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Zwick Center for Food and Resource Policy

Outreach Report No. 16

**An Economic Analysis of Wine Grape
Production in the State of Connecticut**

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April 2013



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ARE 4464/5464

Benefit Cost Analysis and Resource Management

March 13, 2013

R.H. Building, Storrs, CT



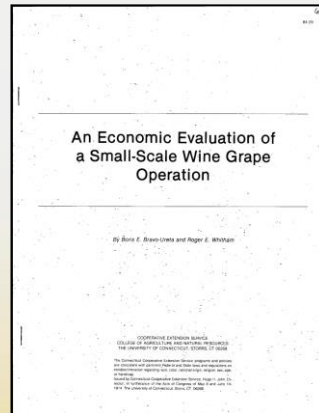
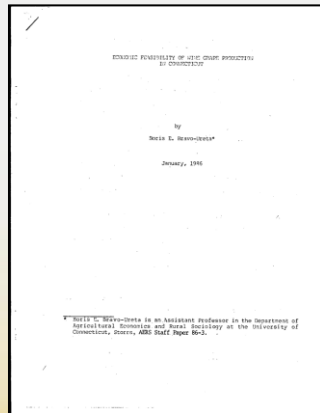
A History of Winemaking in Connecticut



- 1978: Haight-Brown Vineyard is Established in Litchfield County, CT
- 1987: The CT Farm Wine Development Council is Established through the USDA
- 2008: CT Wine Trail Map & Brochure
- 2009: First Annual CT Wine Festival & Passport Program Awards are Given in Goshen, CT



Back In The Day...

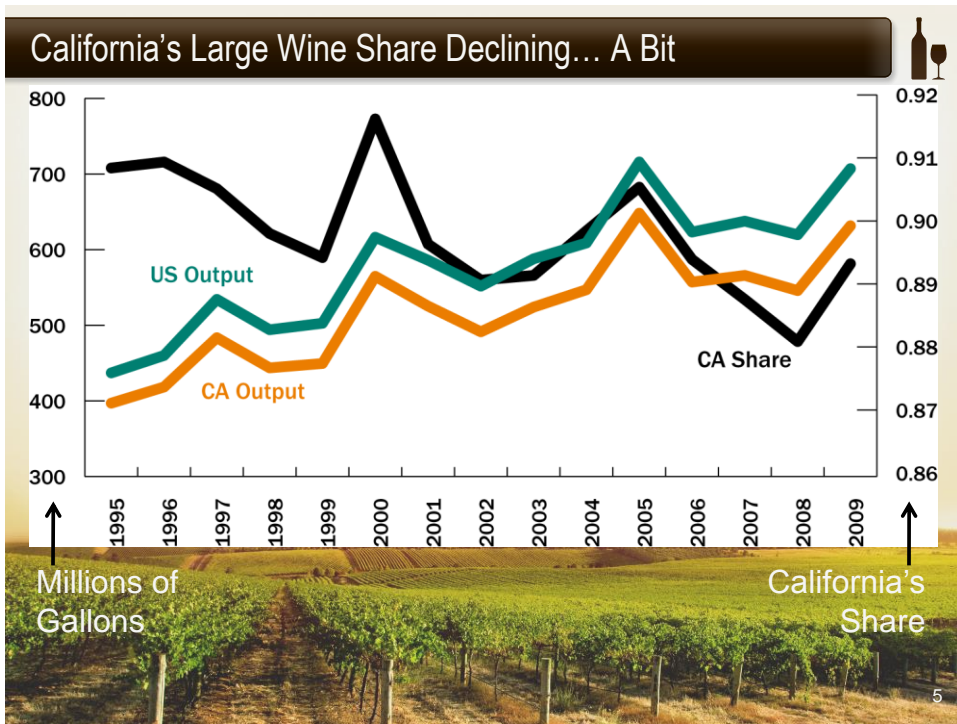


Wine in the US



- All 50 states produce wine - even Alaska
- California is the #1 producer (with 90% of US Wine Output), followed by New York's Finger Lakes and Long Island regions
- CA's market share is declining as wineries continue to sprout up all over the country
- Yet, CA's lions share of production remains as the driver of total US wine output.

