



## HCPI 09/547 rev. 3

Luxembourg, October 2009

# HICP-CT manual

### Document history:

HCPI 06/547 (released April 2006)	Initial version presented in the HICP WG meeting in April 2006
HCPI 07/547 – rev.1 (released Oct 2007)	Update integrating conclusions from HICP WG meetings in October 2006 and March 2007
HCPI 08/547 – rev.2 (released June 2008)	Changes in chapters 3.2 and 5, and annexe 1
HCPI 09/547 – rev.3 (released Oct 2009)	

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## 1. INTRODUCTION

The aim of this manual is to provide some practical guidance for EU Member States for setting up the HICP-CT indices.

Chapter 2 provides definitions and describes quality requirements. Coverage of taxes is dealt with in chapter 3. Calculations, together with reference periods, are described in chapter 4. In chapter 5, the actual implementation is described – including necessary breakdowns, as well as time and geographical coverage.

## 2. DEFINITION AND QUALITY REQUIREMENTS

### 2.1. Definition and use

The HICP-CT is defined as an index where tax rates are kept constant in the observation period compared to the reference period, i.e. through time. Hence, in the event of a tax rate change, the difference between the current HICP-CT and HICP would indicate the effect of the tax rate change on price changes assuming tax changes are passed on instantaneously and fully. It should be noted that the term ‘rate’ refers in this note to the tax *parameter*; a tax rate may be a certain percentage of the price, or an absolute tax amount levied on a physical unit.

The HICP is defined as a Laspeyres type index (Art. 9, Commission Regulation 2494/95), measuring the price change of a basket of goods and services which households acquire for consumption <sup>(1)</sup>. To keep the following notation simple we have focused on index levels which reflect the price movement from a reference period  $t_0$  (which is previous year’s December) to an observation month  $t_n$  within the current year so that linking factors could be ignored.

$$P_{t_0,t_n} = \sum_{i=1}^g \frac{p_{i,t_n}(\tau_{i,t_n})}{p_{i,t_0}(\tau_{i,t_0})} \cdot w_i \quad (1)^{(2)}$$

Given this, the HICP-CT is a Laspeyres price index which reflects the average change of  $g$  item prices  $p_{i,t}$  from the price reference period  $t_0$  (which is previous year’s December) to month  $t_n$ . The expenditure shares which are used for weighting price relations are denoted as  $w_i$ . All product related taxes, which may be merged in vectors  $\tau_{i,t}$ , are part of the prices observed (and refer to the same periods as the prices).

The idea behind a constant tax price index is to keep product related tax rates constant over time. The notation

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<sup>(1)</sup> The formulae have been taken from de Haan, 1998, and adapted by the authors.

<sup>(2)</sup> In verbose notation this reads

$$\begin{aligned} &\text{Price index (movement } t_0 \text{ to } t_n) = \\ &= \sum_{i=1}^g \frac{\text{purchase price of item } i \text{ at } t_n \text{ (including } t_n \text{ taxes)}}{\text{purchase price of item } i \text{ at } t_0 \text{ (including } t_0 \text{ taxes)}} \cdot \text{weight of item } i \end{aligned}$$

$${}_L CTP_{t_0, t_n} = \sum_{i=1}^g \frac{p_{i, t_n}(\tau_{i, t_0})}{p_{i, t_0}(\tau_{i, t_0})} \cdot w_i \quad (2)^{(3)}$$

indicates that prices in  $t_0$  and  $t_n$  refer to the tax rates from the same period  $t_0$ . Whereas the prices  $p_{i, t_0}(\tau_{i, t_0})$  are observable in the base period  $t_0$ , the prices  $p_{i, t_n}(\tau_{i, t_0})$  are not directly observable. They have to be calculated using the reporting period's purchaser prices  $p_{i, t_n}$ , the product related tax rates  $\tau_{i, t_n}$  as well as the tax rates of the base period  $\tau_{i, t_0}$ .

The use of the HICP-CT would not differ systematically from the use of other special aggregates of the HICP sub-indices and the influence of tax rate changes would be easy to see at sub-index level. The main use is for comparing percentage month-on-month index growth rates of the HICP and the HICP-CT. The difference of these two growth rates would be the implicit contribution of tax changes to the overall HICP inflation.

The same applies for the comparison of annual growth rates for the HICP and HICP-CT. In this case however (as in any other long-term comparison), the term 'constant-tax rate index' has a slightly different meaning, because for the HICP chain index the tax rates are to be updated for each new link month December (see below for details).

From equation (1) and (2), it appears that the analytical interest of the HICP-CT only materialises if it is compared with the HICP e.g.; where tax rate changes happen in the observation period, the effect of these changes on prices will be seen by comparing the HICP-CT with the HICP. For example, if the HICP would be 121.3 for country X in a given observation period and HICP-CT would be 118.1 then the 3.2 index point difference would indicate the effect of tax changes (increases) since the reference period. From here it follows that the HICP-CT equals the HICP if tax rates do not change between the reference period and the observation period ( $\tau_{i, t_0} = \tau_{i, t_n}$ ).

## 2.2. Quality requirements and comparability

The HICP-CT should be part of the 'family' of HICPs. It is therefore essential that it is exposed to the same quality requirements as for the HICPs and as implemented through the regulatory framework for the HICPs. As a consequence, the HICP-CT should provide information which is comparable from one EU country to another.

In practice, however, it will be necessary to strike a balance between completeness, feasibility and costs to produce the HICP-CT. Compromises as regards the treatment of taxes which have a negligible impact on the overall HICP (such as local taxes, or specific taxes levied on items with a low weight in the basket, e.g. sugar tax) are acceptable.

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<sup>(3)</sup> In verbose notation this reads

$$\begin{aligned} & \text{Constant tax rate index (movement } t_0 \text{ to } t_n) = \\ & = \sum_{i=1}^g \frac{\text{constant tax price of item } i \text{ at } t_n \text{ (including } t_0 \text{ taxes)}}{\text{purchase price of item } i \text{ at } t_0 \text{ (including } t_0 \text{ taxes)}} \cdot \text{weight of item } i \end{aligned}$$

Beyond this, tax structures in the present Member States show substantial differences. Therefore, it could be that different tax structures cause similar types of tax rate changes to have disparate effects on the HICP-CT. The following examples could be considered.

Example 1: 'Cigarettes – ad valorem versus specific tax' <sup>(4)</sup>

Suppose that country A applies an ad valorem tax on cigarette packets of 20 percent of the purchase price, and that the purchase price of a package of cigarettes equals 3 Euro in the reference period (the amount of tax per package equals 0.6 Euro). Country B applies a specific tax on cigarettes of 0.6 Euro per package. In a later period, the price of a package of cigarettes equals 3.60 Euro (an increase of 20 percent). In country A the ad valorem tax rate is still 20 percent, and the amount of tax per package equals 0.72 Euro. In country B it was decided to raise the specific tax rate from 0.6 Euro to 0.72 Euro.

In country A, the "HICP-CT would show a price rise of 20 percent for a package of cigarettes (the same as in the normal index, since there was no change in the tax rate), while in country B the HICP-CT would show a price rise of 16 percent for a package of cigarettes (which follows from applying the base period tax rate). So, while in both countries the effect on the amount of tax paid is the same, the resulting HICP-CTs differ. This is a consequence of applying taxes with different structural characteristics (e.g. an ad valorem tax as opposed to a specific tax) to the same product.

