Dynamic Pricing:
The Art & Science of Pricing to Increase the Economic Health of Your Wine Business

OREGON WINE

PORTLAND

SYMPOSIUM

Wednesday February 21, 2018

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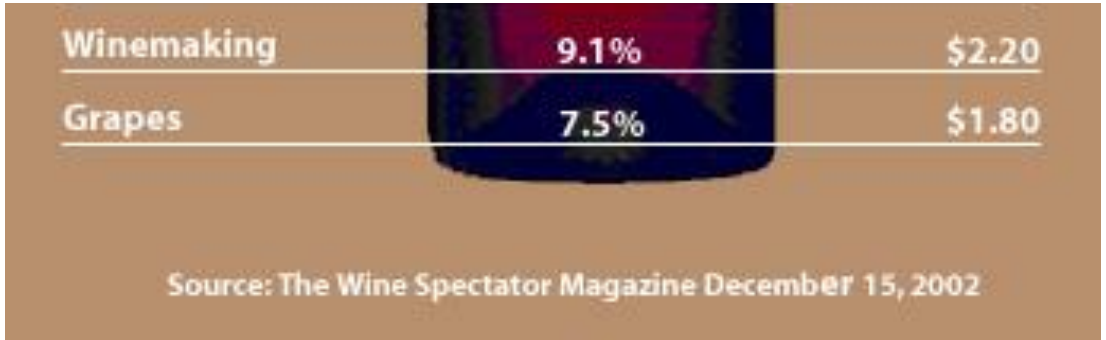
Cost Based Pricing

Cost Based Pricing



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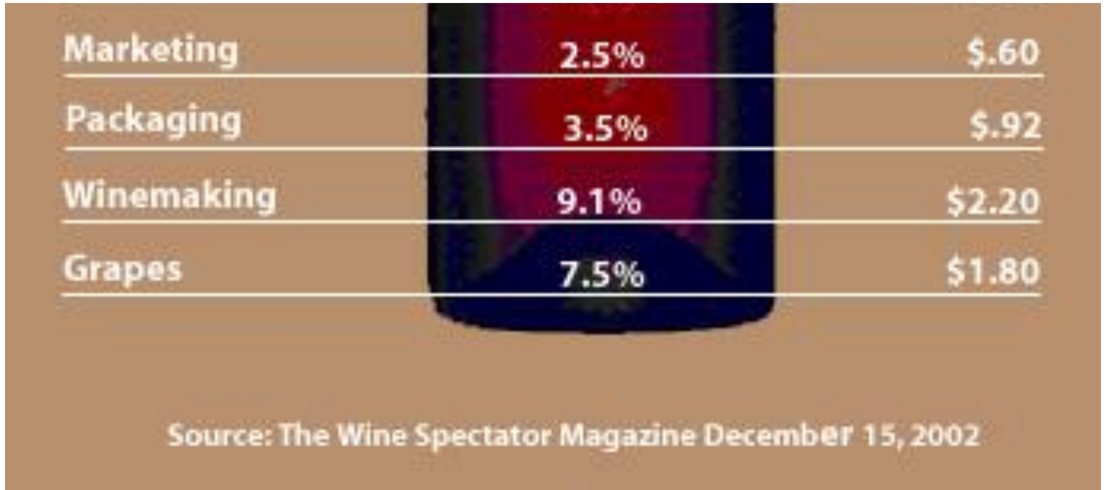


Cost Based Pricing

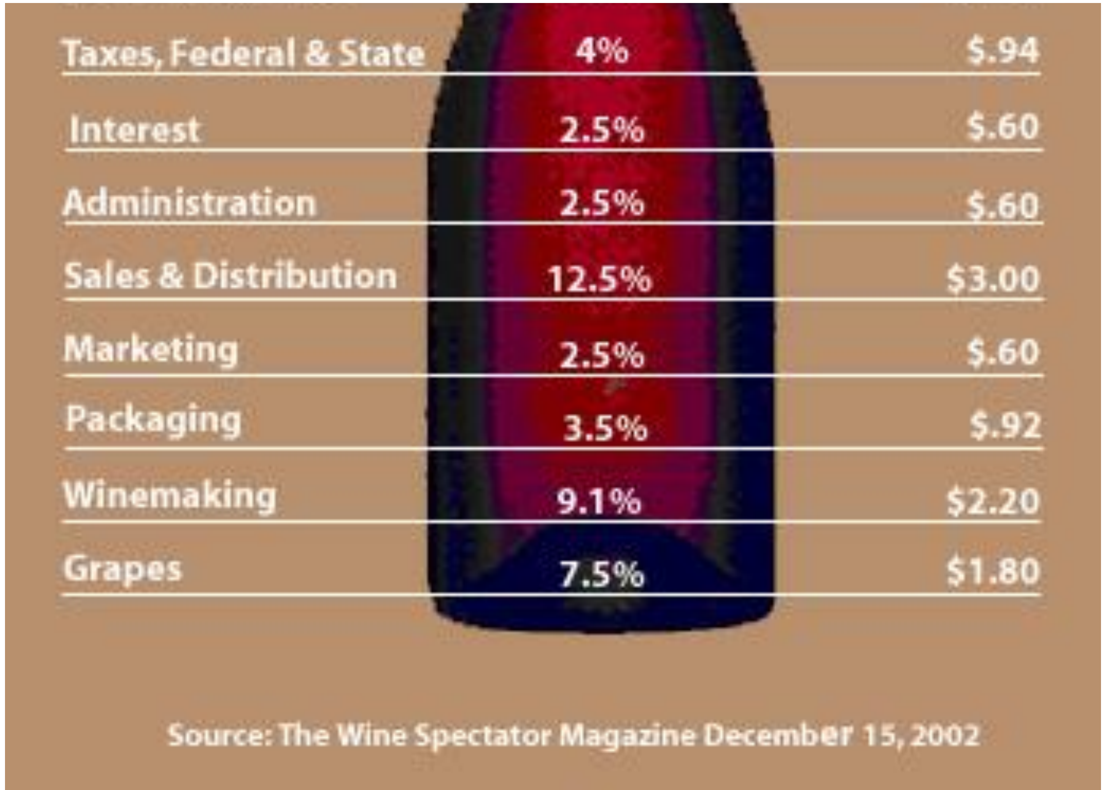
Cost Based Pricing

Cost Based Pricing

Interest	2.5%	$.60
Administration	2.5%	$.60
Sales & Distribution	12.5%	$3.00
Marketing	2.5%	$.60
Packaging	3.5%	$.92
Winemaking	9.1%	$2.20
Grapes	7.5%	$1.80

Source: The Wine Spectator Magazine December 15, 2002

Cost Based Pricing



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Cost Based Pricing

Net Winery Profit	5.6%	$1.35
Taxes, Federal & State	4%	$.94
Interest	2.5%	$.60
Administration	2.5%	$.60
Sales & Distribution	12.5%	$3.00
Marketing	2.5%	$.60
Packaging	3.5%	$.92
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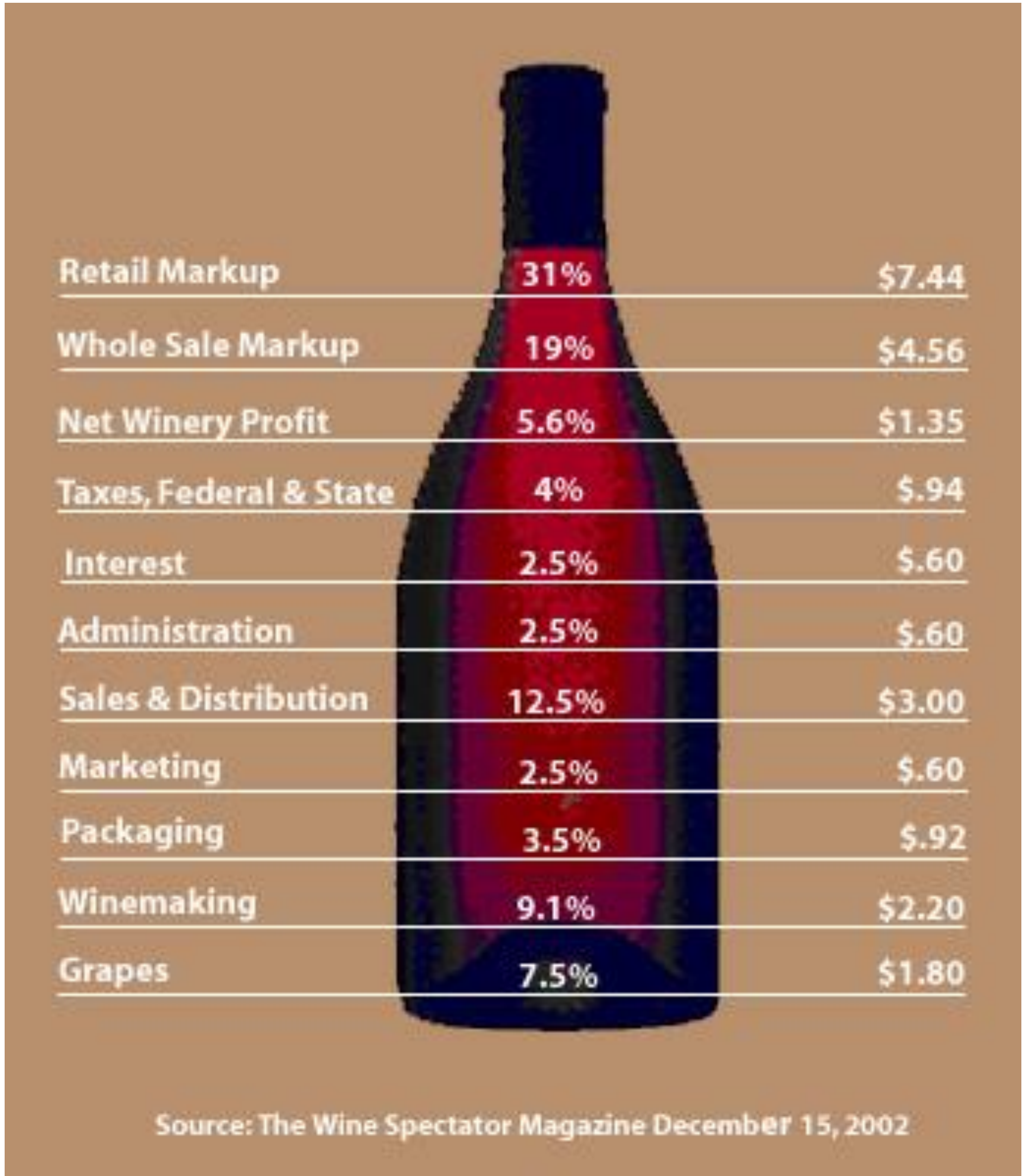

Price=$24.01

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Value Based Pricing

Move from what it costs to what it's worth

What are consumers willing to pay for your wine?

Value -Determined by Consumers based on Price.

- A good wine at $10 is a value.
- That same wine at $50 may not be.

Sales -Determined by Consumers based on Price.

- Whether I buy or not depends on value relative to price.
- How much buy depends on value relative to price.

Revenue -Determined by Consumers based on Price.

- Selling a lot of wine at a deep discount may result in low revenue.
- Selling very little wine at a high price may also result in low revenue.

When does changing price either an increase or decrease revenue?

Price –Is determined by Consumers.

Where in the consumers' purchasing decision is cost? Nowhere!

Price is determined by consumers.

How do we find the maximum price consumers are willing to pay?

Don't ask consumers what they say they are willing to pay!

Analyze what they actually do.

Start by analyzing consumer behavior.

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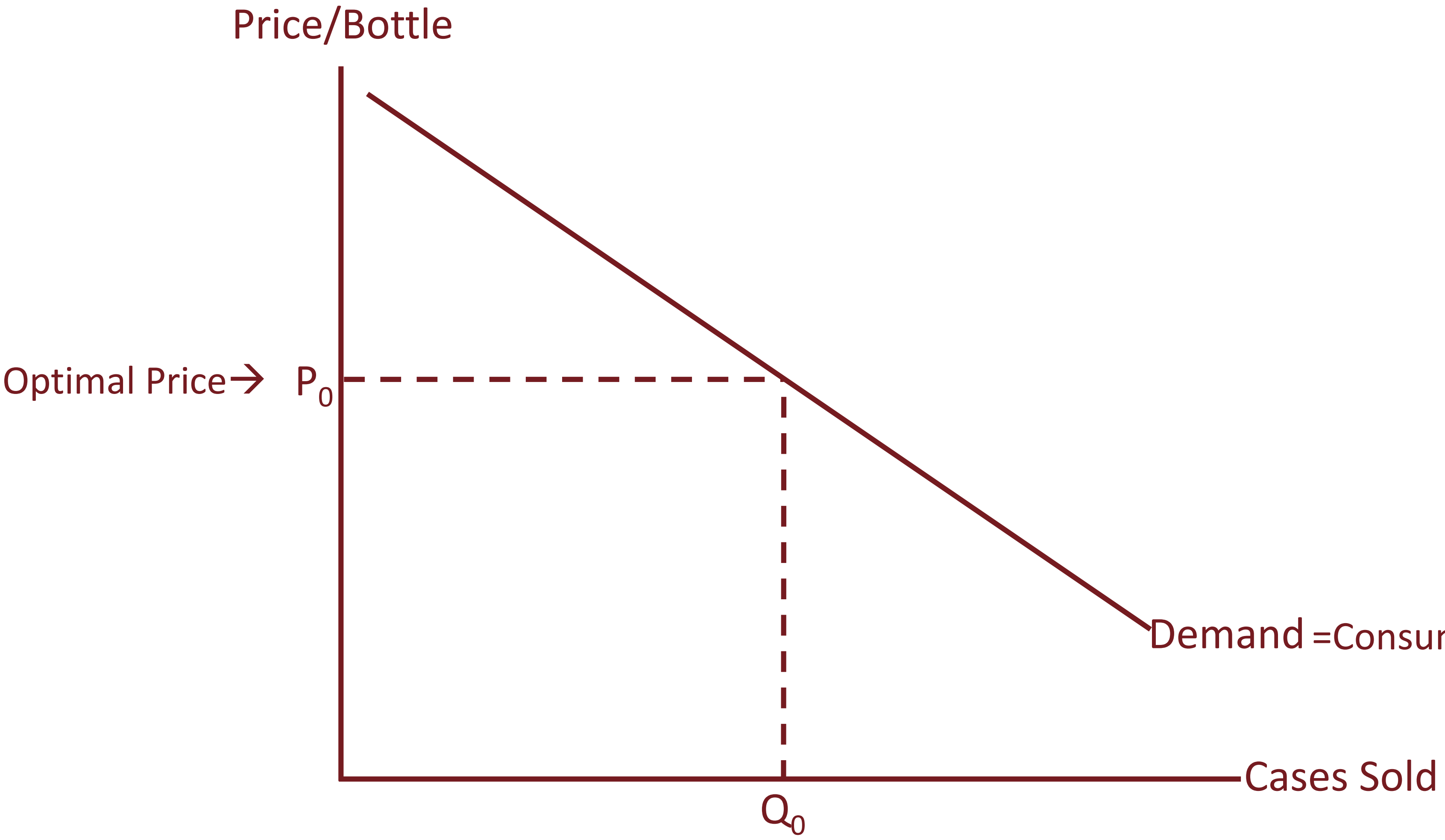
Theory of Consumer Behavior

Price Optimization -Finding the maxaimum price consumers are willing to pay.



