Estimating the Demand for Milk and Meat in Austria Using a Generalized Differenced Demand Model

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***Abstract* - Applying a generalized demand system approach, we estimate current price and income elasticities in the Austrian retail market based on an expansive dataset both in terms of time span and the number of observations included. Within the framework of a three-stage-budgeting approach, more disaggregated demand reactions for milk products and types of meat are estimated, in due consideration of potential structural breaks such as the BSE crisis. In order to assess consumers' sensitivities, a recent analysis for Germany on meat products and a study that comprises several studies of milk demand for European countries serve as a benchmark. Results indicate that demand for meat as an aggregate group is rather price-isoelastic in Austria, whereas on a more disaggregate level, demand for pork and beef turns out fairly price-elastic. Along the same line, Austrian milk demand on an aggregate level is found to be comparably less price-responsive, although disaggregated reactions for cheese and drinking milk are stronger than average results for European markets. Substitutional patterns mainly occur for poultry and beef, whereas the potential for substitution among meat products seems to be higher than in Germany.**

INTRODUCTION

It is a well-known fact that consumer reactions to changes in price and overall expenditure need to be accurately identified for a profound market understanding from both a corporate and a governmental perspective. As corresponding recent studies exist for Germany (Thiele 2008) and a selection of other European countries (Bouamra-Mechemache 2008), we want to investigate Austrian elasticities of demand with respect to changes in prices and income, and compare these to the ones found for other parts of Europe. The Austrian retail landscape has not remained completely uninspected with regard to demand analyses, but local research up to this point is either constrained to a limited number of products or rather antiquated. The aim of this study therefore is to provide up to date estimates on price and income elasticities of demand for the Austrian food retail market, focussing on milk products, butter, meat, fruits and vegetables on a more aggregate level plus meat and milk products products on a more disaggregated basis. Incorporating a multi-stage budgeting approach, we estimate a demand system based on a model by Barten (1993), which nests some of the most popular and common demand model approaches.

DATA

The core of our dataset consists of monthly data on expenditures and quantities purchased during the time period 1997 to 2009. The data is derived from RollAMA, Austria's biggest panel dataset (1400 households) in regard to food purchases, by aggregating all purchases and expenditures of a certain product category on a monthly basis. The utilized data set comprehends purchase information on a variety of food products, including several milk products, butter, fruits, vegetables, pork, poultry, and beef. Annual data from 1977 till 2010 on overall household expenditures and purchased quantities of food and non-food in Austria, which were obtained from the OECD, complement the basis for our analysis.

We incorporate the concept of multi-stage budgeting. Budget allocation in our case contains three stages, where the first one is constituted by the choice between food and non-food products. For the second stage, pork, beef and poultry are combined into the category of meat, so that five broad groups of products remain, namely milk, butter, fruits, meat and vegetables. The third and last stage includes milk and meat products on a more disaggregated level. Here, milk products are clustered into three main groups: 1) drinking milk including fresh milk, ESL (extended shelf life) milk and UHT (ultra high treatment) milk; 2) cheese in all forms; and 3) a residual category of other milk products including yoghurt, whipped cream, curd and sour cream, whereas meat is simply disaggregated again into pork, poultry and beef.

METHOD

Demand at each of the three stages is modelled by a synthetic model developed by Barten (1993), which nests the AIDS (Deaton, Muellbauer 1980) and the Rotterdam (Theil, 1965) model as well as their intermediary cases:

$$(1) \qquad w_i d\ln q_i = (b_i + \delta w_i) d\ln Q$$

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$$+ \sum_j [c_{ij} - \gamma w_i(\delta_{ij} - w_j)] d\ln p_j$$

In the above equation (1), b_i, δ, c_{ij} and γ are the parameters to be estimated, q_i and p_i represent quantities demanded and prices, whereas $d\ln Q$ refers to the Divisia volume index, w_i is the budget share of the respective good and δ_{ij} stands for the Kronecker Delta. As a key feature of the model, different values for the nesting parameters can be hypothesized in order to test which of the nested models is most suitable for the data at hand. To complete the setup for the models, we add an intercept to each equation (1) to (1d), which is represented by $\alpha_i = \alpha_{i0} + \alpha_{il} \sum_{l=2}^{k} D_l$, with the addition of k seasonal dummies (DM) . At the third stage, the intercept is further extended by a dummy variable D_{BSE} , which is included because of the observed leaps in the budget shares for beef and poultry around December 2000, most likely triggered by the fact that the first case of Bovine Spongiform Encephalopathy (BSE) in neighboring Germany was discovered in that month.

A Hausman-Wu test is applied to equation (1) to detect potential endogeneity problems at each stage of the budgeting process. As instruments we use lags of all independent variables, a consumer price index for Austria, an energy price index, an index for agricultural raw material prices, prime interest rates in the Euro zone and the exchange rate between Euro and the Swiss Franc.

Theoretical restrictions of adding- up, symmetry and homogeneity are directly imposed on our parameters. Weak separability of the products from all other goods is presumed to justify the conditional demand specification. Based on the parameter estimates from the respective model, price and income elasticities are derived.

RESULTS

The strongest reactions to the disaggregated meat price changes at the third stage were found for pork and beef, while both drinking milk and cheese demand were also estimated to be highly elastic at the third stage. On the more aggregate second stage, demand for butter turns out to be most elastic, whereas most other price elasticities end up with absolute values less or equal to one. It is noteworthy that for both milk and meat, disaggregate price elasticities are rather heterogeneous in their magnitude. The same insight is maintained for income elasticities, where the aggregate group of meat and the sub-groups of pork and beef are found to be quite expenditure-elastic, while this is not the case for poultry.

In order to match our findings, we chose a paper by Thiele (2008) for the neighboring market of Germany as a reference point. Differences in outcomes with regard to their findings for Germany occur for the three types of meat at the third stage, where price reactions for Austria are throughout higher. In addition, while the propensity to substitute between different types of meat is not detected for Germany, the opposite is the case for Austria. In view of the significant positive cross-price elasticities for meat types at the disaggregate level, it seems likely that substitution of pork, poultry and beef is responsible for the slightly lower own-price elasticity of meat in Austria at the aggregate level.

Looking at the disaggregated stage with regard to milk products, our results are quite in line with the ranges found in Bouamra-Mechemache (2008) for drinking milk and cheese, with price reactions at the upper limit in absolute value.

DISCUSSION

Generally, in light of the varying levels of demand elasticity across the different stages of budgeting, policy considerations based on price and income elasticity estimates for Austria need to rest upon an accurate choice of product aggregation levels.

Given our results, Austrian tax policy makers need to be aware of the potentially strong reactions in e.g. pork when considering an influence on red meat consumption. This is also momentous as the largest difference between uncompensated and compensated price elasticities is found for pork at the third stage, implying potential for large income effects. Likewise, retailers in Austria might want to contemplate that price elasticity of demand for drinking milk is among the highest in Europe, which could become particularly suspenseful with a relatively homogeneous good like drinking milk. In general, the comparably elastic reactions to meat and milk price changes at the more disaggregate level indicate that marginal price decreases could sensibly boost demand here.

This being said, it would be interesting to examine the sensitivity of price and income reactions in Austria to the inclusion of selection mechanisms when household data is available. Along the same line, an interesting starting point for future analyses on the Austrian retail market would be to investigate the role of sociodemographic aspects in demand.

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