

SP 99-02  
September 1999



## Staff Paper

Department of Agricultural, Resource, and Managerial Economics  
Cornell University, Ithaca, New York 14853-7801 USA

### **GRAPE PURCHASING AND DISEASE MANAGEMENT STRATEGIES FOR PREMIUM WINE GRAPES**

**Amir Hefetz and Gerald B. White**

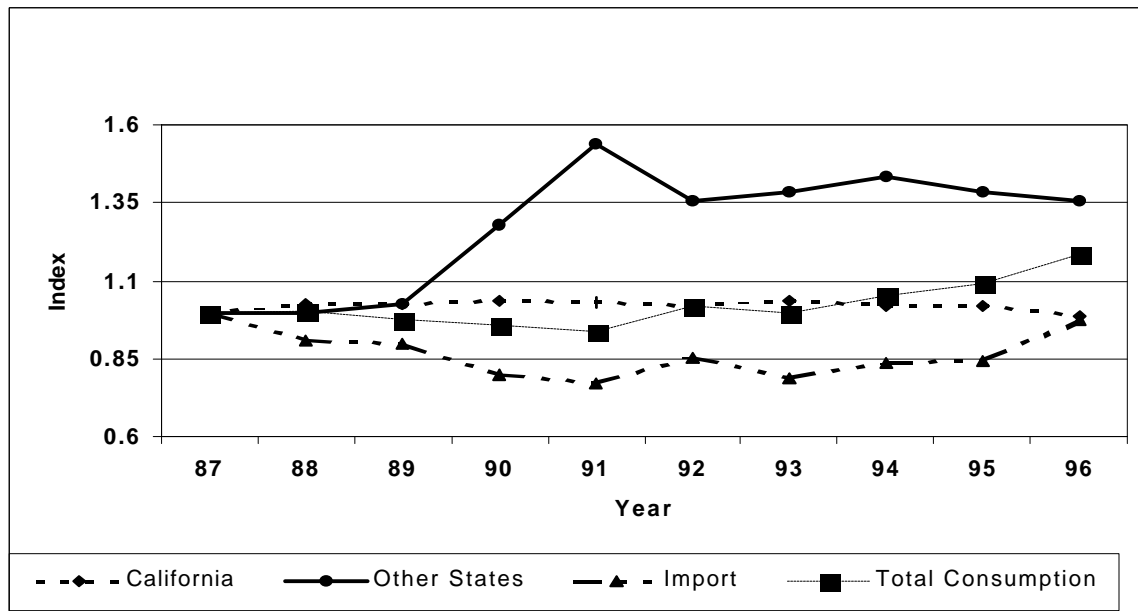
# GRAPE PURCHASING AND DISEASE MANAGEMENT STRATEGIES FOR PREMIUM WINE GRAPES

By Amir Hefetz and Gerald B. White \*

## Introduction

The last several years have shown considerable growth for the national wine industry. The annual rate of growth of table wines indicates a compounded rate of almost six percent for the last four years since bottoming out in 1993 <sup>(1)</sup>. California's market share is now about 75 percent, imports account for another 19 percent, and other states account for the remaining 6 percent. California is losing slightly an 0.8 percent a year market share while other states share is growing linearly at 1.9 percent a year. The total consumption of table wines in 1996 was 18% higher compared to 1987, advancing from 340 million gallons of wine in 1987 to 400 million gallons in 1996. Figure 1 shows a significant growth for the other states table wine production together with the total consumption growth while California wine industry and the import source are losing some of their market share.

**Figure 1: 1987-1996 Table Wine Growth Indexes, Market Shares and Total Consumption. (1987 = 1)**



\*Research Assistant and Professor, respectively, Department of Agricultural, Resource and Managerial Economics, Cornell University.

This growth affects the Finger Lakes industry and offers an opportunity to introduce to the consumer more products (wines of different quality levels as well as added varieties).

Our survey deals with the quality question by trying to explain the relationship between wineries and grape growers. How do wineries reward quality? Do they try to differentiate prices for different quality, especially with respect to disease severity? What measures do winery buyers use to insure a high quality supply of grapes?