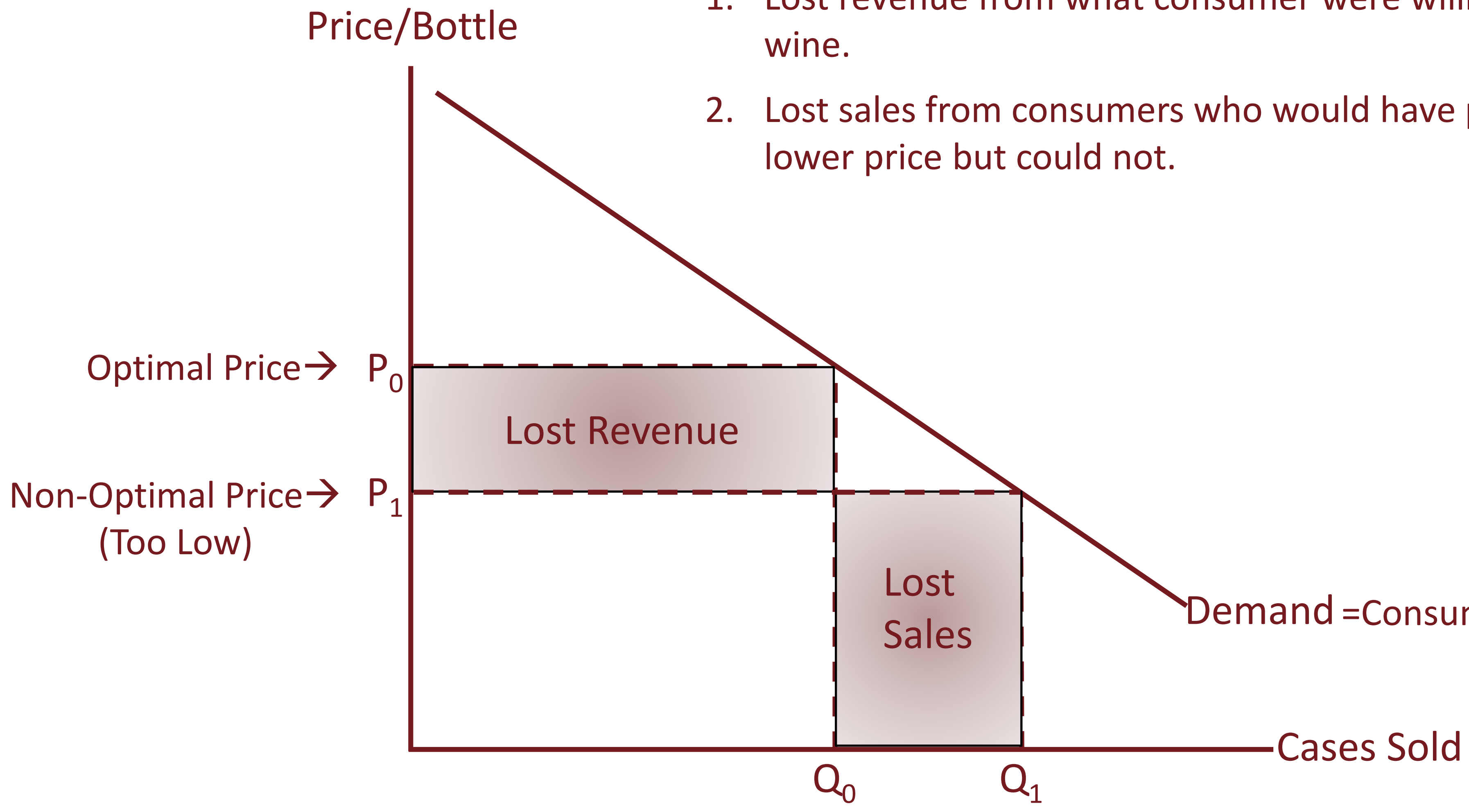
For a given level of sales

Price Optimization -Finding the maxaimum price consumers are willing to pay.

Non-Optimum Price(Too Low)

Results in losses of two types:

1. Lost revenue from what consumer were willing to pay for each bottle of wine.
2. Lost sales from consumers who would have purchased your wine at the lower price but could not.



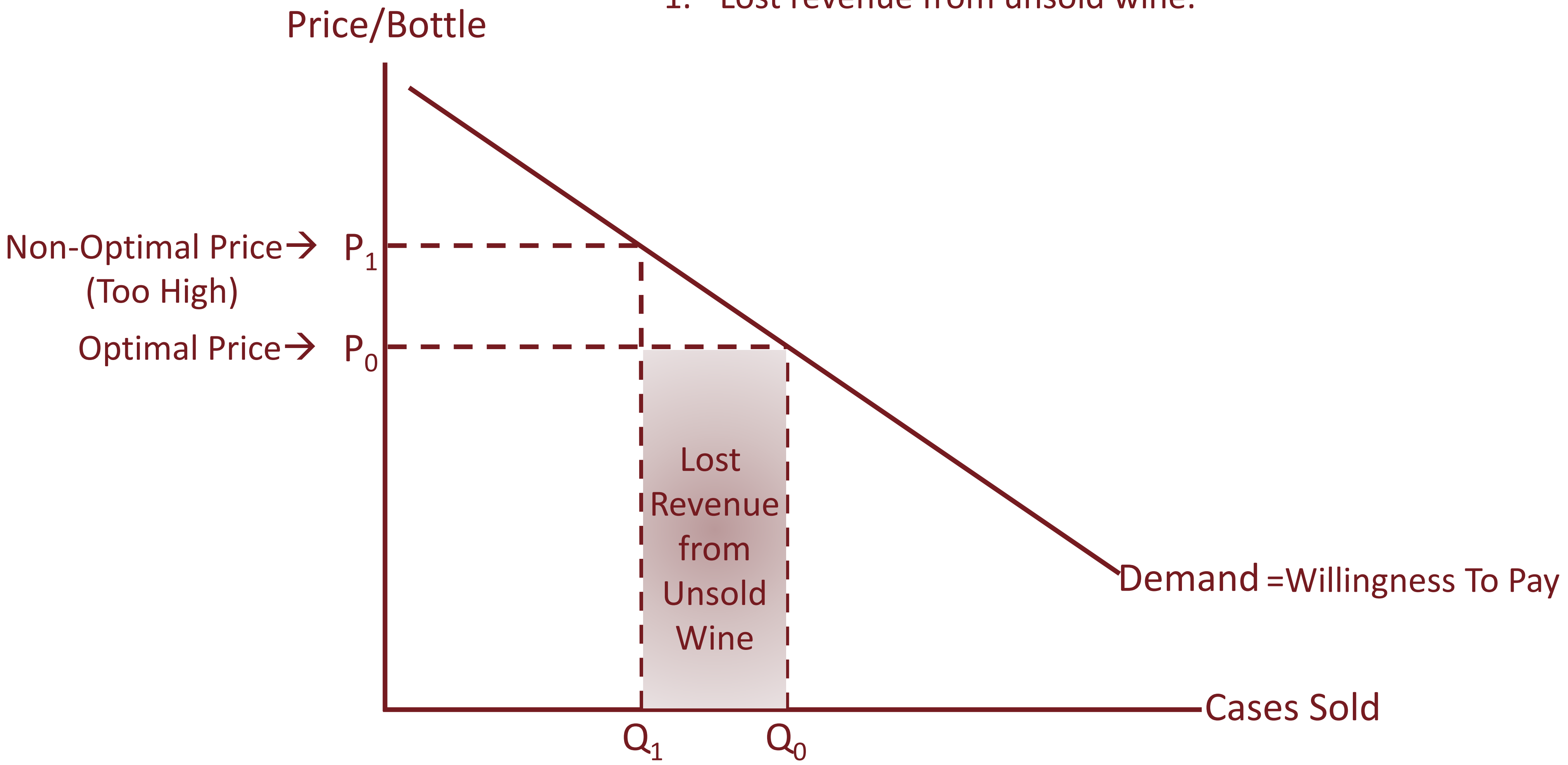
For a given level of sales

Price Optimization -Finding the maxaimum price consumers are willing to pay.

Non-Optimum Price(Too High)

Results in:

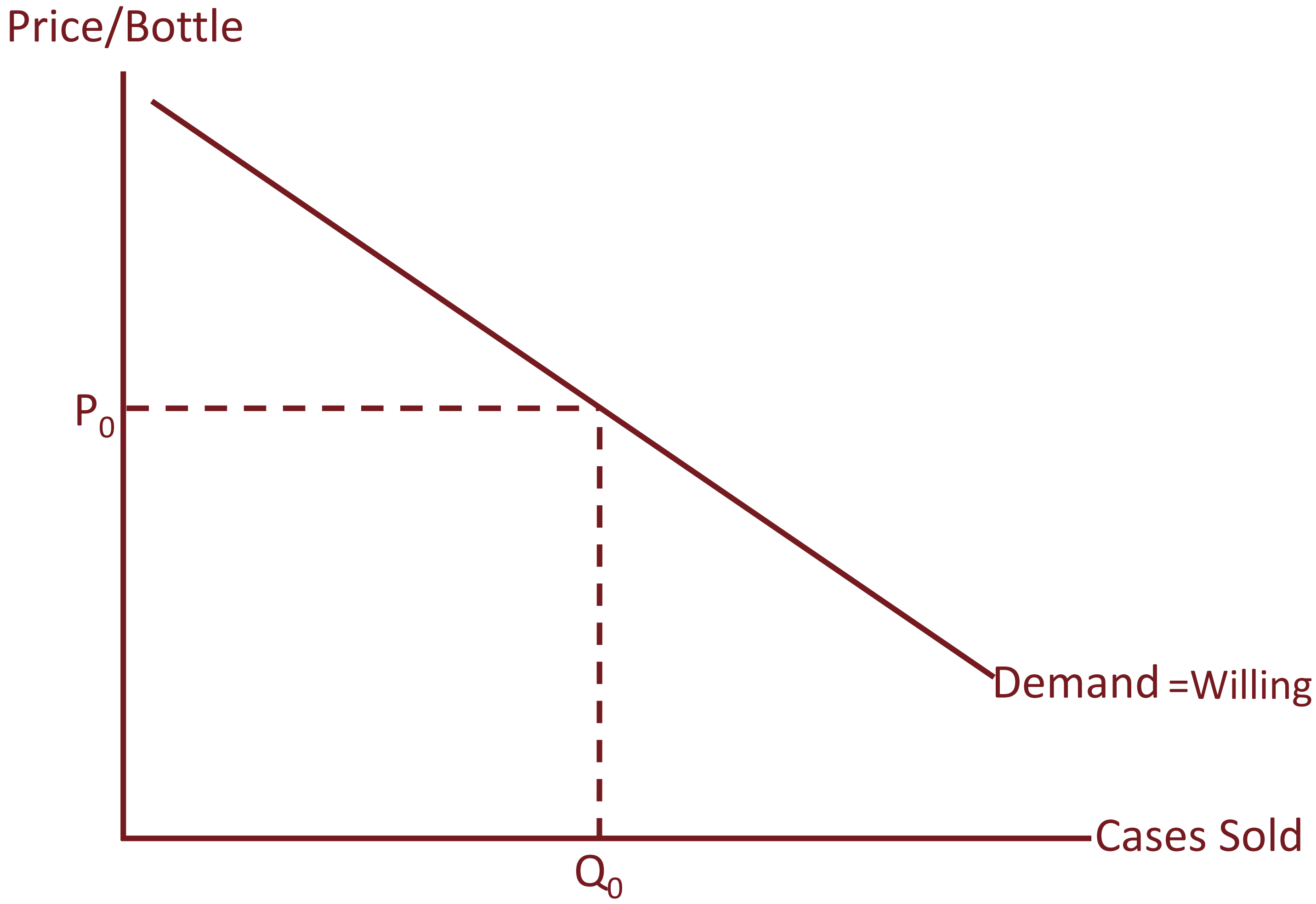
1. Lost revenue from unsold wine.



Theory of Consumer Behavior

Price Optimization -Finding the maxaimum price consumers are willing to pay.

Can we put theory to practice?



