Structural Price Changes Due To H5N1

ZEBEDEE NII-NAATE
Development for Environment, Food and Rural Affairs, UK Government
zebedee.nii-naate@defra.gsi.gov.uk

JOHANNES SAUER
Economics and Sustainable Consumption Institute, University of Manchester, UK
johannes.sauer@manchester.ac.uk

Poster prepared for presentation at the Agricultural & Applied Economics Association's 2010 AAEA, CAES & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010

ZEBEDEE NII-NAATE (Department for Environment, Food and Rural Affairs) and JOHANNES SAUER (University of Manchester)

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Introduction

Poultry meat is the second most important meat type in the European Union today.

To understand how information about Avian Influenza, informally referred to as bird flu (H5N1), affects market prices, we examine market prices' movements to Avian Influenza (Ai) notifications. AI which is a highly contagious viral disease affecting several species of food producing birds, as well as pet birds and wild birds.

Hypothesis

Reports of AI would have had a negative impact on the price of poultry relative to pork. A change in the relative poultry-pork implies a change in the underlying supply and demand structure and enables direct estimation of the price impact of the outbreak.

Little literature estimating structural changes of agricultural commodity prices following a food scare.

Context

The European poultry industry employs a great number of people across Europe and consumes about 20% of the total EU cereal production for poultry.

The H5N1 train of the virus spreads rapidly and may cause serious disease and result in high mortality rates (up to 100% within 48 hours).

The first outbreaks in Western European were recorded in January 2006 when cases were confirmed in wild swans in Italy, Greece, Germany and Austria. Within weeks, cases were confirmed in Slovenia, Slovakia, Hungary, and France, where mass vaccination of ducks and geese on farms was carried out. The 250th death through bird-to human transmission occurred at the end of 2008.

The direct economic costs include loss of poultry due to the disease and control measures such as culling birds, with impacts extending not only to farmers but also to upstream and downstream sectors such as poultry traders, feed mills, breeding farms etc.

Data

Weekly nominal European Union 15 market prices (Euro per 100 kg) for poultry and were assembled for the period 6th January 2002 to 6th July 2008. Sourced from the Eurostat database.

Econometric Analysis

1. Natural experiments

a) The outbreak of AI constitutes a natural experiment.

b) Adds to the existing literature which typically uses laboratory experiments to estimate price discounts associated with genetically modified

2. Relative price of a substitute method

a) Although it is known when outbreak occurs, the exact tipping point of how it may change consumer preferences is unknown.

b) Uses the Carter et al (2007) relative price of a substitute (RPS) method which exploits the equilibrium properties of the relative price of a good to the price of a close substitute.

3. Decomposing log relative pork-poultry prices

First we analyse the time series properties of the two series by decomposing the variables into a variety of components – global trend, cycle, seasonal and an irregular component , with sine and cosine functions to smooth variables into an amplitude.

Estimating the price impact

Economists use natural experiments because: (i) they are plentiful and inexpensive (for researchers, at least); (ii) they often provide convincing control and treatment groups; (iii) they provide real-world evidence (in contrast to randomized trials, where we may have to worry about cream-skimming - considered as a type of moral hazard - and micro vs. macro effects; (iv) the stakes are usually much higher and therefore more realistic in natural experiments; and (v) it would be difficult to simulate a large food safety scare in a laboratory.

$$\log\left(\frac{P_{at}}{P_{2t}}\right) = \mu + \beta' Z_t + u_t$$

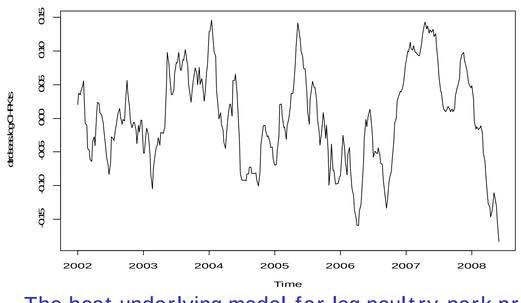
$$x_t = m_t + \sum_{i=1}^{[\frac{s}{2}]} \{s_i \sin\left(\frac{2\pi i t}{s}\right) + c_i \cos\left(\frac{2\pi i t}{s}\right)\} + z_t$$

Estimating the price impact

The results indicate that log poultry and log pork prices are cointegrated at the 5 per cent significant level. The individual log prices contain a unit root and the relative price is mean reverting.

Fitting procedure of log relative prices

Log relative price between poultry and pork after the trend and seasonal variation has been removed



The best underlying model for log poultry-pork prices is when t = 3 and s=52 a cubic trend with 52 seasons. To avoid over-parameterisation, the Bayesian Information Criterion was used in model selection.

Econometric Results

Decomposition of time series

a) The correlation coefficient between log poultry and log pork prices is 0.57.

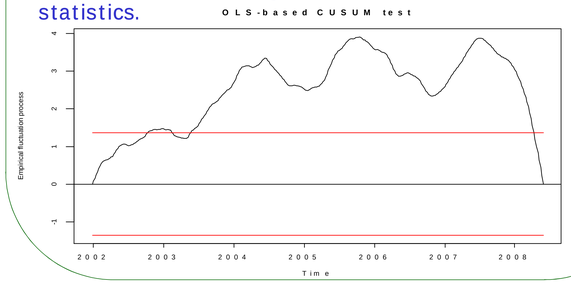
b) The individual log prices contain a unit root and the relative log price is mean reverting.

c) The best fitting model of the detrended and deseasoned log relative price is an ARMA (2, 0 ,0). The dynamic response suggests that there was a very short time delay in the transmission and the reception of birf flu.

d) The ARMA (2, 0, 0) is tested it for specification adequacy by applying Ljung-Box Portmanteau and Dickey-Fuller unit root tests on the model's estimated residuals. Results strongly suggest that the model achieved literature-established standards of statistical adequacy.

Structural change test

OLS-based CUSUM process of Ploberger et al (1992) producing the plot. The associated structural change test, is significant at the 5 per cent level, signalling that the model parameters are not stable throughout the entire sample. A similar conclusion emerges from the test based on F statistics.



Conclusions

1. Co-movement exists between poultry and pork prices.
2. The relationship between poultry and pork is stationary.
3. Avian influenza and higher commodity prices may have caused a structural change in the relative price of poultry and pork.
3. A cointegrating relation between poultry and pork and that structural change due to AI may exist.
4. Given that there is evidence of structural change in the data, a natural strategy is to find a model that incorporates the changes.

Contact Details

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UK Government
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