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Heterogeneity in Producer Price Changes in Business Services

Anita Wölfl[1,2]

Abstract

For a price index to be representative for a certain services activity it has to be based on services products that are "typical" for this activity. The sampling procedure used by the national statistical offices would guarantee homogeneity of products in terms of similarity in product characteristics. However, whenever the information on price changing patterns is used later on for the estimation of missing values for products within each product class, it becomes crucial that the products be similar also in terms of their price changing patterns. We test for this form of homogeneity using individual data collected by INSEE on prices for two activities of business services. We do not find strong evidence for homogeneity of product groups in terms of similar price changing patterns. After controlling for inter-firm variation within product groups, mean price changes per product group do not differ significantly from each other. Moreover, there is a large variation within product groups constituted by large and significant variation in price changes between firms that produce for the respective product groups. However, much seems to depend on how the product groups themselves are defined. In our data, we find no significant differences in mean price changes between product groups whenever we define them solely according to different customer groups. In contrast, whenever we define product groups according to product specifications, the picture changes.

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Introduction

Recent empirical work points to a role of problems in measuring price indices for productivity growth in business services (Wölfl, 2003, 2005). One of the main issues in this regard relates to the heterogeneity of services products, notably business services. These services are often tailored to the specific needs of customers and are as such unique products. However, for a price index to be representative for a certain services activity it would have to be based on services products that are "typical" for this activity. This is normally achieved by a three-step sampling process: First, classes of services products or activities are designed that group together products with similar characteristics. Second, samples of establishments are chosen that produce services products with characteristics that would fall into the respective product class. Third, each establishment is asked to name product specifications that are representative for this activity and for which then prices are collected. This procedure would typically guarantee some homogeneity of products in terms of similarity of product characteristics.

Whether these products are also similar in terms of price changing patterns is not sure, though, and may not be the crucial criterion behind the sampling procedure a priori. However, it becomes a crucial criterion whenever the information on such price changing patterns is used later on for the estimation of missing values for products within each product class. It is normal that over time price observations would no longer be available as the product itself would not be sold any more on the market. National statistical offices typically substitute products that are no longer available by new ones, adjusting for the change in the characteristics or the quality of the respective product. However, this procedure is more difficult to apply for certain business services activities, so that national statistical offices have to or prefer to estimate missing values using information on the price changing pattern of other products within the same product class. Homogeneity of products in terms of price changing pattern within product classes would then be of particular importance.

Within this paper, we analyse the variation in price changes over time as well as within and across firms and product groups for two services activities and ask whether the products that are resulting from the sampling procedures described above fulfil the homogeneity-criterion in terms of similar price changing patterns. We use individual data on prices of services products for selected activities of business services. These data come from the Survey on Producer Price Indices in Business Services, collected by the French statistical office INSEE. The services activities for which we do the analysis in this paper are industrial cleaning services and computer services. The data are quarterly data covering the years 2001 (respectively 2002) to 2005.

This paper is structured as follows: We begin in chapter 1 with some introductory notes on the importance of the similarity in terms of price changing patterns for the final producer price index and with a description of the empirical model and the underlying data. Section 2 provides descriptive results of the variation in producer price changes within subgroups of products. This consists mainly in decomposing graphically the variation in producer price changes within firms and product groups into the variation due to variation across products and variation across time periods. Chapter 3 provides the result from the econometric analysis. We test first for the between and within-variance of producer prices within firms and product groups. We then test for the homogeneity in terms of similar price changing patterns of products that would result from the sampling and price collection procedure described above.

1 Question asked, empirical model and data

1.1 The importance of homogeneous groups in the producer price index

Empirical work suggests that the observable weak productivity growth rates in business services industries may relate to problems measuring productivity growth in services industries, notably in business services (Wölfl, 2003, 2005). One of the main issues in this regard is the measurement of price indices or volume series of value added or gross output. Problems measuring price indices may arise for instance from the heterogeneity of services products, notably business services (Eurostat, 2001; OECD/Eurostat, 2005). These services are often tailored to the specific needs of customers and are as such unique products, or they are provided in a package that bundles together different components for which different pricing scheme would have to be applied. However, for a price index to be representative for a certain services activity one would have to base it on services products that are "typical" for this activity and to disentangle the price developments of each of their components.

This paper focuses on one central element in the measurement of prices on the detailed level, the extent to which products within product classes are 'homogeneous' or similar in terms of their price changing patterns. To understand the importance of this issue, it is reasonable to describe rapidly the steps involved to construct producer price indices (IMF, 2004). After having determined the objectives, the scope and the conceptual basis of the index, the national statistical offices decide on the index coverage and classifications structure. The next step consists in designing the sample of product items for which the prices are collected and edited in two steps: they draw a sample of establishments that produce products belonging to the respective product class. The establishments are then asked to name representative products for which price data are collected. Once the price data have been collected and followed over time, an elementary series, or elementary price index is established. Using constant or changing revenue weights, the elementary series are then aggregated to a price index for the product classes that had been established above.

The classification structure is of particular importance in the construction of producer price indices. The product classes represent the frame within which the product items are selected. They are at the same time the first aggregation level at which the price indices are published and diffused. They can therefore be interpreted as the markets on which the respective products are sold. As a consequence, the product classes have to be chosen such that they comprise similar product items. These product items should be similar enough such that they could be regarded as goods that are representative for the respective market. Similarity or homogeneity can be seen either in terms of products with similar characteristics, or in terms of products with similar price changing patterns.

The hypothesis of this paper is that the chosen product classes should comprise goods that are not only similar in terms of their characteristics, but also in terms of their price changing patterns. The idea behind is to reduce measurement bias or error. The elementary aggregate price index is an estimator for the unobservable mean price change of the population in the respective product class (IMF, 2004). As it is typically not possible to draw an infinite number of different samples such that the estimated mean be identical to the population mean, a systematic bias due to sampling could not be prevented. The aim is rather to keep the bias within close limits. The closer the variance around the estimated mean price change, and therefore, the closer the confidence interval around the mean, the smaller would be the uncertainty of estimating the true value of the unknown population mean price change.

Homogeneity of products within product classes in terms of similar price changing patterns is in particular important whenever the information on price changing patterns of products within the respective product class is used to estimate missing observations for another product within the same product class. Observations may be missing, for instance whenever firms do not respond regularly or the product does no longer exist on the market. National statistical offices typically substitute products that are no longer available by new ones, adjusting for the change in the characteristics or the quality of the respective product. However, this procedure is more difficult to apply for certain business services activities, so that missing values have to be estimated using information on the price changing pattern of other products within the same product class.

Thereby, one procedure that is commonly utilised consists in estimating the price change for the missing observation by applying the (weighted) average price change of the remaining products in the same product group. This assumes that the price change in the case of the product for which observations were missing be in line with the average price change of the other products within the same product class. This is the case whenever the products within the product group are characterised by similar price changing patterns, *i.e.*, whenever the variance around the mean is relatively small. If this was not the case, the computed mean price changes would depend very much on which products stay in the sample, potentially leading to additional measurement error. [3]

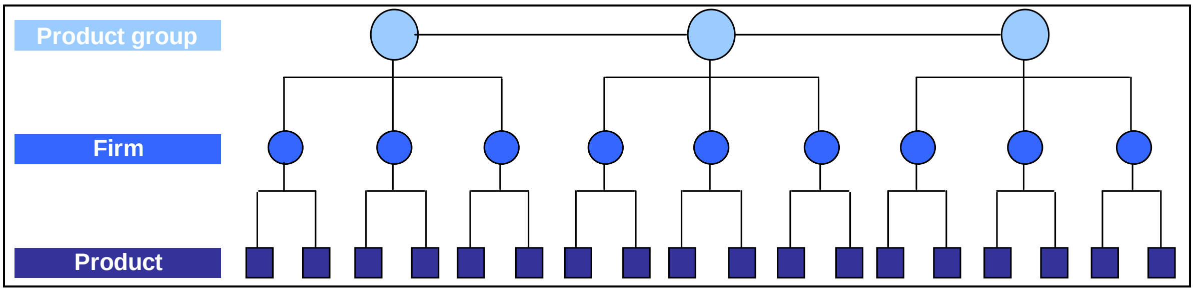
[3] As this would not be systematic any more, one would speak now of measurement error and not measurement bias. Error and bias may be of equal quantitative importance though (IMF, 2004).

1.2 The data

We use individual data on prices of services products for two selected activities of business services, ‘industrial cleaning’ and ‘computer services’. These data come from the Survey on Producer Price Indices in Business Services (below: PPIS), collected by the French statistical office INSEE. The data are quarterly data covering the years 2001 (respectively 2002) to 2005.

The structure of the data can best be described by the structure of the price collection process: As a first step, the classification is designed, *i.e.*, the general product groups. Within the INSEE PPIS, these classes are coded as ‘siref’. The second step consists in designing the samples of establishments that produce products which would fall in the respective product class. However for confidentiality reasons we changed the siren-number, the identification codes for the firms. The third step consists in the choice of the representative products for which then the prices are collected. The product code used by INSEE PPIS is ‘seref’. Figure 1 describes the resulting layout of the data set.

Figure 1: **The layout of the data sets**



Source: Application of Figure 7.1 in Sahai and Ageel (2000) to our dataset.

The central information of interest for our analysis is the elementary price series per product over time. The index has been estimated by the French statistical office INSEE as a Laspeyres (or Lowe-[4]) price index based on the responses of the firms on the price level per product and quarter. In order to achieve a continuous index over a long period, INSEE estimates values that are missing due to non-responses by firms and replaces in few cases services products of which the product specification has slightly changed over time. Based on the resulting price index, we computed quarterly price changes as the differences in the natural logarithm of the quarterly prices between two subsequent periods.

Table 1 presents the balanced panels for each of the two activities. Information on services prices have been collected since a relatively short time only, and the time periods for which price information is available within the original data vary strongly across products. Moreover, there are large differences in the number of products per firm or product group respectively. We have chosen the time periods and number of products that allowed us to compromise between a sufficiently high variety of products

[4] In our data, weights are not updated at every quarter, as would be the case in a Laspeyres price index.

and sufficiently long time series. The resulting data sets per services activity are balanced in terms of equal number of time periods per product, firm and product group.

