The impact of Euro introduction on the vertical price transmission in the German food market – Does money illusion matter?

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Paper prepared for presentation at the XIth Congress the EAAE (European Association of Agricultural Economists), 'The Future of Rural Europe in the Global Agri-Food System', Copenhagen, Denmark, August 24-27, 2005

Abstract:

In this paper the impact of the introduction of the Euro on the vertical price transmission in German food markets is analyzed. It is hypothesized that following the introduction of the Euro the presence of money illusion might have lead to higher real prices, and if so it is likely accompanied by higher margins between respective wholesale and retail prices. While other studies have mainly focused on the behavior of average prices, here reactions at the individual store level are investigated. For cucumber and carrots the vertical price relationships between retail and wholesale prices are estimated by employing an error correction approach, which is enhanced to test for structural breaks with a flexible time frame using a F-max approach. The results indicate significant changes in the vertical price relationships for one forth of the retailers under study. Though significant the directions of changes do not uniquely fit the theoretical predictions for money illusion. Thus, the majority of German food retailers has not used the introduction of the Euro to increase their mark ups.

1 Introduction

The implementation of a single European currency, taking full effect in January 2002, has received a great attention from the public, the press, and the academic society. Much of academic literature has discussed the question of whether Europe is an optimal currency area and has emphasised the incremental increase in the stability of the exchange rate system when the Euro is finally fully adopted (e.g. Bayoumi and Eichengreen, 1993; De Grauwe, 1994; Obstfeld and Peri, 1998). Other works share the popular view that the adoption of the single European currency is a more fundamental change. They explored the role of the Euro as an international currency and suggest that the Euro may become a 'vehicle currency', which competes with the US Dollar (e.g. Hartmann, 1996; Portes and Rey, 1998). More recently, Devereux, Engel and Tille (1999) focussed on the issue how the Euro may alter the responsiveness of consumer prices to exchange rate changes. Their central conjecture is that the acceptance of the Euro will lead European prices to become more insulated from exchange rate fluctuations, much the way U.S. consumer prices already are.

In contrast, only few studies examining the direct impact of the Euro introduction on European consumers' price responsiveness and retail firms' price setting behaviour and thus in turn on real price levels. This seems to be surprising, since, with the beginning of the new century, there was a growing concern among consumers about possible abuses and cheating

on (consumer-, retail) prices during the changeover to the Euro cash (Aucremanne and Cornille, 2001). In particular, the public as well as the press feared that the retail sector would use the cash changeover to carry out 'hidden' price increases. Moreover several descriptive statistics suggest remarkable price changes in some retail sub-sectors during the first month in 2002 compared with the same periods in 2001.

Aucremanne and Cornille (2001) simulate (real) price changes in the Belgian retail sector resulting from recalculations of all 'attractive' prices and psychological pricing points, respectively in national currency into Euro. They report slight positive effects on the consumer price index ranging from 0.54% to 0.72%. However, the authors suggest that their simulation results are very unrealistic, as factors such as competition on product markets, the prevailing demand conditions, and the commitments made by organisations representing the firm/retail sector retrain the possibility of rounding up. In addition, the authors emphasize the problem of isolating the Euro-induced rounding effects from 'regular' price changes. Similarly, Diller and Brambach (2002) empirically examine the extend of Euro attractive price adjustments in the German retail sector around the year 2001/2002. They report that only 30% of the sampled retail prices were converted into Euro attractive prices, whereof less than 10 percent were rounded up. All in all, the authors did not find remarkable Euro-induced rounding effects and thus real price adjustments in the German retail sector due to the introduction of the Euro.

In addition to the rounding effects, Brandstetter and Kehl (2000) offer another explanation for possible Euro-induced real price adjustments for the Austrian beverage sector. The authors experimentally test if consumers alter their willingness to pay when prices are displayed in Euro instead of Schilling (national currency). Results of conjoint analyses suggest that consumer demand responses vary between Euro and Schilling prices, which in turn may lead to real price adjustments.[1]

In this study we do not evaluate the potential relevance of these findings. We do, however, argue that menu costs and particularly money illusion have been dismissed as potential candidates for the examination of Euro-induced real price adjustments in the German food retail sector. It is therefore hypothesized that the existence of both menu costs and money illusion might have lead to higher real prices as a result of the Euro, and if so it

[1] Brandstetter and Kehl (2000) do not explicitly evaluate the impact on real price adjustments.

must be accompanied with a higher margin between the respective wholesale and retail price. Thus, we test for structural breaks in the margins. Moreover, we estimate the timing and duration of Euro-induced price adjustments in the German food retail sector. In particular, as retail stores might have anticipated the effects of the nominal shock and because the impact is expected to vanish over time we use a model that allows for flexible starting and end points as well as for smooth transition back to the real price equilibrium prior to the introduction of the Euro.[2]

While other studies have mainly focused on the behavior of average prices, we study reactions at the individual store level. A unique data set of weekly food prices for 271 individual retail stores is used. We choose two homogenous products for the analysis, cucumber and carrots. Because of the non stationary behavior of the price series, an error correction (ECM) approach is applied to quantify the vertical price transmission between retail and wholesale prices. A standard error correction model is expanded to capture potential structural break points triggered by the introduction of the Euro. As mentioned above, instead of using the date of the introduction of the Euro as a natural break point we endogenously determine the break points.

