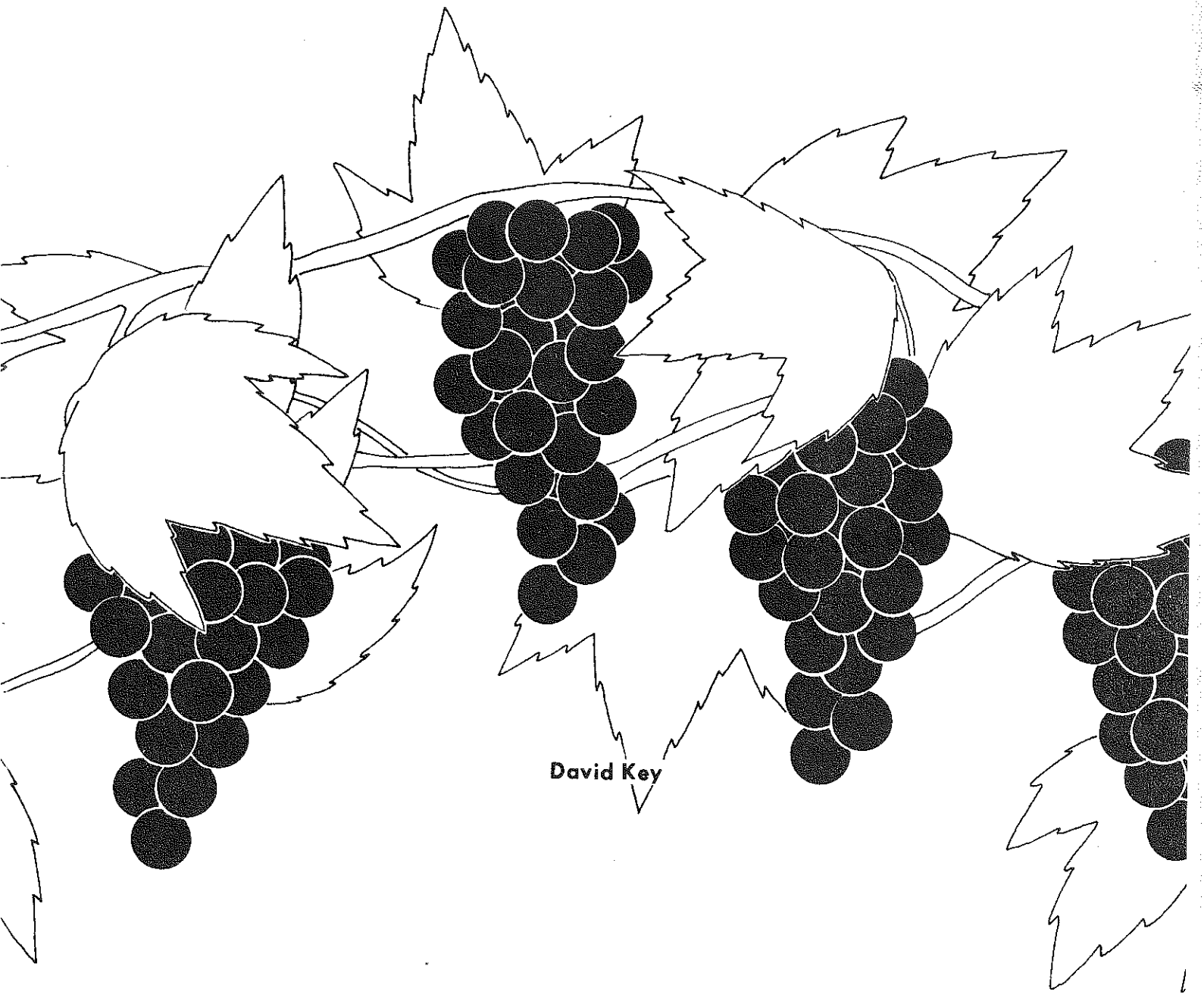
February 1982

A.E. Ext. 82-5



# A Net Present Value Analysis of Vineyard and Winery Investments



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# A NET PRESENT VALUE ANALYSIS OF VINEYARD AND WINERY INVESTMENTS

by
David Key*

## Introduction

This bulletin presents examples of an economic analysis of proposed investments in two projects: (1) a vineyard to produce wine grapes and (2) a small-scale winery. The analysis uses the net present value method of evaluating investment proposals. Prior to the investment analysis, some background on the New York grape and wine industry will be presented.

Most farmers are continually looking for opportunities to increase income. Viticulturalists are no exception. The New York State grape and wine industry has at times been profitable for growers and at other times depressed. The ability to make operational changes in tune with changing economic and market conditions is important. Planting a new vineyard with varieties in demand for winemaking is an adjustment alternative open to growers if capital requirements can be met. Constructing an on-farm winery is another alternative that affords a grower more control over marketing a perishable product.

The economic outlook for grape and wine production in New York State and other parts of the East is changing. During the 1970's red wine grape prices increased very little while input prices increased quite rapidly due to inflation. In this same decade, U.S. wine consumption has doubled with greater demand for white wines and increased prices for white wine grapes. J. W. Moffett, publisher of the Eastern Grape Grower and Winery News, projects another doubling of wine consumption during the next decade. This trend will be driven partly by an increase in the proportion of the United States population between the ages of 35-44, peak earning years for most adults. Moffett explains that with New York wine industry growth rates the same as projected for the U.S., there must be 10,000 acres of new wine grapes planted by 1985 to meet increased demand for wines (at current price levels).

Wine consumption in the U.S. has been increasing primarily due to the growing popularity of table wines. In 1979, U.S.-produced wine sales grew faster than imported brands. Table 1 gives adult per capita consumption changes for the period 1970-79 [Wines and Vines]. The growth rates in consumption have been quite strong in recent years. From a different source [Wine Marketing Handbook], U.S. per capita (total population) consumption was 7.2 liters in 1978. France, Portugal, and Italy led the world in per capita consumption with 98.0, 91.3, 91.0 liters, respectively, in 1978. Argentina, Spain, and West Germany consumed 85, 70, and 23.8 liters per capita in the same year.

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Table 1. Price Indices, Inflation Estimates and Wine Consumption, United States.

| Items | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Price Indices* | | | | | | | | | | | |
| Consumer Price Index (1967=100) | 116.3 | 121.3 | 125.3 | 133.1 | 147.7 | 161.2 | 170.5 | 181.5 | 195.4 | 214.1 | 244.3 |
| Percentage Change | 5.9 | 4.3 | 3.3 | 6.2 | 11.0 | 9.1 | 5.8 | 6.5 | 7.7 | 11.3 | 14.4 |
| U.S. Gross National Product Price Deflator (1972=100) | 91.4 | 96.0 | 100.0 | 105.8 | 116.0 | 127.2 | 133.7 | 141.7 | 152.1 | 165.5 | 180.7 |
| Percentage Change | 5.4 | 5.1 | 4.1 | 5.8 | 9.7 | 9.6 | 5.2 | 6.0 | 7.3 | 8.8 | 9.2 |
| Wine Price Indices (CPI & PPI) and Per Capita (over age 21) Consumption** | | | | | | | | | | | |
| PPI - Table Wines | 122.3 | 110.6 | 127.2 | 137.1 | 155.6 | 164.1 | 161.6 | 159.1 | 174.5 | 191.4 | -- |
| Percentage Change | | -9.6 | +15.0 | 7.8 | 13.5 | 5.5 | -1.5 | -1.5 | 9.7 | 9.7 | |
| CPI - Table and Dessert Wines | 116.7 | 122.5 | 127.0 | 135.0 | 147.3 | 154.0 | 157.4 | 161.9 | 179.9 | 197.5 | -- |
| Percentage Change | | 5.0 | 3.7 | 6.3 | 9.1 | 4.8 | 2.2 | 2.9 | 11.1 | 9.8 | |
| Adult per capita consumption in the U.S.A. - Table Wines (liters) | 4.56 | 5.2 | 5.63 | 6.04 | 6.15 | 6.58 | 7.04 | 7.93 | 8.96 | 9.54 | -- |
| Percentage Change | -- | 14.0 | 8.0 | 7.3 | 1.8 | 7.0 | 7.0 | 12.6 | 13.0 | 6.5 | |
| Projections of Macroeconomic Variables, 1980-1990*** | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
| U.S. Gross National Product ($Bil.) | 2570.0 | 2841.1 | 3210.2 | 3538.1 | 3913.6 | 4309.7 | 4732.3 | 5194.0 | 5687.9 | 6221.3 | 6791.1 |
| Percentage Change | 8.6 | 10.5 | 13.0 | 10.2 | 10.6 | 10.1 | 9.8 | 9.8 | 9.5 | 9.4 | 9.2 |
| Consumer Price Index (1967=100) | 246.6 | 270.4 | 291.2 | 315.9 | 341.0 | 367.6 | 395.2 | 423.9 | 454.0 | 485.3 | 518.1 |
| Percentage Change | 13.4 | 9.7 | 7.7 | 8.5 | 8.0 | 7.8 | 7.5 | 7.3 | 7.1 | 6.9 | 6.7 |

SOURCES: *Statistical Abstracts of the United States, 100th Ed., 1979, U.S. Department of Commerce.
**Bureau of Labor Statistics; Consumption data reported in "Wines and Vines: compiled from several sources. PPI-Producer Price Index; CPI - Consumer Price Index.
***Hughes et al., National Agricultural Credit Study. ESS, U.S.D.A. ESS Staff Report, No. AGESS 810 413, April 1981, p. 64. U.S. GNP in $Bil. an estimate of growth, not inflation.

Analysts expect further increases in sales and consumption. [Wine Marketing Handbook]. Also expected are further increases in California's market share of the U.S. wine market. While California outproduces New York at least ten to one, Figure 1 does not show any major trend in market share. What the bar graph does show is the erratic and fundamentally agricultural nature of wine production.

California grape plantings for wine increased 100% from 1970 to 1976 [Lichine]. However, according to Lichine, during the same period prices for "good" wines dropped 60%. While this price decrease is not substantiated by the producer and consumer price indices for wines as presented in Table 1, grape prices in New York State have declined since 1970 when prices are adjusted for inflation.

A proliferation of new wineries in New York suggests optimism in the industry. It must be remembered that California is also in a strong expansion phase. European imports can be cheap, versatile, and marketable. Still, varieties and wine technology have improved in favor of eastern conditions. White varietal wines are believed to have the most potential due to recent popularity. Consumption patterns can change rapidly, however, as New York State has experienced. Also important to New York growers are red French Hybrid varieties and the native Concord, the latter of which has lower operating and capital costs and can be sold for juice or wine. Table grapes may have long-term growth potential with breeding and selection continuing at the Geneva Experiment Station.

In addition, grapes are susceptible to winter kill, various diseases and insects, and shifting consumer preferences. Prices for some red varieties have been too low to warrant picking at harvest time. Wines have even been prohibited from sale, the latter of which terminated rapid growth in grape plantings in 1919. The investor should be aware of the substantial risks that are assumed when entering this industry.

The purpose of this publication is to provide a method of evaluating vineyard and winery investments. The outcome of an economic evaluation depends not only on inputs and yields but also on the assumptions made about inflation, interest rates, the amount of debt and equity on a farm, and the costs and prices of the commodities involved. The Net Present Value (NPV) method will be used to analyze the proposed vineyard and winery investments. To use this model of an investment decision one must specify the underpinnings of the assumptions made. To change an assumption, perhaps a certain budget item, is not difficult as long as the change is treated consistently throughout. Realistic and flexible assumptions are important foundations for profitable decisions.

The following report makes some generally favorable assumptions on the growth and profitability of the New York Wine Industry. Part of the study is then devoted to substantiation and documentation of those assumptions. A NPV analysis will follow to determine whether vineyard and winery investments are worthwhile for a particular situation. Growers and investors are encouraged to make their own budget estimates and use a similar model to evaluate profitability.

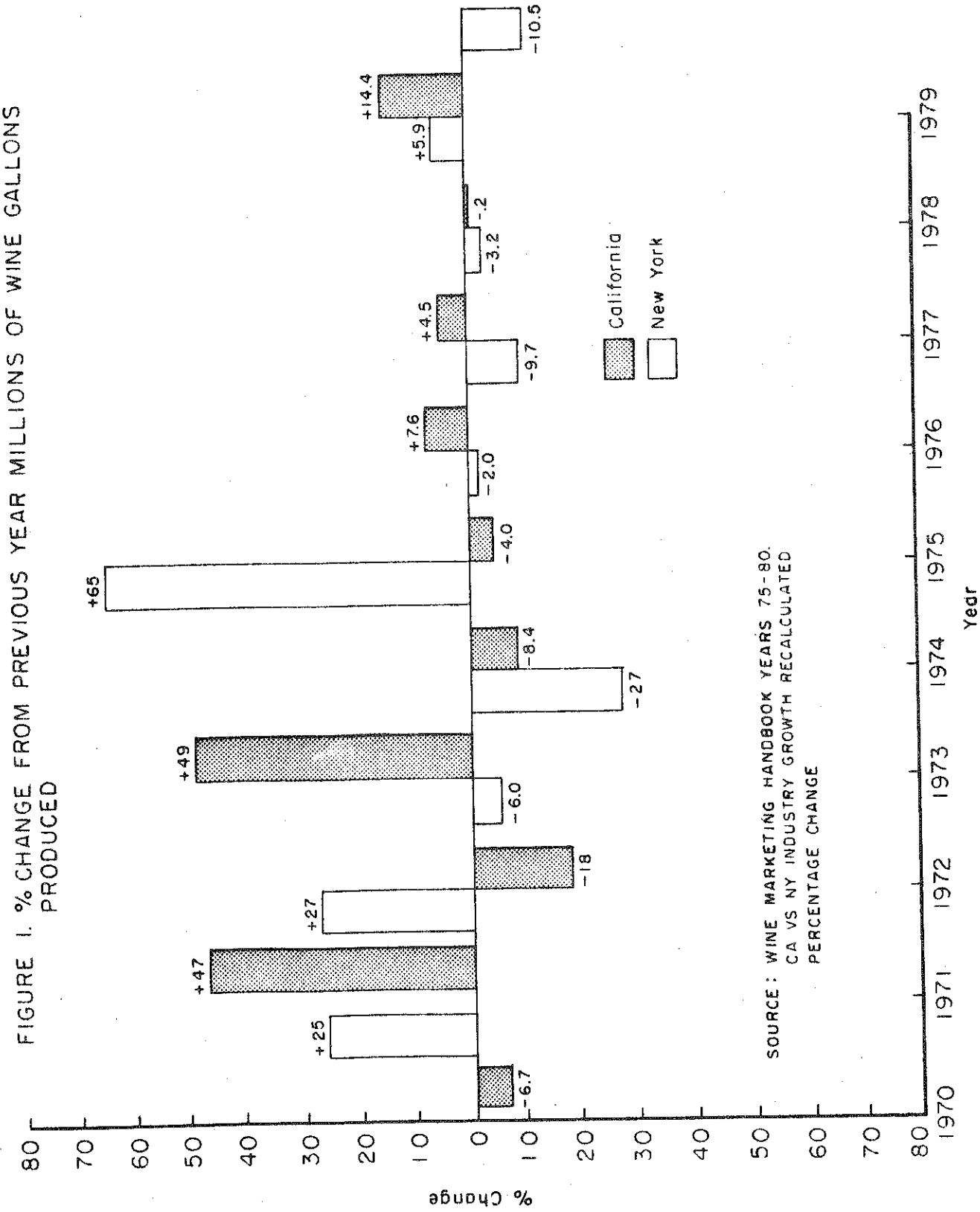
FIGURE 1. % CHANGE FROM PREVIOUS YEAR MILLIONS OF WINE GALLONS PRODUCED
% Change
Year
California
New York
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
-6.7
+25
+47
+27
-18
+49
-6.0
-27
-8.4
+65
-4.0
-2.0
+7.6
-9.7
+4.5
-3.2
-.2
+5.9
+14.4
-10.5
SOURCE: WINE MARKETING HANDBOOK YEARS 75-80.
CA VS NY INDUSTRY GROWTH RECALCULATED
PERCENTAGE CHANGE