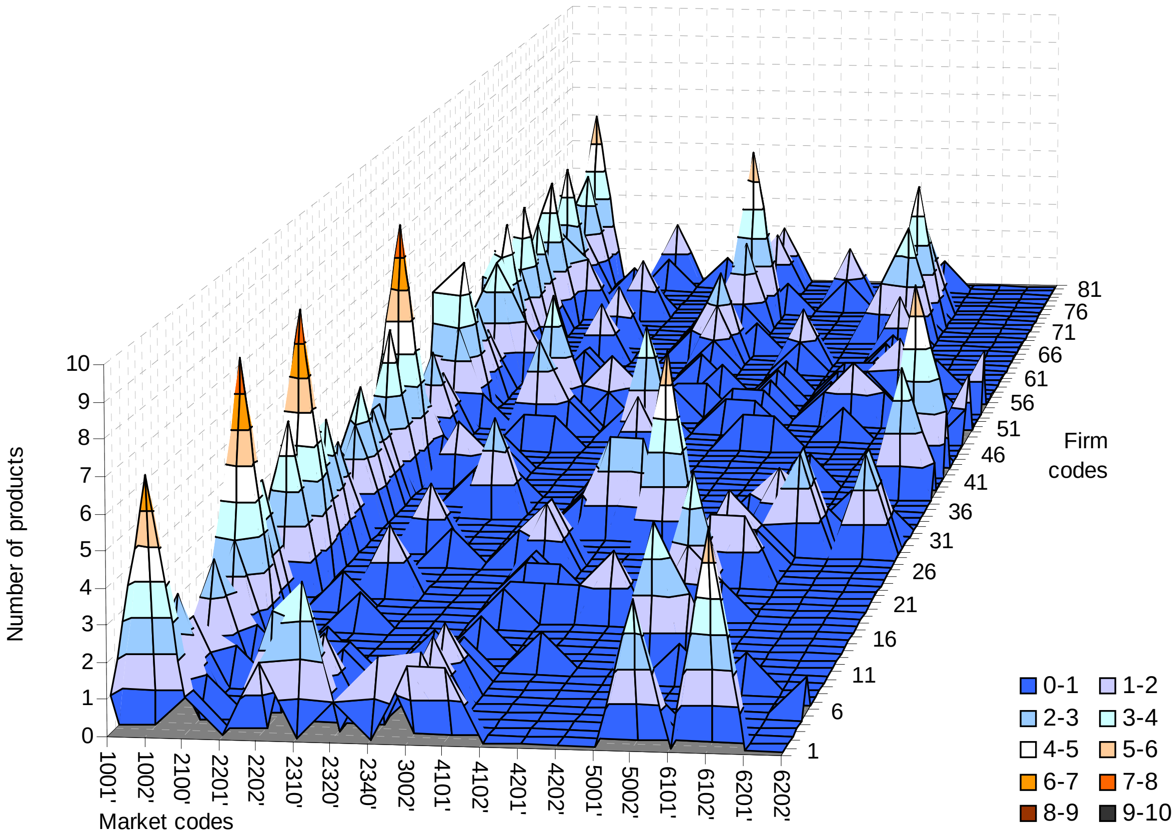
Table 1: **An overview of the 'cleaned' panel data sets**

Services activities	Total number of obser-vations	Time information			Product information		
		Observation period (quarters)	Number of ...		Number of ...		
			Years	Quarters	Products	Product groups	Firms
Cleaning services	10393	2001/1-2005/3	5	19	547	19	82
Computer services	11532	2002/3-2005/2	4	12	961	25	75

Source: INSEE, Survey of Producer Price Indices, 2005.

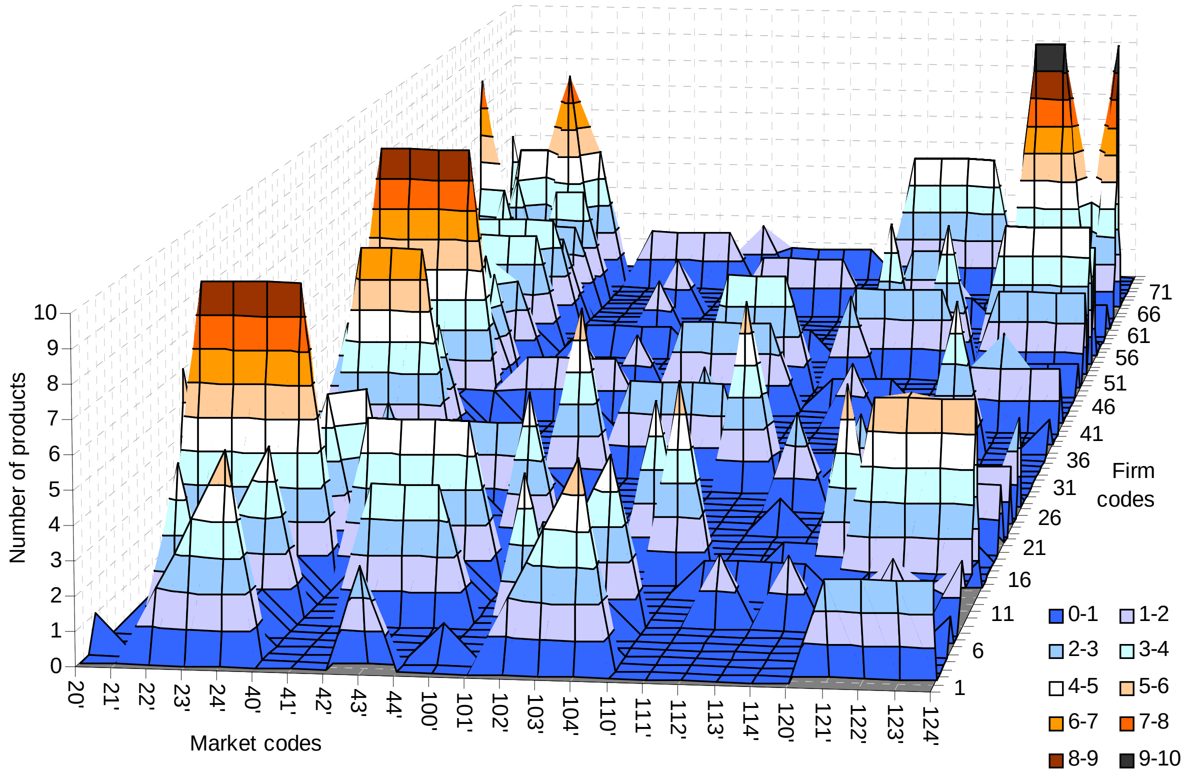
The sampling process described above does not preclude that some firms produce for different product groups or markets though. Figure 2 and Figure 3 plot the number of products (on the vertical axis) by firm (45°-axis) and by product group or market (horizontal axis). In a world with complete specialisation by firms on a certain type of services products and a classification of products into perfectly homogenous groups, one would expect a pattern of observations with peaks on the diagonal and flat points everywhere else.

Figure 2: **Number of products per firm and product group (market)**
– the case of industrial cleaning services –



Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 3: **Number of products per firm and product group (market)**
– the case of computer services –



Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 2 and 3 show neither such a clear specialisation by firms, nor such a clear classification of products. Firms produce services products that fall into different product groups and product groups cluster products from different firms together; no clear pattern can be distinguished. In the case of computer services, the lack of specialisation is even more interesting as our activity 'computer services' covers two sub-activities, i.e., 'hardware consulting' as well as services within the activity 'software consulting' that are related to the rather technical aspects of software services.

1.3 The empirical model

The general setup of analysis of variance – the example of a 2-way cross classification

The aim of this paper is to analyse price changes econometrically applying Analysis of Variance, an approach commonly used in statistical analysis.[5] The analytical model setup of analysis of variance, here applied to the general case of a two-way cross classification with fixed effects, would be as follows: Let's assume that data can be classified into two factors: A with *a* levels and B with b levels. We are interested in the 'effect' of a specific level of a factor on the endogenous variable. If we start with the case in which we have equal numbers of observations for each factor level, we would have in

[5] The following model description follows Searle et al. (2006), Searle (1971), Sahai and Ageel (2000).

each cell $k=1,...,n$ observations y_{ijk} of the endogenous variable. In the more general case interactions between factors, the model would be formulated as in equation (1):

$$y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_{ij} + \varepsilon_{ijk}\,, \qquad \text{for } i=1, ...,a,\ j=1, ...,b, \text{ and } k=1,...,n., \qquad (1)$$

where μ represents the overall mean, the α_i*'s* and the β_j*'s* stand for main effects of the factors *A* and *B* respectively. Thereby, the *i's*, *j*'s and the *k's* are general indices and can stand for different individual effects or time effects.[6]

The central aim of analysis of variance is to decompose the total variance into the parts that are due to each of the main factors and the residual variance. This decomposition into the sum of squares and their respective means in the 2-way crossed classification model without interactions, and for the case of equal number of observations for each factor level would be as follows:

Source of Variation	Sum of Squares (SS)	Mean Squares	
A-Factor	$SSA = bn\sum_{i=1}^{a}(\bar{y}_{i..} - \bar{y}_{...})^2$	$MSA = \frac{SSA}{a-1}$	(2a)
B-Factor	$SSB = an\sum_{j=1}^{b}(\bar{y}_{.j.} - \bar{y}_{...})^2$	$MSB = \frac{SSB}{b-1}$	(2b)
AB-Interaction	$SSAB = n\sum_{i=1}^{a}\sum_{j=1}^{b}(\bar{y}_{ij.} - \bar{y}_{i..} - \bar{y}_{.j.} + \bar{y}_{...})^2$	$MSAB = \frac{SSAB}{(a-1)(b-1)}$	(2c)
Residual error	$SSE = \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{n}(y_{ijk} - \bar{y}_{ij.})^2$	$MSE = \frac{SSE}{ab(n-1)}$	(2d)
Total	$SST = \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{n}(y_{ijk} - \bar{y}_{...})^2$		(2e)

In our case, if we set factor *A* to be product group effects and factor *B* firm effects, and we assume one product per firm and product group respectively, the total variance of price changes would be decomposed into:

- SSA, the variance explained by the factor product groups, as defined by the sum of squared differences between the mean price change of the individual product group *i* and the overall mean price change across all firms, product groups and over time;

- SSB, the variance explained by the factor firms, as defined by the sum of squared differences between the mean price change of the individual firm *j* and the overall mean price change across all firms, product groups and over time;

[6] If we had only firm and time effects with is one product per firm, equation (2) would be a special case of a classical fixed effect panel regression model. See also Baltagi (2001) and Sevestre (2002).

- SSAB, the variance explained by the interaction between the factors firm and product group. This can be written as the sum of squared differences between the mean price change at firm *j* and product group *i* and the deviation of both, the mean price change of the individual product group *i* and the mean price change of the individual firm *j* from the overall mean price change across all firms, product groups and over time;

- SSE, the residual variance, as defined by the sum of squared differences between the individual price change of product group *i* and firm *j* at time *k* as compared to the mean price change of product group *i* and firm *j*;

As in general panel econometric models the null-hypothesis is that there is no effect of any level of the factor, above an overall mean, on the endogenous variable, i.e.: $Ho:\ \alpha_i = ... = \alpha_n = 0.$ (3)

If we assume that the y_{ijk} are realisations of an independent and normally distributed random variable then the sum of squares *SSA* and *SSE,* the ratio of the mean squares is then F-distributed as:

$$F_A = \frac{MSA}{MSE} \sim F^{a-1}_{ab(n-1)}, \qquad F_B = \frac{MSB}{MSE} \sim F^{b-1}_{ab(n-1)}, \tag{4}$$

Homogenous products ? - The nested model

Within the construction of a producer price index, firms and product groups are not chosen independently from each other and are therefore not necessarily orthogonal to each other – as has been described above and demonstrated graphically in Figure 1. This makes a nested model necessary. The question is then not anymore whether each of the factors, firms and product groups, has a significant and independent influence on the price changes. The question becomes rather whether products that result from the sampling process are homogenous. This implies two issues: First, it implies – as in the case of the standard 2-way-classification case above - whether mean price changes per product group are significantly different from each other. Second, it implies whether mean price changes of firms *within a certain product group* are different from each other or not, or in other words, whether firms producing for a particular market (as represented by a certain product group) change prices of their products in a similar way.

