

Estimating the Price Elasticity of Demand for Wine: Problems and Solutions

Presented By

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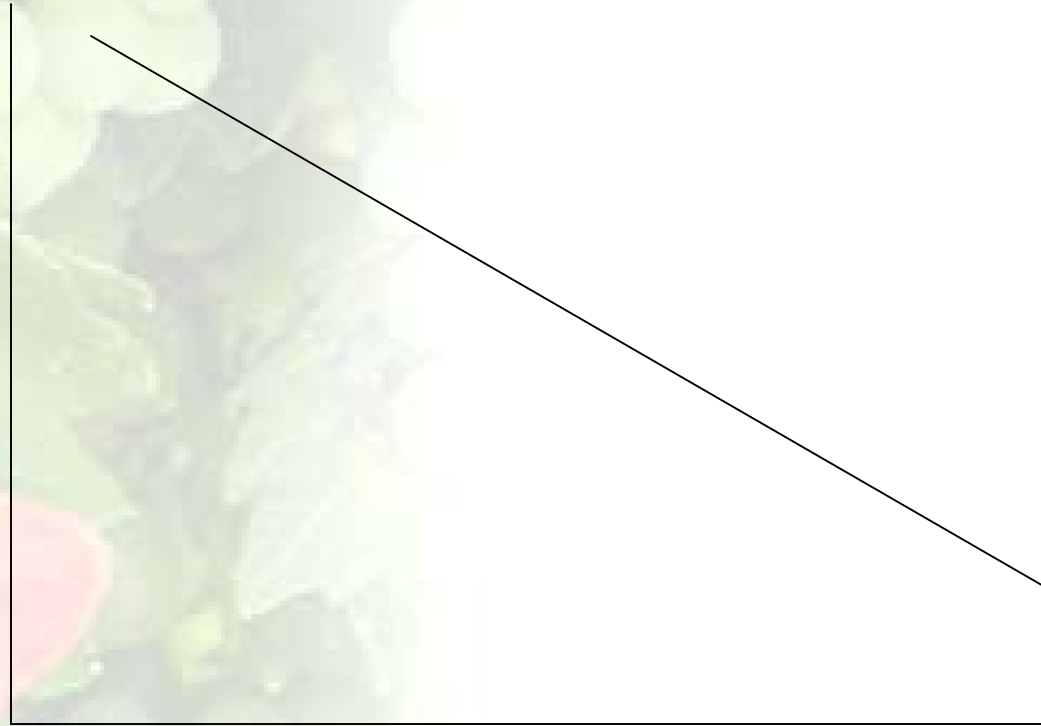
Estimating the Price Elasticity of Demand for Wine Requires Estimating the Demand Function for Wine

A Simple Demand Function for Wine is of the Form:

$$Q = \alpha + \alpha \text{Price} + u$$

Standard Downward Sloping Demand Curve

Price



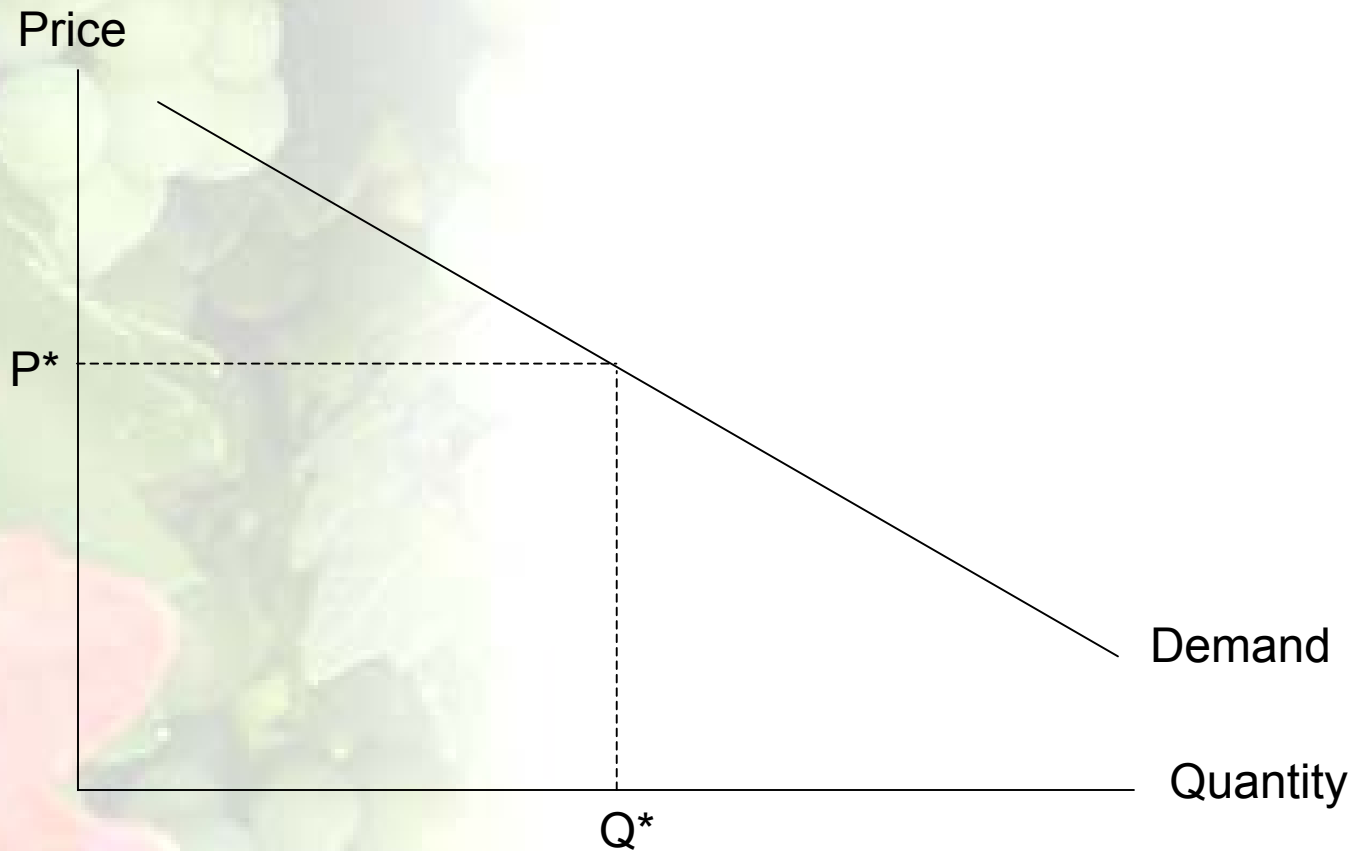
Demand

Quantity

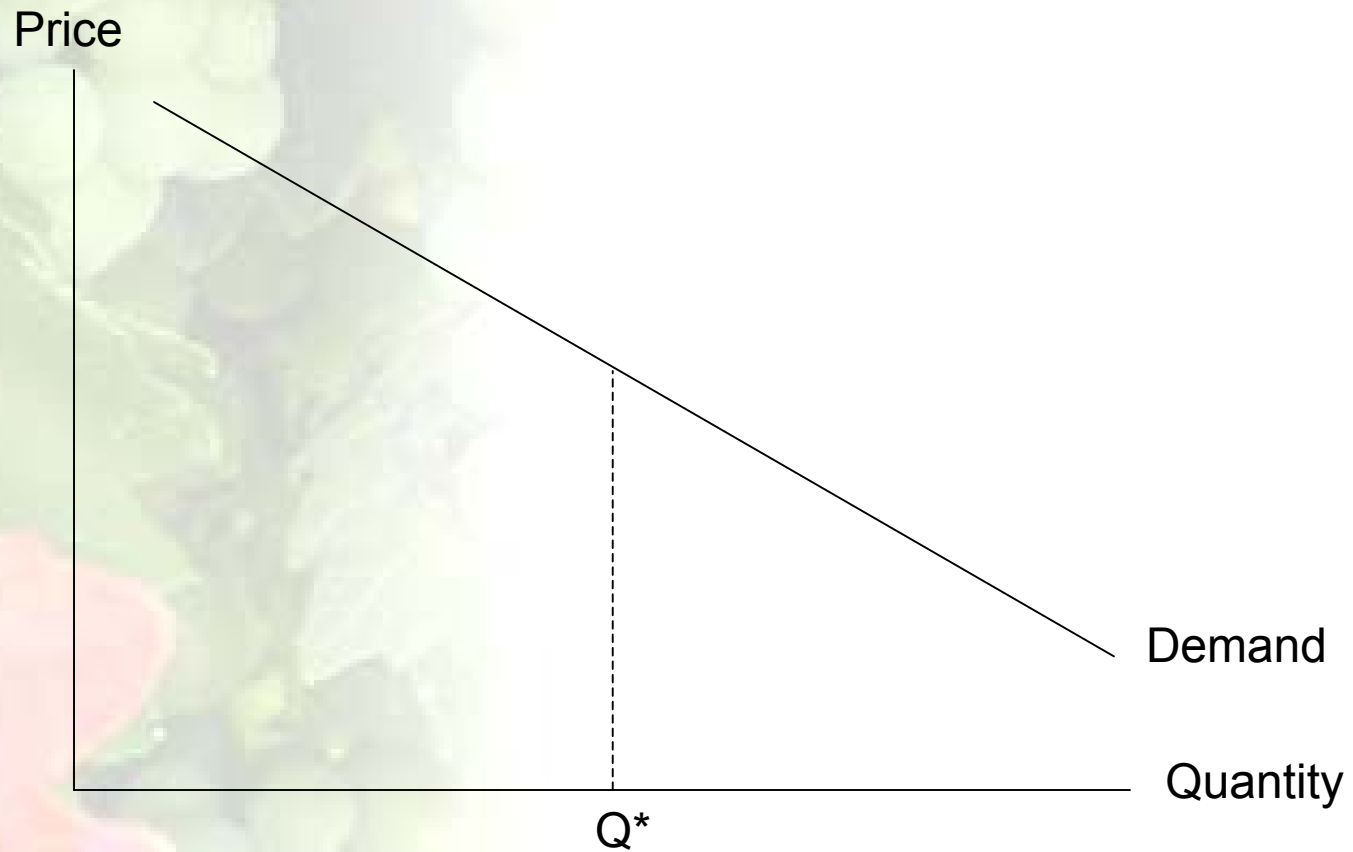
Once the Demand Curve is Estimated,
You Can Answer Questions Such As,
How Much Will I Sell At A Given Price?