## Literature Review

Researchers have addressed the economics of grape and wine production in earlier publications. This analysis uses updated budgets and data generated by White and Jordan [1978], Casler and White [1979], and Tompkins [1981]. These writers have analyzed the use of French Hybrids for vineyard plantings. Ledgerwood [1981] presented a budget for an on-farm winery. Production methods and varieties can be reviewed in Childers [1976], Winkler et al. [1974], Shoemaker [1975], and Jordan et al. Aplin, Casler, and Francis [1977] provide the net present value model for evaluating capital investments. Markin [1980] used an NPV analysis incorporating inflationary expectations (7.1% for costs, 7.6% for grape price increases) and discounted using a before tax weighted average cost of capital (WACC) of 13%. He analyzed conversion to the Geneva Double Curtain Viticultural System from conventional Umbrella Kniffen systems.

Gavin-Jobson Associates publishes a yearly publication on wine production and marketing [Wine Marketing Handbook] with statistical information. Other publications [Wines and Vines, Eastern Grape Grower and Winery News] have provided important statistical and economic information.

## The Analytical Model

### The Net Present Value (NPV) Method

The NPV method[1/] is widely used as a tool in financial management to estimate an investment's profitability. The method is based on the time value of money; a dollar now is worth more than a dollar one year from now. A dollar in the future is worth less because of several factors. These factors are (1) the pure time value of money, (2) inflation, and (3) the risk of holding the asset. The discount rate is comprised of these factors.

Budgets and cash flows are developed and estimated over a planning period of the investment's life. For instance, if buying a mechanical grape harvester will save $20 per ton in reduced costs per year over an estimated life of 12 years, then the $20 saved each year must be discounted by an interest rate that represents the three factors described above. The $20 in each future year must be discounted back to the present with the following formula:

$$PV = X(1+r)^{-t}$$

where PV = present value
X = cash flow in year t
r = the discount rate
t = the period (year) the cash flow occurs.

If r equals .08 then $20 received at the end of year eight is worth $10.80 today. If each year's cash flow is discounted to the present and

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1/Readers not familiar with the NPV method are encouraged to consult a reference such as Aplin, Casler and Francis.

then summed for the 12 year period, a decisionmaker can weigh the discounted savings for the tonnage he expects to harvest against the initial cost of the grape harvester. The two figures are comparable because both are present values.

One can express the 12 year cash flows as an annuity by using the following formula:

$$PV = [X] \cdot \left[\frac{1 - (1+r)^{-n}}{r}\right]$$

where X = expected annual cash flows

r = the discount rate

n = the life of the investment.

An annuity is like a bond that pays a certain amount annually for the life of the investment. A perpetuity has no termination date. However, the discounting procedure reduces the cash flows in distant years to near zero. In the annuity example above, the 12 year cash flows of $20 each year discounted at 8% represent a total present value of $150.72 per ton of grapes.

In practice, present value tables are used extensively to determine these discounting factors. One can use a calculator with an exponential function to arrive at the same result.

The simplicity with which the NPV method can be employed makes it a flexible tool to handle many kinds of situations. In this analysis estimates are made of capital outlays and annual expenses and revenues. If the analysis is done on an after-tax basis, the tax shield effects of depreciation and investment tax credits must be included and all cash income and expenses must be adjusted to an after-tax basis. These estimates are then discounted by the appropriate discount factor, expressed in present value form, summed, and the NPV calculated. A positive NPV figure represents a worthwhile investment or, alternatively, a return to those factors for which a cost was not assigned. A proposed investment exhibiting a negative NPV should be avoided.

Under variable cash flow patterns, different outcomes will occur even if the total cash flow is always the same. The timing of the cash flows is important. If a large portion of the income expected from an investment occurs early in the life of the investment, it will give more value in present terms than a similarly large cash flow occurring later. The NPV method is particularly useful for proposed investments such as a vineyard or winery which has several years of outflows before inflows begin. As we shall see, price increases for grapes will have an important effect on the final NPV, depending on the timing of those price increases. Increases or decreases in costs will have similar effects.

To use the NPV analysis correctly, estimated cash flows must be expressed in either nominal terms or real terms.[2/] Likewise, the

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[2/] Nominal means the dollars that actually change hands (inflated dollars) while real means dollars deflated to represent constant purchasing power in terms of a base year.

discount rate used should be either nominal, meaning inclusive of inflation, or real, with inflation removed. Nominal cash flows should be discounted with a nominal discount rate and real flows with a real rate. The real rate would include the pure time value of money and the risk of the investment but not inflation. This analysis included inflation in the cash flows and in the discount rate. Deriving the discount rate will be discussed in a later section.

In this NPV analysis, financing is separated from determination of investment profitability. Including interest expense would be double-counting.

## Initial Assumptions - Vineyard

The nature of the problem is to find out if investing in a new vineyard results in a positive NPV for the life of the investment. A 50-acre vineyard was developed according to the time plan in Figure 2. No yields are expected until the 4th year. All production is sold at market prices. Full production begins in the 7th year and continues until the 20th year when the vineyard and equipment are assumed to be sold. An alternative model with improved yield estimates is also evaluated. The termination date represents an evaluation of assets at the market value based on the assumptions of costs, prices for grapes, and land values explained below. A new line of machinery is purchased at year 7 and 14, an assumption generally consistent with average turnover of farm equipment in New York State. A useful life of seven years for machinery allows for maximum use of investment credit and depreciation tax savings--assuming the viticulturalist has sufficient income to shield.3/

The vineyard planting plan is presented in Table 2. White French Hybrid grapes predominate. Reisling, a vinifera, and Foch, a red, are planted for diversity. Cayuga white is an improved native variety developed by the Geneva Experiment Station. Aurore is a widely accepted grape variety and Seyval blanc has led white grape prices recently and become a favored wine. The picture for red wines is rapidly changing and substitutions for these representative varieties is encouraged for those planning a different variety mix. Ten acres of headland are purchased with the 50 acres of vineyard land. Total cost per planted acre is $1200 for the land only. Land is purchased in year zero. It is assumed that the vineyard is situated in a location which provides adequate frost protection and that the land is bare and suitable for plowing and cultivation, and immediate planting of vines.

### Yields

Yields for each variety are projected in Tables 3a and 3b. Sustained yields in year 7 are slightly above the New York State average. Sustained yield for the vineyard is 4.25 tons per acre per year. Table 3b shows a faster increase in yield during the initial years with sustained yields

3/This analysis is based on the Federal and New York Income Tax Laws in existence at the beginning of 1981. New 1981 tax legislation is presently in effect.

FIGURE 2. DEVELOPMENT OF A 50 ACRE VINEYARD FOR WINE GRAPES

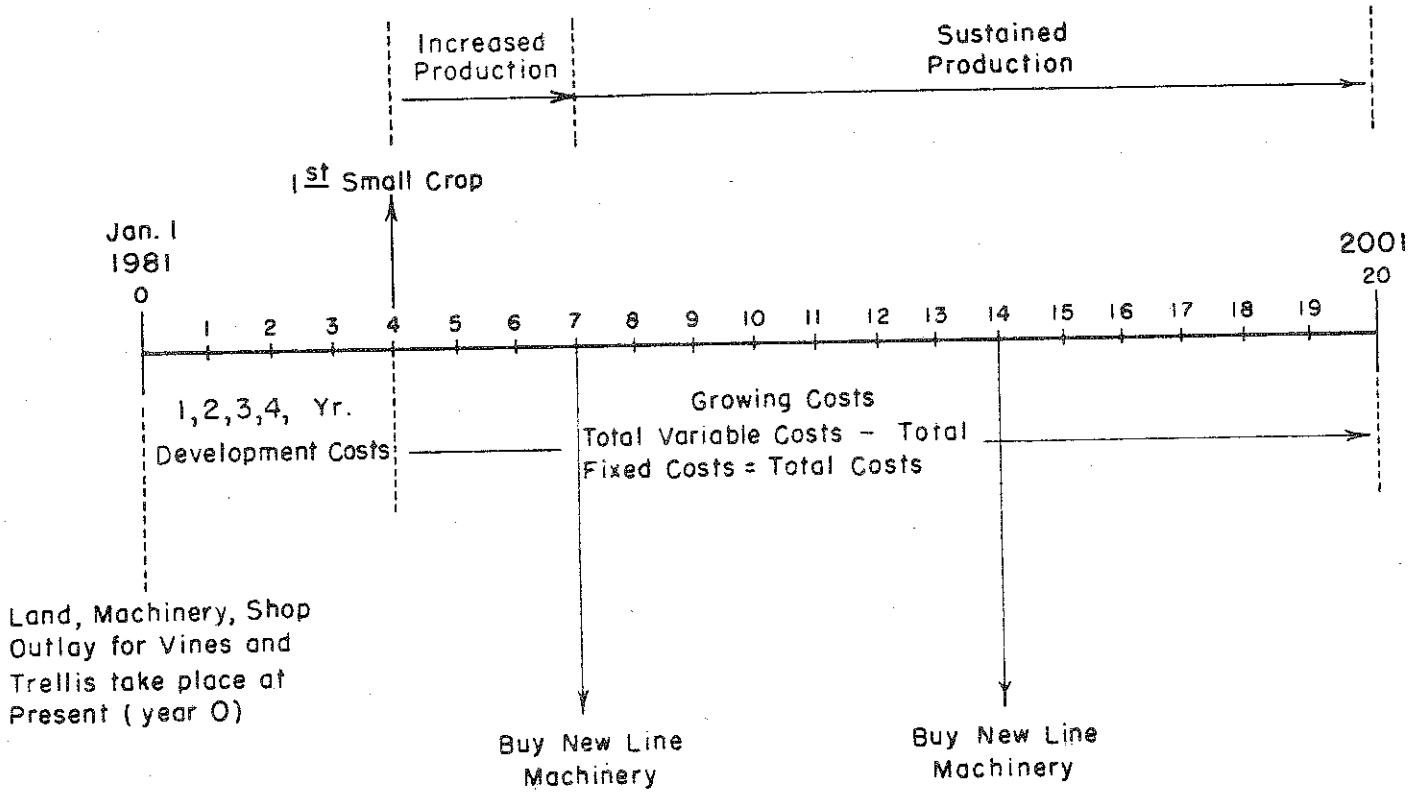


Table 2. Planting Plan.

| Variety | Type | Acres | % Total Planted | $ Cost/A |
|---|---|---|---|---|
| Seyval blanc | French Hybrid | 15 | 30 | 1,000 |
| Cayuga White | American | 15 | 30 | 1,000 |
| Aurore | French Hybrid | 10 | 20 | 1,000 |
| Reisling | Vinifera | 5 | 10 | 1,000 |
| Foch (red) | French Hybrid | 5 | 10 | 1,000 |
| Headland (not planted) | | 10 | | 1,000 |
| | | 60 acres | 100 | |
| Land cost per planted acre: $1200 | | | | $60,000 |

Table 3a. Baseline Yield Over Time.

| Variety | Years: 0-3 | 4 | 5 | 6 | 7-20 |
|---|---|---|---|---|---|
| | | | tons per acre | | |
| Seyval | 0 | 1 | 2 | 3 | 4.5 |
| Cayuga | 0 | 1 | 2 | 3 | 4.5 |
| Aurore | 0 | 1 | 2 | 3 | 4.5 |
| Reisling* | 0 | .5 | 1 | 2.5 | 3.0 |
| Foch | 0 | .5 | 2 | 3 | 3.5 |

SOURCE: See below.

Table 3b. Improved Yields Over Time.

| Variety | Years: 0-2 | 3 | 4 | 5 | 6-20 |
|---|---|---|---|---|---|
| | | | tons per acre | | |
| Seyval | 0 | .5 | 2 | 3 | 4.5 |
| Cayuga | 0 | .5 | 2 | 3 | 4.5 |
| Aurore | 0 | .5 | 2 | 3 | 4.5 |
| Reisling* | 0 | 0 | 1 | 2.0 | 3.0 |
| Foch | 0 | .5 | 2 | 2.5 | 3.5 |

SOURCE: John P. Tomkins, Department of Pomology, Cornell University, Ithaca, New York, May, 1981; and Trenholm D. Jordan Extension Viticulturalist, Great Lakes Region, New York, August, 1981.

* Separate budgets for Reisling were not developed. The analysis incorporates different yield and price estimates but assumes similar development and operating costs as French hybrids.

beginning in year 6. While the improved yield estimates may be a more realistic goal for some, the baseline yield estimates shown in Table 3a are used for the detailed illustrations of the NPV model.

Both yield models are used and the results are presented separately. Other yield estimates can be used in the model to adjust for different management capability or various soil and climate conditions.