For readability and comparability reasons, we concentrate in the formal derivation of the model on the two-factor nested model. Lets apply this to our example above: Say we have two factors, *A* (product group), *B* (firm), with *a* and *b* levels respectively. The *b* levels of factor *B* are nested under each level of *A*, i.e., we look at mean price changes of the firms within a certain product group *a*. Assume as above that each firm produces one product only and that there are *n* replicates within the combination of levels of *A* and *B,* in our case *n* periods. The analysis of variance model for this type of experimental layout is given as:

$$y_{ijk} = \mu + \alpha_i + \beta_{j(i)} + \varepsilon_{k(ij)}, \qquad \text{for } i=1, ...,a, j=1, ...,b, k=1,..., n., \qquad (5)$$

where μ represents the overall mean, α_i is the effect due to the *i*-th level of factor *A*, $\beta_{j(i)}$ stands for the effects due to the *j*-th level of factor *B* within the *i*-th level of factor *A*, and $\varepsilon_{k(ij)}$ stands for the error term. The decomposition into the sum of squares and their respective means in the 2-way nested classification model would be as follows:

Source of Variation	Sum of Squares (SS)	Mean Squares	
A-Factor	$SSA = bn\sum_{i=1}^{a}(\bar{y}_{i..} - \bar{y}_{...})^2$	$MSA = \frac{SSA}{a-1}$	(6a)
B(A)-Factor	$SSB(A) = n\sum_{i=1}^{a}\sum_{j=1}^{b}(\bar{y}_{ij.} - \bar{y}_{i..})^2$	$MSB(A) = \frac{SSB}{a(b-1)}$	(6b)
Residual error	$SSE = \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{n}(y_{ijk} - \bar{y}_{ij.})^2$	$MSE = \frac{SSE}{ab(n-1)}$	(6c)
Total	$SST = \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{n}(y_{ijk} - \bar{y}_{...})^2$		(6d)

In the case of the nested model, if we set factor *A* to represent product groups and factor *B* firms, and we assume one product per firm, the total variance of price changes would be decomposed into:

- SSA, i.e., the variance explained by the factor firm, as defined – as above - by the sum of squared differences between the mean price change of the individual product group *i* and the overall mean price change across all firms, product groups and over time. SSA can also be called 'between-product group variance'.

- SSB(A), i.e. the variance explained by the factor firm within product group *i*, as defined by the sum of squared differences between the mean price change of the individual firm *j* producing a product that falls into product group *i* and the mean price change across all firms producing for product group *i*. SSB(A) can also be called 'within-product group variance'.

- SSE, the residual variance, as defined by the sum of squared differences between the individual price change of product group *i* and firm *j* at time *k* as compared to the mean price change of product group *i* and firm *j*;

The F-statistic for the two factors are then:

$$F_A = \frac{MSA}{MSE} \sim F_{ab(n-1)}^{a-1}, \qquad F_{B(A)} = \frac{MSB(A)}{MSE} \sim F_{ab(n-1)}^{a(b-1)}, \qquad (7)$$

Estimation problems arise whenever the number of observations for each factor are not equal across factors. For instance, each firm may produce several products and the number of products per firm varies across firms and there are thus some factor-combinations with empty cells. The problem is solved by using different decompositions. One distinguishes usually three different forms, the Type I to Type III-models of decomposition of sum of squares. The Type III decomposition is the most appropriate to test for significant differences in variation across the levels of any factor. It applies strictly the restriction that the individual effects per factor sum up to zero. As a consequence, one would test the H_0's of zero differences between the different levels of each factor based on the 'pure' effects of this factor, without this effect being affected by the effects of the respectively other factor.[7]

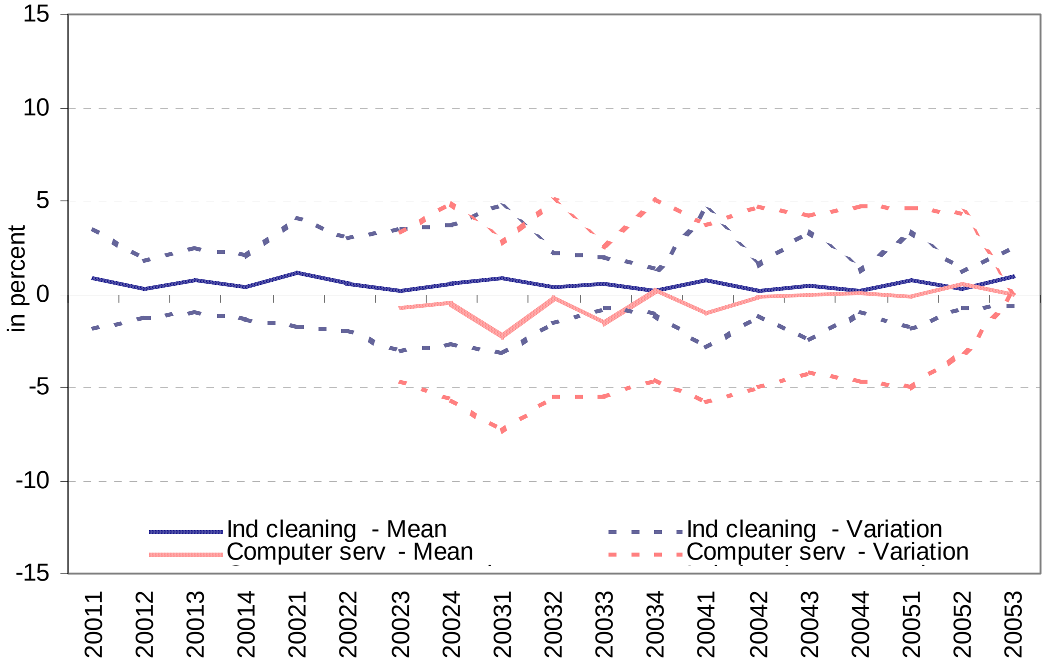
2 Variation in quarterly price changes – some descriptive results

We start our empirical analysis with some descriptive graphs on the variation in price changes across time, products, firms and product groups for the two services activities. This description does not only provide a first view on how prices change in business services. It may also give some first indication as regards possible hypotheses for the econometric analysis below.

2.1 Variation by product and over time …

Figure 4 plots mean price changes and their variance *over time* for our two activities. The blue curves represent thereby industrial cleaning services and the red ones computer services. The continuous curves plot the total mean price change per quarter, while the dotted curves plot the variance around the means, computed as the mean plus/minus the standard deviation.

Figure 4: **Mean and variation of quarterly price changes over time**



Note: Unweighted means of quarterly price changes (logarithmic).
Source: INSEE, Survey of Producer Price Indices, 2005.

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7 See the appendix for a more detailed description.

Average price changes in both services activities range between -2 % and 1 % , with relatively stable prices in industrial cleaning and slowly increasing prices in computer services. Mean price changes vary more strongly over time in the case of computer services as reflected in a movement of annual price changes from -2 % in the first quarter of 2002 to 0 % in the second quarter of 2003. Both services activities show also strong variation around the mean, whereby the variation is more pronounced in the case of computer services as compared to industrial cleaning.

Figure 5 and 6 plot the total mean price changes and their variation *by product* for industrial cleaning services and computer services. The bold curve plots the total means of quarterly price changes by product.[8] The products (not all cited on the horizontal axis) are ranked according to their mean price change. Based on the computed standard deviations, we plotted the variance of quarterly price changes around the means; this is reflected in the curves called "mean+/- standard deviation".

The variation around the mean represents differences in price changes across different time periods. A variation curve that is relatively close to the horizontal line suggests that the price for a particular product would be changed regularly and by a similar amount for all quarters. In contrast, peaks in the variation curve would suggest that prices for this particular product were changed differently for different periods. For instance, firms may change the prices of the respective products only once within the period of one to three years and then at a relatively strong amount, but leave them constant or change them only marginally during the remaining time. This could be the case for instance whenever firms choose a long-term contract for their services provision.[9] Alternatively, firms may face menu costs, i.e., costs of changing the prices of their products. In the case of services, this may be due to transaction costs if prices were to be re-negotiated regularly.[10]

Figure 5 and 6 shows two main results: First, within the cleaning services, quarterly price changes amount on average across products to between -2 and +2 % by product, and are around 1 % for most products. This latter point implies no large differences in mean price changes across products. In the case of computer services, quarterly prices change more strongly than for industrial cleaning services. Prices change on average across products by between -5 % and +3 %, with the majority of products showing negative mean price changes. An interesting feature as regards the computer services is that mean price changes as well as their variation are equal for several products. This can be seen by variation curves that are horizontal for several products, e.g., close to product code 1240 in Figure 6. These suggest that some firms change the prices for all or several of their products in the same way.

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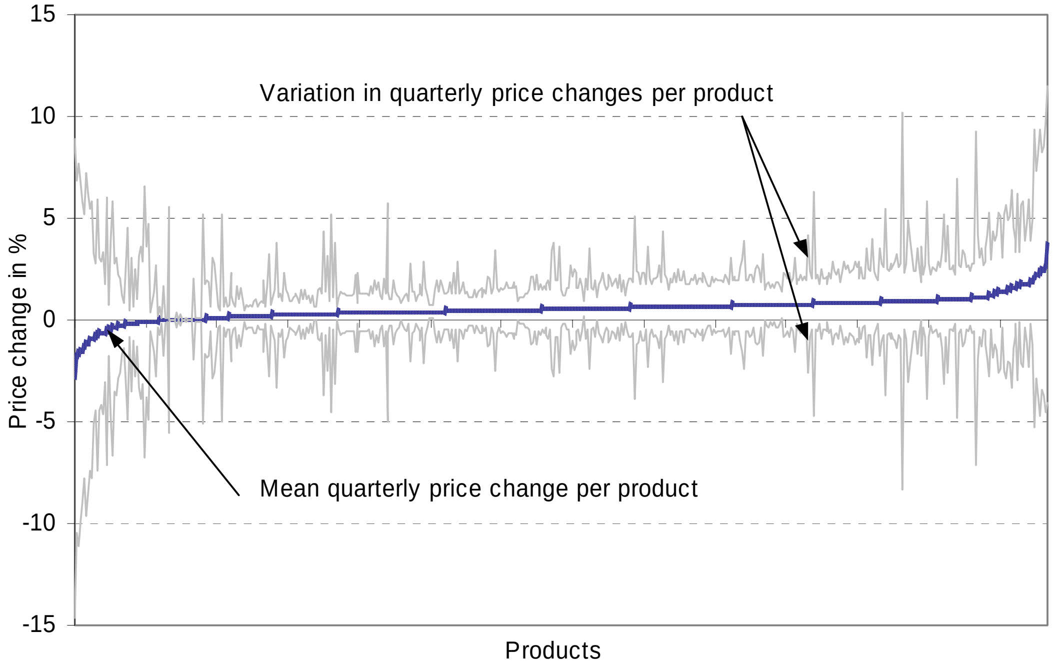
8 As we do not have a time series of observations, one should plot only the point values without connecting them by lines. Due to the high number of products, the graphs would not be readable, though.

9 For 'technical assistance' or other computer services, for instance, prices are set in such a long-term contract with the time spent on the project being a main determinant of the price setting (Buisson, 2002).

