Changing baskets in the CPI

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1. Introduction and most important results

In this paper, we investigate the long-term development of the results of the Harmonized Index of Consumer Prices (HICP) in the Netherlands. The HICP was introduced in 1997, starting with results for January 1996. The paper covers the years 1996-2018. However, in order to avoid breaks in series, most results will only cover 2003-2018. We focus on annual average index results, which were calculated as averages of 12 monthly results.

The HICP calculation is based on a chained Laspeyres index method, where each year in December a new weighting scheme is introduced that is used for 13 months (December y-1 to December y). Since 2003, weights in year y are based primarily on National Accounts consumption figures for year y-2, and additional detailed data from Household Budget Surveys and other sources. Before 2003, the budget survey of 1995 was the main source for the weights.

In the period covered since the start of the HICP there have been 23 weighting schemes. The question we will discuss in this paper is how the HICP results have been impacted by the changing baskets in these 23 years. What we would have liked to do, is a recalculation of the HICP for 23 years using each of the 23 baskets of articles with article weights and compare the results. This is however not possible because of lack of data, most of all because many of the articles in the various baskets have not existed in the full 23 years. Many articles that were available in 1996 have since disappeared and many new articles have appeared on the markets and replaced the disappearing ones. Moreover, even if an article was on the market for the full 23 years maybe it was not selected in the HICP sample, because it was not always equally important for consumers.

However, the HICP has been calculated in all 23 years using the same COICOP classification. Data for most COICOP categories (divisions, groups and classes) are available for the full period. We will therefore calculate the impacts of changing baskets in a stepwise analysis.

First, we investigate the changes in the weights at the level of COICOP-divisions. We will show that the more recent are the basket weights, the lower are the average outcomes of the annual rates of change. In a second step, we will investigate how the results change if we calculate them at the more detailed level of COICOP groups. In the third step, we make the calculations at the level of COICOP classes. In every step, the differences between the baskets will show to be more important in the sense that the differences between the long-term changes of the HICP using more recent baskets instead of the older ones grow bigger. We think, but cannot prove, that if we would have been able to calculate the 23 index series at the article level for the 23 baskets the differences between the average annual rates in the baskets would be even larger.

In every step, we calculate the impact of bringing in more detail in the classification at the level of each division or group. It will appear that most of the product divisions and groups have an impact on the lower inflation in more recent baskets, but the major impact comes from COICOP division 9 Recreation and Culture and particularly from electronic goods.

Having found these results the question is what could be the consequences. If it is true that the consumption behavior of consumers and the availability of ever-new products leads to lower inflation, the question could be whether the inflation target of central banks could remain at an

unchanged level of e.g. 2% per annum in the long run. It may be a reason why it took so much effort for the European Central Bank (ECB) to increase EMU inflation in recent years to the 2% target.

Alternatively, it may also be that the HICP is biased downwards, if quality adjustments have too much impact on the price development of certain goods (e.g. electronics). To investigate this possibility we can calculate from the HICP indices and the weights in the subsequent baskets an implicit quantity index of the consumption per COICOP category. We also try to estimate what COICOP categories have most influence on results. This will show two things.
First, the development of nominal expenditure weights shows that the nominal weights of product classes has been remarkably stable in the past 23 years, even in those classes where price indices went down rapidly. Furthermore, it implies that the volume change of consumption in certain COICOP classes is very high and we may discuss the plausibility of these results.

Finally we will calculate what the development of the HICP would have been if the quality adjustments that have been applied in the past would have been different.

2. The used data

We use published index numbers and weights of the HICP series 2015=100. The series start in January 1996 and we have used data up until December 2018. Most results in this paper are calculated from monthly figures and then aggregated to annual averages.
The series contain several breaks that may have impact on the results. They are:

1. The coverage of the HICP was extended several times in the early years:
   - In 2000 Refuse collection (COICOP 04.4.1) and sewerage collection (04.4.2) were added to the coverage,
   - The coverage of medical goods and services was largely extended in 2000; hospital services were added in 2001. Note that medical goods and services that are covered by social insurance are excluded from the HICP coverage.
   - Social protection services (12.4) were included in 2000 (Child care etc.) and in 2001 (Homes for the elderly etc.),
   - Health insurance (12.5.3) and other insurance (12.5.5) were included in 2000,
2. In 2006, a new health insurance system was introduced in the Netherlands. Part of health care for which prices were covered by the HICP before 2006 shifted to social insurance and disappeared from the HICP coverage. Another part that was under social insurance before 2006 became not insured or insured under private insurance. It therefore entered the HICP basket. As a result, the weight for health care did not change significantly but at a more detailed level, the compositions of the basket for health (06) before and after 2006 are not comparable.
3. From 1996-2002 the weights were based on the Household Budget Survey of 1995 with some corrections for underestimated expenditures, like on tobacco and alcoholic drinks. As of 2003, National Accounts results on consumption are the basic source for the weights. This sometimes led to significantly different weights, e.g. for financial services (12.6) and for other services (12.7). Differences in HICP-weights between 1996 and 2002 come from price-updating and extensions of the HICP coverage. From 2003, the weights were based on National Accounts (2001 results). An annual base revision was then announced but it was postponed to 2007 for logistic reasons. Differences in HICP-weights in the period 2003-2006 only come from price-updating and the change in the health insurance system.
4. National Accounts series are revised about once every five years. Revision of NA-figures do not lead to a revision of already published HICP results. Therefore, in the first year after a NA-revision the weights in the basket may show a larger change than in years between revisions. First years after a NA-revision are 2007 and 2015.
5. Some detailed series are not available for the full period. When the weight falls below a threshold of 1 per 1000 price collection may be stopped. Therefore the following series are not available throughout the full period that they were in principle covered:
   - Clothing materials (COICOP 0311),
   - Heat energy (0455),
   - Repair of furniture, furnishings and floor coverings (0513),
   - Combined passenger transport (0735),
   - Maintenance and repair of other major durables for recreation and culture (0923).

