A decomposition model of vertical price transmission with scanner data

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A decomposition model of vertical price transmission with scanner data

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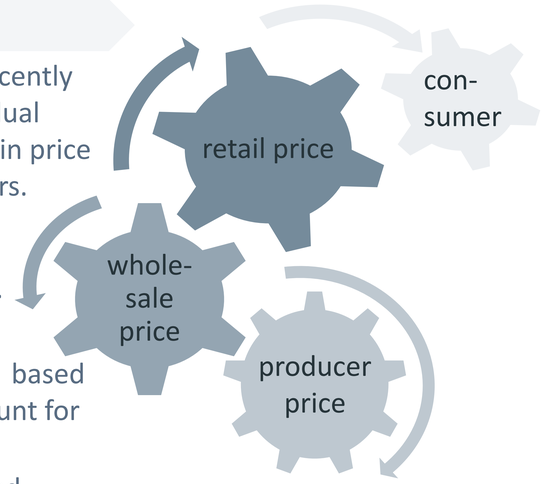
DFG Deutsche Forschungsgemeinschaft

INTRODUCTION

Food retailing is often highly concentrated: recently studied is the price-setting behavior of individual retailers looking for evidence of asymmetries in price transmission between wholesaler and retailers.

Scanner data for retail prices are increasingly used therein.

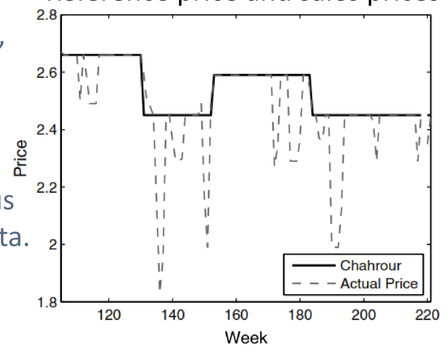


However standard price transmission models based on cointegration methods are unable to account for two main characteristics of scanner prices:

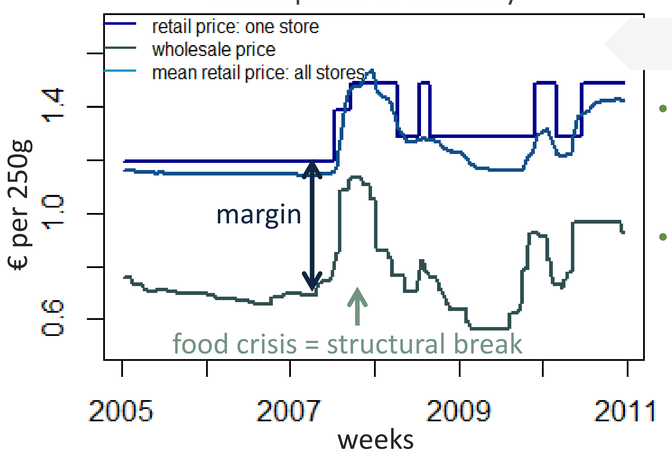
1. short-term promotional prices are included which are asymmetric in nature and can therefore bias estimates of price transmission,
2. if promotional prices are filtered out, the remaining so-called reference prices follow discontinuous jump processes.

Standard cointegration models assume continuous adjustment, thus are not appropriate for such data.

Reference price and sales prices



Example for weekly wholesale and retail butter prices in Germany



OBJECTIVES

- How to account for discontinuous jump processes of individual retail price series?
- How do retail reference prices respond to indiscrete jumps of wholesale price changes? Role of margin?