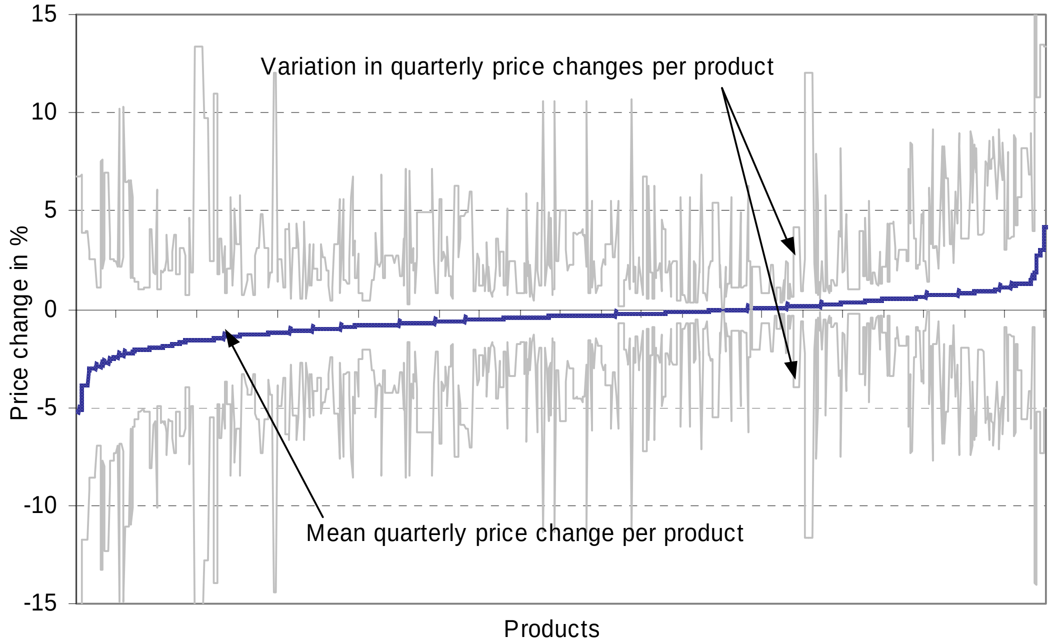
10 For relevant theoretical models in this regard see for instance Calvo (1983).

Figure 5: **Mean and variation of quarterly price changes per product**
– the case of industrial cleaning services –



Note: Unweighted means of quarterly price changes (logarithmic). Products are ranked according to their mean price change.
Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 6: **Mean and variation of quarterly price changes per product**
– the case of computer services –



Note: Unweighted means of quarterly price changes (logarithmic). Products are ranked according to their mean price change.
Source: INSEE, Survey of Producer Price Indices, 2005.

In both activities, price changes per product vary over time, and this variation is different for different products; here again the results are much more pronounced in computer services than in the case of cleaning services. Whether this suggests that prices per services product are not changed in a continuous process over time cannot be said unambiguously, though. Tables A1a and b suggest that prices change more regularly in the case of cleaning services, whereby the amounts are significantly different from one period to the other. In contrast, in the case of computer services, significant bilateral differences in price changes across periods can be observed only for three periods. This pattern does not imply that firms do not change their prices in the other periods; it implies that if they change, the amounts of the individual price changes are not significantly different from each other.

2.2 Variation by firm and by product group

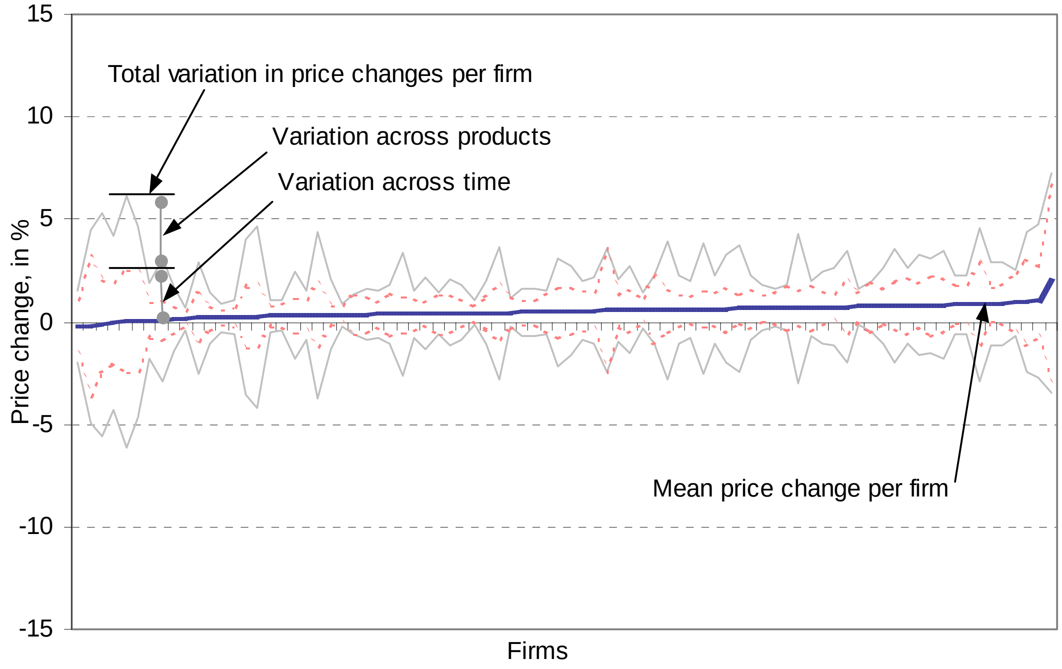
Figures 7 to 10 provide some evidence on the variation in price changes by firm and product group and whether this variation is due to variation across products or across time. The graphs show three different kinds of curves: The dark blue line in the middle plots the total mean price change by firm or product group respectively. The lighter blue curves above and below plot the standard deviations around the mean by firm or product group respectively and reflect total variance around the mean. This variance can be due to variation across products and variation across time. The red dotted curve decomposes the total variance into these two variance components. It results from a data set where we computed mean price changes and their standard deviations across quarters after having averaged (controlled for) price changes across products per firm or product groups respectively.

Figure 7 shows that for most firms of the industrial cleaning sector the total variation in price changes is almost equally distributed between variation across products and variation over time. The variation curve after controlling for inter-product variation lies more or less in the middle between the curve representing mean price changes and the curve representing total variation of price changes per firm. In computer services in contrast (Figure 8), the total variation of price changes by firm is almost fully due to variation of price changes over time.

Figures 9 to 10 provide the same type of evidence as in Figures 7 and 8, but now for the variation in price changes per *product group*. These graphs point to a strong difference between product groups and firms: In both services activities, Figure 9 and 10 indicate that the total variation of price changes per product group is almost fully due to variation across products, with the time component playing only a minor role, while the total variation within firms was to a larger extent due to variation across time and less due to inter-product variation. This observation is of importance for the central question in this paper as it suggests that product groups are no ‘homogenous’ entities that group together products with similar price changing patterns.

Figure 7: **Inter-product versus inter-time differences in variation by firm**

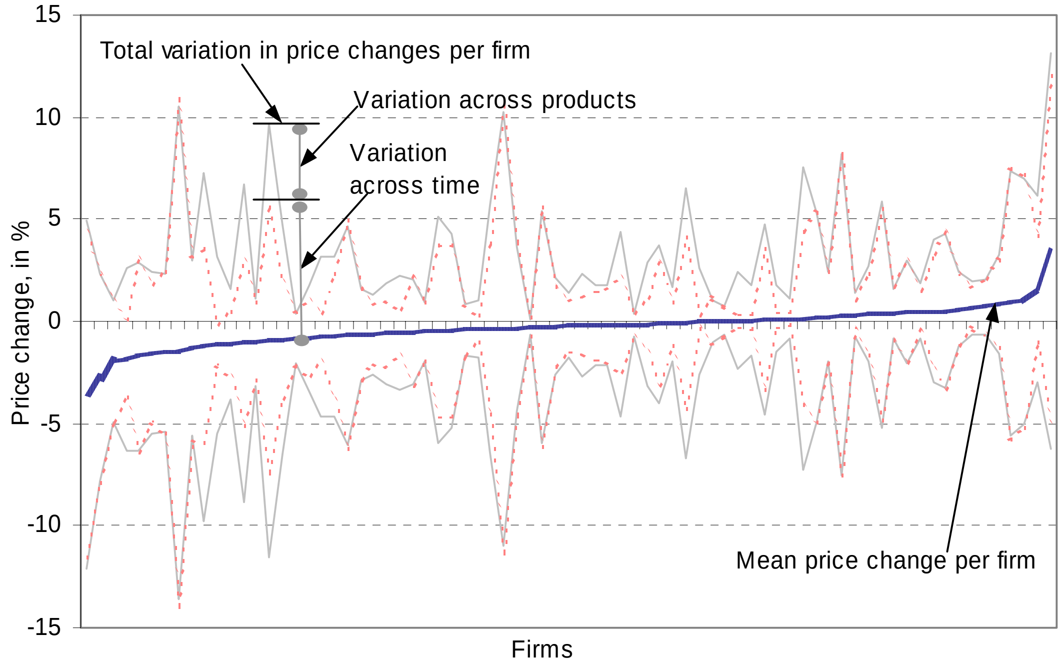
– the case of industrial cleaning services –



Note: Unweighted means of quarterly price changes (logarithmic). Firms are ranked according to their mean price change.
Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 8: **Inter-product versus inter-time differences in variation by firm**

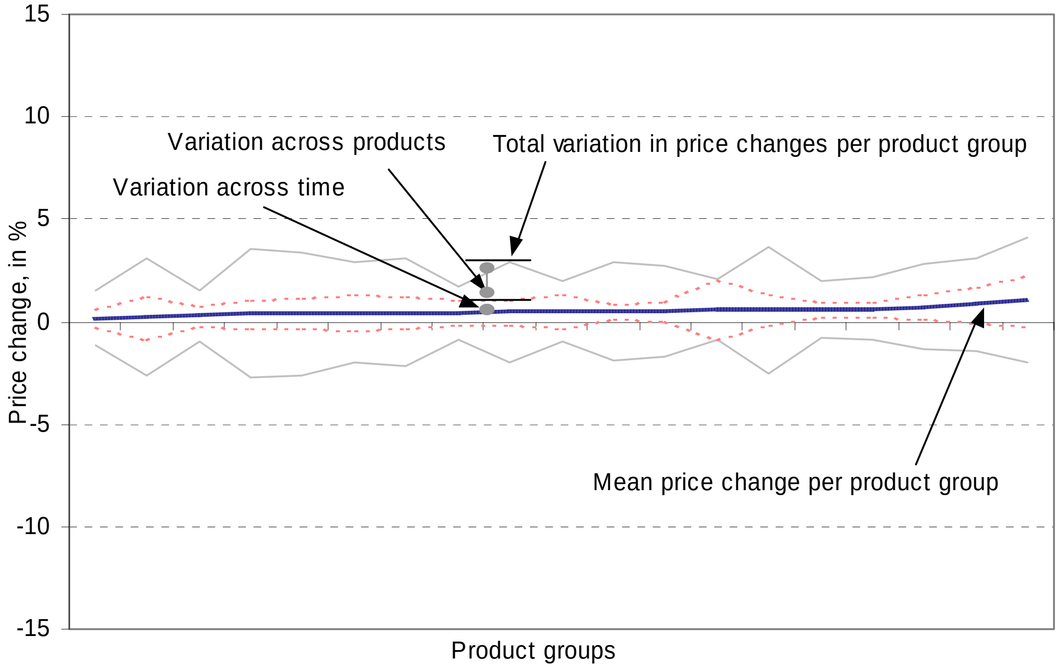
– the case of computer services –



Note: Unweighted means of quarterly price changes (logarithmic). Firms are ranked according to their mean price change.
Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 9: **Inter-product versus inter-time differences in variation by product group**