## Budget Development

Machinery and equipment purchases are made in year zero and are presented in Appendix A. Considerable variation in equipment purchases and use can be expected as existing vineyards will spread their fixed costs over a larger acreage. Nevertheless, substantial machinery allocations will need to be made to operate an additional 50 acres of vineyard. The data in Appendix Table A1 were collected in 1978 by White in small group discussions with vineyardists in the Great Lakes Region. The data were updated for 1979 by White and Casler. For this study, machinery costs were updated from 1979 using agricultural price indices calculated from survey data collected by the Crop Reporting Board of the U.S.D.A. The indices are presented in Table 4 for years 1967-1981.

Prices for young vines, one year old of good quality, are presently about 75¢ each when ordering wholesale quantities. For many varieties, growers will have to order two to three years in advance from nursery suppliers. The planting plan calls for 691 plants/acre. Budgets were constructed from earlier work to reflect the cost of developing a vineyard during four growing seasons [White and Jordan, 1978; White and Casler, 1979]. A separate budget for growing and operating costs was used for years 5-20. Fixed costs were calculated to include repairs and maintenance of machinery. Harvest and delivery costs were adjusted to account for increasing yields as the vineyard came to full bearing age. These budgets are presented in Appendix A, Tables A2, A3, A4, and A5 respec- tively. Capital, development, and operating costs are summarized from Appendix A and presented in Table 5. These costs were used for the present value analysis.

Included in capital items are the vines and trellis of the vineyard, including planting and construction labor. According to Federal Tax Law, they are to be capitalized and depreciated over their useful life beginning at bearing age. It is common practice to expense other development costs because of the more immediate reduction in taxable income generated from other sources.

## Grape Prices

In farming, prices for agricultural products are often discussed more enthusiastically than costs. Wine grape prices have fluctuated substantially. Projecting prices is subject to greater risk than projecting costs.

Figures 3 and 4 show the trend of selected white and red wine grape prices paid by the Taylor Wine Company for the period 1966-1980. Taylor prices are detailed for an extended period and have provided a backdrop

Table 4. Index of Prices Paid by Farmers, 1967 = 100.

| % of Total Expenses* Year | (4) Fertilizer | (4) Chemicals | (3) Fuel & Energy | (14) Tractors & Machinery | (4) Buildings & Fences | (38) Wages | (28) Interest | (5) Taxes |
|---|---|---|---|---|---|---|---|---|
| 1967 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1968 | 94 | 101 | 101 | 104 | 106 | 108 | 112 | 110 |
| 1969 | 87 | 100 | 102 | 116 | 113 | 119 | 125 | 120 |
| 1970 | 88 | 98 | 104 | 116 | 113 | 128 | 134 | 129 |
| 1971 | 91 | 100 | 107 | 122 | 121 | 134 | 142 | 136 |
| 1972 | 94 | 103 | 108 | 128 | 131 | 142 | 156 | 142 |
| 1973 | 102 | 105 | 116 | 137 | 147 | 155 | 184 | 145 |
| 1974 | 167 | 119 | 159 | 161 | 181 | 178 | 223 | 154 |
| 1975 | 217 | 160 | 177 | 195 | 206 | 192 | 262 | 166 |
| 1976 | 185 | 174 | 187 | 217 | 215 | 210 | 299 | 178 |
| 1977 | 181 | 157 | 202 | 238 | 229 | 226 | 339 | 195 |
| 1978 | 180 | 147 | 212 | 259 | 248 | 242 | 396 | 210 |
| 1979 | 196 | 150 | 276 | 289 | 272 | 265 | 501 | 226 |
| 1980 (Feb. 15) | 222 | 151 | 365 | 302 | 288 | 284 | 640 | 216 |
| 1981 (Feb. 15) | 247 | 183 | 427 | 337 | 304 | 318 | 699 | 226 |

SOURCE: U.S. Crop Reporting Board, Agricultural Prices, Annual Summary 1979; and updated for 1980-81 using monthly reports.

* From White and Jordan, 1978 and Markin, 1980.

Table 5. Summary of Costs and Expenses in 1981 Dollars.*

| Item | Per Planted Acre | 50 Acres |
|---|---|---|
| **Capital Items:** | | |
| Land | $1200 | $ 60,000 |
| Equipment | 900 | 45,000 |
| Building/shop/storage | 200 | 10,000 |
| **Plants | 615 | 30,750 |
| **Trellis | 1292 | 64,600 |
| Total Capital | $4207 | $210,350 |
| **Development Costs:** | | |
| 1st year | $ 203 | $ 10,150 |
| 2nd year | 229 | 11,450 |
| 3rd year | 347 | 17,350 |
| 4th year | 512 | 25,600 |
| | $1291 | $ 64,550 |
| **Growing Costs:** | | |
| Year 5-20 (each year) | $ 654 | $ 32,700 |
| **Fixed Costs:** | | |
| Year 0 to 20 (each year) | $ 193 | $ 9,650 |
| **Harvesting Costs:** | | |
| Sustained yields (see table A.5) | $ 45/ton | $ 9,563 |

*Figures rounded to nearest dollar for ease of calculation in the analysis.

**According to IRS, the labor for planting must be included in the capitalization of the plants and trellis.

FIGURE 3. WHITE WINE GRAPES - QUOTED (NOMINAL) PRICES, TAYLOR WINE CO. 1966 - 1980

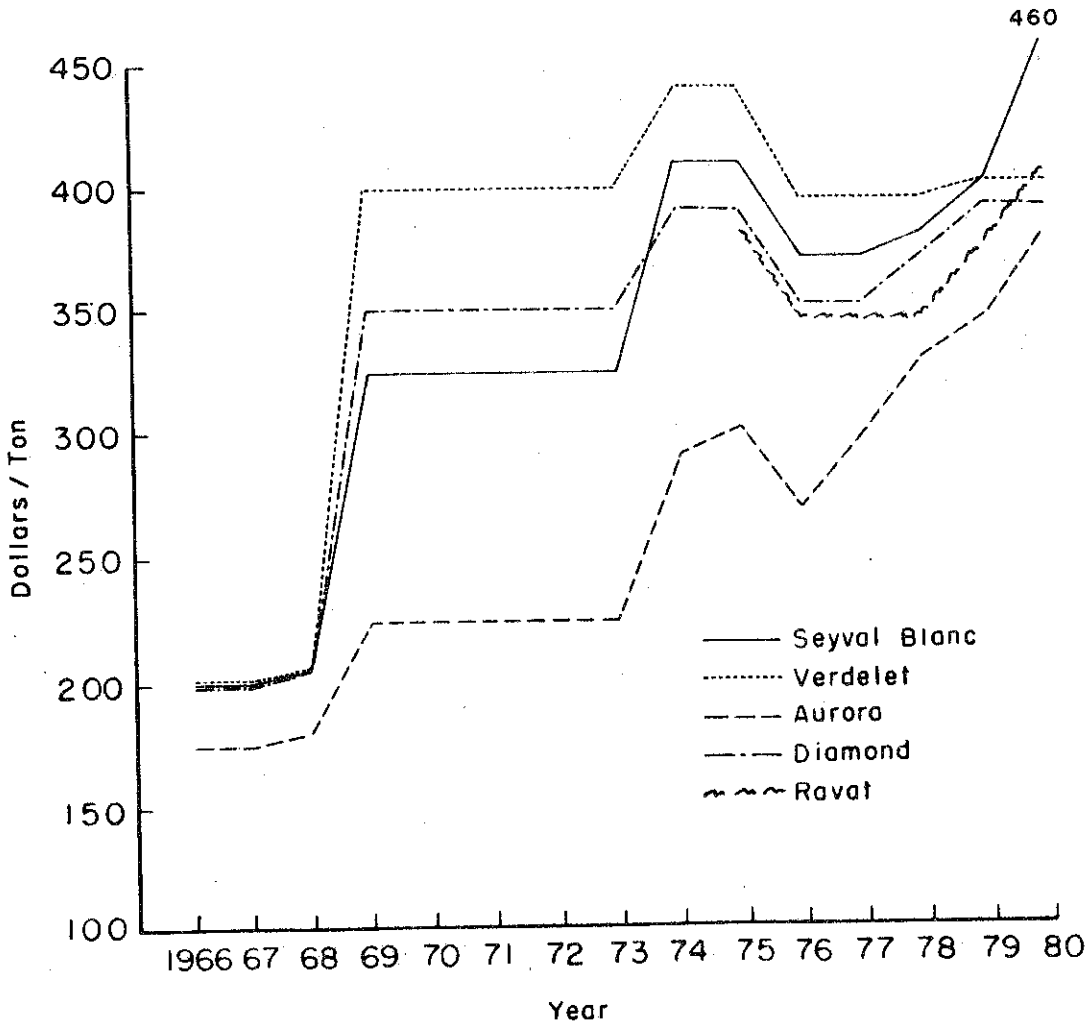
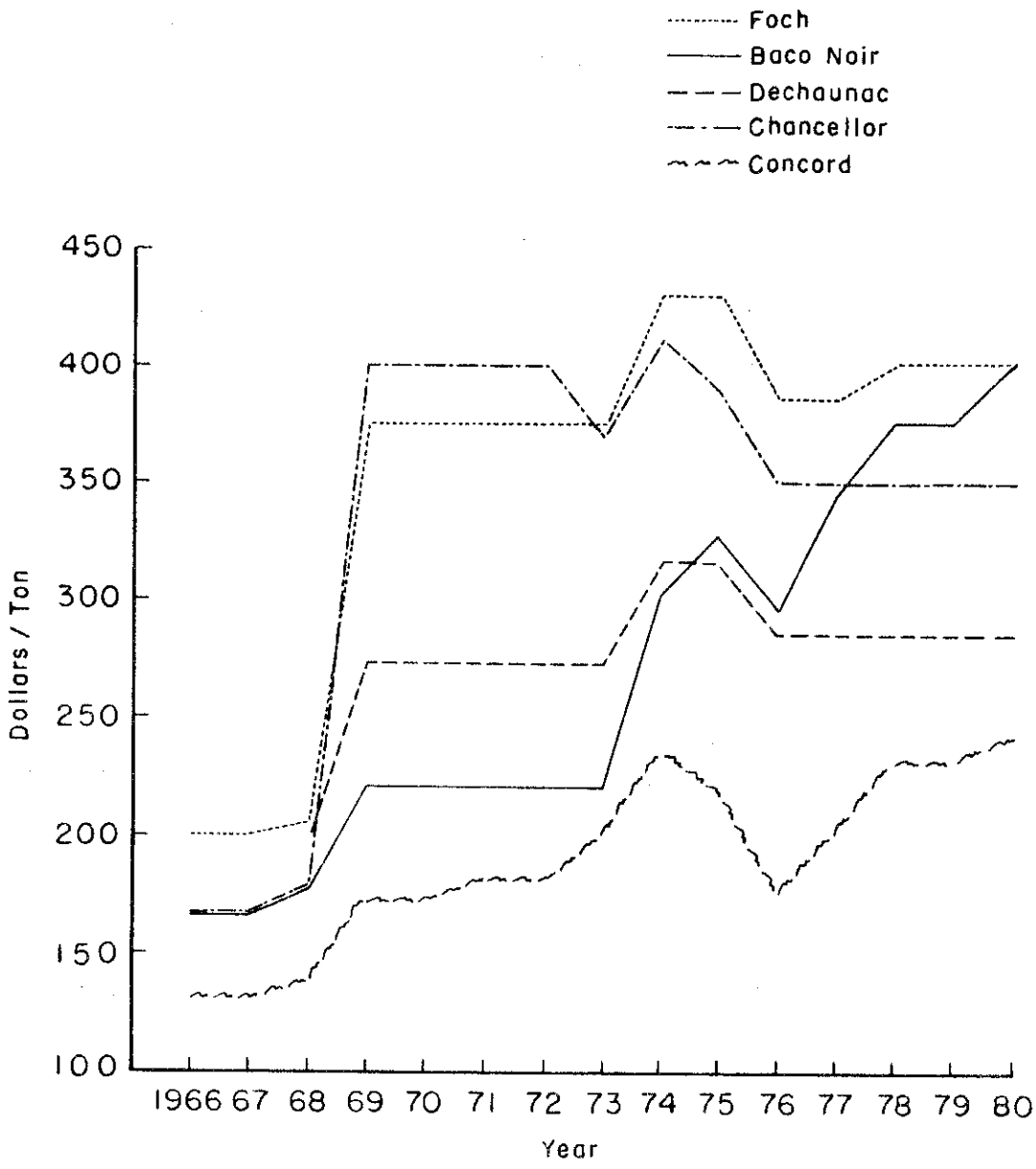


FIGURE 4. RED WINE GRAPES - QUOTED (NOMINAL) PRICES, TAYLOR WINE CO. 1966 - 1980



for the grape market in New York State. Large increases for both red and white varieties occurred in 1969. Smaller increases occurred thereafter. Figures 5 and 6 show the same data for Taylor expressed in 1972 constant dollars (deflated by the GNP price deflator). For the white varieties, similar real prices were paid in 1980 as in 1968. From this point of view one can say that prices kept up with inflation. However, if one uses the base point of 1969 in the price series, dramatic declines in real white grape prices have taken place. Similar results are seen with the red varieties though reds have suffered a decline in real price since 1966 and a larger decline since 1969 than whites.

The basic assumption that was made for this analysis was that white wine grape prices will keep up with inflation over a long period. Markin in his study, concluded that Concord prices had kept up with inflation in the 1970's. While this says nothing of the variability of cash flow requirements from year to year, the length of this present value analysis (20 years) allows for long-run grape price increases of 8% per year from 1980 prices. If sharp increases occur early in the life of the investment, this will benefit the present value of income for the 20-year period. If large increases in price are grouped toward the end of the 20-year period, the present value of income will be reduced.

There was a dramatic downward trend in real prices since 1969 for wine grapes, especially red varieties. A projection on this trend would be ominous indeed. While the view presented in this analysis is optimistic in light of this trend, it will be sufficient to continue the illustration of the present value analysis. Turnaround situations do occur, and lately nominal prices for white varieties have increased substantially. While 1981 prices at Taylor are shown in Table 6, they are not used in the analysis because of the December 1980 freeze and subsequent short crop. If 1981 does prove to be an unusual year in prices, then it is not reflected in the analysis. However, the 1981 prices being paid by Taylor do not appear to include unusual increases.

The base prices used in this study are presented in Table 6 and are inflated at 8% annually for the period of the investment. The prices should only be used as a guideline. Considerable price variability will be experienced among the various wineries, especially among those producing specialty table wines.