To avoid features of this kind an alternative to the proposed HICP-CT methodology would be to opt for the Irish method which is based on the idea of keeping the amount (the effect) of taxes paid per product unit unchanged in their Constant Tax Price index. However, in the case of increasing pre-tax-prices this type of index takes into account that the amount of VAT and/or ad valorem tax paid per product unit increases even if the tax rates are not changed. In defining the HICP-CT as being dependent on tax rate changes, this feature has on purpose been avoided.

In fact, the HICP-CT has been designed to measure the impact of taxation policy, as opposed to measuring the impact of the actual amount of taxes paid by the consumer.

Example 2: 'Fuel taxes – special excise in Belgium'

In Belgium, four taxes are levied on fuels: VAT, two independent specific taxes and a 'special excise' in form of an ad valorem tax. The tax rate of the ad valorem tax is set following pre-defined rules and depends on pre-VAT price movements as well as on the purchase price.

The HICP Working Group discussed whether tax rate changes of the special ad valorem tax should be reflected in the HICP-CT, or whether the setting up of the rules as such should be considered as the 'taxation policy'. It was concluded that tax rate changes should be reflected in the HICP-CT.

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<sup>(4)</sup> Thanks to Leendert Hoven for providing this example.

### 3. COVERAGE OF TAXES

#### 3.1. Definition of tax coverage according to HICP framework and ESA95

##### 3.1.1. General principles

In scope for the HICP-CT:

- Taxes on products relating to final consumption expenditure
- Taxes directly linked to the level of final consumption

In scope for the HICP-CT, but not considered for the time being:

- Subsidies

Out-of-scope for the HICP-CT:

- Taxes to be paid on intermediate stages (e.g. production, transport)
- Administrative fees (to be considered as administered prices)
- Taxes on income and wealth

##### 3.1.2. Distinction of taxes and fees

The difference between *taxes* and *administrative fees* is important for the HICP-CT, because administrative fees should be considered as administered prices and therefore not kept constant in an HICP-CT.

For the borderline cases between taxes and fees for the purchase of services from the government, the ESA 1995, par. 4.79, gives the following criteria: "... if the licences are being granted automatically on payment of the amounts due, their payment is treated as taxes. But if the government uses the issue of licences to organise some proper regulatory function (such as checking the competence, or qualifications, of the person concerned), the payments made should be treated as purchases from government rather than payment of taxes, unless the payments are clearly out of all proportion to the cost of providing the services." Moreover according to (ESA, para 4.80) "driving or pilot's licences, television or radio licences, firearm licences, museum or library admissions, garbage disposal fees are treated in most cases as purchases of services rendered by government".

### 3.1.3. Detailed definitions and borderline cases

The detailed ESA95 classification for D21 'Taxes on products' (D211, D212 and D214) is given in Table 1.

The main taxes in scope of the HICP-CT are VAT and excise duties on particularly alcoholic beverages, tobacco and energy items (fuel, heating oil etc.). Also taxes on some specific items as cars, insurances and entertainment are widely used within the EU and are in scope of the HICP-CT.

Table 1: ESA95 classification for D21 'Taxes on products' (D211, D212, D214) and coverage of the HICP-CT

		Relevance for the HICP-CT
D211	Value added type taxes	In scope
D212	Taxes and duties on imports excluding VAT	Out-of-scope
D2121	Import duties	Out-of-scope
D2122	Taxes on imports, excluding VAT and import duties	Out-of-scope
D2122A	Levies on imported agricultural products	Out-of-scope
D2122B	Monetary compensatory amounts on imports	Out-of-scope
D2122C	Excise duties	In scope
D2122D	General sales taxes	Out-of-scope
D2122E	Taxes on specific services	In scope
D2122F	Profits of import monopolies	Out-of-scope
D214	Taxes on products, except VAT and import taxes	Out-of-scope
D214A	Excise duties and consumption taxes	In scope
D214B	Stamp taxes	Out-of-scope
D214C	Taxes on financial and capital transactions	Out-of-scope
D214D	Car registration taxes	In scope
D214E	Taxes on entertainment	In scope
D214F	Taxes on lotteries, gambling and betting	Out-of-scope
D214G	Taxes on insurance premiums	In scope
D214H	Other taxes on specific services	In scope
D214I	General sales or turnover taxes	Out-of-scope
D214J	Profits of fiscal monopolies	Out-of-scope
D214K	Export duties and monetary comp. amounts on exports	Out-of-scope
D214L	Other taxes on products n.e.c.	In scope

Remark:

It should be noted that the distinction between D212 and D214 is a matter of if the good/service have been imported or produced within the domestic territory. Hence, a number of items under D212 and D214 are from the point of view of HICP coverage identical.

### 3.1.3.1. Taxes in scope for the HICP-CT

**D211**, 'Value added type taxes' (VAT) are in the tax coverage of the HICP-CT given their definition: "A value added type tax (VAT) is a tax on goods or services collected in stages by enterprises and which is ultimately charged in full to the final purchasers" (SNA93 7.63 and ESA95 4.17).

For **D212**, the NA distinction between import duties and excise duties/general sales taxes should be kept in mind. Import duties are normally not household expenditure (households rarely import consumer goods themselves although Internet shopping might change this gradually) whereas the latter relate to the price of goods and services which the households pay. Hence, 'Excise duties' (**D2122C**) would be in scope as well as 'Taxes on specific services' (**D2122E**).

**D214A** 'Excise duties and consumption taxes', **D214D** 'Car registration taxes' and **D214E** 'Entertainment taxes' are covered in the HICP.

As regards insurances covered by the scope of the HICP then 'Taxes on insurance premiums' (**D214G**) are relevant <sup>(5)</sup>. In fact, the prices used in the HICP for the compilation of insurance-price indices are the gross insurance premiums which include the insurance service charge and thereby insurance premium taxes.

'Other taxes on specific services' (**D214H**) are normally covered in the HICP. Examples would be airport duties (taxes) or the toll paid for driving on motorways in some countries, - however these could also be seen as fees for a service rendered.

**D214L** is a miscellaneous category and the relevance of this category for the HICP should be investigated further in each Member State.

### 3.1.3.2. Taxes out-of-scope for the HICP-CT

A number of taxes are out-of-scope because they can not be readily identified in relation to the end product/service. This counts for the following categories: **D2121** Import duties, **D2122A** levies on imported agricultural products, **D2122B** monetary compensatory amounts on imports, **D2122D** general sales taxes, **D2122F** profits of import monopolies, **D214I** general sales or turnover taxes, **D214J** profits of fiscal monopolies and **D214K** export duties and monetary compensation amounts on exports.

**D214B** stamp taxes, **D214C** taxes on financial and capital transactions and **D214F** taxes on lotteries, gambling and betting not relevant because the corresponding products/services are not included in the HFCME definition for HICPs.

Besides category D21 'Taxes on products', the ESA95 classifies taxes under D29 'Other taxes on production', D51 'Taxes on income' and D59 'other current taxes'. These are all not relevant for the following reasons:

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<sup>(5)</sup> However, the service charge related to life insurance is specifically excluded from COICOP/HICP 12.5 and hence tax on the premium of a life insurance is not covered. Similarly, service charges (including taxes) related to insurances taken out by owner occupiers (COICOP 12.5.2) are not covered until further notice.

