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Statistical Decomposition of Product-Specific Inflation Rates in Austria

For the period from January 2002 to August 2008, monthly inflation rates for the euro area have been decomposed into two components: a product-specific component common to all countries ("international" component) and a country-specific component for each product in each country of the euro area (domestic component). The results show for Austria that the larger part of the overall inflation rate is explained by the international component. However, ten product groups (some categories of food, housing, energy, health and transport) exhibited a strong positive country-specific inflation component in late 2007 and early 2008. This domestic component (significantly) declined again in the course of 2008, except for pharmaceutical products and fuels.

Upon request by the Ministry of Economics and Labour, WIFO carried out an analysis of the relative contribution of international and domestic factors to the acceleration of inflation, (*Baumgartner,* 2008A). The study, to be submitted to the Wettbewerbskommission discusses methods and selected findings of a statistical decomposition of monthly inflation rates for the euro area into

- product-specific components common to all countries of the euro area ("international" component) and
- product-specific components for each of the 12 countries (country-specific components).

First, similarities in the inflation dynamics across all countries can be attributed to similar consumption patterns with similar price and demand cycles, and to a similar business cycle pattern. European integration, from the creation of a common market to a common European monetary policy within the framework of the EMS (until 1998) and, since 1999, of the European Monetary Union has probably also contributed to a convergence of inflation trends (e.g., *Baumgartner,* 2003). In addition, the common inflation trend was caused by similar product-specific price developments such as the influence of world market prices for crude oil on energy prices and technological advances in the area of computers and cellular phones that influence the dynamics of prices in a similar fashion in all countries of the euro area.

In addition, there are also country-specific effects that affect either all product groups in a country or have a country-specific and a product-specific effect, i.e., influencing the prices of certain goods in one country.

Comparing the Austrian development of inflation in one particular or just a few months with the euro area as a whole or with single countries of the euro area would, however, not be an adequate method for identifying a European ("international") and a country-specific component in the overall inflation trend. For this reason, an approach has been selected that simultaneously examines the inflation trend for all countries included (12 countries of the euro area) and all product

groups investigated (61 product groups) over a longer period of time (2002 to mid-2008).

In order to decompose the inflation rates at the product group level into an international and a country-specific component, the definition of the product groups needs to be the same for all countries. Disaggregated price indices for the euro area are available from Eurostat (*Eurostat,* 2004, *Statistics Austria,* 2006). The euro area is defined as excluding the latest accessions of Slovenia, Cyprus and Malta, because harmonised disaggregated price indices for these countries are available only for a shorter period. The study covers the period from January 2001 (for rates of inflation from January 2002) through August 2008, because from the year 2001 (2002) onwards, data are disaggregated to a higher degree (i.e., the number of product groups is higher) and the remaining number of observations is still sufficient to apply the statistical decomposition approach described below. *80 observations* were available for each individual inflation time series, and for each of the *12 countries 61 HICP sub-indices* were used. The delimitation of the product groups was dictated by data availability, i.e., within a product group the level of detail was determined by that country whose price time series were least disaggregated[1]. The total sample thus consisted of 58,560 observations.

The inflation rate π for product i in country n at time t is defined as the logarithmic difference of the price index P between the current month and the same month of the previous year:

$$\pi(i,n,t) = d \ln P(i,n,t) = \ln P(i,n,t) - \ln P(i,n,t-12).$$

For the decomposition of the rate of inflation into international and country-specific and product-specific components, the fixed-effect panel-econometric approach of *Marimon – Zilibotti* (1998) has been applied. It is based on *Stockman* (1988) and *Costello* (1993), but different assumptions for model identification are used (for more details, see below)[2].

A model based on the following specification is estimated, whereby a large number of dummy variables is regressed on the rate of inflation.

$$(1) \quad \pi(i,n,t) = \sum_{s=1}^{T} \alpha_s^{time}\, time(s) + \sum_{j=1}^{I} \alpha_j^{prod}\, prod(j) + \sum_{j=1}^{I}\sum_{s=1}^{T} \alpha_{j,s}^{prodtime}\, prodtime(j,s)$$

$$+ \sum_{m=1}^{N}\sum_{s=1}^{T} \alpha_{j,s}^{countrytime}\, countrytime(m,s) + \sum_{j=1}^{I}\sum_{m=1}^{N} \alpha_{j,m}^{prodcountry}\, prodcountry(j,m)$$

$$+ \varepsilon(i,n,t),$$

$i, j = 1, \ldots, I$, $I = 61$ product groups; $n, m = 1, \ldots, N$, $N = 12$ euro area countries; $s, t = 1, \ldots, T$, $T = 80$ months (January 2002 to August 2008).

The inflation components common to all countries and product groups, i.e., the "underlying" inflation in the euro area for all product groups, are represented by the dummy variables *time (s)*. The 80 variables have the value of 1 at time s, otherwise 0.

The product-specific inflation component common to all countries investigated consists of two parts:

- *prod (j)* is the average inflation rate throughout the sample period for product j in all countries. The 61 dummies for *prod (j)* are assigned the value 1 for product j, otherwise 0.

- Additionally, the price development of a product group may exhibit an autonomous dynamic. This is captured by the interaction terms *prodtime (j, s)*. The 4,880 dummies are assigned the value 1 for product j at time s, otherwise 0.

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[1] For details on the product groups, imputations and data corrections see *Baumgartner* (2008), pp. 5-11.

[2] I am indebted to Franziska Ohnsorge (IMF) for the valuable indications on the implementation of the decomposition method in the programme package Stata.

The remaining part of the inflation rate is assigned to the *country-specific component*. This component is broken down into three elements:

- A country-specific effect contingent on time *countrytime (m, s)*. The 960 dummies are assigned the value 1 in country m at time s, otherwise 0.

- A product-specific constant for every country *prodcountry (j, m)*. The 732 dummies are assigned the value 1 for land m and product j, otherwise 0.

- A country and product-specific and time variable term $\varepsilon\,(i, n, t)$ for product i in country n at time t.

In total, there are 6,713 parameters to be estimated from the data set for model *(1)*. As the groups of dummy variables and their interaction terms are perfectly co-linear, model (1) is not identified. Therefore, appropriate restrictions must be applied to the parameters of the model in order to be able to identify and estimate these.

