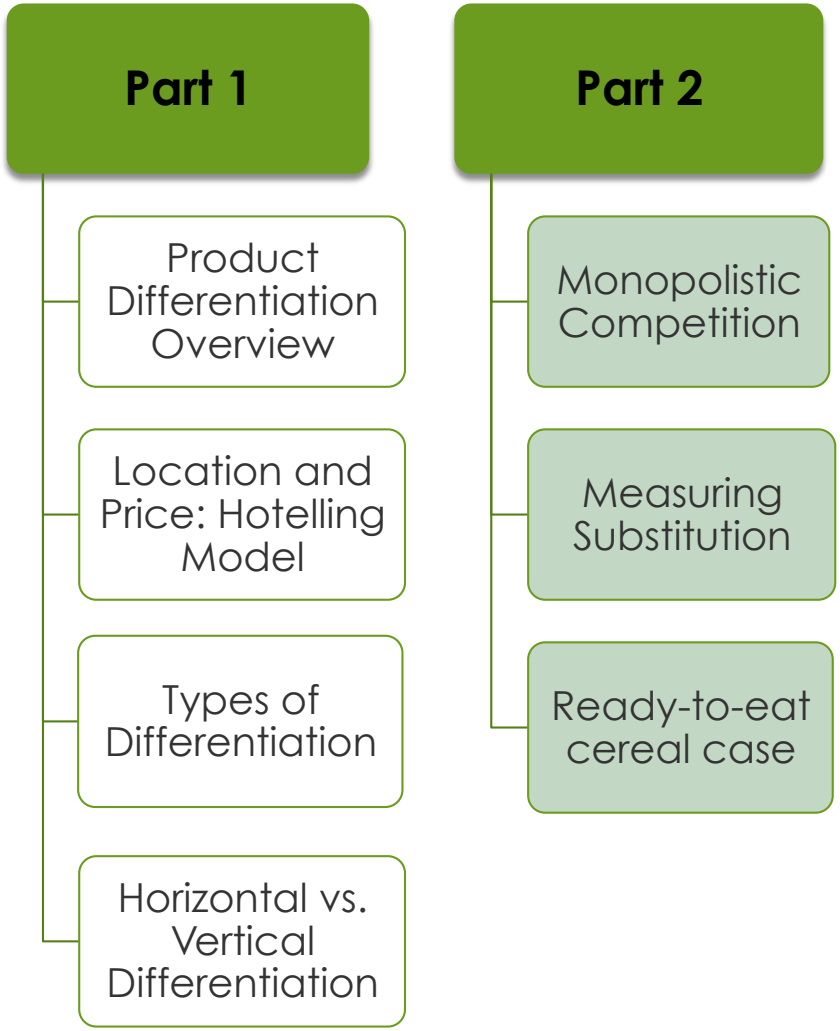
## TOPIC 5: PRODUCT DIFFERENTIATION

# Overview




Part 1
Product Differentiation Overview
Location and Price: Hotelling Model
Types of Differentiation
Horizontal vs. Vertical Differentiation
Part 2
Monopolistic Competition
Measuring Substitution
Ready-to-eat cereal case

# Monopolistic Competition

# "Perfect" vs. "Imperfect" Competition



Many markets with product differentiation seem "pretty competitive" but firms engage in price discrimination and advertising and have some control over price and features which is inconsistent with perfect competition.

Economists started developing models of these markets in the 1930s with the introduction of Chamberlin's notion of "monopolistic competition" and Robinson's "imperfect competition" (both books published in 1933). The idea was that real markets are usually somewhere between perfect competition and monopoly.

Chamberlin had the more rigorous and influential model and it provided the foundation to the modern theory of monopolistic competition which was formalized by Dixit and Stiglitz in 1977.

# Monopolistic Competition



Consumers have ***preferences for particular sellers*** because of product differentiation. Think for example about the location and quality of coffee bars.

Firms have ***some control over price*** as a result of their unique advantages. The simplest case is location. There is only one Starbucks at the corner of Charles and Beacon St. in Boston.