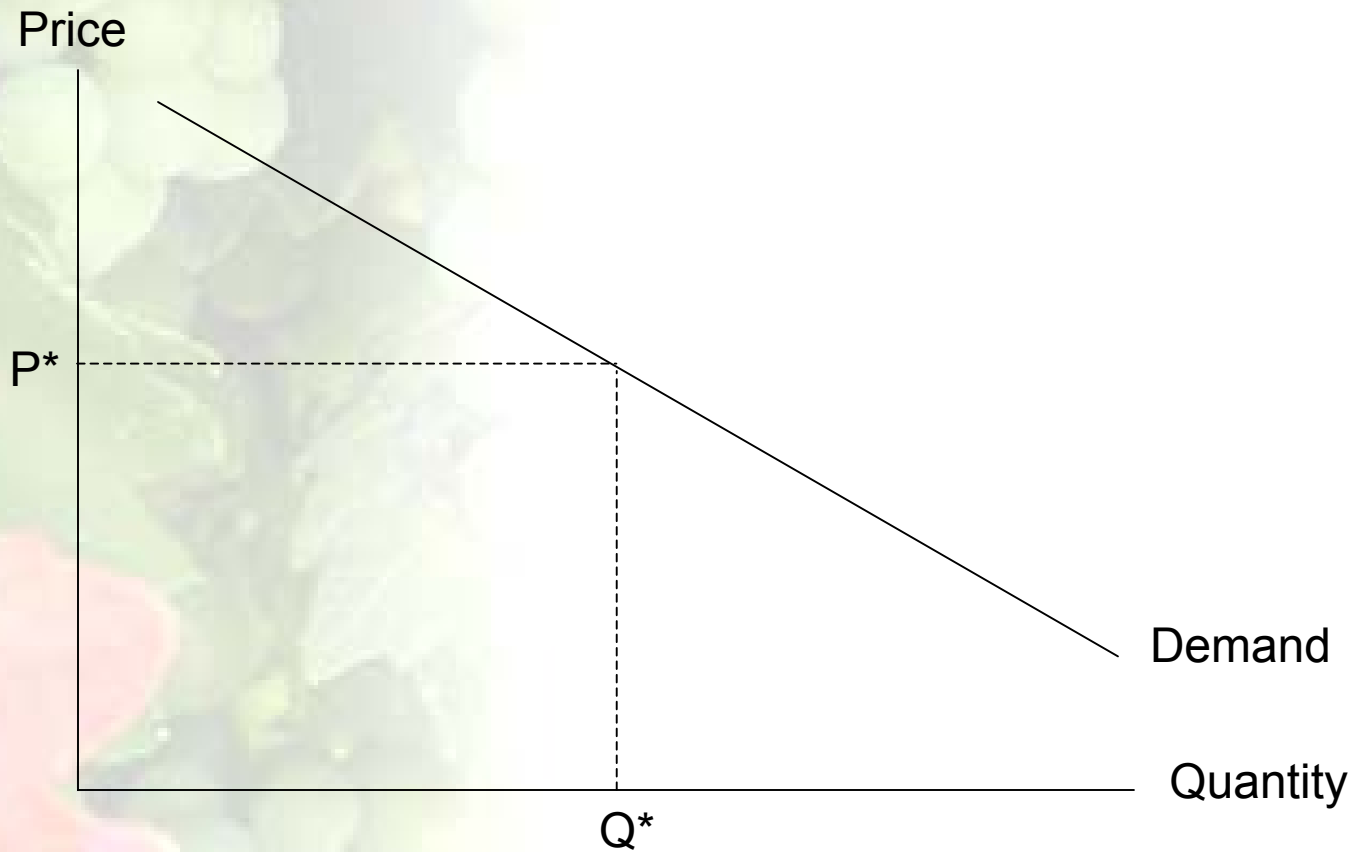
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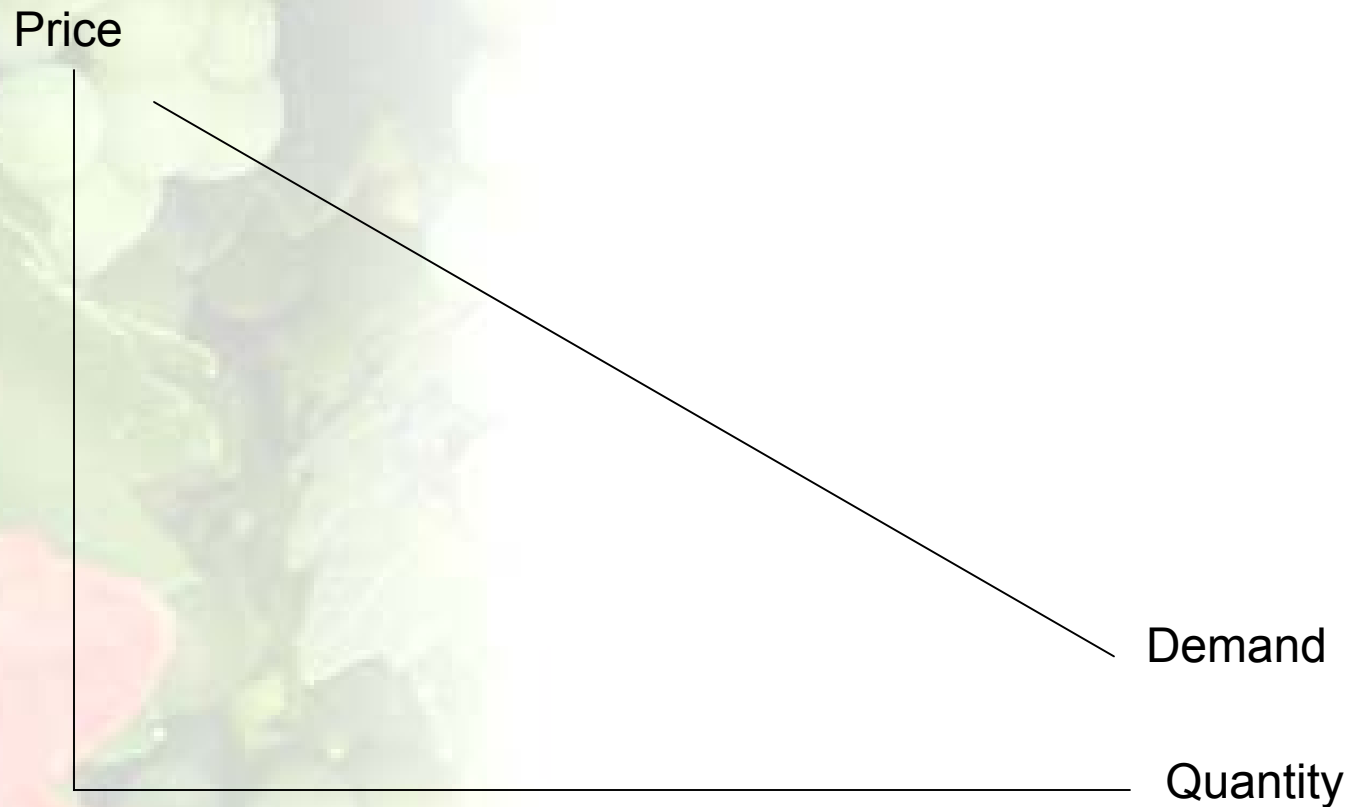
Or How Much Can I Charge For A Given Quantity?