Stockman (1988) and *Costello* (1993) apply zero restrictions to certain parameters to be able to identify and estimate the model. For our analysis, this would mean defining an observation (e.g., the first observation), a country (e.g., the first country) and a product (e.g., the first product) as numéraire and applying zero restrictions to these parameters, i.e., excluding the related dummy variables together with the interaction terms in which they occur. The estimated parameters are then interpreted relative to the reference group (e.g., product 1 in country 1 at time 1). Overall, 293 parameters have to be excluded in this manner. From the estimated 6,420 parameters, the country-specific share of the inflation rate could be computed for each product in every country at any time in relation to the reference group. The interpretation of these values is very complicated and also has a number of further disadvantages (see *Marimon – Zilibotti,* 1998, p. 127).

Marimon – Zilibotti (1998) propose a method that is easier to interpret but requires more cumbersome computations in order to include the restrictions (*Mody – Ohnsorge,* 2007, also follow this strategy). The main assumption is that the effects represented by the various variable groups are orthogonal to each other. Hence, it is not a specific country-product observation that is used as reference value, but rather the respective mean value. The model restrictions are formulated so that the sum of the respective dummy variables is zero. As regards the interaction terms, the sums of the rows as well as of the columns must equal zero.

Formally this means that the following conditions must be met:

$$(2) \quad \sum_{s=1}^{T} \alpha_s^{time} = 0 \,,$$

$$\sum_{s=1}^{T} \alpha_{j,s}^{prodtime} = 0 \qquad \forall \quad j = 1, \dots, I \,,$$

$$\sum_{j=1}^{I} \alpha_{j,s}^{prodtime} = 0 \qquad \forall \quad s = 1, \dots, T \,,$$

$$\sum_{s=1}^{T} \alpha_{m,s}^{countrytime} = 0 \qquad \forall \quad m = 1, \dots, N \,,$$

$$\sum_{m=1}^{N} \alpha_{m,s}^{countrytime} = 0 \qquad \forall \quad s = 1, \dots, T \,,$$

$$\sum_{m=1}^{N} \alpha_{j,m}^{prodcountry} = 0 \qquad \forall \quad j = 1, \dots, I \,.$$

This results in $2\,T + 2\,I + N + 1 = 295$ restrictions. One of the $I + T$ restrictions on the average of the dummies *prodtime (j, s)* is a linear combination of the other restrictions. By analogy, the $N + T$ restrictions on the averages of the dummies *countrytime (m, s)* result in a restriction as a linear combination of the other restrictions. Thus, only 293 restrictions need to be implemented in a restricted regression model.

Model *(1)* is estimated as a restricted regression model with fixed time, country and product effects under conditions *(2)* (restricted fixed-effects panel regression model).

Based on the estimated parameters of the model, the components described below can be determined, which are then compiled into two component groups – the euro area component ("international" inflation contribution) and the country-specific component ("domestic" inflation contribution).

For each product in each country, the inflation time series $\pi\,(i, n, t)$ can be decomposed into the components of equation *(1)*:

$$(3) \quad \pi\,(i, n, t) = \underbrace{\pi^{EA}\,(t) + \pi^{EA\,prod}\,(i, t)}_{\substack{\text{international}\\\text{inflation components}}} + + \underbrace{\pi^{nat}\,(n, t) + \pi^{nat\,prod}\,(i, n) + \varepsilon\,(i, n, t)}_{\substack{\text{country-specific}\\\text{inflation components}}}$$

$$= \quad \pi^{EA\,all}\,(i, t) \quad + \quad \pi^{nat\,all}\,(i, n, t)\,,$$

$\pi^{EA}(t)$ is derived from the estimated coefficients for $time\,(t), \alpha_t^{time}$, $\pi^{EA\,prod}(i, t)$ from the estimated coefficients for $prod\,(i), \alpha_i^{prod}$ and $prodtime\,(i, t), \alpha_{i,t}^{prodtime}$, $\pi^{nat}(n, t)$ from the estimated coefficients for $countrytime\,(n, t), \alpha_{n,t}^{countrytime}$, $\pi^{natprod}\,(i, n)$ from the estimated coefficients for $prodcounty\,(i, n), \alpha_{n,i}^{countryprod}$. $\varepsilon\,(i, n, t)$ is the residual of equation *(1)* and yields the estimated time-dependent (t) country- (n) and product-specific (i) inflation contribution.

The euro area inflation component for the respective country is the sum of the coefficients

$$(4) \quad \pi^{EA\,all}\,(i, t) = \alpha_t^{time} + \alpha_i^{prod} + \alpha_{i,t}^{prodtime}\,.$$

This component has a product-specific and a time variation, but is the same for each country for the respective product i at time t. The euro area component here is the "underlying inflation" of the respective product group in the euro area. This is the common inflation component for the respective product group for all 12 countries of the euro area (shown as white bars in the charts).

The country-specific inflation component is obtained as the sum of the coefficients

$$(5) \quad \pi^{nat\,all}\,(i, n, t) = \alpha_{n,t}^{countrytime} + \alpha_{n,i}^{countryprod} + \varepsilon\,(i, n, t)\,.$$

The time-variable country-specific component $\alpha_{n,t}^{countrytime}$ indicates the country-specific deviation (across all products) of inflation *vis-à-vis* the euro area. The coefficient $\alpha_{n,i}^{countryprod}$ indicates the constant product-specific deviation over time for each country *vis-à-vis* the euro area. The residual value $\varepsilon\,(i, n, t)$ contains all other time-variable, country- and product-specific factors. The country-specific (domestic or "home-made") component (in the charts in grey bars) for each product group is the difference between the current inflation in Austria (black line) and the euro area component. The common euro area component thus serves as reference value for the country-specific contribution.

For reasons of readability, not all six subcomponents of the inflation trend are presented in the overview, but only the two combined terms $\pi^{EA\,all}\,(i, t)$ as a measure of the international inflation contribution and $\pi^{nat\,all}\,(i, n, t)$ for the country-specific inflation contribution.

When interpreting the charts, one should take note of whether the results are shown for tradeable and for non-tradeable goods. *Tradeable goods* can also be procured from abroad and thus international competition should enforce the "law of one price", causing convergence of price levels within the product groups over the long term.

For this reason, the relative price indices for the year 2007, wherever available, were also included in the discussion of the results (Table 2). If the relative price level is below the average for the 12 euro area countries, then a positive spread between the product-specific inflation rate in Austria and the "underlying rate" of the 12 euro area countries may also be attributable to the convergence process towards a common European price level. However, if the Austrian price level is higher than that of the 12 euro area countries, then price convergence is hard to argue as a cause and other

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**Interpretation of the results**

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reasons must be behind the higher inflation rate in Austria (e.g., legal regulations, taxes, consumer preferences, sector-specific economic developments, market restrictions).