- **D29** Other taxes on production <sup>(6)</sup>: they are independent of the actual quantity and value of consumption, and are not related to the final consumption of a product.
- **D51** Taxes on income <sup>(7)</sup>: they reduce the primary income and are not included in disposable income which is available for private consumption or saving. They are not included in the coverage of the HICP <sup>(8)</sup>.
- **D59** Other current taxes: The part of these taxes which can be related to household final expenditure is within the definitional scope of 'Taxes on consumption' (mainly D59D 'Payments by households for licences', but in the NA definition of consumption taxes also D59B 'Poll taxes'). However, as these are taxes on income and wealth, they have to be generally excluded from the coverage of the HICP <sup>(9)</sup>.

#### 3.1.4. Taxes set at different governmental levels

Finally, a slightly different problem in relation to tax coverage of the HICP should be raised. This concerns **taxes set at different governmental levels**, e.g. at central, state, local or EU level for example. In a number of EU Member States, local/regional authorities have the right to set and collect taxes which are relevant in the HICP context. Consequently, these tax rates may be set at very different levels and changed randomly according to local/regional revenue needs. In theory they are within the scope of the HICP-CT but the practical difficulties in following the tax rate changes might hinder them being kept constant.

Further to the above, it is proposed that local/regional relevant taxes would potentially not be kept constant to the extent that the local/regional authorities have the right to define/set the tax themselves including setting the revenue level. If the local/regional power over setting and defining tax levels is limited to collecting tax revenues in relation to centrally fixed legislation and rules then the tax should be in the HICP-CT coverage.

This point should be controlled when piloting the HICP-CT. For example, Member States which have a federal structure (as Belgium, Germany and Spain), but also Italy, might have quite extensive regional discretions for defining taxes and determining tax levels. However, for the purpose of the HICP-CT, if the tax revenue of these relevant taxes makes up a large proportion of the overall relevant taxes then their inclusion might be warranted. This could be a smaller problem than it sounds because the CPI samples in those countries would be based on regional samples.

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<sup>(6)</sup> Other taxes on production (D29) "consist of all taxes that enterprises incur as a result of engaging in production, independently of the quantity or value of the goods and services produced or sold" (ESA para 4.22). Examples for "Other taxes on production" are taxes on the ownership of land and buildings, taxes on the wage bill and taxes on pollution resulting from production.

<sup>(7)</sup> Taxes on income (D51) are commonly called "direct taxes".

<sup>(8)</sup> See note 18 of annexe 1b, Council Regulation (EC) No 1687/98.

<sup>(9)</sup> Notes 9 and 18 of annex 1b in Council regulation 1687/98 clearly specify that "if the licenses are being granted automatically on payment of the amounts due, payments should be treated as direct taxes and *not prices*" (italics added). As examples, it is specified that "licences on the use of vehicles, boats or aircraft are treated in most cases as taxes". Hence, these licenses are neither covered in the HICP nor to be kept constant in the HICP-CT.

### 3.2. Tax coverage and relevance in Member States

For the purpose of the HICP-CT, care should be taken that similar types of taxes are treated in the same way across countries. Similar in this context means how it is defined 'legally' and not economically, e.g. from a purchaser's point of view a fee in one country might be similar to a tax in another country; however only the tax would be relevant for the HICP-CT. Hence it is the definition of the tax which should be taken into account for when it is decided to consider it and not its classification in the ESA95 terminology.

Some of the taxes which are potentially in scope for the HICP would, in terms of tax revenue, be small and hence it would be unlikely that a tax rate change would influence the HICP. Therefore it is suggested to implement the following **two criteria for deciding when a relevant tax should be kept constant**:

- **All taxes ought to be kept constant. At least those taxes which each cover 2% or more of the total tax revenue for all the relevant taxes in the HICP and,**
- **Of the relevant taxes, a minimum of 90% total coverage should be kept constant in the HICP-CT (defined as 90% of total revenue of relevant taxes).**

These criteria are **defined in relation to the tax revenue** of the relevant tax items and not in relation to the weight which each component makes up of total consumption (HFCME). The reason for this is that these definitions facilitate the identification of relevant product taxes to be kept constant and thus the products can easily be identified at national level via the detailed product groups which are included in the HICP.

Hence, the criteria avoid complications caused by tax structures being different from one country to another and at the same time give assurance of a minimum coverage of 90% of the relevant taxes (please note that both criteria should be fulfilled). These criteria are considered to be the minimum requirement. Where ever feasible, taxes should be kept constant as far as possible.

In general, the number of relevant excise duties and consumption taxes (specific taxes) is limited to well-defined product/service groups per country. The two groups D214H/D2122E other taxes on specific services and D214L other taxes on products n.e.c. ('rest' categories) do normally not contain taxes which take up a large percentage of total relevant tax revenue. However, they are in scope 'in case of', because they could assure comparability across countries.

## 4. THE ALGEBRA, REFERENCE PERIODS AND EXAMPLES

This section goes, firstly, into detail about the calculation of the tax rate changes for the different types of taxes covered in the definition. Secondly, it looks at reference periods. Finally, some examples of calculations at the most detailed product level are shown.

#### 4.1. The algebra for the HICP-CT

As outlined in section 2.1, a Laspeyres type constant tax rate price index  ${}_L CTP_{t_0, t_n}$  may be written as follows:

$${}_L CTP_{t_0, t_n} = \sum_{i=1}^g \frac{P_{i, t_n}(\tau_{i, t_0})}{P_{i, t_0}(\tau_{i, t_0})} \cdot W_i, \quad (2')$$

Where  $p_{i,t}(\tau_{i,t_0})$  denotes the constant tax rate price of item  $i$  ( $i=1, 2, \dots, g$ ) in period  $t$  ( $t=t_0, t_1, t_2, \dots, t_n$ ). The vector  $\tau_{i,t_0}$  comprises product related taxes to be considered within the scope of a constant tax rate price index. For each item  $i$  the vector  $\tau_{i,t}$  generally comprises three tax rates:  $\tau_{i,t} = (\alpha_{i,t}, \beta_{i,t}, \gamma_{i,t})$ .

According to de Haan three types of taxes on products may be distinguished: <sup>(10)</sup>

- $\alpha_{i,t}$ : tax levied at a constant rate (= fixed amount) per physical unit of item  $i$  in period  $t$  (specific tax),  $\alpha_{i,t} \geq 0$ ;
- $\beta_{i,t}$ : tax levied at a constant rate per monetary unit of the price of item  $i$  in period  $t$  (ad valorem tax),  $\beta_{i,t} \geq 0$ ;
- $\gamma_{i,t}$ : value added tax levied at a constant rate on the price for item  $i$  in period  $t$ ,  $\gamma_{i,t} \geq 0$ .

The sequence of taxes (i.e. what price an ad-valorem tax is levied on) may differ by type of product:

- The specific tax  $\alpha_{i,t}$  may be levied before or after the ad valorem tax  $\beta_{i,t}$ .
- The ad valorem tax  $\beta_{i,t}$  is levied either directly on the pre-tax price or on the pre-tax price plus the specific tax  $\alpha_{i,t}$ , or it is linked to the final purchaser price.
- The VAT  $\gamma_{i,t}$  is levied on the pre-tax price plus all other taxes (the last tax to be applied) <sup>(11)</sup>.