### **Survey methodology and descriptive results**

In August and September of 1998, the authors conducted a survey of 14 wineries that purchase grapes from Finger Lakes growers. The survey was designed to support a field experiment, which is evaluating different treatments against powdery mildew. Powdery mildew is considered a severe disease in vineyards. This fungus attacks the leaves and the berries as well, and breaks the berry's skin letting non-desirable tastes penetrate into the must. Powdery mildew is one of the major problems in grape growing and management and causes a considerable economic damage. Over using of pesticides can also have a number of undesirable effects on wine <sup>(2)</sup>. The impact on prices of diseased-free grapes in general, and free of powdery mildew specifically, was examined by a questionnaire that was aimed at identifying the importance winemakers give to different level of qualities of grapes that they purchase and how they react once a quality problem is occurring.

The authors met the managers or vintners of 14 of the Finger Lakes area wineries of different types and sizes. Some of them are selling their products out of the state. One is buying from out of the state sources. The questionnaire was mailed in advance and directed toward the person in management who had the primary responsibility for purchasing grapes from area growers.

More than a half of those interviewed described their marketing position as premium or boutique wineries. Others used different kind of price/quality strategies, but they are well aware of the modern customer's ability to identify wine quality and thus are trying to produce a quality product. As boutique or premium wineries, a meaningful source of market share is tourists, especially during the summer season. The winery tasting room is an important channel to increase sales and to introduce new types of wine. We routinely observed during a day five and up to 20 vehicles in the parking lots of wineries we surveyed. The weekends are much busier. Most customers were from New York State, but vehicles from Pennsylvania, Ontario, and New England were often observed.

A brief summary description of the surveyed wineries shows an average growth rate in sales of 18% a year for the last few years. The approximate number of cases sold the last year averaged 30,000 cases per a winery. This number varied from small wineries producing around 5,000 cases up to 2,000,000 cases, excluding the largest winery in the survey. The key for expansion is the logistics capacity. Once a winery enters out of state distribution system or uses a wholesaler, it depends on a consistently large grape supply for those products it markets during the entire year.

### **New York State wine industry compare with survey results**

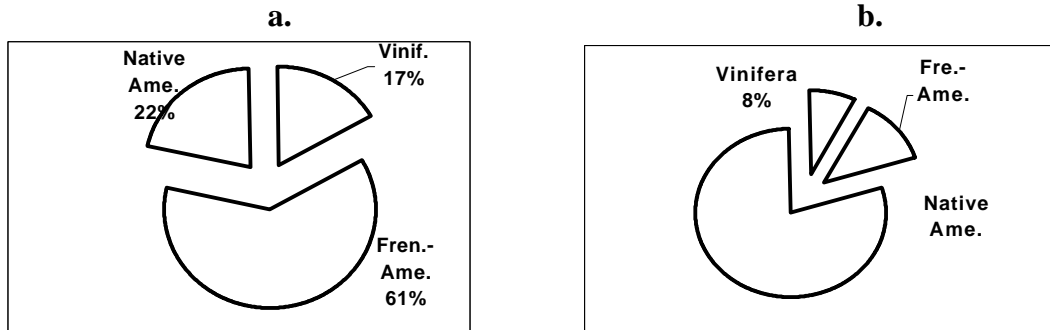
The total production of New York grapes delivered to wineries in the state in 1997 was 46,500 tons <sup>(3)</sup>. Vinifera varieties amounted to 3,500 tons, French -American hybrids accounted for 5,600 tons, and the other 35,400 tons were American varieties and other. The wineries in our survey crushed 31,700 tons of in-state grapes in 1997, which was 71% of all New York State grape crush. The buying activity was 36,600 tons for '97 including all wineries in the survey. Some grape sources are from out of the State.