Theory of Consumer Behavior

Case Study
Price Optimization

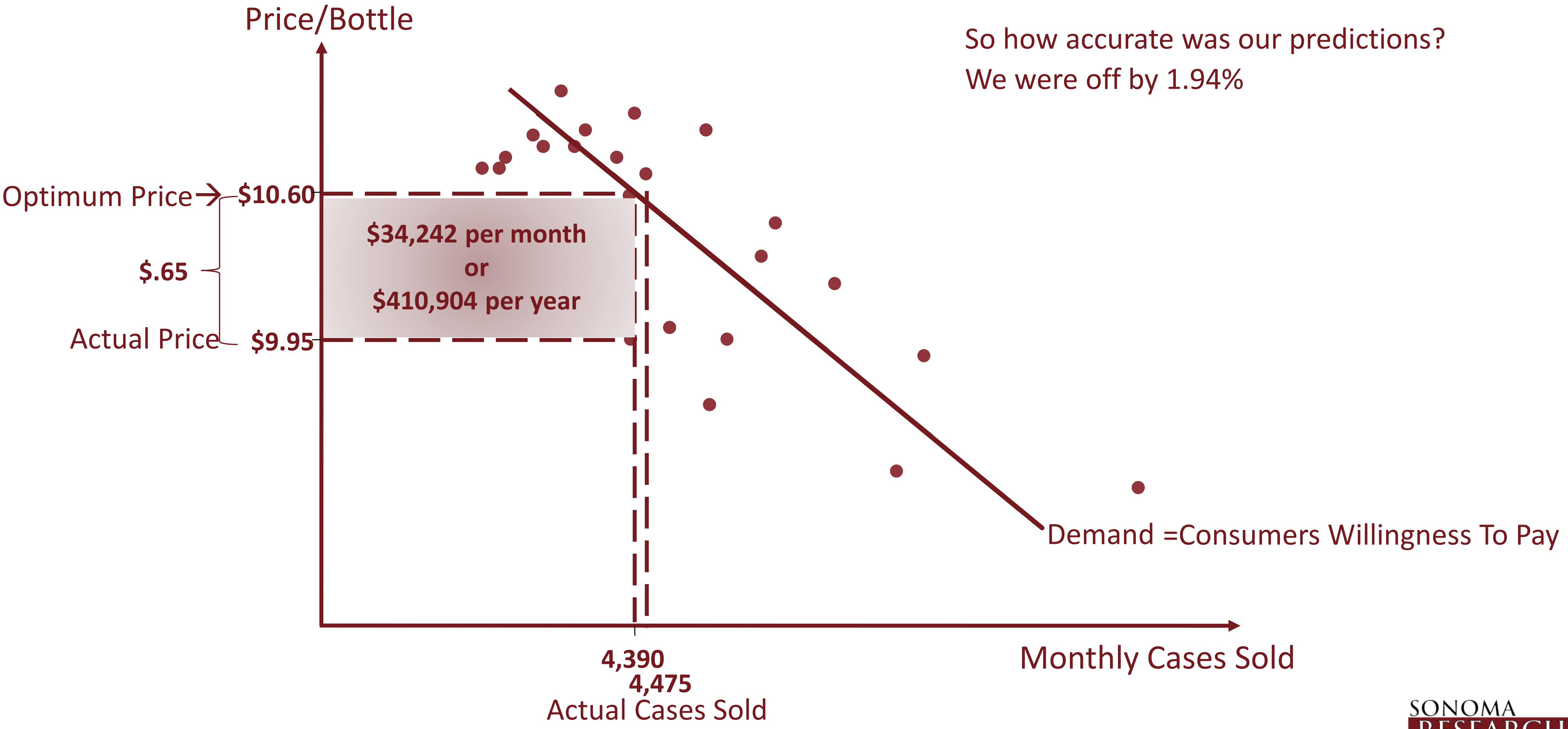
We were given data on a particular item (SKU) and asked to evaluate price for a specific month.

Case Study
Price Optimization

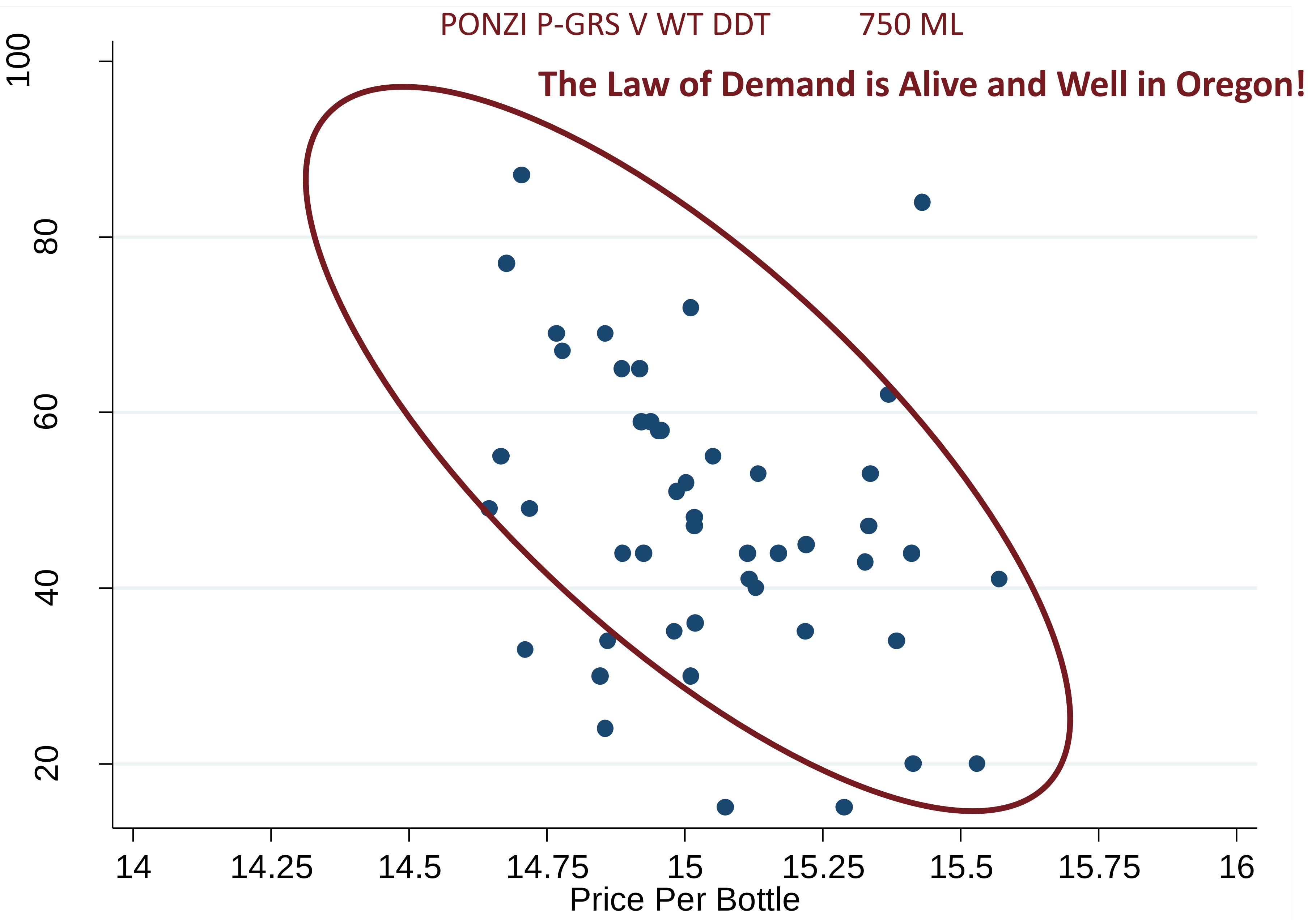
We were given data on a particular item (SKU) and asked to evaluate price for a specific month.

Based on our analysis, the optimal price for that month should be $10.60 per bottle.

So how accurate was our predictions?
We were off by 1.94%



Price Optimization
Closer to home



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Useful references

Journal of Wine Economics, Volume 3, Issue 2, Fall 2008, Pages 1–13

Estimating the Demand for Wine Using

Steven S. Cuellar[a] and Ryan Huffman[b]

The demand for wine is generally estimated on an aggregate level as a single commodity. However, as recent history shows us, the demand for wine not only varies considerably by varietal, but also by price point within each varietal. As a result, although estimates of the demand for wine may be beneficial to the wine industry as a whole, they provide little benefit to individual wine producers. Using scan data of purchases from US retail chain stores, this paper uses store keeping unit (sku) level data to overcome the limitations of prior research on the demand for wine by providing estimates for the demand for wine by varietal and price point. We also provide estimates of own price effects, income effects as well as cross price effects by color, varietal and price point. Problems of endogeneity inherent in demand estimation are corrected by utilizing a novel instrumental variable technique using grape prices as the instrument. (JEL Classification: C23, D12)

I. Introduction

The purpose of this paper is to investigate the demand for wine and provide insight into the behavior of U.S. wine consumers. We use a unique data set consisting of pooled cross sectional data on the price paid and number of cases sold of wine at the store keeping unit (sku) level. The data set allows us to disaggregate the demand for wine by color, varietal and price segment. We use a fixed effects model and correct for endogeneity by using an obvious yet novel instrument, grape prices, to identify the demand for wine. In addition to providing own price and income elasticities by color, varietal and price segment, the paper also provides empirical estimates of cross price elasticities by color, varietal and price segment.

* The authors would like to thank an anonymous referee for critical comments that helped improving this paper. We are also grateful for helpful comments from participants at Sonoma State University's Department of Economics Seminar Series. We would also like to thank Sonoma State University's Wine Business Program for funding this research.

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The demand for wine in the USA

Steven S. Cuellar
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Tim Colgan
Foster's Wine Estate, Napa, California, USA
Heather Hunnicutt
Wine Business Program, Sonoma State University, Rohnert Park, California, USA, and
Gabriel Ransom
Sonoma Research Associates, Glen Ellen, California, USA

While the law of demand is confirmed, differences were found in the price elasticity of demand by varietal and price point. Also, these wines are found to be normal good as defined by economic theory and the results generally hold across color, varietal and price segment. There was a greater willingness of red wine drinkers to switch to white wines than white wine drinkers to switch to red wines.

Practical implications – No statistically significant cross price effects were found.

Originality/value – This paper provides an important contribution to the current literature by disaggregating the demand for wine by color, major varietal and price segment to analyze cross price effects.

Keywords Wines, United States of America, Demand, Consumer behaviour

Paper type Research paper

Introduction

The purpose of this paper is to investigate the demand for wine and provide insight into the behavior of US wine consumers. In this paper, we utilize the instrumental variable method of Cuellar and Huffman (2008) and take a more detailed view of US wine demand. We use a data set consisting of pooled cross sectional data on the price paid and number of cases sold of wine at the store keeping unit (SKU) level. The data set allows us to disaggregate the demand for wine by color, varietal and price segment. In addition to providing own price and income elasticities by color, varietal and price segment, the paper also provides empirical estimates of cross price elasticities by color, varietal and price segment.

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Theory of Consumer Behavior

Consumers' willingness to pay is often measured using the price elasticity of demand.

$$\mathcal{E}_P = \frac{\%\Delta Q^D}{\%\Delta P}$$

Tells us how ***responsive*** or ***sensitive*** consumers are to a price change.

Also tells us whether revenue increases or decreases in response to a price change & by how much it will change.

If consumers are very sensitive to price changes, then a price increase will decrease revenue.

If consumers are not very sensitive to price changes, then a price increase will increase revenue.

The optimal price is inversely proportional to the price elasticity of demand.

$$P = \frac{MC}{(1 - \frac{1}{|\mathcal{E}_P|})} \quad P = \frac{MC}{(1 - \frac{1}{1.1})} \quad P = \frac{MC}{(1 - .90909091)} \quad P = \frac{MC}{(.09090909)} \quad P = 11MC$$

Price Elasticity (ε)	MC=$10 Price	Price Mark-Up	Percentage Mark-Up
1.1	$110.00	11X	1000%

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2	$20.00	2	100%
3	$15.00	1.5	50%
5	$12.50	1.25	25%
10	$11.11	1.11	11%

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Theory of Consumer Behavior

The optimal pricing formula also allows us to understand how the price responds to a change in costs.

Using the optimal price formula, $P = \frac{MC}{(1+\frac{1}{\varepsilon})}$ Rearranging we get $P = \frac{\varepsilon}{\varepsilon + 1} MC$

Which shows that price is a multiple of marginal cost.

This helps us understand what happens to price when marginal cost changes.

Suppose that $\varepsilon = -2$

$P = \frac{-2}{-2+1} MC =$2MC If marginal cost increases by \$1, then price will increase by \$2.

Suppose that $\varepsilon = -3$

$P = \frac{-3}{-3+1} MC =$1.5MC If marginal cost increases by \$1, then price will increase by \$1.50.

In this case, consumers are more price sensitive, thus firms are less able to pass along cost increases to consumers.

How price responds to a change in costs is called the ***pass through rate***.

This helps us understand how changes in:

- Input prices
- Taxes
- Exchange Rates

affect prices.

Dynamic Pricing

Once we understand how to price optimally, we can now engage in dynamic pricing.

What is dynamic pricing?