– the case of cleaning services –

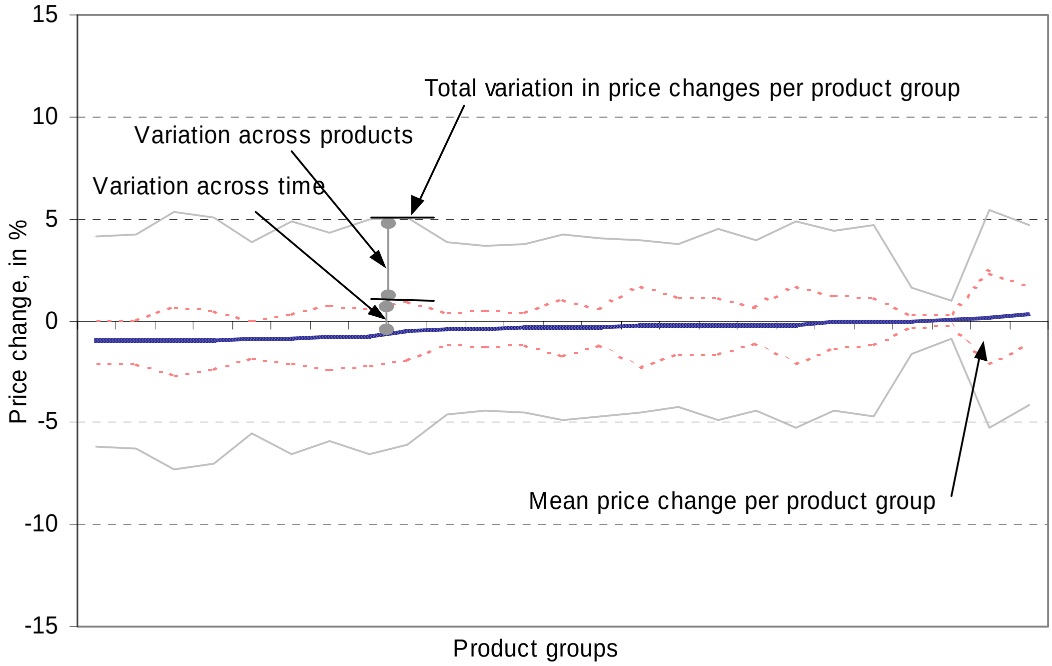


Note: Unweighted means of quarterly price changes (logarithmic). Product groups are ranked according to their mean price change.

Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 10: **Inter-product versus inter-time differences in variation by product group**

– the case of computer services –



Note: Unweighted means of quarterly price changes (logarithmic). Product groups are ranked according to their mean price change.

Source: INSEE, Survey of Producer Price Indices, 2005.

This descriptive part suggests four main results: First, within both, cleaning and computer services, prices change at between 2 and 5 % per quarter in absolute terms, with higher rates in the case of computer services. Second, mean price changes do not differ drastically between products, firms or product groups, in cleaning services; somewhat larger differences across mean price changes can be observed in the case of computer services. The overall range of price changes between 2 and 5 % in absolute terms is much due to extreme values at the left- and right-hand side of the spectrum of quarterly price changes. Third, one can observe strong differences in the variation of price changes across products, and to a smaller extent also by firms and product groups.

Fourth and most importantly, the results suggest the total variation per product group to be due to variation across products within product groups, with relatively similar price change patterns across different product groups. The contrary can be observed for the variation by firm: this variation is to about 50 % (in the case of industrial cleaning services) or almost entirely (in the case of computer services) due to variation over time; price changes do not differ strongly between products within firms. For the econometric analysis below this indicates that the product groups as observed here may not be as homogenous as one may wish to.

3 Test for homogeneity – results from the Analysis of Variance

3.1 Between and within variance

The first part of the econometric analysis – Tables 2 and 3 - look at firms and product groups at the most detailed level (siref) separately. We analyse the variation in price changes between and within different firms and product groups respectively. For instance, if product groups were well-defined entities grouping homogenous products in terms of the price trends we would find a) mean price changes that are significantly different from one product group to the other and b) mean price changes that are similar across products (seref) within each product group.[11]

For both activities, the results in Tables 2 and 3 suggest significant differences in mean price changes across *product groups* and across *firms*. The results suggest furthermore that the variation between different product groups and firms is larger than the variation within product groups and firms respectively. This can be seen by comparing the mean sum of squares of the factors ‘siref’ or ‘firm’ with the ones of the factors ‘seref (siref)’ or ‘seref (firm)’.

Comparing the results in Tables 2 and 3 with each other there are two points worth noting. First, the general results as regards the variation by both product group and firm are much more pronounced for computer services than for industrial cleaning services. Second, if we judge from the respective significance levels of the between variance on the one hand and the within variance on the other, the

[11] In each estimation we took into account that the factor time may have an additional independant influence on the variation in price changes. The quantitative results stay the same also without this effect, though.

results are much more pronounced in the case of inter- and intra-*firm* than for intra and inter-*product group* variance. Thus, firms seem to be to a higher extent homogenous entities than product groups.

Table 2: **Between and within variance** – the case of industrial cleaning –

GLM, nested model fixed effects			Dependent Variable:		$dlnp_{ijt}$
Test of fixed effects product group					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Siref	18	0.0177	0.0010	1.72	0.029
Seref (Siref)	528	0.3017	0.0006	1.00	0.486
Year	4	0.0071	0.0018	3.10	0.015
Trim (Year)	14	0.0855	0.0061	10.70	<.0001
Test of fixed effects firm					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Firm	81	0.0756	0.0009	1.64	0.000
Seref (Firm)	465	0.2438	0.0005	0.92	0.891
Year	4	0.0071	0.0018	3.10	0.015
Trim (Year)	14	0.0855	0.0061	10.70	<.0001

Source: INSEE, Survey of Producer Price Indices, 2005.

Table 3: **Between and within variance** – the case of computer services –

GLM, nested model fixed effects			Dependent Variable:		$dlnp_{ijt}$
Test of fixed effects product group					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Siref	24	0.1207	0.0050	2.26	0.000
Seref (Siref)	936	1.2209	0.0013	0.59	1.000
Year	3	0.1767	0.0589	26.50	<.0001
Trim (Year)	8	0.5035	0.0629	28.31	<.0001
Test of fixed effects firm					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Firm	74	0.9492	0.0128	5.77	<.0001
Seref (Firm)	886	0.3923	0.0004	0.20	1.000
Year	3	0.1767	0.0589	26.50	<.0001
Trim (Year)	8	0.5035	0.0629	28.31	<.0001

Source: INSEE, Survey of Producer Price Indices, 2005.

3.2 Homogeneity along the sampling process?

Tables 4 and 5 test whether the products that result from the sampling process show similar price changing patterns. It takes into account the interdependencies of product groups and firms as described above. This is equivalent with modelling a three-way nested model in which product groups are the sole main factor and firms are nested within the factor 'product groups'. It implies the question whether the results of the between- and within-product group variance from above apply still after controlling for the inter-firm variation within product groups.

Table 4: **Homogeneity along the sampling process ?** – the case of industrial cleaning –

GLM, nested model fixed effects			Dependent Variable:		$dlnp_{ijkt}$
Test of homogeneity of product groups - detailed level of aggregation					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Siref	18	0.0127	0.0007	1.24	0.221
Firm (Siref)	267	0.1729	0.0006	1.13	0.067
Seref (Siref * Firm)	261	0.1288	0.0005	0.86	0.943
Year	4	0.0071	0.0018	3.10	0.015
Trim (Year)	14	0.0855	0.0061	10.70	<.0001
Test of homogeneity of product groups - higher level of aggregation					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Sirefa	5	0.0013	0.0003	0.44	0.821
Siref (Sirefa)	13	0.0100	0.0008	1.34	0.180
Firm (Siref & Sirefa)	267	0.1729	0.0006	1.13	0.067
Seref (Firm & Siref & Sirefa)	261	0.1288	0.0005	0.86	0.943
Year	4	0.0071	0.0018	3.10	0.015
Trim (Year)	14	0.0855	0.0061	10.70	<.0001

Source: INSEE, Survey of Producer Price Indices, 2005.

Table 5: **Homogeneity along the sampling process?** – the case of computer services –

GLM, nested model fixed effects			Dependent Variable:		$dlnp_{ijkt}$
Test of homogeneity of product groups - detailed level of aggregation					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Siref	24	0.0679	0.0028	1.27	0.168
Firm (Siref)	346	0.9015	0.0026	1.17	0.017
Seref (Siref & Firm)	590	0.3194	0.0005	0.24	1.000
Year	3	0.1767	0.0589	26.50	<.0001
Trim (Year)	8	0.5035	0.0629	28.31	<.0001
Test of homogeneity of product groups - higher level of aggregation					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Sirefa	4	0.0370	0.0093	4.16	0.002
Siref (Sirefa)	20	0.0145	0.0007	0.33	0.998
Firm (Sirefa & siref)	346	0.9015	0.0026	1.17	0.017
Seref (Sirefa & Siref & Firm)	590	0.3194	0.0005	0.24	1.000
Year	3	0.1767	0.0589	26.50	<.0001
Trim (Year)	8	0.5035	0.0629	28.31	<.0001

Source: INSEE, Survey of Producer Price Indices, 2005.

The results in the first block of Tables 4 and 5 suggest that this is not necessarily the case. After controlling for inter-firm variation within product groups, product groups do not differ from each other in terms of mean price changes. In contrast, there is a large variation within product groups constituted by large and significant variation between firms that produce for the respective product groups. Finally if there was an insignificant variation within product groups, as indicated in Tables 2 and 3 above, this would be due to low variance of producer price changes across products of those firms that are producing for a particular product group or market and not directly within product groups themselves.

It is striking though that we do not find any significant variation between product groups any longer – at least on the most detailed level to which the first block of Tables 4 and 5 refers. This raises an important question of interpretation: If product groups are chosen such as to represent the markets for which firms are producing, this result may mean that markets would not play an important role in the price-setting behaviour of firms over time. This would be a very strong result and would be at odds with the theoretical literature.[12] Alternatively, it may suggest that product groups can not be identified as markets for services transactions. This is the question that we want to analyse a bit deeper in what follows, and this will lead us finally to the results of the second block of Tables 4 and 5.