Breaks in series may cause problems in the calculations, particularly when a COICOP category is not observed in a certain period and has weight zero. If a COICOP category has a zero weight in a certain basket, the prices for that category will not be taken into account in any of the years

when using that years' basket. On the other hand the weighting schemes from the years when the category was observed encounter the problem that for certain years the price indices are missing. In these cases we always used COCIOP categories of a higher aggregated level. Specifically, because of the breaks, we did not go into more detail for the following COICOP categories:

- No more detail than for COICOP divisions is given for COICOP 06 Health and COICOP 10 Education,
- For results prior to 2003 we use no more detail than division for COICOP 12 Miscellaneous goods and services,
- For COICOP groups 31, 45, 51, 73 and 92 we made no calculations at class levels.
- For COICOP Groups 22, 32, 41, 52, 54, 55, 81, 82-83, 96, 112, 124, 126 and 127 no detailed COICOP classes were defined in the HICP before 2015,
- For the years prior to 2003, also group 44 cannot be subdivided into classes.

After taking these restrictions into account the HICP for the years 2003 – 2018 does not show important breaks in series. It is for this reason that we will focus on results that compare 2018 with 2003.

All data can be retrieved from the CBS website:
https://opendata.cbs.nl/statline/#/CBS/en/dataset/83133ENG/table?ts=1556547187603

3. The impact of changing baskets on inflation results

The HICP is published as a chained index. The overall index for the most important years are:

Table 1: HICP for the Netherlands, main outcomes

Year	Index	Long term development until 2018
1996	68,83	49,7
2003	83,16	23,9
2015	100,00	3,0
2018	103,03	0,0

The published index change between 1996 and 2018 is 49.7% and between 2003 and 2018, it is 23.9%. In the main text, we will discuss the results for the years and baskets from 2003 until 2018; in an appendix, we will publish some comparable tables of the full period of 23 years of HICP.

In the first step of the calculations for the 16 baskets, we use the published index series at division level. We assume that these division indices are correct but we aggregate them using 16 different weighting schemes from the years 2003-2018. For the calculation using the basket of year y, we rescale the 12 index series by COICOP division to December y - 1 = 100.
Then we can aggregate all 192 months over the 12 divisions using a fixed base index formula and the published division weights for year y. From the monthly aggregated indices, we calculate annual averages and average annual rates of change. The time series of the annual rate of inflation for the weights of 2003, 2008, 2013 and 2018 are shown in graph 1.

In the second step, we made the same calculations at the level of COICOP groups, with a few exceptions as explained in section 2. Therefore, in the second step we use indices and weights results for 35 COICOP groups and 2 divisions. Results as before are shown in graph 2.

In the third step, we subdivide Groups into classes to the extent that data are available and make the calculations with 54 COICOP classes, 18 groups and 2 divisions. Results are in graph 3.

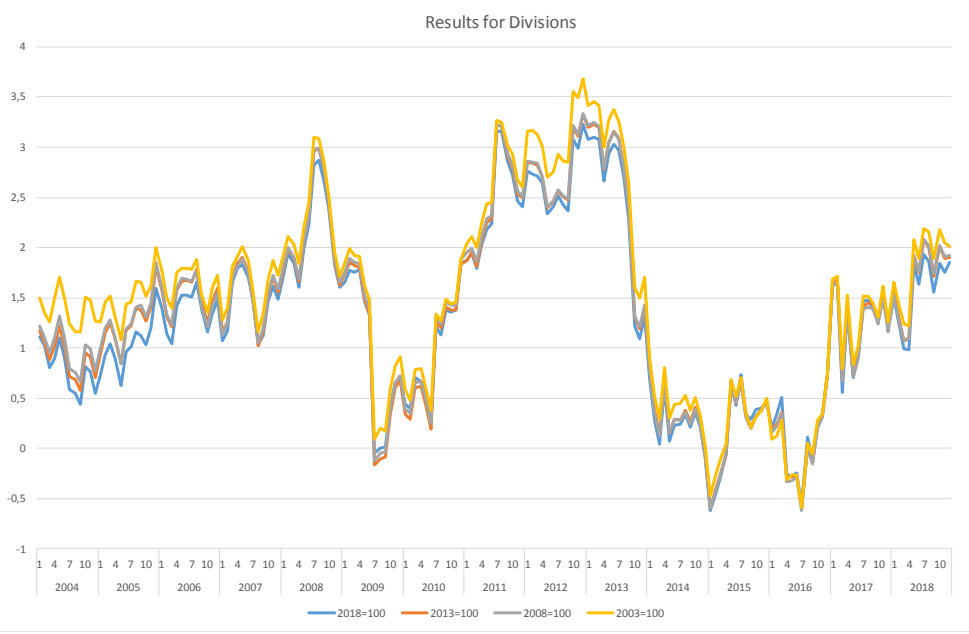
The results for all 16 series are summarized in table 2. For each series, the development of the index between 2003 and 2018 is given, and the average annual rate over the 15 years period. In the bottom line of table 2, we entered the published chained index series. These results are of course the same regardless of the level of detail of the calculation.

The results in table 2 show that using more recent weights distributions lead to lower inflation results. They also show that when we use more detailed categories (Classes instead of groups instead of divisions) the impact on inflation becomes ever bigger. In the case we used COICOP classes to compare the baskets the annual average rate of inflation was 0.1 percentage points lower for every about three years the basket is more recent.
In the following chapters, we try to find the underlying causes for these results.

