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UNIVERSITY of FLORIDA
FOOD & RESOURCE ECONOMICS DEPARTMENT

Crop Insurance for Wine Grapes: Wildfires and Subsequent Smoke Taint

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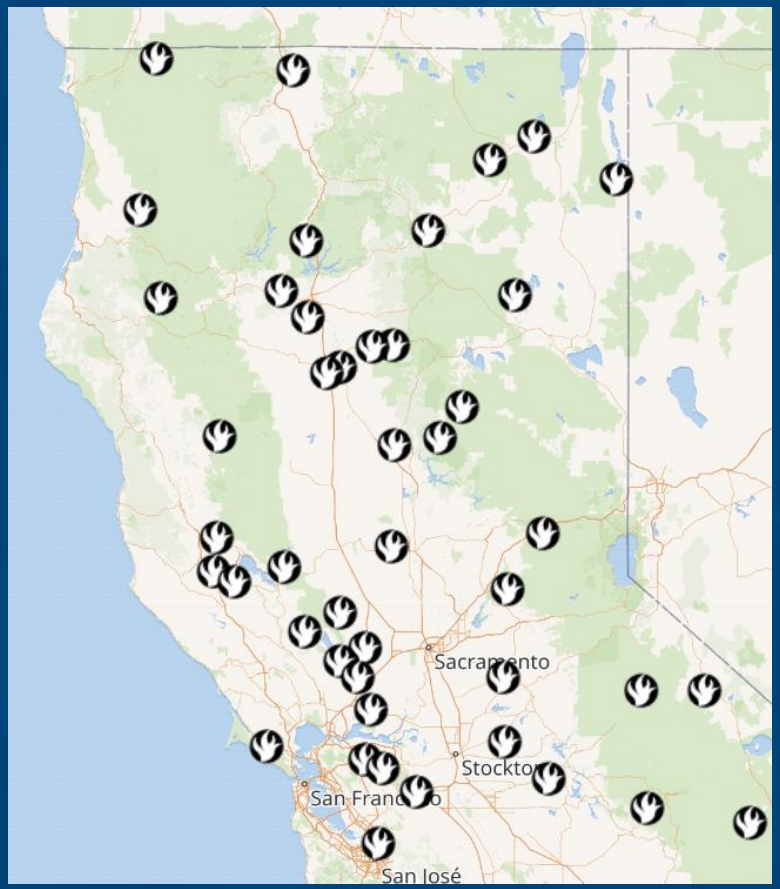
California Wildfires



2018 Wildfires
Source: San Francisco Chronicle

- 2017:
  - 9,133 fires
  - 1,381,405 acres
- 2018:
  - 8,527 fires
  - 1,893,913 acres
    - Largest burned in a fire season

(California Department of Forestry and Fire Protection)

What is smoke taint?

- Smoke exposure can lead to:
  - “ashy,” “burnt” and “smoky” aromas
  - “an excessively drying” back-palate and retro-nasal “ash” perception
- Caused by volatile phenols such as guaiacol, 4-methylguaiacol, syringol, m-cresol, o-cresol and p-cresol
- Often not detectable in the grape but expressed in the wine
- Reduces the value of the wine or leads to rejection by consumers

(Härtl and Schwab 2018)

What is smoke taint?

- Big issue because 2018 fires occurred prior to harvest & late in the growing season
  - Wineries rejected delivery of grapes
- $37.1 million of losses in Lake County alone (Lake County Winegrape Commission)