**Table 1: Variety Distribution, Survey\* vs. All NY State.**

Variety	Survey	New York State
Vinifera	17%	8%
French-American	61%	13%
Native American	22%	79%

\*Excluding Canandaigua Wine Company

**Figure 2: Distribution of grape varieties, delivered to the wineries, a: 1998 Survey of Growers, August 98, b: All NYS 1997 (New York Agricultural Statistics Service)**



Excluding the largest winery, The Vinifera varieties share is 17 percent of the total buying activity and French-American hybrids are more than 60% of the total (Table 1, Figure 2). The percentage of Vinifera purchased by the Finger Lakes wineries surveyed was more than twice larger than for the NYS industry. The purchased portion of the total crushed grapes was 74%, which makes small wineries highly dependent on purchased grapes (Table 2). It was higher for the French-American hybrids where wineries are buying 76% of the hybrid grapes and utilizing from their own production the rest. These statistics point out the importance of the relationship between the grower and the wineries as the key to achieve a quality product.

**Table 2: Buying Activity vs. Own Production Utilization, Tons**

Variety	Purchased	Own prod. utilized	%purchased of total
<b>Vinifera, Total</b>	551	491	53%
<b>Chardonnay</b>	160	187	46%
<b>French-American hybrids,</b>	2,797	861	76%
<b>Total</b>			
<b>Seyval Blanc</b>	285	164	63%
<b>Native American, Total</b>	1,082	205	84%
<b>Total (Vin. + FA. Hy. + NA)</b>	4,430	1,556	74%

(1998 Survey of Growers, August 98)

Wineries purchased from 6 different growers on average, with a range of 3 growers to as many as 42 growers. They describe their buying as being from 2/3 steady suppliers, with the rest having the possibility of changing from one season to another.

### **Pricing the Grapes**

The high annual growth rate of wine consumption over the last few years has strengthened the demand for quality grapes. A surplus of low quality wine does not affect the demand for medium and high quality wine<sup>(4)</sup>. The market share in the United States of wines priced below \$4.25 is less than 6%, while wines priced from \$4.25 and up to \$7.50 (retail prices, 1996) share the major part of the table wine market, 72%. The rest (22%) is priced \$7.50 and up<sup>(5)</sup>.

The tight supply situation of quality products helps to describe the nature of the current wine grape market, and explains how wineries currently respond when some quality problems occur. Wineries were asked whether or not they gave a premium for disease free grapes, or whether they discounted grapes which had significant disease level. The bonus/penalty tool is limited given the current supply of premium wine grapes. Wineries rarely discount diseased grapes. Just 9% mentioned a discount as a possibility, though several said they would like to be able to discount diseased grapes. Either they accept the load as it is, or they won't have an alternative supply. Three wineries

remembered an incident of a complete load rejection, and one mentioned a rejection due to powdery mildew.

What factors affect the price paid for wine grapes? Interviewees indicated the price their competitors would pay as the most important factor (Table 3). Ten of the thirteen winery interviewees gave it the highest level of importance for Chardonnay and six of ten for Seyval (not all 13 purchased Seyval). Other important factors are the expected price per bottle and the tonnage of grapes produced in the Finger Lakes. Disease severity was a less important issue, but it was explained that having disease-free grapes is a basic requisite for any supply.

**Table 3 (a,b): Importance Level Frequencies for Price Affecting Factors**

	<b>Low 0 - 1</b>	<b>Med. 2 - 3</b>	<b>High 4 - 5</b>	<b>%high</b>
<b>3a: Factors affecting price, Chardonnay, n=13 wineries</b>				
<b>a. Estimated tonnage produced in the Finger Lakes, 97</b>	2	3	8	62%
<b>b. The inventory of wine in tanks (un-bottled).</b>	5	3	5	38%
<b>c. The inventory of wine in bottles.</b>	4	4	5	38%
<b>d. Disease severity</b>	2	7	3	25%
<b>e. The prices you paid last year</b>	1	4	8	62%
<b>f. The prices your competitors will pay</b>	0	3	10	77%
<b>g. Expected price for a bottle of wine</b>	0	4	9	69%
<b>3b: Factors affecting price, Seyval Blanc, n=13 wineries</b>				
<b>a. Estimated tonnage produced in the Finger Lakes, 97</b>	3	3	4	40%
<b>b. The inventory of wine in tanks (un-bottled).</b>	5	2	3	30%
<b>c. The inventory of wine in bottles.</b>	4	3	3	30%
<b>d. Disease severity</b>	3	5	1	11%
<b>e. The prices you paid last year</b>	1	3	6	60%
<b>f. The prices your competitors will pay</b>	2	2	6	60%
<b>g. Expected price for a bottle of wine</b>	0	2	8	80%