In a general way, one can see that between 1968 and 1981 grape prices as paid by Taylor have approximately doubled. Costs of production were estimated in 1968 [Dominick and Jordan] and are estimated in this study for 1981. In 1968, average expenses per acre were $438 and average capital investment was $1,780. In 1981, these same costs are estimated to be $1,038 inclusive of harvesting costs. Average per acre capital investment at present is estimated at $4,207. In fact, as these numbers demonstrate, costs have grown faster than prices for grapes. Growers make up the difference in increased yields and efficiency in order to remain in business over the long term.

FIGURE 5. WHITE WINE GRAPE PRICE-1972 CONSTANT DOLLARS, TAYLOR WINE CO. 1966-1980

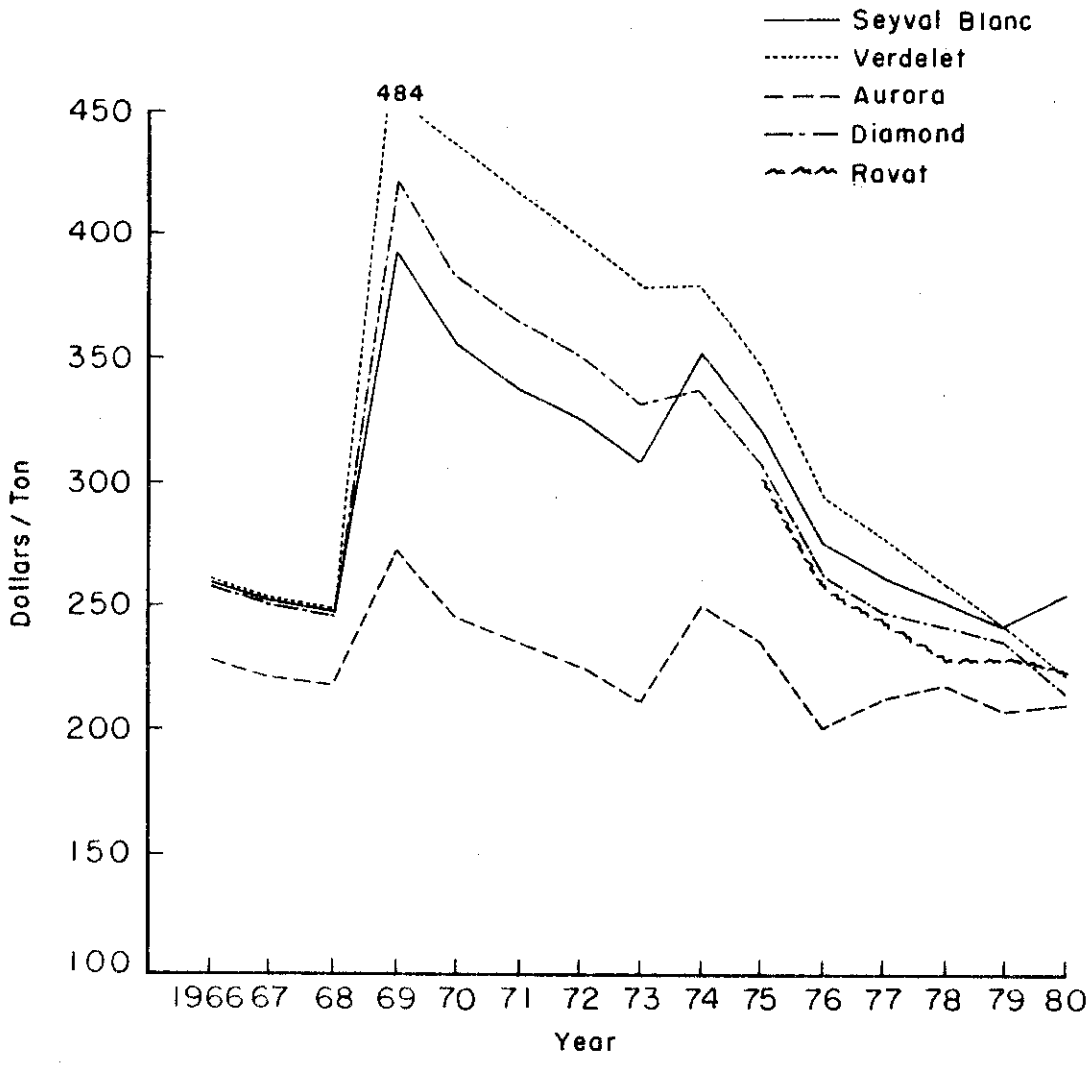


FIGURE 6. RED WINE GRAPE PRICES - 1972 CONSTANT DOLLARS, TAYLOR WINE CO. 1966-1980

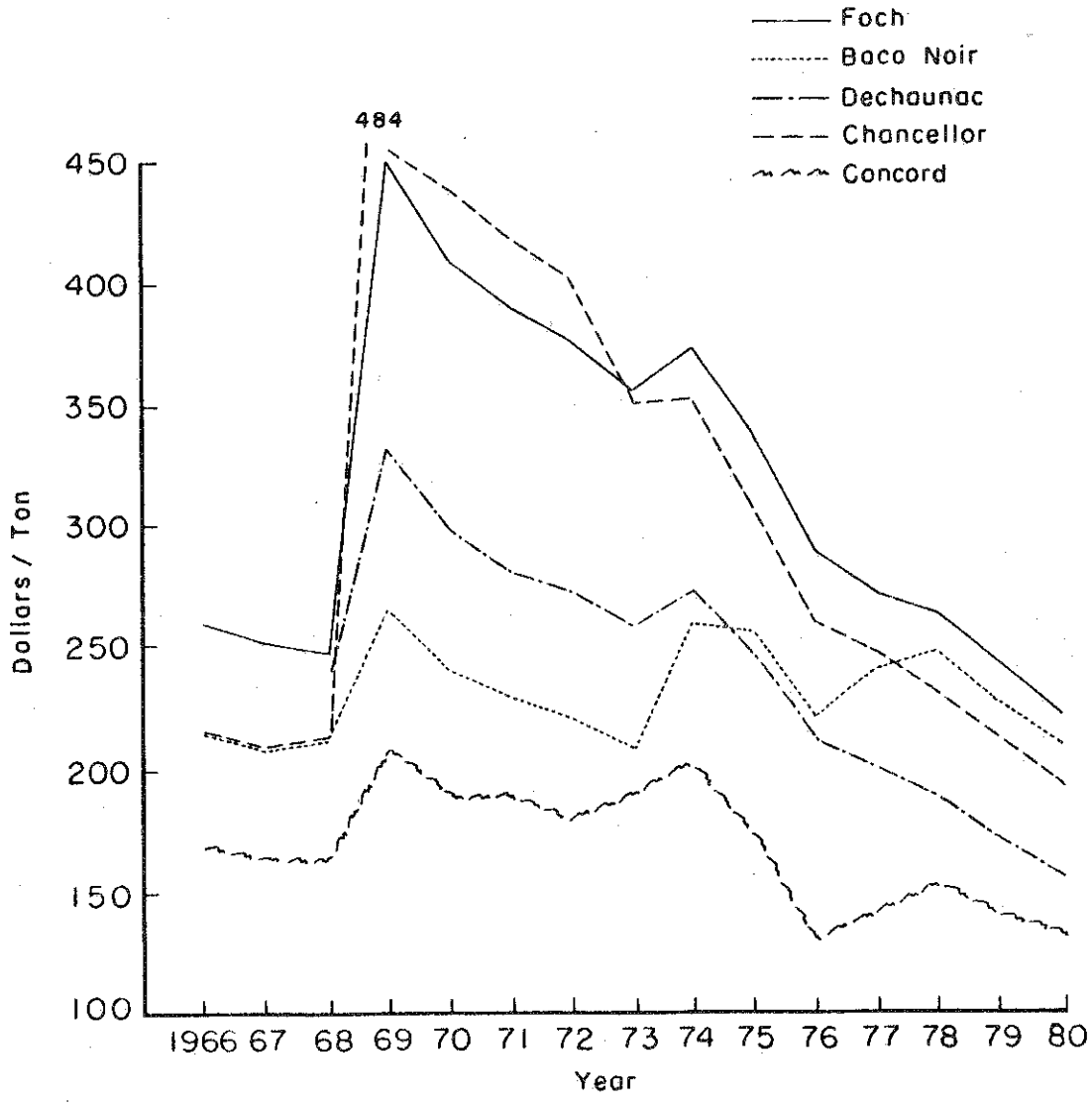


Table 6. Grape Prices, 1980.

| Variety | 1981 Actual Taylor Price | 1980 Taylor Price | 1981= 1980(1.08) Inflation** |
|---|---|---|---|
| Seyval blanc | 490 | 460 | 497 |
| Cayuga white | 410 | 370 | 400 |
| Aurore | 425 | 380 | 410 |
| Reisling* | - | 600 (1978 price) | 756 |
| Foch (red) | 400 | 400 | 432 |

*Extended price data unobtainable. Some Reisling had transferred for $1,000/ton in 1980. The 1981 base figure is perhaps a conservative estimate.

**These figures used in the cash flow estimates.

Grape land property transfers have, in the 1978-1980 period, been priced at approximately $2000 per acre [Conneman].4/ The Federal Land Bank (FLB) uses a benchmark farm for appraising loans for grape production. In 1980 the FLB benchmark was $2000 per acre. The difference between a $5000 capital and initial development cost per acre and the market prices are largely due to (1) direct capital loss after the investment is undertaken and (2) renovation and conversion costs from native varieties to the presently more popular wine hybrids. However, it should be understood that grape property markets may be quite thin and price data is variable.

## Inflation

The present value model used here includes inflation. Table 1 presented data on the major price indices. Between 1970 and 1980, the CPI increased an average of 7.7% annually using the geometric mean. For the same period, the GNP price deflator increased an annual average of 7.0%. From 1968-1978, Concord grape prices increased an average of 7.6% annually according to Markin. Per capita consumption of wine increased 8.5% from 1970 to 1979. Hughes et al. project a 7.8% annual average increase in the CPI between 1980-1990. Based on the trend of recent years and the geometric means of Table 1 data, an 8% inflation rate is used here. While the budgets were updated by directly using agricultural price indices for the same period for the items in question, projections for both costs and income were made with the 8% inflation rate. Different results are obtained in this study with inflation rates of 10, 8, and 6 percent in wine grape prices and consideration is given to a situation where initial grape price increases are large but are followed by a period of relative stagnation.

## The Discount Factor(WACC)

The discount rate chosen for the present value calculation has a major impact on the net present value. A weighted average cost of capital (WACC) [Aplin, Casler, Francis] is presented in Table 7. The vineyardist is assumed to have 48% equity in the business and 52% debt. The WACC is computed before and after tax and the interest rates are recent rates charged by lenders. Presumably, these loan rates embody the lender's estimates on inflation, the pure time value of money, and the risk of the loan. All cash flows of vineyard operation were discounted using the before-tax discount rate of 15.75%. The second and larger analysis was carried out with the 11% after-tax rate using after-tax cash flows. These rates are used in the winery investment also.

## Taxes

A Net Present Value analysis is first carried out on a before-tax basis. This might be helpful to a person just beginning farming with no income to shield.

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4/A widely used rule of thumb for pricing mature vineyards is 5 yr. avg. yield per acre X 2 yr. avg. price X 2 = value per acre of vineyard. The difference in variety yields for the variety and prices will give different values per acre.

Table 7. Weighted Average Cost of Capital.

| Source | Amount | Proportion | Interest Rate | Tax* | After-Tax Cost | Weighted Cost |
|---|---|---|---|---|---|---|
| Credit line | 20,000 | .083 | .15 | .7 | .105 | .0087 |
| 7 year loan | 75,000 | .312 | .14 | .7 | .098 | .0306 |
| Mortgage | 30,000 | .125 | .12 | .7 | .084 | .0105 |
| Equity | 115,000 | .48 | .18 | | | .0604 |
| | 240,000 | 1.0 | .1575 | | | .1102 |

| Assuming: | Debt | Equity | |
|---|---|---|---|
| Operating needs | 20,000 | 12,500 | 11% WACC after tax |
| Land purchase | 30,000 | 30,000 | 15.75% before tax |
| Buildings/equipment | 30,000 | 28,000 | |
| Development cost | 45,000 | 45,000 | |
| | $125,000 | $115,000 | |

* With a marginal tax rate of .3, the after tax cost equals the interest rate x .7.

The second analysis is carried out with some assumptions about taxes. In essence, it is assumed that the owner/operator of the vineyard or winery has income from existing farm operations or other sources which can be shielded by normal business expenses, investment credit and recovery of capital costs (depreciation tax savings). The tax deductibility of interest, expenses, and depreciation modifies the cost projections. The income projections must also be modified to account for taxes. A 30% marginal tax rate is assumed here and incorporates New York State and Federal tax rates. This means that the additional investment in the vineyard will place the owner/operator in the 30% marginal income tax bracket. While it can be argued that inflation will push the investor into higher tax brackets as time passes, in 1984 the brackets also will be indexed to inflation as the result of the 1981 Federal tax legislation.

This analysis assumed that Federal investment credit was 10% and the New York State credit was 4%. New York law has since increased the credit to 5%. Implications of the new Federal Tax Law of 1981 are still being researched, particularly in regard to the effect on the lives of machinery and buildings. The current law's figures should be inserted into any recalculation of this NPV model (in Appendix Tables B1 and B4). A total of 14% investment credit was assumed available as a direct cost recovery occurring one year after initial outlay.

Simplifying assumptions were made in relation to capital gains. Forty percent of capital gains from sale of the vineyard were included in taxable income. While this is true for Federal law, it is not for New York State. This relatively small difference between New York and Federal capital gains tax was ignored.

When capital items are sold for a gain, the 60% exclusion may be subject to the alternative minimum tax (AMT). The AMT is not brought into the calculations of this analysis, but in reality could apply to gain on the land.

## Depreciation and Salvage Values

Rapid depreciation offers a larger present value than straight line depreciation over the same life. The sum-of-the-year (SOYD) digits method is used here for eligible items. Straight line is used on the building and the vineyard. When no salvage value for tax purposes is used, as is assumed here, then SOYD allows for the greatest cost recovery. Depreciable lives are generally consistent with maximum allowable investment credit (for instance, 7 years for machinery before the 1981 tax bill). Additional first-year depreciation is also calculated on eligible items.

Salvage values for equipment were estimated at 10% of the initial investment in year zero and then inflated at selected inflation rates until the item was sold as used equipment. In the case of the vines and trellis, the estimated salvage value is 10 percent of the initial investment. Land values were directly inflated at 8 percent per year. The estimated value of land, vines, and trellis items at the end of 20 years is $324,099. This is only a 108% increase over the initial capital outlay of $155,350 for land, vines, and trellis; whereas if the initial

investment was inflated at 8% for 20 years, the final value would be an increase of 366%. The land alone was estimated to increase 366% for the 20-year period.