The exact sequence will have to be considered in each case. In order to show formulae reflecting practices of taxation, three possible cases are presented hereafter. However, other taxation rules may exist and the calculations would have to be done accordingly. <sup>(12)</sup>

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<sup>(10)</sup> See de Haan, Jan: "Empirical studies on consumer price index construction", Voorburg/Heerlen 2000, p. 126.

<sup>(11)</sup> The specific tax is levied first – and not after the VAT.

<sup>(12)</sup> Where other situations exist, they could be included in this manual. Member States are invited to provide any relevant information to Eurostat.

## Case 1

### Sequence of taxes:

- the ad valorem tax  $\beta_{i,t}$  is levied on the pre-tax price plus the specific tax  $\alpha_{i,t}$ ,<sup>(13)</sup>
- the VAT  $\gamma_{i,t}$  is levied on the pre-tax price plus all other taxes (the VAT is the last tax to be applied).

The purchaser price  $p_{i,t}$  to be paid for an item  $i$  in period  $t$  may be written as follows:

$$p_{i,t} = \tilde{p}_{i,t} + \alpha_{i,t} + \beta_{i,t}(\tilde{p}_{i,t} + \alpha_{i,t}) + \gamma_{i,t}[\tilde{p}_{i,t} + \alpha_{i,t} + \beta_{i,t}(\tilde{p}_{i,t} + \alpha_{i,t})], \quad (3.1)$$

where  $\tilde{p}_{i,t}$  denotes the p pre-tax price of item  $i$  in period  $t$ , which is the price excluding product related taxes.

From formula (3.1) it follows that:

$$p_{i,t} = (1 + \gamma_{i,t})(1 + \beta_{i,t})(\tilde{p}_{i,t} + \alpha_{i,t}). \quad (4.1)$$

Solving this for  $\tilde{p}_{i,t}$ , the pre-tax price of a product is defined as:

$$\tilde{p}_{i,t} = \frac{p_{i,t}}{(1 + \gamma_{i,t})(1 + \beta_{i,t})} - \alpha_{i,t}. \quad (5.1)$$

And the constant tax rate price  ${}^{\text{ct}}p_{i,t_n}$ , i.e. the (not observable) price of item  $i$  in the reporting period  $t_n$  which would have appeared if the reference period's ( $t_0$ 's) tax rates had been in force can be calculated as:

$$p_{i,t_n}(\tau_{i,t_0}) = (1 + \gamma_{i,t_0})(1 + \beta_{i,t_0})(\tilde{p}_{i,t} + \alpha_{i,t_0}) \quad (6.1)$$

Given this and referring to formula (2) the price relation which reflects the relative price movement of item  $i$  from  $t_0$  to  $t_n$  is:

$$\frac{p_{i,t_n}(\tau_{i,t_0})}{p_{i,t_0}(\tau_{i,t_0})} = \frac{(1 + \gamma_{i,t_0})(1 + \beta_{i,t_0})(\tilde{p}_{i,t} + \alpha_{i,t_0})}{(1 + \gamma_{i,t_0})(1 + \beta_{i,t_0})(\tilde{p}_{i,t_0} + \alpha_{i,t_0})} = \frac{\tilde{p}_{i,t_n} + \alpha_{i,t_0}}{\tilde{p}_{i,t_0} + \alpha_{i,t_0}} \quad (7.1).$$

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<sup>(13)</sup> The specific tax is levied after part of the proportional taxes.

<sup>(14)</sup> There are several other ways to define an equation which relates the purchaser price of an item to its product related taxes and its pre-tax price. De Haan (l.c., p. 126)

## Case 2

Sequence of taxes:

- the ad valorem tax  $\beta_{i,t}$  is levied on the pre-tax price,
- the VAT  $\gamma_{i,t}$  is levied on the pre-tax price plus all other taxes (the VAT is the last tax to be applied).

The purchaser price  $p_{i,t}$  to be paid for an item  $i$  in period  $t$  may be written as follows:

$$p_{i,t} = \tilde{p}_{i,t} + \alpha_{i,t} + \beta_{i,t} \tilde{p}_{i,t} + \gamma_{i,t} (\tilde{p}_{i,t} + \alpha_{i,t} + \beta_{i,t} \tilde{p}_{i,t}) \quad (3.2)$$

where  $\tilde{p}_{i,t}$  denotes the pre-tax price of item  $i$  in period  $t$ , which is the price excluding product related taxes.

From formula (3.2) it follows that:

$$\begin{aligned} p_{i,t} &= (1 + \gamma_{i,t}) (\tilde{p}_{i,t} + \alpha_{i,t} + \beta_{i,t} \tilde{p}_{i,t}) \\ &= (1 + \gamma_{i,t}) (1 + \beta_{i,t}) \tilde{p}_{i,t} + (1 + \gamma_{i,t}) \alpha_{i,t} \end{aligned} \quad (4.2)$$

Solving this for  $\tilde{p}_{i,t}$ , the pre-tax price of a product is defined as:

$$\tilde{p}_{i,t} = \frac{p_{i,t}}{(1 + \gamma_{i,t})(1 + \beta_{i,t})} - \frac{\alpha_{i,t}}{(1 + \beta_{i,t})} \quad (5.2)$$

And the constant tax rate price  ${}^{\text{ct}}p_{i,t_n}$ , i.e. the (not observable) price of item  $i$  in the reporting period  $t_n$  which would have appeared if the reference period's ( $t_0$ 's) tax rates had been in force can be calculated as:

$$p_{i,t_n}(\tau_{i,t_0}) = (1 + \gamma_{i,t_0}) (\tilde{p}_{i,t} + \alpha_{i,t_0} + \beta_{i,t_0} \tilde{p}_{i,t}) \quad (6.2)$$

Given this and referring to formula (2) the price relation which reflects the relative price movement of item  $i$  from  $t_0$  to  $t_n$  is:

$$\frac{p_{i,t_n}(\tau_{i,t_0})}{p_{i,t_0}(\tau_{i,t_0})} = \frac{(1 + \gamma_{i,t_0}) (\tilde{p}_{i,t_n} + \alpha_{i,t_0} + \beta_{i,t_0} \tilde{p}_{i,t_n})}{(1 + \gamma_{i,t_0}) (\tilde{p}_{i,t_0} + \alpha_{i,t_0} + \beta_{i,t_0} \tilde{p}_{i,t_0})} = \frac{(\tilde{p}_{i,t_n} + \alpha_{i,t_0} + \beta_{i,t_0} \tilde{p}_{i,t_n})}{(\tilde{p}_{i,t_0} + \alpha_{i,t_0} + \beta_{i,t_0} \tilde{p}_{i,t_0})} \quad (7.2)$$

This case could be described with the same formula as case 1. Then, the specific tax rate  $\alpha'$  would be defined as  $\alpha/(1+\beta)$ . This means that any change of the ad valorem tax  $\beta$  would imply a change of the specific tax  $\alpha'$ . The price relation (7.2) becomes:

$$\frac{p_{i,t_n}(\tau_{i,t_0})}{p_{i,t_0}(\tau_{i,t_0})} = \frac{(1 + \gamma_{i,t_0}) (1 + \beta_{i,t_0}) (\tilde{p}_{i,t} + \alpha'_{i,t_0})}{(1 + \gamma_{i,t_0}) (1 + \beta_{i,t_0}) (\tilde{p}_{i,t_0} + \alpha'_{i,t_0})} = \frac{\tilde{p}_{i,t_n} + \alpha'_{i,t_0}}{\tilde{p}_{i,t_0} + \alpha'_{i,t_0}} \quad (7.2a)$$

### Case 3 <sup>(15)</sup>

Sequence of taxes:

- the ad valorem tax  $\beta_{i,t}$  is linked to the final purchaser price <sup>(16)</sup>,
- the VAT  $\gamma_{i,t}$  is levied on the pre-tax price plus all other taxes (the VAT is the last tax to be applied, even though it has some impact on the ad valorem tax).