(1998 Survey of Growers, August 98)

It is important to note that, in general, these factors have less of an effect on Seyval than on Chardonnay, since Chardonnay grapes are almost completely destined to varietal wine, while Seyval is often used in blends.

The expected price for a bottle of wine is an interesting factor in grape pricing. The standard of a \$100 payment per ton for each \$1 of retail price was mentioned by one interviewee, but is hardly in use, and is not much more than an indication tool. This traditional way of price calculation does not fit completely the modern wine list that is developed by a winery, when a \$17 reserved varietal wine lies near a \$5 magnum bottle of blended wine. Each different wine type carries different cellar costs. The weight of the purchased grapes in a complete cost accounting changes from one type to another. While for an inexpensive wine production the grape price is crucial, producing more expensive wines involve a higher proportion of cellar costs.

Average prices per ton of Chardonnay increased from \$900 in 1993 to \$1200 in 1997. Seyval prices were rising from \$360 to \$420. The prices for the same varieties in 1998 remained about the same as for 1997.

The answer to the quality question must be considered in the long-term. Growers who do not regularly meet the minimum quality level might find themselves off the supplier list and would have to sell their crop to low quality/low price buyers.

### **How Growers Make Disease Management Decisions**

The grower will choose the most effective program for disease prevention. Most interviewees evaluated powdery mildew as the most important disease (Table 4). Eighty - five percent gave powdery mildew the highest level of importance for Chardonnay but just 60 percent gave the same level of importance for Seyval. Disease problems are considered less important with the Seyval variety.

**Table 4: Percentage Ranked Highly Important, Chardonnay vs. Seyval Blanc**

Type of Disease	Chardonnay	Seyval
<b>Powdery mildew</b>	85%	60%
<b>Black rot</b>	15%	0%
<b>Botrytis</b>	62%	30%
<b>Sour rot</b>	62%	40%

(1998 Survey of Growers, August 98)

Disease-free grapes are crucial in order to get good wine. The main criterion affecting the choice of fungicides is the efficacy of the chemical in use. All wineries mentioned this factor as the key for high quality grapes. Costs play a secondary role in the vintner’s judgment. Spraying cost are 20% of total cost per acre, and saving a few dollars out of total operating costs of \$1,474 per acre of Vinifera grapes<sup>(6)</sup> doesn’t have much importance when compared against the possible impact of diseased grapes on wine quality.

The results indicate that resistance management, or prolonging the effectiveness of a particular pesticide, is an important factor in choice of fungicides.

**Tables 5: Importance Levels Frequencies for Fungicides Choice.**

Importance Level:	Low 0 – 1	med. 2 – 3	High 4 – 5	%high
<b>Factor</b>				
<b>Efficacy</b>	0	0	14	100%
<b>Cost</b>	1	7	6	43%
<b>Resistance management</b>	0	2	12	86%
<b>Environmental impact and/or toxicity</b>	3	6	5	36%
<b>Handlers or workers safety</b>	2	5	7	50%

(1998 Survey of Growers, August 98)

The risk of having grapes infested by diseases is thus considered too high to justify a small saving in the use of pesticides. Growers are likely to choose the best spraying program that will yield disease free grapes. Most growers are using the same sources of information in their decision making process. In table 6, past experience, of course, and Cornell Recommends were chosen as the main sources of information. Both were rated as

highly important sources. Other sources in common use are “extension news letters” and grower meetings.