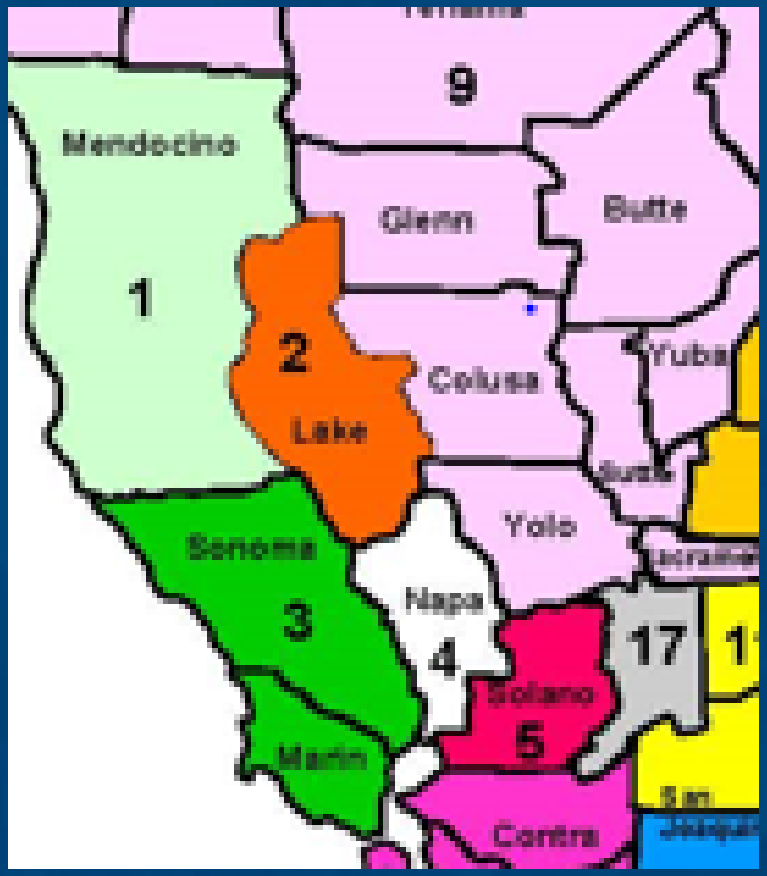
Contracting

- 95% of Napa AVA is forward contracted (Robinson)
- Length:
  - Fixed – set contract length
  - "Evergreen" – continues unless cancelled
  - "Look-see" – set length that converts to evergreen unless cancelled prior to end of initial period (90 days notice)
- Price:
  - Fixed
  - Formula – bottle pricing
  - Third party index – % of average crush district price

Pricing

MAP AND DEFINITIONS OF CALIFORNIA GRAPE PRICING DISTRICTS

1. Mendocino County
2. Lake County
3. Sonoma and Marin Counties
4. Napa County
5. Solano County
6. Alameda, Contra Costa, Santa Clara, San Francisco, San Mateo, and Santa Cruz Counties
7. Monterey and San Benito Counties
8. San Luis Obispo, Santa Barbara, and Ventura Counties
9. Yolo County north of Interstate 80 to the junction of Interstate 80 and U.S. 50 and north of U.S. 50; Sacramento County north of U.S. 50; Del Norte, Siskiyou, Modoc, Humboldt, Trinity, Shasta, Lassen, Tehama, Plumas, Glenn, Butte, Colusa, Sutter, Yuba, and Sierra Counties
10. Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne and Mariposa Counties
11. San Joaquin County north of State Highway 4; and Sacramento County south of U.S. 50 and east of Interstate 5
12. San Joaquin County south of State Highway 4; Stanislaus and Merced Counties
13. Madera, Fresno, Alpine, Mono, Inyo Counties; and Kings and Tulare Counties north of Nevada Avenue (Avenue 192)
14. Kings and Tulare Counties south of Nevada Avenue (Avenue 192); and Kern County
15. Los Angeles and San Bernardino Counties
16. Orange, Riverside, San Diego, and Imperial Counties
17. Yolo County south of Interstate 80 from the Solano County line to the Junction of Interstate 80 and U.S. 50 and south of U.S. 50 and Sacramento County south of U.S. 50 and west of Interstate 5



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Berryhill Act

- Clare Berryhill Grape Crush Report Act of 1976 (Food & Agric. Code §55601.5)
- Processor must report tonnage and pricing to Department of Food and Agriculture
- Price determination of all contracted grapes must occur by January 10 following harvest
- Requires processor to pay for crop within 30 days of delivery unless different payment date set in contract

Contracting

- Quantity:
  - Fixed
  - Plot – Rows X, of block Y, in plot Z
    - Winery bears quantity risk (and quality risk to some degree)
- Quality
  - Specified in contract
  - Winery can reject

Contracting

Variety	Block	Clone	Rootstock	Estimated Tons	Estimated Tons / Ac
Cab Franc					
Total CF					
Zinfandel					
Total Z					

	Minimum	Target	Maximum
Brix			
Acid			
pH			

Contracting

- Repeat game
- Winery rejects grapes if the expected cost of damaging brand (reduction of NPV of brand equity) due to smoke taint (or other quality defects) exceeds expected loss of not producing current vintage of wine
  - If grower disagrees with rejection, quality is assessed by third-party with winery fee liable for evaluation

Insurance

- RMA
- Based on producers actual production history (APH)
  - Rolling average (min of 4 yrs. – max of 10 yrs.)
- Coverage rates: 50 - 85%
- Growers can't cherry pick coverage
  - Must insure all acres of same varietal within the county at same coverage level