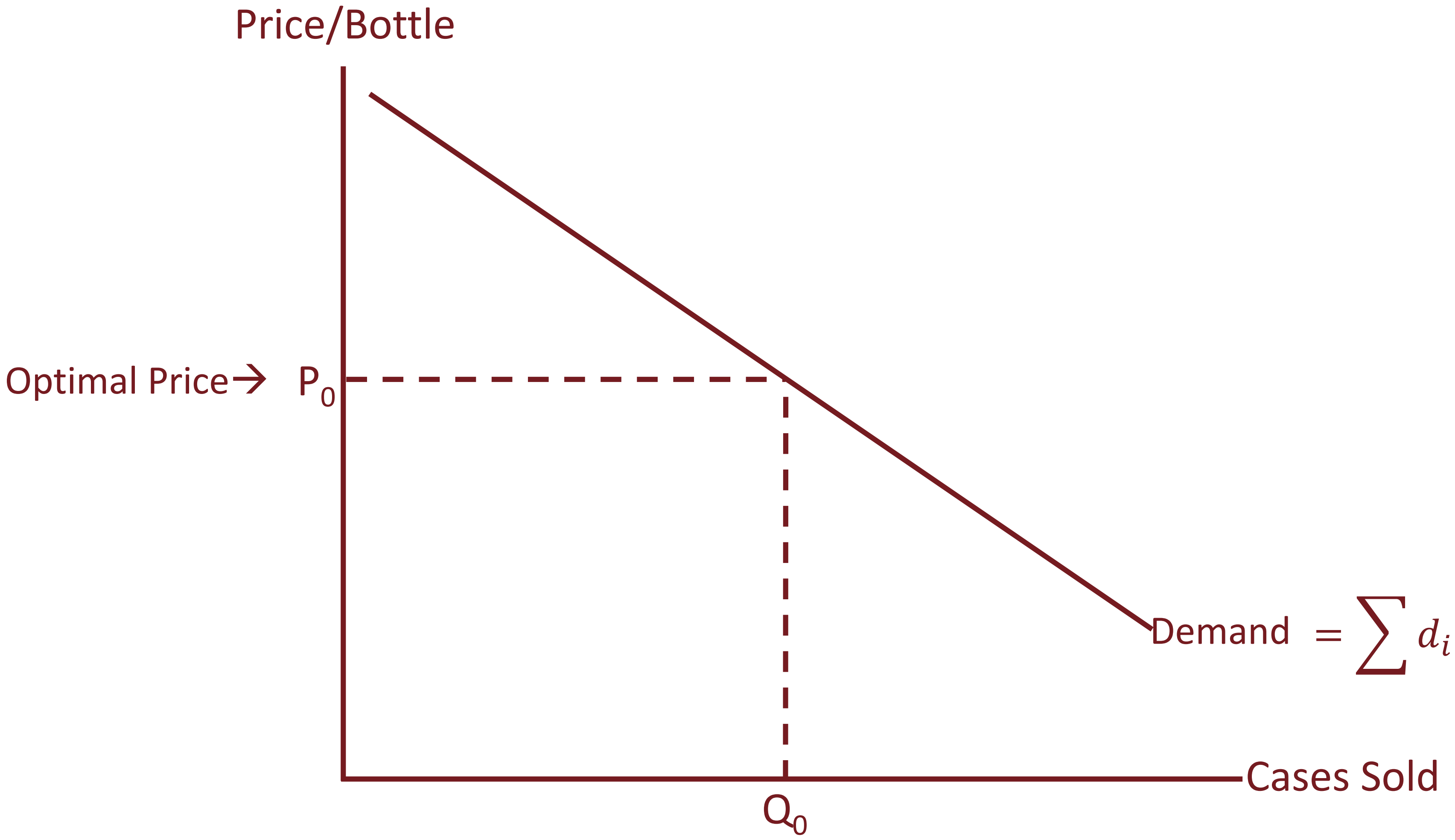
Charging different market segments, different prices based on their willingness to pay.

Dynamic Pricing

Dynamic Pricing

Once we understand how to price optimally, we can now engage in dynamic pricing

What may be the optimal price for the average consumer, is non-optimal for different market segments



Demand is composed of different market segments that differ in their willingness to pay

Once we understand how to price optimally, we can now engage in dynamic pricing

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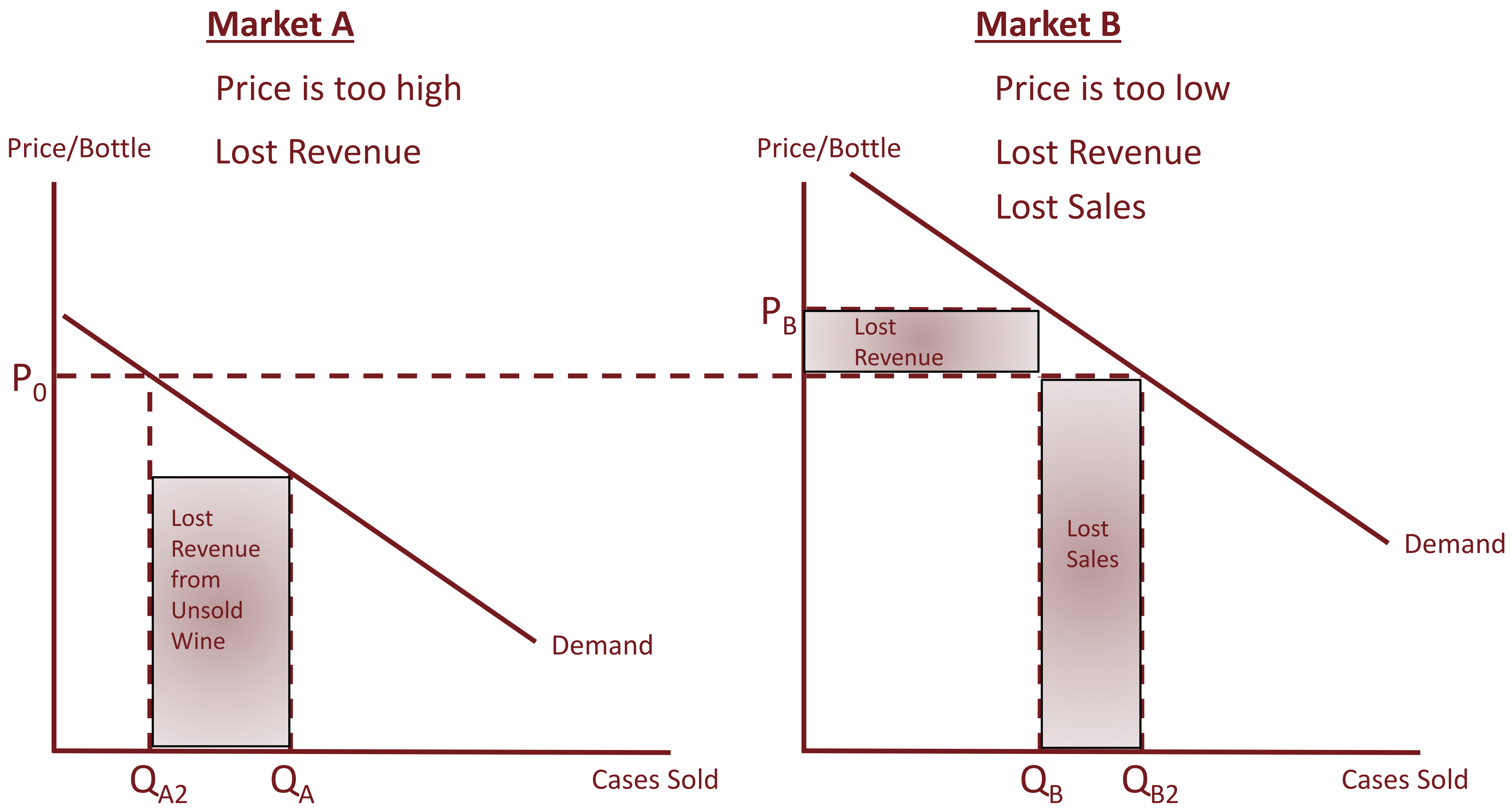
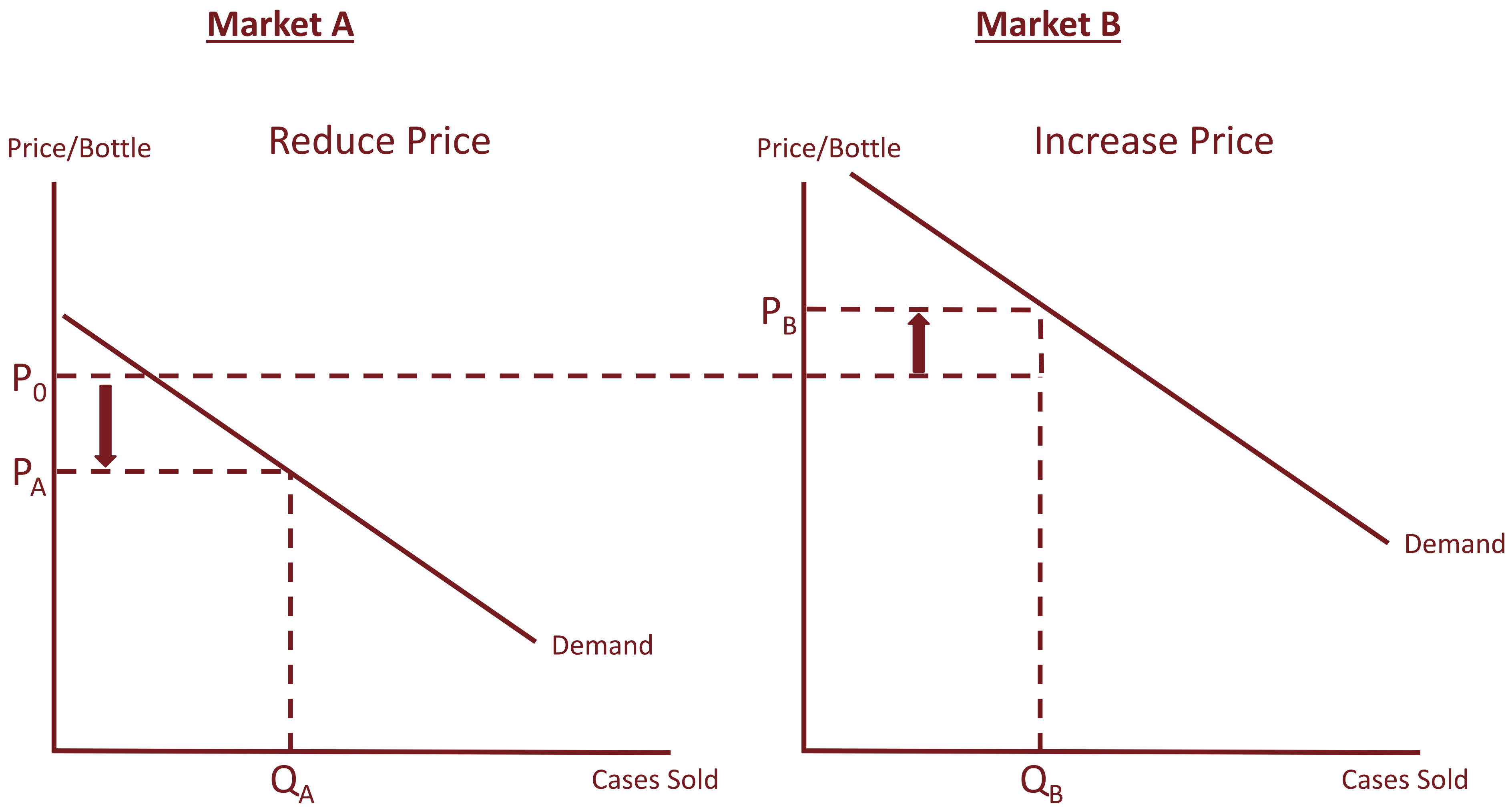


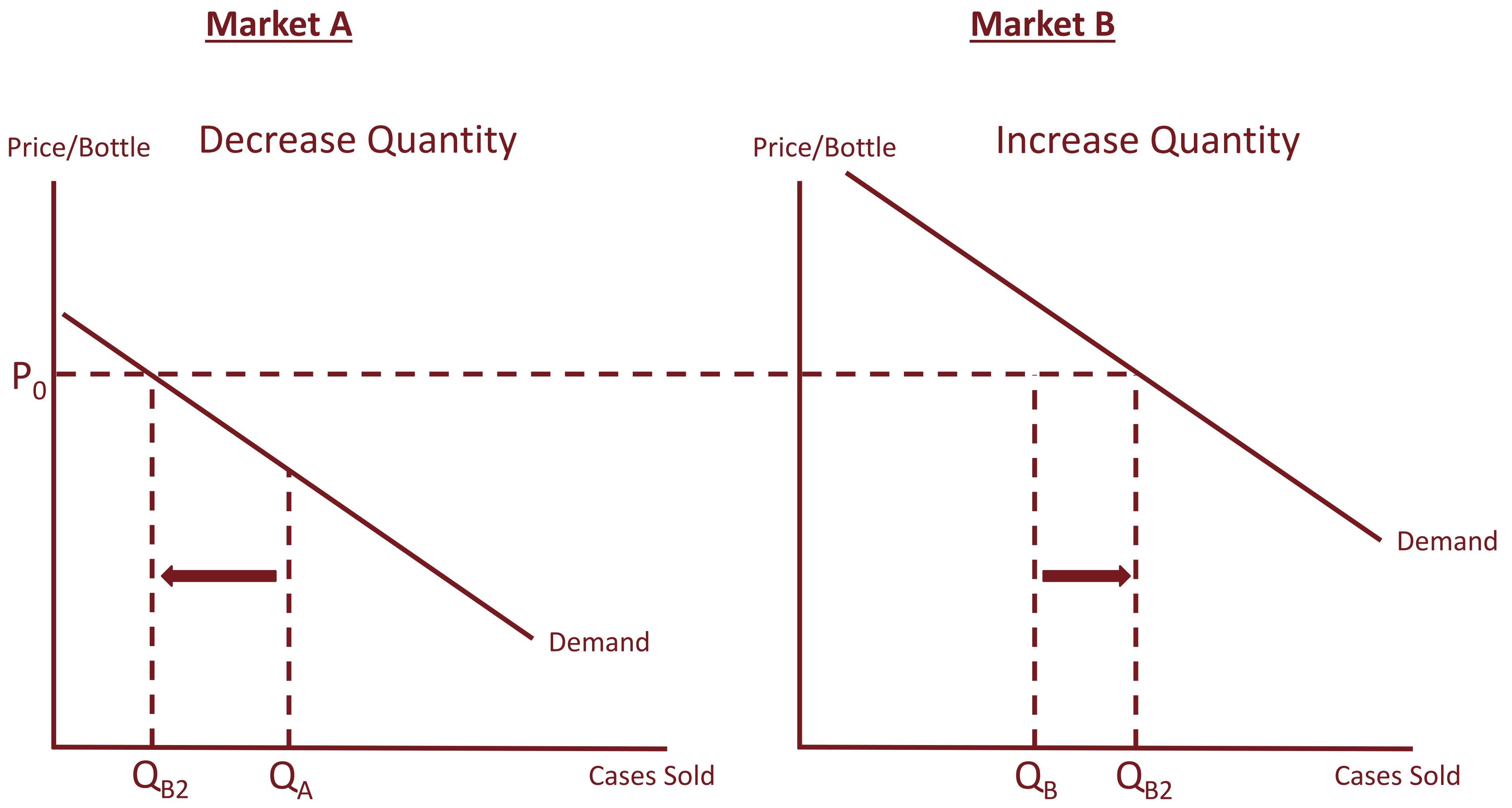
Once we understand how to price optimally, we can now engage in dynamic pricing