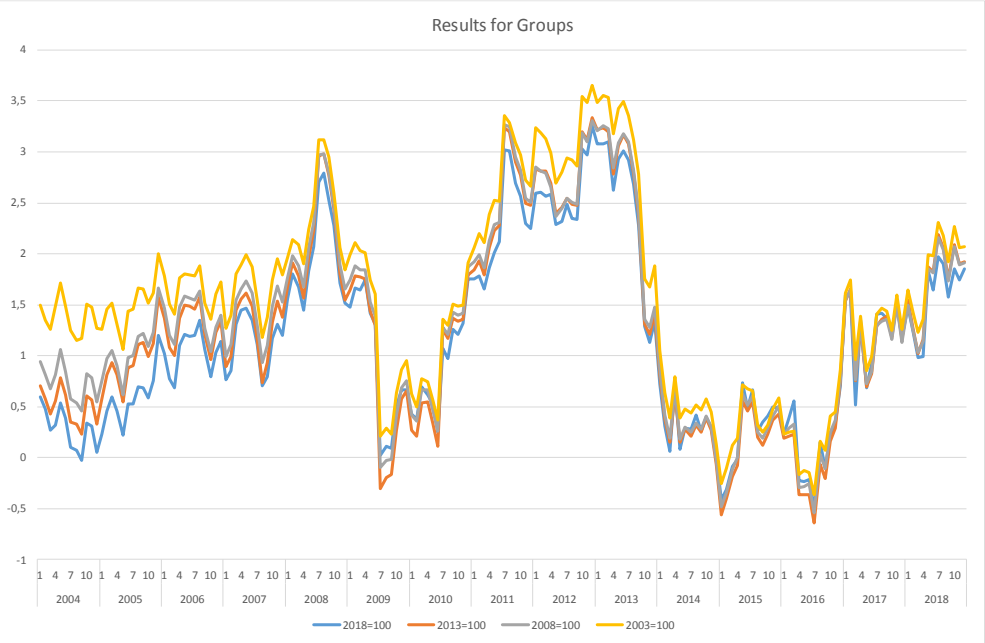
Table 2 Overall HICP development using 16 baskets at three levels of detail

	Index change			Average annual rate		
Weighting scheme	COICOP Divsions	COICOP Groups	COICOP Classes	COICOP Divsions	COICOP Groups	COICOP Classes
2018=100	21,44	19,14	16,79	1,30	1,17	1,04
2017=100	21,71	19,45	17,24	1,32	1,19	1,07
2016=100	22,04	19,99	17,68	1,34	1,22	1,09
2015=100	22,17	20,52	18,41	1,34	1,25	1,13
2014=100	22,46	20,80	19,61	1,36	1,27	1,20
2013=100	22,55	20,73	19,51	1,37	1,26	1,20
2012=100	22,75	21,02	19,93	1,38	1,28	1,22
2011=100	22,78	21,37	20,63	1,38	1,30	1,26
2010=100	22,50	21,19	20,61	1,36	1,29	1,26
2009=100	22,60	21,37	20,86	1,37	1,30	1,27
2008=100	22,80	22,03	21,76	1,38	1,34	1,32
2007=100	22,94	22,77	22,89	1,39	1,38	1,38
2006=100	25,22	25,96	26,26	1,51	1,55	1,57
2005=100	25,65	26,51	27,10	1,53	1,58	1,61
2004=100	25,65	26,51	27,10	1,53	1,58	1,61
2003=100	25,65	26,51	27,10	1,53	1,58	1,61
Chained index	23,88	23,88	23,88	1,44	1,44	1,44

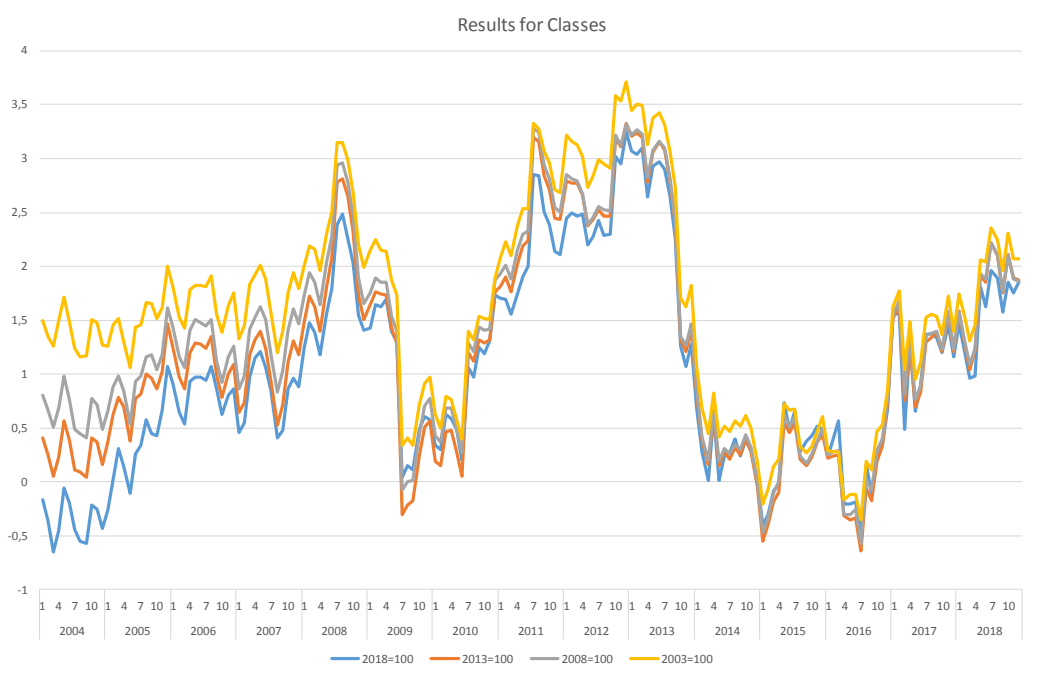
Graph 1 Time series of annual rates of inflation using aggregates based on COICOP Division price indices



Graph 2 Time series of annual rates of inflation using aggregates based on COICOP Groups price indices



Graph 3 Time series of annual rates of inflation using aggregates based on COICOP Classes price indices



4. The development of expenditure weights in the longer term

The first thing we investigate is whether there have been significant changes in expenditure weights over the period concerned. In table 3, we present the weights per COICOP division since 2003.