Insurance

- Is smoke taint is covered?
  - Some growers do not have insurance
  - Seeking compensation under the Wildfires and Hurricanes Indemnity Program (WHIP)
  - Those that do have insurance missed the window to file:
    - RMA requires notice of loss within 72 hours of the event causing the damage
    - Must prove smoke taint through independent laboratory tests screening for “elevated levels” of guaiacol and 4-methylguaiacol
    - Provide a rejection letter from the contracted winery stating the reason for rejection or price reduction (Prengaman and Courtney, 2018)

Insurance

- Statewide 75% of vineyards insured (Farm Bureau)
- 61% Lake County (Farm Bureau)
- 70% of Napa acreage is insured (AgCredit)

Methods

- Formalize the repeat game between growers and using game theory
- Model the value of insurance for protecting against losses due to smoke taint
  - 2 price (quality) distributions
    - No smoke
    - Smoke – lower mean; skewed toward lower prices; leptokurtotic (fatter tails); inferior distribution (stochastically dominated)

Methods

- Use Hyperbolic Sine (IHS) transformation to normality introduce by Moss and Shonkwiler (1993)
  - Modification of the transformation introduced by Burbidge, Magee, and Robb (1988)

$$f(x,\mu,\theta,\sigma,\psi) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(g(x,\theta,\mu)-\psi)^2}{2\sigma^2}\right) \times \frac{1}{\sqrt{1+(x-\mu)^2\theta^2}}$$

Methods

Non-central moments of the IHS transformation (Moss 2010)

$$m_1(\psi,\theta,\sigma) = \exp\left(\frac{1}{2}\theta^2\sigma^2\right)\left(\exp(\psi\theta) - \exp(-\psi\theta)\right) / (2\theta)$$

$$m_2(\psi,\theta,\sigma) = \frac{\exp\left(2\psi\theta + 2\theta^2\sigma^2\right) + \exp\left(-2\psi\theta + 2\theta^2\sigma^2\right) - 2}{4\theta^2}$$

$$m_3(\psi,\theta,\sigma) = \frac{\exp\left(3\psi\theta\frac{9}{2}\theta^2\sigma^2\right) - 3\exp\left(\psi\theta + \frac{1}{2}\theta^2\sigma^2\right) + 3\exp\left(-\psi\theta + \frac{1}{2}\theta^2\sigma^2\right) - \exp\left(-3\psi\theta + \frac{9}{2}\theta^2\sigma^2\right)}{8\theta^3}$$

$$m_4(\psi,\theta,\sigma) = \left(6 + \exp\left(-4\psi\theta + 8\sigma^2\theta^2\right) - 4\exp\left(-2\psi\theta + 2\theta^2\sigma^2\right)\right.$$
$$\left. -4\exp\left(2\psi\theta + 2\theta^2\sigma^2\right) + \exp\left(4\psi\theta + 8\sigma^2\theta^2\right)\right) / \left(16\theta^4\right)$$

Methods

- Estimating distribution of prices with smoke:
  - Could use observed prices – but we don't have price data
  - So take variation of the distribution function around the estimated parameters
    - Similar to mean-preserving spreads developed by Rothschild and Stiglitz (1970)