There is relatively ***easy entry and exit***. Anyone can open a coffee shop and close it if unsuccessful.

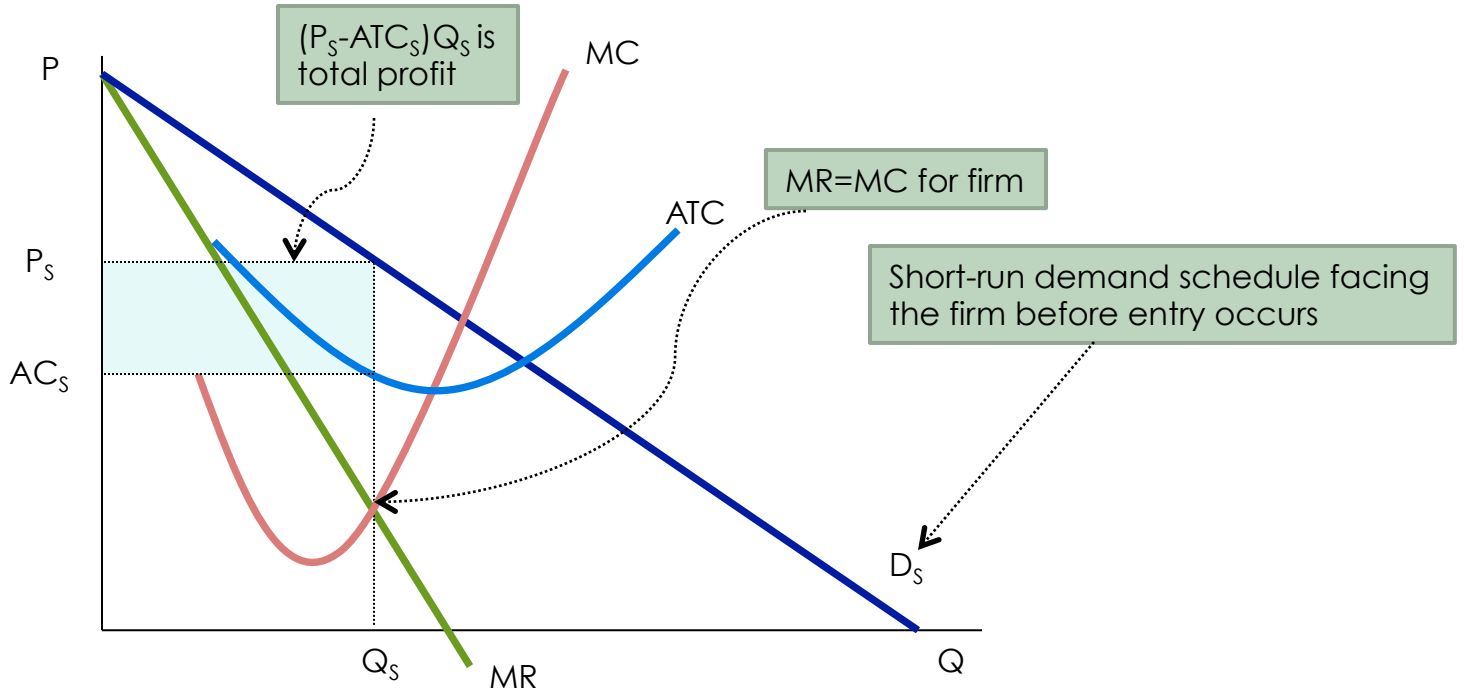
There are many ***firms*** which therefore do not act strategically in the sense that they ***take the price and product differentiation decisions of other firms as given***. Think again about the number of coffee shops in major cities.