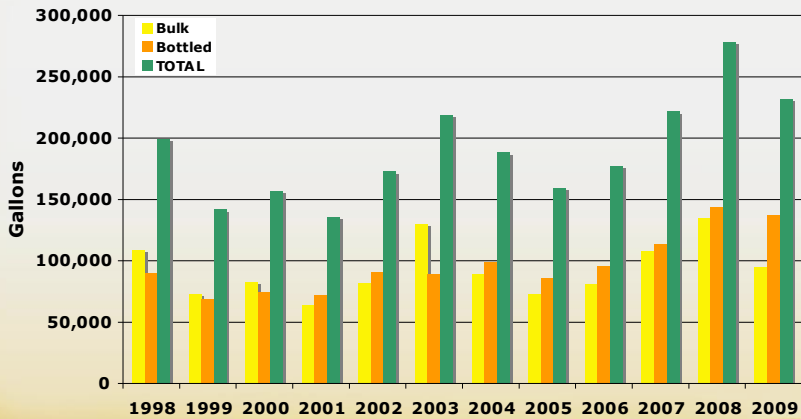




Connecticut's Wine Industry: Grape Cycles and Growth

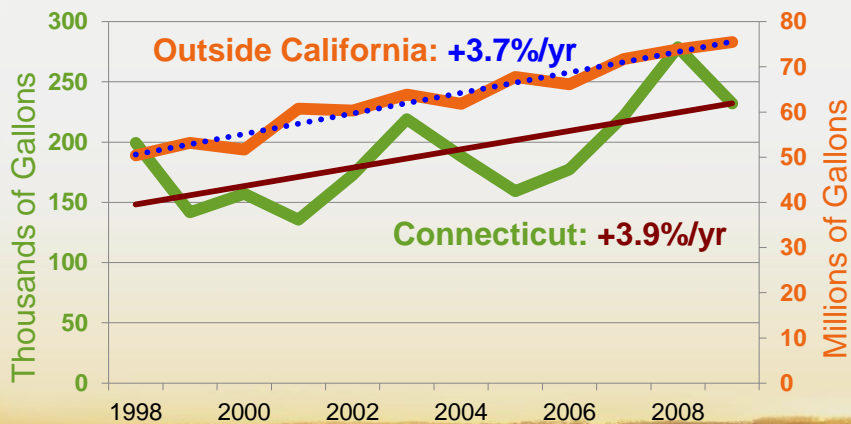
- Grape yields are cyclical and oscillate through the years like the daily tide.
- Thus, to determine a trend, output growth in grape production needs to be examined over a long period.
- Market data suggest considerable variability in output growth over the past 20 years.
- The average growth rate in CT is +3.9% per year.
- Excluding California, the national avg. is +3.7% per year.

Connecticut Wine Production (1998-2009)



Source: Alcohol and Tobacco Tax and Trade Bureau
U.S. Department of the Treasury
<http://www.ttb.treas.gov/wine/wine-stats.shtml>

CT Posts Its Share of Industry Growth



Why Connecticut, Why Now?



- In Recent Years, Wine Makers have gone Crazy over Climate Change!
- "If you look at most of the places growing grapes worldwide, many of them have been right at the cool-limit margins and so a little bit of warming has made them more suitable" (Dr. Greg Jones, The University of Oregon).
- "This means that over time wine-growing regions will shift north toward cooler climates in the Northern Hemisphere and further south in the Southern Hemisphere." - CT growers may produce more sensitive & appealing varieties
- "Among other things, the warming trend has resulted in longer growing seasons and warmer dormant periods, reduced frost damage (although when frost does occur it is causing greater damage to vines), and earlier phenology, or events in the growth cycle." - Edward Deitch

Thompson Reuters, August 17th, 2010
"Vine Talk: Warming Trends May Change
Global Wine Map," by Edward Deitch.