The purchaser price  $p_{i,t}$  to be paid for an item  $i$  in period  $t$  may be written as follows:

$$p_{i,t} = \tilde{p}_{i,t} + \alpha_{i,t} + \beta_{i,t} p_{i,t} + \gamma_{i,t} (\tilde{p}_{i,t} + \alpha_{i,t} + \beta_{i,t} p_{i,t}) \quad (3.3)$$

where  $\tilde{p}_{i,t}$  denotes the pre-tax price of item  $i$  in period  $t$ , which is the price excluding product related taxes.

Solving (3") for  $p_{i,t}$  this becomes:

$$p_{i,t} = (\tilde{p}_{i,t} + \alpha_{i,t})(1 + \gamma_{i,t}) + \beta_{i,t} p_{i,t} (1 + \gamma_{i,t}) = \frac{(\tilde{p}_{i,t} + \alpha_{i,t})(1 + \gamma_{i,t})}{1 - \beta_{i,t}(1 + \gamma_{i,t})} \quad (4.3)$$

Accordingly, the pre-tax price  $\tilde{p}_{i,t}$  is:

$$\tilde{p}_{i,t} = \frac{p_{i,t} \{1 - \beta_{i,t}(1 + \gamma_{i,t})\}}{(1 + \gamma_{i,t})} - \alpha_{i,t}. \quad (5.3)$$

And the constant tax rate price  ${}^{\text{ct}}p_{i,t_n}$ , i.e. the (not observable) price of item  $i$  in the reporting period  $t_n$  which would have appeared if the reference period's ( $t_0$ 's) tax rates had been in force can be calculated as:

$$p_{i,t_n}(\tau_{i,t_0}) = \frac{(p_{i,t_n} + \alpha_{i,t_0})(1 + \gamma_{i,t_0})}{\{1 - \beta_{i,t_0}(1 + \gamma_{i,t_0})\}} \quad (6.3)$$

Given this and referring to formula (2) the price relation which reflects the relative price movement of item  $i$  from  $t_0$  to  $t_n$  is:

$$\frac{p_{i,t_n}(\tau_{i,t_0})}{p_{i,t_0}(\tau_{i,t_0})} = \frac{(\tilde{p}_{i,t_n} + \alpha_{i,t_0})(1 + \gamma_{i,t_0})}{1 - \beta_{i,t_0}(1 + \gamma_{i,t_0})} \bigg/ \frac{(\tilde{p}_{i,t_0} + \alpha_{i,t_0})(1 + \gamma_{i,t_0})}{1 - \beta_{i,t_0}(1 + \gamma_{i,t_0})} = \frac{\tilde{p}_{i,t_n} + \alpha_{i,t_0}}{\tilde{p}_{i,t_0} + \alpha_{i,t_0}} \quad (7.3)$$

<sup>(15)</sup> It is quite common to relate ad valorem tax rates on tobacco products directly to the purchaser price.

<sup>(16)</sup> Comparing this ad valorem tax linked to the final purchaser price to the ad valorem tax linked to the pre-tax price including specific taxes (case 1), this implies that any VAT rate change results implicitly in a change of the ad valorem tax (if it was applied as in case 1). In fact, when an ad valorem tax is linked to the final purchase price, a VAT rate change has a higher impact than if the ad valorem tax was linked to the pre-tax price.

These three cases indicate that the relative price movement keeping base period's tax rates constant depends not only on the changes in the pre-tax prices but also on the values of specific tax rates in the reference period or even on the ad valorem tax rate  $\beta$  if it is levied on a price prior to a specific tax. However, the VAT rate has no influence. In other words, the choice of the constant tax reference period is neutral as regards the treatment of VAT, but the reference period matters for the treatment of specific taxes and sometimes for the treatment of ad valorem taxes other than VAT. <sup>(17)</sup>

So far the notation has been focused on price relations assuming that the tax rates to be kept constant stem from the price reference period (price reference period = tax rate reference period). This assumption should also be made to write down the formulae for a "constant tax rate" HICP (HICP-CT). Taking previous year's December ( $y, t_0$ ) as base period to reflect the price movement from that period to concurrent year's reporting period  $y, t_n$  this index is:

$$\text{HICP-CT}_{y, t_0; y, t_n} = \sum_{i=1}^g \frac{P_{i, y, t_n}(\tau_{i, y, t_0})}{P_{i, y, t_0}(\tau_{i, y, t_0})} \cdot w_{i, y}, \quad (8)$$

where  $y, t_0$  denotes December in year  $y-1$  being price and tax rate reference period for the index levels computed for the concurrent year  $y$ . The weights used for the compilation of these index levels are symbolised by  $w_{i, y}$ .

To provide notation for an HICP-CT covering time spans of several years  $y$  ( $y=y_0, y_1, y_2, \dots, y_m$ ) the set of periods per year should comprise 13 months:  $t_0, t_1, \dots, t_n, \dots, t_{12}$  so that each period of time is specified by two indices:  $y_j, t_k$  with  $j=1, 2, \dots, m$  and  $k=0, 1, 2, \dots, 12$ .

$$\begin{aligned} \text{HICP-CT}_{y_0, t_0; y_m, t_n} &= \sum_{i=1}^g \frac{P_{i, y_0, t_{12}}(\tau_{i, y_0, t_0})}{P_{i, y_0, t_0}(\tau_{i, y_0, t_0})} \cdot w_{i, y_0} \cdot \sum_{i=1}^g \frac{P_{i, y_1, t_{12}}(\tau_{i, y_1, t_{12}})}{P_{i, y_1, t_0}(\tau_{i, y_1, t_0})} \cdot w_{i, y_1} \cdot \\ &\dots \cdot \sum_{i=1}^g \frac{P_{i, y_m, t_n}(\tau_{i, y_m, t_n})}{P_{i, y_m, t_0}(\tau_{i, y_m, t_0})} \cdot w_{i, y_m} \end{aligned} \quad (9)$$

For case 1, referring to (7.1) this becomes:

$$\begin{aligned} \text{HICP-CT}_{y_0, t_0; y_m, t_n} &= \sum_{i=1}^g \frac{\tilde{p}_{i, y_0, t_{12}} + \alpha_{i, y_0, t_0}}{\tilde{p}_{i, y_0, t_0} + \alpha_{i, y_0, t_0}} \cdot w_{i, y_0} \cdot \sum_{i=1}^g \frac{\tilde{p}_{i, y_1, t_{12}} + \alpha_{i, y_1, t_0}}{\tilde{p}_{i, y_1, t_0} + \alpha_{i, y_1, t_0}} \cdot w_{i, y_1} \cdot \\ &\dots \cdot \sum_{i=1}^g \frac{\tilde{p}_{i, y_m, t_{12}} + \alpha_{i, y_m, t_0}}{\tilde{p}_{i, y_m, t_0} + \alpha_{i, y_m, t_0}} \cdot w_{i, y_m} \end{aligned} \quad (10)$$

Equation (10) indicates that "chaining effects" in a HICP-CT following the above outlined concept appear not only due to using up-dated weights but also in the case when specific tax rates have been changed.