A reviewer of this investment analysis must keep in mind that a substantial part of the present value accumulation is in land salvage value, investment credit and the tax deductibility of depreciation and expenses acting as cost recovery. A person in a low income tax bracket would not have tax benefits from the large capital and expense flows. In regard to land, however, many economists and farmers have realized that a substantial part of farm income comes in the form of realized capital gains or real estate appreciation (which can be used as collateral). These estimates, which are presented in Appendix B, can be adjusted to suit the estimates of the reviewer.

## Cash Flow Summary

Appendix B, Tables B1 and B4 illustrate the calculations made for capital outlays and depreciation for before tax and after tax analyses. Machinery and vine purchases take place at present and the full cost of those items becomes the present value. In the after-tax example, the tax credits and the first depreciation tax savings take place one year hence, when they are claimed, and are therefore discounted by one year at 11%. The capitalized value of vines and trellis, including labor, is depreciated beginning year four. Investment credit on the vineyard is taken this year also. The expected machinery purchases beginning year seven are inflated at 8% per year and discounted by the 11% rate. While straight line depreciation is calculated as an annuity, sum of the year's digits requires a different present value calculation. The factor is taken from the depreciation tables in Aplin, Casler and Francis.

Calculations for revenues and expenses are presented in Appendix B, Tables B2, B3, B5, and B6. Fixed and variable costs are combined and inflated at 8% per year. The before- and after-tax cash flows are discounted at the WACC. The present values were summed and presented cumulatively for either a positive or negative NPV result.

## Results

The results are summarized from Appendix B and presented in Tables 8, 9, and 10. Both the before-tax and after-tax analyses are shown and can be compared. Two characteristics are immediately evident in the comparison. First, the 15.75 WACC used in the before-tax analysis is a very powerful discount factor. Initial income is not received until year four and peak income begins in year seven, while expenses and capital purchases take place in period zero and year one. Second, if expenses and capital costs cannot be recovered (through depreciation) and no investment credit is taken, no tax savings can be recorded. The two differences in the analyses account for the relatively wide difference in NPV.5/

The results of Table 8 were the main thrust of this study. The specific calculations for the baseline yield at projected 8% inflation rates for costs and revenues are illustrated in Appendix B. Results for other inflation rates are calculated for revenues only.

Table 9 presents the same assumptions and calculations as used in Table 8 but uses the improved yield condition. In both the before-tax and after-tax cases, the improved yields have increased the present value of cash receipts, largely because the flows occur earlier in the analysis. A much brighter outlook for the wine grape growers is presented in Table 9.

Both Tables 8 and 9 express the NPVs as annual equivalent cash flows. This represents the annual cash benefit (cost) accruing to the grower that is equal to the total NPV if the NPV were received today.

A positive NPV represents a return to capital higher than the cost of capital. All other costs, except for management, are assumed to have been deducted. The NPV can be called a return to management in this case or a break-even point if it were equal to zero. Negative NPVs are not worthwhile investments given the costs that are incurred. Under the conditions specified, an investment that exhibits a positive NPV should be undertaken.

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5/Of particular note is the large amount of investment credit as seen in Table 8. Consult Appendix Table B4 to see in what years the credits occur. The entire sum does not occur all in the same year but this analysis does assume that each credit is taken in the year in which it occurs.

It still may be unrealistic to assume that the credits can be deducted when they occur. They would be carried forward and therefore discounted by a smaller factor reducing the present value of investment credit.

Credit may be carried back three years and forward seven years (15 years under 1981 tax legislation). To estimate the amount of tax shielded by investment credit in each year is beyond the illustrative calculations of the study. However, it is likely that the present value of the Investment Credit would be less than the amount indicated in Table 8.

Table 8. Summary of Vineyard Present Values - Baseline Yields - 8% Inflation.

| Item | Before Tax Present Value (15.75% discount rate) | After Tax Present Value (11.00% discount rate) |
|---|---|---|
| Initial capital outlay (year 0) | -210,350 | -210,350 |
| Machinery costs in year 7 and 14 | -44,752 | - 67,809 |
| PV of capital outlays | -255,102 | -$278,159 |
| Investment credit years 1-20 | -- | + 22,535 |
| Depreciation tax savings | | |
| AFYD (on machinery) | -- | + 1,519 |
| SOYD (on machinery) | -- | + 22,857 |
| S.L. (vines, trellis, shop) | -- | + 8,697 |
| Salvage Values | | |
| Machinery | + 3,319 | + 3,917 |
| Vines | + 2,382 | + 4,850 |
| Land | + 14,990 | + 23,969 |
| PV of credits and salvage | + 20,691 | + 88,344 |
| PV of net capital outlay | -234,411 | -189,816 |
| PV of outflows, years 1-20 | -447,650 | -478,950 |
| Total cost | -682,061 | -668,766 |
| PV of revenues, years 4-20 | +650,300 | 746,850 |
| Net Present Value | - 31,761 | + 78,084 |
| Annual Equivalent Cash Flow* | $\frac{-31,761}{6.0086} = -5,286$ | $\frac{78,084}{7.9633} = 9,805.$ |

* The annual equivalent cash flow expresses the Net Present Value as an annual payment (gain or loss) or annuity that equals the NPV. Hence at 11% WACC, $78,084 today equals a $9,805 payment for 20 years.

Table 9. Summary of Vineyard Present Values - Improved Yields - 8% Inflation.

| Item | Before Tax Present Value (15.75% discount rate) | After Tax Present Value (11.00% discount rate) |
|---|---|---|
| Present value of capital outlays | -255,102 | -278,159 |
| Present value of credits and salvage | + 20,691 | + 86,106 |
| Present value of net cap. outlay | -234,411 | -189,816 |
| *PV of outflows year 1-20 (with change in harvest cost) 50 acres | -454,650 | -484,550 |
| PV of all costs | -689,061 | -674,366 |
| *PV of inflows years 3-20 | +710,700 | +798,500 |
| Net Present Value | + 21,639 | +124,134 |
| Annual Equivalent Cash Flow | $\frac{21,636}{6.0086}$ = +3,601 | $\frac{124,134}{7.9633}$ = +15,588 |

* Cash flow estimates were increased in the early years. See Tables B2 and B3 for estimates and method.

As we have seen, grape prices have historically been volatile and at times declining. Holding all costs and capital requirements constant, revenues were inflated at 10% over the 20-year period and then at 6%. This was done for both the baseline yield and the improved yield conditions (Table 10). Present values were calculated on a before-tax and an after-tax basis. Another type of scenario was also developed to illustrate that the timing of the cash flows is important to the analysis. Here it was assumed that grape prices increased 50% in year one and increased 4% annually thereafter. An illustration of how timing affects present value analysis will improve understanding of the method.

When one dollar is inflated at 6% for 20 years, it becomes $3.21. We use the compound interest formula to arrive at this figure:

$$1(1.06)^{20} = \$3.21.$$

If one dollar inflates 50% in the first year and only at 4% for the remaining 19 years, that dollar becomes $3.16 after the entire period. We compute this figure as before:

$$1(1.5)^{1} \cdot (1.04)^{19} = \$3.16$$

The latter example parallels what occurred in grape prices from 1968 to 1980 (Charts 2 and 3), that is, a dramatic increase in one year followed by small increases thereafter.

How does this affect the net present value? Even though compounding at 6% annually gives a higher value to the dollar than the 50% initial increase and a 4% annual increase thereafter, the latter case gives a higher net present value. When discounting, more weight is given to the cash flows early in the investment's life, where the increase in price occurred, than to the later cash flows toward the end of the investment's life.

The discounted payback period is the sum of the present value of outflows and inflows beginning with the initial outlay and continuing each year until the NPV first becomes positive. From that year forward, increases in the NPV will take place.

The four groups of assumptions calculated here are presented in Table 10. The results in the table emphasize that the expectation of the inflation rate for grape prices can have a large effect on the final NPV, AECF, and the discounted payback period. The ability to recover costs through investment credit, depreciation tax savings, and deductible expenses also plays an important part in the profitability of the investment. The actual timing of the cash flows will have an important influence on the NPV outcome. As one would expect, improved yields offer more profitability. It should be remembered that sustained yields are the same in both yield models. The improved yield condition allows for a more rapid increase in yields during the initial years (1-6) of the vineyard.

The use of the WACC does implicitly make an assumption about risk. If, after studying the variability of the possible outcomes in Table 10, the assumptions on uncertainty seem too small, one way to make an

Table 10. Summary of NPV and AECF Under Different Yield, Price, and Tax Assumptions.

| Scenario | Value of $1 after 20 Years | Vineyard NPV | AECF | Discounted Payback (years) |
|---|---|---|---|---|
| Expected grape price inflation: | | | | |
| 10% annually | 6.73 | | | |
| A. baseline yield | | | | |
| - before tax | | +122,239 | +20,344 | 16 |
| - after tax | | +264,785 | +33,251 | 14 |
| B. improved yield | | | | |
| - before tax | | +181,189 | +30,155 | 13 |
| - after tax | | +319,535 | +40,126 | 12 |
| 8% annually | 4.66 | | | |
| A. baseline yield | | | | |
| - before tax | | - 31,761 | - 5,286 | -- |
| - after tax | | + 78,084 | + 9,805 | 18 |
| B. improved yield | | | | |
| - before tax | | + 21,639 | + 3,601 | 20 |
| - after tax | | +124,134 | + 15,588 | 16 |
| 6% annually | 3.21 | | | |
| A. baseline yield | | | | |
| - before tax | | -154,811 | - 25,765 | -- |
| - after tax | | - 72,065 | - 9,050 | -- |
| B. improved yield | | | | |
| - before tax | | -106,011 | - 17,643 | -- |
| - after tax | | - 31,015 | - 3,895 | -- |
| A 50% increase in year one with a 4% increase thereafter. | 3.16 | | | |
| A. baseline yield | | | | |
| - before tax | | - 64,111 | - 10,670 | -- |
| - after tax | | + 20,085 | + 2,522 | 19 |
| B. improved yield | | | | |
| - before tax | | + 1,689 | + 281 | 20 |
| - after tax | | + 75,585 | + 9,492 | 13 |

adjustment is to increase the cost of equity capital when computing the WACC. Of course, any of the assumptions about the cost of capital, the capital outlays, expenses, taxes, receipts, etc. can be altered and the analysis recalculated. This exercise presents a framework that can be used by investors and decisionmakers to estimate the profitability of vineyard investments.

## Addition of an Estate Winery

The NPV approach will be taken in evaluating the winery. Capital cost and operating expense data were not widely available. Much variability can be expected, depending on the type of grapes used, wines made, and quality of wine sought. Ledgerwood [1981] presented capital cost and expense data for an onfarm winery. These data will be used here with only slight modification.

A 12,000-gallon winery was evaluated in the framework of the time plan in Figure 7. It was assumed that land, supporting equipment, and a reasonably attractive location and tasting facility were already present.[6/] The winery budget as developed by Ledgerwood was based on 1980 estimates and the same prices will be used here. One major change is in the price per acre the winery pays for its grapes. Ledgerwood apparently assumed that the grapes were bought at cost from the vineyard. In calculating this present value analysis market prices for grapes will be used. This accounts for the opportunity cost of the grapes if sold in the market and allows the winery to buy grapes elsewhere if necessary. However, our grape cost to the winery is more than twice the cost that Ledgerwood used. The market price of grapes is the same price earlier developed for a 1981 vineyard in sustained production.[7/]

Ledgerwood did not incorporate the time value of money into his budgeting analysis. He included interest costs in the cashflow evaluation. While it is useful to project cash flows, including interest, a present value analysis would double-count interest charges. Therefore, interest costs were not included in the budget used for this present value evaluation.

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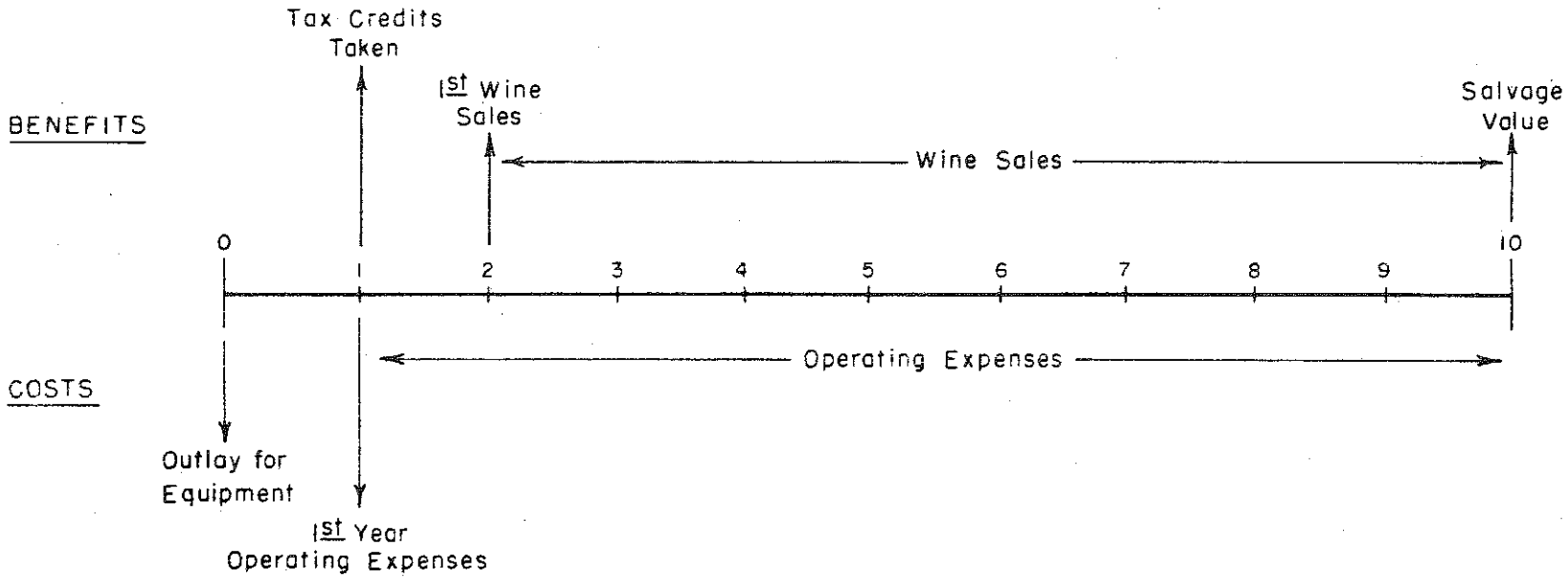
[6/]This exclusion of certain items needs emphasis. While a 12,000 gallon winery is small, capital will still be needed to develop a tasting facility, operate it, and advertise. The operation of a winery may include a picnic area on the grounds, use of the produced wine in the tasting room, and maintenance. As this is not included in Ledgerwood's budgets, and there is little empirical evidence from survey work currently available, this analysis does not include a charge for the location and tasting facility.