Table 3 development of expenditure weights HICP Netherlands

COICOP	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CP00 - All-items HICP	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
CP01 - Food and non-alcoholic beverages	128,5	126,3	120,9	122,2	131,3	134,9	133,5	138,2	139,8	140,4	142,6	144,1	144,4	144,9	145,9	145,4
CP02 - Alcoholic beverages, tobacco	36,7	36,9	39,8	40,6	37,2	34,8	36,2	37,0	38,6	38,9	37,6	38,6	37,6	38,6	33,8	35,0
CP03 - Clothing and footwear	66,8	64,6	60,9	60,8	66,1	64,1	63,9	61,2	62,2	63,4	61,0	59,5	60,4	59,7	61,4	64,3
CP04 - Housing, water, electricity, gas	154,1	158,1	160,8	171,1	174,3	174,9	178,5	170,3	173,9	172,5	176,0	179,2	164,7	163,2	157,8	156,0
CP05 - Furnishings, household equipment etc.	84,6	83,7	81,9	82,4	76,3	78,6	77,8	79,7	75,9	74,3	72,6	69,3	65,1	65,6	66,6	66,1
CP06 - Health	46,8	46,6	51,1	31,7	26,0	26,4	28,8	27,2	26,8	28,6	28,2	30,3	32,2	28,1	29,3	28,3
CP07 - Transport	138,0	138,8	141,7	150,3	139,2	145,7	137,4	140,6	149,0	151,8	150,6	145,6	136,5	135,9	141,0	137,7
CP08 - Communications	37,8	37,9	36,3	35,9	54,5	49,1	47,2	45,0	43,0	39,9	40,0	39,5	37,8	39,2	39,1	37,1
CP09 - Recreation and culture	117,4	115,5	113,0	113,3	114,7	117,8	124,5	124,3	119,9	121,7	120,0	118,3	130,4	125,3	123,5	124,2
CP10 - Education	6,8	6,9	6,9	5,9	6,8	6,6	6,5	7,1	7,4	7,5	7,8	8,1	9,8	9,9	9,8	9,7
CP11 - Restaurants and hotels	68,7	69,1	69,6	71,1	63,4	63,9	64,6	64,9	61,7	59,8	61,4	61,0	83,0	84,6	87,3	91,9
CP12 - Miscellaneous goods and services	113,9	115,7	116,9	114,7	110,3	103,2	101,1	104,6	101,9	101,2	102,4	106,6	98,3	105,0	104,6	104,3

The largest relative changes are recorded for COICOP 06 Health, mainly attributed to the health insurance reform. The second largest relative change is in COICOP 10 Education, which is however the smallest division. Restaurants and hotels expenditures have grown significantly since 2015, and COICOP 05 Furnishings shows a rather steady decline. For the rest the weights have been remarkably stable over de past 16 years.
There are some significant developments at the more detailed level like the decline in expenditures on COICOP 0914 Recording media, COICOP 0951 Books and 0952 Newspapers and periodicals. For details we refer to the CBS-website where all data can be found.

5. A volume index based on the HICP time series.

Even though the HICP is no more than a price index, we can derive from the various weighting schemes over the years a relative volume index. This relative volume index disregards the consumption growth because of changing population size or because of overall income growth per capita.
Under the assumption that total consumption expenditures develop exactly with the pace of inflation, we calculate which product groups show a relative increase in consumption volume and which show a decrease.
The calculation is straightforward:

- Since the published HICP is 2015=100, we assume that total expenditures are 100000 euro in 2015.
- The overall HICP index for the years 1996-2018 then determines total expenditures in each year,
- The weights data for each COICOP category and the overall expenditures determine the expenditures on each COICOP category in each year,
- For each COICOP category, we calculate an expenditure index 2015=100,
- Dividing the expenditures index by the HICP for the COICOP category we get the volume index for the category which can be rescaled to 1996=100 or 2003 = 100 or any other year.

N.B. It can be easily seen that the choice of the base year 2015=100 has no impact on the results.

Table 4 gives the results when comparing the consumption volumes in 2018 with those in 2003 (2003 = 100). At the level of COICOP Divisions, consumption has increased most in COICOP 08 (Communications) by 83.6%. Other COICOP divisions for which consumption level increased are Education (+61.7%), Clothing and footwear (+26.3%), Recreation and culture (+25.1%), Food and non-alcoholic beverages (+19%) and Restaurants and hotels (+12.4%).
Reductions in consumption volume are recorded for Health (-48.8%), Alcoholic beverages and tobacco (-31.7%), Miscellaneous goods and services (-14.5%), Housing, water, electricity and gas (-11.5%), Furnishings etc. (-11.3%) and Transport (-10.2).

The table also gives results at a more detailed level. Many of the results are plausible, but there are also results that are flawed.
I give two examples:

- The decrease in expenditures on Maintenance and repair of the dwelling (COICOP 043) is a result of a change in the consumption boundary in National Accounts with the introduction of ESA 2010.
- The growth of COICOP 0313 by 288.7% must be due to a revision in National Accounts that led to an increase of the expenditure share from 0.61 per 1000 in 2006 to 2.00 per 1000 after revision in 2007.

We must realize that the HICP and HICP weights are not revised if consumption figures from National Accounts are revised. This may lead to breaks in series in the HICP, particularly in the weights. This is also the reason why CBS always recommends to use other data than CPI weights for time series of consumption. The results of table 4 must therefore also be treated with care.

Nevertheless, we point at some remarkable results in the table like the large increase in consumption for several product groups, like:
- Information processing equipment (+1094.1%)
- Photographic and cinematographic equipment and optical instruments (+478.6%)
- Equipment for the reception, recording and reproduction of sound and picture (+142.2%)
- Cultural services (+149.9%)

Remarkable reductions in the volume of consumption are recorded for Tobacco (-46.3%), books (-42.3%), papers and periodicals (-69.4%).