The paper is organized as follows. In section two we present a brief discussion of the theory to explain the impact of the Euro introduction on the vertical price transmission. In section three data and sampling issues are described and discussed. In section four and five the model specification is developed and the empirical results are summarized. Finally some conclusions are drawn.

2 Brief review of the theory

The literature so far provides four arguments for the impact of the introduction of the Euro on the retail price transmission. A first argument, which is often mentioned, is the rounding of Euro prices into ‘attractive’ prices. Converted to Euro, attractive prices in national currency may not look attractive anymore, which could give rise to temptation to round prices up (or down) to the nearest attractive price in Euro. In this paper, we do not explicitly examine this

[2] It should be noted that our empirical approach does not allow to distinguishing between the impacts of menu cost or money illusion on real retail prices. We estimate a cumulative effect of any cause that appears in the period of the introduction of the Euro. However, the occurrence of structural breaks before January 2002 indicates the role of anticipated effects by the retailers.

argument since previous studies (e.g. Diller and Brambach, 2002) signal that rounding effects can be neglected.

A second argument is based on the impact of menu costs[3] that is the price adjustment itself might cause some costs of adjustment. For example, Levy et al. (1997) and Dutta et al. (1999) provide a quantification of menu costs in US retail markets, demonstrating that they on average account for 27% to 35% of net profit margins. The introduction of the Euro might have caused such menu costs which in the following might have passed on to the consumer via retail price increases. The major part of these costs is attributable to the IT infrastructure (e.g. currency adjustments in cash registers and PC's), staff training and internal communication. Retailing differs from other branches in a larger proportion of costs incurred in modifying payment points, additional cash handling, special security measures and dual pricing. As these costs represent only 1% to 3% of the turnover (Müller-Hagedorn and Zielke, 1998) significant price impacts are not very likely. However, assuming retail stores act as price setter these adjustment costs lead to price increases in order to stabilize the profit margins at least in the short term. In addition (supplementary) charges, i.e. the difference between wholesale and retail prices, will increase ceteris paribus. However, because of the menu costs' share is small and food prices are adjusted regularly, we do not expect significant effects following the Euro introduction.

Third, the presence of money illusion might be an important source of Euro-induced retail price adjustments. Wassily Leontief (1936) defined money illusion as a violation of the 'homogeneity postulates', which stipulates that demand and supply functions are homogenous of degree zero in all (nominal) prices. Thus only relative price changes matter. Shafir, Diamond and Tversky (1997) provided questionnaire evidence for the presence of money illusion. Their results suggest that preferences of people as well as their perceptions of constraints are affected by nominal and not only by real values. Moreover many people do also expect other peoples' behaviours to be affected by money illusion. Fehr and Tyran (2001) provided experimental evidence that money illusion affects the price adjustment process following a monetary shock. The results indicate for a negative shock (smaller units) firms tend to increase real prices. This is particularly true, when firms believe that nominal prices of other firms are kept close to the pre-shock equilibrium (see also Haitwanger and Waldman,

[3] Menu costs consist of printing new price labels or menus, new prices advertisements, setting new prices in the cashier system etc.

1989). Similar, real price increases might be likely when consumers suffer from money illusion. This follows from a higher marginal willingness to pay in the case of a negative monetary shock (Brandstetter and Kehl, 2000). As in the case of menu costs, the presence of money illusion might lead to higher real Euro food retail prices and thereby to increased retail margins. The experiments also indicate that the effects of money illusion fade in time (Fehr and Tyran, 2001).

Finally, the Euro introduction might have induced some strategic behaviour of retailers. Firstly, because of a great public debate prior to the introduction of the Euro, retailers might have tried to hide their (real) price adjustments by anticipating or delaying their reaction. To overcome consumers' concerns of Euro related increases in prices and margins after the first of January 2002, retailers might have anticipated or postponed these adjustments to some weeks or month. Although, economic theory do not provide strong arguments for this hypothesis, it seems at least plausible that firms might have applied such strategies. Secondly, contrary to the money illusion hypothesis some retailers might have cut prices and margins following the Euro introduction to reinforce their low price strategy and to overcome potential consumer 'protests'. Moreover, retailers could have raised prices in advance to fake a real price cut after the Euro introduction to seemingly reemphasize their low-price strategy.

To summarize, the impact of the introduction of the Euro on the retail price transmission might be a result of a mix of the four effects and pricing strategies mentioned above. While, it is expected that the presence of menu costs and in particular money illusion lead to higher retail margins, the impact of both 'price rounding' and the timing on price adjustment is less clear. For example, if sellers have anticipated price adjustments, real price decreases at the date of the Euro introduction could be observed. Therefore, we employ a flexible time series approach to identify any potential structural change related to a certain period prior and post the introduction of the Euro. As all the above discussed effects by an inherent one time deflationary shock are assumed to be temporary, our approach is designed to allow for a smooth transition back to the pre-shock equilibrium. Though the outlined effects describe output price reactions only, we include wholesale prices to separate the effects of coincidental costs changes.

