A Functional Approach to Test Trending Volatility: Evidence of Trending Volatility in the Price of Mexican Agricultural Products

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Selected Poster prepared for presentation at the 2015 Agricultural & Applied Economics Association and Western Agricultural Economics Association Joint Annual Meeting, San Francisco, CA, July 26-28.

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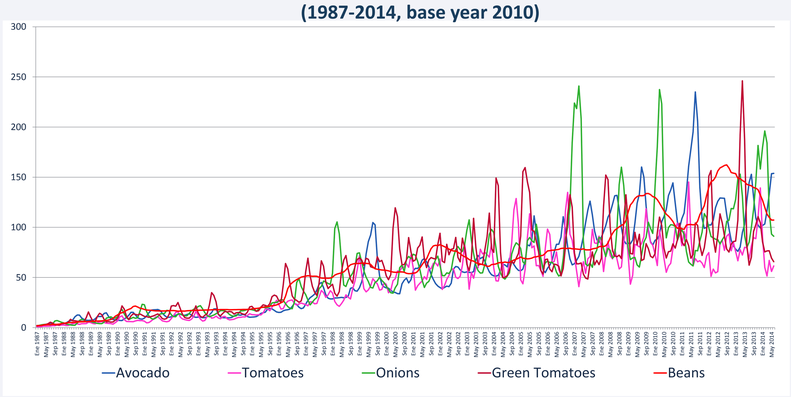
Introduction

- In Mexico, prices of fruits, vegetables and livestock show large fluctuations compared to other products prices. In recent periods, variations of these prices seem to have increased.

Selected fruits and vegetables CPI (1987-2014, base year 2010)



Importance of price volatility and Objectives

- Increasing trends in the price volatility of agricultural commodities can have negative effects on poverty and nutrition.
- The objective of this paper is to characterize Mexican agricultural prices in two dimensions of their volatility: clustering and trend.
- This can help the government to improve the targeting of existent programs and to design support policies that more effectively cope with the different risk dimensions of price volatility (hedging instruments, insurance schemes, etc.).

The Model

- The ARCH with trend model adds a linear trend component to the standard ARCH (1) model of Engel (1982).

$$\varepsilon_t = \sigma_t \omega_t , \qquad \omega_t \overset{i.i.d.}{\sim} N(0,1)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta t$$

- Volatility clustering is given by α_1: the larger the parameter the more likely periods with high (low) volatility will be clustered together.
- Volatility trend is given by β: a positive parameter indicates that the price volatility increases over time.
- Depending on the values of α_1 and β, the unconditional variance of the model can:
- 1. Be constant and identical to the one obtained by the ARCH (1) model ($\beta=0$).
- 2. Grow linearly over time ($\beta\neq0$ and $|\alpha_1|<1$).
- 3. Exploit over time ($\beta\neq0$ and $|\alpha_1|>1$).
- In terms of policy the most concerning cases are 2 or 3, where the variance grows over time.

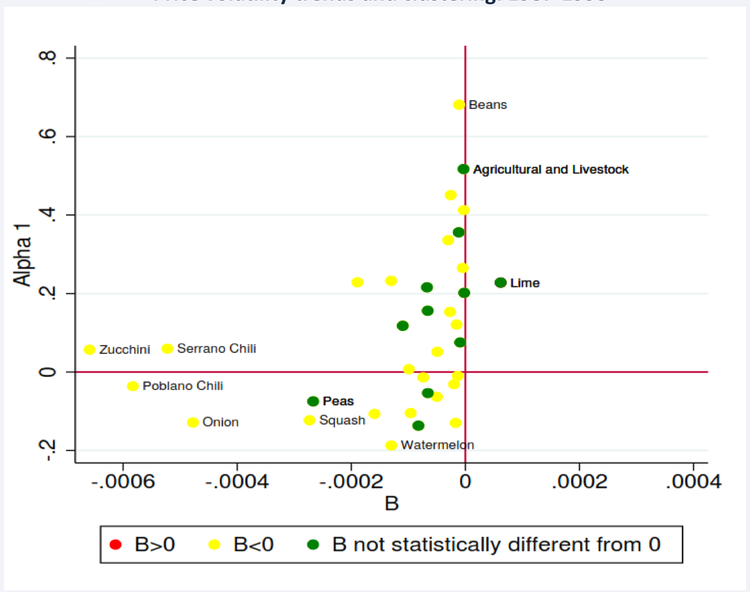
Data and analytical issues

- The model is applied to 43 monthly agricultural and livestock price time series and the composite agricultural CPI for three selected periods based on historical considerations of price policies:
  - 1987-1993: Pre-NAFTA and government price regulations.
  - 1994-2005: Post-NAFTA and previous to the commodity supercycle.
  - 2006-2014: Commodity supercycle.

Results

- Before 1994, many products exhibited negative volatility trends and no clustering.