Table 4 Relative volume index, development between 2003 and 2018 by COICOP, Netherlands

CP00 - All-items HICP	100,0		
CP01 - Food and non-alcoholic beverages	119,0		
CP011 - Food		119,8	
CP0111 - Bread and cereals			167,8
CP0112 - Meat			110,2
CP0113 - Fish and seafood			79,4
CP0114 - Milk, cheese and eggs			93,1
CP0115 - Oils and fats			100,7
CP0116 - Fruit			98,2
CP0117 - Vegetables			149,6
CP0118 - Sugar, jam, honey, chocolate and confectionery			129,6
CP0119 - Food products n.e.c.			111,4
CP012 - Non-alcoholic beverages		110,5	
CP0121 - Coffee, tea and cocoa			121,3
CP0122 - Mineral waters, soft drinks, fruit and vegetable juices			106,8
CP02 - Alcoholic beverages, tobacco and narcotics	68,3		
CP021 - Alcoholic beverages		97,1	
CP0211 - Spirits			108,4
CP0212 - Wine			118,0
CP0213 - Beer			72,7
CP022 - Tobacco		53,7	
CP03 - Clothing and footwear	126,3		
CP031 - Clothing		131,4	
CP0311 - Clothing materials			
CP0312 - Garments			136,0
CP0313 - Other articles of clothing and clothing accessories			388,7
CP0314 - Cleaning, repair and hire of clothing			22,6
CP032 - Footwear		104,5	
CP04 - Housing, water, electricity, gas and other fuels	88,5		
CP041 - Actual rentals for housing		106,8	
CP043 - Maintenance and repair of the dwelling		30,6	
CP0431 - Materials for the maintenance and repair of the dwelling			31,4
CP0432 - Services for the maintenance and repair of the dwelling			28,4
CP044 - Water supply and miscellaneous services relating to the dwelling		88,0	
CP0441 - Water supply			86,8
CP0442 - Refuse collection			118,0
CP0443 - Sewerage collection			79,4
CP0444 - Other services relating to the dwelling n.e.c.			39,3
CP045 - Electricity, gas and other fuels		81,0	
CP0451 - Electricity			96,2
CP0452 - Gas			69,0
CP0455 - Heat energy			53,6
CP05 - Furnishings, household equipment and routine household maintenance	88,7		
CP051 - Furniture and furnishings, carpets and other floor coverings		72,3	
CP0511 - Furniture and furnishings			76,7
CP0512 - Carpets and other floor coverings			66,9
CP0513 - Repair of furniture, furnishings and floor coverings			
CP052 - Household textiles		79,6	
CP053 - Household appliances		128,0	
CP0531_0532 - Major household appliances whether electric or not and small electric household appliances			127,4
CP0533 - Repair of household appliances			167,9
CP054 - Glassware, tableware and household utensils		98,8	
CP055 - Tools and equipment for house and garden		135,6	
CP056 - Goods and services for routine household maintenance		101,9	
CP0561 - Non-durable household goods			104,0
CP0562 - Domestic services and household services			101,5
CP06 - Health	51,2		

Table 4 Relative volume index, development between 2003 and 2018 by COICOP, Netherlands, continued

CP07 - Transport	89,8		
CP071 - Purchase of vehicles		77,6	
CP0711 - Motor cars			75,1
CP0712-0714 - Motor cycles, bicycles and animal drawn vehicles			93,8
CP072 - Operation of personal transport equipment		85,5	
CP0721 - Spare parts and accessories for personal transport equipment			81,8
CP0722 - Fuels and lubricants for personal transport equipment			82,4
CP0723 - Maintenance and repair of personal transport equipment			80,2
CP0724 - Other services in respect of personal transport equipment			142,3
CP073 - Transport services		152,3	
CP0731 - Passenger transport by railway			192,2
CP0732 - Passenger transport by road			96,8
CP0733 - Passenger transport by air			107,1
CP0734 - Passenger transport by sea and inland waterway			424,7
CP0736 - Other purchased transport services			766,1
CP08 - Communications	183,6		
CP081 - Postal services		49,6	
CP082_083 - Telephone and telefax equipment and services		193,3	
CP09 - Recreation and culture	125,1		
CP091 - Audio-visual, photographic and information processing equipment		271,0	
CP0911 - Equipment for the reception, recording and reproduction of sound and picture			242,2
CP0912 - Photographic and cinematographic equipment and optical instruments			578,6
CP0913 - Information processing equipment			1194,1
CP0914 - Recording media			73,4
CP0915 - Repair of audio-visual, photographic and information processing equipment			81,1
CP092 - Other major durables for recreation and culture		74,8	
CP093 - Other recreational items and equipment, gardens and pets		133,4	
CP0931 - Games, toys and hobbies			116,9
CP0932 - Equipment for sport, camping and open-air recreation			187,1
CP0933 - Gardens, plants and flowers			112,3
CP0934_0935 - Pets and related products; veterinary and other services for pets			157,1
CP094 - Recreational and cultural services		150,0	
CP0941 - Recreational and sporting services			114,0
CP0942 - Cultural services			249,9
CP095 - Newspapers, books and stationery		54,5	
CP0951 - Books			57,7
CP0952 - Newspapers and periodicals			30,6
CP0953_0954 - Miscellaneous printed matter; stationery and drawing materials			116,2
CP096 - Package holidays		95,9	
CP10 - Education	161,7		
CP11 - Restaurants and hotels	112,4		
CP111 - Catering services		103,7	
CP1111 - Restaurants, cafés and the like			111,7
CP1112 - Canteens			45,8
CP112 - Accommodation services		193,0	
CP12 - Miscellaneous goods and services	85,5		
CP121 - Personal care		122,8	
CP1211 - Hairdressing salons and personal grooming establishments			96,9
CP1212_1213 - Electrical appliances for personal care; other appliances, articles and products for personal care			139,3
CP123 - Personal effects n.e.c.		58,9	
CP1231 - Jewellery, clocks and watches			51,5
CP1232 - Other personal effects			72,7
CP124 - Social protection		93,5	
CP125 - Insurance		84,4	
CP1252 - Insurance connected with the dwelling			190,4
CP1253 - Insurance connected with health			39,5
CP1254 - Insurance connected with transport			85,8
CP1255 - Other insurance			300,3
CP126 - Financial services n.e.c.		90,3	
CP127 - Other services n.e.c.		61,5	