Yet price is greater than marginal cost…

*Invented by Edward Chamberlin (1899-1967), a Harvard economics professor, in 1933. He also coined the term "product differentiation".*

# A firm prices just like a firm with market power in the short run





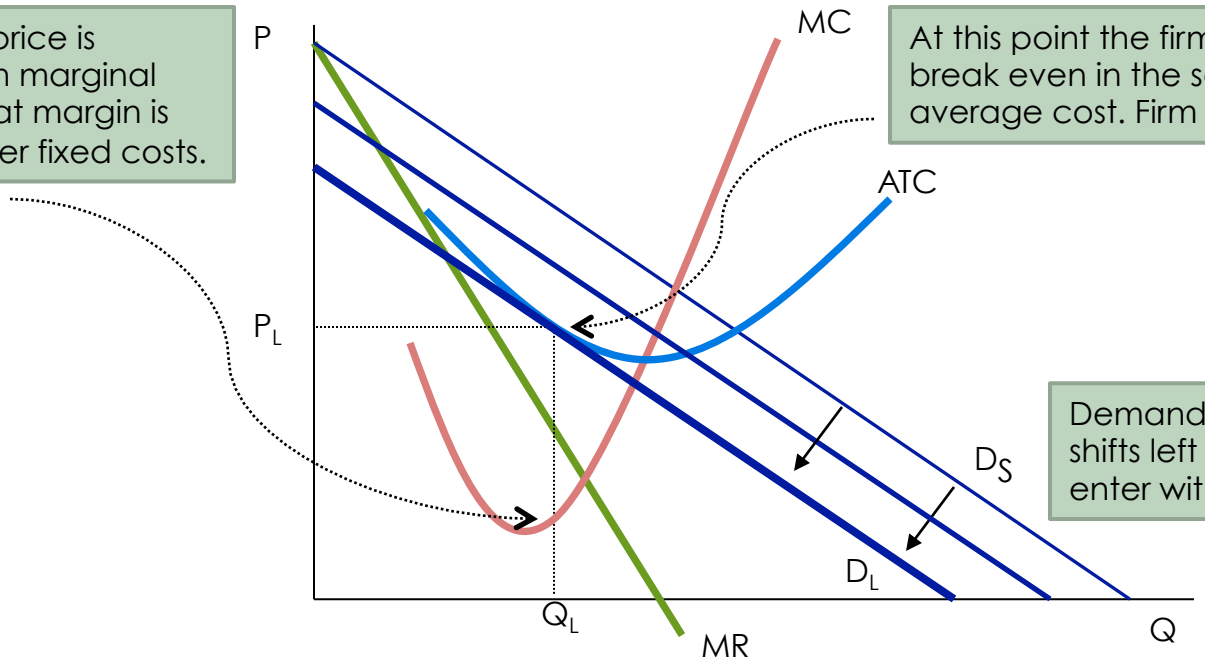

Output set by MR=MC. Total profit is the price-average cost margin times output, while incremental margin is price minus marginal cost.

At this point this looks like a typical "monopoly" firm maximizing profit.

# Entry continues until each firm breaks even



Equilibrium price is greater than marginal cost and that margin is used to cover fixed costs.




At this point the firm (and similar firms) just break even in the sense that price equals average cost. Firm recovers its fixed costs.

Demand schedule for a firm shifts left over time as more firms enter with substitute products

Entry of firms shifts the market demand curve $D_S$ to the left as fewer consumers purchase from the firm at any price.

The opportunity for entry continues until firms can't make a profit including covering their total costs. That happens when the demand schedule facing each firm is tangent to the average cost curve.

# Key Results of Simple Monopolistic Competition



- Entry continues until firms can just cover their average costs and only earn a competitive rate of return
- At the price equal to average total cost, equilibrium price is greater than marginal costs and firms have market power in that sense.
- The model therefore reconciles that fact that many firms seem to have some pricing power, and charge prices greater than marginal cost, but seem competitive and not terribly profitable.

# Modern Models of Monopolistic Competition*



- Typically assume either there is a continuum of consumers who have different preferences over product features or there is a "representative consumer" who purchases many different varieties.
- Typically assume there are fixed costs and linear variable costs (F + vQ where F is fixed cost and v is unit cost) so that there are scale economies for each firm (AC = v + F/Q)
- Typically assume there is a very large number of firms and there is easy entry and exit
- Competitive equilibrium is—as in Chamberlin—with p = ATC > MC so firms break even but have local monopoly power.