In the case of *non-tradeable goods*, the euro area components are merely a reference value for how prices have developed in Austria compared with the average for the other euro area countries. There is no direct international competition for these products and services. A comparison with other countries is useful nonetheless, because, for example, the providers of services may possibly also offer such services across borders or within the country through a subsidiary. Relative prices higher than the European level and inflation rates above the average for the euro area may point to country-specific factors that might be investigated more closely.

For most of the product categories investigated, the greater part of inflation was caused by international factors as the euro area components account for the largest share in the price rise. In Figure 1, the international component (white bar) is shown to dominate Austria's overall inflation rate (black line). The comparison of the "underlying inflation trend" of the euro area with the overall inflation trend reveals that, with the exception of the first months of the year 2005 and the last months of the year 2007, the country-specific components (grey bar) had an inflation-dampening effect throughout the sample period[3].

Results

Figure 1: Inflation components in Austria
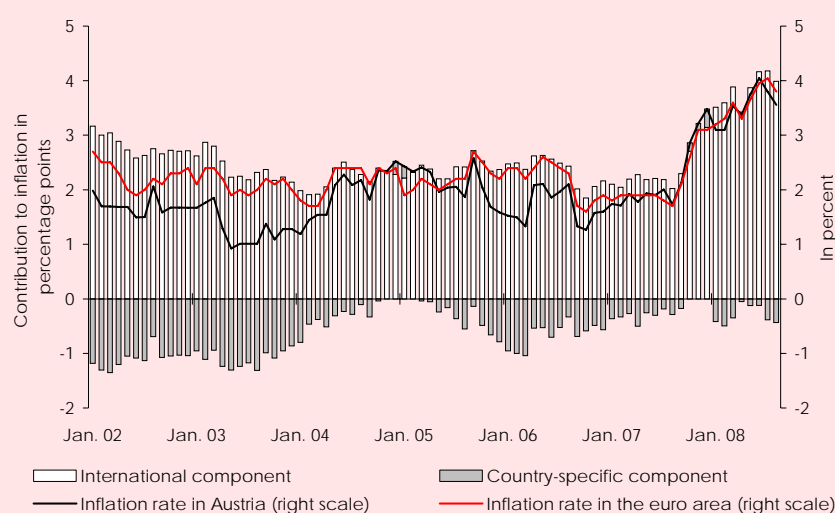
Source: Eurostat, WIFO calculations.

Furthermore, the estimated "underlying inflation trend" for the euro area (white bar) is slightly higher than the "headline inflation rate" (red line). The differences between the "headline" rates and the "underlying" rates for the euro area in Figure 1 and in Table 1 (inflation rate for the average of the 12 euro area countries and international components, respectively) are due to different weighting schemes in the calculation: The average of the inflation rates for the euro area according to Eurostat are weighted by size of country (GDP shares), while the estimated "underlying inflation" is unweighted and therefore price changes in smaller countries have the same impact ("weight") as those in large countries.

Apart from Austria (with the exception of early 2005 and late 2007), Finland and the Netherlands (as of the year 2004), it is especially the larger countries Germany (except for the second half of 2007) and France (except for the period October 2003 to September 2004) that exhibited (at times very pronounced) inflation-dampening country-specific components (*Baumgartner*, 2008A, Figures 3 to 13). Since these

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[3] The euro area components were calculated with the Austrian HICP weights so that the size of the country-specific component is not influenced by weighting differences.

country-specific components of the larger countries are factored into the estimate of the "overall underlying inflation trend" with a lower weight than in the Eurostat calculations of "headline inflation", the latter is therefore systematically lower throughout the sample period.

The estimates for the individual product groups reveal a (very) high degree of heterogeneity for the country-specific inflation contributions (across product groups and over time; *Baumgartner,* 2008A, Figures 14 to 74). Thus, in comparison to the *respective "international" component,* the product groups listed below reveal for Austria in 2007 a significant *inflation-enhancing country-specific contribution* (sorted in descending order by the weighted amount of the country-specific contribution in 2007):

- "Milk, cheese and eggs" (cp0114),
- "Electricity" (cp0451),
- "Clothing" (cp031),
- "Gas" (cp0452),
- "Materials for the maintenance and repair of the dwelling" (cp0431),
- "Pharmaceutical products" (cp0611),
- "Oils and fats " (cp0115),
- "Mineral waters, soft drinks, fruit and vegetable juices" (cp0122),
- "Social protection" (cp124),
- "Footwear including repair" (cp032),
- "Solid fuels" (cp0454),
- "Spare parts and accessories for personal transport equipment" (cp0721),
- "Motor cycles, bicycles and animal-drawn vehicles" (cp0712, 713, 714),
- "Other medical products; therapeutic appliances and equipment" (cp0612, 613),
- "Other personal effects" (cp1232).

Austrian data for 2007 reveal an *inflation-dampening effect vis-à-vis the euro area component* for the following product categories (also sorted in descending order by the size of the country-specific contribution):

- "Transport services" (cp073),
- "Accommodation services" (cp112),
- "Hospital services" (cp063),
- "Tobacco" (cp022),
- "Restaurants and cafés" (cp1111),
- "Dental services " (cp0622),
- " Housing rentals" (cp041),
- "Recreation and culture" (cp09),
- "Education" (cp10),
- "Coffee, tee and cocoa" (cp0121),
- "Services for the maintenance and repair of the dwelling" (cp0432),
- "Medical services; paramedical services" (cp0621, 623),
- "Other services in respect of personal transport equipment" (cp0724),
- "Tools and equipment for house and garden" (cp055),
- "Insurances" (cp125).

The results of the decomposition of the product-specific inflation rates are discussed in greater detail for ten selected product groups for Austria (Table 1, second col-

umn). This selection is based on those used by the *Wettbewerbskommission* (2008) and by the Chamber of Labour in its petition to the Price Commission of June 2008 (and their allocation to the available COICOP four-digit codes of the HICP).

