Spatial Price Dynamics and Product Aggregation: An application to the U.S. Dairy Market

Wenying Li
The University of Georgia

Yunhan Li
The University of Georgia

Presentation for the 2018 SAEA Annual Meeting
Jacksonville, FL, 2018

Introduction

- The consistent aggregate product is inadequate for capturing the spatial dynamics of elementary products.

- A case study of the U.S. beverages market where spatial price equilibrium for both consistent aggregated product and disaggregated elementary products are tested.

Introduction

- Spatial price integration of separated markets is an important indicator of market efficiency and well-functioning of an economy's pricing system.

- This principle is usually referred to as the Law of One Price (LOP) in a spatial dimension.

Introduction

- As for the product aggregation, both Composite Commodity Theorem (CCT) (Hicks 1963; Leontief 1936) and General Composite Commodity Theorem (GCCT) (Lewbel 1996), are based on the relationship between price movement.
- The latest theory, GCCT, implies that consistent aggregation concurs with the widely-observed price multicollinearity among elementary goods.
- Thus, there is a close relationship between spatial price equilibrium and product aggregation.

Data

- Scanner data is considered a reliable source for academic studies on price dynamics and composite aggregation. The IRI Academic Data Set (Bronnenberg et al.,2008) is used in our study.

- We focus on the beverages category because of its large purchase volume and variety in elementary products. IRI scanner data allows us to track store-level prices and sales across the country. Every recorded transaction contains information such as Universal Product Code (UPC), quantity, price paid, size, multipack, brand, etc.

Model

Concerning the nonstationarity of prices, market linkage between two spatially separated markets was normally tested by running regression (1)

$$(1)\ lnp_t^1 = B + A\ lnp_t^2 + \in_t$$

where p_t^1, p_t^2 are the prices of elementary products in location 1 and 2, respectively, at time t. Spatial price integration requires that deviations from economic equilibrium, represented by $\in_t$, have a mean invariant to time.

A two-step Engle Granger cointegration tests are empirically used.

Model

Consistent aggregation provides the conditions under which a vast number of elementary goods can be accurately described by a smaller number of aggregated goods.

Following the product aggregation theory, relative elementary prices of one product are defined as: $\rho_t^i = lnp_t^i - lnP_t^i$, where p_t^i is the price of elementary products in location i at time t, and P_t^i is the composite price index of the group product which the associated elementary product belongs to.

The aggregation test between two markets depends on time series properties of ρ_t^1, and ρ_t^2. The procedure involves two steps

Result

We tested three aggregate commodities: coffee and tea, dairy beverage, and soft drink.

High linkage between prices in aggregate composite does not allow us to identify the same pattern in disaggregate products.

An existence of a long-run equilibrium relationship between aggregate milk products, but we also identified a certain-level of market segmentation for the three elementary products.