[7/]Here, the price per acre is based on the prices presented in Table 5. A yield of 4.25 tons/acre with the same ratio of varieties as explained earlier in the vineyard analysis (Table 1) was assumed. Ledgerwood apparently used lower yields as 25 acres yielding 4.25 tons/acre may be more than 12,000 gallons. The 8% inflation scenario is used. Hence, the per acre price is calculated as follows: The sum of (1981 variety price)x(proportion of vineyard in variety)x(yield in tons of variety)x$(1.08)^t$, where t is the year in which the grapes are purchased from the vineyard.

FIGURE 7. INVESTMENT IN AN ON FARM ESTATE WINERY



## Cash Flow Summary

The same methodology was used here as was used for the present value analysis of the vineyard. Wine sales do not begin until year two. Revenues and expenses were inflated at the projected 8% rate. Rapid depreciation methods and investment credits were used fully. A marginal tax rate of 30% was assumed as was an 11% WACC discount rate.[8/] Salvage values were calculated as previously. Other assumptions are similar to those in the vineyard analysis.

Appendix C, Table 1 illustrates the calculations made for capital items and operating expenses. Budgets are not separately included, but are the same as in Ledgerwood's analysis. Appendix C, Table 2 shows the present value of wine sales where 50% are marketed wholesale and 50% are marketed retail. The average price consists of these two components of total sales and is the revenue used for the analysis.

The sensitivity analyses carried out on the vineyard were not carried out for this model. The model will be sensitive to changing assumptions. The NPV model is presented so that others can make their own estimates and obtain their own outcomes.

## Results

Table 11 summarizes the present values of Ledgerwood's winery. Given the assumptions, the investment in the winery also appears to be a profitable one. The net present value of $128,338 constitutes a return to those factors not considered in the analysis. A tasting facility, different types of cooperage, advertising costs and management return are not fully accounted for in the analysis. Nevertheless, the major capital and operating costs have been included and the results appear realistic.

Retail and wholesale wine prices are also very sensitive to consumer tastes. Large new plantings in California that are coming into production must find a market. Increased European wine sales can be expected. While there is great potential for Americans to increase consumption, this must occur in the early part of the 1980's to assume a strong price for wines. Disposable income has been shown to have an important influence on wine purchases by consumers.

A winemaker will generally have more control over prices received than a vineyardist. Winemakers can differentiate their product, increase sales through advertising, have more flexibility in selling to different markets, can attract tourist dollars, and are storing and handling a less perishable product than vineyardists. A diligent manager and a good winemaker may expect a good return from the investment under the assumptions in this analysis.

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[8/] This analysis was conducted using the tax laws in use until June 1981. The 1981 Federal Tax bill was not used. Principle changes will be in depreciable lives and allowable investment credit.

Table 11. Summary of Winery Present Values on an After-Tax Basis.

| Item | Present Value Subtotal | Total |
|---|---|---|
| **Costs** | | |
| Initial Outlay | | |
| -Building | -36,000 | |
| -Crushing equipment | -55,000 | |
| -Storage and processing | -37,130 | |
| -Bottling equipment | - 6,680 | |
| Total | | -134,810 |
| Additional Storage Purchase year 2 and 3 | | - 22,413 |
| Operating Expenses year 1-10 | | -571,860 |
| Present value of all costs | | -729,083 |
| **Benefits** | | |
| Investment credit - all years | +15,289 | |
| Tax benefits from A.F.Y.D. | + 1,081 | |
| Tax benefits from S.O.Y.D. | +19,327 | |
| Tax benefits from Straight Line Depreciation | + 7,606 | |
| Total | | + 43,303 |
| Salvage Values | | |
| Original building and equipment | + 7,390 | |
| Additional storage | + 718 | |
| Total | | + 8,108 |
| Operating Revenues (wine sales) | | +806,010 |
| Total Benefits | | 857,421 |
| Net present value | | 128,338 |
| Annual Equivalent Cash Flow $\frac{128,338}{5.8892}$ = | | $ 21,792 |

## Limitations of This Study

One limitation of this study of vineyard and winery investments is the lack of current data collected from vineyardists and winemakers themselves. The data used here are reconstructed and updated budgets from earlier work in this field. A useful approach would be to gather cost and revenue data from the industry with surveys for use in the NPV analysis.

Grape variety price statistics for the New York wine industry are not readily available. The prices used were for the Taylor wine company only. Considerable variation does exist. In addition, it was assumed that all the production from the vineyard could be sold. This has not been historically true. Recently, some red wine grapes have been left to rot on the vine. In this light, the analysis may give an overly optimistic view of the outlook for the industry. Furthermore, the number of estate wineries in New York is increasing rapidly. The potential price depressing effect of many new labels coming on the market at once was ignored. The assumptions on inflation and the components of the weighted average cost of capital have a great effect on the final value of the analysis. This is an implicit risk of using an analysis of this kind. The best approach for a decisionmaker is to test how sensitive the model is to changes in these two parameters.

An unrealistic but necessary assumption was made in regard to the availability and price of nursery stock used for initial planting. A grower may have a 2-3 year wait for some varieties.

It may be unrealistic to assume that if grape prices increase at 10% annually that costs will not do the same. The purpose of selecting different rates of increase in prices and costs was to illustrate the effects of disproportionate rates of inflation.

As with any model of an investment decision, other assumptions are arrived at subjectively. A new vineyardist may have limited income and not be able to take advantage of the tax credits and deductions. In other investments, this tax shield component has been saleable to other investors who can take advantage of tax credits, depreciation tax savings, and certain expenses. The possibilities suggested here are beyond the scope of this study.

## Summary and Conclusions

The NPV method of evaluating capital investments is the preferred decision criterion. The model is flexible. If the decisionmaker is in a different tax bracket or has a higher cost of equity capital, then this can be immediately incorporated into the analysis.

Based on the material presented, an investment in either a winery or a vineyard would be worthwhile on an after-tax basis if wine grape prices keep up with inflation. If one invested in both projects, considerable income would accrue to the owner. However, the capital costs would be twice as much. Tables 8, 9, 10 and 11 summarize the findings of vineyard and winery analyses.

The solutions are sensitive to changes in the various parameters. As shown, grape prices and inflation can have a very large impact on the profitability of the enterprise. In times of accelerating inflation rates, the degree of risk being assumed also accelerates. Risk exposure increases if inflation unexpectedly declines. While the model is sensitive, it reflects what can happen in an inflationary environment.

Additional research is needed to project grape and wine prices using more complete data than presented here. Marketing studies to determine the changing tastes of consumers and the elasticity of demand for wine would be useful. Other studies taking place concurrently include marketing alternatives for wineries and financing on-farm wineries. Research on wine industry regulation would be useful in understanding the constraints on distribution and marketing.

Converting an existing vineyard to alternative varieties is a fruitful area for further present value analysis. If land is left fallow for three years before vine planting, discounting will have a large negative impact on the investment's profitability. Conversion options open to vineyardists can be evaluated within the present value framework.

A most interesting future lies ahead for this industry, a future that would benefit from immediate aggressive investment and marketing.

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# APPENDIX A

## Capital and Operating Budgets

Table A1. Equipment Purchases

| Item | 1979 Cost | Inflation factor* | 1981 Cost (New) |
|---|---|---|---|
| Tractor 40 h.p. | $10,212 | $(1.08)^2$ | $11,911 |
| Sprayer | 7,770 | " | 9,063 |
| Brush chopper | 1,143 | " | 1,333 |
| Fertilizer spreader | 921 | " | 1,074 |
| Disc, Large | 2,775 | " | 3,237 |
| Disc, Small | 1,143 | " | 1,333 |
| Weed sprayer | 1,288 | " | 1,502 |
| Post driver | 1,243 | " | 1,450 |
| Trailer | 500 | " | 583 |
| Auger | 999 | " | 1,165 |
| Containers (550 plastic crates) | 833 | " | 972 |
| Bird control (French Hybrids-1978 | 2,830 | $(1.08)^3$ | 3,565 |
| Shop equipment | 3,330 | " | 3,884 |
| Miscellaneous equipment | 3,330 | " | 3,884 |
| Total equipment | | | $44,956 |
| Shop and Storage Building (48' x 36') | 8,884 | $(1.06)^2$ | 9,982 |

SOURCES: Good, D. and T. Jordan, Vineyard Establishment Costs in the Great Lakes Region of New York. A.E. Ext. 76-31, August 1976. Costs updated to 1979 by White and Casler--updated here to 1981.

White, G. and T. B. Jordan, Economics of Grape Production in the Great Lakes Region of New York, A.E. Ext. 78-36, November 1978.

*Inflation factor derived from agricultural price data as described in Table 3. Is the average of 1979-81 price increases for tractors and machinery as given in the index.

Table A2. Single Curtain French Hybrid Development Costs/Ave. 1981 $

| Operations | Labor Hours | Equipment Hours | $(1.096)^{2}$* Labor Costs | $(1.096)^{2}$* Equipment Costs | (1.096)* Materials Costs | Total Costs |
|---|---|---|---|---|---|---|
| First Year | | | | | | |
| Plowing | 2.0 | 2.0 | 10.20 | 3.20 | --- | 13.40 |
| Discing (2x) | 1.6 | 1.6 | 8.20 | 2.56 | --- | 10.76 |
| Planting/pruning | 19.0 | 5.5 | --- | 8.86 | --- | 8.86 |
| Fertilization | 1.0 | 1.0 | 5.10 | 1.60 | 24.02 | 30.72 |
| Pushup | 4.0 | 3.0 | 20.42 | 4.80 | --- | 25.22 |
| Weed spray (1x) | 1.0 | 1.0 | 5.10 | 1.60 | 6.20 | 12.90 |
| Tillage | 2.0 | 1.0 | 10.20 | 1.60 | --- | 11.80 |
| Spraying (2x) | 1.0 | 1.0 | 5.10 | 1.60 | 20.18 | 26.88 |
| Cover crop seeding | 1.0 | 1.0 | 5.10 | 1.60 | 3.96 | 10.66 |
| Rogueing | 1.0 | --- | 5.10 | --- | --- | 5.10 |
| Stone removal/lad mont | 3.0 | 3.0 | 15.75 | 4.80 | --- | 20.55 |
| Trellis construction | 40.5 | 13.5 | --- | --- | --- | --- |
| Other $(1.10)^{2}$ | | | | | | 26.62 |
| Total | | | | | | 203.47 |
| Capitalized: | | | | | | |
| Plants 691 vines/ave. at .75 each plus labor | | | 97.00 | | 518.25 | 615 |
| Trellis construction plus labor | | | 206.76 | | 1085.00 | 1292 |
| Second Year | | | | | | |
| Pruning/brush removal | 5.0 | --- | 25.52 | --- | --- | 25.52 |
| Tying | 7.0 | --- | 35.70 | --- | 2.52 | 38.22 |
| Fertilizer | 1.0 | 1.0 | 5.10 | 1.60 | 10.57 | 17.27 |
| Weed control | 1.0 | 1.0 | 5.10 | 1.60 | 6.20 | 12.90 |
| Suckering/flower removal | 8.0 | --- | 40.84 | --- | --- | 40.84 |
| Tillage | 4.0 | 4.0 | 20.42 | 6.40 | --- | 26.82 |
| Spraying | .5 | .5 | 2.56 | .80 | 10.10 | 13.46 |
| Covercrop seed/chop | 1.0 | 1.0 | 5.10 | 1.60 | 3.96 | 10.66 |
| Vine replacement | --- | --- | 5.10 | --- | 6.20 | 11.30 |
| Rogueing | --- | --- | 5.10 | --- | --- | 5.10 |
| Other | --- | --- | --- | --- | --- | 26.62 |
| Total | | | | | | 228.71 |
| Third Year | | | | | | |
| Pruning/brush removal | 18.0 | --- | 91.89 | --- | --- | 91.89 |
| Tying | 12.0 | --- | 61.26 | --- | 4.20 | 65.46 |
| Fertilizer | .5 | .5 | 2.55 | .80 | 21.14 | 24.49 |
| Pushup | 1.0 | 1.0 | 5.10 | 1.60 | --- | 6.70 |
| Weed control | 1.0 | 1.0 | 5.10 | 1.60 | 6.20 | 12.90 |
| Suckering/flowers removal | 8.0 | --- | 40.84 | --- | --- | 40.84 |
| Tillage (3x) | 4.0 | 4.0 | 20.42 | 6.40 | --- | 26.82 |
| Spray (3x) | 1.5 | 1.5 | 7.66 | 2.40 | 30.27 | 40.33 |
| Covercrop seed/chop | 1.0 | 1.0 | 5.10 | 1.60 | 3.96 | 10.66 |
| Other | | | | | | 26.62 |
| Total | | | | | | 346.71 |
| Fourth Year | | | | | | |
| Fall fertilizer | .2 | .2 | 1.02 | .32 | 11.99 | 13.33 |
| Pruning | pcwk | --- | 159.88 | --- | --- | 159.88 |
| Brush pulling | pcwk | --- | 23.99 | --- | --- | 23.99 |
| Brush chopping | .5 | .5 | 2.55 | .80 | --- | 3.35 |
| Trellis maint. | 1.0 | .5 | 5.10 | .80 | 3.84 | 9.74 |
| Tying (umbrella) | 20.0 | --- | 102.10 | --- | 4.20 | 106.30 |
| Spring fertilizer | .5 | .5 | 2.55 | .80 | 22.20 | 25.55 |
| Layering | 2.0 | --- | 10.21 | --- | --- | 10.21 |
| Weed Spray | 1.5 | 1.5 | 7.66 | 2.40 | 6.20 | 16.26 |
| Phomopsis spray | .3 | .3 | 1.54 | .48 | 2.40 | 4.42 |
| Suckering/sprouting | 3.0 | --- | 15.32 | --- | .86 | 16.18 |
| Diseased trunk removal | 1.0 | --- | 5.10 | --- | --- | 5.10 |
| Tillage (3x) | 4.0 | 4.0 | 20.42 | 6.40 | --- | 26.82 |
| Spraying (3x) | 2.0 | 2.0 | 10.21 | 3.20 | 40.36 | 53.77 |
| Covercrop | 1.0 | 1.0 | 5.10 | 1.60 | 3.96 | 10.66 |
| Other | | | | | | 26.62 |
| Total | | | | | | $512.18 |

SOURCE: White and Casler, 1979. All data is expressed in 1981 dollars.