Table 1: Actual inflation in Austria and in the euro area and estimated inflation components for Austria by product group

		Actual inflation rate		Austria components, estimated		Actual inflation rate		Austria components, estimated		Actual inflation rate		Austria components, estimated	
		Austria	Euro-area[1]	NAT	INT	Austria	Euro-area[1]	NAT	INT	Austria	Euro-area[1]	NAT	INT
		In percent		Inflation contribution in percentage points		In percent		Inflation contribution in percentage points		In percent		Inflation contribution in percentage points	
		2007				2006				2005			
Selected product groups													
cp0111	Bread and cereals	4.5	3.4	+ 0.8	+ 3.8	1.2	1.4	– 0.3	+ 1.6	1.3	0.7	+ 0.4	+ 0.9
cp0114	Milk, cheese and eggs	8.3	3.3	+ 4.4	+ 3.8	0.4	0.6	– 0.6	+ 1.0	1.5	– 0.1	+ 1.3	+ 0.2
cp0115	Oils and fats	5.2	– 1.7	+ 5.1	+ 0.1	3.0	9.9	– 3.6	+ 6.6	0.8	2.2	– 0.3	+ 1.1
cp0122	Mineral waters, soft drinks, fruit and vegetable juices	4.8	2.8	+ 2.1	+ 2.7	4.1	1.8	+ 2.3	+ 1.7	– 2.3	– 0.6	– 1.8	– 0.4
cp0431	Materials for the maintenance and repair of the dwelling	6.3	3.6	+ 2.7	+ 3.6	4.8	2.9	+ 1.9	+ 2.9	2.5	2.0	+ 0.4	+ 2.1
cp044	Water supply and other services	4.6	3.4	– 0.1	+ 4.7	8.6	3.2	+ 4.4	+ 4.2	10.2	3.4	+ 3.9	+ 6.3
cp0451	Electricity	9.2	4.6	+ 3.8	+ 5.4	3.5	4.3	– 1.1	+ 4.7	3.0	2.8	– 0.9	+ 3.9
cp0452	Gas	8.3	1.8	+ 5.6	+ 2.7	6.2	14.1	– 8.1	+ 14.3	6.2	9.8	– 4.2	+ 10.4
cp0611	Pharmaceutical products	3.1	0.5	+ 3.1	– 0.0	2.4	– 0.3	+ 2.1	+ 0.3	1.4	1.1	+ 1.0	+ 0.5
cp0722	Fuels and lubricants	1.9	2.3	– 0.5	+ 2.4	6.3	5.9	– 0.4	+ 6.7	12.0	10.4	+ 1.0	+ 11.0
		Second quarter 2008				First quarter 2008				Fourth quarter 2007			
cp0111	Bread and cereals	11.0	9.5	+ 1.0	+ 10.0	10.8	8.4	+ 1.6	+ 9.3	7.7	6.3	+ 0.8	+ 6.9
cp0114	Milk, cheese and eggs	15.2	13.7	+ 0.4	+ 14.8	16.1	13.6	+ 2.2	+ 13.9	15.4	9.4	+ 5.9	+ 9.5
cp0115	Oils and fats	14.7	8.3	+ 3.2	+ 11.5	14.6	6.8	+ 5.4	+ 9.3	12.6	2.5	+ 7.8	+ 4.7
cp0122	Mineral waters, soft drinks, fruit and vegetable juices	4.0	4.2	+ 0.4	+ 3.6	5.2	4.2	+ 1.5	+ 3.8	5.2	3.2	+ 2.1	+ 3.1
cp0431	Materials for the maintenance and repair of the dwelling	4.0	3.4	+ 0.6	+ 3.4	4.3	3.5	+ 0.9	+ 3.4	5.6	3.6	+ 1.9	+ 3.7
cp044	Water supply and other services	– 0.8	2.3	– 3.7	+ 3.0	0.3	2.6	– 3.2	+ 3.5	2.6	3.5	– 2.0	+ 4.6
cp0451	Electricity	0.8	4.3	– 2.2	+ 3.0	1.0	3.5	– 0.6	+ 1.6	8.5	4.2	+ 4.4	+ 4.1
cp0452	Gas	– 0.6	8.9	– 11.6	+ 10.9	– 0.7	3.1	– 5.2	+ 4.5	5.9	– 0.9	+ 6.4	– 0.5
cp0611	Pharmaceutical products	2.1	1.4	+ 2.6	– 0.5	2.8	0.6	+ 3.9	– 1.1	2.8	0.3	+ 3.4	– 0.6
cp0722	Fuels and lubricants	28.1	15.4	+ 12.0	+ 16.1	24.9	14.6	+ 8.8	+ 16.0	17.2	12.6	+ 4.3	+ 12.9

Source: Eurostat, WIFO calculations. – [1] Excluding Slovenia, Malta and Cyprus. NAT . . . national components, INT . . . international components (euro area).

With the exception of "Water supply and other services in connection with housing (cp044)" the product groups listed in Table 1 comprise tradeable goods. For these ten product groups (Tables 1 and 2 and Figures 2 to 11) the results are discussed in more detail below.

Table 2 presents the relative price level indices for the year 2007 for the various product groups (for housing, water, electricity, gas and other fuels, and health, only the figures for 2006 are currently available). For the product group "food" the classification of the relative price indices in Table 2 largely corresponds to the four-digit COICOP code applied to Table 1. For the other product groups listed, these data are available only in a higher aggregation (comparable to COICOP two-digit group). The relative price indices only indicate the relative price position of a country in a year or how the ranking has changed over time. But they do not permit any direct conclusions to be drawn on the development of price levels over time (*Égert,* 2008).

Table 2: Comparative price level indices for the euro area in 2007

	Bread and cereals	Milk, cheese and eggs	Oils and fats	Non-alcoholic beverages	Housing, water, electricity, gas and other fuels[1]	Health[1]	Transport
				EU 15 = 100			
Euro area 13	*99.1*	*97.7*	*98.3*	*94.2*	*100.6*	*97.7*	*95.7*
Belgium	104.8	106.7	111.8	100.2	106.9	103.8	94.8
Germany	99.6	85.2	95.6	100.3	103.0	95.8	99.6
Ireland	113.0	122.9	97.7	128.0	128.1	122.9	107.2
Greece	92.9	133.9	108.4	114.4	75.2	75.4	79.4
Spain	106.2	94.2	76.9	86.1	91.4	79.8	88.6
France	93.6	93.5	103.5	80.6	110.1	100.5	96.1
Italy	101.9	119.7	111.6	104.4	94.3	114.6	92.0
Luxembourg	112.5	108.4	112.8	100.9	112.4	114.8	90.3
The Netherlands	82.1	74.3	67.2	81.2	110.5	93.5	111.0
Austria	118.5	97.9	117.9	94.2	85.7	100.0	100.9
Portugal	88.9	100.2	89.6	89.7	69.5	82.4	91.5
Finland	128.0	101.8	118.0	128.3	115.2	118.5	117.2

Source: Eurostat. – [1] Figures are available for 2006.