* E.g. Avinash Dixit and Joseph Stigler, "Monopolistic Competition and Optimum Product Diversity", *American Economic Review*, Volume 67 (1977), No. 3 (June), pp. 297-308.

# Oligopoly Models of Product Differentiation



- Most antitrust/industrial organization analysis uses modern game theory to analyze competition among a small number of firms with product differentiation.
- A leading model is "Bertrand competition with differentiated products" in which firms have fixed differences (are imperfect substitutes) and compete on price.
- The model is consistent with p > MC although with a small numbers of firms where each makes a profit. As the number of firms increase profits decline and eventually vanish.
- The model is consistent with the view that firms can "soften competition" (as in Hotelling) by differentiating. However, the model itself assumes fixed product differences.

# Model of Bertrand with Product Differentiation



This model allows differences in prices because products are differentiated

We can express demand as follows:

- $P_1 = a - b(Q_1 + \lambda Q_2)$
- $P_2 = a - b(Q_2 + \lambda Q_1)$

The term $\lambda$ is a number between 0 and 1 and is a measure of the degree of differentiation (the lower the $\lambda$, the higher is differentiation).

If $\lambda$ is zero, then there won't be cross-price effects and there would be two different non-related markets.

# Model of Bertrand with Product Differentiation



The price each firm can charge depends of the quantities sold by both firms in the market.

Products in the market place have fixed differences and are close substitutes.

Firms have some monopoly power even with price competition if differentiation is possible. Differentiation allows them to avoid the toughness of price competition.

# Measuring Substitution

# Product Differentiation and Substitution



A common question in antitrust is how closely various products compete with each other and therefore impose competitive constraints on each other.

To answer that question we need to examine the extent to which products are "substitutes" in demand.

Substitution is often measured by "cross-elasticity of demand": the percent change in the quantity of one good with respect to a change in the price of another good which is positive for substitutes