For case 2, specific tax rates and ad valorem tax rates would have some impact. For cases 1 and 3, only the specific tax rates have an impact on the HICP-CT.

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<sup>(17)</sup> The relative price movement keeping base period's tax rates constant depends only on the changes in the pre-tax prices and on the values of specific tax rates in the reference period if all proportional taxes relate to prices **including specific taxes** which is the case in scenarios 1 and 3. If alternatively a proportional tax is directly related to the pre-tax price, then these tax rates will become relevant (see scenario 2).

## 4.2. Reference periods

The HICP-CT should be chained at the end of every year according to the same method as used for the HICPs. From an analytical point of view, the impact of tax rate changes as the difference between the HICP and the HICP-CT can only be evaluated if the weights in the two indices are identical.

<b>Weighting reference period:</b>	<b>same as for HICP (period ending no more than 7 years before preceding December)</b>
<b>Tax reference period:</b>	<b>December of previous year</b>
<b>Price reference period:</b>	<b>same as for HICP (= December of previous year)</b>
<b>Index reference period:</b>	<b>2005 = 100</b>

Within the algebra developed in 4.1, the tax rates to be kept constant should be taken from December of each previous year. This means that the price reference period (of HICP and HICP-CT) and the tax rate reference period (of HICP-CT) would be identical. Consequently, HICP and HICP-CT could be compiled in the same way and exactly the same weights can be used. These weights reflect the actual expenditure shares of the weight reference period, price-updated to previous year's December. Hence, they show also changes in product related taxes which may have appeared since the former weighting structure has been used.

Differences between the HICP and the HICP-CT appear only to be due to different tax rates relied on in both indices because the same weights are used. Additionally, the impact of yearly up-dating the weights is the same in the HICP and the HICP-CT. Both could be regarded as an advantage in terms of interpretation. On the other hand, it may be seen as a disadvantage that due to yearly up-dating of the tax reference period the specific tax rates of each past year's December have an impact on HICP-CT levels.

Finally, a note on new taxes: As the HICP-CT is a price index for the same goods and services as covered by the HICP, regardless of the product related taxes which are levied on them, the inclusion of new taxes will not pose any problem. Whenever a new relevant tax is introduced, the pre-tax price for the observation period has to exclude this tax for the current year, i.e. the tax will be kept constant at 0 for the current year. From the following year onwards, the tax rate of previous year's December will be used.

## 4.3. Examples of constant tax rate calculations for different types of taxes

A practical and systematic way of recording the contributions of different tax types to the price of a good or service would be to introduce the calculations at the most detailed product level (normally at the level of the national average price for a product).

The information necessary for each item (article)  $i$  for creating the system would be (per month) (Concerning the meaning of the symbols used below see 4.1):

- Article classification (the most detailed product level)
- Article description
- Reference period purchaser price ( $p_{i,t0}$ )
- Observation period purchaser price ( $p_{i,t1}$ )
- Tax rates in reference period and observation period:
  - Specific taxes ( $\alpha_{i,t0}, \alpha_{i,t1}$ )
  - Ad valorem taxes ( $\beta_{i,t0}, \beta_{i,t1}$ )
  - VAT ( $\gamma_{i,t0}, \gamma_{i,t1}$ )
- Product characteristics relevant for the product related taxation (namely specific taxes)

Below examples are shown on how this is done in practice for when a VAT rate changes (up and down), for when excise duties (specific and ad valorem tax) change and when a new tax is introduced.

<b>Example 1a: VAT rate goes from 19.6% to 5.5%</b>	
Item:	Hotel services
Classification code:	11.1.1.x.x
Reference period	
... purchaser price:	45.58 Euro (incl. 19.6% VAT)
Observation period	
... purchaser price:	50.71 Euro (incl. 5.5% VAT)
... price index :	111.25
... purchaser price excl. VAT= $50.71 \cdot 100 / 105.5$ :	48.07 Euro
... purchaser price incl. original VAT= $48.07 \cdot 1.196$ :	57.49 Euro
... CT price index = $57.49 / 45.58 \cdot 100$ :	126.12
As the VAT rate has fallen, the higher CT price index (126.12) compared to the lower price index (111.25) indicates how much higher the inflation would have been had the original (high) VAT-rate been kept in the sub-index.	

<b>Example 1b: VAT rate changes from 7% to 16%</b>	
Item:	Admission to cultural services/theatres
Classification code:	09.4.2.x.x
Reference period	
... purchaser price:	30.50 Euro (incl. 7% VAT)
Observation period	
... purchaser price:	33.39 Euro (incl. 16% VAT)
... price index:	109.48
... purchaser price excl. VAT= $33.39 \cdot 100 / 116$ :	28.78 Euro
... purchaser price incl. original VAT= $28.78 \cdot 1.07$ :	30.80 Euro
... CT price index = $30.80 / 30.50 \cdot 100$ :	100.98
As the VAT rate has increased, the lower CT price index (100.98) compared to the higher price index (109.48) indicates how much lower the inflation would have been had the original (low) VAT-rate been kept in the sub-index.	

**Example 2: Specific tax and the ad valorem tax increase**

All three types of taxes are levied on whisky in this example, e.g. a specific tax an ad-valorem tax and the VAT-rate, - the VAT rate is not changed from the reference to the observation period.

Item:	Whisky, brand X
Quantity:	25 cl
Classification code:	02.2.0.x.x
Reference period ( $t_0$ )	
... purchaser price $p_{i,t_0}$ :	7.88 Euro (incl. taxes)
Observation period ( $t_n$ )	
... purchaser price $p_{i,t_n}$ :	10.00 Euro (incl. taxes)
... price index in $t_n$ :	126.90
Taxes	
... VAT rate in reference and observation period: $\gamma_{i,t_0} = \gamma_{i,t_n} =$	19%
... Specific tax (per liter) in $t_0$ : $\alpha_{i,t_0} =$	7.5678
... ... for 25 cl: $7.5678 \cdot 25 / 100 =$	1.89195
... Specific tax (per liter) in $t_n$ : $\alpha_{i,t_n} =$	8.4578
... ... for 25 cl: $8.4578 \cdot 25 / 100 =$	2.11445
... Ad valorem tax in $t_0$ : $\beta_{i,t_0} =$	21.5%
... Ad valorem tax in $t_n$ : $\beta_{i,t_n} =$	21.6%

Pre-tax prices  $\tilde{p}_{i,t_n}$  and  $\tilde{p}_{i,t_0}$  to be deducted (formula 5):

$$\tilde{p}_{i,t} = \frac{P_{i,t}}{(1 + \gamma_{i,t})(1 + \beta_{i,t})} - \alpha_{i,t} \text{ with } t = t_n \text{ and } t = t_0, \text{ respectively.}$$

Obs. period pre-tax price  $\tilde{p}_{i,t_n} = 10.00 / (1.19 \cdot 1.216) - 2.11445 = 4.80$  Euro

Ref. period pre-tax price  $\tilde{p}_{i,t_0} = 7.88 / (1.19 \cdot 1.215) - 1.89195 = 3.56$  Euro