Based on the relative price indices of Eurostat for the year 2007, bread and cereals were the most expensive in Austria (after Finland) of the euro area and up to 19.6 percent more expensive than the average price level in the euro area.

Despite the higher price level, prices rose in 2007 and 2008 more steeply than in the euro area. For 2007, the Austria-specific components (grey bar) account on average for +0.8 percentage points (December +1.2 percentage points). In the first half-year 2008, the inflation rate persisted at around 10 percent but the domestic component declined from +1.6 percentage points in January to +0.7 percentage points in August (Figure 2).

Food and non-alcoholic beverages

Bread and cereals

*Figure 2: Inflation components for bread and cereals (cp0111)*
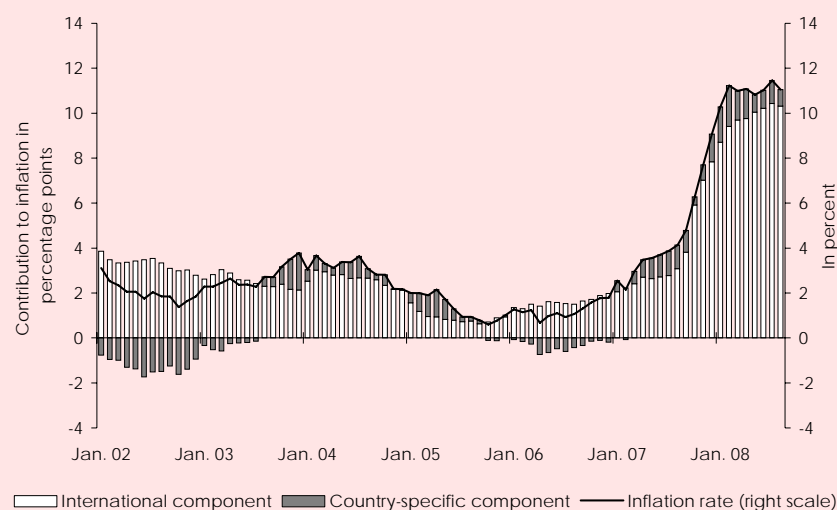
Source: Eurostat, WIFO calculations.

Measured by the relative price level in 2007, the products of the group "milk, cheese and eggs" were the cheapest in Austria within the euro area, after the Netherlands, Germany, France and Spain, (Figure 3).

In this product group, the Austria-specific contribution to inflation averaged +4.4 percentage points in 2007 and thus accounted for more than half of the total price increase.

Milk, cheese and eggs

*Figure 3: Inflation components for milk, cheese and eggs (cp0114)*
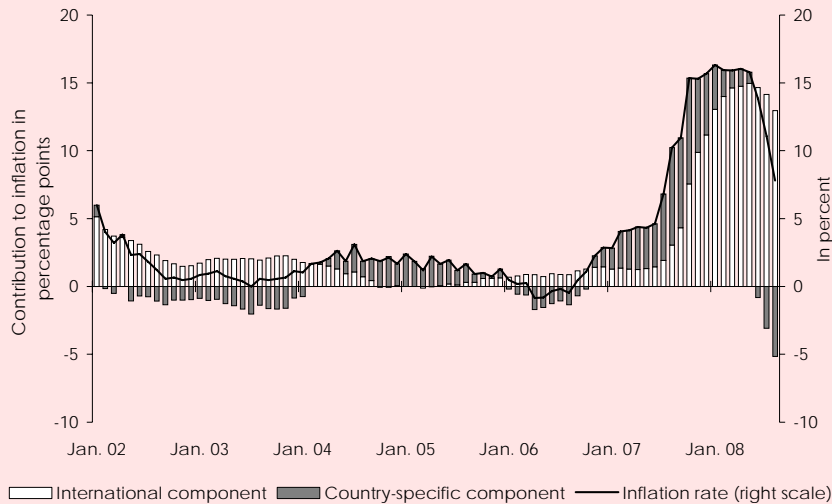
Source: Eurostat, WIFO calculations.

The country-specific component was much larger in 2007 than in the preceding years; but due to the steep increase of the international component, the domestic share decreased around the end of the year. Overall, in the product group "milk, cheese and eggs" prices in Austria increased much more strongly than in the euro area. In the course of the year 2008, the domestic component gradually receded, and since June 2008, the inflation rate in Austria has been below the "underlying inflation trend" of the euro area.

Since 2002 the country-specific contribution in the product group "oils and fats" had been at almost all times inflation-dampening (2006 even strongly). In 2007 the domestic component swung to inflation-enhancing (Figure 4). It accounted for the largest share of the inflation rate and its contribution to inflation increased until year-end. However, over the course of 2008, the country-specific share shrunk again.

Oils and fats

Figure 4: Inflation components for oils and fats (cp0115)
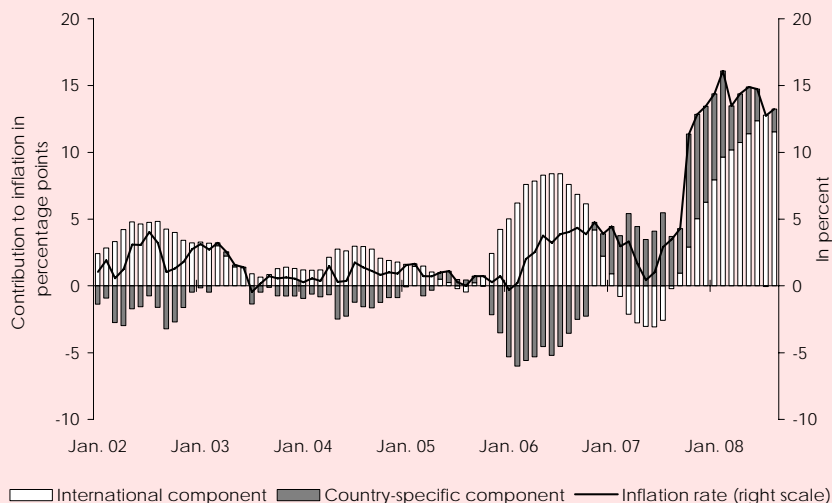
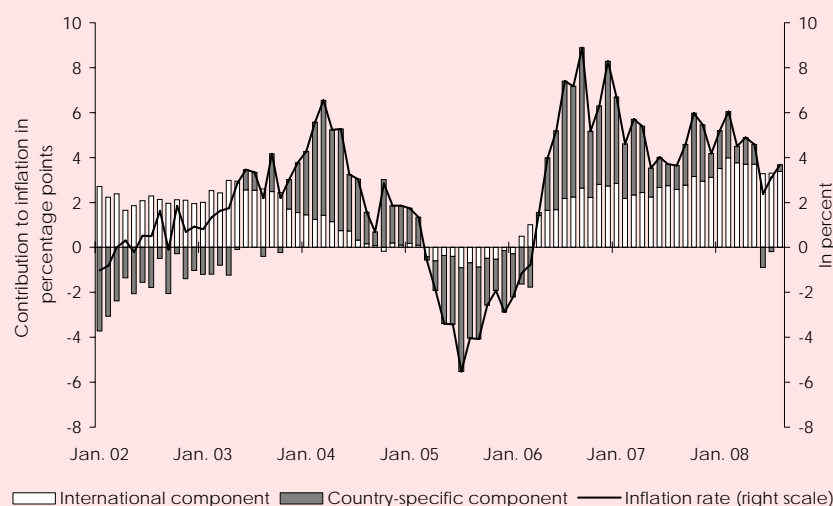Source: Eurostat, WIFO calculations.