3 Data and sample reduction

We use weekly food retail and wholesale food prices for Germany from October 2000 to

March 2002 which makes a total of 131 observations for each individual retailer. The data has been provided by the "Zentrale Markt- und Preisberichtstelle" (ZMP) in Bonn, Germany. To inform consumers and retailers about the developments in food retail prices, the ZMP has set up a price reporting system on a weekly basis. The ZMP maintains a network of roughly 450 so-called 'Melder' ('melden' = to report) who visit about 1,300 retail food stores in Germany and collect price data for a variety of standard fresh foods.[4] The sample is designed to represent the geographic regions and the type of stores with respect to their population values. Thus, the ZMP tries to reflect the relative weights of the region measured by its population and the number of store types for the underlying population in construction of the sample. Germany is divided into 8 geographic regions for this purpose, and retail stores are divided into 6 categories (small supermarkets (SSM: primarily food less than 400 square meter shopping area), big supermarkets (BSM: primarily food more than 400 but less than 800 square meter shopping area), combined supermarkets (CSM: food and other items more than 800 square meter shopping area), discounter (DC: primarily food with self service), butchers (BU), fruit and vegetable markets (FV)). In accordance to the relative weights given by the underlying populations with respect to regional, peoples', and store types' aspects the ZMP decides what kind of store from what region enters the sample.

To ensure the homogeneity of food products, the Melder is given detailed instructions on the quality of the product and the measure (price per piece or per kg). The Melder decides on what day of the week she visits the stores to report on. Special offers are to be considered. The Melder fills out a standard sheet that is send back to the ZMP weekly. The ZMP does not publish individual store prices or any information on the price setting behaviour. Instead, on a weekly or monthly basis, average prices for regions and store types for all products are published.[5]

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[4] The list of products does only include some processed items, such as butter, yoghurt, or sausage.

[5] The data sent by the Melder are processed as follows by the ZMP prior to publishing:

i) Removal of 'obvious outliers' (e.g. misplaced decimal points) by hand and removal of observations that deviate by more than 2.6 standard deviations from the mean. Roughly 1-2 % of the available observations are lost in this way.

ii) Calculation of the unweighted average price for each store type within a region.

iii) Calculation of the regional average as a weighted average of the store type averages from ii), with weights equal to share of each store type in total purchases of the commodity in question.

The ZMP-panel is designed to be a random sample of the above-mentioned types of food stores in Germany. However, reporters decide on the store they visit to report prices and neither the reporter nor the store she selects is chosen *a priori* randomly. As we do not have information about the group of reporters, such as age, education, income etc. we can only speculate towards which direction the actual sample might be biased. For instance, it is likely that low income pensioners are over represented in the sample of reporters; thus, it might well be that these people prefer to report on low price stores. In this case estimates of average prices or conclusions drawn from our analysis might be biased with respect to the underlying population. By controlling the regional number of stores and the number of the various store types, potential biases of sample parameters due to these characteristics are limited.

For our study we selected two out of the 56 food products available. As we focus on the price transmission behaviour during the introduction of the Euro we aim to get a full panel data set. We first selected the food products by excluding the items that are only offered seasonally, such as cherries, by excluding the products that are only reported on a monthly basis, such as milk products or bread. Between the remaining we selected those that maximize the number of observations; by this sampling we aimed to maximise the number of stores with a continuous reporting over time. We define continuous price reporting by availability of price observations for each product in more than 95 % of all weeks in the sample. For missing observations we set the price of the product in the week before. This entire selection process reduced the number of observations by about 80 percent. For the products under study we end up with retail price data for 271 stores. Prices are reported in German cent or pennies per kilogram in the case of carrots and in German cent or pennies per piece in the case of cucumber. Since 2002 prices are reported in Euro cent. For the analysis prices in the pre Euro

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iv) Calculation of the national average price for each store type as the weighted average of the store type averages from ii), with regional population shares as weights.

v) Calculation of the national average over all store types as the weighted average of the regional averages from iii), with regional population shares as weights.

vi) Average product prices are only published if at least 100 observations were available over all store types and regions.

The resulting regional, store type and national averages for each food product are published weekly and also provide the basis for a variety of monthly, quarterly, and annual publications produced by the ZMP (see ZMP internet page at http://www.zmp.de). Furthermore, this data is reproduced in many other publications, such as local farm journals and consumer affairs publications etc.

period are transformed by applying the official conversion rate of 1.95583 Deutschmark per Euro.

To study the vertical price transmission we also collected wholesale prices of cucumber and carrots. As prices at the wholesale level indicate a high level of market integration we use average wholesale prices in Germany to reflect buying in prices for retailers.[6] These data are also available weekly and are also provided by the ZMP (2003). The average retail prices and the corresponding wholesale prices for the period from January 2001 to April 2003 are shown in Figure 1.[7]

Insert Figure 1 about here

Figure 1 shows no obvious significant structural break related to the introduction of the Euro for the aggregate series. The aggregate retail price is here the simple average over the individual stores' prices. For the individual stores, information on the corresponding zip code (exact regional location), the type of the store (see above for definition), the name of the store, and the company that owns the store are also available. The stores in our final sample belong to type and companies shown in Table 1. Because of confidentiality reasons, the real names of the companies have been suppressed and substituted for alphabetical letters.[8]

Insert Table 1 about here

[6] We collected prices from various German wholesale markets. These prices are highly integrated and the hypothesis that prices appear identical from a statistical point of view could not be rejected. Therefore, we decided to use one representative price which is the simple average wholesale price. Nonetheless we are aware that wholesale prices might not be the adequate input price indicator of individual retail stores. Retail chains often negotiate prices with supplying firms on a contract basis. These prices might not be correctly be reflected by the average wholesale price. Unfortunately those contract prices are not published; however, wholesale prices can at the least always be interpreted as opportunity costs and thereby might still have an impact on output price decisions even for retailers that have contracted their buy in prices.