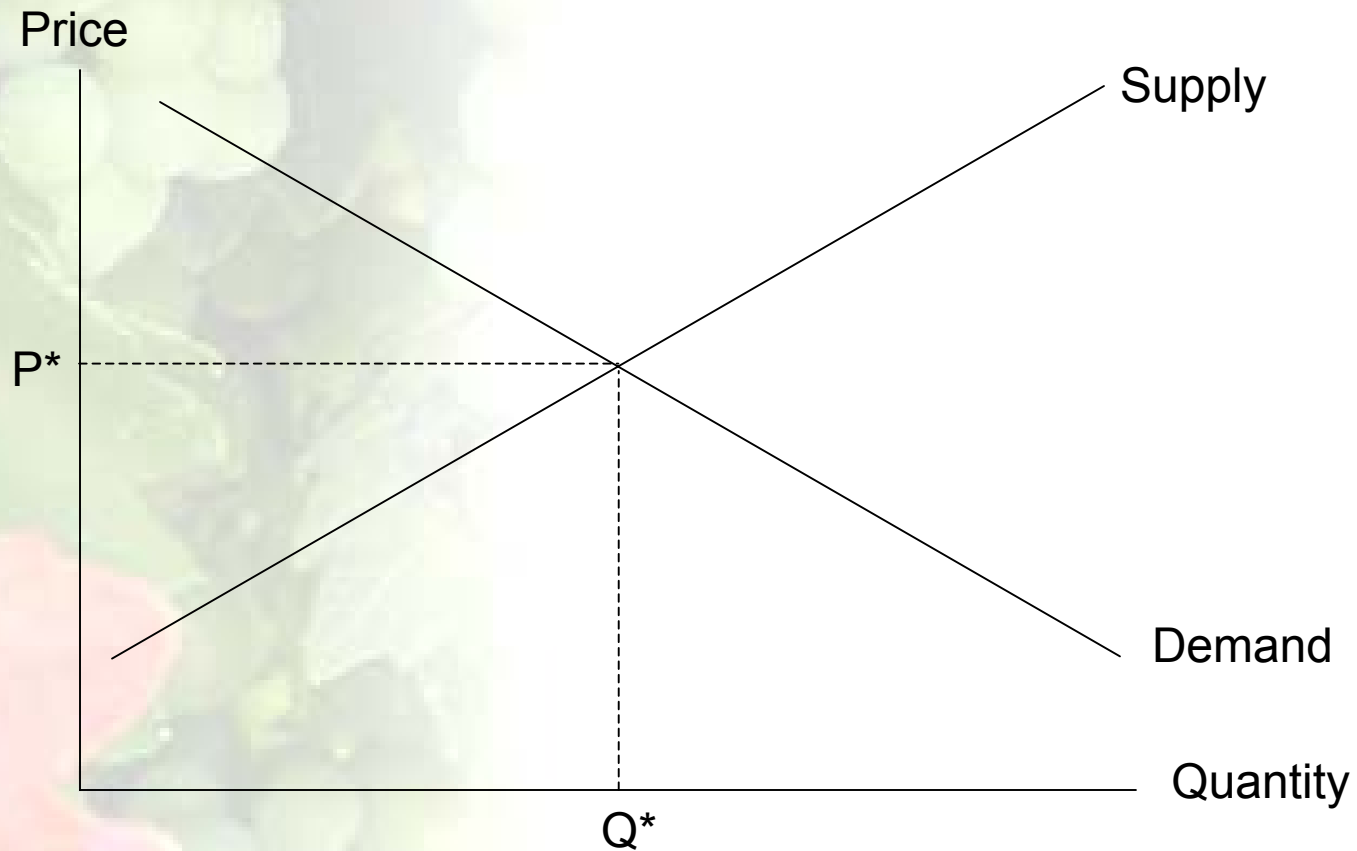
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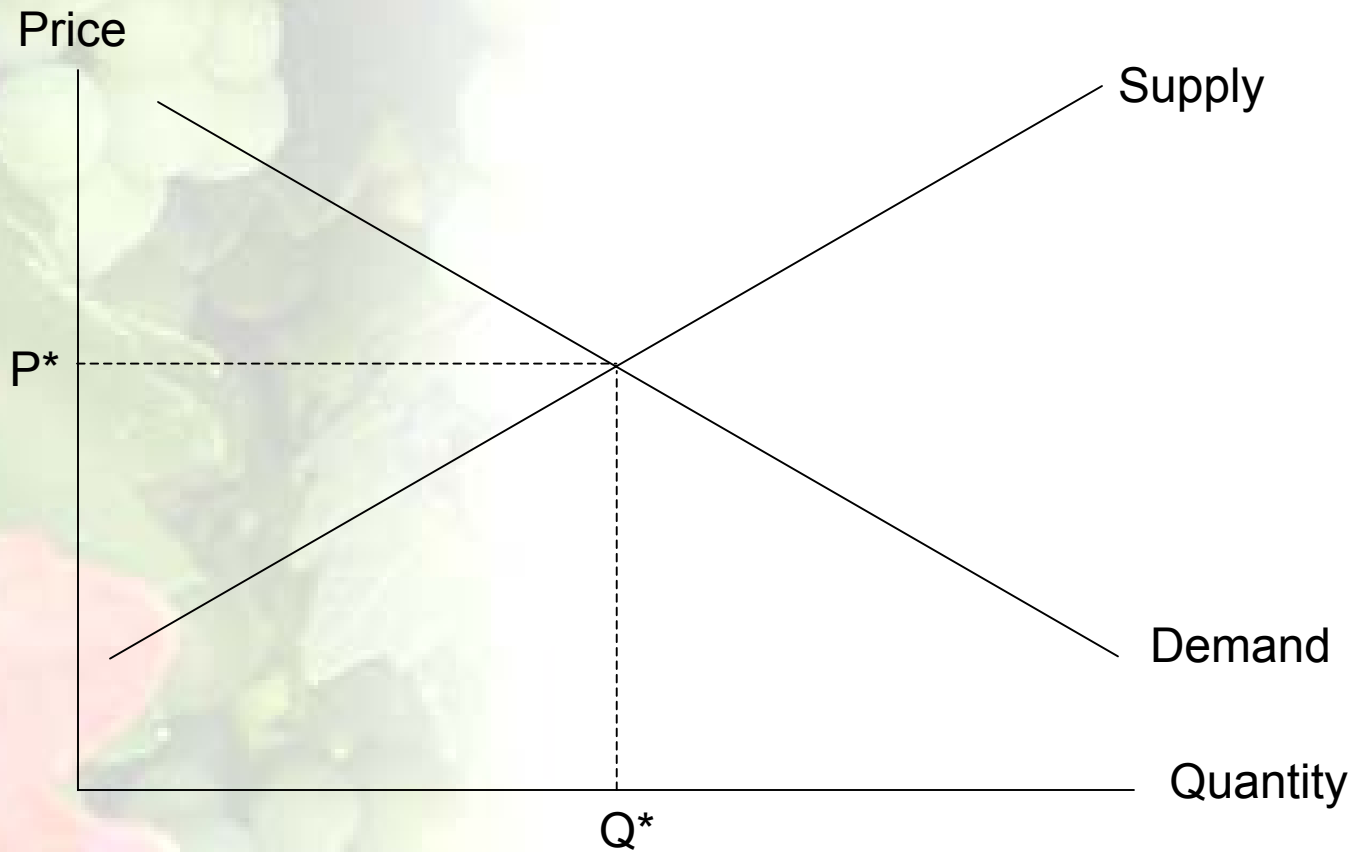
However, Price and Quantity are Simultaneously Determined by the Interaction of Supply and Demand.