The fact that price inflation in Austria in 2007 was well above the euro area average becomes more important when one looks at the relative price level: after Finland, "oils and fats" were the most expensive in Austria (ahead of Luxembourg and Bel-

gium). On average, the price level for this group was around 19.9 percent higher than the euro area average.

Since the beginning of 2006, the group "mineral waters, soft drinks, fruit and vegetable juices" has shown a strong positive domestic inflation component that was at times much more pronounced than the international component (Figure 5). On average, more than half of the price increase resulted from the domestic component in the years 2006 and 2007. In the course of 2008, the Austrian component lost significance, and since July, the inflation rate has been in the range of the "underlying inflation" of the euro area.

Mineral waters, soft drinks, fruit and vegetable juices

Figure 5: Inflation components for mineral waters, soft drinks, fruit and vegetable juices (cp0122)

Source: Eurostat, WIFO calculations.

For a comparison of price levels only the two-digit group "non-alcoholic beverages" is available. Apart from the items discussed here (their share accounts for about two-thirds), it contains coffee, tea and cocoa. In the product group "non-alcoholic beverages", Austria ranked in the middle range of the 12 euro area countries in 2007.

Relative price indices are available only for the overall category "housing, water, energy" for the year 2006. Apart from the four sub-categories discussed below (with a share around 55 percent) these two-digit positions include rental cost, solid and liquid fuels, heating energy and services for the maintenance and repair of the dwelling. In 2006, the Austrian price level in this category was the lowest within the euro area after Portugal and Greece.

**Housing, water and (household) energy**

Since the second quarter 2005, inflation in the category "materials for the maintenance and repair of the dwelling" was increasingly driven by the domestic component. On average of 2006 and 2007, some 40 percent of the inflation rate were due to the domestic component, which corresponded to almost +2 percentage points in the year 2006 and +2.7 percentage points in 2007 (Figure 6). The inflation rate was thus well above the euro area average in this product category. As the domestic inflation component decreased in 2008, the inflation rate also decreased.

Materials for the maintenance and repair of the dwelling

The products of the group "water supply and miscellaneous services related to the dwelling" are non-tradeable goods and there is no international competition. Moreover, most of these services are provided by municipalities (i.e., by local monopolies). As shown by the comparison with the price increases in the other countries of the euro area, price inflation in Austria has been (far) above the average since the fourth quarter 2004 (Figure 7). But since mid-2007, it fell behind the unweighted average of the euro area. This development continued into 2008, and as of March 2008, prices in Austria were lower than one year earlier.

**Water supply and miscellaneous services related to the dwelling**

Figure 6: Inflation components for materials for the maintenance and repair of the dwelling (cp0431)
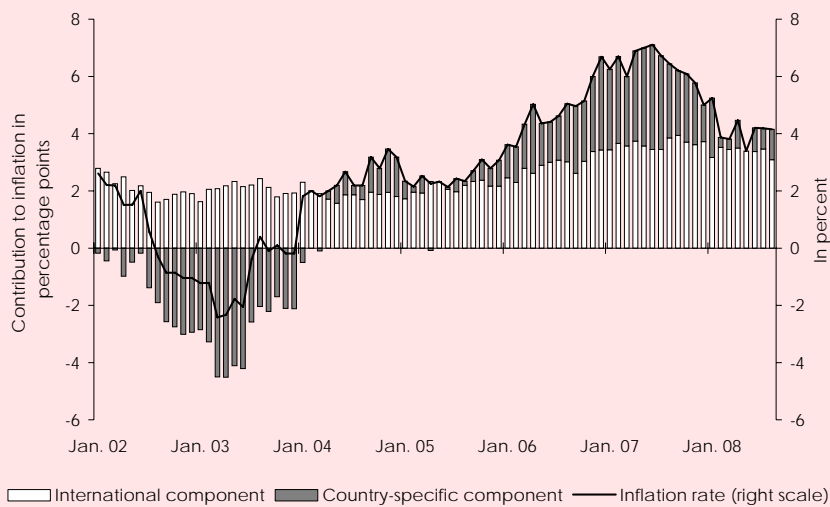
Source: Eurostat, WIFO calculations.

The difference between the inflation rate in the weighted average of the euro area and the "underlying inflation" in the euro area (unweighted) in Table 1 for the years 2005 to 2007 is due to the low rate of price inflation in Germany (around +1.5 percent) which is included in the euro area inflation rate with a weight of 29 percent, but is only weighted with 8.3 percent in the "underlying inflation" of the euro area.

