

## Testing for the Alchian Allen Theorem

The initial description of the data in Table 2 provides an avenue of testing the Alchian Allen theorem put forward by Pritchett and Chamberlain (1993). The Alchian Allen theorem states that if two substitutes of differing quality have the same transportation cost, the higher quality good will be relatively cheaper at the destination location than at the departure location. According to this theory, we are more likely to observe slaves with more valued characteristics being shipped from further regions. A common finding from earlier works like Kotlikoff (1979), Greenwald and Glasspiegel (1983) and our results, is that males on average (all else equal) are more valued in the secondary slave market. Hence, if this theorem holds, the proportion of males from distant regions, like the Old South, would be higher relative to females. Let  $\theta_{i,j}$  be the proportion of gender  $j$  from region  $i = 1, \dots, I$ . If  $\theta$  denotes the  $(2 \times I)$  vector of population proportions, then the maximum likelihood estimator of  $\theta$  is the observed empirical proportions  $\hat{\theta}$ . This estimator will have a multinomial distribution with mean  $\theta$  and variance-covariance

matrix  $\Omega$   $\Lambda(I_{2I} - A)$  where,  $\Lambda$  with  $\frac{\theta_i (1 - \theta_i)}{n}$  on the diagonal and  $-\frac{\theta_i \theta_j}{n}$  elsewhere. We posit the following hypothesis to test this theorem:

$$H_o : \frac{\theta_{New\ South\ Male}}{\theta_{New\ South,\ Female}} \underset{\text{deleted}}{\leq} \underset{\text{added}}{\geq} \frac{\theta_{Old\ South,\ Male}}{\theta_{Old\ South,\ Female}} \quad H_a : H_o \text{ is false.}$$

This hypothesis is tested using a likelihood ratio test for the entire sample (of individually and group priced observations) and a subsample containing only individually priced slaves. We estimate the vectors of multinomial probabilities implied by the restricted and unrestricted models using the method of maximum likelihood. The likelihood is simply the multinomial probability function and the unrestricted estimates are the observed empirical proportions reported in Table 2. Table 7 reports the estimates of the unrestricted and restricted model for both test and the corresponding likelihood ratio test statistic. In the first test involving the entire sample, we fail to reject the null at the 5 percent level but reject it at the 10 percent level of significance.

The test using only individually priced observations provides much stronger empirical evidence against this hypothesis. This suggests that the proportion of males to females from the 'New South' is significantly ~~larger~~ <sup>added</sup> smaller than the ratio originating from the 'Old South'. Since male slaves on average earn a higher price in New Orleans, this ~~contradicts~~ <sup>added</sup> supports the Alchian Allen theorem.