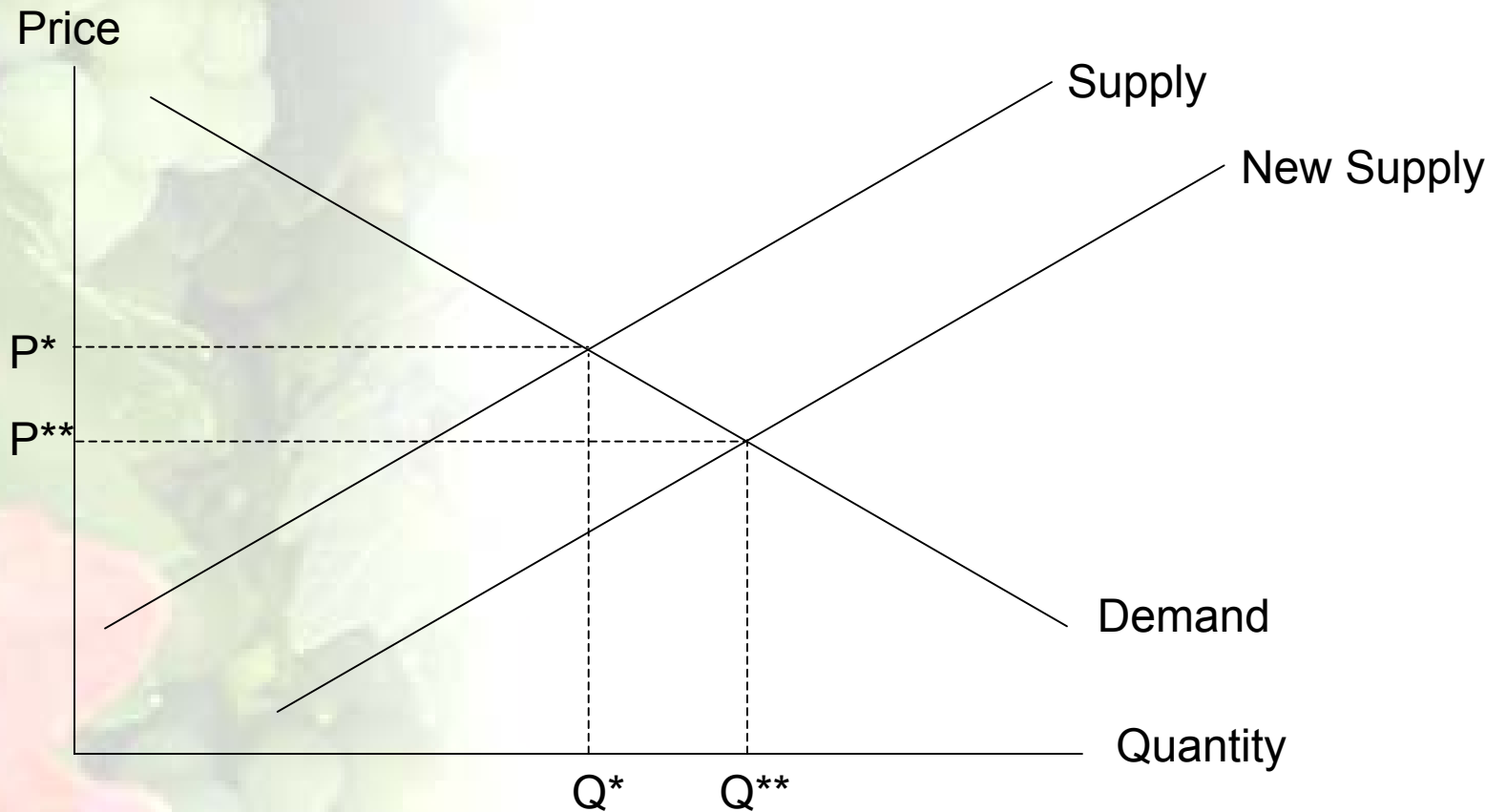
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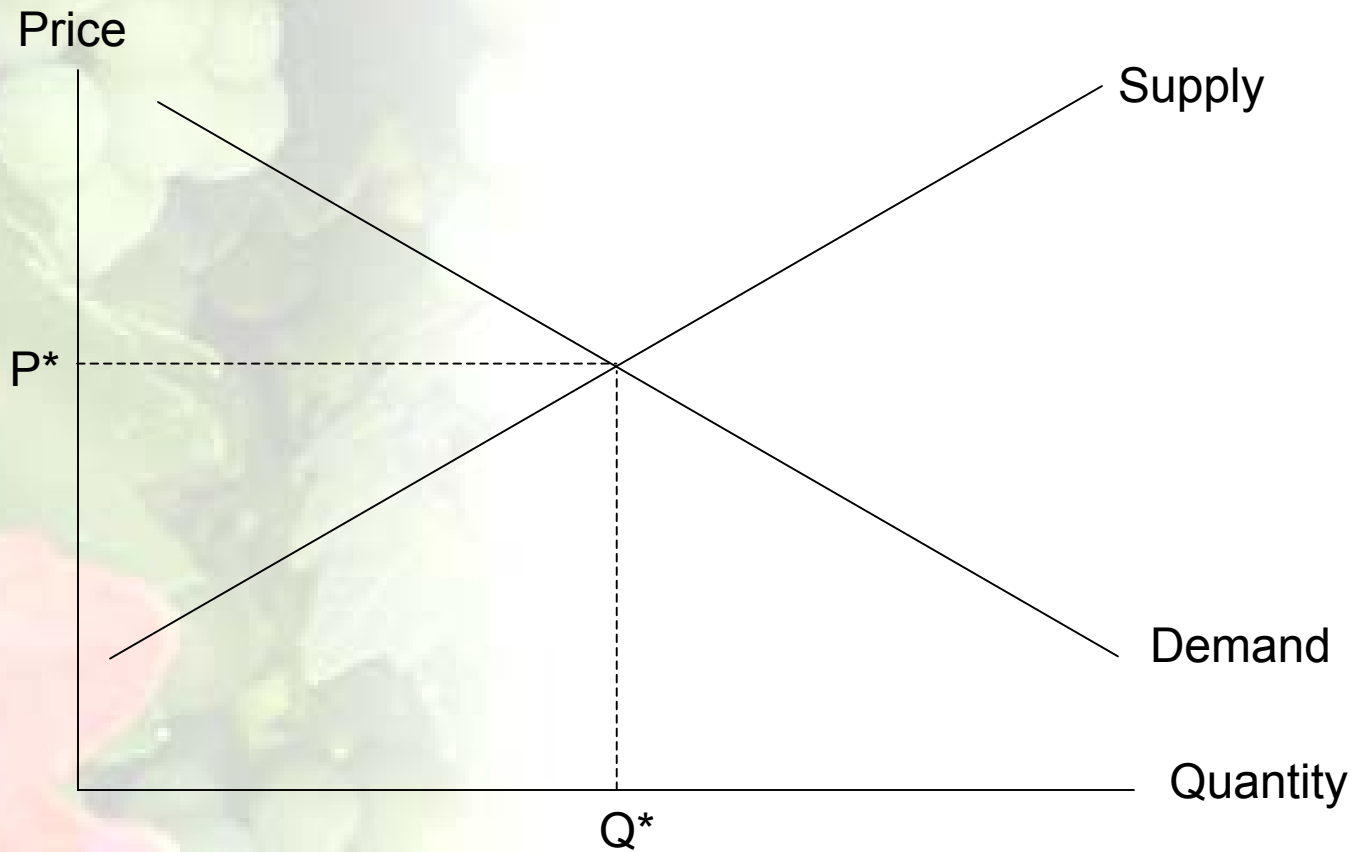
When Price and Quantity Change,



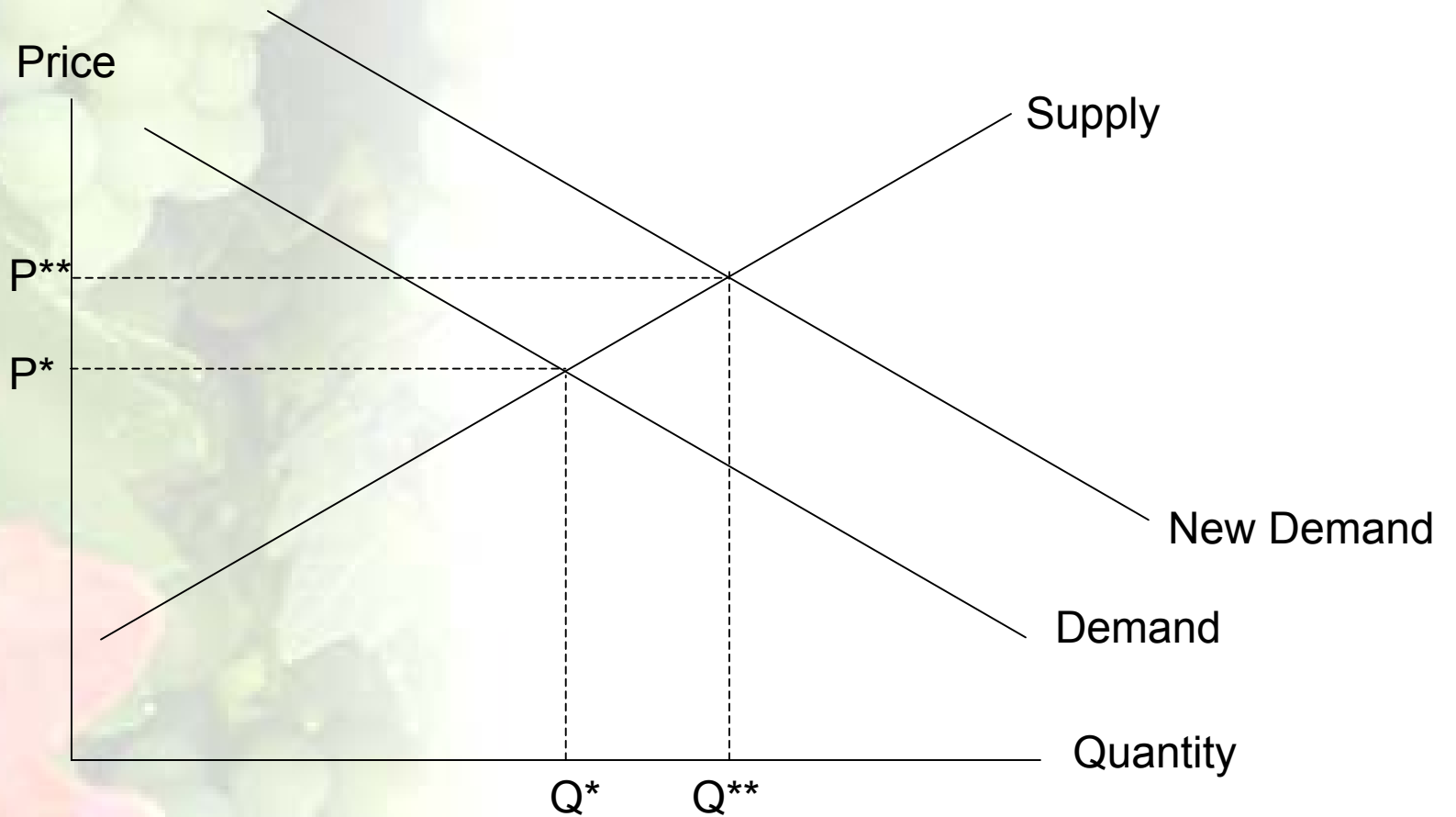
When Price and Quantity Change, How Do You Know Whether Supply Changed