9

Wine & The CT Economy



- "An Economy Based on Wine, I don't think so - just ask the French."
(The CT Economy, Summer 2010)
- California's booming wine industry is dwarfed by Silicon Valley, Hollywood, and the overall agribusiness sector.
- Connecticut Wine production may "boost" the states economy.
- Local & regional consumption of CT products generates further economic activity within the area if a portion is re-spent locally.



10

Keynesian Thoughts & Wine



- “My only regret in life is that I did not drink more champagne.”
- John Maynard Keynes
- Increased local production leads to increased exports, and a “multiplier effect”, through the re-spending of income on imports as well as tax revenues generated by local government.
- The “multiplier effect” ranges from 1.25 - 2.75 (Heffley et al., 2010).



Wine Spillovers



- Why Should The Public Promote Local Wine Grape Production?
 - Clean Green Industry: Low Impact Waste, Aesthetically Pleasing (at least to some).
 - Preservation of Farmland & Open Space: Piggybacks on CT's Purchase of Development Rights (PDR) Program.
 - Potential Benefits to other segments of the Economy: Food, Lodging and Entertainment.
 - Wine oriented events: CT Wine Festival!!!



Finding the Right Lever



- How do we promote vineyard growth to increase “spillover” effects?
 - Increase the requirement for CT wine production from the current 25% CT grown Grapes back to the pre-2004 51%.
 - This would require an additional 155 to 208 acres of vineyards, and
 - An additional 450 to 617 acres would be needed to fully supply the CT wine industry.
 - Tax incentives: reduce the cost of grape production thus increasing farm revenue.



The Connecticut Film Tax-Credit Program



- Offering tax-credits, a “carrot” for the film industry, to promote in state production.
- Program better suited for vineyards
 - Film production is temporary, vineyards are permanent
 - Film Crew “just visiting”, income is taken with them, Vineyard owner “residents” who reinvest a greater portion of their income into the CT economy.



Objectives of the Project

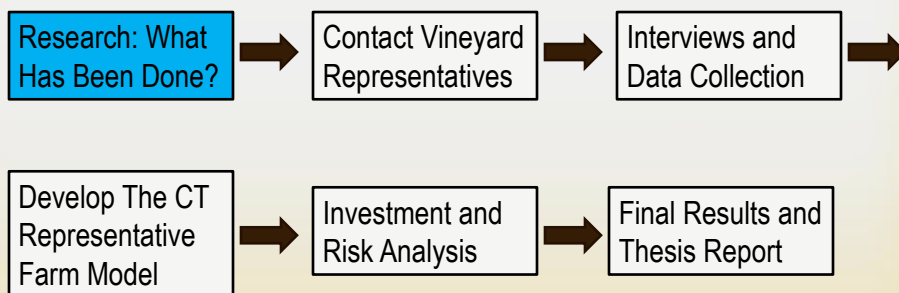


1. To develop a budget generator model suitable to analyze the expected profitability of vineyards & investment analysis
2. To use the model to analyze variation in cost structure and profitability under differing technological assumptions & risk scenarios (sensitivity)
3. To examine the potential market for locally produced grapes as an input to Connecticut wine producers.
4. To develop and implement outreach programs targeted to growers, farm groups and policy makers to deliver information concerning the expected profitability of grape production.