The Firm Should Either Optimize Price Across Markets



Once we understand how to price optimally, we can now engage in dynamic pricing

Or The Firm Should Optimize Quantity Across Markets



Useful reference on dynamic pricing

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journal homepage: www.elsevier.com/locate/jretconser

Retail channel price discrimination

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ARTICLE INFO

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Keywords:
Price discrimination
Market segmentation
Fixed effects models

ABSTRACT

This paper examines price differentials of identical items across retail channels. Many consumer packaged goods are sold through both grocery and drug stores. Liquor is unique in that in much of the country there is a third retail channel of distribution, liquor stores. If consumers in each retail channel differ in their willingness to pay for certain items, then sellers can exploit those differences and charge different prices for the same items in each channel. We examine a unique data set of pooled cross sectional retail scanner data on wine to test whether sellers use retail channel to identify heterogeneous consumer market segments and engage in price discrimination. We begin by presenting a model of price discrimination by retail channel along with behavioural assumptions regarding shoppers in each channel. Next we examine sales by retail channel and find persistent price differentials for the same item across retail channel after controlling for sample selection bias and seasonality. Lastly, we estimate the price elasticity of demand correcting for endogeneity and find differences across channel consistent with the price differentials. The extent of price differential, however, differs significantly with respect to price point.

1. Literature review

This paper investigates the difference in price of identical items across retail channel. We argue that these retail channel price differentials are a form of first degree or market segmented price discrimination in which consumers, who differ in their price elasticities of demand, self-select themselves into each retail channel. Modern concepts of price discrimination in non-competitive markets go back at least to Pigou (1920), whose categorization of price discrimination into first, second and third degree is still used today. Robinson (1933) elaborated on the conditions required for firms to engage in effective third degree price discrimination, namely that there exist identifiable market segments that differ in their price elasticities of demand. Using this background, Blattberg and Sen (1974, 1976) and Blattberg et al. (1978) show how market segmentation based on identifiable demographic characteristics can be effectively exploited. More recently, Hoch et al. (1995) use scanner data to show how demographic characteristics can be used to price discriminate by store location. Where differences in price elasticity are not easily identifiable, Moorthy (1984) provides a model where firms exploit differences in consumer preferences across market segments by offering product variants at different prices, allowing consumers to self-select among those products. More generalized models of price discrimination in contestable markets with differentiated products have been developed by Salop and Stiglitz (1977), Narasimhan (1984), Borenstein (1985) and Holmes (1989). The type of consumer behavior closest to that examined in this paper is that of Narasimhan (1984), who presents a model of coupon use as a form of price discrimination for identical goods. Specifically, Narasimhan presents a model in which consumers, who differ in their price elasticity of demand, self-select themselves into coupon use based on comparing the savings associated with using coupons with the opportunity cost of using coupons. We extend this model by allowing consumers to compare the savings associated with one retail outlet with the associated opportunity cost as defined in Kahn and Schmittlein (1989) and Bell et al. (1998). Finally, with respect to retail channel, Gerstner et al. (1994) examine price discrimination by retail channel, however, their paper concentrates on the effect of retailer mark-up on the size of discount offered, while Park and Keh (2003) look at the effect of manufacturers utilizing both the traditional retail channel as well as selling direct to consumers. Our paper, on the other hand, provides a unique perspective on the use of retail channel itself as a means of price discrimination.

2. A model of price discrimination

We model retail channel as a form of market segmentation. Just as coupons serve as a means of consumers self-identifying

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Dynamic Pricing

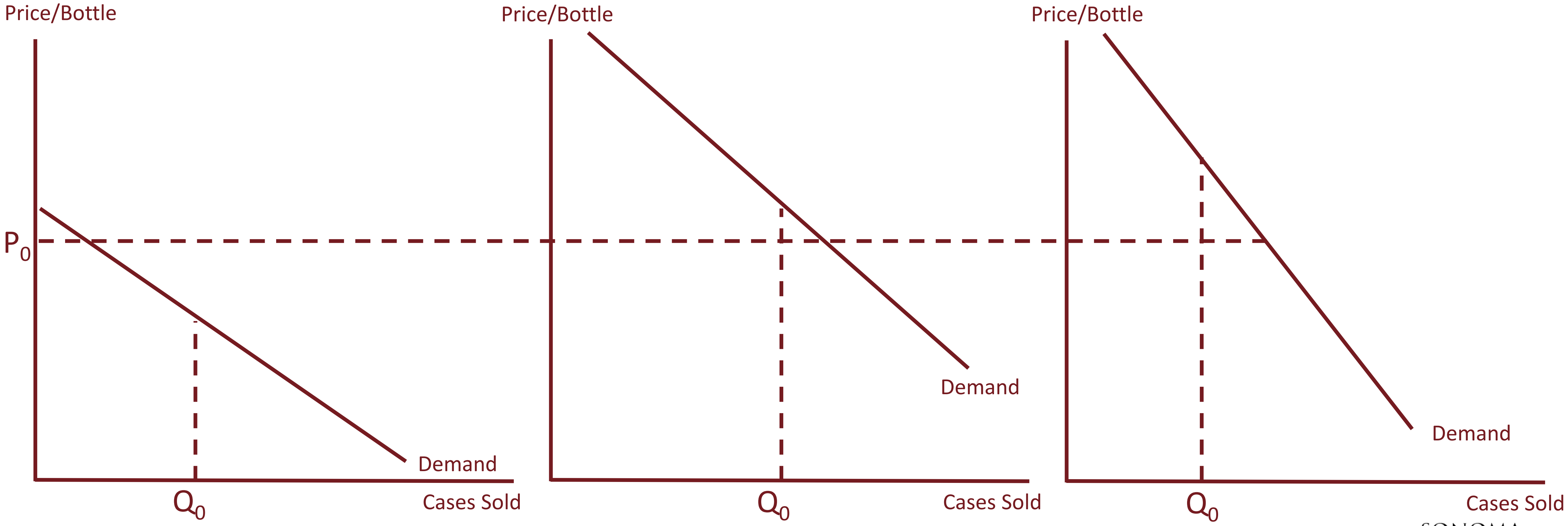
Retail Channel Price Discrimination (Cuellar and Brunamonte 2013)

The paper examines the three main retail channels:

A uniform price may be inefficient across all three channels if consumers differ in their willingness to pay.

Drug Stores **Grocery Stores** **Liquor Stores**

If $|\varepsilon_D| > |\varepsilon_G| > |\varepsilon_L|$ Then there may be an opportunity to engage in dynamic pricing. Specifically we should see $P_D < P_G < P_L$



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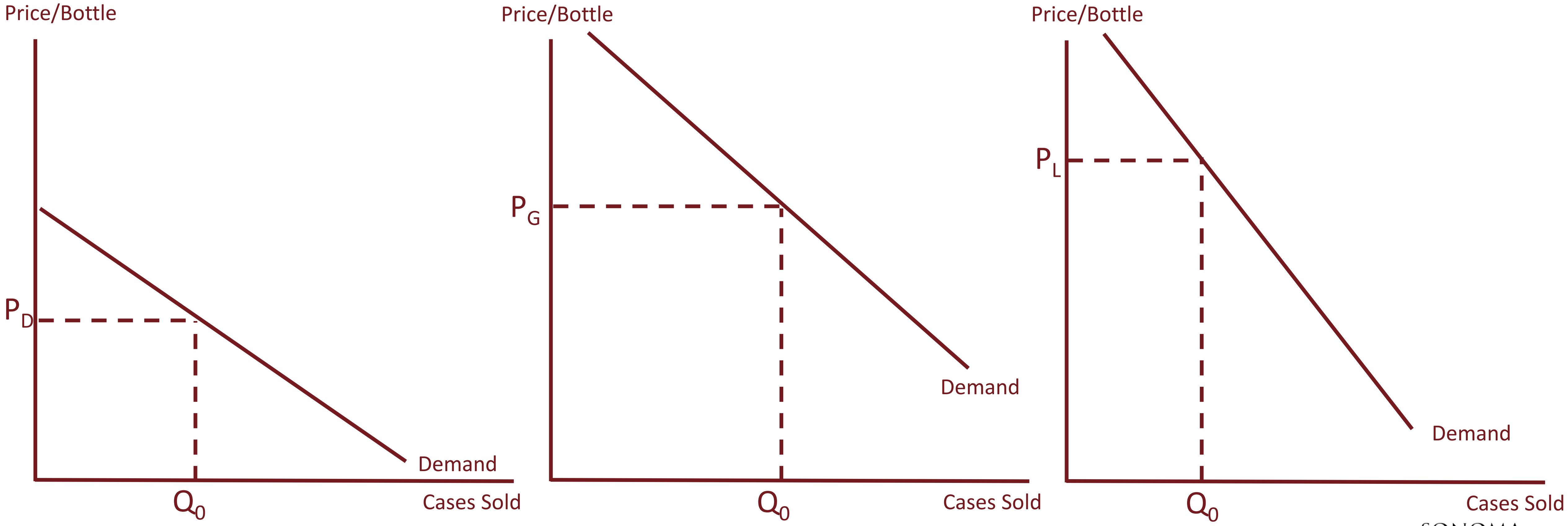

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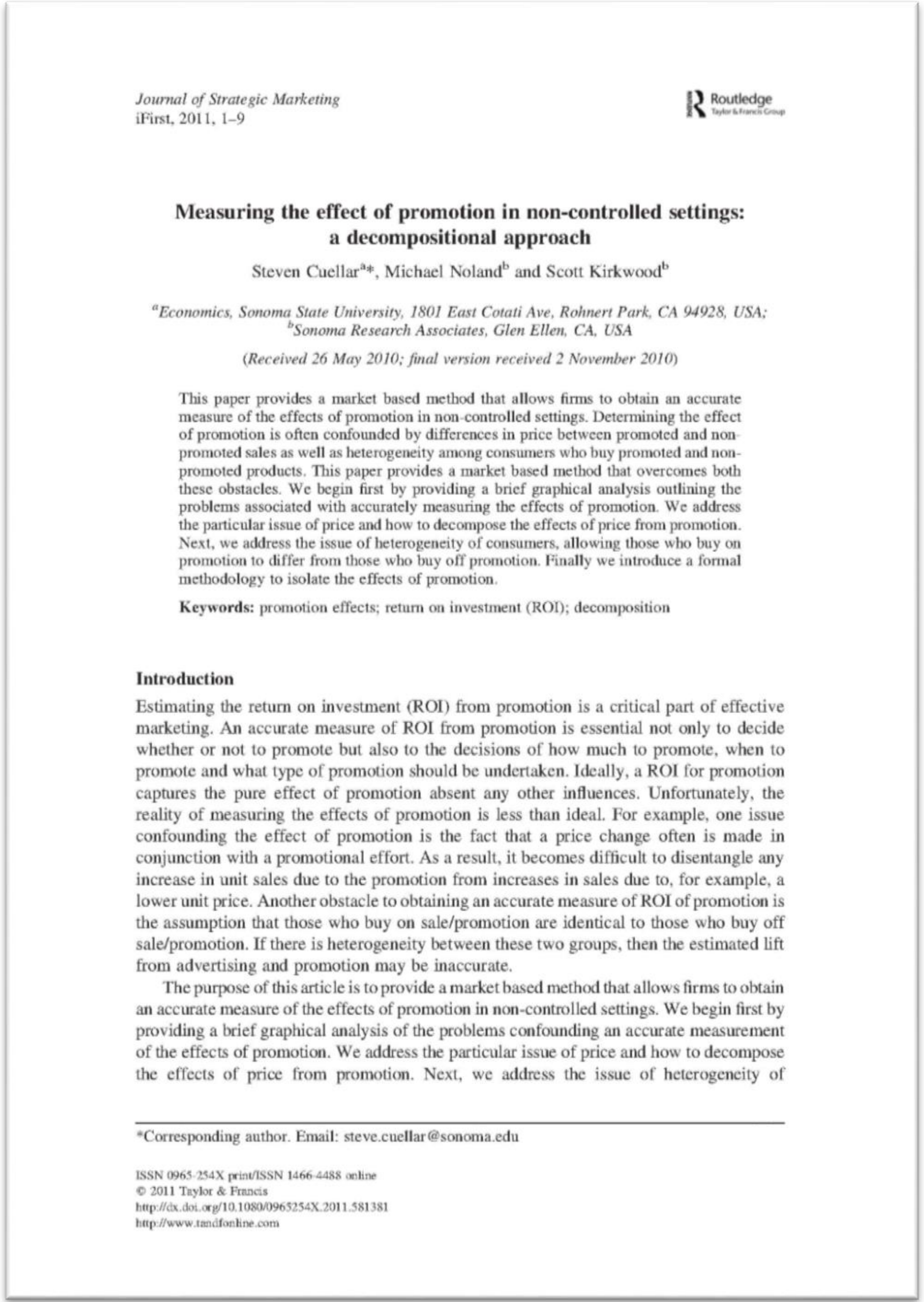
Measuring the Effect of Promotion

Once we have moved to value based pricing, we can also accurately measure the effect of promotion.