*Figure 7: Inflation components for water supply and miscellaneous services related to the dwelling (cp044)*
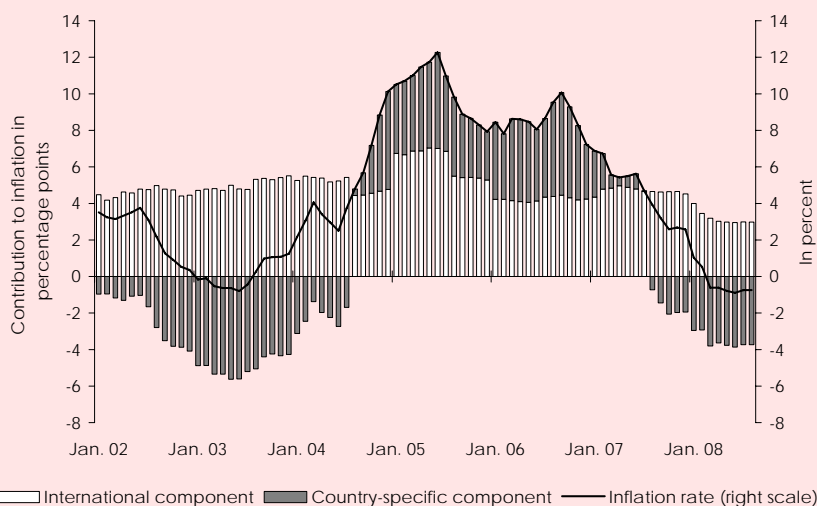
Source: Eurostat, WIFO calculations.

Electricity

From 2002 to 2006, the price of electricity in Austria increased, with a few exceptions, less strongly (in 2002 quite significantly so) than the euro area average (Figure 8). In 2007, this pattern changed markedly: the domestic component swung from an inflation-dampening factor to an inflation driver – the domestic inflation rate for the product group was almost 4 percentage points above the euro area trend.

The ebbing of base effects caused this pattern to change again in the first half of 2008 and price inflation in Austria is now far below the "underlying inflation trend" of the euro area.

Figure 8: Inflation components for electricity (cp0451)
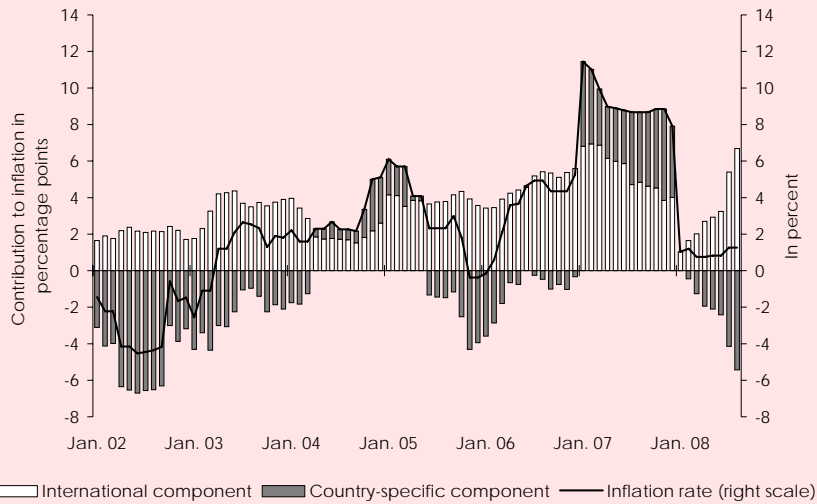
Source: Eurostat, WIFO calculations.

While in the years 2005 and 2006, the domestic component (grey bar) caused price increases for gas to remain far below the average of the euro area (white bar), the picture changed at the beginning of 2007: The domestic contribution became an inflation driver and pushed up inflation far above the trend for the euro area (Figure 9). In 2007, price increases were on average 2.9 percentage points above the "underlying inflation" of the euro area. Thus, two-thirds of the price-driving influence came from the domestic component.

Gas

Figure 9: Inflation components for gas (cp0452)
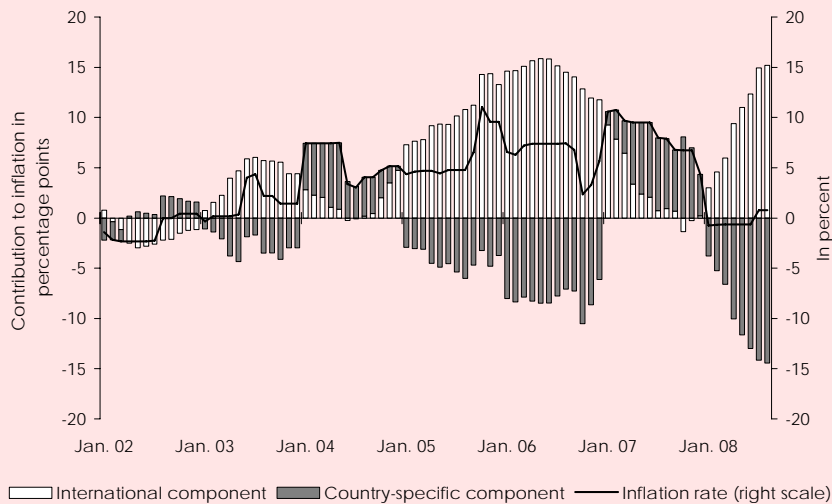
Source: Eurostat, WIFO calculations.

Also in the product group "gas", the inflation dynamics in Austria changed due to the ebbing of base effects in the first half year 2008: While Austrian consumer prices for gas are now slightly lower than one year ago, they have increased markedly in the euro area.

Since the second quarter 2005, there has been a marked country-specific component for the position "pharmaceutical products" accounting for almost the entire price inflation (Figure 10). The domestic contribution to inflation was 3.1 percentage points in 2007 and 3.2 percentage points in the first half of 2008.

Health

Pharmaceutical products

Relative price indices are available only for the two-digit group "health" for 2006. Pharmaceutical products make up around 20 percent in this group, while 80 percent are due to out-patient and hospital services. In Austria, prices in the product group "health" were around 2 percent higher than the average price level and thus in the middle range of the euro area.