$\varepsilon_{12} = (\%\Delta Q_1 / \%\Delta P_2)$

# Estimating cross-elasticities from data

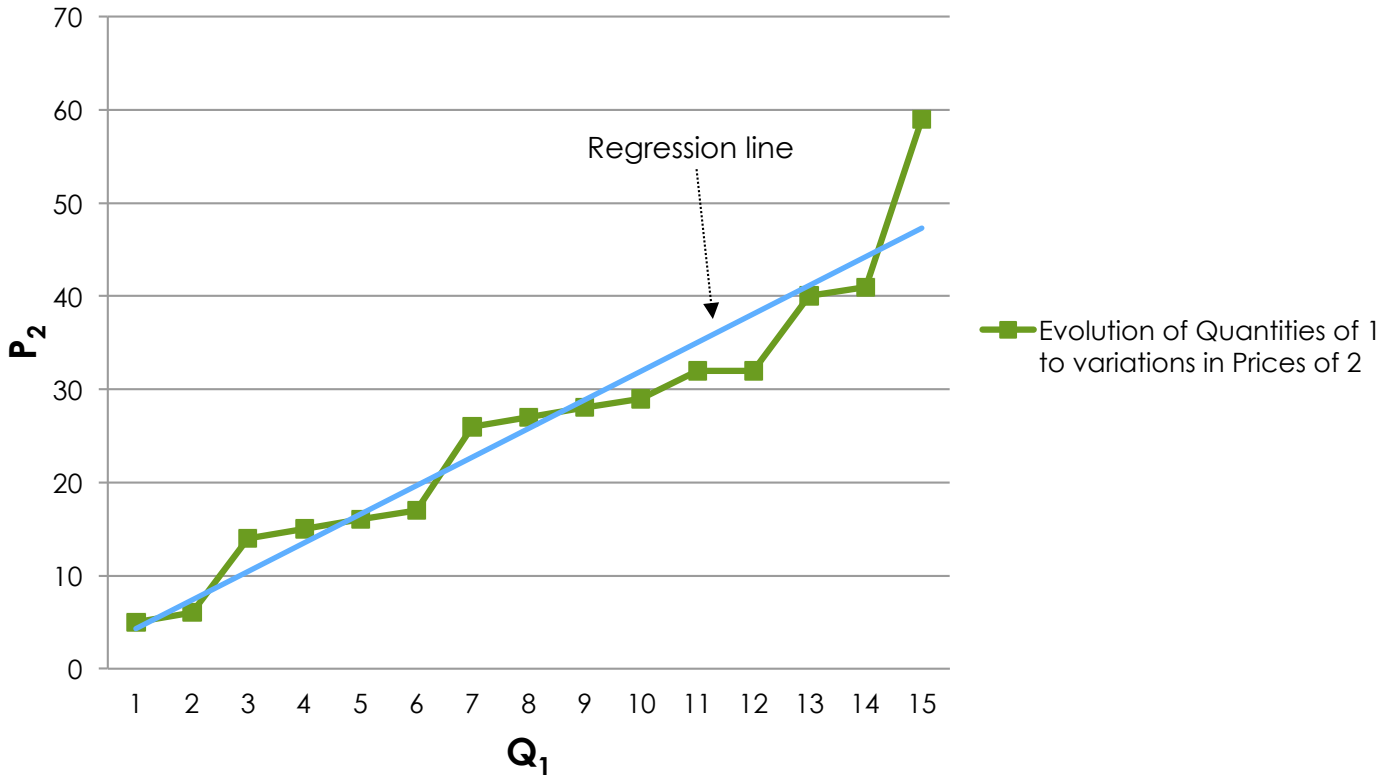


One could estimate cross-elasticity from a "***natural experiment***" where there is a sudden change in the price of good 2 (perhaps because of a supply disruption or increase in input costs), nothing else changes, and we observe the change in the quantity sold of good 1.

One could estimate cross elasticity from a "***regression***" study where historical data is used to estimate the relationship between the sales of good 1 and the price of good 2 and include "control" variables to factor out the price of good 1 and other factors that drive demand.

# Regression estimates of a cross-elasticity






This shows the basic idea from a regression study, although in practice the regression will be "multivariate" meaning it will include multiple variables and control for factors such as the price of good 1. In addition, it will deal with many other statistical issues such as "endogenous variables".

# Diversion ratios



- Suppose the price of product 1 goes up.
- Some consumers will stop buying the product and switch to other substitute products.
- The ***diversion ratio*** for competitor ***n*** is the fraction of sales that is diverted to that competitor.
- Competitors that have higher diversion ratios are closer competitors, closer substitutes and have higher cross-elasticities of demand.
- Diversion ratios are used mainly in mergers to assess the importance of constraints that each firm places on the other.

# Diversion ratio example



| To | From LOVEFiLM | From Amazon |
|---|---|---|
| LOVEFiLM | NA | [30-40%] |
| Amazon | [0-10%] | NA |
| Blockbuster | [0-10%] | [0-10%] |
| Other | [0-10%] | [0-10%] |
| Don't know | [50-60%] | [30-40%] |

Diversion analysis based on survey data in LOVEFiLM's acquisition of Amazon's business of ordering DVDs online and mailing them to customers. OFT, 2007, Decision.

The table shows LOVEFiLM as a close competitor of Amazon. Survey asked who customers would switch to in response to a 10% increase in price.

# Diversion ratios



It is possible to estimate the price change for firm A from a proposed merger from the diversion ratio between firm A and B ***(D)*** and the price-cost margin of firm A ***(m)***

The percent price change = mD/[2(1-D)] assuming the diversion ratio is the same between each firm.

If the margin is 20% and diversion ratio is 10% then the price change is 0.2*0.1/2*(0.9) = 0.02 / 1.8 = 0.0111 or 1.1%.

If the margin is 50% and the diversion ratio is 20% then the price change is 0.5*0.2/2*(0.8) = 0.0625 or 6.3%

Price effects are high when diversion ratios are high (i.e. merging products are close substitutes) and margins are high.