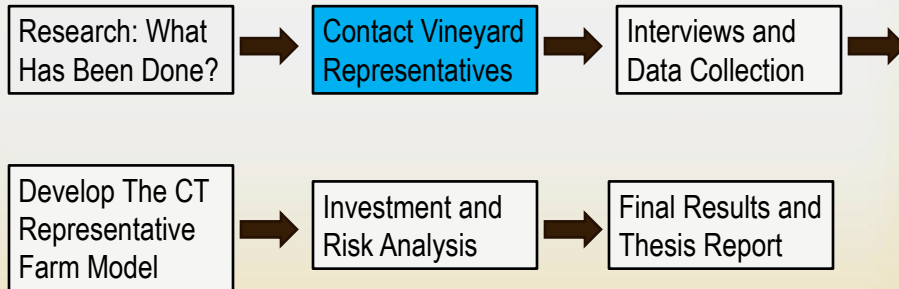
15

Methodology

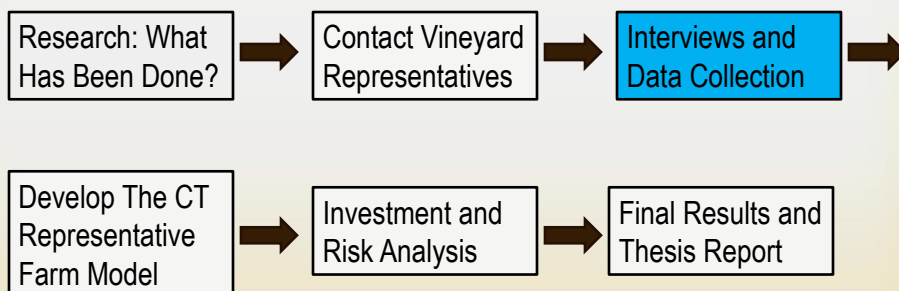


16

Methodology



Methodology



Interview Questions

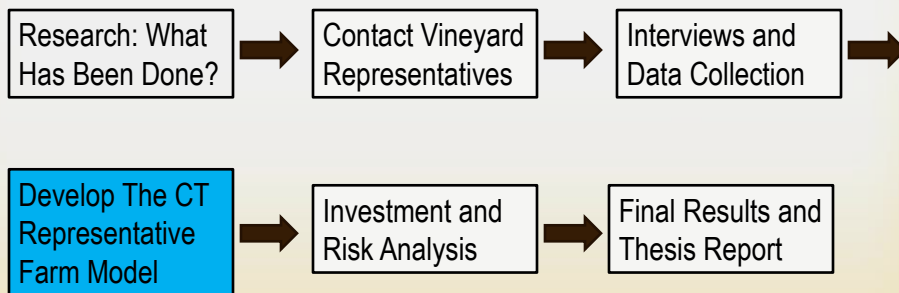


Q #	Question	
1	What is the current size of your farm?	<input type="text"/> acres
2	What portion of your farm is tillable land?	<input type="text"/> acres
3	What portion of your farm is devoted to grape production?	<input type="text"/> acres
4	Have you acquired more land for grape production? If yes, how much?	<input type="text"/> acres
5	When did you start your vineyard? When did you begin producing grapes for wine?	<input type="text"/>
6	Do you sell grapes? Do you produce wine?	<input type="text"/>
7	Do you think there is room to expand wine grape production in CT? If so, please mark all that apply:	<input type="text"/>
	Convert unfarmed land to vineyards	<input type="text"/>
	Convert existing farms to vineyards	<input type="text"/>
	Other (please explain below)	



19

Methodology



20

The Representative Farm Model and Budgets



EFFECTS OF VINEYARD ESTABLISHMENT	GROSS INFLOW	OUTFLOW / ACRE	NET FLOW
WITH VINEYARD	3,883.0	3,183.1	699.9
W/O VINEYARD	350.0	131.0	219.0
DIFFERENCE	3,533.0	3,052.1	480.9

GRAPE VARIETY	FARM PRODUCTION DYNAMICS							
	WITHOUT VINEYARD			WITH VINEYARD				
	TOTAL OUTFLOW / ACRE	INFLOW/ ACRE	NET CASH FLOW	TOTAL OUTFLOW/ ACRE	YIELD/ ACRE	PRICE/ TON	NET CASH FLOW	ACRES PLANTED
Cabernet Franc	TAXES AND INSURANCE	RENTAL RATE		3183	2.65	1709	1,346	1.1
Lemberger				3183	3.42	1500	1,947	1.1
Marechal Foch				3183	5.00	684	238	1.1
Chardonnay				3183	3.36	1399	1,516	1.1
Pinot Gris				3183	2.65	1732	1,406	1.1
Traminette				3183	2.94	1135	154	1.1
Seyval				3183	5.68	609	273	1.1
Cayuga White				3183	4.95	588	-272	1.1
Vidal Blanc				3183	4.28	670	-316	1.1
TOTAL / ACRE	131	350	219				3883	