Measuring the Effect of Promotion in Non-Controlled Settings: A Decompositional Approach



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Routledge

Measuring the effect of promotion in non-controlled settings: a decompositional approach

Steven Cuellar[a]*, Michael Noland[b] and Scott Kirkwood[b]

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(Received 26 May 2010; final version received 2 November 2010)

This paper provides a market based method that allows firms to obtain an accurate measure of the effects of promotion in non-controlled settings. Determining the effect of promotion is often confounded by differences in price between promoted and non-promoted sales as well as heterogeneity among consumers who buy promoted and non-promoted products. This paper provides a market based method that overcomes both these obstacles. We begin first by providing a brief graphical analysis outlining the problems associated with accurately measuring the effects of promotion. We address the particular issue of price and how to decompose the effects of price from promotion. Next, we address the issue of heterogeneity of consumers, allowing those who buy on promotion to differ from those who buy off promotion. Finally we introduce a formal methodology to isolate the effects of promotion.

Keywords: promotion effects; return on investment (ROI); decomposition

Introduction

Estimating the return on investment (ROI) from promotion is a critical part of effective marketing. An accurate measure of ROI from promotion is essential not only to decide whether or not to promote but also to the decisions of how much to promote, when to promote and what type of promotion should be undertaken. Ideally, a ROI for promotion captures the pure effect of promotion absent any other influences. Unfortunately, the reality of measuring the effects of promotion is less than ideal. For example, one issue confounding the effect of promotion is the fact that a price change often is made in conjunction with a promotional effort. As a result, it becomes difficult to disentangle any increase in unit sales due to the promotion from increases in sales due to, for example, a lower unit price. Another obstacle to obtaining an accurate measure of ROI of promotion is the assumption that those who buy on sale/promotion are identical to those who buy off sale/promotion. If there is heterogeneity between these two groups, then the estimated lift from advertising and promotion may be inaccurate.

The purpose of this article is to provide a market based method that allows firms to obtain an accurate measure of the effects of promotion in non-controlled settings. We begin first by providing a brief graphical analysis of the problems confounding an accurate measurement of the effects of promotion. We address the particular issue of price and how to decompose the effects of price from promotion. Next, we address the issue of heterogeneity of

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Measuring Promotion

What is the effect of promotion?

How do we measure promotion?

This works as long as:

1. Promoted price is the same as the non-promoted price.
2. Promoted and non-promoted consumers are homogeneous.

In the simplest case, measuring the effect of promotion would be easy

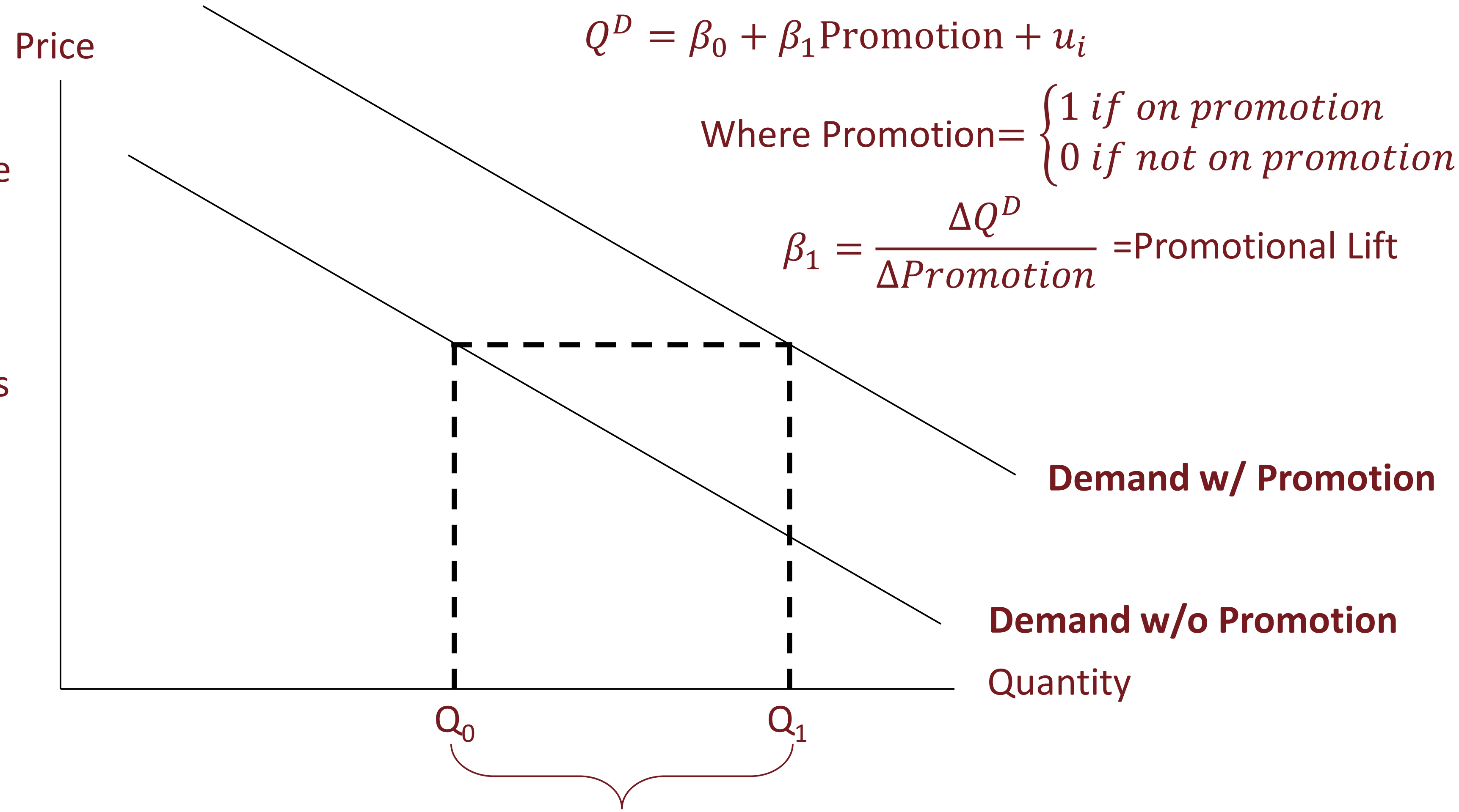
Promotional Lift is measured as the horizontal distance (i.e. shift) between the promoted and non-promoted demand curves.

Using regression analysis:

$$Q^D = \beta_0 + \beta_1 \text{Promotion} + u_i$$

Where Promotion= $\begin{cases} 1 \; if \; on \; promotion \\ 0 \; if \; not \; on \; promotion \end{cases}$

$$\beta_1 = \frac{\Delta Q^D}{\Delta Promotion}$$ =Promotional Lift



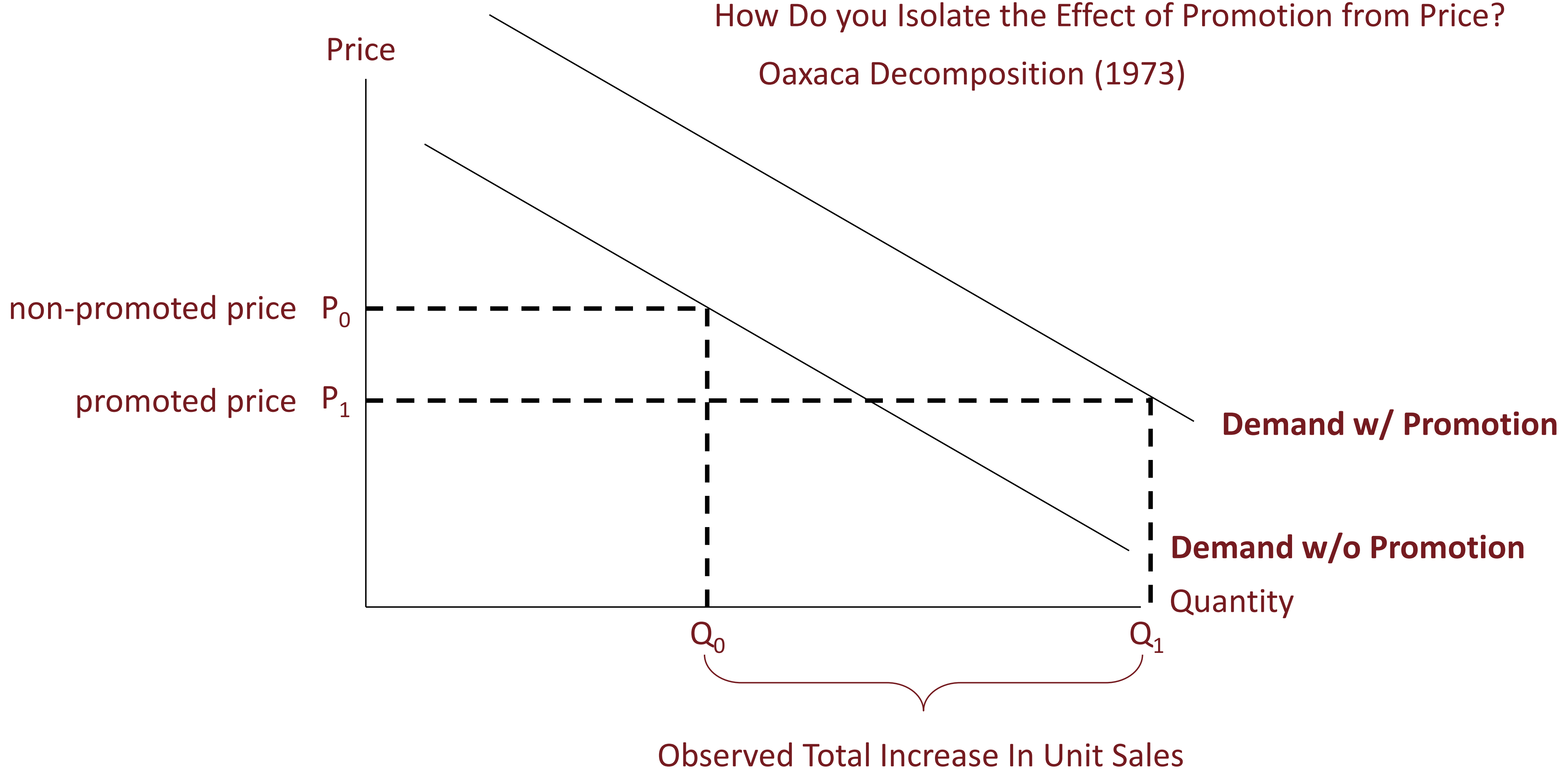
The increase in unit sales = Promotional Lift

What Happens When Promotion is Combined with a Price Reduction?

The Observed Total Increase in Unit Sales (i.e., Lift) Confounds the Effect of the Price Reduction with the Promotional Effect Resulting in an Over Estimate of the Effect of Promotion.

How Do you Isolate the Effect of Promotion from Price?

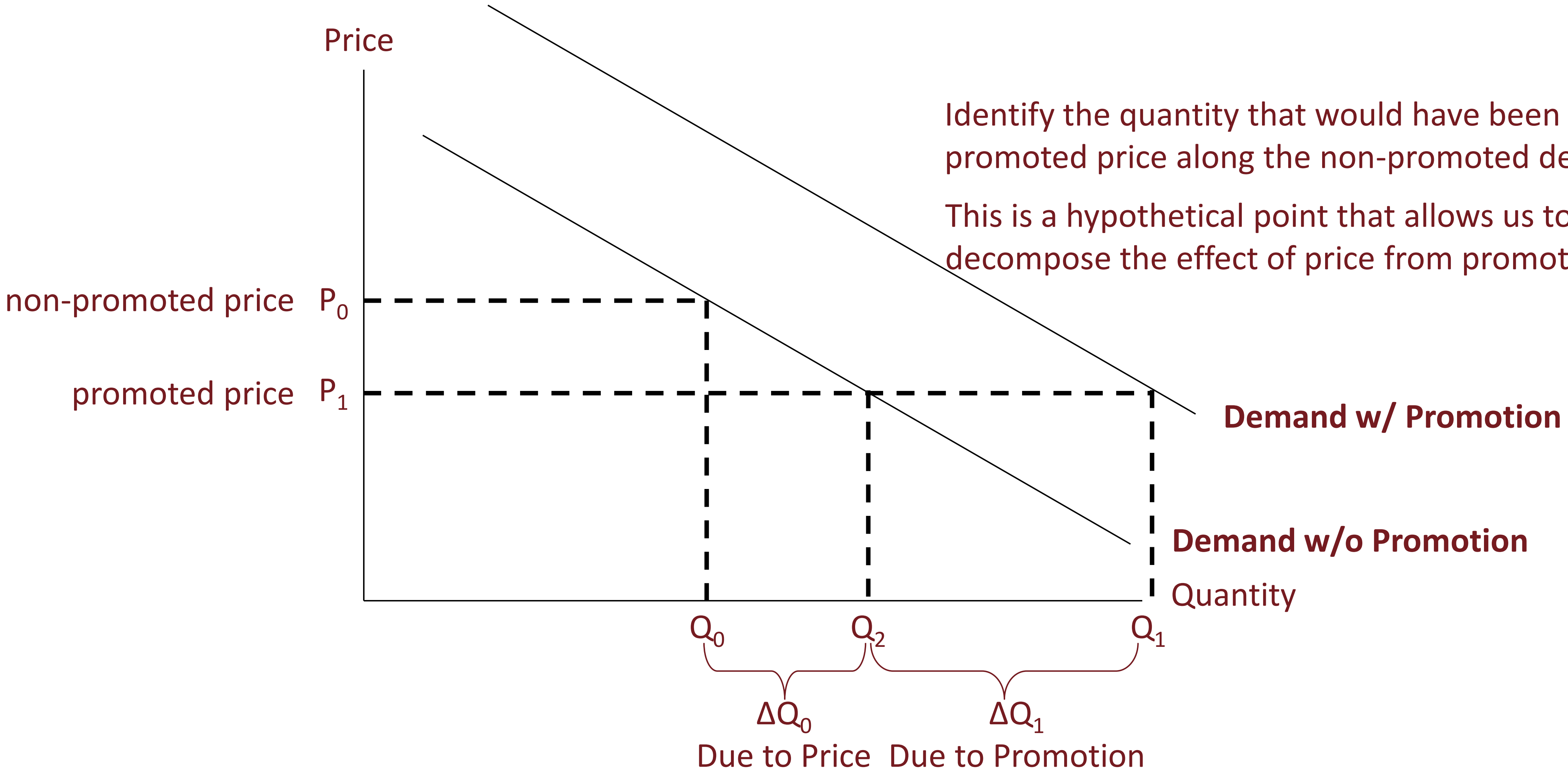
Oaxaca Decomposition (1973)



Measuring Promotion when Combined with a Price Reduction

Identify the quantity that would have been sold at the lower promoted price along the non-promoted demand.