# Ready-to-Eat Cereal

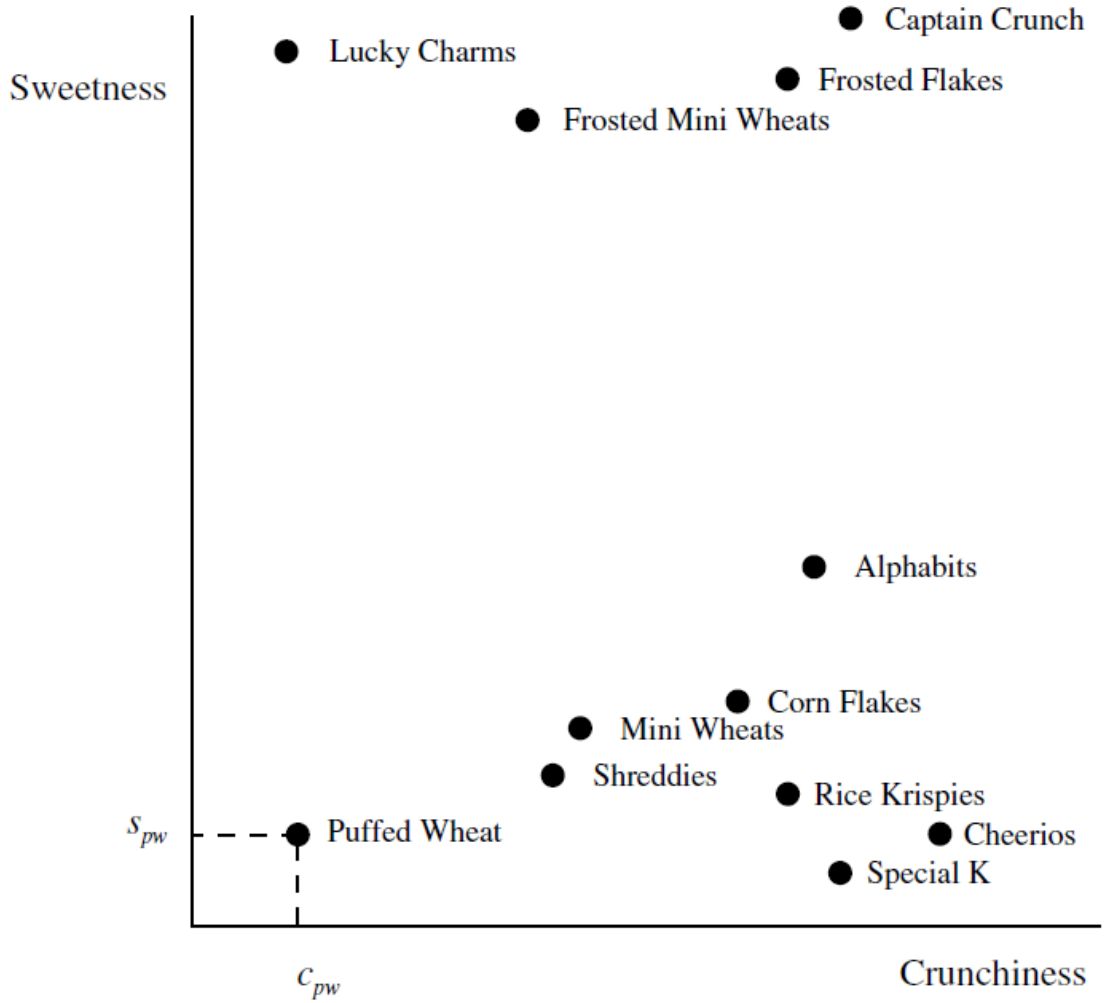
# Review: Market for breakfast cereals



- Assume consumers have preferences for only two attributes, crunchiness and sweetness.
- Then, the relevant product space is two dimensional and the set of possible products correspond to every potential combination of crunchiness and sweetness.
- The locations of the products indicate that Puffed Wheat is neither very sweet or crunchy, while Captain Crunch is both very sweet and crunchy.
- The distance (difference) between attributes of two products provides some indication of whether two products are similar.