For each of the two activities, there are two distinct features that set up the product group classification. These are first, the specification, or broad characteristics, of the products themselves. In the case of industrial cleaning, for instance, products are characterised by the type of space that would have to be cleaned. Examples are office space, factory space or sensible zones such as health sector equipment. In the case of computer services, the products are characterised by the detailed ‘service’ that is provided. Examples are hardware consulting, systems integration and technical assistance. The second feature according to which products are classified are broad customer groups. In the case of industrial cleaning, a distinction is made between private and public sector. In the case of computer services, the product groups follow a broad sectoral classification into public sector, financial intermediation, tertiary sector and manufacturing and construction. In that sense, the general way in which products are classified reflect the definition of markets in the theory of industrial organisation and its application in competition policy.[13]

Figures 11 and 12 plot the elementary aggregates of the producer price indices on the first level(s) of selected product groups for the two services activities.[14]

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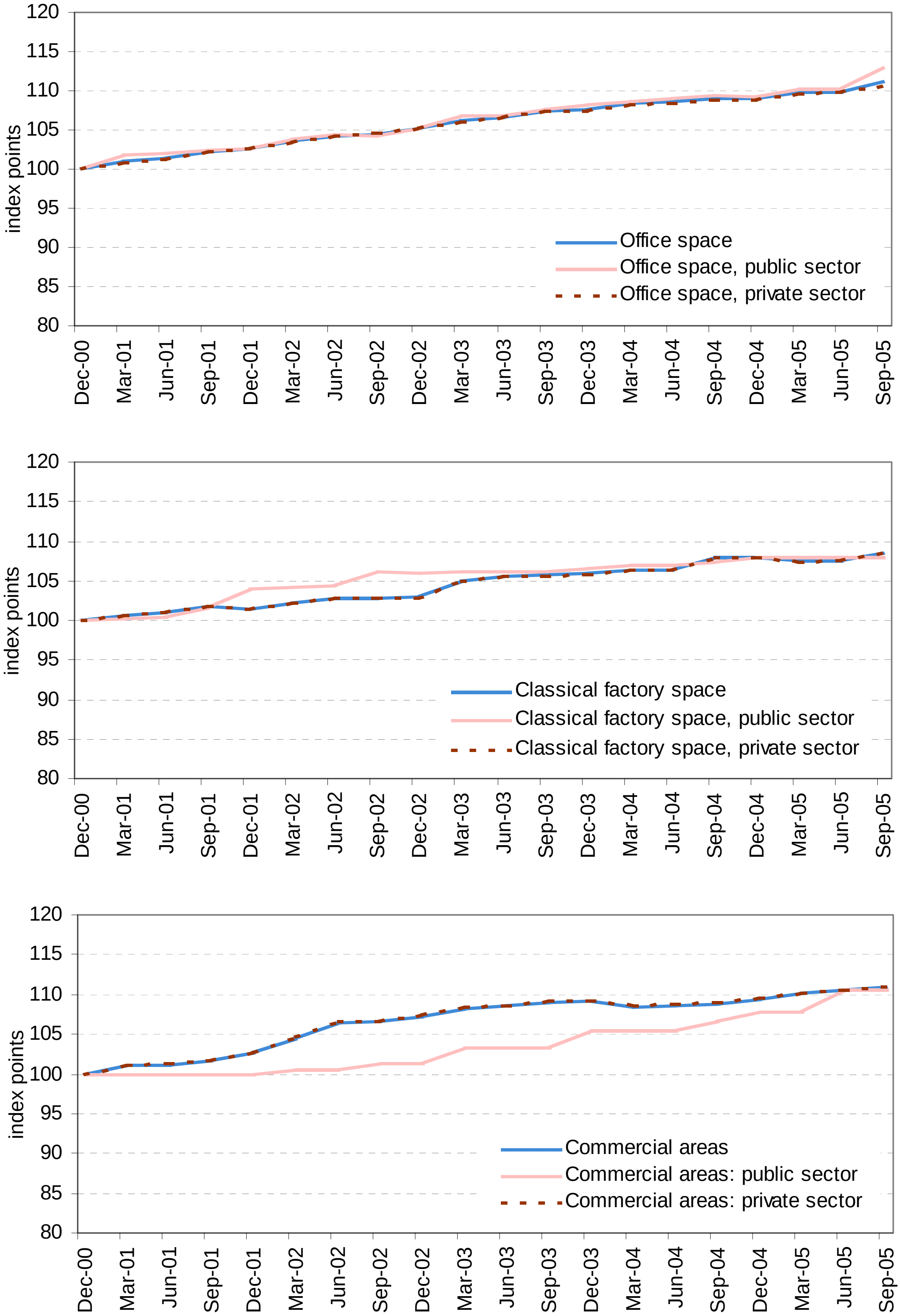
12 See here for instance Varian (1992, and Nagle et al. (1998) for overviews of price setting from a microeconomic and marketing point of view.

13 For instance, the (relevant) product market underlying the competition policy of the European Commission (1997) " .. comprises all those products and/or services which are regarded as interchangeable or substitutable by the consumer, by reason of the products' characteristics, their prices and their intended use." According to Tirole (1985) products are either horizontally or vertically differentiated, reflecting the consumer’s preference for different characteristics and the ranking that consumers attribute to these characteristics.

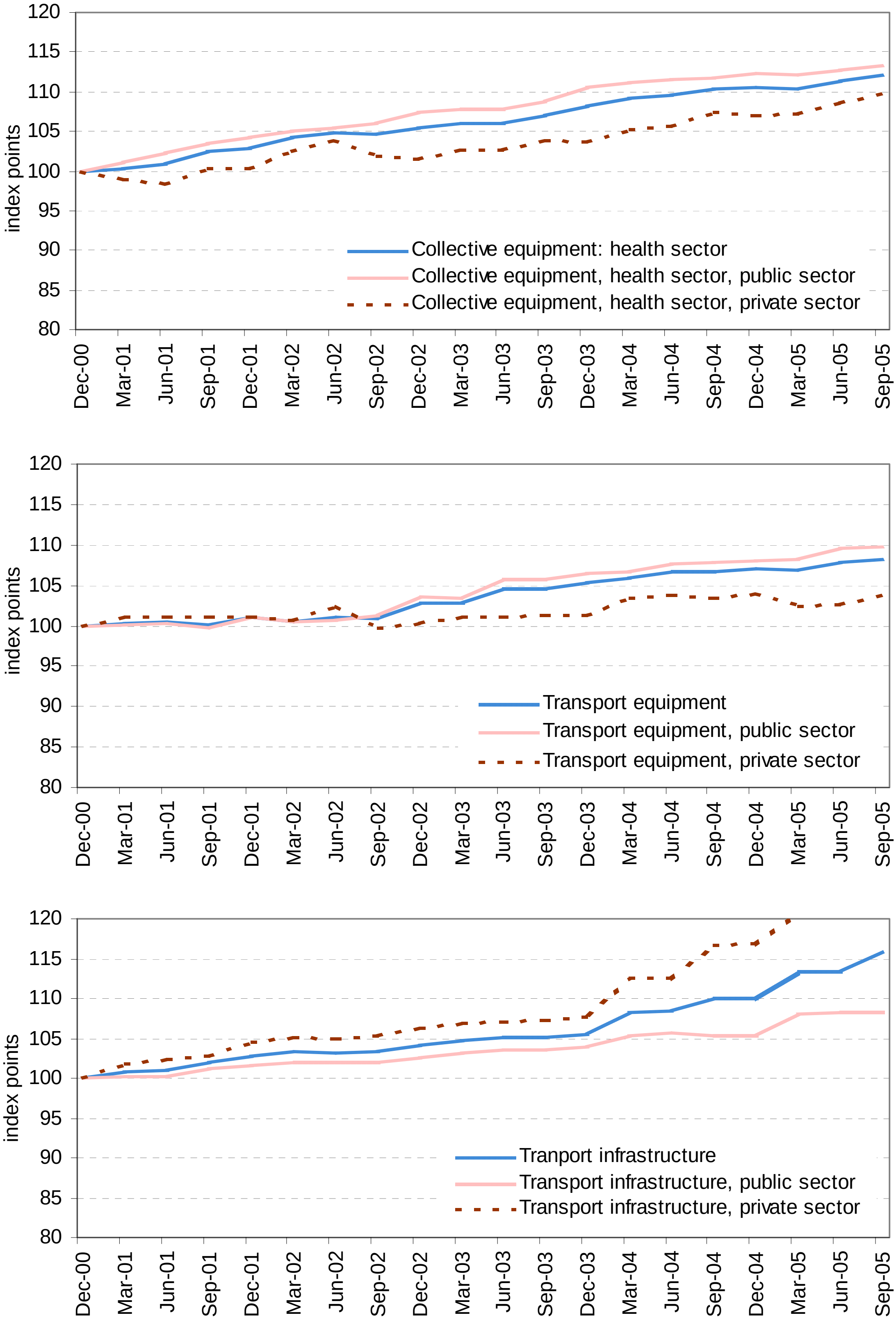
14 Table A2 in the appendix details the product groups on the both levels of aggregation as they are defined and used in this paper.

Figure 11: **Producer price indices for selected product groups in industrial cleaning**



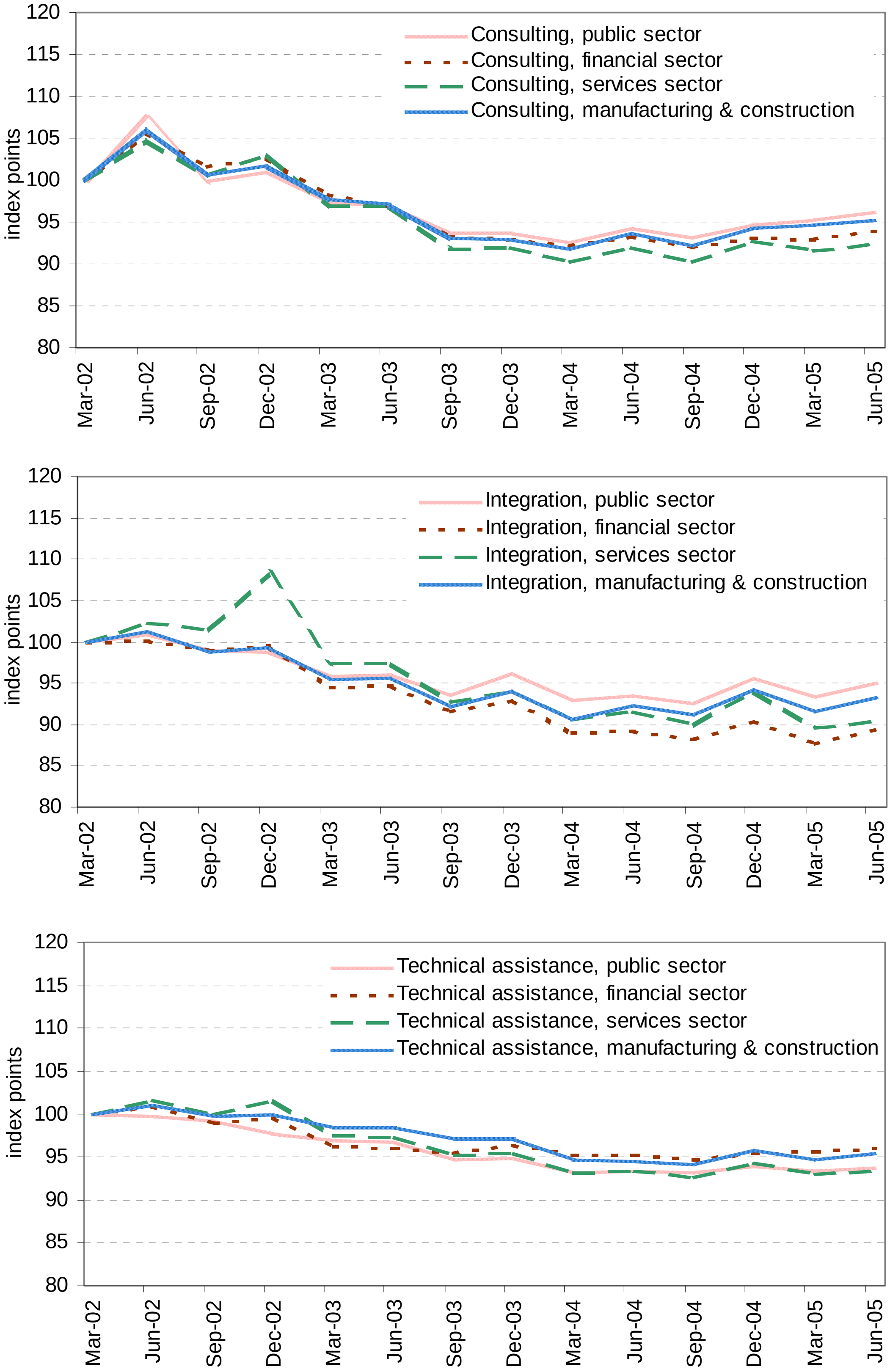
Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 11: **Producer price indices for selected product groups in industrial cleaning con’td**



Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 12: **Producer price indices for selected product groups in computer services**



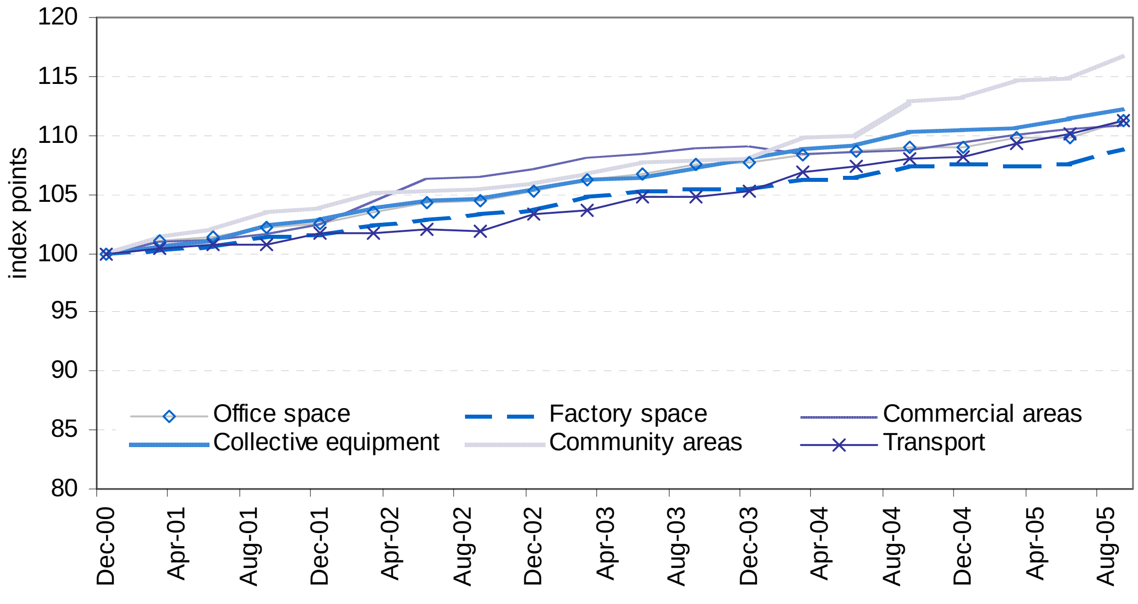
Source: INSEE, Survey of Producer Price Indices, 2005.

The figures suggest that for both activities mean price changes do not differ strongly between different customer groups. The price indices per group of characteristics follow very similar patterns independent of the respective customer groups, public versus private sector in the case of industrial cleaning services, or the broad sectors in the case of computer services. This suggests that if there was differentiated demand for cleaning or customer services that would influence the price changing patterns of the producing firms, this customer differentiation could not be captured in the product groups as defined here.

As regards the first component, the influence of product characteristics on the mean price changes, the picture differs for the two activities. This can be seen in Figures 13 and 14 which plot the price indices for aggregated product groups, i.e., after aggregating over the different customer groups. In industrial cleaning services, the price trends follow more or less the same pattern; an exception can only be found in the price trends of cleaning of 'community areas' during the most recent quarters. In computer services, price trends seem to be more heterogeneous across different activities, notably between consulting activities on the one hand and rather technical activities on the other hand.

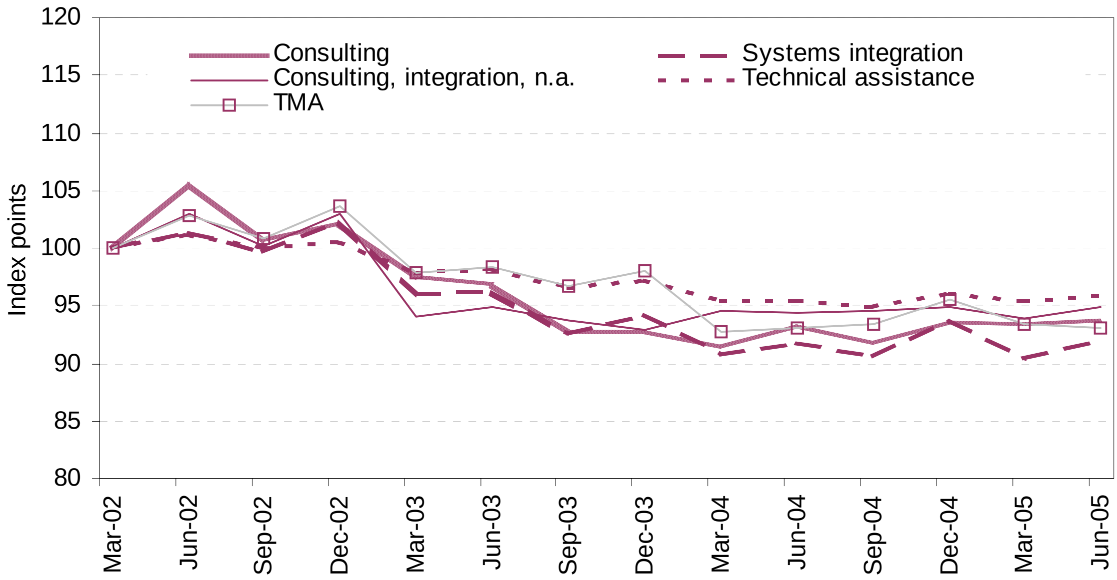
These two results show then also up in the econometric analysis, the second block of results in Table 4 and Table 5. Mean price changes across aggregated product groups (sirefa) are significantly different from each other in the case of computer services, but not in the case of industrial cleaning. Furthermore, mean price changes of detailed product groups (siref) within their respective first aggregation (sirefa) are not significantly different from each other. The within variation is relatively small. This reflects the lack of differences in mean price changes across the different customer groups chosen within the product group classification.

Figure 13: **Producer price indices for aggregated product groups - industrial cleaning services**



Source: INSEE, Survey of Producer Price Indices, 2005.

Figure 14: **Producer price indices for aggregated product groups - computer services**



Source: INSEE, Survey of Producer Price Indices, 2005.

Conclusion

For a price index to be representative for a certain services activity it would have to be based on services products that are "typical" for this activity. The sampling process utilised by the national statistical offices would typically guarantee some homogeneity of products in terms of similarity of product characteristics. However, whenever the information on such price changing patterns is used later on for the estimation of missing values for products within each product class it becomes also crucial that the products are similar in terms of price changing patterns. Within this paper, we analysed the variation in price changes over time as well as within and across firms and product groups for two services activities and ask whether the products that are resulting from the sampling procedures described above fulfil the homogeneity-criterion in terms of similar price changing patterns.

A first descriptive part suggests four main results: First, within both, cleaning and computer services, prices change at between 2 and 5 % per quarter in absolute terms, with higher rates in the case of computer services. Second, mean price changes do not differ drastically between products, firms or product groups, in cleaning services; somewhat larger differences across mean price changes can be observed in the case of computer services. Third, one can observe strong differences in the variation of price changes across products and to a smaller extent also by firms and product groups. Fourth and most importantly, the results suggest the total variation per product group to be due to variation across products within product groups, with relatively similar price change patterns across different product groups. The contrary can be observed for the variation by firm: this variation is to about 50 % (in the case of industrial cleaning services) or almost entirely (in the case of computer services) due to variation over time; price changes do not differ strongly between products within firms.

The econometric results do not find strong evidence for the product groups in our dataset to be homogeneous entities in terms of similar price changes. The analysis points to two main aspects: First, the results would suggest that firms are more homogeneous entities in terms of price changing patterns than product groups. After controlling for inter-firm variation within product groups, product groups do not differ any more significantly from each other in terms of price trends. Moreover, there is a large variation within product groups constituted by a large and significant variation between firms that produce for the respective product groups. Furthermore, the insignificant variation within product groups that could be found by looking at product groups separately from firms is due to low variance of producer price changes across products of those firms that are producing for a particular product group or market.

Second, the level of detail matters and as a consequence the question how product groups are defined. When we looked at product groups that are set up according to the *product specifications or product characteristics*, independent of the respective customer group, then mean price changes are significantly different across product groups. This is at least the case for computer services, albeit not in industrial cleaning services. In contrast, when we looked at product groups that are set up according to different *customer groups,* mean price changes do not differ significantly across product groups; this is reflected in an insignificant contribution of the variation of detailed product groups within their respective higher order product group aggregate. This does not mean that there would not exist differentiated demands or markets for cleaning or computer services that would influence the price changing patterns. It means that the relevant customer differentiation may not be captured in the product groups as they are defined in our data base.

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Appendix

Type I – to Type III decomposition in the case of unequal numbers of observations per cell

In what follows, we will use the so-called R-notation in order to describe shortly these different types of decomposition (Searle, 1971, Searle *et al.*,2006). The general idea behind this notation is to be able to compare the residual variation that results from fitting different, and more complex models than the 1-way classification model. The question is what is the reduction of sum of squares due to fitting a particular model. The sum of squares *SSA*, for instance, is equal to SST-SSE; It is thus, the reduction in total sum of squares due to fitting any particular model. Analogously, $R(\mu,\alpha)$ means that the *SSA* in the 1-way classification model is equivalent with the reduction in sum of squares after fitting the model containing a general mean and the factor α. $R(\alpha|\mu)=R(\mu,\alpha) - R(\mu)$ is the reduction in sum of squares due to fitting an α-factor, having already fitted μ. And $R(\alpha|\mu,\beta)=R(\mu,\alpha,\beta) - R(\mu,\beta)$ measures the extent to which the factor β can explain the variation in y after having controlled for the variation due to μ and α.

The type I decomposition is the decomposition that is normally used in 1-way classification models. In a 2-way classification model with interaction, it would decompose the total reduction in variation into $SSA= R(\alpha|\mu)$, $SSB=R(\beta|\mu,\alpha)$ and $SSAB=R(\gamma|\mu,\alpha,\beta)$. Within the 2-way classification – in contrast to the 1-way classification model - however, testing the underlying hypothesis for testing differences across effects of factors α and β would implicitly mean testing for combined effects, including other terms than the main respective effects; testing the H_0 would mean in this case testing for differences across levels of factor α combined with effects due to factor β as well as the interaction term γ. Testing the H_0 for the factor β would not include anymore effects from factor α, but would include effects of the interaction term. Only testing the hypothesis for the interaction term would be based on 'pure' effects of any individual combinations of levels of the two factors, just as is done for testing for differences across different levels of one factor in the 1-way classification model.