21

The Representative Farm Model and Budgets



- Budget Assumptions
 - Land: Opportunity Cost (rent)
 - Drainage System
 - Vineyard Layout – 10 acres
 - 6'x 9' (vines and rows)
 - 725 vines/acre, 2% replanting
 - Trellis – Vertical Shoot Position
 - Spraying and Fertilization
 - Harvesting – \$200 per acre
 - Overhead – The DIRT 5
- Viticultural Assumptions

ADDITIONAL COST ASSUMPTIONS

Use a capital Y for inclusion, a capital N for omission, or the estimated value.

ITEM	CHOICE (Y/N)
MACHINERY: COST AT 65% NEW	Y
OPTIONAL PRACTICES	
IRRIGATION	N
DEER FENCE	N
BIRD CONTROL	N
GRAPE PRICES	
NYS PRICE	N
VINIFERA CT PRICE	2000
HYBRID CT PRICE	1000
LABOR WAGES	
SKILLED	17
UNSKILLED	12



22

The Representative Farm Model and Budgets



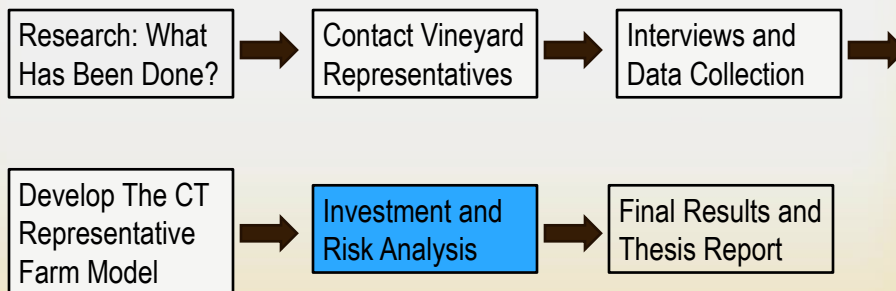
ITEM	YEAR 1 OUTFLOW	YEAR 2 OUTFLOW	YEAR 3 OUTFLOW	YEAR 4+ OUTFLOW
Operating Expenses				
Site Preparation	225			
Vines and planting	1,785			
Replanting and Roqueing		37	59	74
Dormant pruning & br. removal		51	362	396
Herbicide application	23	47	47	49
Fertilization	41	41	41	65
Canopy management		60	424	593
Disease and insect control	67	103	248	501
Take away and hilling up	42	133	133	133
Mowing		72	72	72
Establishment Expenses				
Machinery	4,180	643	643	643
Trellis		3,810	95	95
Drainage	2,372			
Optional Practices				
Irrigation	0	0	0	0
Deer Fence			0	0
Bird Control			0	0
Annual Fixed Expenses				
Taxes - Property	88	88	88	88
Insurance - Farm	43	43	43	43
\$ TOTAL	8,865	5,128	2,255	2,753

Year	WITHOUT VINEYARD	CASHFLOW WITH VINEYARD			
	Total Net Cash Flow	Annual Outflow/ Acre	Total outflow	Total inflow	Cash Flow
1	2,190	8,865	88,646	0	-88,646
2	2,190	5,128	51,279	0	-51,279
3	2,190	2,255	22,555	36,073	13,519
4	2,190	2,753	27,534	55,498	27,963
5	2,190	2,753	27,534	55,498	27,963
6	2,190	2,753	27,534	55,498	27,963
7	2,190	2,753	27,534	55,498	27,963
8	2,190	2,753	27,534	55,498	27,963
9	2,190	2,753	27,534	55,498	27,963
10	2,190	2,753	27,534	57,998	30,463
11	2,190	5,253	52,534	55,498	2,963
12	2,190	2,753	27,534	55,498	27,963
13	2,190	2,753	27,534	55,498	27,963
14	2,190	2,753	27,534	55,498	27,963
15	2,190	2,753	27,534	55,498	27,963
16	2,190	2,753	27,534	55,498	27,963
17	2,190	2,753	27,534	55,498	27,963
18	2,190	2,753	27,534	55,498	27,963
19	2,190	2,753	27,534	55,498	27,963
20	2,190	2,753	27,534	61,928	34,393
Res Val				6,430	
Total	43,800	65,556	655,564	994,891	332,897