*Inflation factors based on Table 4 data. Equipment cost index a weighted average of tractor and machinery and fuel indices. Materials costs inflated using fertilizer, chemical, and building indices.

Table A3. Typical Variable Cost Per Acre of Growing French Hybrid Grapes, Great Lakes Region, 1978 Updated to 1981.

| Inflation rates used:* | | $(1.095)^3$ Labor | | | | $(1.246)^3$ Equipment | | | | $(1.086)^3$ Materials | | Total Variable Costs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Operation | Type | Hours | Rate[a] | Cost | Type | Hours | Rate[b] | Cost | | Item | Cost | |
| Fall fertilization (1/3 of acreage) | hourly | .17 | 6.07 | 1.03 | tractor/ spreader | .17 | 1.93 | .33 | | 400# potash | 10.25 | 11.61 |
| Pruning[c] | piecework @ $.26/vine | | | 179.66 | | | | | | | | 179.66 |
| Brush pulling[c] | piecework @ $.04/vine | | | 27.64 | | | | | | | | 27.64 |
| Brush cropping | hourly | .50 | 6.07 | 3.04 | tractor/ chopper | .50 | 1.93 | .97 | | | | 4.01 |
| Trellis maintenance[d] | hourly | 4.00 | 6.07 | 24.28 | tractor/ post driver/ trailer | 1.00 | 1.93 | 1.93 | | 6 posts @ $2.30<br>miscellaneous sup. | 17.68<br>2.24 | 46.13 |
| Tying | hourly | 20.00 | 4.26 | 85.22 | | | | | | 2 lbs. wire<br>2 lbs. twine | 2.24<br>1.84 | 89.30 |
| Spring fertilization | hourly | .50 | 6.07 | 3.04 | tractor/ spreader | .50 | 1.93 | .97 | | 210 lbs. Am. Nit. | 20.17 | 24.18 |
| Layering | hourly | 2.00 | 6.07 | 12.14 | | | | | | | | 12.14 |
| Weed spray (1.5x) | hourly | 1.50 | 6.07 | 9.11 | tractor/ sprayer | 1.50 | 1.93 | 2.90 | | herbicide | 9.57 | 21.58 |
| Phomopsis spray | hourly | .33 | 6.07 | 2.00 | tractor/ sprayer | .33 | 1.93 | .64 | | fungicide | 2.56 | 5.20 |
| Suckering and sprouting[e] | hourly | 9.00 | 4.26 | 38.34 | | | | | | twine | .92 | 39.26 |
| Diseased & dead trunk removal[f] | hourly | 1.00 | 6.07 | 6.07 | | | | | | | | 6.07 |
| Sprouting & thinning[e] | hourly | 8.00 | 4.26 | 34.08 | | | | | | | | 34.08 |
| Tillage (3x) | hourly | 4.00 | 6.07 | 24.28 | tractor/ disc | 4.00 | 1.93 | 7.72 | | | | 32.00 |
| Spraying (5x)[g] | hourly | 2.50 | 6.07 | 15.18 | tractor/ sprayer | 2.50 | 1.93 | 4.83 | | spray materials | 61.22 | 81.23 |
| Seeding cover crop | hourly | .33 | 6.07 | 2.00 | tractor/ spreader | .33 | 1.93 | .64 | | 50 lb. rye | 3.84 | 6.48 |
| Chopping cover crop | hourly | .33 | 6.07 | 2.00 | tractor/ mower | .33 | 1.93 | .64 | | | | 2.64 |

Table A3. (continued)

| Inflation rates used:* | | $(1.095)^3$ Labor | | | | $(1.246)^3$ Equipment | | | $(1.086)^3$ Materials | | Total Variable Costs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Operation | Type | Hours | Rate[a/] | Cost | Type | Hours | Rate[b/] | Cost | Item | Cost | |
| Crop estimate | hourly | .25 | 6.07 | 1.52 | | | | | | | 1.52 |
| Leaf analysis (1/4 of acreage) | hourly | .25 | 6.07 | 1.52 | | | | | leaf and soil kit | 3.68 | 7.84 |
| Pickup truck (gas) | | | | | | | | 13.66 | | | 13.66 |
| Land maintenance | hourly | 1.00 | 1.00 | 6.07 | tractor | 1.00 | 1.93 | 1.92 | | | 8.00 |
| Total[h/] | | 54.66 | | 478.20 | | 12.16 | 3.68 | 23.50 | | 136.21 | 654.23 |

a/ Wage rates are $4.25/hour for labor of the same quality as the owner's labor, and $3.68 for other hired labor. Additional costs for Social Security at 6.65% and Workmen's Compensation at 9.01% are included in the cost of labor.

b/ Fuel, oil, and lubrication for tractor only.

c/ Assumes 691 vines (9'x7' spacing) per acre. Piecework rate includes Social Security and Compensation.

d/ Dependent on age; assumes high tensile crop support wire, treated posts, and anchored end structure.

e/ Suckering and sprouting costs vary considerably by variety and age of vineyard. Assumes mature (6+ years) vineyards of varieties like Aurora and Dechaunac.

f/ Diseased and dead trunk removal includes "Eutypa Dieing Arm" plus winter-killed or mechanically damaged trunks.

g/ Includes a pre-bloom and the standard three post-bloom insect and disease control sprays plus one additional spray that could be a pre-bloom insect/disease control application, an alar application on 1/3 of acreage, a midsummer banded leaf roller application, or a late season mildew control application. Cost is the average of prices quoted to 50-acre growers by two major chemical suppliers.

h/ On those farms spreading grape promace, the variable cost per acre would be increased by an estimated $3.50.

SOURCE: White et al., 1978. *Inflation rates obtained from Agricultural Price Indices, Table 3.

Table A4. Fixed Costs: French Hybrid Vineyard 1981 Per Acre.

| | 1978 Costs | Inflation Factor* | 1981 Cost |
|---|---|---|---|
| Annual repairs, maintenance and insurance, taxes on machinery and building | 98.77 | $(1.092)^3$ | 128.62 |
| Property taxes | 33.00 | $(1.029)^3$ | 35.95 |
| Utilities | 7.00 | $(1.094)^3$ | 9.16 |
| Bus. organization, accounting, office | 13.00 | $(1.094)^3$ | 17.02 |
| Liability insurance | 2.00 | $(1.094)^3$ | 2.62 |
| | | | $193.36 |

SOURCE: White et al., 1978.

* Factors used--machinery index $(1.092)^3$, R.E. tax index $(1.029)^3$, and GNP price deflator $(1.094)^3$.

Table A5. Harvesting Costs in 1981 Prices - Baseline Yield.

| | | dollars cost per acre per year | | | | |
|---|---|---|---|---|---|---|
| Variety | Acres | 0-3 | 4 | 5 | 6 | 7-20 |
| Seyval blanc | 15 | 0 | 45 | 90 | 135 | 202.50 |
| Cayuga white | 15 | 0 | 45 | 90 | 135 | 202.50 |
| Aurore | 10 | 0 | 45 | 90 | 135 | 202.50 |
| Reisling | 5 | 0 | 22.50 | 45 | 112.5 | 135 |
| Foch | 5 | 0 | 22.50 | 90 | 135 | 157.50 |

* Assume $45/ton harvesting cost and delivery to processor. The cash flow estimates are inflated at 8% from 1981 to the year in which they take place for use in Table B2.

# APPENDIX B

## Vineyard Present Value Calculations

Table B1. Capital Outlays and Depreciation - Vineyard 50 Acres, Before Tax Cash Flow Analysis.

| Year | Item | Amount | Before Tax 15.75% WACC | PV |
|---|---|---|---|---|
| 0 | 50 planted acres @ $1200/A | 60,000 | 1.0 | - 60,000 |
| 0 | machinery and equipment | 45,000 | 1.0 | - 45,000 |
| 0 | shop and storage | 10,000 | 1.0 | - 10,000 |
| 0 | vines - plant 1 yr. old rooted (50A) | 30,750 | 1.0 | - 30,750 |
| 0 | trellis (50 acres) and labor | 64,600 | 1.0 | - 64,600 |
| 7 | outlay - new line of equip. $45,000\ (1.08)^7 = 77,122$ | 77,122 | .3592 | - 27,702 |
| 14 | outlay - new line of equip. $\$45,000\ (1.08)^{14} = 132,174$ | 132,174 | .1290 | - 17,050 |
| | | | PV of outlays | -255,102 |
| | Salvage Values | | | |
| 7 | machinery salvage value - (no tax S.V. but expected to receive 10% of initial cost | 4,500 | .3592 | + 1,616 |
| 14 | as above | 7,712 | .1290 | + 995 |
| 20 | as above plus 1 yr. undep. balance - 15% of initial cost | 13,217 | .0536 | + 708 |
| 20 | salvage value on shop | 0 | - | |
| 20 | salvage value on vineyard 10% S.V. $95,350\ 9535(1.08)^{20}$ | 44,442 | .0536 | + 2,382 |
| 20 | salvage value of land 60A @ $1000/A $60,000\ (1.08)^{20} = 279,657$ | 279,657 | .0536 | + 14,990 |
| | | | PV of Salvage Values | + 20,691 |
| | | | Total PV of Capital Cost | -234,411 |

Table B2. Present Value of Before Tax Cash Outflows Per Acre (expenses) Baseline Yields.

| Period Beginning in Year | 8% Inflation Rate Costs | Before Tax .1575 WACC | PV |
|---|---|---|---|
| | Development + Fixed Costs | | |
| 1 | 428 | .8639 | - 370 |
| 2 | 492 | .7464 | - 367 |
| 3 | 680 | .6448 | - 438 |
| 4 | 959 | .5571 | - 534 |
| 4 | 1st harvest cost 55 | .5571 | - 31 |
| | Combined Growing, Fixed and Harvesting Costs* | | |
| 5 | 1,330 | .4813 | - 640 |
| 6 | 1,555 | .4158 | - 646 |
| 7 | 1,779 | .3592 | - 639 |
| 8 | 1,922 | .3103 | - 596 |
| 9 | 2,076 | .2681 | - 557 |
| 10 | 2,242 | .2316 | - 519 |
| 11 | 2,421 | .2001 | - 484 |
| 12 | 2,615 | .1729 | - 452 |
| 13 | 2,824 | .1494 | - 422 |
| 14 | 3,050 | .1290 | - 393 |
| 15 | 3,294 | .1115 | - 367 |
| 16 | 3,557 | .0963 | - 343 |
| 17 | 3,842 | .0832 | - 320 |
| 18 | 4,149 | .0719 | - 298 |
| 19 | 4,481 | .0621 | - 278 |
| 20 | 4,840 | .0536 | - 259 |
| | | PV of Costs/Acre | - 8,953 |
| | | PV of Costs 50 Acres | -447,650 |

* Growing and fixed cost in Tables A3 and A4, respectively, harvest costs a weighted average of variety yields. Refer to Table A5. The weighted average is calculated as follows:

The sum of (1981 harvest cost) (proportion of vineyard in variety) (yields in tons) $(1.08)^t$ = harvest costs in year t.

Table B3. Before Tax Present Value of Cash Inflows/Acre (receipts) Baseline Yields.

| Year | 8% Inflation of Grape Prices Weighted Average Price/Acre* | Before Tax 15.75% WACC | PV |
|---|---|---|---|
| 1 | 0 | - | |
| 2 | 0 | - | |
| 3 | 0 | - | |
| 4 | 558 | .5571 | + 311 |
| 5 | 1,270 | .4813 | + 611 |
| 6 | 2,177 | .4158 | + 905 |
| 7 | 3,356 | .3592 | + 1,205 |
| 8 | 3,624 | .3103 | + 1,125 |
| 9 | 3,914 | .2681 | + 1,049 |
| 10 | 4,227 | .2316 | + 979 |
| 11 | 4,565 | .2001 | + 913 |
| 12 | 4,930 | .1729 | + 852 |
| 13 | 5,324 | .1494 | + 795 |
| 14 | 5,751 | .1296 | + 742 |
| 15 | 6,211 | .1115 | + 693 |
| 16 | 6,708 | .0963 | + 646 |
| 17 | 7,245 | .0832 | + 603 |
| 18 | 7,824 | .0719 | + 563 |
| 19 | 8,450 | .0621 | + 525 |
| 20 | 9,126 | .0536 | + 489 |
| | | PV of receipts/acre | 13,006 |
| | | Total PV of receipts 50 acres | +650,300 |

* The weighted average is calculated as follows:

The sum of (1981 price) (proportion of variety in vineyard) (yield in tons) $(1.08)^t$ = receipt in year t.

Mature vineyard receipts in 1981 dollars = $1958.