Or How Whether Demand Changed



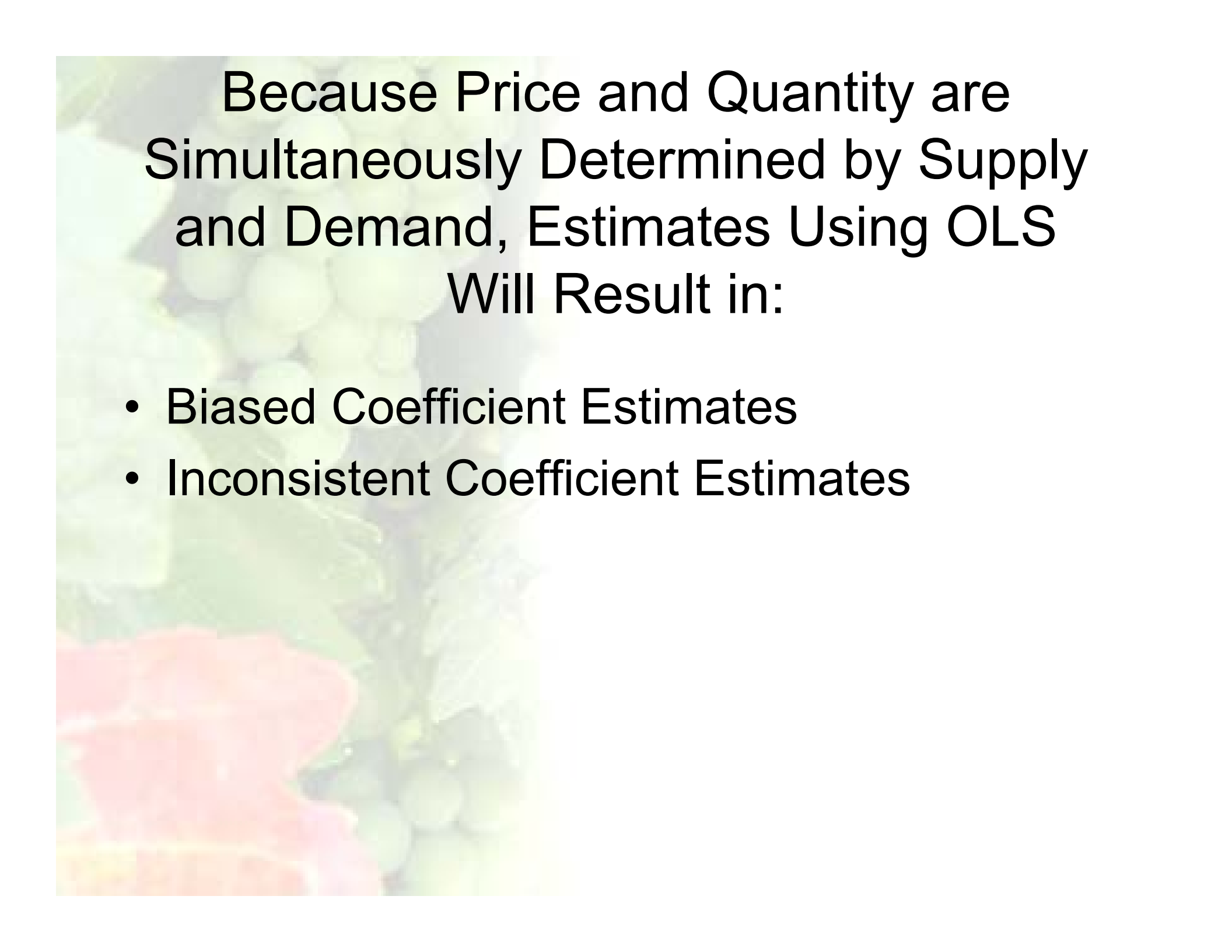
Or How Whether Demand Changed





Because Price and Quantity are Simultaneously Determined by Supply and Demand, Estimates Using OLS Will Result in:

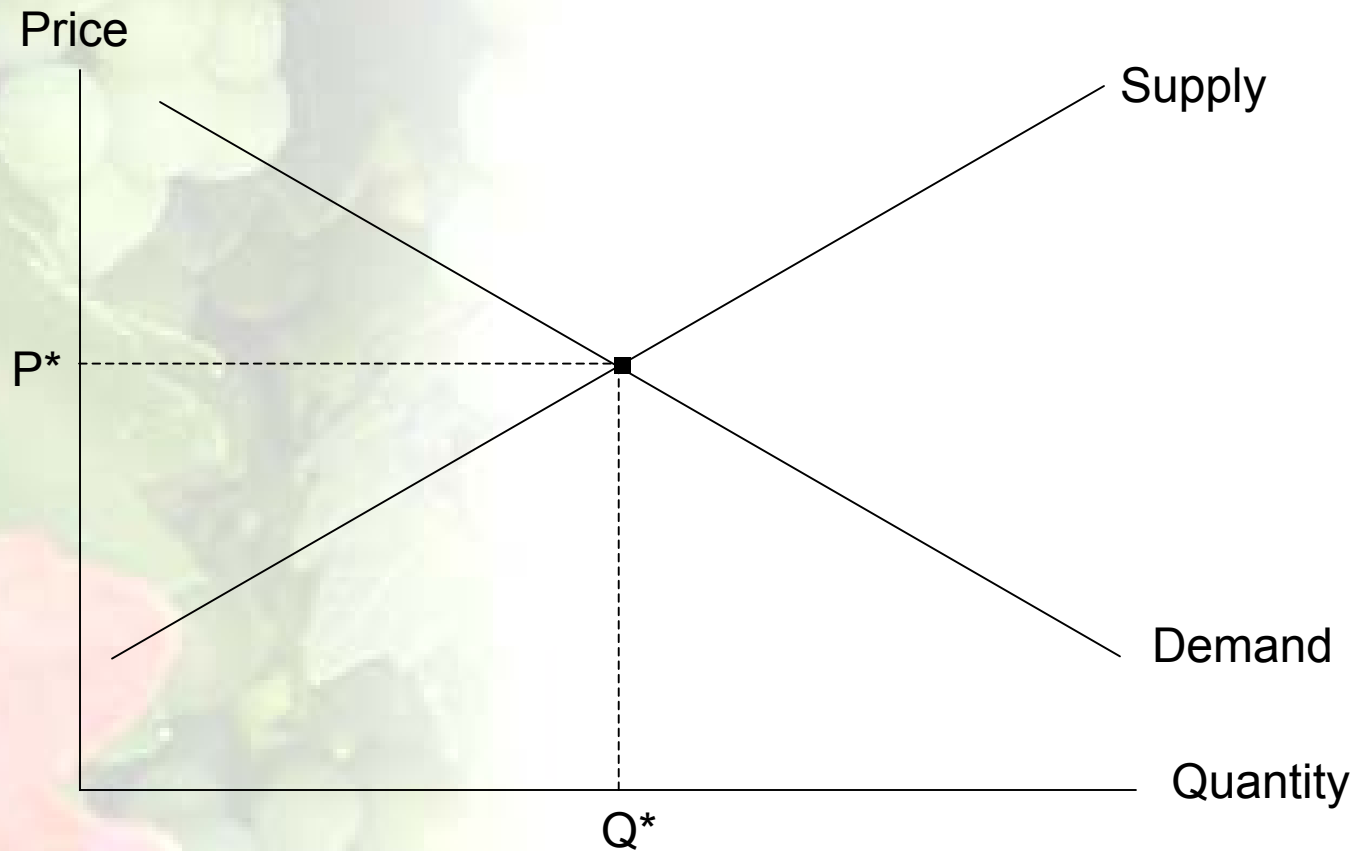
- Biased Coefficient Estimates



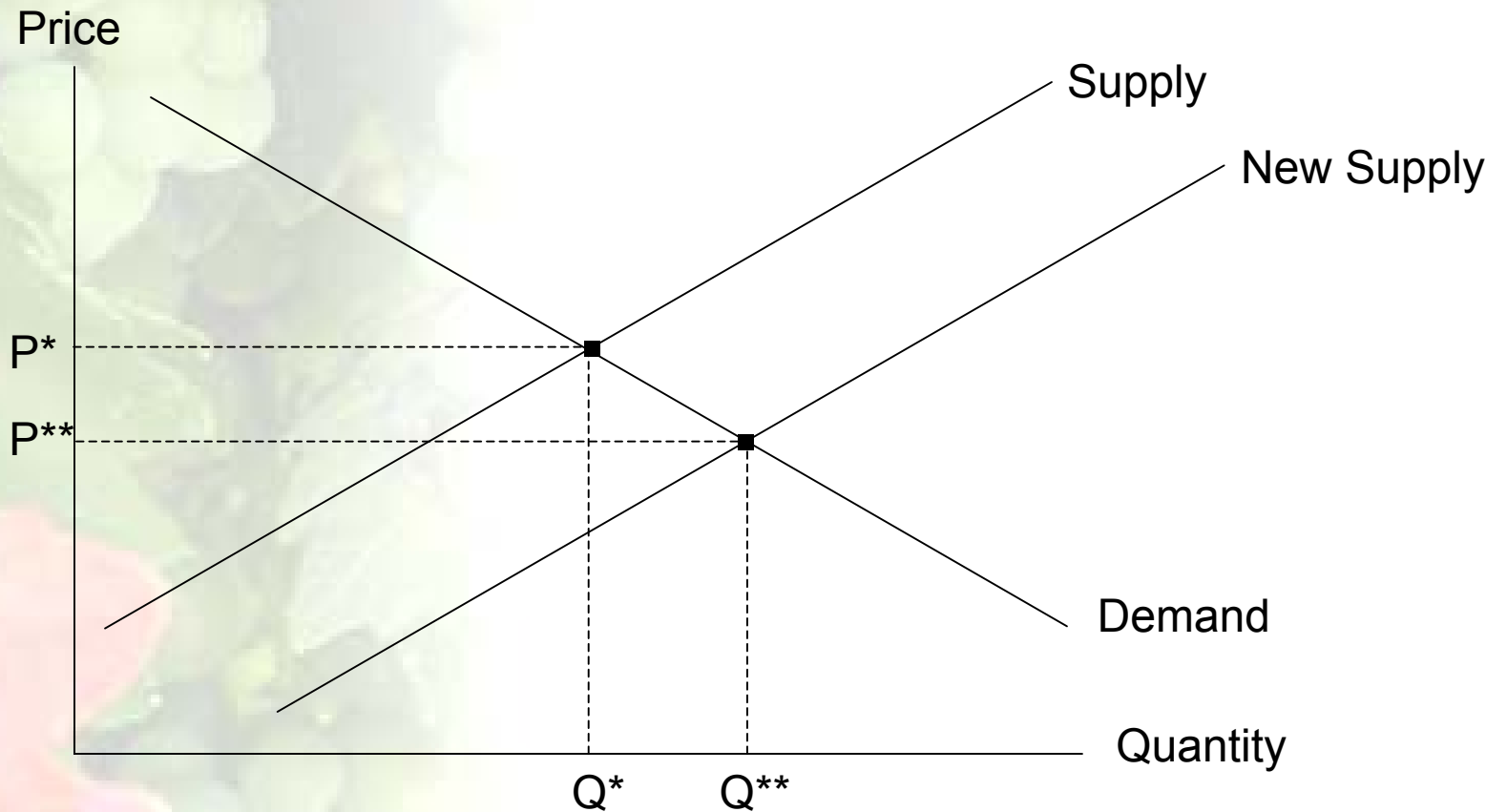
Because Price and Quantity are Simultaneously Determined by Supply and Demand, Estimates Using OLS Will Result in:

- Biased Coefficient Estimates
- Inconsistent Coefficient Estimates

To Properly Estimate A Demand Function, You Must Be Able to Identify or Trace Out The Demand Function



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Econometrically, We Use a Simultaneous Equations Model To Estimate The Demand Function.

A Standard Demand and Supply Model:

$$Q^D = \alpha_0 + \alpha_1 \text{Price} + \alpha_2 \text{Income} + u$$

$$Q^S = \beta_0 + \beta_1 \text{Price} + \beta_2 \text{Input Price} + v$$



One Method of Estimating A
Simultaneous Equations Model is
Through
Instrumental Variable Estimation

Since Price and Quantity are Simultaneously Determined, We Need to Find An Instrument or Proxy for Price To Use in the Estimating Equation for Demand.

The Instrument Must Satisfy Two Properties:

1. Must Be Uncorrelated With the Error Term
2. Must Be Highly Correlated with Price



**For Wine, What Would Work
As A Good Instrument?**



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Grape Prices



For Wine, What Would Work As A Good Instrument?

Grape Prices

1. Grape Prices Should Not Be Correlated With the Error Term in the Demand Function.



For Wine, What Would Work As A Good Instrument?

Grape Prices

1. Grape Prices Should Not Be Correlated With the Error Term in the Demand Function.
2. Grape Prices Should Be Highly Correlated With Wine Prices.



What is the Relationship Between Grape Prices and Wine Prices?



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According To Andrew Beckstoffer of Beckstoffer Vineyards, the largest family, non-corporate vineyard owner in Napa Valley, You Can Use the “Bottle Pricing Formula.”

What is the Relationship Between Grape Prices and Wine Prices?

According To Andrew Beckstoffer of Beckstoffer Vineyards, the largest family, non-corporate vineyard owner in Napa Valley, You Can Use the “Bottle Pricing Formula.”

The Price Per Ton of Grapes in a Bottle of Wine is 100 times the Retail Price of that Bottle of Wine.



What Bottle Price?



What Bottle Price?