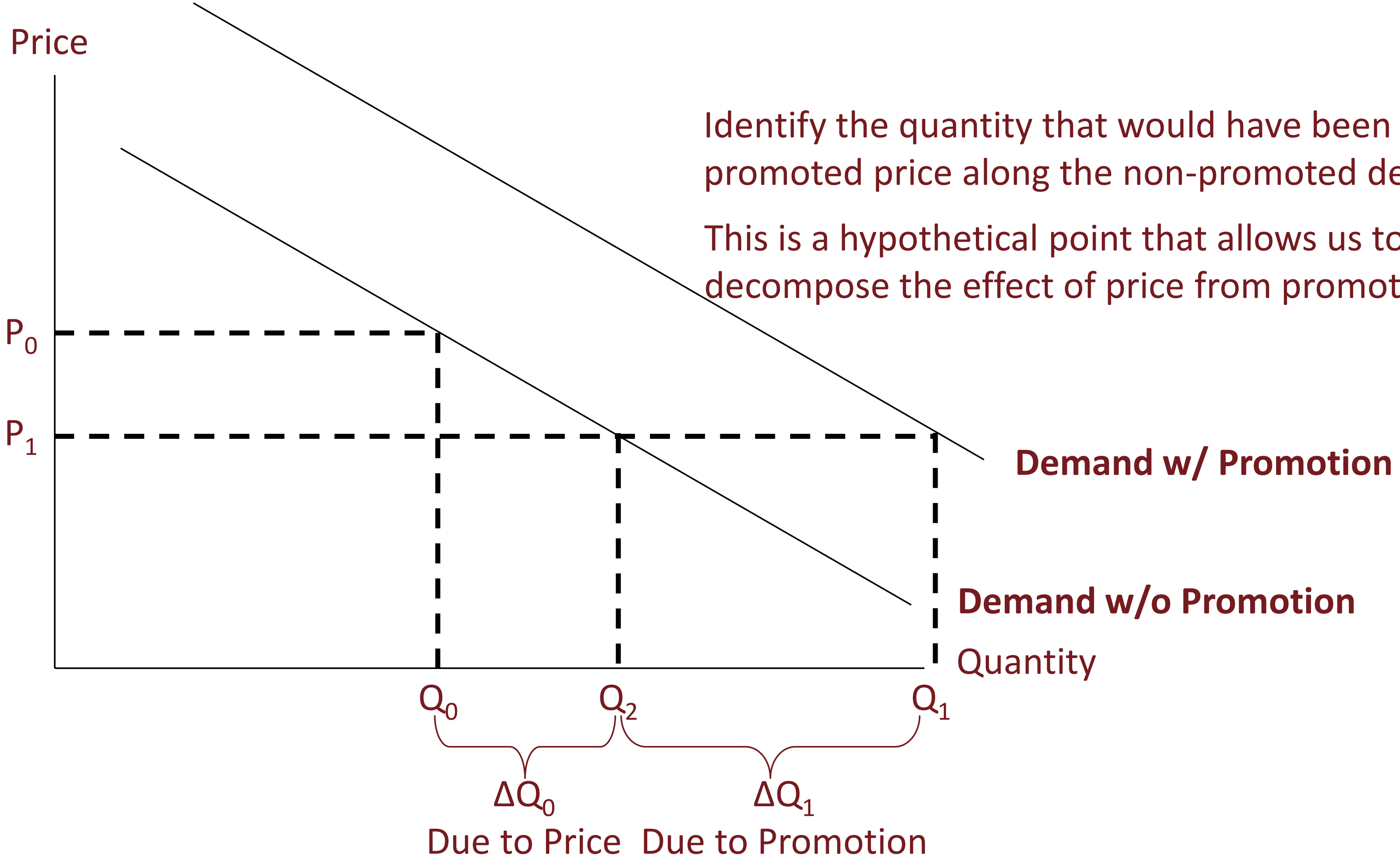
This is a hypothetical point that allows us to decompose the effect of price from promotion.



Decomposing the Effect of Price and Promotion

Identify the quantity that would have been sold at the lower promoted price along the non-promoted demand.

This is a hypothetical point that allows us to decompose the effect of price from promotion.



Decomposing the Effect of Price and Promotion

Anonymous Cabernet Sauvignon
Summary Statistics

	Mean Unit Price	Mean Weekly Sales
Non-Promoted	$9.75	1,429
Promoted	$8.68	2,147
Feature	$8.18	508
Display	$9.04	545
Feature & Display	$8.18	217
Temporary Price Reduction	$8.87	877

Decomposing the Effect of Price and Promotion

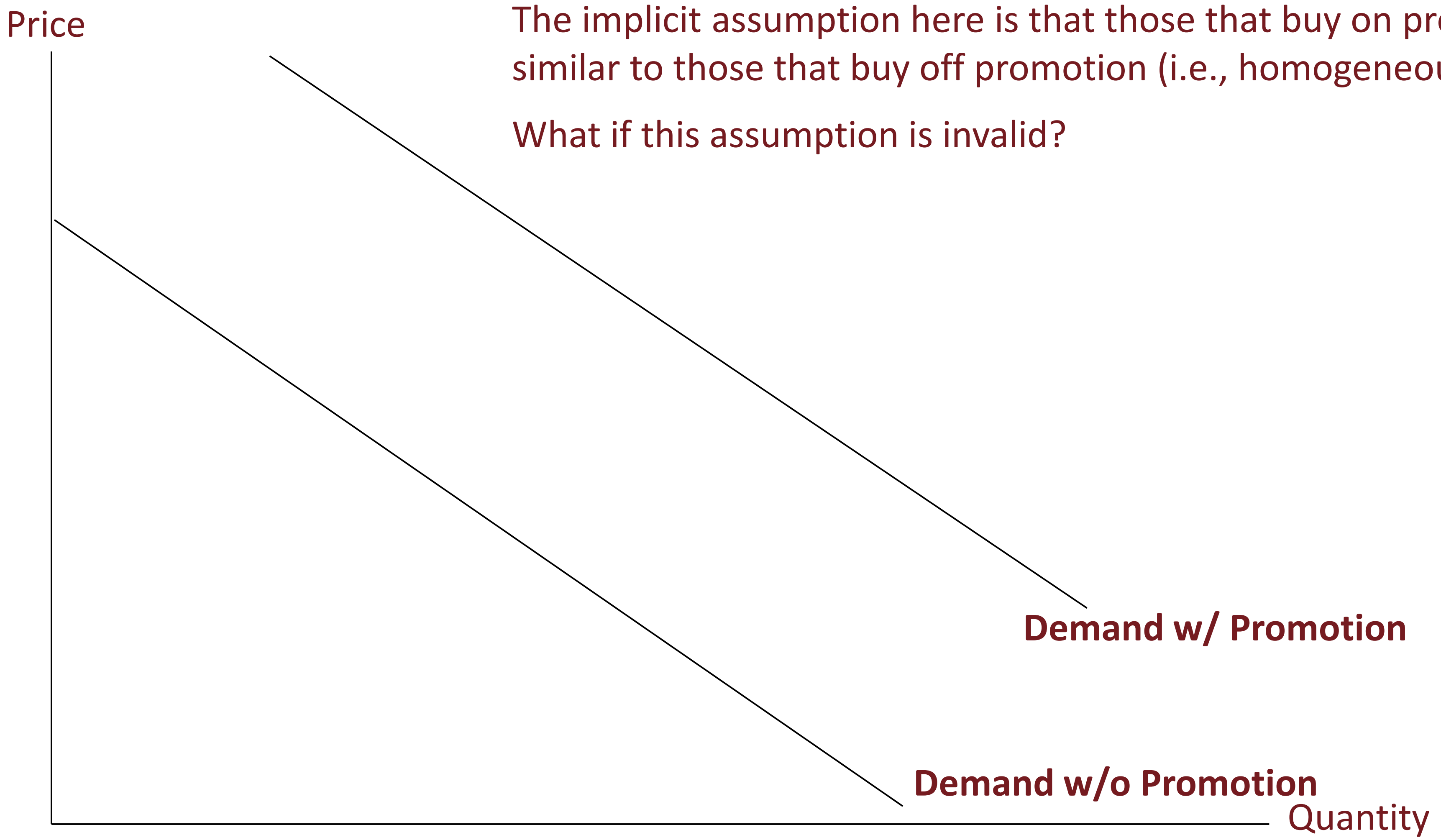
Compare with the promotional effect when price is not decomposed from promotion

Decomposition I
Non-Promoted Price \$9 and Promoted Price \$8

Differences	Unit Change	%Change	%Decomposition
Total Difference in Sales	1,156	53.53%	100.00%
Difference in Sales Due to Price: $\beta_1^N (P^P - P^N)$	976	45.22%	84.47%
Difference in Sales Due to Promotion: $(\beta_0^P - \beta_0^N) + P^P(\beta_1^P - \beta_1^N)$	180	8.32%	15.53%

True Effect of Promotion

Heterogeneity



The implicit assumption here is that those that buy on promotion are similar to those that buy off promotion (i.e., homogeneous consumers).

What if this assumption is invalid?

Heterogeneity

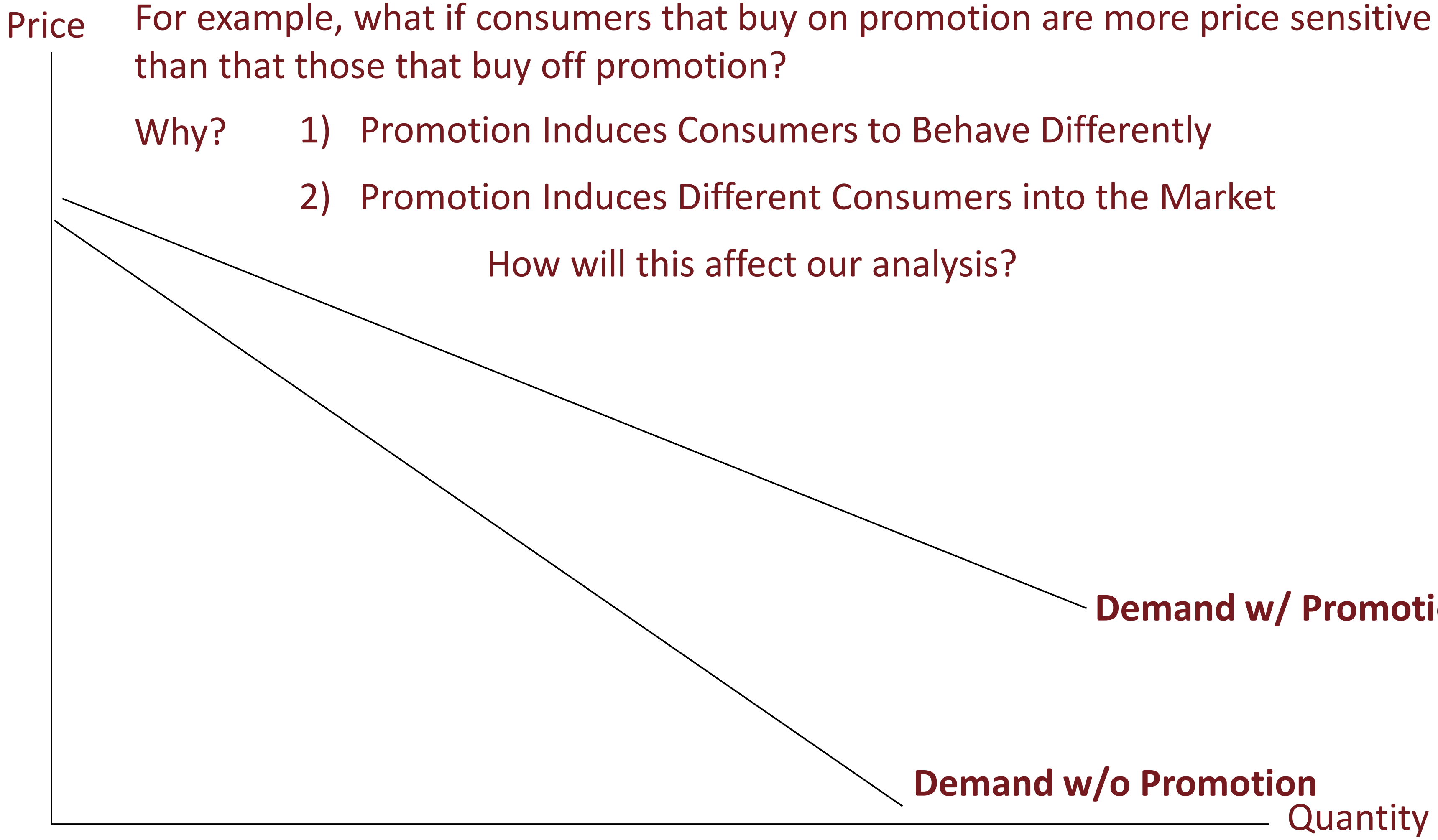
What if consumers that buy on promotion are different than that those that buy off promotion?