DATA

• German market for 250g-packaged butter • weekly retail scanner data • weekly wholesale prices • 01/2005-12/2010 • filter for reference price: 13-weeks-rolling window

METHODS

Decomposition model by Rydberg and Shephard (2003) accounts for discreteness and rare occurrence of retail price changes:

Specify the probability function of retail price movements y_t instead of the joint distribution:

$$P(y_1, \dots, y_n|\mathcal{F}_0) = \prod_{t=1}^{n} P(y_t|\mathcal{F}_{t-1})$$

Decompose retail price movements y_t into three consecutive parts:

$$y_t \equiv P_t - P_{t-1} = A_t D_t S_t$$

Accordingly, estimate three probability functions:

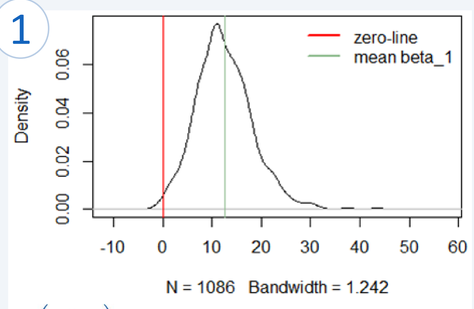
$$P(y_t|F_t) = P(A_t D_t S_t|F_{t-1})$$
$$= P(S_t|A_t, D_t, F_{t-1})P(D_t|A_t, F_{t-1})P(A_t|F_{t-1})$$

1. A_t: Modelling the probability that a retail price changes by a Firth-type penalized logistic regression
2. D_t: Given that the retail price has changed, modelling the probability for an increase or decrease by a Firth-type penalized logistic regression
3. S_t: Given that the retail price has changed and in which direction, the size of an increase or decrease is governed by a geometric distribution

RESULTS

➢ crucial parameter: ($margin_{t-1}$ – ∅ margin) ≡ squeezed or enlarged distance from the target, the mean margin

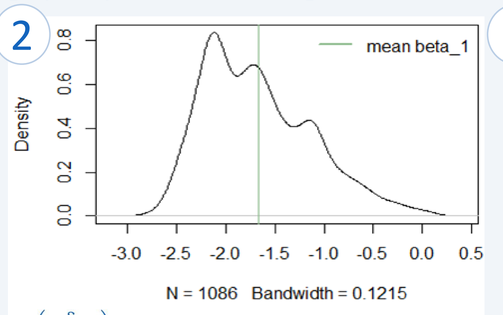
1



$$ln\left(\frac{p_t}{1-p_t}\right) = \beta_0 + \beta_1|margin_{t-1} - \emptyset margin| + \epsilon_t$$

density of β_1 (***) for all retailers: retail price change highly probable

2

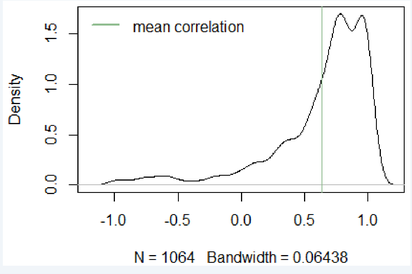


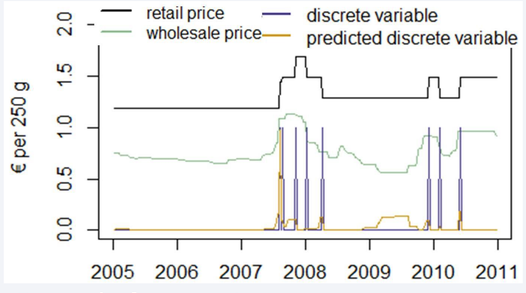
$$ln\left(\frac{\delta_t}{1-\delta_t}\right) = \beta_0 + \beta_1 I(margin_{t-1} - \emptyset margin) + \varepsilon_t$$

density of β_1 (*** and *) for all retailers: some are more likely to increase (decrease) their prices

3 estimations not meaningful due to few observations per retailer

but: positive correlation between size and negative crucial parameter





Example for part A_t

CONCLUSION

- promising: model reveals hierarchical price-setting behavior
- margin: significant driver in retail price-setting
- duration between two retail price changes: insignificant
- evidence for asymmetry
- problem: small sample size to estimate size of retail price change

REFERENCES
Rydberg, T.H., and N. Shephard. 2003. "Dynamics of Trade-by-Trade Price Movements: Decomposition and Models." In: Journal of Financial Econometrics 1(1):2-25.

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