1. There is Considerable Price Variation

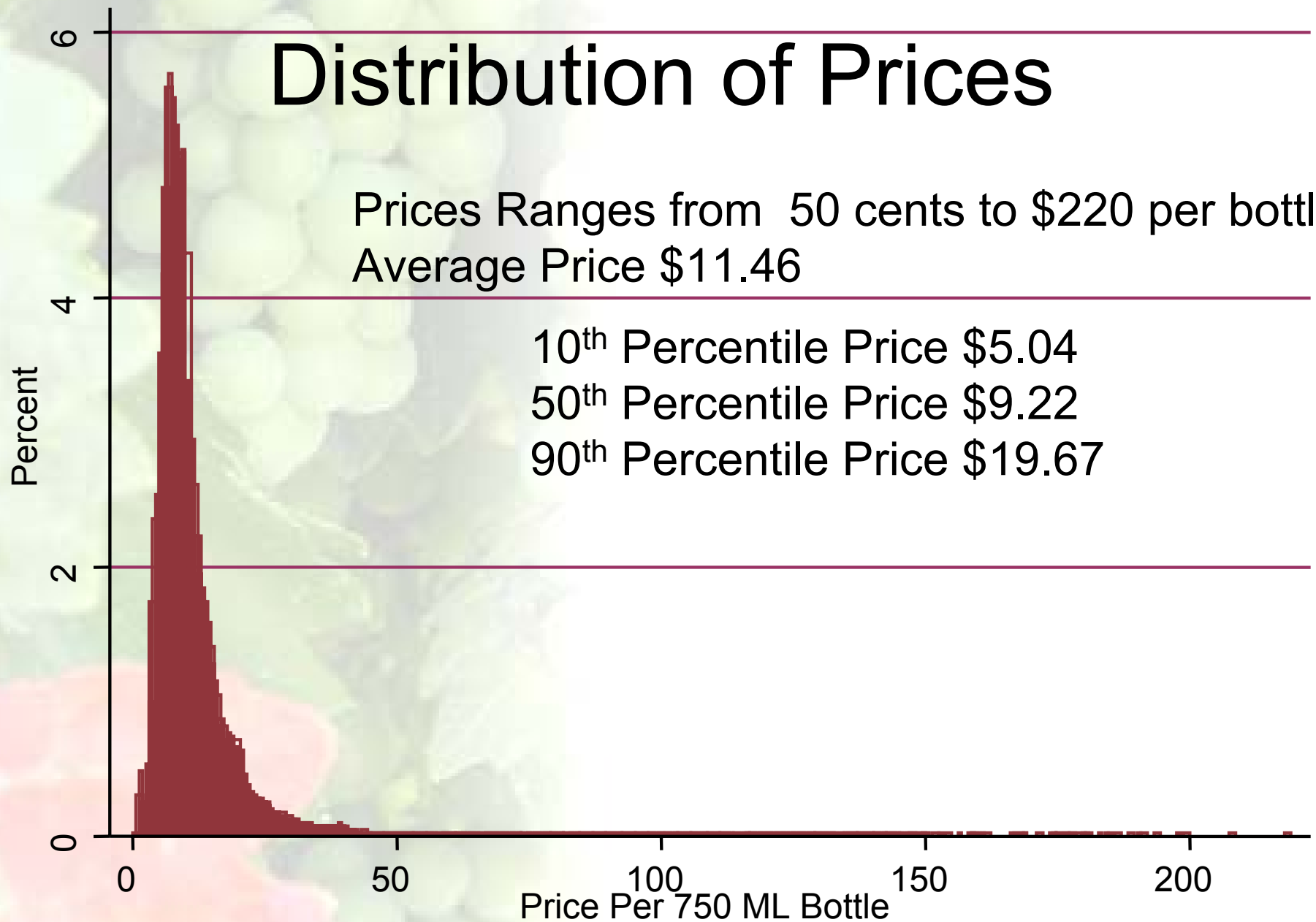
Distribution of Prices

Prices Ranges from 50 cents to \$220 per bottle
Average Price \$11.46

10th Percentile Price \$5.04

50th Percentile Price \$9.22

90th Percentile Price \$19.67



Source: AC Nielsen Scan Data

Common Industry Price Categories Used for example by AC Nielsen

Category	Price Point
Economy	Under \$6
Pop-Premium	\$6 - \$9
Premium	\$9 - \$12
Ultra Premium	\$12 - \$15
Deluxe	Above \$15



What Bottle Price?

1. There is Considerable Price Variation
2. Wines vary not just by price but by Varietal.

Besides the Major Varietals

White

- Chardonnay
- Chenin Blanc
- Gewurztraminer
- Pinot Grigio
- Riesling

Red

- Merlot
- Cabernet Sauvignon
- Pinot Noir
- Zinfandel
- Syrah

There are Over 1,000 Varietals

First 100 Varietals Alphabetically

ALBARINO	AURORA CREAM RED	BARDOLINO	BERN ASLE
ALENTEJANO	AURORA CREAM WHITE	BARDOLINO NOVELLO	BERN KRF KAB
ALFRESCO RED	AUTUMN BLUSH	BAROLO	BERN KRF RIESLING ASLE
ALIGOTE	AUTUMN BLUSH MUSCADINE	BARONESS NADINE CHARDONNAY	BERN KRF RIESLING SPAT
ALLUVIUM BLANC	AUTUMN SWEET RED	BARONNE	BERN KRF SPAT
ALPENGLLOW	AVDAT	BAROSSA CUVEE	BERN SPAT
AMARONE	AYLER KUPP RIESLING KAB	BAY MIST JOHANNISBERG RIESLING	BIANCA
AMARONE DELLA VALPOLICELLA	BACCHUS KAB	BEACON SHIRAZ	BIANCO
ANGEL CHARDONNAY	BACCOROSA VINO SPUMANTE	BEANBLOSSOM BLUSH	BIANCO DI TOSCANA
ANGELI CUVEE	BACO NOIR	BEAU NOIR	BIEN NACIDO CUVEE
ANTHILIA	BADGER BLUSH	BEAUJOLAIS	BIG HOUSE PINK
ANTHOLOGY	BADSTOBE RIESLING SPAT	BEAUJOLAIS BLANC	BIG RED
ANTIGUAS	BAIRRADA	BEAUJOLAIS NOUVEAU	BIG STUFF RED
APREMONT	BALD HEAD RED	BEAUJOLAIS ST LOUIS	BIG TATTOO RED
ARCALE	BALLET OF ANGELS	BEAUJOLAIS VILLAGE	BIG TATTOO WHITE
ARIA	BANDA AZUL	BEAUJOLAIS VILLAGE NOUVEAU	BISTRO
ARNALDO B ETCHART	BARBARESCO	BEAUJOLAIS VILLAGES	BLACK BEAUTY MRLT
ARNEIS	BARBEQUE BLUSH	BEAUJOLAIS VILLAGES CHAMEROY	BLACK DOG
ARTE ITALIANA	BARBEQUE RED	BEAUZEAUX	BLACK DOG BLANC
ARTHUR	BARBEQUE WHITE	BEEREN ASLE	BLACK MAIDEN
ASLE	BARBERA	BELLERUCHE	BLACK MUSCAT
ASLE BURGUNDY	BARBERA D ALBA	BEREICH BERN	BLANC
ASSORTED	BARBERA D ASTI	BEREICH BERN RIESLING	BLANC DE BLANC
ASSORTED RIESLING	BARBERONE	BERGERAC SEC	BLANC DE NOIR
ASTI SPUMANTE	BARBERONE BIANCO	BERN	BLANC DE NOIRS



**Estimates of the Demand for
Wine Should be for Specific
Varietals at Specific Price Points**

**For this Presentation I Chose to
Examine Merlot**





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**Merlot is Well Represented in All
Price Points**



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Price Range \$1.16 to \$71.61 Per Bottle
Mean Price \$10.91



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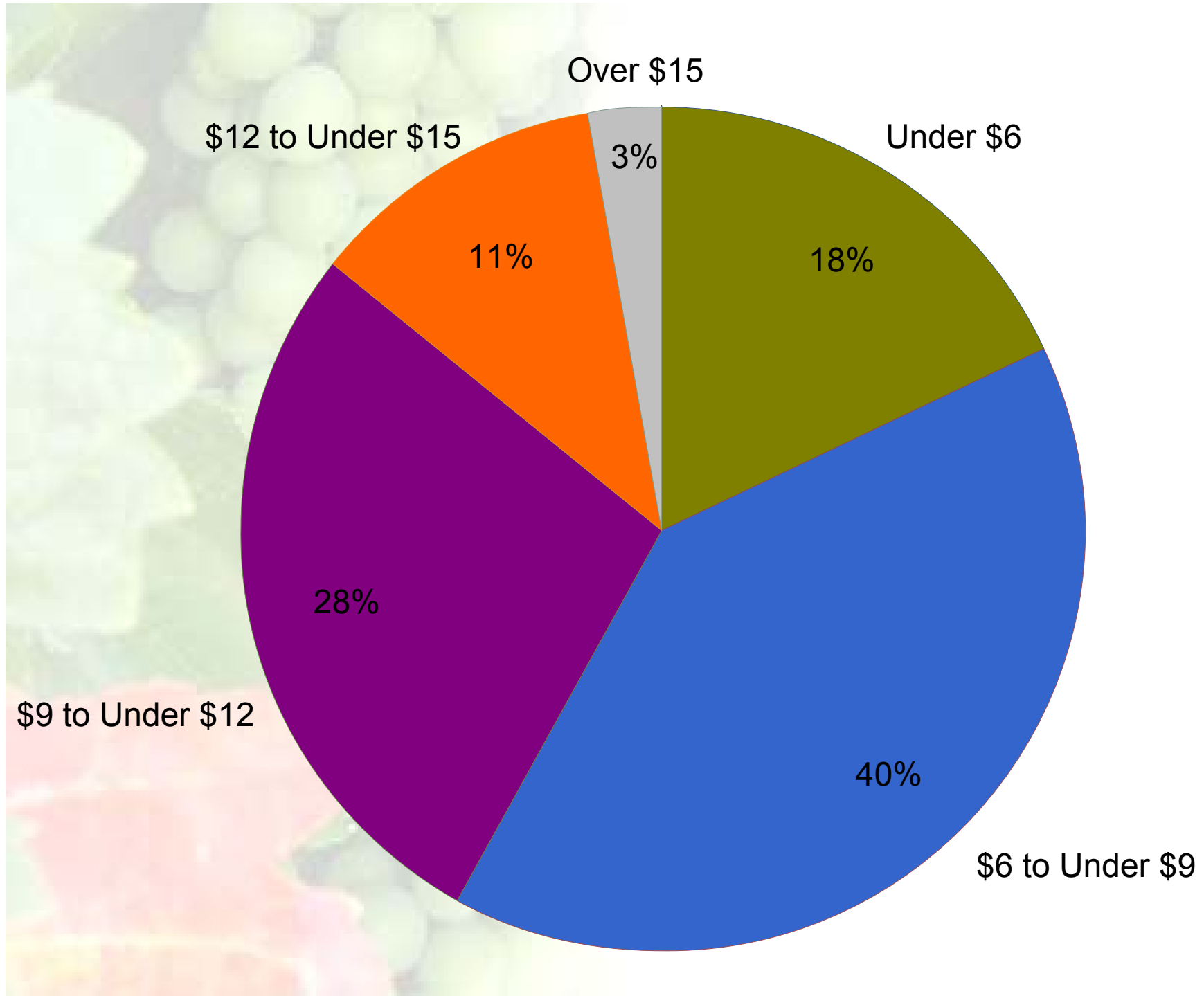
Price Range \$1.16 to \$71.61 Per Bottle

Mean Price \$10.91

10th Percentile Price \$5.02

50th Percentile Price \$9.26

90th Percentile Price \$19.29



The Demand for Merlot

$$Q^D_{ij} = \alpha_0 + \alpha_1 \text{Price}_{ij} + \alpha_2 \text{Income}_{ij} + u_{ij}$$

Where:

- Q^D_{ij} -is case volume per month of Merlot in period i and price point j.
- Price_{ij} -is the price per 750ML bottle of Merlot in period i and price point j.
- Income_{ij} -is a measure of income in period i.