**Table 6: Sources of Information, Percentage Ranked Highly Important.**

<b>Source of Information</b>	<b>% Highly Important</b>
<b>Own Experience</b>	93%
<b>Cornell Recommends</b>	86%
<b>Extension news letters</b>	64%
<b>Grower Meetings</b>	43%
<b>Extension Code-a-phone</b>	21%
<b>Chemical field rep.</b>	14%
<b>Other</b>	14%
<b>Ag. Chemical Handbook</b>	7%

(1998 Survey of Growers, August 98)

### **Relationship between Wineries and growers**

The relationship between wineries and growers starts at the vineyard. What methods does the buyer use to keep tracks of the growing process? How can the buyer ensure the quality grapes that the winery needs? The answers to those questions might vary depending upon the types of relationship with growers that the buyer is attempting to develop. It may vary during the season and over seasons.

The first step is the interaction with growers during the growing season and the next is how to contract with growers for steady and sequential supply.

#### **a. Interactions with Growers**

Most purchasing wineries, 82 percent, are doing vineyard visits, from 3 to 8 in a season, and use it as their most important method to follow grape quality. Some add a suggested control program, but the basic approach leaves the pest management decisions to the grower. This suggests that wine makers believe in the growers’ capacity to produce the quality they need.

## **b. Types of Agreement between Wineries and Growers.**

Growers have a commitment to supply quality grapes above a specific level. Poor quality growers will not survive in this market for the long term. Although grape markets are tight at this time, the long-term selection leaves producers who can grow high quality product at a distinct advantage.

The constraint of grape supply does not allow the grower-wineries relationship to be developed into a long-term contract. Multi-year relationships are based on a mutual trust and satisfaction. Each winery works with a steady kernel of suppliers, that is covering about two-thirds of its supply. Just 40 percent of the wineries use written agreements. All of them mention quality as a key to purchasing readiness.

## **c. Statistical Analysis of prices.**

In order to examine the relationship between wineries and grower, we established a database containing the retail prices of the current year from the price list of the wineries and the price they pay for the grapes in the relevant production year. This analysis assumes a linear relation between the former prices. The results can provide a better explanation for the mutual responsibility of both the wineries and the grower for the wine quality. Prices of grapes were taken from the years: 1997,1996,1995. (Finger Lakes Vineyard Notes, various issues, 1995-1997.) (No price adjustment for inflation was calculated in the data, since inflation rates were minimal over this three-year period).

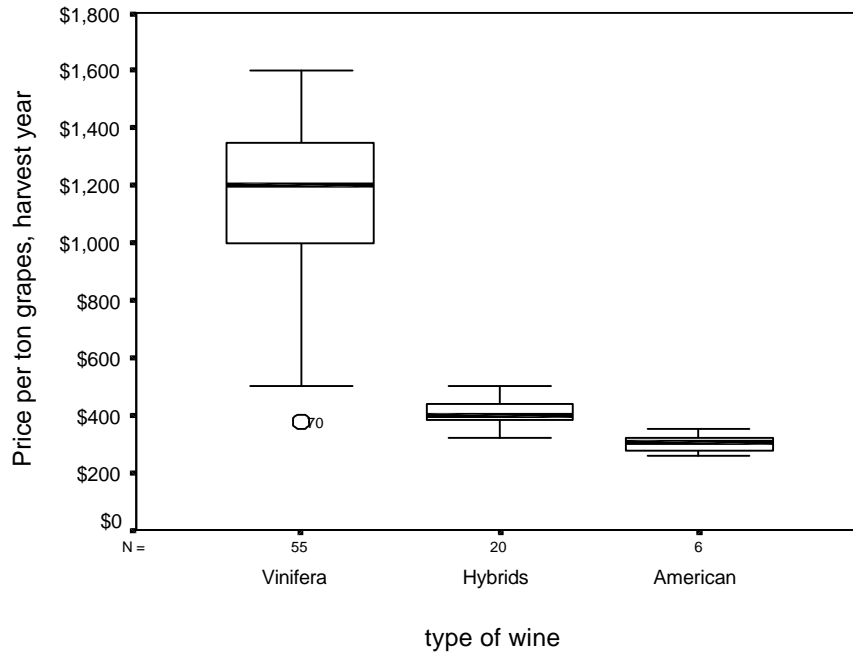
The prices were first examined as a simple linear model and than dummy variables were added, looking for a significant difference between different varieties of wine. It was expected to find different pattern or different level of pricing for at least the major groups of varieties (Vinifera, French – American Hybrids, Native American).