23

Methodology



24

Investment and Risk Analysis



- Investment Analysis – with and without project
 - Using the incremental cash flow to calculate: NPV, IRR and PP
- Risk Analysis
 - Sensitivity Analysis
 - A test of the robustness of the results of the investment analysis, which is done by systematically altering the values for **key variables**
 - Discount rate (r), Farm Size and Technologies, Inflows (prices/yields)
 - Monte Carlo Simulation



25

Investment and Risk Analysis: Monte Carlo Simulation



- Simulation is an outgrowth of sensitivity and expected value analysis
- Incorporates the statistical distributions of particularly variable inputs in the model in order to determine the likelihood of investment outcomes
- Works by taking a random draw from the chosen variables' distributions to use for calculation of investment results, the process is repeated for a set number of iterations to create a distribution for investment outcomes
- Results are given in the form of confidence intervals, or a proportion of investment outcome greater or less than a value of interest, i.e., the break even point

	Static	Risk Model		
		Mean	StdDev	Sample
Revenue	100	100	10	100
Cost	80	80	10	80
Profit	20			20



26

Analysis with the Representative Farm Model

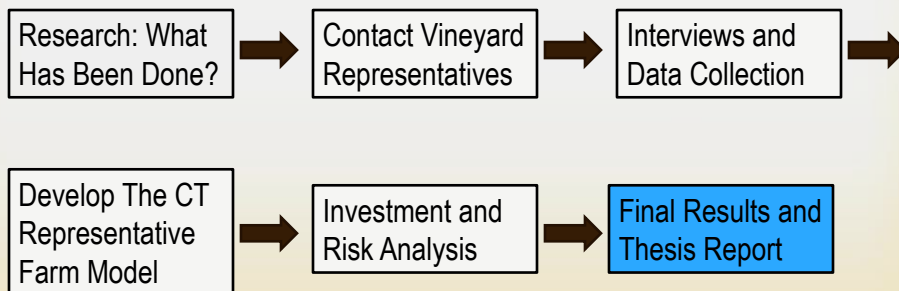


Year	WITHOUT VINEYARD	CASHFLOW WITH VINEYARD				INVESTMENT ANALYSIS			
	Total Net Cash Flow	Annual Outflow/Acre	Total outflow	Total inflow	Cash Flow	Incremental Cash Flow	Cumulative Cash Flow	Discount (r)	9.0%
1	2,190	8,865	88,646	0	-88,646	-90,836	-90,836	IRR	13%
2	2,190	5,128	51,279	0	-51,279	-53,469	-135,840	NPV	42,955
3	2,190	2,255	22,555	36,073	13,519	11,329	-127,092	PP	15
4	2,190	2,753	27,534	55,498	27,963	25,773	-108,834		
5	2,190	2,753	27,534	55,498	27,963	25,773	-92,083		
6	2,190	2,753	27,534	55,498	27,963	25,773	-76,715		
7	2,190	2,753	27,534	55,498	27,963	25,773	-62,617		
8	2,190	2,753	27,534	55,498	27,963	25,773	-49,682		
9	2,190	2,753	27,534	55,498	27,963	25,773	-37,815		
10	2,190	2,753	27,534	57,998	30,463	28,273	-25,872		
11	2,190	5,253	52,534	55,498	2,963	773	-25,573		
12	2,190	2,753	27,534	55,498	27,963	25,773	-16,409		
13	2,190	2,753	27,534	55,498	27,963	25,773	-8,003		
14	2,190	2,753	27,534	55,498	27,963	25,773	-290		
15	2,190	2,753	27,534	55,498	27,963	25,773	6,785		
16	2,190	2,753	27,534	55,498	27,963	25,773	13,277		
17	2,190	2,753	27,534	55,498	27,963	25,773	19,232		
18	2,190	2,753	27,534	55,498	27,963	25,773	24,696		
19	2,190	2,753	27,534	55,498	27,963	25,773	29,709		
20	2,190	2,753	27,534	61,928	34,393	32,203	35,455		
Res Val				6,430		6,430.0			
Total	43,800	65,556	655,564	994,891	332,897	295,527			