To Solve The Simultaneity Problem, We Use The Price Per Ton of Merlot Grapes as an Instrument of the Price Per Bottle of Merlot

Instrumental Variable = GrapePrice_{ij}

Where:

GrapePrice_{ij} - is The Mean Price Per Ton of Merlot Grapes in period i and price point j

Each Price Point is Defined Using the Following Price Categorization

Category	Price Point
Economy	Under \$6
Pop-Premium	\$6 - Under \$9
Premium	\$9 - Under \$12
Ultra Premium	\$12 - Under \$15
Deluxe	Above \$15

Each Price Point is Defined Using the Following Price Categorization

Using the Bottle Price Formula,
Grape Prices Per Ton for Each Price Point
Are Shown in the Table

Category	Price Point	Grape Prices
Economy	Under \$6	Under \$600
Pop-Premium	\$6 - Under \$9	\$600 - Under \$900
Premium	\$9 - Under \$12	\$900 - Under \$1,200
Ultra Premium	\$12 - Under \$15	\$1,200 - Under \$1,500
Deluxe	Above \$15	Above \$1,500

**Price Point 1
Under \$6**

	OLS	IV
	Cases	Cases
Price	1.244 (3.84)**	-6.829 (2.19)*
Income	-1.9 -0.36	-5.253 -0.23
Winter	0.167 -0.62	0.339 -0.29
Spring	0.228 -0.78	0.388 -0.36
Summer	0.335 -1.32	0.418 -0.68
Timetrend	-0.095 -0.34	-0.191 -0.27
Constant	20.866	47.488
Observations	7656	7656
R-squared	0.03	

Absolute value of t-statistics in parentheses

* significant at 5% level; ** significant at 1% level

	Price Point 1		Price Point 2	
	Under \$6		\$6 - Under \$9	
	OLS	IV	OLS	IV
	Cases	Cases	Cases	Cases
Price	1.244	-6.829	0.357	-3.483
	(3.84)**	(2.19)*	(2.74)**	(4.52)*
Income	-1.9	-5.253	0.416	0.463
	-0.36	-0.23	-0.25	-0.27
Winter	0.167	0.339	0.083	0.091
	-0.62	-0.29	-1	-1.04
Spring	0.228	0.388	0.041	0.045
	-0.78	-0.36	-0.46	-0.48
Summer	0.335	0.418	-0.045	-0.027
	-1.32	-0.68	-0.56	-0.29
Timetrend	-0.095	-0.191	-0.037	-0.018
	-0.34	-0.27	-0.42	-0.18
Constant	20.866	47.488	0.363	-5.426
	-0.44	-0.26	-0.02	-0.27
Observations	7656	7656	8026	8026
R-squared	0.03		0	

Absolute value of t-statistics in parentheses

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	Price Point 1 Under \$6		Price Point 2 \$6 - Under \$9		Price Point 3 \$9 - Under \$12	
	OLS	IV	OLS	IV	OLS	IV
	Cases	Cases	Cases	Cases	Cases	Cases
Price	1.244 (3.84)**	-6.829 (2.19)*	0.357 (2.74)**	-3.483 (4.52)*	-1.701 (7.25)**	-1.363 -0.3
Income	-1.9	-5.253	0.416	0.463	1.676	5.237
Winter	-0.36	-0.23	-0.25	-0.27	1.03	0.48
Spring	0.167	0.339	0.083	0.091	-0.027	-0.089
Summer	-0.62	-0.29	-1	-1.04	-0.34	-0.41
Timetrend	0.228	0.388	0.041	0.045	-0.081	-0.172
	-0.78	-0.36	-0.46	-0.48	-0.94	-0.57
Constant	0.335	0.418	-0.045	-0.027	-0.156	-0.176
	-1.32	-0.68	-0.56	-0.29	(2.05)*	-1.45
Observations	-0.095	-0.191	-0.037	-0.018	0.059	0.179
R-squared	-0.34	-0.27	-0.42	-0.18	-0.69	-0.47
	20.866	47.488	0.363	-5.426	22.919	9.915
	-0.44	-0.26	-0.02	-0.27	-1.58	-0.22
Observations	7656	7656	8026	8026	8686	8686
R-squared	0.03		0		0.01	

Absolute value of t-statistics in parentheses

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	Price Point 1		Price Point 2		Price Point 3		Price Point 4	
	Under \$6		\$6 - Under \$9		\$9 - Under \$12		\$12 - Under \$15	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	Cases	Cases	Cases	Cases	Cases	Cases	Cases	Cases
Price	1.244	-6.829	0.357	-3.483	-1.701	-1.363	-1.646	-.669
	(3.84)**	(2.19)*	(2.74)**	(4.52)*	(7.25)**	-0.3	(6.85)**	-0.05
Income	-1.9	-5.253	0.416	0.463	1.676	5.237	-0.877	44.019
	-0.36	-0.23	-0.25	-0.27	1.03	0.48	-0.48	0.05
Winter	0.167	0.339	0.083	0.091	-0.027	-0.089	0.113	-5.794
	-0.62	-0.29	-1	-1.04	-0.34	-0.41	-1.27	-0.05
Spring	0.228	0.388	0.041	0.045	-0.081	-0.172	0.015	-3.073
	-0.78	-0.36	-0.46	-0.48	-0.94	-0.57	-0.16	-0.05
Summer	0.335	0.418	-0.045	-0.027	-0.156	-0.176	-0.049	-4.292
	-1.32	-0.68	-0.56	-0.29	(2.05)*	-1.45	-0.58	-0.05
Timetrend	-0.095	-0.191	-0.037	-0.018	0.059	0.179	0.001	-2.85
	-0.34	-0.27	-0.42	-0.18	-0.69	-0.47	-0.01	-0.05
Constant	20.866	47.488	0.363	-5.426	22.919	9.915	15.828	-2,344.63
	-0.44	-0.26	-0.02	-0.27	-1.58	-0.22	-0.97	-0.05
Observations	7656	7656	8026	8026	8686	8686	7151	7151
R-squared	0.03		0		0.01		0.01	

Absolute value of t-statistics in parentheses

* significant at 5% level; ** significant at 1% level

	Price Point 1 Under \$6		Price Point 2 \$6 - Under \$9		Price Point 3 \$9 - Under \$12		Price Point 4 \$12 - Under \$15		Price Point 5 \$15 & Above	
	OLS Cases	IV Cases	OLS Cases	IV Cases	OLS Cases	IV Cases	OLS Cases	IV Cases	OLS Cases	IV Cases
Price	1.244 (3.84)**	-6.829 (2.19)*	0.357 (2.74)**	-3.483 (4.52)*	-1.701 (7.25)**	-1.363 -0.3	-1.646 (6.85)**	-.669 -0.05	-1.159 (5.36)**	-.977 -0.02
Income	-1.9	-5.253	0.416	0.463	1.676	5.237	-0.877	44.019	2.636	130.4
Winter	-0.36	-0.23	-0.25	-0.27	1.03	0.48	-0.48	0.05	1.37	0.02
Spring	0.167	0.339	0.083	0.091	-0.027	-0.089	0.113	-5.794	0.148	9.477
Summer	-0.62	-0.29	-1	-1.04	-0.34	-0.41	-1.27	-0.05	-1.59	-0.02
Timetrend	0.228	0.388	0.041	0.045	-0.081	-0.172	0.015	-3.073	-0.012	5.098
Constant	-0.78	-0.36	-0.46	-0.48	-0.94	-0.57	-0.16	-0.05	-0.12	-0.02
	0.335	0.418	-0.045	-0.027	-0.156	-0.176	-0.049	-4.292	-0.058	9.289
	-1.32	-0.68	-0.56	-0.29	(2.05)*	-1.45	-0.58	-0.05	-0.64	-0.02
	-0.095	-0.191	-0.037	-0.018	0.059	0.179	0.001	-2.85	-0.081	-1.487
	-0.34	-0.27	-0.42	-0.18	-0.69	-0.47	-0.01	-0.05	-0.8	-0.02
Observations	20.866	47.488	0.363	-5.426	22.919	9.915	15.828	-2,344.63	-17.072	3,977.70
R-squared	-0.44	-0.26	-0.02	-0.27	-1.58	-0.22	-0.97	-0.05	-0.99	-0.02
	7656	7656	8026	8026	8686	8686	7151	7151	4345	4345
	0.23	.49	.06	.68	0.01	.32	0.01	.72	0.01	.63

Absolute value of t-statistics in parentheses

* significant at 5% level; ** significant at 1% level