Figure 10: Inflation components for pharmaceutical products (cp0611)
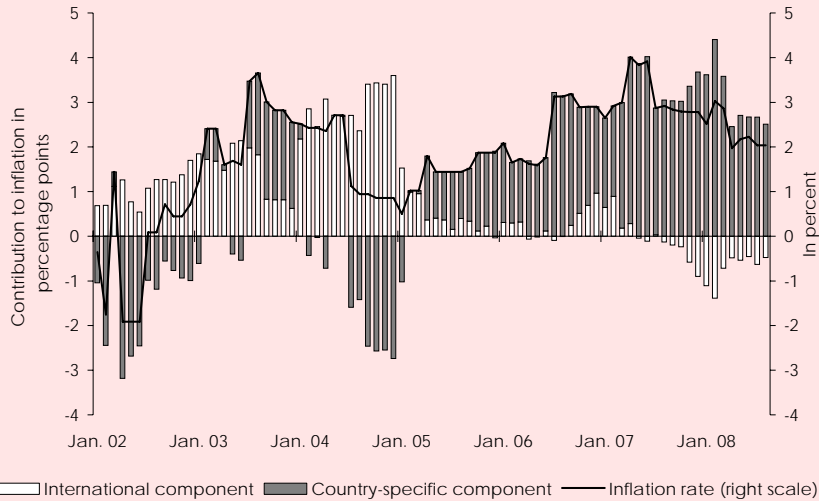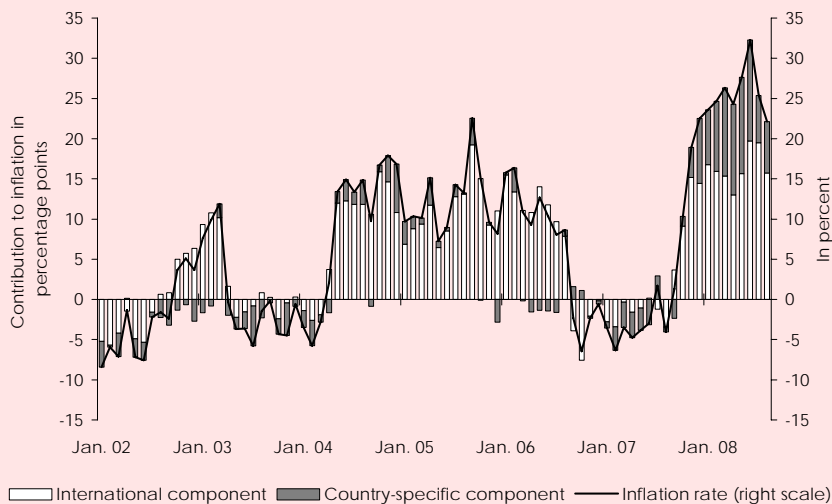

Source: Eurostat, WIFO calculations.

Until autumn 2007, price increases in Austria in the category of "fuels and lubricants for personal transport equipment" were largely in line with the "underlying inflation" of the euro area (Figure 11). On annual average 2007, the Austria-specific component was –0.5 percentage points. However, in December 2007, it was +8.1 percentage points and rose to +12.6 percentage points by June 2008 – the highest level of the sample period.

Transport

Fuels and lubricants for personal transport equipment

Figure 11: Inflation components for fuels and lubricants (cp0722)

Source: Eurostat, WIFO calculations.

Due to the ebbing of the base effect of the increase in the mineral oil tax in July 2007, the contribution of the national component decreased in July 2008 to +5.9 percentage points. Adjusted for the effect of the increase in the mineral oil tax (around +5 to +6 percentage points), fuel prices in Austria went up by 3 to 6 percentage points more than the "underlying inflation trend" in the euro area. Com-

pared with the period 2002 to 2007, this represents a pronounced increase of the Austria-specific component.

A relative price index is available only for the two-digit group "transport". The share of fuel and lubricants amounts to 26 percent, and the purchase and repair of vehicles as well as automobile accessories and transport services (public transport, taxi rates, and airline tickets) account for the rest. In 2007, prices in the category "transport" in Austria were 5 percent above the euro area average and the highest after Finland, the Netherlands and Ireland.

Conclusions

The statistical decomposition of monthly inflation rates (by product group and country) in the euro area yields a product-specific component common to all countries ("international" component) and a country-specific component for each product in every country of the euro area (domestic component). The calculations are based on disaggregated inflation rates according to Eurostat's Harmonised Index of Consumer Prices (HICP). The sample covers the period from January 2002 to August 2008. For each of the 12 countries of the euro area (excluding Slovenia, Cyprus and Malta) 61 sub-indices of the HICP were used. The approach applied, a panel econometric procedure as presented by *Marimon – Zilibotti* (1998), permits the simultaneous investigation of inflation for all countries covered and for all product groups examined for the total sample period.

Over the sample period, the larger part of the inflation rate in Austria is explained by the international component. With the exception of the first few months of 2005 and the last months of 2007, the country-specific component pushed the inflation rate below the "underlying inflation trend" for the euro area, thereby exerting an inflation-dampening impact.

The decomposition of inflation for ten selected product groups in Austria revealed markedly Austria-specific inflation contributions towards the end of 2007 and in early 2008. For most products investigated here, the domestic inflation component decreased in the course of 2008. Exceptions to this pattern were pharmaceutical products and fuels where the Austria-specific contribution to inflation was still substantial in mid-2008. Beyond the focus of the present study, the causes of the "homemade" acceleration of inflation still need to be clarified. The report of the *Wettbewerbskommission* (2008) and the contributions of *Janger* (2008), *Böheim* (2002, 2008) and *Baumgartner* (2008B) provide first orientations in this regard.

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Statistical Decomposition of Product-Specific Inflation Rates in Austria – Summary

This study presents a statistical decomposition of the monthly inflation rates (by product group and country) for the euro area into a common, product-specific component for all countries ("international"), and a country-specific component for each product in every country of the euro area (domestic component). A panel econometric approach has been applied to simultaneously cover the inflation dynamics for all product groups in all countries over the whole sample period.

Disaggregated inflation rates by product and country based on the Harmonised Index of Consumer Prices (HICP) for the euro area as published by Eurostat form the data base for the analysis. The sample ranges from January 2002 to August 2008 and includes 61 sub-indices of the HICP for each of the 12 countries (euro area excluding Slovenia, Cyprus and Malta).

Over the sample period, most of the inflation dynamics in Austria was caused by international factors. Compared with the "underlying inflation trend" of the euro area, the domestic component had an inflation-dampening effect (with the exception of the first months of 2005 and the last months of 2007).

The results of the decomposition of the inflation development are presented in more detail for ten product groups in Austria (bread and cereals, milk, cheese and eggs, oils and fats, mineral waters, soft drinks, fruit and vegetable juices, materials for the maintenance and repair of the dwelling, water supply and miscellaneous services related to the dwelling, electricity, gas, pharmaceutical products, fuels and lubricants). This selection of product groups was guided by the products investigated by the Wettbewerbskommission as well as the goods listed in the petition of the Austrian Chamber of Labour to the Price Commission.

Around the end of 2007 and the beginning of 2008, these ten product groups exhibited a marked positive (in some cases even substantial) Austria-specific inflation component. In the course of 2008, the domestic component decreased again among most of the ten product groups investigated. Exceptions to this pattern are pharmaceutical products and fuels: in these two groups, the Austria-specific contributions to inflation were still significant in mid-2008.