[7] To use equal numbers of observations before and after the Euro introduction, our estimation sample starts in October 2000.

[8] Because of the small number of observations in some cases we have to be cautious with some conclusions, for instance, with respect to DC and retail chains D and F.

4 Modelling approach

As some of the data indicate non-stationary behaviour[9], we start with an error correction model (ECM) specification to analyse the price transmission process from wholesale (p^W) to retail prices (p^R). In line with other studies, we assume that wholesale prices lead retail prices.[10] The general specification of the model we use is given in equation (1):

$$\Delta p_{it}^R = \alpha_{i0} + \gamma_{i1} p_{t-1}^W + \gamma_{i2} p_{it-1}^R + \sum_{k=0}^{K} \beta_{ik} \Delta p_{t-k}^W + \sum_{l=1}^{L} \delta_{il} \Delta p_{it-l}^R + \varepsilon_{it} \qquad (1)$$

with *t* as a time index for each week and *i* as index for each individual retail shop. The superscripts R_i and W indicate retail and wholesale prices, respectively. Allowing for individual price adjustments the lag-lengths *K* and *L* are determined using the Akaike Information Criteria (AIC). The selected lags of contemporaneous price changes vary from 1 to 5 weeks in the case of the retailers selling cucumber and from 1 to 8 weeks in the case of those retailers that carry carrots. For both products 271 price transmission processes between wholesale price and individual retail price are estimated. The period of observed prices lasts from October 9th in 2000 to March 3rd in 2003.[11]

To test whether the introduction of the Euro had an impact on the individual price spread between wholesale and retail prices, we add a dummy and a trend variable to the ECM specification (see Equation 2).

$$\Delta p_{it}^R = \alpha_{i0} + \alpha_{i1} D_{it} + \alpha_{i2} T D_{it} + \gamma_{i1} p_{t-1}^W + \gamma_{i2} p_{it-1}^R + \sum_{k=0}^{K} \beta_{ik} \Delta p_{t-k}^W + \sum_{l=1}^{L} \delta_{il} \Delta p_{it-l}^R + \varepsilon_{it} \qquad (2)$$

T is a time-trend dummy variable and D_{it} is a conventional dummy variable with: $D_{it} = 1$ if $t_{start} \leq t \leq t_{end}$ and $D_{it} = 0$ otherwise. T covers the numbers from 1 to t_{end} minus t_{start} for those periods and zero otherwise. By means of this dummy variable, a flexible structural adjustment of the marketing margin between wholesale and individual retail prices is introduced into the

[9] For reasons of brevity we do not present the results of the stationarity tests, but upon request we are pleased to provide them.

[10] See amongst others Kinnucan and Forker (1987), Boyd and Brorsen (1988), Pick et al. (1990), Griffith and Piggott (1994), Powers (1995), Brooker et al. (1997) and Worth (1999). In addition, because of the high concentration of food retailers retail prices are more likely to be endogenous than wholesale prices.

[11] We choose a symmetric period around January 1st 2002 to equally weight the periods before and after the Euro introduction.

model. Because theoretically the impact of the Euro is supposed to vanish over time, we allow, after the introduction of a structural break at t_{start}, also for an end of such break at t_{end}. Using a trend variable (T) together with the dummy variable $\left(D_{it}\right)$ allows reduction (or expansion) of the potential shift during the period of the structural break. For each pair of individual retail and wholesale prices the most likely structural break is determined by an iterative search procedure. Starting (t_{start}) and ending (t_{end}) points of the structural breaks are specified within a grid-search procedure, over all potential starting and ending periods in time[12]. The search procedures determine for each pair of t_{start} and t_{end} the critical F-values for significance of such structural breaks. Those periods are selected which maximise the F-value. The resulting periods with the most likely structural break are then related to the introduction of the Euro.

5 Empirical results

The final sample for the estimation of the structural break procedure explained above consists of prices of cucumber and carrots for 271 grocery stores and the two respective wholesale prices. The composition of the selected stores is shown in Table 1. Most of the shops are combined supermarkets. The other groups are about equally distributed.

As mentioned above, instead of using the time of introduction of the Euro as a natural break point (starting point) we opt for a more flexible model as the market participants had full information about the currency introduction. To veil the direct impact of the Euro from the public and/or consumers, retailers might have reacted to the new currency prior or after its introduction. Therefore it has to be determined what time frame for the structural break is considered to be Euro-related. We assume that structural breaks related to the introduction of the Euro have to start in the period 4 months prior or post the official introduction of the Euro at January 1.

For the average retail prices we observe no Euro related structural change for the cucumber price relationship and no change for carrots price relationship. As we show in the following these relationships are not representing the behaviour at the individual store levels correctly.

[12] Due to reason of degrees of freedom some pairs of starting and ending points have to be excluded.