CT price index (in observation period)  $t_n$ :

$$\begin{aligned} \frac{P_{i,t_n}(\tau_{i,t_0})}{P_{i,t_0}(\tau_{i,t_0})} \cdot 100 &= \frac{(\tilde{p}_{i,t_n} + \alpha_{i,t_0}) * (1 + \gamma_{i,t_0}) * (1 + \beta_{i,t_0})}{(\tilde{p}_{i,t_0} + \alpha_{i,t_0}) * (1 + \gamma_{i,t_0}) * (1 + \beta_{i,t_0})} \cdot 100 \\ &= \frac{\tilde{p}_{i,t_n} + \alpha_{i,t_0}}{\tilde{p}_{i,t_0} + \alpha_{i,t_0}} \cdot 100 \\ &= (4.80 + 1.89195) / (3.56 + 1.89195) * 100 = 122.72 \end{aligned}$$

Hence, the lower specific tax rates and ad valorem taxes in the reference period mean that the inflation in the observation period would have been lower (CT price index=122.72) compared to what it actually is (price index 126.90).

**Example 3: Taxes on energy, unleaded petrol**

Item:	Unleaded petrol, 98 oct., chain X
Quantity:	10 liter
Classification code:	07.2.2.x.x
Reference period ( $t_0$ )	
... purchaser price $p_{i,t_0}$ :	15.58 Euro (incl. taxes)
Observation period ( $t_n$ )	
... purchaser price $p_{i,t_n}$ :	21.32 Euro
... price index in $t_n$ :	136.84
Taxes:	
... VAT rate in reference and observation period: $\gamma_{i,t_0} = \gamma_{i,t_n} =$	16%
... Excise duty per 100 liter in $t_0$ ; $\alpha_{1,t_0} =$	45.98 Euro
... ... for 10 liter : $45.98 / 100 * 10 =$	4.598 Euro
... Excise duty per 100 liter in $t_n$ ; $\alpha_{1,t_n} =$	84.54 Euro
... ... for 10 liter : $84.54 / 100 * 10 =$	8.454 Euro
... Environmental taxes per 100 liter in $t_0$ ; $\alpha_{2,t_0} =$	5.12 Euro
... ... For 10 liter : $5.12 / 100 * 10 =$	0.512 Euro
... Environmental taxes per 100 liter in $t_n$ ; $\alpha_{2,t_n} =$	4.62 Euro
... ... For 10 liter : $4.62 / 100 * 10 =$	0.462 Euro

Pre-tax prices  $\tilde{p}_{i,t_n}$  and  $\tilde{p}_{i,t_0}$  to be deducted (formula 5):

$$\tilde{p}_{i,t} = \frac{p_{i,t}}{(1 + \gamma_{i,t})} - \alpha_{1,t} - \alpha_{2,t} \text{ with } t = t_n \text{ and } t = t_0, \text{ respectively.}$$

Obs. period pre-tax price  $\tilde{p}_{i,t_n} = 21.32 / 1.16 - 8.454 - 0.462 = 9.46$  Euro

Ref. period pre-tax price  $\tilde{p}_{i,t_0} = 15.58 / 1.16 - 4.598 - 0.512 = 8.32$  Euro

CT price index (in observation period)  $t_n$ :

$$\begin{aligned} & \frac{p_{i,t_n}(\tau_{i,t_0})}{p_{i,t_0}(\tau_{i,t_0})} \cdot 100 \\ &= \frac{(\tilde{p}_{i,t_n} + \alpha_{1,t_n} + \alpha_{2,t_n}) * (1 + \gamma_{i,t_n}) * (1 + \beta_{i,t_n})}{(\tilde{p}_{i,t_0} + \alpha_{1,t_0} + \alpha_{2,t_0}) * (1 + \gamma_{i,t_0}) * (1 + \beta_{i,t_0})} \cdot 100 \\ &= \frac{(\tilde{p}_{i,t_n} + \alpha_{1,t_n} + \alpha_{2,t_n})}{(\tilde{p}_{i,t_0} + \alpha_{1,t_0} + \alpha_{2,t_0})} \cdot 100 \\ &= (9.46 + 4.598 + 0.512) / (8.32 + 4.598 + 0.512) * 100 = 108.50 \end{aligned}$$

In this example, two specific taxes and the VAT rate make up the product taxes. The total direct effect of the tax rate changes is 28.34 index points. That is to say, that if the reference period's overall lower tax rates had been in force in the observation period then the index would only had been 108.50 in place of the actual 136.84. The example illustrates that the specific tax decrease on environmental taxes from the reference to the observation period has only a small impact on the index level compared to the impact of the big increase in the excise duty (taking this tax out would make the CT price index equal 108.13).

#### Example 4: Introduction of a new tax on energy

A new specific tax is introduced after the reference month.

Item:	Electricity
Quantity:	10 KWH
Classification code:	04.5.1.x.x
Reference period ( $t_0$ )	
... purchaser price $p_{i,t_0}$ :	2.10 Euro (incl. taxes)
Observation period ( $t_n$ )	
... purchaser price $p_{i,t_n}$ :	2.30 Euro (incl. taxes)
... price index in $t_n$ :	109.52
Taxes	
... VAT rate in reference and observation period: $\gamma_{i,t_0} = \gamma_{i,t_n} =$	20%
... Specific tax (per KWH) in $t_0$ : $\alpha_{i,t_0} =$	0 Euro
... .. for 10 KWH: $0 \cdot 10/1 =$	0 Euro
... Specific tax (per KWH) in $t_n$ : $\alpha_{i,t_n} =$	0.015 Euro
... .. for 10 KWH: $0.015 \cdot 10/1 =$	0.15 Euro

Pre-tax prices  $\tilde{p}_{i,t_n}$  and  $\tilde{p}_{i,t_0}$  to be deducted (formula 5):

$$\tilde{p}_{i,t} = \frac{p_{i,t}}{(1 + \gamma_{i,t})(1 + \beta_{i,t})} - \alpha_{i,t} \text{ with } t = t_n \text{ and } t = t_0, \text{ respectively.}$$

$$\text{Obs. period pre-tax price } \tilde{p}_{i,t_n} = 2.30 / (1.20) - 0.15 = 1.77 \text{ Euro}$$

$$\text{Ref. period pre-tax price } \tilde{p}_{i,t_0} = 2.10 / (1.20) - 0 = 1.75 \text{ Euro}$$

CT price index (in observation period)  $t_n$ :

$$\frac{p_{i,t_n}(\tau_{i,t_0})}{p_{i,t_0}(\tau_{i,t_0})} \cdot 100 = \frac{(\tilde{p}_{i,t_n} + \alpha_{i,t_0}) * (1 + \gamma_{i,t_0})}{(\tilde{p}_{i,t_0} + \alpha_{i,t_0}) * (1 + \gamma_{i,t_0})} \cdot 100$$

$$= \frac{\tilde{p}_{i,t_n} + \alpha_{i,t_0}}{\tilde{p}_{i,t_0} + \alpha_{i,t_0}} \cdot 100$$

$$= (1.77 + 0) / (1.75 + 0) * 100 = 100.95$$

Hence, the non existence of the specific tax in the reference period means that the inflation in the observation period would have been lower (CT price index=100.95) compared to what it actually is (price index 109.52).

