What’s for Dinner? Meat Demand and Separability by Quality and Type in Indianapolis vs. Seattle

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Testing for Nested Barton Models

To test which, if any, of the nested models fit the data, a general testing framework for nested Barton models was developed. The parameter variance matrices for the nested Barton model were tested against the unrestricted Barton model using Wald tests. The parameter values and the results of the Wald tests are presented in Table 1. Table 1: Demand Elasticities

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Asymmetric Separability

A key element of asymmetric separability is that the utility derived from consumption of meats within separate groups can be modeled separately from one another within groups. This allows for the utility function to be expressed as:

$$ u = u_i (\theta_i, \sigma_i, \psi_i) $$

where $$ \theta_i $$ represents the vector of coefficients, $$ \sigma_i $$ are the price coefficients, and $$ \psi_i $$ are the income coefficients. When $$ \psi_i $$ is zero, separability is not achieved. However, when $$ \psi_i $$ is non-zero, separability is achieved.

Separability is tested using a log likelihood ratio (LLR) test, where the LLR statistic is:

$$ L = \frac{1}{2} \left( \ln \frac{L_{null}}{L_{full}} \right) $$

where $$ L_{null} $$ is the log likelihood of the unrestricted model and $$ L_{full} $$ is the log likelihood of the restricted model.

The results of the LLR test are presented in Table 2. Table 2: LLR Tests for Asymmetric Separability

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Potential Separability Relationships

Graph 1: A separability relationship exists between the types of meats within each category. The demand for meats within each category is a function of the prices of the other items and the total expenditure on all items.

Graph 2: High quality meats are separate from low quality meats. Low meats are separate from high quality meats. This implies that expenditure is allocated between high and low quality meat first, then to specific meat types within each category.

Conclusion

We examined the demand for beef, pork, and chicken by type and quality in the Indianapolis and Seattle markets during 2000-2010. The data for Indianapolis was used to test the hypothesis that meat cross price elasticities are not symmetrically separable. The results indicate that cross price elasticities are not symmetrically separable. The results also suggest that there are significant differences in demand between high and low quality meats.

References

Barten (1994) developed a generalized demand system that tests the Barton, AID, and CBS models (Sales, Dunlop, and Wimsatt, 1994). The Barton model is:

$$ d_i = \frac{1}{\sigma_i} \left( \theta_i + \psi_i \cdot x_i \right) $$

where $$ d_i $$ is the change in the share of item $$ i $$ in the diet when income increases. Let $$ x_i $$ be the total expenditure, $$ \pi_i $$ is the price of item $$ i $$, and $$ \theta_i $$ is the income coefficient. The parameter $$ \psi_i $$ represents the difference in the marginal budget shares with respect to income changes.

The marginal budget share is given by:

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