Applying the model to individual store prices, we obtain 148 Euro-related structural breaks in the case of cucumber and 62 in the case of carrots (Table 2). Thus in the case of cucumber, a remarkable share of about 55 percent of the retail stores indicates a structural break related to the introduction of the Euro. As explained above, the impact of the introduction of the Euro on the retail price transmission might be a result of a mix of the four effects and/or pricing strategies. It is primary expected that the presence of menu costs and in particular money illusion lead to higher retail margins, whereby this effect is supposed to fade out in time.[13] Thus, we would expect a positive dummy variable and a negative trend-dummy to return to the equilibrium prior to the Euro introduction. On the other hand, the impact of both price rounding and the timing on price adjustments or other marketing strategies is less clear. For example, if sellers have anticipated changes in the consumer behaviour after the Euro introduction or if retailers use the Euro to reinforce their low pricing strategy, real price could also decrease at the date around the Euro introduction. Thus, also lower retail margins could be observed.

We find that from 147 (62) Euro related structural breaks in the case of cucumber (carrots) 75 (43) show a significant positive sign. That is, about 28 (16) percent of all retailers indicate effects fitting money illusion and/or menu cost. Within the group of shops that indicate a Euro related positive dummy 64 (37) also show a negative trend during the break period for cucumber (carrots) prices.

In about further 27 (7) percent of the stores we observe a negative sign of the Euro related structural break dummy. This might be the result of the other Euro induced pricing (marketing) strategies as for example the reinforcement of low pricing strategies.

Some variation in the number of structural breaks between store types and retail chains can be observed. Unfortunately, no systematic relationships between the identified structural breaks and the store types and/or the products under considerations are easily identifiable, which is partly caused by the small number of stores for most store types or retail chains. On the other hand some conclusions are not supported by cross commodity comparisons. Discounters, for example, show less structural breaks in absolute number and in percentage terms for cucumber. The reason might be that discounters have publicly committed themselves to not use the Euro introduction to push prices and margins. Moreover,

[13] This potential fading is covered by the trend-dummy variable which in this case should show a negative sign.

Discounters seem to have reinforced their low price strategy looking at the cucumber market. On the other hand, this picture does not fit the observations for the carrot prices. Discounters have in 25 percent changed their margin because of the Euro and 47 percent of these changes started with price increases at the starting break point. Here, money illusion would explain this Euro induced pricing strategy. Following, no conclusive picture can be drawn from the observed deviations. The same is to be said about the regional variations in the number of structural breaks (Table 3)

Insert Table 2 and 3 about here

The estimated coefficients for the dummy variables range from -143 to 290 (-105 to 556) Euro cent between shops for cucumber (carrots). Considering the average price levels in the period of observations - average price of carrots is about 0.89 Euro per kg, the average price of cucumber is about 0.77 Euro per piece - the structural breaks can be called significant from an economic point of view.

Figure 2 shows an example for an individual store price series for cucumber which indicated a Euro related structural break. It is clearly seen that this store often set significantly above normal margins from end of December 2001 to end of March 2002 compared with other periods. A similar picture can be drawn for a margin of an individual store for carrots which also shows a significant increase in the margin at the time of the introduction of the Euro (Figure 2).

Insert Figure 2 about here

Besides the magnitude (dummy) and the development of the structural break (trend dummy), our model also results the starting and ending point of structural breaks and thereby the length of structural breaks can be calculated. In Figure 3 the length of the structural break is drawn against the size of the Euro dummy. Most of the structural breaks are short very lived as they only last for 2 to ten weeks. With a few exception, in particular those structural breaks of larger magnitude last only a few weeks.

Insert Figure 3 about here

Conclusions

In the decades following World War Two the German Mark has gained a remarkable image from consumers. This trust in the national currency has been challenged in the process of the transition from the Deutschmark to the Euro. Even though this transition was supposed to be only a change in the nominal scale, consumers were very much concerned about its impact on real prices. Many consumers feared the Euro would be used to enforce real price increase by retailers and other suppliers. This fear was strongly taken up and enforced by mass media prior to the introduction of the Euro. The economic literature provides several arguments for potential impacts of a nominal shock such as the introduction of the Euro on the retail price and retail-wholesale margin.

This study empirically examines the impact of the Euro introduction on the retail-wholesale price margin in the German food retail sector. In particular, it is hypothesized that money illusion and/or menu costs can cause real effects on prices and margins. As the retail sector is highly concentrated in Germany, particularly money illusion and/or menu costs might have caused an increase in retail margins following the introduction of the Euro in Germany in January 2002. Experimental studies proof the potential significance of this effect. On the other hand, the impact of price rounding, the timing of price adjustments and pricing strategies is less clear. For example, if sellers have anticipated price adjustments or have used the Euro to reinforce their pricing strategy, real price decreases at the date around the Euro introduction could also be a reasonable reaction.

We employ a panel data set of food retail prices for 271 Germany grocery stores to investigate the empirical impact of the nominal shock caused by the introduction of the Euro in the retail sector. As retail stores might have anticipated the effects of the nominal shock and because the impact is expected to fade out in time, our model accounts for flexible starting and ending points as well as for a smooth transition back to the price equilibrium prior the Euro introduction.

Though on average no significant impact of the Euro introduction is detected, the individual price series show some significant changes in the price setting by retailers. In about 23-55 percent of all stores the vertical price relationship between wholesale and retail prices did change around the date of the introduction of the Euro Germany. Most of the detected structural breaks indicate significant increases in the retail margins at the starting break point. The respective trend dummies mostly show negative signs, which would consistent with the

money illusion theory. Further, in about 7-27 percent of the stores we observe a negative sign of the Euro related structural breaks. This might be the result of the other Euro induced pricing strategy to reinforce a low price image of the store.