# Product map of breakfast cereals






Consumers are more likely to substitute between products that are "close" in the attribute's location

Source: Church and Ware (2000) pp. 379

# Do we have too many or too few cereal brands?








For the United States the annual consumers' surplus is approximately $78.1 million from the introduction of a new brand of cereal (Apple Cinnamon Cheerios).

# Number of New Cereal Brands Introduced by Top 6



The rate at which new brands are introduced is high and has been increasing over time.

The rate of new brand creation peaked in the second half of the 1980s, with a sharp drop in the beginning of the 1990s.

Most of the brands introduced nationally did not survive in the long run.

| Year | Test Trials | Introduced Nationally | % Introduced Nationally |
|---|---|---|---|
| 1988 | 28 | 26 | 93% |
| 1989 | 29 | 21 | 72% |
| 1990 | 20 | 15 | 75% |

Source: Own compilation based on Nevo (2000)

# Price sensitivity and cross price elasticities in ready to eat cereals



- Results suggest that individual price sensitivity is heterogeneous. Most of the heterogeneity is explained by demographics.
- Own-price elasticities are not linear in price. This is due to heterogeneity in price sensitivity.
- Consumers who purchase different products have different price sensitivity.
- In addition, substitution patterns across brands are driven by product characteristics.

# Median and Cross-Price Elasticities of Ready to Eat Cereals



| | K Rice Krispies | GM Cheerios | GM Lucky Charms | P Grape Nuts | Q Life | R Chex | N Shredded Wheat |
|---|---|---|---|---|---|---|---|
| **K Rice Krispies** | 1.320 | 0.069 | 0.041 | 0.050 | 0.048 | 0.081 | 0.049 |
| **GM Cheerios** | 0.106 | 1.709 | 0.049 | 0.089 | 0.08 | 0.106 | 0.099 |
| **GM Lucky Charms** | 0.025 | 0.02 | 1.945 | 0.025 | 0.072 | 0.024 | 0.099 |
| **P Grape Nuts** | 0.03 | 0.037 | 0.026 | 2.096 | 0.028 | 0.027 | 0.115 |
| **Q Life** | 0.033 | 0.028 | 0.149 | 0.032 | 0.103 | 0.031 | 0.02 |
| **R Chex** | 0.024 | 0.021 | 0.011 | 0.013 | 0.014 | 1.749 | 0.014 |
| **N Shredded Wheat** | 0.018 | 0.024 | 0.009 | 0.07 | 0.015 | 0.017 | 2.268 |

# Predicted percent change in price as a result of a merger



| | Post and Nabisco | | GM and Nabisco | | GM and Chex | | Kellogg and Quaker Oats | | GM and Quaker Oats | |
|---|---|---|---|---|---|---|---|---|---|---|
| | P | Q | P | Q | P | Q | P | Q | P | Q |
| K Rice Krispies | 0.0 | 0.1 | 0.1 | 0.2 | 0.1 | 0.4 | 5.1 | 4.1 | 0.7 | 2.0 |
| GM Cheerios | 0.0 | 0.2 | 0.7 | 0.9 | 1.1 | 1.3 | 0.5 | 1.3 | 4.1 | 3.5 |
| GM Lucky Charms | 0.0 | 0.1 | 0.3 | 0.4 | 0.7 | 0.8 | 0.8 | 3.3 | 9.3 | 10.6 |
| P Grape Nuts | 1.5 | 2.8 | 0.1 | 0.7 | 0.0 | 0.4 | 0.1 | 2.3 | 0.1 | 3.0 |
| Q Life | 0.0 | 0.1 | 0.0 | 0.3 | 0.1 | 0.5 | 15.5 | 16.7 | 23.8 | 25.3 |
| R Chex | 0.0 | 0.2 | 0.0 | 0.3 | 12.2 | 19.0 | 0.0 | 2.1 | 0.1 | 3.4 |
| N Shredded Wheat | 3.1 | 8.6 | 7.5 | 18.8 | 0.0 | 0.4 | 0.0 | 1.9 | 0.0 | 2.5 |

# End Part 2, Next Class Topic 6