## 5. IMPLEMENTATION

### 5.1. Tax coverage and rates

When implementing the HICP-CTs compliance with the coverage criterion should be ensured for past years (back to 2003). Coverage will have to be reassessed regularly in order to ensure comparability over time and between countries.

#### 5.1.1. Level of detail required for calculation

In practical terms, COICOP-4-digits level could be regarded as sufficient with respect to the precision of a HICP-CT. Different tax rates or even tax types within a 4-digit aggregate may be treated by computing appropriate averages.

In practice, the MS implemented the computations at rather diverse levels:

- Some NSI compute CT prices at the level of individual price quotes. For example the United Kingdom uses average tax rates for the item and then computes geometric mean average prices, Austria starts from observed prices and CT-prices are calculated for each item.
- Some NSI starts computation at the level of average item prices. For example Portugal, Slovakia, Malta, Estonia Germany and the Czech Republic compute average prices for elementary aggregates. Denmark estimated HICP-CTs from HICPs and the national net price index up to December 2006 but since January 2007 the computation starts from item prices. Elementary indices are then calculated and aggregated.
- Other NSI start from sub-indices (Sweden) or elementary price indices (Lithuania calculates price indices for each product for each territorial unit and Cyprus and Poland start at 6-digit COICOP level).
- In the Spanish implementation, the computation differs for VAT and special excises. A general formula is applied to elementary prices indices in order to adjust VAT. For items on which special levies apply, the central HICP unit in INE calculates the price at constant taxes.

#### 5.1.2. Sources of information

When implementing the HICP-CT, sources of information will have to be investigated in each Member State.

The Commission Directorate for taxation and customs has information on **VAT rates and excise duties** for all EU Member States and for some other countries. They also have information sheets (in English) about every existing type of tax in each country. This information might not be updated at a frequency necessary for constructing the HICP-CT but it can be used as a source of control for tax coverage. (website: [http://ec.europa.eu/taxation\\_customs/common/publications/info\\_docs/taxation/index\\_en.htm](http://ec.europa.eu/taxation_customs/common/publications/info_docs/taxation/index_en.htm))

See also: "Taxation trends in the European Union – Data for the EU Member States and Norway, 2009 edition"  
[http://epp.eurostat.ec.europa.eu/cache/ITY\\_OFFPUB/KS-DU-09-001/EN/KS-DU-09-001-EN.PDF](http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-DU-09-001/EN/KS-DU-09-001-EN.PDF)

### *5.1.3. Treatment of taxes on cigarettes*

One basic assumption of the HICP-CT is that tax changes are passed on instantaneously and fully. In special cases, such as for cigarettes in several countries, stocks with 'pre-change' tax stamps are available on the market for some time after the tax change came into force.

It is often very well known to the price statisticians whether the collected prices include old or new tax rates. From the pilot studies carried out in 2006, it was concluded that if such information is available, then the tax actually paid should be reflected in the HICP-CT.

### *5.1.4. Tax change in the middle of a month*

The 2006 pilot studies showed some situations where a tax changed within a month. In these cases it was concluded to reflect the taxes actually paid as closely as possible. If the date of a specific price collection is available to the price statisticians, then the tax actually paid should be reflected – otherwise, appropriate averages should be applied.

## **5.2. Geographical coverage**

While for the ECB the first priority is to set-up a comparable HICP-CT covering the euro area countries and to compile results for the euro area as a whole, there are other potential national or European uses and users which may wish to obtain this information for all EU countries. Therefore, it is suggested that the geographical coverage should include the 27 EU Member States.

## **5.3. Sub-indices**

For ECB purposes, the most important information of the HICP-CT is provided by the all-items HICP. HICP-CTs in the form of monthly indices from December 2002 onwards should be provided to Eurostat. 2005=100 should be the index reference period.

The following data should be provided to Eurostat:

- HICP-CTs for all COICOP-HICP sub-indices. (See also Commission Regulation no 1749/1999 of 23 July 1999 amending Regulation (EC) No 2214/96, concerning the sub-indices of the Harmonized Indices of Consumer Price).
- And the following special aggregates:
  - HICP-CT Goods (ct\_goods)
  - HICP-CT Un-processed food (ct\_foodup)
  - HICP-CT Processed food (ct\_foodp)
  - HICP-CP Non-energy industrial goods (ct\_igoodsxe)
  - HICP-CT Energy (ct\_e)
  - HICP-CT Services (ct\_serv)

These special aggregates are defined as follows:

	Code	All lowest level COICOP sub-indices =
HICP-CT Goods	ct_goods	0111, 0112, 0113, 0114, 0115, 0116, 0117, 0118, 0119, 0121, 0122, 0211, 0212, 0213, 0220, 0311, 0312, 0313, 0321_2, 0431, 0441, 0451, 0452, 0453, 0454, 0455, 0511, 0512, 0520, 0531_2, 0540, 0551_2, 0561, 0611, 0612_3, 0711, 0712_34, 0721, 0722, 0911, 0912, 0913, 0914, 0921_2, 0931, 0932, 0933, 0934_5, 0951, 0952, 0953_4, 1212_3, 1231, 1232
HICP-CT Un-processed food	ct_foodup	0112, 0113, 0116, 0117
HICP-CT Processed food	ct_foodp	0111, 0114, 0115, 0118, 0119, 0121, 0122, 0211, 0212, 0213, 0220
HICP-CT Non-energy industrial goods	ct_igoodsxe	0311, 0312, 0313, 0321_2, 0431, 0441, 0511, 0512, 0520, 0531_2, 0540, 0551_2, 0561, 0611, 0612_3, 0711, 0712_34, 0721, 0911, 0912, 0913, 0914, 0921_2, 0931, 0932, 0933, 0934_5, 0951, 0952, 0953_4, 1212_3, 1231, 1232
HICP-CT Energy	ct_e	0451, 0452, 0453, 0454, 0455, 0722
HICP-CT Services	ct_serv	0314, 0411_2, 0432, 0442, 0443, 0444, 0513, 0533, 0562, 0621_3, 0622, 0630, 0723, 0724, 0731, 0732, 0733, 0734, 0735, 0736, 0810, 082_30, 0915, 0923, 0941, 0942, 0960, 10X0, 1111, 1112, 1120, 1211, 1240, 1252, 1253, 1254, 1255, 1262, 1270.

#### 5.4. Timing of implementation, data transmission and dissemination

During 2006-2009, HICP-CT pilot projects have been carried out in most EU Member States and have been evaluated by EUROSTAT. Starting from October 2009, HICP-CTs are regularly produced for the all-items category by all EU Member States, except Ireland.

##### 5.4.1. Timing of implementation and back data

For the provision of back data for the HICP-CT, information on tax rates of previous years (December) periods has to be available. The index should be piloted from 2003 onwards and thereby make December 2002 the first tax reference period.

##### 5.4.2. Transmission of HICP-CT indices to Eurostat

NSIs of the EU Member States transmit HICP-CTs to Eurostat in the standard HICP transmission process. A technical description of the data files and transmission channel is given in the "HICP Data Transmission Guide".

##### 5.4.3. Dissemination

The HICP-CTs are integrated into the standard Eurostat online databases.

##### 5.4.4. Revision, timeliness and preliminary results

As with the HICPs, the HICP-CT is revisable. HICP-CTs are made available one month later than the HICPs.

## REFERENCES

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