6. Which categories of COICOP have most influence on the results?

In this chapter, we try to indicate which developments in prices and weights have the highest influence to the fact that more recent baskets (weights) show lower inflation. The most commonly used indicators for describing this are “contribution“ and “impact”.
In a fixed base index series, the price development between period t1 and t2 is defined as:

$$Rate_{t1}^{t2} = \frac{Index_{t2} - Index_{t1}}{Index_{t1}} = \frac{\sum_{i=1}^{N} w_i * (Index_{i,t2} - Index_{i,t1})}{\sum_{i=1}^{N} w_i * Index_{i,t1}}$$

It follows that the “contribution” of a COICOP category i to the price development between period t1 and t2 is:

$$Contribution_{i,t2/t1} = \frac{w_i * (Index_{i,t2} - Index_{i,t1})}{\sum_{i=1}^{N} w_i * Index_{i,t1}}$$

The impact of a COICOP category on the price development is defined as the difference between the overall price development and the price development if the COICOP category is left out of the basket.

Contributions

In the 16 series with weights for the years 2003 until 2018, we can calculate the contributions of COICOP categories to the long-term price development 2003-2018 and investigate which of them contribute to the fact that the overall development is the lowest in the 2018 basket.
In table 4, we give the COICOP classes for which the contribution to inflation has diminished strongest between 2003 and 2019.

Table 4 Contribution to Price index change and difference between baskets of 2003 and 2018

	Contribution to Price index change 2003 - 2018		
COICOP classes	2018=100	2003=100	reduction
CP022 - Tobacco	1,28	2,51	-1,23
CP06 - Health	1,04	2,17	-1,13
CP082_083 - Telephone and telefax equipment and services	-2,29	-1,31	-0,98
CP0911 - Equipment for the reception, recording and reproduction of sound and picture	-1,53	-0,72	-0,81
CP0912 - Photographic and cinematographic equipment and optical instruments	-0,78	-0,13	-0,64
CP0913 - Information processing equipment	-2,72	-0,21	-2,50
CP0952 - Newspapers and periodicals	0,23	0,79	-0,57
CP1253 - Insurance connected with health	0,36	1,01	-0,65
CP127 - Other services n.e.c.	0,73	1,27	-0,54
All other classes, total	20,48	21,73	-1,25
Total computed by Classes	16,79	27,10	-10,31

There seems to be a mix of reasons why these COICOP classes cause the reduction in inflation in the more recent baskets. For COICOP 06, 1253 and 0952 there has been a clear reduction in expenditure share in the 2018 basket as compared to 2003. A lower expenditure share in combination with rising prices leads to lower contributions.
On the other hand, COICOP 912 and 913 showed a large increase in expenditure share. For these products, however the prices tend to go down in the long run and a combination of larger shares and lower prices leads to lower contributions to overall price developments.

Impacts

In table 5, we give the impact of COICOP divisions on inflation. The table was calculated from aggregating COICOP class index results for the basket weights of 2003 and 2018. The top line gives the total development, and the other lines are calculated by leaving out of the basket the classes in the respective COICOP divisions. The left three columns give the index development between 2003 and 2018 and the right three columns give the impact, i.e. difference between the overall price development and the price development when leaving out part of the basket.

Table 5 Impact of excluding COICOP divisions from the HICP

	HICP increase 2003-2018			Impact		
	Basket 2003	Basket 2018	Difference	Basket 2003	Basket 2018	Difference
Total	27,10	16,79	-10,31			
Total excluding						
excl COICOP01	28,41	16,66	-11,75	-1,32	0,13	1,44
excl COICOP02	25,20	15,62	-9,58	1,90	1,17	-0,73
excl COICOP03	29,36	18,68	-10,68	-2,27	-1,90	0,37
excl COICOP04	24,38	12,89	-11,49	2,71	3,90	1,19
excl COICOP05	28,75	17,44	-11,30	-1,65	-0,65	0,99
excl COICOP06	26,15	16,11	-10,04	0,95	0,68	-0,27
excl COICOP07	25,64	14,07	-11,57	1,46	2,72	1,27
excl COICOP08	29,34	20,30	-9,04	-2,24	-3,51	-1,27
excl COICOP09	28,80	23,01	-5,79	-1,70	-6,22	-4,52
excl COICOP10	27,21	16,86	-10,35	-0,12	-0,07	0,05
excl COICOP11	25,73	14,49	-11,24	1,37	2,30	0,93
excl COICOP12	25,97	15,61	-10,36	1,13	1,18	0,05
excl COICOP091	29,06	23,73	-5,33	-1,96	-6,94	-4,97

A COICOP category has a positive impact on inflation if the prices rise faster than general inflation. The impact is negative if prices grow at a slower pace. When using the weights for 2003 the biggest negative impact is for Clothing (03), Communications (08) and Recreation and Culture (09). When using the 2018 basket weights the impact on lowering inflation is by far the biggest for Recreation and culture and for Communications.
It is also clear from this table that the difference between inflation in a more recent basket and older basket is largely attributable to COICOP 09 and COICOP 08.
In the bottom line, we also calculated the impact and impact change of COICOP group 091 alone. This impact is even bigger than for the whole of COICOP 09.