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Figures and Tables

Tab. 1: Number store types and retailer companies in the sample for cucumber and carrots

Cucumber	Retailer chain							
	Total	A	B	C	D	E	F	Other
SSM	43	7	17	10	6	1	0	2
BSM	75	16	16	7	13	7	0	16
DC	61	0	1	2	12	0	14	32
CSM	92	8	15	6	12	27	8	16
Total	271	31	49	25	43	35	22	66

Carrots	Retailer chain							
	Total	A	B	C	D	E	F	Other
SSM	43	8	16	10	6	1	0	2
BSM	72	14	15	7	13	7	0	16
DC	61	0	1	2	12	0	15	31
CSM	95	9	15	6	13	28	7	17
Total	271	31	47	25	44	36	22	66

Notes: SSM: Small supermarkets, BSM: Big supermarkets, DC: Discounter, CSM: Combined supermarkets. A to F: Different retailer companies, such as Edeka or Spar group.

Source: Data by ZMP, 2003.

Tab. 2: Number (percentage) of Euro related structural breaks by store type and chain [in brackets the number of Euro related structural breaks with a positive dummy]

Cucumber	Retailer chain							
	Total	A	B	C	D	E	F	Other
SSM	26 (60%) [14]	7	11	3	4	1	0	0
BSM	39 (52%) [15]	8	10	3	7	4	0	7
DC	29 (48%) [15]	0	1	1	6	0	7	14
CSM	54 (59%) [31]	4	9	3	8	21	3	6
Total	148 (55%) [75]	19 (61%)	31 (63%)	10 (40%)	25 (58%)	26 (74%)	10 (46%)	27 (41%)

Carrots	Retailer chain							
	Total	A	B	C	D	E	F	Other
SSM	9 (21%) [8]	2	3	2	1	1	0	0
BSM	13 (18%) [11]	2	3	4	1	0	0	3
DC	15 (25%) [7]	0	0	1	5	0	3	6
CSM	25 (26%) [17]	2	0	3	3	8	3	6
Total	62 (23%) [43]	6 (19%)	6 (13%)	9 (38%)	10 (23%)	9 (25%)	6 (27%)	15 (23%)

Notes: SSM: Small supermarkets, BSM: Big supermarkets, DC: Discounter, CSM: Combined supermarkets. A to F: Different retailer companies, such as Edeka or Spar group.

Source: Data by ZMP, 2003.

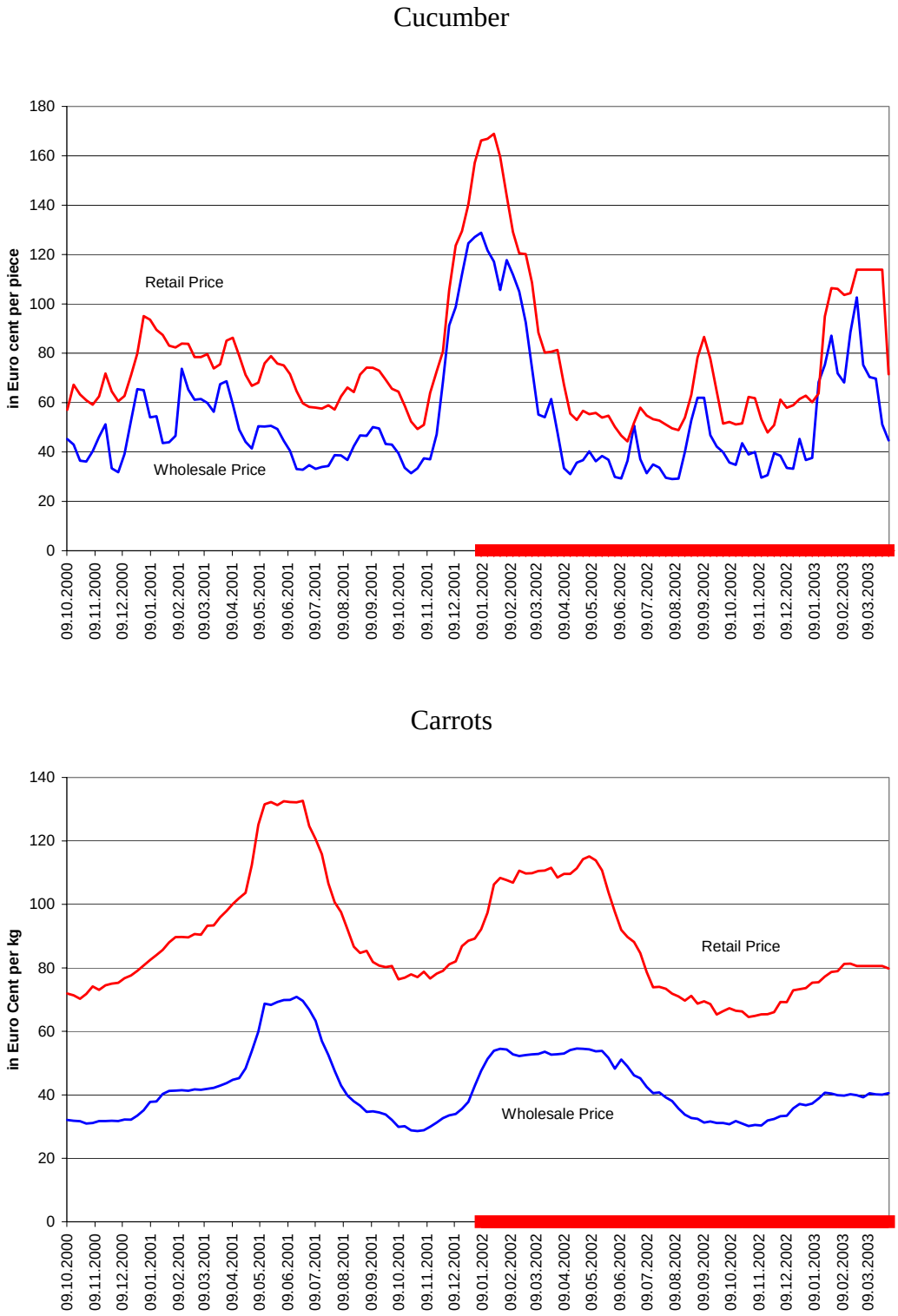
Tab. 3: Number of Euro related structural breaks by region (In bracket the number of Euro related breaks with a positive dummy)