Eleven wineries' prices were sampled. The total number of observations was 81; 55 were Vinifera, 20 were French-American Hybrids and 6 were Native-American wines.

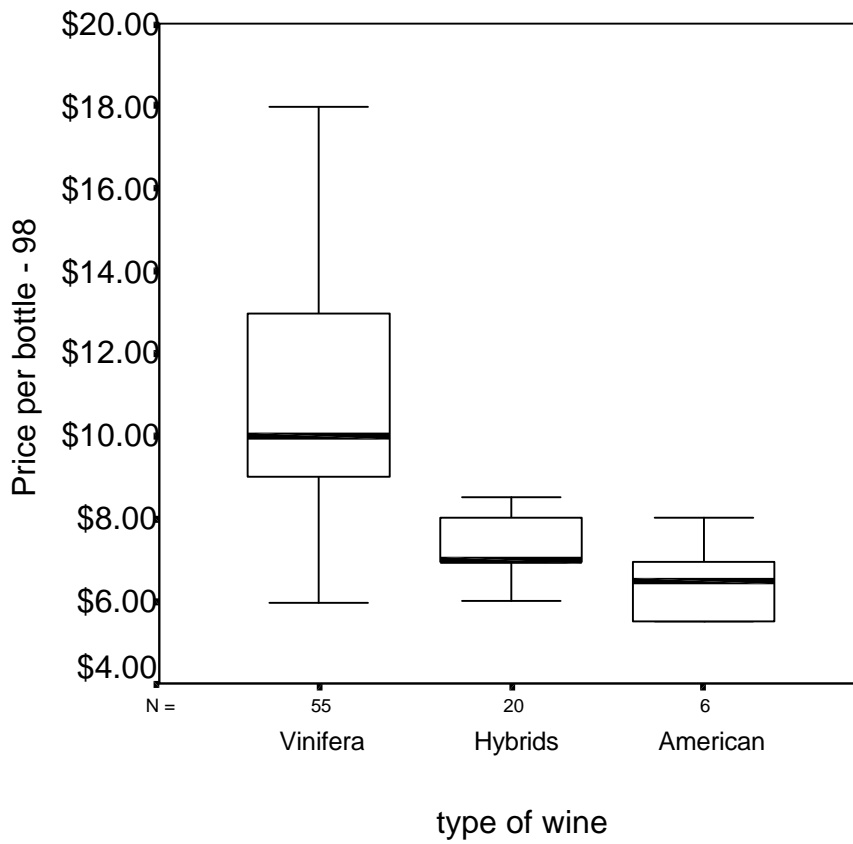
The average price for a bottle of wine was \$10.02. The average price per ton of grapes was \$916.98.

**Table 7: Descriptive Statistics**

	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Error</b>
<b>Price per bottle - 98, All Varieties</b>	\$5.49	\$17.99	\$10.02	\$.36



**Figure 3b:** Price per bottle - box plot, average and range,



According to figures 3a and b, above, prices of Vinifera show a high degree of variability both as wine and as grapes, which gives the indication of sensitivity to different quality levels when compared with the other types. Other research does not always show a proportional bottle price contribution for additional quality, but enables growers and wine makers to make their own appropriate decision about what quality mix to produce <sup>(7)(8)</sup>.

Linear models were run in order to find relationship between retail prices of wine and farm prices of grapes. The first model was a linear regression where the dependent variable was the price per bottle during the current year. The independent variable was the price per ton of grapes in the relevant year of production. Table-8 shows the regression results with coefficients and significant level for each variable.