7. Do we make too many quality adjustments?

In the previous chapters, we tried to describe how changing baskets in the long run have influence on price developments. We showed that price developments are lower if we use more recent weights distributions, and we also showed that the biggest impacts on these changes seems to come from technological products. The results we have reported for these product categories have a lot in common:

- Price indices go down consistently
- Expenditures are relatively stable
- A volume index shows a significant upward change

Some examples:

	2003	2018	change	2003	2018	change	2003	2018
		Price index			Weight		Volume index	
CP082_083 - Telephone and telefax equipment and services	129,8	82,6	-36,3	36,09	35,84	-0,7	100	193,3
CP091 - Audio-visual, photographic and information processing equipment	244,8	92,6	-62,2	24,14	19,98	-17,2	100	271,0
CP0911 - Equipment for the reception, recording and reproduction of sound and picture	305,0	88,6	-70,9	10,79	6,13	-43,2	100	242,2
CP0912 - Photographic and cinematographic equipment and optical instruments	396,1	97,5	-75,4	1,94	2,23	14,9	100	578,6
CP0913 - Information processing equipment	360,2	91,3	-74,7	3,41	8,33	144,3	100	1194,1

These are typically products where the production of the price index involves quality adjustments, by implicit or explicit methods. What can often be seen is that these products have more or less the same price development during their lifetime as their predecessor and their successor, but each generation has a higher quality. An individual consumer, who buys such products maybe once in a few years has no choice but to buy the better quality product if his old product needs replacement. It is in a way a forced replacement for the consumer. Then the consumer may have a different point of view than the price statistician. The consumer buys a product that has the same price as the one he bought a few years ago, and yes, it is better than the old one. The price statistician publishes a price index that has gone down because of the quality change. It is difficult to explain that consumers spend about the same part of their income on television sets in 2018 as they did in 1996 while CBS publishes that the price index is almost 90% lower.

Without denying the fact that the quality of electronic products has changed significantly in the past decades, it is not easy to judge whether the quality adjustments applied in those years in the production of the CPIs have been correct. The only thing we want to do now is to estimate how different results would have been, had the quality adjustments been different.

The approach is as follows. If the quality adjustment has been 1% per year too high then we can correct the index for a certain aggregate with 1% per annum. The expenditures and the weights data need not be adjusted. The expenditures in a certain COICOP category were not quality adjusted. Therefore, we can adjust the index series of the aggregate and use the original weights for the aggregation.

In a simulation we assumed that the quality adjustments in COICOP classes 0911, 0912, 0913, 0914 and 0915 have been 1%-point too high in all years since 2003. Then we compare the

results that we get from aggregating the COICOP class results with the results we had when we used the published figures.

In table 6, we first give the impact of the assumption of less quality change and more price change on the results for the COICOP classes under COICOP 091.

TABLE 6 Adjustment of data used in the simulations

Originally published results								
	2003	2018	change	2003	2018	change	2003	2018
	Price index		in %	Weight		in %	Volume index	
CP0911 - Equipment for the reception, recording and reproduction of sound and picture	305,0	88,6	-70,9	10,79	6,13	-43,2	100	242,2
CP0912 - Photographic and cinematographic equipment and optical instruments	396,1	97,5	-75,4	1,94	2,23	14,9	100	578,6
CP0913 - Information processing equipment	360,2	91,3	-74,7	3,41	8,33	144,3	100	1194,1
CP0914 - Recording media	151,9	98,3	-35,3	7,69	2,95	-61,6	100	73,4
CP0915 - Repair of audio-visual, photographic and information processing equipment	64,5	108,1	67,5	0,31	0,34	9,7	100	81,1
results under the assumption of 1% less QA and 1% more price change per year								
	2003	2018	change	2003	2018	change	2003	2018
	Price index		in %	Weight		in %	Volume index	
CP0911 - Equipment for the reception, recording and reproduction of sound and picture	270,7	91,3	-66,3	10,79	6,13	-43,2	100	208,6
CP0912 - Photographic and cinematographic equipment and optical instruments	351,5	100,4	-71,4	1,94	2,23	14,9	100	498,4
CP0913 - Information processing equipment	319,6	94,0	-70,6	3,41	8,33	144,3	100	1028,6
CP0914 - Recording media	134,8	101,3	-24,8	7,69	2,95	-61,6	100	63,2
CP0915 - Repair of audio-visual, photographic and information processing equipment	57,3	111,3	94,4	0,31	0,34	9,7	100	69,9

Even after these adjustments of the data, the long-term price change is still very high. Prices for COICOP 0912 would in 2018 be 71.4% lower than in 2003, while the original data say that prices went down by 75.4%. In addition, the volume indices as defined in chapter 5 still show a large increase in consumption volume. The volume of COICOP 913 would have gone up by 928.6% instead of 1094.1%.

In table 7, we reproduce the results from table 5 on the impact of COICOP divisions on the long-term development of the CPI, and the difference between the baskets of 2003 and 2018.

The difference between the long run price development using the 2003 and the 2018 weights has gone down from 10.31%-points to 9.29%-points. The impact of COICOP class 091 on total price development using the 2003 weights reduces from -1.96 %-points to -1.83%-points. When using the 2018 weighting scheme the reduction of the impact is from -6.94 to -5.79%-points.

Finally it is of course possible to calculate the effect on the chained index if we make the same assumptions on less quality adjustments and more price development in the same simulation. The outcome is that the overall HICP index would have gone up by 24.23% between 2003 and 2018 rather than the 23.89%.