27

Methodology



28

Results



- Quantitative Findings –
 - The 10-acre representative farm under base-case assumptions
 - Connecticut versus New York State Prices
 - Sensitivity analysis –
 - Best/worst-case, farm size and discount rate effects
 - Optional technologies: bird nets, deer fence and irrigation
 - Monte Carlo Simulation
 - Incorporating yield and price variability into the model
- Qualitative Findings – from interviews with industry representatives



29

Results



Table 2. Investment Analysis for a Representative 10-Acre CT Farm Vineyard

Grape Price Assumption	NPV	IRR	PP
Average NYS Prices	(75,367)	(---)	20+ yrs
All varieties \$2000 per ton	199,847	25%	7 yrs
CT Grape Prices	42,955	13%	15 yrs

Table 3. Best and Worst-Case Analysis: Three Alternative Cash Inflow Scenarios

CT Grape Price Assumption	NPV	IRR	PP
Below Average (-25%)	(55,542)	3%	20+ yrs
Average	42,955	13%	15 yrs
Above Average (+25%)	141,452	21%	9 yrs



30

Results



Table 4. The Effect of Discount Rate and Farm Size on Net Present Values

Vineyard Size	<u>Discount Rate (r)</u>				
	4%	6%	8%	10%	12%
5 acres	3,747	(11,816)	(23,261)	(31,730)	(38,027)
10 acres	140,420	93,185	57,485	30,228	9,228
15 acres*	255,813	177,250	117,636	71,933	36,562

^ Assumes the same machinery complement for all three sizes;

* New machinery cost is included, 65% of new value assumed for 5 and 10 acres.

• Optional Practices –

- Irrigation and deer fencing both lead to a decrease in IRR from 13% to 11%
- Bird control is slightly more costly with a reduction in IRR from 13% to 9%



31

Results



Table 5. Varietal Analysis: NPVs for 10-Acre Plantings of Individual Varieties

Wine Grape Variety	<u>CT Prices</u>		<u>Average NYS Prices</u>	
	NPV	IRR	NPV	IRR
<i>Red</i>				
Cabernet Franc	25,225	11%	(29,523)	6%
Lemberger*	13,156	10%	13,194	10%
Marechal Foch	3,927	9%	(108,152)	(---)
<i>White</i>				
Chardonnay	126,033	20%	(17,436)	7%
Pinot Gris	25,225	11%	(25,212)	6%
Traminette*	(37,958)	5%	(114,098)	(---)
Seyval	52,202	14%	(105,642)	(---)
Cayuga White	378	9%	(144,341)	(---)
Vidal Blanc	(47,187)	5%	(147,511)	(---)

*Premium hybrid price of \$1500/ton used in individual analysis.



32

Results



- The Palisade Software Companies @Risk program is used for simulation
 - Functions as an “add-on” built into Microsoft Excel
 - Features included: “auto” iteration setting and distribution fitting

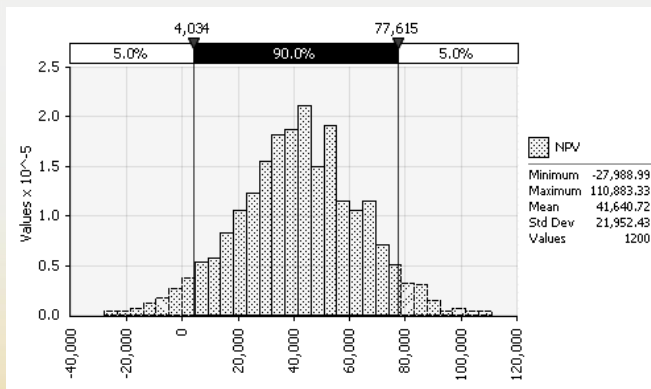
Table 6. Simulation Results: The Representative 10-Acre CT Farm Vineyard