**Regression results for five models for the relationship between grape prices and wine bottle prices, 11 wineries, 1995, 1996, and 1997 vintage.**

**Table 8: Regression Results**

<b>Model</b>	<b>Variable</b>	<b>Coefficient</b>	<b>t-value</b>	<b>P</b>
1.	Price per ton	0.006	10.048	0.00**
	Constant	4.81	8.445	0.00**
2.	Price per ton	0.0061	5.209	0.00**
	Constant	4.63	4.862	0.00**
	Vinefera – Dummy	-0.38	-0.277	0.78
	French-American - Dummy	0.12	.114	0.9
3.	Price per ton	0.0065	6.174	0.00**
	Constant	4.31	6.283	0.00**
	Chardonnay - Dummy	0.49	0.511	0.61
	Cabernet, Red - Dummy	-1.53	-1.599	0.11
	Riesling – Dummy	-0.58	-0.487	0.62
	Seyval – Dummy	0.68	0.885	0.38
4a.	Price per ton	0.006	10.732	0.00**

<b>Model</b>	<b>Variable</b>	<b>Coefficient</b>	<b>t-value</b>	<b>P</b>
	Constant	4.83	8.771	0.00**
	Cabernet, Red - Dummy	-1.48	-2.61	0.01**
4b.	Price per ton	0.005	9.83	0.00**
	Constant	4.75	8.42	0.00**
	Chardonnay - Dummy	1.086	1.73	0.08*
4c.	Price per ton	0.06	9.689	0.00**
	Constant	4.42	6.691	0.00**
	Seyval – Dummy	0.856	1.173	0.24
5.	Price per ton	0.01	31.14	0.00**
Power	Price per ton (exponent)	0.429	11.676	0.00**
	Exp.(a)	0.54	-2.473	0.02**

\*\* p<0.05, \* p<0.10

The first model shows simple relationships between prices of grapes and prices of wine. There is a \$0.6 linear increasing value per a price for a bottle of wine against each \$100 paid per ton of grapes. This simple model supports the idea of vertical connection from the farm to the winery's sale outlet <sup>(9)</sup>. Although the model is missing quantities, the significant relation between the prices is pointing out that grape prices are on the average a major component in the pricing process of wines. It shows a meaningful grower share in the bottle of wine price. The intercept can be taken as a fixed cost level (for the bottle, corks, labels, and some other fixed overhead items). In this case a fixed cost per bottle of wine is \$4.81.

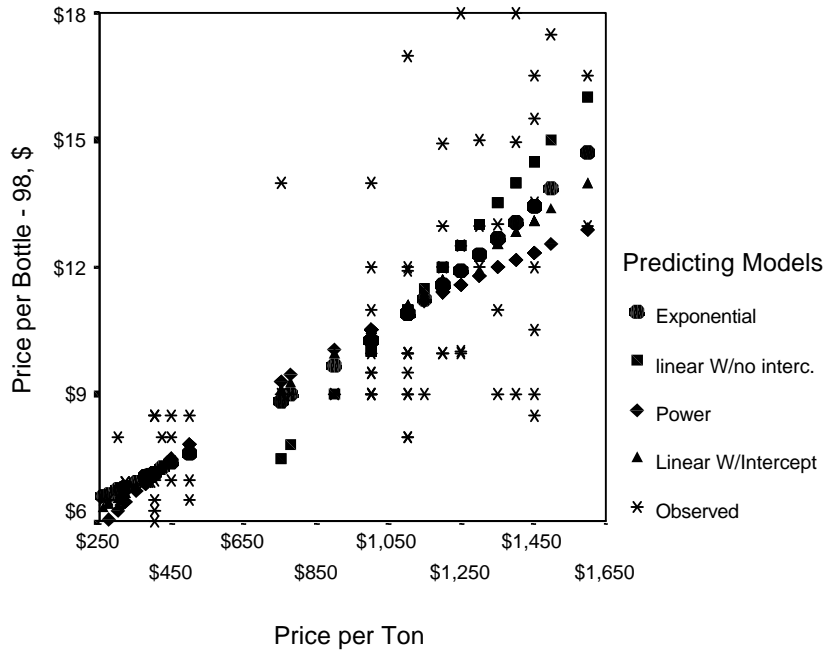
Once dummy variables added to the linear model (Model 2) no significant results were found. The idea of Model 2 was to examine the assumption that the price relationship might act differently for different wine types. Premium wines were suspected to develop different pattern than other types. The results of model 2 and 3 didn't show this, although the Cabernet in model 3 is getting closer to a “p” level of 0.10. When those variables were tried one against all others in model 4, the Cabernet and the Chardonnay