	Region							
Cucumber	1	2	3	4	5	6	7	8
Number of stores	52	39	30	16	51	33	32	18
Structural breaks	21 (12)	22 (15)	12 (3)	9 (2)	30 (15)	23 (14)	21 (15)	10 (3)
In percent	40	56	40	56	59	70	66	56
Carrots	1	2	3	4	5	6	7	8
Number of stores	56	41	31	16	49	28	31	19
Structural breaks	14 (8)	10 (4)	8 (4)	3 (3)	7 (7)	7 (5)	10 (9)	3 (3)
In percent	25	24	26	19	14	25	32	16

Notes: SSM: Small supermarkets, BSM: Big supermarkets, DC: Discounter, CSM: Combined supermarkets. A to F: Different retailer companies, such as Edeka or Spar group.

Source: Data by ZMP, 2003.

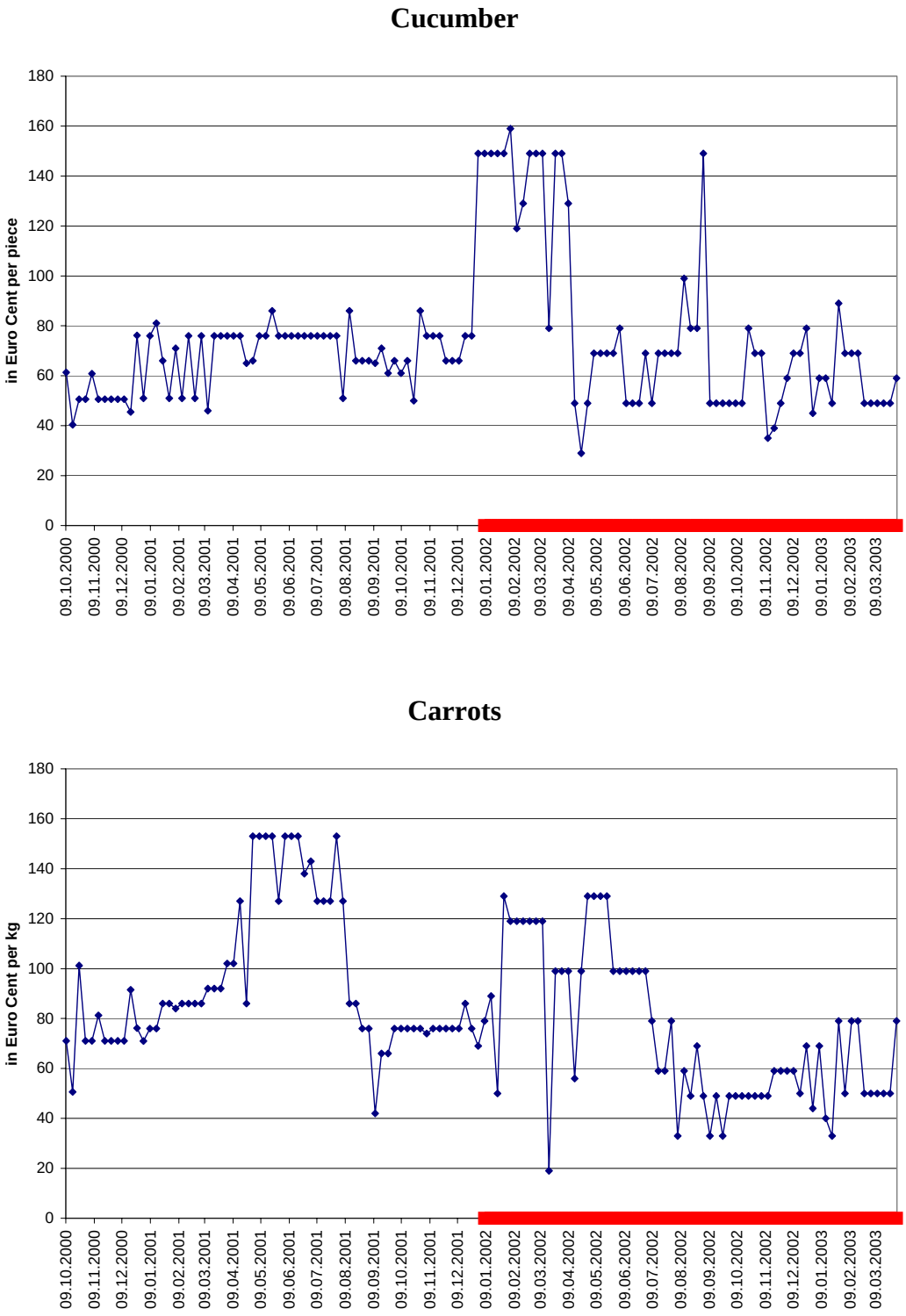
Fig. 1: Average retail and wholesale prices for cucumber and carrots



Notes: The thick line marks the official introduction of the Euro in January 2002

Source: Data by ZMP, 2003.