<i>Simulation Statistics</i>	<u>CT Prices (Yield only)</u>		<u>Historical NYS Prices</u>	
	NPV	IRR	NPV	IRR
Mean	41,641	12.9%	(68,050)	1.0%
Confidence Level				
Upper 95%	77,615	16.0%	(32,811)	5.0%
Lower 95%	4,034	9.4%	(102,044)	(---)



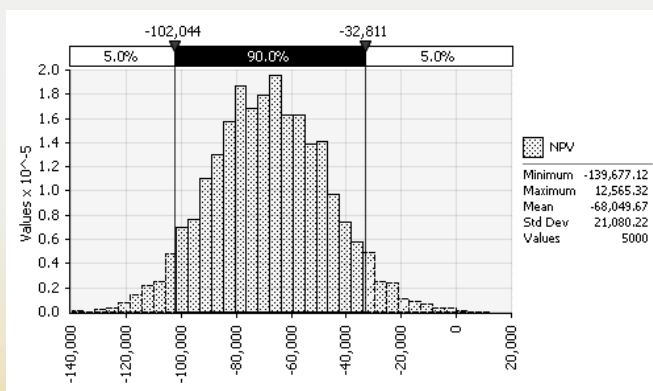
33

@Risk Simulation Results for NPV: CT Prices



34

@Risk Simulation Results for NPV: NYS Prices



35

Results



Table 7. Simulation Results: NPVs for 10-Acre Plantings of Individual Varieties

Wine Grape Variety	CT Prices (Yield only)			Historical NYS Prices		
	Mean	95% Confidence		Mean	95% Confidence	
<i>Red</i>		Upper	Lower		Upper	Lower
Cabernet Franc	24,616	118,567	(71,156)	(4,038)	162,971	(135,770)
Lemberger*	12,542	96,687	(74,749)	10,703	102,871	(81,585)
Marechal Foch	1,721	111,149	(112,114)	(109,427)	(11,314)	(197,083)
<i>White</i>						
Chardonnay	120,530	199,935	33,799	(14,739)	113,567	(125,093)
Pinot Gris	13,852	101,387	(88,120)	(36,589)	52,166	(130,551)
Traminette*	(40,663)	74,800	(159,489)	(99,463)	22,259	(204,701)
Seyval	38,325	143,713	(85,881)	(105,816)	(1,969)	(196,710)
Cayuga White	22,476	137,365	(71,538)	(119,172)	(17,820)	(198,129)
Vidal Blanc	(39,769)	35,991	(108,531)	(133,491)	(37,294)	(211,997)

*Premium hybrid price of \$1500/ton used in the yield-only simulation



36

Additional Qualitative Findings



- Interviews with state industry representatives, growers and winemakers
- Three general topics of discussion –
 - Grape growing and varietal selection
 - Do we grow the popular varieties or less well-known ones particularly suited to the regional climate
 - The current state of the CT vineyard industry
 - Contrasting business models across state farm vineyards
 - The future of wine grape production in Connecticut?



On a Final Note: Summary and Conclusions



- Grape growing can be a profitable enterprise in Connecticut (50-50)
 - Highly variable, requires skilled management to mitigate risk
- Additional strategies for mitigating risk
 - Equipment and machinery sharing
 - Cooperative vineyard establishment by state wineries
- Limitations of Study – Lack of study participation among state growers
 - Market demand indicated but not quantified by growers
 - Returning to the old 51% rule would require an additional 15 to 20 10-acre representative farm vineyards, or expansion of existing farms



Thank You!



An Economic Analysis of Wine Grape Production in the State of Connecticut



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Masters Thesis Defense

August 31, 2012

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