showed some significance. We were expecting the assumption of fixed costs to be supported by these models. Since premium varieties are likely to have a higher level of fixed costs, we expected the coefficient to be greater than zero, but the results show the opposite. It is better thus to return to the market structure and realize that growers share a higher part of the sales revenue in varieties for which their supply is tighter. Such a relationship is better to be measured by a power model.

Another model, model 5 was examined without an intercept. The non-intercept model assumes that prices should cross the origin in this equation and ignores any fixed cost. The results suggest the 1\$ per bottle for a 100\$ for ton of grapes principle. Looking at figure 4, below, we can see that the distribution of prices at high level is higher, so that such a principle might work sometimes over the average and the low level of prices.

The power model,  $Y=0.54*(x)^{0.43}$  is decreasing and reflects the constraint of grape supply in the wholesale market as the level of grape price is increasing. The grower's share in the retail price of higher quality wine is increasing.

**Figure 4: Predicting Models.**



### How Wineries maintain quality (Conclusion)

The chance to be rejected due to disease problem is very low, but exists. Even though it is a low chance, growers take a long-term chance of being marked as poor quality producers and may find themselves out of the market.

Wineries rarely use load rejection, but will give up poor quality suppliers later on. Developing a long-term relationship system by delivering information during the year would help to raise quality

The clear and significant relations between retail prices and grape prices result from the sharing of revenue from wine sales between the grape growers and the wine makers. It delivers a meaningful part of the responsibility for the wine quality toward the grape grower together with the wineries.

The grape supply is not covering the current demand for grapes. This creates the impression that the retail market is far from being supplied. It is a common interest of both

the wineries and the grape suppliers to maintain quality as a key for increasing the future consumption, and to be aware of price stability in the future once supply will increase.

### **Acknowledgements**

This research was supported by Research Project 504, sponsored by USDA, Northeast Regional Pesticide Impact Assessment Program administered through the Pennsylvania State University.

Appreciation is expressed to Harry Kaiser for his helpful review of this staff paper.

**Reference:**

1. Wines & Vines, July 1997. (Selected tables).
2. Navarro s. and B Garcia, Effect of Wine-Making Practice on the Concentrations of Fenarimol and Penconazole in Rose Wines, Journal of Food Protection, V. 60, (9), 1997. PP 1120-1124.
3. Survey of Wineries and Grape Processing Plants, New York Agricultural Statistics Service, January 1998. (Selected tables).
4. Jackson D. and Lombard P., Environmental and Management. Practices Affecting Grape Composition and Wine Quality, American Journal of Enology and Viticulture, V.44 (4) 1993. PP 409-430.
5. Adams Media-Wine Handbook, 1997. (Selected tables).
6. White G., Peterson D., Martinson T., Cost of Establishment and Production of Vinifera Grapes in The Finger Lakes Region of New York - 1997, E.B. 99-04, Department of Agriculture, Resource, and Managerial Economics, Cornell University, 1999, 16PP.
7. Edward O., A Hedonic Price Function for Australian Premium Table Wine, Australian Journal of Agricultural Economics, V. 38, (1), April 1994. PP 93-110.
8. Golan A. and H. Shalit, Wine Quality Differentials in Hedonic Grape Pricing, Journal of Agricultural Economics, V. 44, (2), May, 1993. pp 312-321.
9. Tomek, W. and K. Robinson, Agricultural Product Prices (3<sup>rd</sup> Edition), Cornell University Press, 1990.