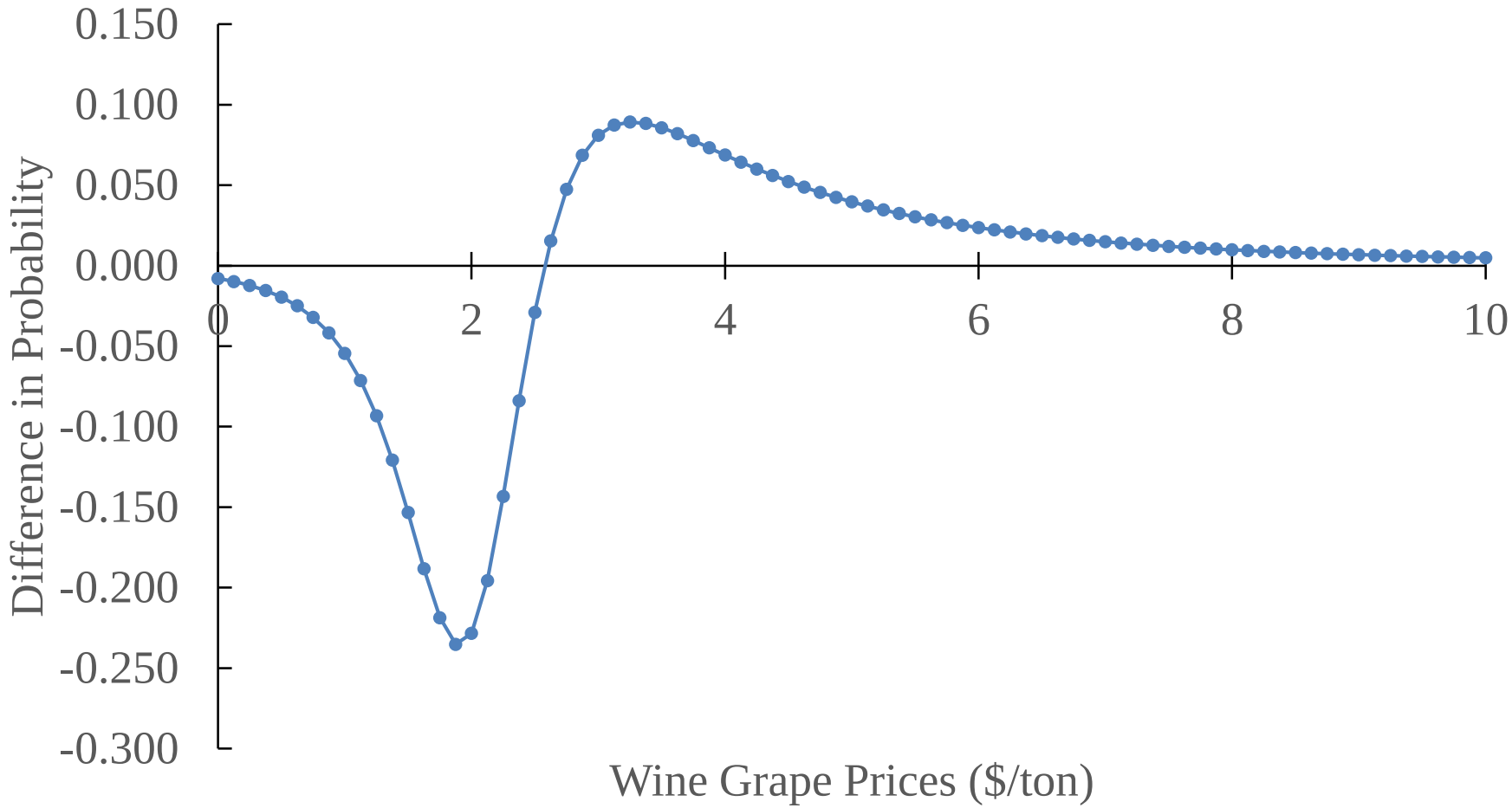
$$\delta f\left(x,\mu,\theta,\sigma,\psi\right)=\left.\frac{\partial f\left(.\right)}{\partial\mu}\right|_{\mu=\hat{\mu},\theta=\hat{\theta},\sigma=\hat{\sigma},\psi=\hat{\psi}}\left(\mu-\hat{\mu}\right)+\left.\frac{\partial f\left(.\right)}{\partial\theta}\right|_{\mu=\hat{\mu},\theta=\hat{\theta},\sigma=\hat{\sigma},\psi=\hat{\psi}}\left(\theta-\hat{\theta}\right)+\left.\frac{\partial f\left(.\right)}{\partial\sigma}\right|_{\mu=\hat{\mu},\theta=\hat{\theta},\sigma=\hat{\sigma},\psi=\hat{\psi}}\left(\sigma-\hat{\sigma}\right)+\left.\frac{\partial f\left(.\right)}{\partial\psi}\right|_{\mu=\hat{\mu},\theta=\hat{\theta},\sigma=\hat{\sigma},\psi=\hat{\psi}}\left(\psi-\hat{\psi}\right)$$