For example, what if consumers that buy on promotion are more price sensitive (i.e., elastic) than that those that buy off promotion?

Why?

1) Promotion Induces Consumers to Behave Differently
2) Promotion Induces Different Consumers into the Market

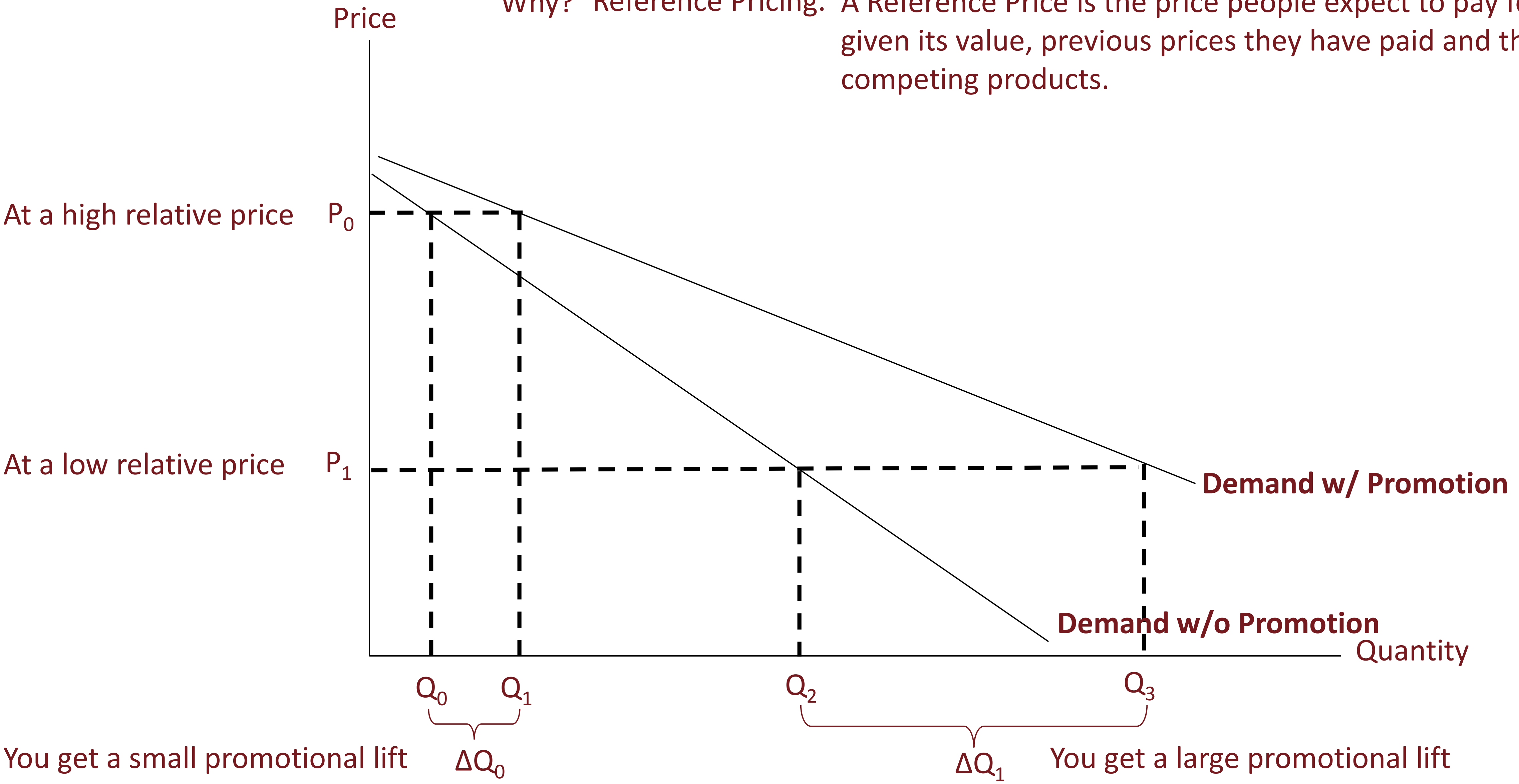
How will this affect our analysis?



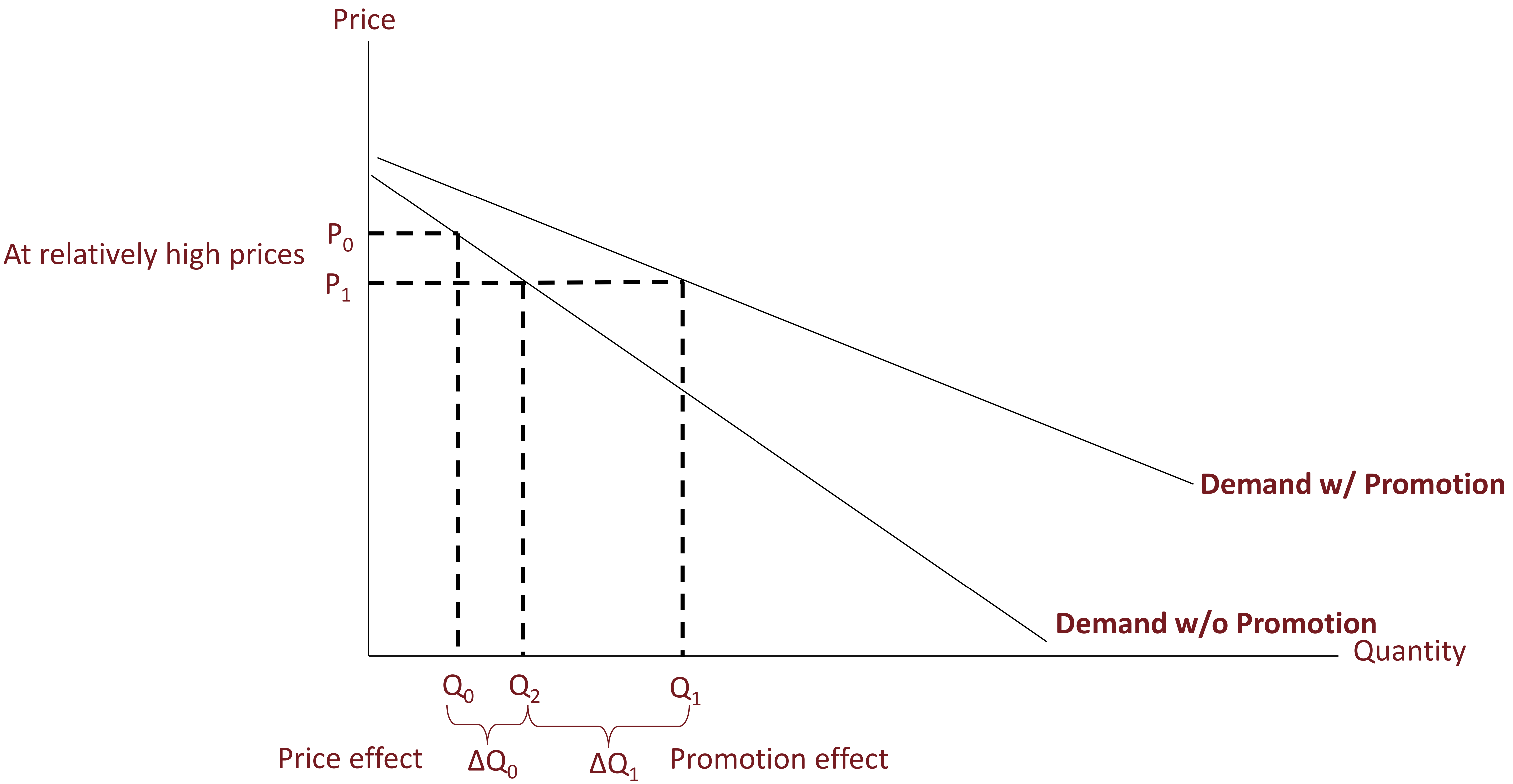
Heterogeneity

With Heterogeneous Consumers, Promotion will have Different Effects at Different Prices

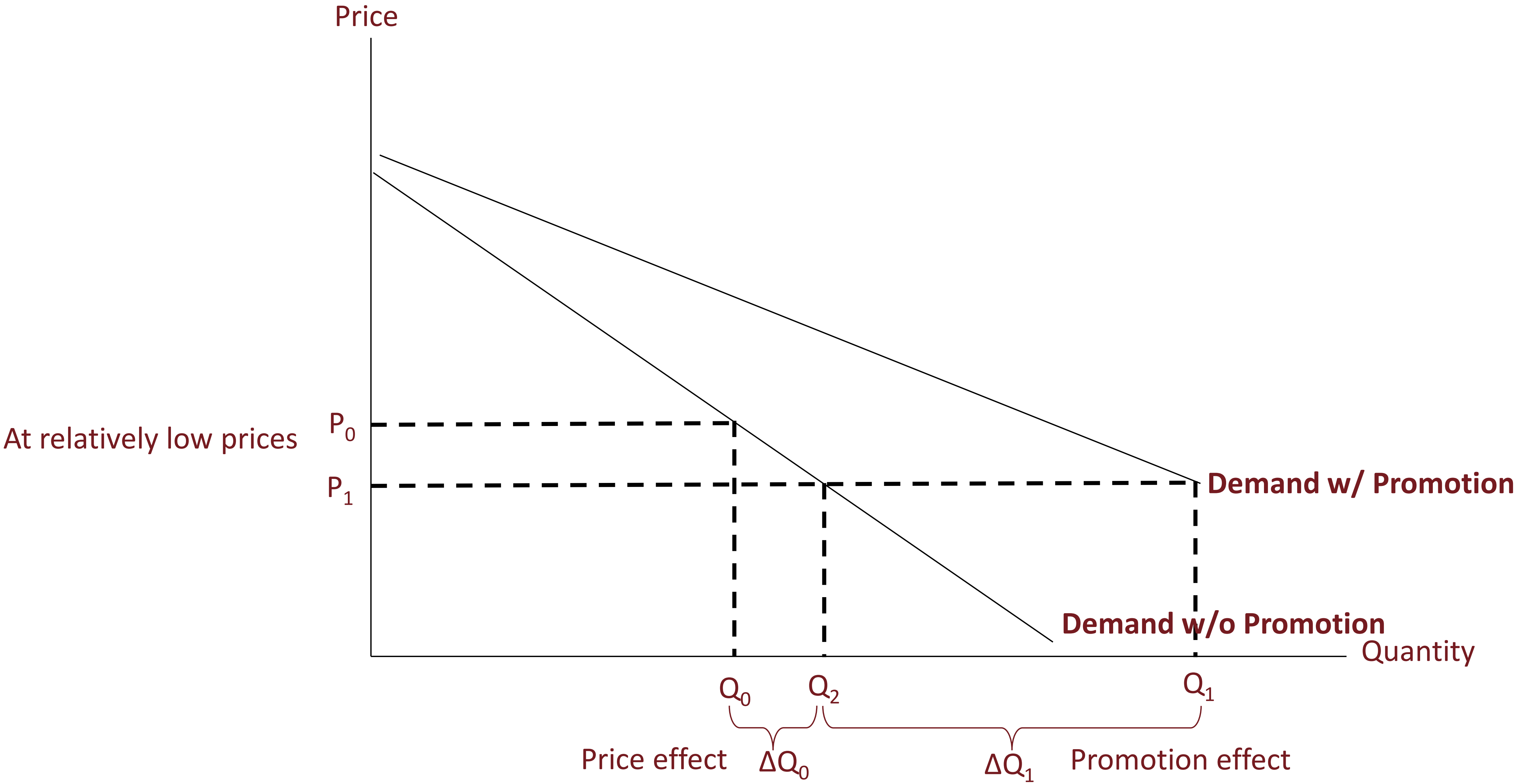
Why? Reference Pricing. A Reference Price is the price people expect to pay for a product given its value, previous prices they have paid and the price of competing products.



Heterogeneity, Price Reductions & The Decomposition



Heterogeneity, Price Reductions & The Decomposition



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Decomposition I

At a Relatively High Non-Promoted Price of \$9 and Promoted Price of \$8

Differences	Unit Change	%Change	%Decomposition
Total Difference in Sales	1,156	53.53%	100.00%
Difference in Sales Due to Price: $\beta_1^N (P^P - P^N)$	976	45.22%	84.47%
Difference in Sales Due to Promotion: $(\beta_0^P - \beta_0^N) + P^P(\beta_1^P - \beta_1^N)$	180	8.32%	15.53%

Promotional Lift

Decomposition II

At a Relatively Low Non-Promoted Price of \$8 and Promoted Price of \$7

Differences	Unit Change	%Change	%Decomposition
Total Difference in Sales	1,910	60.91%	100.00%
Difference in Sales Due to Price: $\beta_1^N (P^P - P^N)$	976	31.14%	51.12%
Difference in Sales Due to Promotion: $(\beta_0^P - \beta_0^N) + P^P(\beta_1^P - \beta_1^N)$	934	29.77%	48.88%

Promotional Lift

Thank You

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