The Type II decomposition would decompose the total reduction of sum of squares due to the model into $SSA= R(\alpha|\mu,\beta)$, $SSB=R(\beta|\mu,\alpha)$ and $SSAB=R(\gamma|\mu,\alpha,\beta)$. In this case, the sum of squares of any of the main factors is controlled for the effect of the respectively other factor, but includes still the interaction effect. This model is for instance often used for models without interaction effects.

Finally, the Type III decomposition is the most appropriate to test for significant differences in variation across the levels of any factor and the interaction in a 2-way cross classification model. It is based on the restriction that is also underlying the formal derivation of the sum of squares above, namely that the individual effects per factor sum up to zero. Indexing the restricted reductions by *'r'*, the decomposition is then $SSA= R(\alpha|\mu,\beta,\gamma)^r$, $SSB=R(\beta|\mu,\alpha,\gamma)^r$ and $SSAB=R(\gamma|\mu,\alpha,\beta)^r$. As a consequence of applying the restriction, one would test the H_0's of zero differences between the different levels of each factor or interaction based on the 'pure' effects of the two main factors and their interaction, without these effects being 'biased' by the effects of other factors.

Type I		
A	$R(\alpha\|\mu)$	$H_0: \alpha_1 + \sum_j^b \frac{n_{1j}}{n_{1.}}(\beta_j + \gamma_{1j}) = ... = \alpha_a + \sum_j^b \frac{n_{aj}}{n_{a.}}(\beta_j + \gamma_{aj})$.
B	$R(\beta\|\mu,\alpha)$	$H_0: \sum_{i=1}^a n_{ij}(\beta_j + \gamma_{ij}) = ... = \sum_{i=1}^a \sum_{s=1}^b \frac{n_{ij} n_{as}}{n_{i.}}(\beta_s + \gamma_{is})$, $j=1, \ldots, b$.
A*B	$R(\gamma\|\mu,\alpha,\beta)$	$H_0: \gamma_{ij} - \gamma_{ij'} = \gamma_{i'j} - \gamma_{i'j'}$, for all i, j, i', j' .
Type II		
A	$R(\alpha\|\mu,\beta)$	$H_0: \sum_{s=1}^b n_{is}(\alpha_i + \gamma_{is}) = ... = \sum_{r=1}^a \sum_{s=1}^b \frac{n_{is} n_{rs}}{n_{.s}}(\alpha_r + \gamma_{rs})$, $i=1, \ldots, a$.
B	$R(\beta\|\mu,\alpha)$	$H_0: \sum_{r=1}^a n_{rj}(\beta_j + \gamma_{rj}) = ... = \sum_{r=1}^a \sum_{s=1}^b \frac{n_{rj} n_{rs}}{n_{r.}}(\beta_s + \gamma_{rs})$, $j=1, \ldots, b$.
A*B	$R(\gamma\|\mu,\alpha,\beta)$	$H_0: \gamma_{ij} - \gamma_{ij'} = \gamma_{i'j} - \gamma_{i'j'}$, for all i, j, i', j'
Type III		
A	$R(\alpha\|\mu,\beta,\gamma)^r$	$H_0: \alpha_1^r = ... = \alpha_a^r = 0$
B	$R(\beta\|\mu,\alpha,\gamma)^r$	$H_0: \beta_1^r = ... = \beta_a^r = 0$,
A*B	$R(\gamma\|\mu,\alpha,\beta)^r$	$H_0: \gamma_{ij}^r = 0$, for all i, j.

Table A1a: **Multiple comparisons of mean price changes between quarters**

– the case of Industrial cleaning –

i/j	20011	20012	20013	20014	20021	20022	20023	20024	20031	20032	20033	20034	20041	20042	20043	20044	20051	20052	20053
20011	na	0.004	1.000	0.048	0.737	0.745	0.001	0.705	1.000	0.027	0.977	0.001	1.000	0.000	0.510	0.001	1.000	0.002	1.000
20012	0.004	na	0.029	1.000	<.0001	0.903	1.000	0.924	0.003	1.000	0.529	1.000	0.030	1.000	0.980	1.000	0.042	1.000	0.000
20013	1.000	0.029	na	0.219	0.336	0.972	0.012	0.961	1.000	0.144	1.000	0.012	1.000	0.004	0.876	0.005	1.000	0.015	1.000
20014	0.048	1.000	0.219	na	<.0001	0.999	1.000	1.000	0.040	1.000	0.941	1.000	0.224	1.000	1.000	1.000	0.280	1.000	0.008
20021	0.737	<.0001	0.336	<.0001	na	0.001	<.0001	0.001	0.773	<.0001	0.011	<.0001	0.330	<.0001	0.000	<.0001	0.267	<.0001	0.963
20022	0.745	0.903	0.972	0.999	0.001	na	0.779	1.000	0.708	0.996	1.000	0.780	0.973	0.582	1.000	0.614	0.986	0.810	0.368
20023	0.001	1.000	0.012	1.000	<.0001	0.779	na	0.814	0.001	1.000	0.353	1.000	0.013	1.000	0.930	1.000	0.019	1.000	0.000
20024	0.705	0.924	0.961	1.000	0.001	1.000	0.814	na	0.667	0.997	1.000	0.815	0.963	0.625	1.000	0.657	0.979	0.842	0.329
20031	1.000	0.003	1.000	0.040	0.773	0.708	0.001	0.667	na	0.023	0.969	0.001	1.000	0.000	0.469	0.000	1.000	0.001	1.000
20032	0.027	1.000	0.144	1.000	<.0001	0.996	1.000	0.997	0.023	na	0.879	1.000	0.148	1.000	1.000	1.000	0.191	1.000	0.004
20033	0.977	0.529	1.000	0.941	0.011	1.000	0.353	1.000	0.969	0.879	na	0.354	1.000	0.194	1.000	0.215	1.000	0.388	0.793
20034	0.001	1.000	0.012	1.000	<.0001	0.780	1.000	0.815	0.001	1.000	0.354	na	0.013	1.000	0.931	1.000	0.019	1.000	0.000
20041	1.000	0.030	1.000	0.224	0.330	0.973	0.013	0.963	1.000	0.148	1.000	0.013	na	0.004	0.881	0.005	1.000	0.015	1.000
20042	0.000	1.000	0.004	1.000	<.0001	0.582	1.000	0.625	0.000	1.000	0.194	1.000	0.004	na	0.804	1.000	0.007	1.000	<.0001
20043	0.510	0.980	0.876	1.000	0.000	1.000	0.930	1.000	0.469	1.000	1.000	0.931	0.881	0.804	na	0.829	0.921	0.945	0.186
20044	0.001	1.000	0.005	1.000	<.0001	0.614	1.000	0.657	0.000	1.000	0.215	1.000	0.005	1.000	0.829	na	0.008	1.000	<.0001
20051	1.000	0.042	1.000	0.280	0.267	0.986	0.019	0.979	1.000	0.191	1.000	0.019	1.000	0.007	0.921	0.008	na	0.022	1.000
20052	0.002	1.000	0.015	1.000	<.0001	0.810	1.000	0.842	0.001	1.000	0.388	1.000	0.015	1.000	0.945	1.000	0.022	na	0.000
20053	1.000	0.000	1.000	0.008	0.963	0.368	0.000	0.329	1.000	0.004	0.793	0.000	1.000	<.0001	0.186	<.0001	1.000	0.000	na

Note:* Test of significant differences in mean price changes between two respective quarters *i* (rows) and *j* (columns), p-values.

Source: INSEE, Survey of Producer Price Indices, 2005.

Table A1b: **Multiple comparisons of mean price changes between quarters**

– the case of Computer services –

i/j	20022	20023	20024	20031	20032	20033	20034	20041	20042	20043	20044	20051	20052
20022	na	0.999	0.998	<.0001	1.000	0.001	1.000	0.902	0.987	1.000	0.997	1.000	0.078
20023	0.999	na	1.000	<.0001	0.966	0.028	0.947	1.000	0.545	1.000	0.674	1.000	0.003
20024	0.998	1.000	na	<.0001	0.947	0.038	0.920	1.000	0.478	1.000	0.608	1.000	0.002
20031	<.0001	<.0001	<.0001	na	<.0001	0.149	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
20032	1.000	0.966	0.947	<.0001	na	<.0001	1.000	0.622	1.000	0.987	1.000	0.994	0.259
20033	0.001	0.028	0.038	0.149	<.0001	na	<.0001	0.211	<.0001	0.016	<.0001	0.011	<.0001
20034	1.000	0.947	0.920	<.0001	1.000	<.0001	na	0.555	1.000	0.977	1.000	0.989	0.312
20041	0.902	1.000	1.000	<.0001	0.622	0.211	0.555	na	0.133	1.000	0.204	0.999	<.0001
20042	0.987	0.545	0.478	<.0001	1.000	<.0001	1.000	0.133	na	0.663	1.000	0.742	0.810
20043	1.000	1.000	1.000	<.0001	0.987	0.016	0.977	1.000	0.663	na	0.780	1.000	0.005
20044	0.997	0.674	0.608	<.0001	1.000	<.0001	1.000	0.204	1.000	0.780	na	0.845	0.698
20051	1.000	1.000	1.000	<.0001	0.994	0.011	0.989	0.999	0.742	1.000	0.845	na	0.007
20052	0.078	0.003	0.002	<.0001	0.259	<.0001	0.312	<.0001	0.810	0.005	0.698	0.007	na

Note:* Test of significant differences in mean price changes between two respective quarters *i* (rows) and *j* (columns), p-values.

Source: INSEE, Survey of Producer Price Indices, 2005

Table A2**: Definition of product groups at the detailed and aggregated level**

Industrial Cleaning

Sirefa	Siref
Office space	Office space - public sector
	Office space - private sector
Factory space	Classical factory space - public sector
	Classical factory space - private sector
	Equipment
	Sensible agro-alimentary zones
	Sensible chemical zones
	Other sensible zones
Commercial space	Commercial space - private sector
Collective equipment	Health related equipment - public sector
	Health related equipment - private sector
	Others - public sector
	Others - private sector
Community areas	Community areas - public sector
	Community areas - private sector
Transport	Transport infrastructure - public sector
	Transport infrastructure - private sector
	Transport equipment - public sector
	Transport equipment - private sector

Computer Services

Sirefa	Siref
Technical assistance	Public sector
	Manufacturing & construction
	Financial intermediation
	Services
	Non-specified
TMA (maintenance)	Public sector
	Manufacturing & construction
	Financial intermediation
	Services
	Non-specified
Consulting	Public sector
	Manufacturing & construction
	Financial intermediation
	Services
	Non-specified
Systems integration	Public sector
	Manufacturing & construction
	Financial intermediation
	Services
	Non-specified
Consulting/integration nec	Public sector
	Manufacturing & construction
	Financial intermediation
	Services
	Non-specified

Source: INSEE, Survey of Producer Price Indices, 2005, own translation

EU KLEMS

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