Estimating the Supply of California Wine Grapes Using Regional Systems of Equations

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Motivation

- Elasticities are measurements of price responsiveness
- Key to forecasting
- Welfare analysis
  - Consumer, producer surplus and profits

Major Growing Regions

Varieties Covered

- Reds
  - Cabernet Sauvignon
  - Merlot
  - Zinfandel
  - Pinot Noir
Varieties Covered

- Whites
  - Chardonnay
  - Sauvignon Blanc
  - French Colombard
  - Chenin Blanc

Industry Overview

- Huge growth overall
  - 400,000 tons in 1976
  - 2.2 million in 2006
- Prices for grapes rise with prices for wine
  - $235 per ton in ’76
  - $916 in ’06
- Growth is not uniform across regions or varieties

Grape production, 1976-2006

Grower prices received, 1976-2006
Theoretical Underpinnings

- Dynamic adjustment model
  - Allocation of quasi-fixed inputs is key
    - $A = A_t - \alpha A_{t-1}$
- Model output and Q-F inputs simultaneously
  - Output and acreage response

Estimation

- 4 growing regions * 8 varieties = 32 combinations to estimate
- Every region/variety combination has 3 equations
  - Crush (output)
  - Acreage (quasi-fixed input)
  - Prices received

Estimation

- Weather is a major factor in grape production
  - Temperature and precipitation
  - Bloom and harvest
- Costs include labor wages and land prices

Estimation

- Output: Crush = f(lagcrush, expected returns, acreage, t, weather, costs)
- Q-F Input: Acreage = g(lagacreage, expected returns, costs, t, r)
- Prices: Prices = h(crush, income, t)
Estimation

- Expected returns yield far better results than do current or even lagged
  - Calculated somewhat differently for crush, acreage
  - Discounted using prime rate
- All continuous variables in natural log form
  - Mitigate skewed distributions, yield elasticities

Estimation

- Estimate 8 regional systems
  - e.g. North Coast reds, Central Valley whites
- Employ 3SLS and GMM to account for simultaneity and RHS endogeneity

Results

- California wine grape supply is inelastic with respect to price
- Weather, technology play large roles
- Robust evidence for price responsiveness in eight cases

Results

- Chardonnay price response is significant in all 4 regions
- Evidence for Merlot, Zinfandel
- Coastal regions somewhat more responsive than inland
  - Prevalence of contracts
Results

- For several cases, significant long-run elasticities are smaller than short-run
  - Counterintuitive finding
  - If long-run supply is not responsive to price, what is going on?
  - Acreage response: work in progress

Implications

- Prior work on grape forecasting (Lave, Lobell & Cahill), focus on weather
  - Insufficient in several instances
- Any analysis on the CA wine grape industry must be disaggregated
  - Regional/variety level