Fig. 2: Example for a store with an Euro related structural break in prices

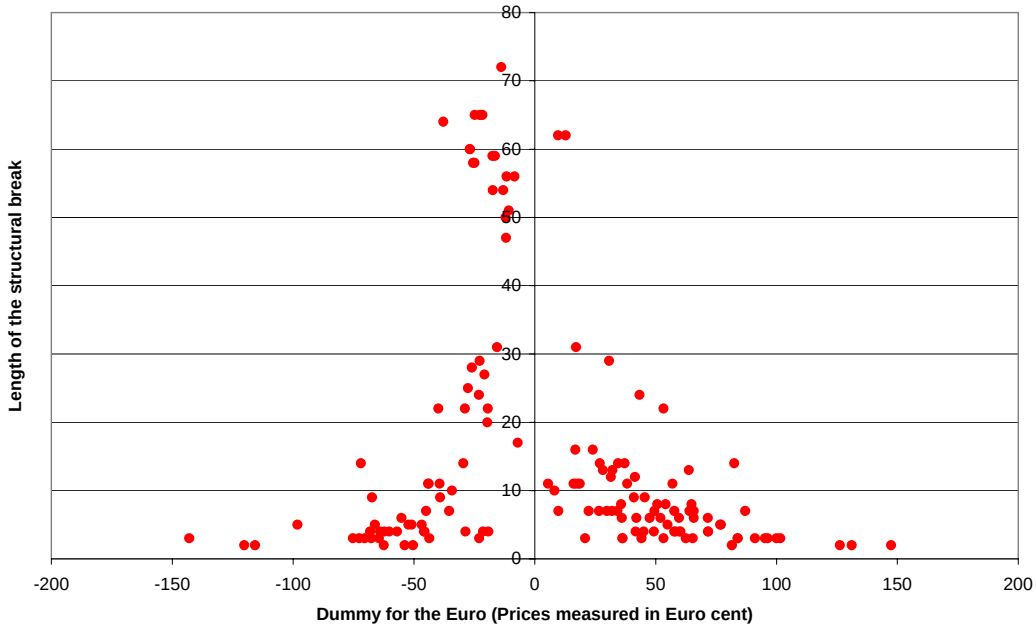


Notes: The thick line marks the official introduction of the Euro in January 2002

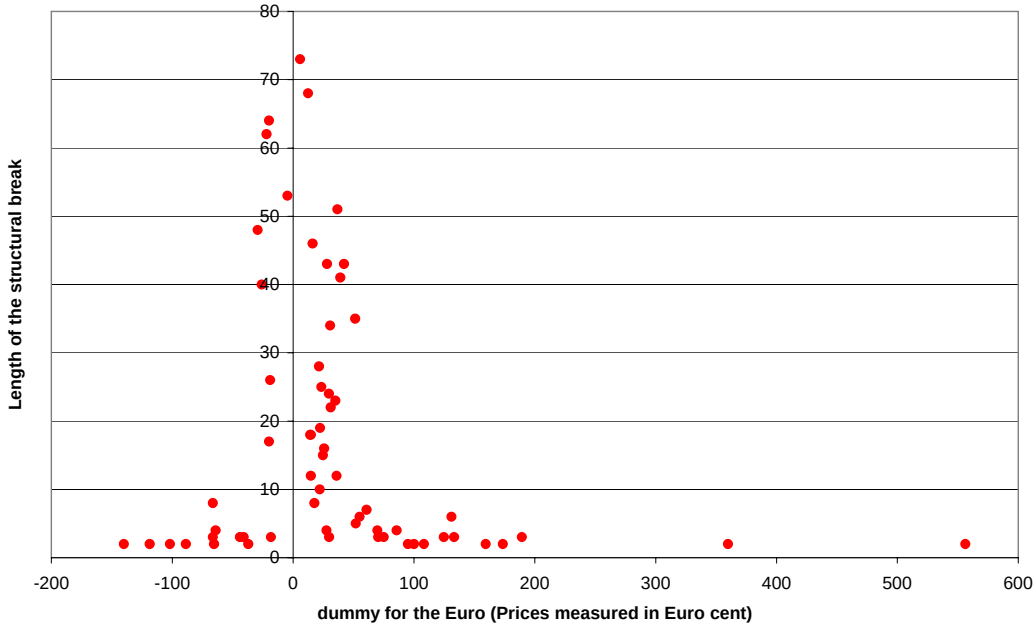
Source: Data by ZMP, 2003.

Fig. 3: Relationship between the length of the Euro related structural break in prices and the magnitude of the estimated break dummy

Cucumber



Carrots



Source: Data by ZMP, 2003.