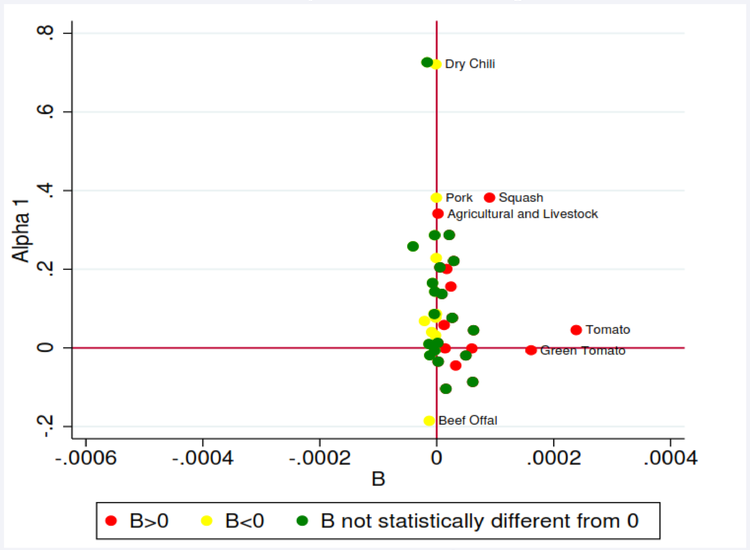
Price volatility trends and clustering: 1987-1993



Estimate α_0 represents the constant, α_1 the clustering and β the trend of the price volatility.
*, **, *** statistically significant at 10%, 5% and 1% levels, respectively.

- During the period 1994-2005, both price volatility trends and clustering increased for most agricultural products, indicating that deregulation and opening up to trade increased price volatility of these products.

Price volatility trends and clustering: 1994-2005



Estimate α_0 represents the constant, α_1 the clustering and β the trend of the price volatility.
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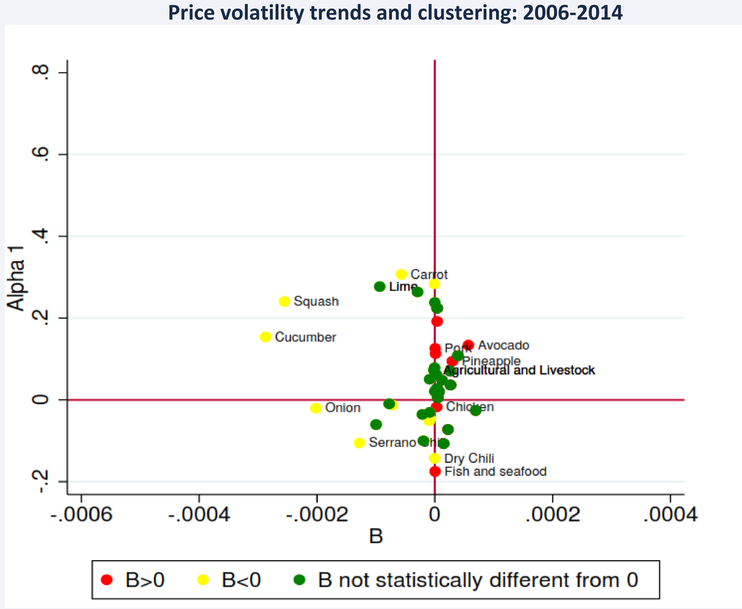
- In the commodity supercycle period (2006-2014), price volatility trends decreased for fruits and vegetables but increased for some livestock products.

Price volatility trends and clustering: 2006-2014



Estimate α_0 represents the constant, α_1 the clustering and β the trend of the price volatility.
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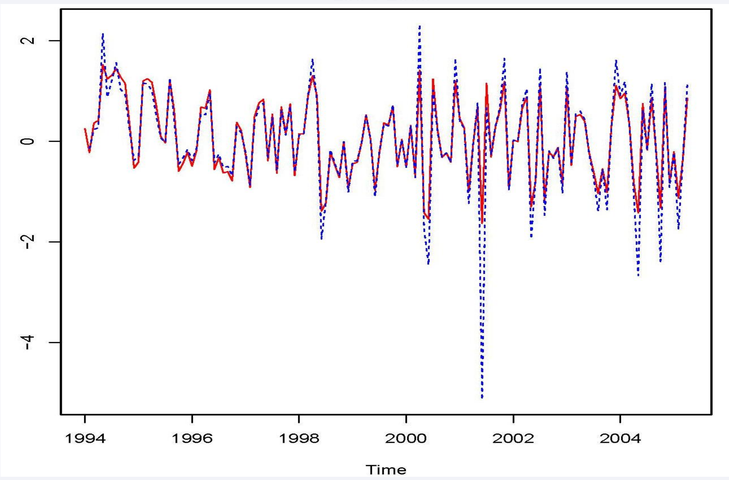
- The ARCH with trend model outperforms the GARCH(1,1) model in the presence of statistically significant trends in the conditional variance.

Goodness of fit GARCH(1,1) vs. ARCH with Trend for Agricultural CPI: 1994-2005



Conclusions

- Perishable agricultural products show higher price volatility trends than the non-perishable ones.
- For most products, volatility clustering and trends increased after 1994.
- Price volatility of the fruit and vegetable CPI increased ten-fold between 1994-2014 compared to the period 1987-1993.