Methods

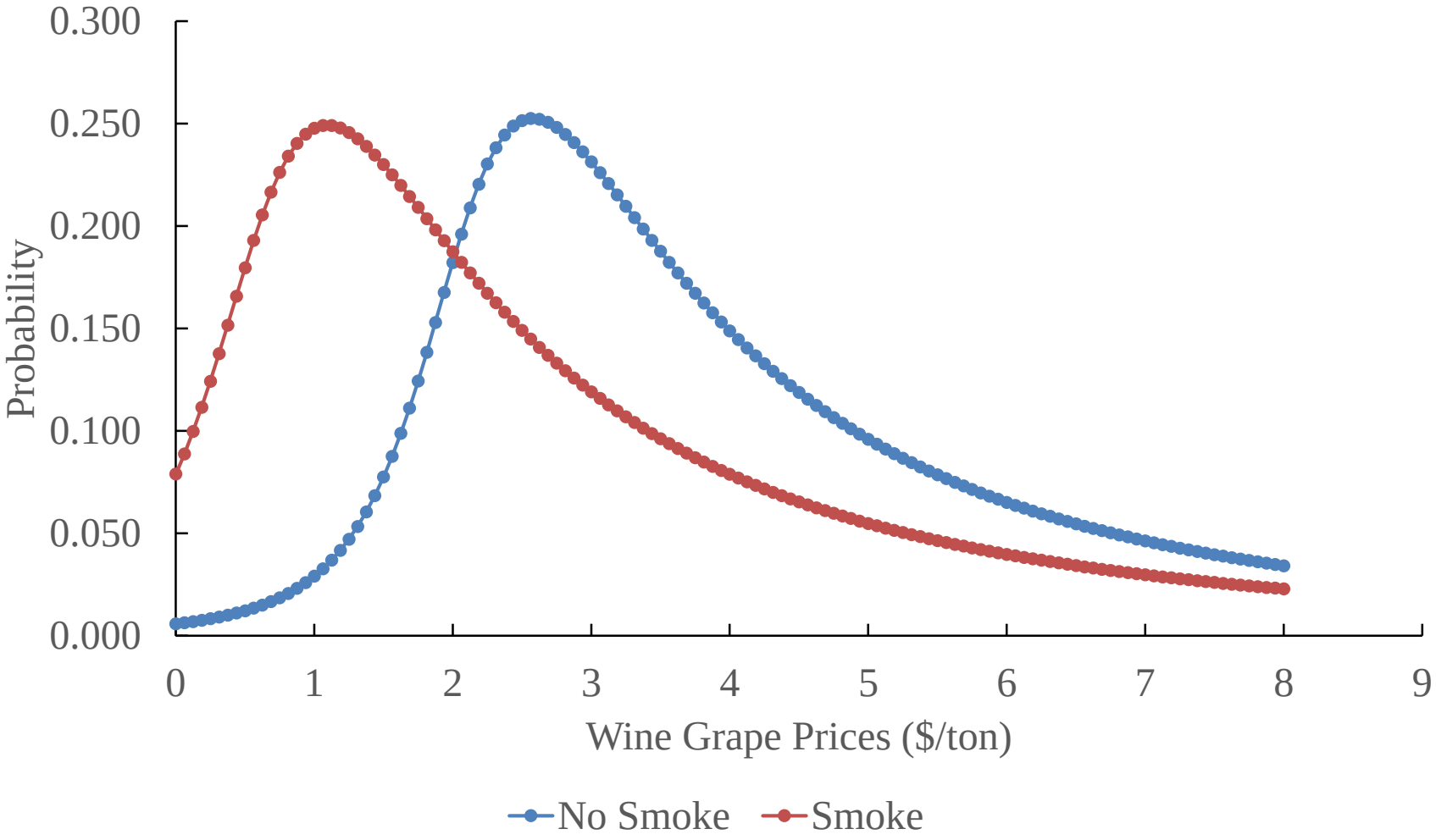
- Mean = 5.895 (in thousands)
- Variance = (1.35 Mean)^2 = 63.3337
- Skewness = 1.05 Variance^(3/2) = 1,019.98
- Kurtosis = 3.75 Variance^2 = 36,077.3

Parameter	No Smoke	Smoke
Mu	2.01828	0.52985
Delta	1.23926	1.25236
Sigma	1.01269	1.04361
Theta	1.23203	1.19440

- Coverage Rate 2.54266 (85% coverage)



Variation with Respect to Mu


0.300
0.250
0.200
0.150
0.100
0.050
0.000
Probability
0
1
2
3
4
5
6
7
8
9
Wine Grape Prices ($/ton)
No Smoke
Smoke

Results

- Price 1 (Insurance Price for Original Distribution) = 0.156014
- Price 2 (Value of Insurance under Shifted Distribution) = 1.19033
- Price 3 (Value Recognizing a Probability of Smoke) = 0.371497

Conclusion

- Insurance is valuable if a loss of quality due to smoke taint
- Smoke taint is rare but widespread when it occurs
- Smoke taint is hard to detect
  - Grower bears the risk that winery will reject grapes; hence do not always report when they should

Questions

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