Table B4. Capital Outlays and Depreciation - Vineyard 50 Acres - After Tax Cash Flow.

| Year | | Amount | I.C. .14 Tax .3 | After Tax Cashflow | 11% WACC | Present Value |
|---|---|---|---|---|---|---|
| 0 | 50 planted acres at 1200/acre | 60,000 | | | 1.0 | - 60,000 |
| 0 | Machinery and equipment | 45,000 | | | 1.0 | - 45,000 |
| 0 | Shop and storage | 10,000 | | | 1.0 | - 10,000 |
| 0 | Vines 1 year old rooted (50 acres) | 30,750 | | | 1.0 | - 30,750 |
| 0 | Trellis (50 acres) | 64,600 | | | 1.0 | - 64,600 |
| | | | | | | -210,350 |
| 1 | Investment credit on machinery (N.Y.S. plus Federal) | 45,000 | .14 | 6,300 | .9009 | + 5,676 |
| 1 | Add 1st year depreciation tax savings machinery | 4,000 | .3 | 1,200 | .9009 | + 1,081 |
| 1 | Sum of year's digits (S.O.Y.D.) on machinery--no salvage value for tax purposes | 41,000 | .3 | 12,300 | .7428 | + 9,632 |
| 1 | Shop and storage - straight line depreciation. An annuity $\frac{10,000}{20 \text{ years}} = \$500/\text{year}$ | 500 | .3 | 150 | 7.9633 | + 1,194 |
| 4 | Capitalized value of plants and trellis, incl. labor $\frac{95350}{20 \text{ yr.}}$ 20 year straight line depr. 24 year - 4 year annuity factor | 4,768 | .3 | 1,430 | 5.2457 | + 7,503 |
| 4 | Vineyard investment credit | 95,350 | .14 | 13,349 | .65873 | + 8,793 |
| | **Expected Machinery Purchases in Years 7 and 14** | | | | | |
| 7 | Outlay - New line of equipment $45,000\ (1.08)^7 = 77,122$ | 77,122 | | | .48165 | - 37,146 |
| 8 | Investment credit on new machinery | 77,122 | .14 | 10,797 | .4339 | + 4,685 |
| 8 | A.F.Y.D. - New machinery | 4,000 | .3 | 1,200 | .18269 | + 219 |
| 8 | S.O.Y.D. - New machinery | 73,122 | .3 | 21,937 | .32232 | + 7,071 |
| 14 | Outlay - New line machinery $45,000\ (1.08)^{14} = 132,174$ | 132,174 | | | .23199 | - 30,663 |
| 15 | Investment credit - new machinery | 132,174 | .14 | 18,504 | .18269 | + 3,381 |
| 15 | A.F.Y.D. - New machinery | 4,000 | .3 | 1,200 | .18269 | + 219 |
| 15 | S.O.Y.D. - New machinery | 132,174 | .3 | 39,652 | .1552 | + 6,154 |
| | **Salvage Values** | | | | | |
| 7 | Machinery salvage value - (No tax S.V. but expected to receive 10% of initial cost) | 4,500 | .7 | 3,150 | .48165 | + 1,570 |
| 14 | As above | 7,712 | .7 | 5,398 | .23199 | + 1,252 |
| 20 | As above plus 1 year undep. balance, 15% of initial cost | 13,217 | .7 | 9,252 | .1240 | + 1,147 |
| 20 | Salvage value on shop | 0 | | | | 0 |
| 20 | *Salvage value on vineyard $10\%$ S.V. $95,350 = 9,535\ (1.08)^{20}$ capital gain treatment $44,442 (.4 gain reported)(.3 taxed) = 5,333$, $44,442 - 5,333 = 39,109$ | | | | | + 4,850 |
| 20 | *Salvage of land - 60 A at 1,000/acre $(1.08)^{20} = 4,661 \times 60$ acres = 279,657; cost = -60,000; gain = 219,657; tax rate .12; tax $ 26,359 = 193,298 return | | | | .1240 | + 23,969 |
| | | | | P.V. of capital costs | | - 189,816 |

* Note: Assumptions on tax rates in tax discussion section in text.

Table B5. Present Value of After-Tax Cash Outflows (expenses) Per Acre.

| Period Beginning in Year | 8% Inflation Rate Cost | Tax Rate | ATCF | 11% Factor | P.V. of Expenses |
|---|---|---|---|---|---|
| | Development and Fixed Costs | | | | |
| 1 | 428 | .7 | 300 | .9009 | -270 |
| 2 | 492 | .7 | 344 | .8116 | -280 |
| 3 | 680 | .7 | 476 | .7311 | -348 |
| 4 | 959 | .7 | 671 | .6587 | -442 |
| 4 | 55 | .7 | 39 | .6587 | - 25 |
| | Harvest cost Growing, fixed, harvesting costs* | | | | |
| 5 | 1,330 | .7 | 931 | .5935 | -553 |
| 6 | 1,555 | .7 | 1,089 | .5346 | -582 |
| 7 | 1,779 | .7 | 1,245 | .4817 | -600 |
| 8 | 1,922 | .7 | 1,345 | .4339 | -584 |
| 9 | 2,076 | .7 | 1,453 | .3909 | -568 |
| 10 | 2,242 | .7 | 1,569 | .3522 | -553 |
| 11 | 2,421 | .7 | 1,695 | .3173 | -538 |
| 12 | 2,615 | .7 | 1,831 | .2858 | -523 |
| 13 | 2,824 | .7 | 1,917 | .2575 | -509 |
| 14 | 3,050 | .7 | 2,135 | .2320 | -495 |
| 15 | 3,294 | .7 | 2,306 | .2090 | -482 |
| 16 | 3,557 | .7 | 2,490 | .1883 | -469 |
| 17 | 3,842 | .7 | 2,689 | .1696 | -456 |
| 18 | 4,149 | .7 | 2,904 | .1528 | -444 |
| 19 | 4,481 | .7 | 3,137 | .1377 | -438 |
| 20 | 4,840 | .7 | 3,388 | .1240 | -420 |
| | | | | P.V. of cost/acre = | 9,579 |
| | | | | | x 50 |
| | | | | Total | -478,950 |

* Costs combined from summary table. Harvesting cost a weighted average of costs per acre and yield.

Table B6. Present Value of After-Tax Cash Inflows (revenue) Per Acre - Baseline Yield.

| Year | 8% Inflation of Grape Prices Income (weighted avg.)* | Tax Rate | ATCF | 11% Factor | P.V. of Inflows |
|---|---|---|---|---|---|
| 1 | 0 | .7 | 0 | | |
| 2 | 0 | .7 | 0 | | |
| 3 | 0 | .7 | 0 | | |
| 4 | 558 | .7 | 391 | .6857 | + 257 |
| 5 | 1,270 | .7 | 889 | .5935 | + 528 |
| 6 | 2,177 | .7 | 1,524 | .5346 | + 815 |
| 7 | 3,356 | .7 | 2,349 | .4817 | + 1,132 |
| 8 | 3,624 | .7 | 2,537 | .4339 | + 1,101 |
| 9 | 3,914 | .7 | 2,740 | .3909 | + 1,071 |
| 10 | 4,227 | .7 | 2,959 | .3522 | + 1,042 |
| 11 | 4,565 | .7 | 3,196 | .3173 | + 1,014 |
| 12 | 4,930 | .7 | 3,451 | .2858 | + 986 |
| 13 | 5,325 | .7 | 3,728 | .2575 | + 960 |
| 14 | 5,751 | .7 | 4,026 | .2320 | + 934 |
| 15 | 6,211 | .7 | 4,348 | .2090 | + 909 |
| 16 | 6,708 | .7 | 4,696 | .1883 | + 884 |
| 17 | 7,245 | .7 | 5,072 | .1696 | + 860 |
| 18 | 7,824 | .7 | 5,477 | .1528 | + 837 |
| 19 | 8,450 | .7 | 5,915 | .1377 | + 815 |
| 20 | 9,126 | .7 | 6,388 | .1240 | + 792 |
| | | | P.V. of income per acre | | 14,937 |
| | | | | | x 50 |
| | | | | Total | +746,850 |

* For years 4-6 income is a weighted average of varieties multiplied by the yield of that variety in that year. For years 7-20, the weighted average is consistent with sustained yields (see Table 2).

# APPENDIX C

## Winery Present Value Calculations

Table C1. NPV Analysis of a 12,000 Gal. Winery (Larry Ledgerwood).

| Year | Item - Description | BTCF* | Tax | ATCF** | 11% WACC | P.V. of Flows |
|---|---|---|---|---|---|---|
| 0 | Building - 4,000 sq. ft. insulated shell w/concrete floor | 36,000 | | | | -36,000 |
| 0 | Crushing equipment | 55,000 | | | | -55,000 |
| 0 | Storage and processing | 37,130 | | | | -37,130 |
| 0 | Bottling equipment | 6,680 | | | | - 6,680 |
| 1 | Investment credit | | | | | |
| | - crushing equipment | 55,000 | .14 | 7,700 | .9009 | + 6,937 |
| | - storage/process | 37,130 | .14 | 5,198 | .9009 | + 4,683 |
| | - bottling equipment | 6,680 | .14 | 935 | .9009 | + 842 |
| 1 | A.F.Y.D. Tax savings | 4,000 | .3 | 1,200 | .9009 | + 1,081 |
| 1 | S.O.Y.D. Tax savings 98,810 - 4,000 = | 94,810 | .3 | 28,443 | .6795 (10 yr.) | +19,327 |
| 1-10 | Building straight line $\frac{36000}{20}$ = 1800/yr. | 1,800 | .3 | 540 | 5.8892 | + 3,180 |
| 10 | Salvage value - 10% of original cost 9,881 x $(1.08)^{10}$ = | 21,332 | .7 | 14,933 | .35218 | + 5,259 |
| 10 | Salvage undep. balance on building 18000 x $(1.04)^{10}$ = 22,644 infl. at 1/2 rate -18,000 cost 4,644 | 8,644 | .7 | 6,051 | .35218 | + 2,131 |
| | | Present value of equipment cost = | | | | -91,370 |
| | P.V. of Cash Flows (Expenses and Receipts) 8% Inflation from 1980 Budget Base | | | | | |
| First Year | | | | | | |
| 1 | Salary of winemaker | 19,440 | .7 | 13,608 | .9009 | -12,259 |
| 1 | Labor at crush | 6,480 | .7 | 4,536 | .9009 | - 4,086 |
| 1 | Labor at bottling | 3,240 | .7 | 2,268 | .9009 | - 2,043 |
| 1 | Utilities | 2,160 | .7 | 1,512 | .9009 | - 1,362 |
| 1 | Cost of bottling supplies | 12,096 | .7 | 8,467 | .9009 | - 7,628 |
| 1 | Cost of grapes (4.25 tons/acre, 25 acres, $1,997/acre) | 49,927 | .7 | 34,949 | .9909 | -31,486 |
| | | | | | P.V. 1st year costs | -58,864 |
| Year 2 | | | | | | |
| 2 | Add used 6,000 gal. storage | 13,997 | | | .8116 | -11,360 |
| 2 | Investment credit | 13,997 | .14 | 1,960 | .73119 | + 1,433 |
| | Storage depreciation, 7 yr. S.L. 10-2 yr. factor $\frac{13,997}{8\text{ yr.}}$ = 1,750 | 1,750 | .3 | 525 | 4.1767 | + 2,193 |
| 10 | Salvage value .10 x 13,997 = 1,400 | 1,400 | .7 | 980 | .35218 | + 345 |
| 2 | Salary and labor costs | 31,493 | .7 | 22,045 | .8116 | -17,892 |
| 2 | Utilities | 2,333 | .7 | 1,633 | .8116 | - 1,325 |
| 2 | Cost of bottling supplies | 23,795 | .7 | 16,656 | .8116 | -13,518 |
| 2 | Cost of grapes ($2,157/acre x 25) = | 53,919 | .7 | 37,743 | .8116 | -30,632 |
| | | | | | P.V. of 2nd year cost | -70,756 |
| | | | | | Cumulative | -129,620 |

Table C1. (continued)

| Year | Item - Description | BTCF | Tax | ATCF | 11% WACC | P.V. of Flows |
|---|---|---|---|---|---|---|
| Year 3 | | | | | | |
| 3 | 6,000 gal. storage | 15,117 | | | .73119 | -11,053 |
| 4 | Inv. credit | 15,117 | .14 | 2,116 | .6587 | + 1,394 |
| 4 | Storage depreciation $\frac{15,117}{7\ yr.} = 2,160$ | 2,160 | .3 | 648 | 3.4455 | + 2,233 |
| 10 | Salvage value .10 x 15,117 = | 1,512 | .7 | 1,058 | .35218 | + 373 |
| 3 | Salary and labor costs | 34,012 | .7 | 23,809 | .73119 | -17,409 |
| 3 | Utilities | 2,520 | .7 | 1,764 | .73119 | - 1,290 |
| 3 | Cost of bottling supplies | 25,698 | .7 | 17,989 | .73119 | -13,753 |
| 3 | Cost of grapes ($2,329/a x 25 a) | 58,233 | .7 | 40,763 | .73119 | -29,805 |
| | | | | P.V. of 3rd year cost | | -69,310 |
| | | | | Cumulative | | -198,930 |
| Year 4-10 Present value of operating expenses - 8% inflation | | | | | | |
| 4 | Operating expenses | 133,100 | .7 | 91,070 | .6587 | -59,988 |
| 5 | " | 140,508 | .7 | 98,356 | .5935 | -58,374 |
| 6 | " | 151,749 | .7 | 106,224 | .5346 | -56,787 |
| 7 | " | 163,884 | .7 | 114,718 | .4817 | -55,260 |
| 8 | " | 176,995 | .7 | 123,896 | .4339 | -53,759 |
| 9 | " | 191,155 | .7 | 133,808 | .3909 | -52,306 |
| 10 | " | 206,447 | .7 | 144,513 | .3522 | -50,898 |
| | | | | P.V. of operating costs yr. 4-10 | | -387,372 |
| | | | | P.V. cumulative operating costs | | -571,860† |
| | | | | P.V. of all equipment and operating costs | | -677,672 |

* Before-tax cash flow.
** After-tax cash flow.
† This figure represents operating costs only for all years, tax credit are taken out.

Table C2. Present Value of Cash Inflows (Wine Sales).*

| Year | Sales - 8% Inflation/year | Before-Tax Cash Flow | Tax | After-Tax Cash Flow | 11% WACC | P.V. |
|---|---|---|---|---|---|---|
| 0 | No Sales - Begin Winemaking | | | | | |
| 1 | | | | | | |
| 2 | 2,500 cases, R = 46.66 W = 28.00 A = 37.33 | 93,325 | .7 | 65,328 | .8116 | + 53,020 |
| 3 | 5,000 cases, R = 50.39 W = 30.24 A = 40.32 | 201,600 | .7 | 141,120 | .7312 | +103,187 |
| 4 | 5,000 cases, R = 54.42 W = 32.66 A = 43.54 | 217,700 | .7 | 152,390 | .6587 | +100,379 |
| 5 | 5,000 cases, R = 58.77 W = 35.27 A = 47.02 | 235,100 | .7 | 164,570 | .5935 | + 97,672 |
| 6 | 5,000 cases, R = 63.47 W = 38.09 A = 50.78 | 253,900 | .7 | 177,730 | .5436 | + 96,614 |
| 7 | 5,000 cases, R = 68.55 W = 41.14 A = 54.85 | 274,250 | .7 | 191,975 | .4817 | + 92,474 |
| 8 | 5,000 cases, R = 74.04 W = 44.43 A = 59.23 | 296,150 | .7 | 207,305 | .4339 | + 89,950 |
| 9 | 5,000 cases, R = 79.96 W = 47.99 A = 63.98 | 319,900 | .7 | 223,930 | .3909 | + 87,534 |
| 10 | 5,000 cases, R = 86.36 W = 51.83 A = 69.10 | 345,500 | .7 | 241,850 | .3522 | + 85,180 |
| | | | | | P.V. of sales = | +806,010 |

* Sales a 50% Retail (R) and 50% Wholesale (W).

A = average price/case