Table 7 Impact of excluding COICOP divisions from the HICP, after lowering QA in COICOP 091

	HICP increase 2003-2018			Impact		
	Basket 2003	Basket 2018	Difference	Basket 2003	Basket 2018	Difference
Total	27,23	17,94	-9,29			
Total excluding						
excl COICOP01	28,57	18,00	-10,56	-1,33	-0,06	1,27
excl COICOP02	25,34	16,79	-8,55	1,89	1,15	-0,75
excl COICOP03	29,51	19,95	-9,55	-2,28	-2,01	0,26
excl COICOP04	24,54	14,17	-10,37	2,69	3,77	1,08
excl COICOP05	28,89	18,69	-10,20	-1,66	-0,75	0,91
excl COICOP06	26,29	17,28	-9,01	0,94	0,66	-0,28
excl COICOP07	25,80	15,34	-10,45	1,44	2,60	1,16
excl COICOP08	29,48	21,57	-7,91	-2,25	-3,63	-1,38
excl COICOP09	28,80	23,01	-5,79	-1,56	-5,07	-3,50
excl COICOP10	27,35	18,02	-9,33	-0,12	-0,08	0,03
excl COICOP11	25,88	15,71	-10,16	1,36	2,23	0,87
excl COICOP12	26,12	16,87	-9,25	1,11	1,07	-0,04
excl COICOP091	29,06	23,73	-5,33	-1,83	-5,79	-3,96

8. Summary and conclusion

In this paper, we investigated how changes in the composition of the consumption basket of the CPI has influenced the long-term price development. Since the start of the HICP in 1996, there are 23 weighting schemes available that have all been in use for one year. The resulting chain index was published as the official HICP.
There have been several breaks in the data series, in particular between 1996 and 2003. From 2003 until 2018, there are no important breaks in the series, and therefore we have concentrated on the long-term price development between 2003 and 2018.

The long-term price development from 2003 until 2018 has been published as 23.88% or 1.44% per annum. We compare this result of the chained series with results that we would have got if the basket had been fixed. In general, the result is that a more recent basket leads to lower price development. Depending on the level of detail of the used data, the lowering of inflation may be more significant. Using only COICOP division data the average inflation reduced from 1.53% in the 2003 basket to 1.30% in the 2018 basket. Using COICOP groups, the reduction was from 1.58% to 1.17%. Finally, using COICOP classes' inflation reduced from an average of 1.61% to 1.04% using more recent baskets. What the development would have been, had we been able to use the articles from the various basket, remains an open question, but we suspect that the difference might have been even bigger. If the results at COICOP class level would be true, they would indicate that long-term average inflation is reduced by 0.1%-points about every 3 years.

The question that needs to be answered is what are the reasons for these developments. How do the baskets change? And how does this reduce long-term inflation.
The first observation is that expenditure weights are remarkably stable. So the amounts of money consumers spend on product groups do not change very drastically.
The second observation is that there are COICOP categories that show a very strong price development. From the time series of weights and price indices, we derived a volume index showing how consumption volumes per COICOP category developed if we assume that overall spending follows the overall inflation. The largest increase is in COICOP 091 where consumption volume increased by 173% between 2003 and 2018. At the more detailed level the development was the biggest for COICOP 0911 (TV and sound; +142.2%), COICOP 0912 (Photo, video; +478.6%) and COICOP 0913 (Computers; +1094.1%).

We then tried to measure the influence of COICOP categories on the reduction of inflation in more recent baskets.
The third observation was that the reduction of long-term inflation from 27.10% to 16.79% was mainly due to the reduction of the contribution to inflation of 9 COICOP categories, including COICOP 082-083, and 0911, 0912 and 0913. These categories combine a strong increase in consumption volume with lowering prices. Other COICOP categories had lower contribution because of lower consumption like tobacco and newspapers and periodicals. Therefore, the development of the Contribution is not the best indicator to answer the question.

The fourth observation is that the calculation of the change of the "impact" of a COICOP category on inflation seems to be a better indicator. The impact is very large for COICOP 091. In the 2003 basket, the impact on long-term inflation was -1.96%-point. In the 2018 basket, this figure has developed to -6.94%-points. So the developments for this COICOP class explain

almost 5%-points of the 10.3%-points lower inflation in the 2018 basket, even though the expenditure weight of COICOP 091 has never been higher than 2.5%.
Another COICOP category that has a big impact on the lower inflation and the reduction of inflation with more recent baskets is COICOP 082-083 (Telephone equipment and services).
In summary the main reason why inflation becomes lower in more recent baskets than in older baskets is the development of consumption and price indices for electronic goods and related services. These are typically the COICOP categories where most quality adjustment is applied, implicitly or explicitly.

One of the problems with quality adjustment for electronic goods is that there is a situation of forced replacements for consumers. Even though it cannot be denied that a 2018 television set has a better quality than one from 2003, the consumer has no choice but to buy the higher quality set when he has to buy a new television set. The consumer may have to pay the same or a higher nominal amount for the new television set, while the price statistician publishes that the price index has fallen. The consumer may have had lower income compensation for rising prices because the price index for electronic goods went down.

At this stage, it is not possible to determine whether quality adjustments have been wrong in the past and by how much. What we can do is estimate what the impact might have been if the balance between nominal price developments, quality change and price index development would have been different. We made one simulation in which we calculated the effect of increasing the price development of the COICOP classes in COICOP 091 by 1% per year and thus assuming that quality development accounted for 1% less per year. This is only a small correction on the results in the sense that the long term results for COICOP 091 do not look more or less plausible than the published ones. Nevertheless even this small adjustment of results for only a small, but important, part of the basket has a significant effect on the outcome. The reduction of long-term inflation is reduced from 10.3 to 9.3 %-points.

Conclusion

- The data as they have been published for the HICP in the past decades indicate that there is a continuous trend towards lower inflation figures, reducing inflation by maybe 0.1 %-point every 3 years. If this result is correct one may wonder if the long-term inflation target of 2% per annum of Central Banks, that has been stable in all these years should or could not be adjusted.
- The main driver for this development is the continuous volume increase of consumption of e.g. electronic goods. For these products, a strongly decreasing price index was published in combination with relatively stable expenditure shares.
- If the balance of price development and quality change applied in quality adjustment methods would shift towards less quality increase and a higher price index, then the first mentioned result may be strongly weakened.